Coping with Drought in Sub-Saharan Africa: Better Use of Climate Information

United Nations Development Programme, Office to Combat Desertification (UNDP/UNSO)
World Meteorological Organization (WMO)

AGM-1
WMO/TD No. 1035
2000

CONTENTS

	Foreword	ii
1.	Background and Summary	1
2.	Country Study Reports	4
3.	Farmers' Panel on Use of Climate Information	7
4.	Climate Forecasting Services	9
5.	Application of Seasonal Forecasts	12
6.	Working Groups	15
7.	Conclusions	17
	Annex I: Opening Statements	18
	Annex II: List of Participants	21
	Annex III: Workshop Agenda	26
	Annex IV: List of Acronyms	29

FOREWORD

Despite Sub-Saharan Africa's (SSA) natural and human potential to support the livelihood of its people, recurrent droughts, coupled with poor governance, conflicts, and poverty have exposed certain communities to food insecurity. The effects of such disasters may often override past development gains. The drought crisis, as portrayed by global media, has triggered mainly short-term emergency responses that target symptoms but hardly address the root causes. The realization of this limitation has led to the creation of new paradigms in development, as reflected in United Nations Convention to Combat Desertification (UNCCD).

In addressing this crisis, UNDP's support to SSA countries targets the creation of an enabling environment through national action programmes to implement the UNCCD. Within this broad context, UNDP endeavours to empower subsistence farmers and organizations that serve them in drought preparedness and mitigation (DPM). This approach addresses the close linkages between drought, land degradation and climate change. One of the goals of DPM is to bridge the gap between short-term emergencies and long-term development measures. This is accomplished by integrating a risk management component into the national planning process and broadening options for sustainable livelihoods.

Programme development in DPM has been guided by two key questions: (1) what is the status of DPM and how can UNDP assist SSA countries in DPM, and (2) how can drought-prone communities is SSA benefit from recent advances in climatology and weather forecasting to enhance their own drought coping strategies.

An assessment conducted by UNDP/UNSO in SSA in 1997 indicated that early warning systems are highly centralized with *ad hoc* activities that are poorly linked to long-term risk management practices of subsistence farmers and herders. Furthermore, the study found that communication barriers between farmers and government institutions limit the use of early warning information. In response to this need UNDP and the World Meteorological Organization (WMO) joined forces to support countries to formulate drought policies that address among others, unequal access to information through an improved communication network. To this end, UNDP/UNSO and WMO conducted a farmer-focused survey in six countries (Ethiopia, Kenya, Mali, Mozambique, Senegal and Zimbabwe) to assess the status of accessibility and use of contemporary and indigenous climate information. The surveys were followed by an International Workshop that was held at the Kadoma Ranch Hotel and Conference Centre in Zimbabwe from 4 to 6 October 1999.

This report captures the Kadoma Ranch workshop deliberations on the outcome of the survey and recommendations for a programme to address farmers' needs for information on climate and drought. The major partners who supported this work include USAID, the US Drought Mitigation Center, the US National Oceanographic and Atmospheric Administration, the UNCCD Global Mechanism and the Government of Zimbabwe through National Meteorological Directorate.

The workshop organizers are now assisting several SSA countries to adapt the programme to their own requirements and to mobilize resources to support programme implementation.

We hope that you will find this report useful in your work. We welcome any comments and suggestions you may have to guide us in our mission.

Philip Dobie
Director
UNDP/UNSO
Office to Combat Desertification and Drought

Michael J. Coughlan
Director Coordinator
Climate Activities Programmes
World Meteorological Organization

1. Background and Summary

Desertification and drought have been recognized as worldwide problems that have serious implications to food security and poverty in the dryland areas of Africa and other continents. This fact is supported by the United Nations Convention to Combat Desertification (UNCCD) which entered into force on 26 December 1996. The UNCCD places greater emphasis on drought preparedness and mitigation as opposed to reactive measures that have been adopted in the past. The Convention also emphasizes the role of climate, in particular drought in the desertification process. Many international organizations have taken major steps in support of the implementation process of the UNCCD within sub-Saharan Africa.

Establishment and/or strengthening of Early Warning Systems and drought preparedness and management which take into consideration seasonal to inter-annual climate predictions have been recognized as critical measures to mitigate impacts of drought (article 10 of UNCCD). These measures are partly being driven by increased reliability of seasonal forecasts and the application of this information in agricultural decision making.

The World Meteorological Organization (WMO) has established a Climate Information and Prediction Services (CLIPS) to assist in the adoption of new science and technology during the development of climate information. WMO has also established activity centres including the African Center of Meteorological Applications for Development (ACMAD) and Drought Monitoring Centers (DMCs) to support agricultural sectors through provision of real-time climate forecasts.

UNDP/UNSO has taken major steps in support of the UNCCD implementation process in sub-Saharan Africa through Drought Preparedness and Mitigation (DPM) in the context of National Action Programmes (NAP). The first step was an assessment of policies and strategies for DPM in Africa in 1997. This was technically supported by the US National Drought Mitigation Center (NDMC) of the University of Nebraska. Findings from this assessment indicate that a refocus from crisis response to drought preparedness strategies is necessary in Africa. For this to happen, farmers must gain access to and make better use of both traditional and contemporary climate information.

Taking this into account, UNDP/UNSO and WMO have jointly initiated a programme to improve farmer accessibility and use of climate forecasts to strengthen farmer drought preparedness and mitigation. The programme is receiving technical support from the African Desk of National Oceanic and Atmospheric Administration's (NOAA) Global Programmes. The programme is picking momentum and other international agencies such as the International Research Institute for climate prediction (IRI) based in Columbia University perceive this work as complementary to their own initiatives for Africa and are therefore interested in collaborating.

The project preparatory phase which commenced in January 1999 involved a literature review, developing contacts with potential sponsors, conducting a survey in six African countries (Ethiopia, Kenya, Mali, Mozambique, Senegal and Zimbabwe) and planning and designing a workshop. A summary of the country study reports is given in Section 2. From 4-6 October 1999, 48 participants convened at the Kadoma Ranch Hotel and Conference Centre, Zimbabwe, for a workshop on the role of climate forecasts in farmer decision making. The workshop was made possible through financial contributions of WMO, UNDP/UNSO, NOAA, USAID, IFAD (Global Mechanism) and logistics support from NDMC and Zimbabwe Meteorological Services. The participants represented diverse disciplines and came from national, regional, and international institutions and agencies. Workshop deliberations elaborated the status of accessibility and use of climate forecasts by farmers.

During the first day of the workshop user needs for climate information were identified. The process involved short presentations of lessons learnt from case study countries and a farmer and extension services panel. These sessions underscored that farmers rely mostly on site specific traditional indicators to predict climate and make decisions on different farm operations. However, farmers also expressed the need for contemporary climate products, information on whether the season is normal, below normal or above normal. The greatest limitations to the use of these products are: inaccessibility, timeliness and poor reliability. A summary report on the discussion in the Farmers' Panel is given in Section 3.

The technical presentations gave valuable lessons on use of climate information from other continents, and broad perspectives on long range forecasting for Africa, meteorological and hydrological service networks, and limitations of downscaling climate products. The probabilistic forecast was noted as the best possible climate product because it reflects the real scientific background of the forecast. Presentation from the WMO Climate Information and Prediction Services (CLIPS) asked two basic questions of the workshop: (i) what is the best possible forecast? and (ii) what can a farmer do with this forecast? A short summary of the presentation made on climate forecasting services is given in Section 4. Presentations were made on the application of seasonal climate forecasts in Peru, Zimbabwe, Australia and Zambia. Short summaries of these presentations are given in Section 5.

During the second day of the workshop, user needs were addressed by three working groups and technical presentations. The working groups also investigated how traditional indicators can be blended with contemporary forecasting tools. Major gaps exist within the production, dissemination and application of the forecast. The main findings from the session were that a formal system should be put in place to disseminate climate information to the farming community. Furthermore, regular feedback must be obtained from farmers on the value of climate information in farm operations. The providers and users need to interact better to improve their understanding of both traditional indicators and contemporary climate products. Only a limited effort has been made within scientific fields to understand traditional indicators and their possible integration into climate product development.

In order to produce elements of a programme that could address the identified gaps, three working groups were formed during the last day of the workshop to represent the western, eastern and southern African regions. Recommendations ensuing from the three groups are as follows:

- Research projects should be undertaken on the value of climate information in farmer decision making and of traditional indicators across the three regions.

- Traditional indicators should be integrated into climate products.

- Further work should be undertaken to enhance a two-way communication between producers and users of climate products. This may involve engaging media experts to translate products into local languages and to assist farmers in the application of probabilistic climate products.

- The training of producers, extension, and farmer communities across the three African regions should be carried out.

- Further work at the producer level should be carried out to improve the quality of the forecast.

- Collaboration among different stakeholders that would be required to take charge of various elements of the programme.

A summary report of the discussions in the working groups is given in Section 6.

Findings from the workshop will be used in the development of a programme document targeting eastern, southern and western Africa regions.

2. Country Study Reports

Six countries (Ethiopia, Kenya, Mali, Mozambique, Senegal and Zimbabwe) were selected for pilot studies where surveys could be conducted to assess the status on use of indigenous and contemporary information on climate and drought preparedness. National consultants were recruited to conduct surveys that appraised the types of climate products and services provided at the institutional level, the delivery system of that information to farmers, and its level of adoption and application in decision making. Selected areas were mostly arid and semi-arid with mixed land use systems (crop and livestock). The areas did not include pure pastoral systems, which should nevertheless be considered as a possible target for programme development. The survey encompassed diverse socio-economic factors e.g. land tenure, income of respondents, ethnic groups, etc.

The national consultants came from different disciplinary backgrounds. Consultants from Mali, Senegal, Mozambique and Ethiopia are from meteorological departments, the Kenyan consultant is a university lecturer with a background in the management of arid and semi-arid lands, the Zimbabwean consultant works in rural development, the consultants' backgrounds influenced the perspective presented in the national reports, with the meteorologists concentrating on product development and applications and the other two focussing on extension systems and uptake.

Rapid appraisal of indigenous knowledge on climate and drought was an important aspect of the survey. In order to standardize survey results for comparison and workshop discussion purposes, a questionnaire on uptake and use of contemporary climate and indigenous climate forecasting was developed and distributed to all the national consultants. The consultants used the questionnaire with other methods such as focussed group discussion, participatory approaches, key informant surveys, literature review, etc. to obtain the required information. The Mali and Senegal reports mentioned results from present and past project experience to introduce climate information within a treatment and control experiment.

Ethiopia

Mr T. Wodajo presented the survey findings in the absence of the consultant, Mr Dagnachew Asfaw. The presenter recommended establishment of a direct link between the Department of Agriculture and the Meteorological Services.

According to this report, the most critical information required by farmers is the time when the rainy season begins. The farmers do not get this information in time to adjust their on-farm decisions because there are too many stages in the delivery system. It was noted that farmers are willing to use contemporary information but the above constraints need to be addressed and the Meteorological Department must be strengthened to respond to the farmers' needs for climate information.

Kenya

In the absence of the consultant, Mr Robinson Ngugi, Ms Lucy Mwangi presented key observations. According to the survey, farmers base their decisions on several factors such as their knowledge of climate forecasting, availability of seeds and other inputs and crop variety. Decisions include when to plant or harvest. For example, the survey found that 80% of the farmers plant at the beginning of the short rains (September/October) which are reliable and the remaining plant at the beginning of the long rains (March/April) which are less reliable. However

results from the survey indicated that harvesting of beans is spread out from January to March. About 13% of the respondents indicated that they harvest beans in January, while 75% harvest in February and only 12% harvest in March.

Farmers get climate information from extension services, daily radio reports after the news, television, newspapers and through word-of-mouth. Ms Mwangi indicated that a majority of the farmers prefer indigenous over contemporary forecasting. Their reasons are that indigenous information is more compatible with local culture and it has been tested, tried and trusted. In addition, it is more specific and is in a language that can be understood.

Mali

Mr Malich Gning presented the Mali summary in the absence of Mr Diarra Birama, the consultant. He reported on the importance of climatological models in predicting seasonal parameters (start and length of the season). According to Mr Gning, the farmers receive information on the use of fertilizer and other inputs in addition to long-range forecasts that are issued by the statistics office.

The use of traditional indicators to predict short, medium and long-term seasonal characteristics was well noted. Mr Gning reported that Mali farmers appreciate forecast information because of its perceived benefits in improving crop production through better decisions on when, what and how to plant and manage the use of fertilizers and insecticides. One elderly farmer claimed "these days, without weather information, we farmers would be like a mouse trapped in a bottle".

In all cases, the farmers felt that contemporary information was more reliable and manageable than traditional information due to its scientific and technological characteristics. However, its effectiveness needs to be improved. More effort is needed to improve the spatial resolution of the forecast and expand the range of radio forecasts to all localities. The survey recommended greater participation of women in agrometeorological information dissemination and use.

Mozambique

Mr Domingos Lucio-Filipe reported on the findings of the Mozambique survey. According to his report, seasonal forecasts have been issued since 1994 and the products include tables, risk maps and decadal agromet bulletins. More specific information such as probability tables of tri-monthly water requirements for maize is also produced.

According to this survey, Mozambique does not have any formalized or institutionalized mechanism of transferring information from the meteorological services to the farmers. According to Mr Filipe, the farmers find contemporary information too general and technical. Furthermore, the information is not received on time and some local communities do not receive the information at all. He mentioned that in some cases the official and non-official channels of disseminating the forecasts are contradictory.

He noted that although the farmers have traditional drought mitigation strategies (such as crop diversification, food conservation, early planting and water conservation), they are still in need of reliable seasonal forecasts.

Senegal

Mr Gorgui Bamar Diagne presented the Senegal survey and identified farmer needs for seasonal and short-term predictions. Predictions made in May for a four-month rainy season are based

on historical information. Farmers use this forecast to make decisions on crop choice and other farm operations.

Products from the Meteorological Departments are compiled every 10 days for comprehensive assessment. NGOs are instrumental in the dissemination of this information to crop and livestock producers. There is no formalized process to deal with information dissemination or to coordinate activities. It is also worth noting that although the information dissemination programme from AGRYMET has been under way for several years with a focus on villages, there is no drought early warning system in place.

Mr Diagne noted that experience and knowledge of rural farmers is not taken into consideration at the national planning level. In summary, the main constraints are: institutional, economic, political and lack of participation by rural people in the national planning process.

Zimbabwe

Mr Owen Shumba reported on the Zimbabwe survey and explained the near real time forecasts including a 10-day weather outlook. He identified the farmers' sources of climate information as radios, newspapers, schools/headmasters, televisions and Agritex extension workers, farmers TV, NGO, word-of-mouth, newspapers, the electronic media and periodic publications (pamphlets/bulletins). He further noted that women get information by word-of-mouth from husbands working in town.

The information could be used to make farm decisions including when, what and how to plant, whether ridging is necessary, whether techniques of soil and water conservation or infiltration pits are to be used and which fertilizer and pesticides to use. According to this report, only 3% of farmers use climate information for planning purposes. The reasons given for this low level of use are poor timing, poor quality and ethnic and cultural constraints. Several adaptive and coping strategies were identified including multi-cropping, contour ridging and storage of maize and sorghum.

The survey identified church as the institution with the largest impact on the community. Although farmers listen to climate forecasts on radios, the poor and marginalized use their traditional knowledge systems as control. The more contemporary information deviates from the control the less likely it is to be adopted by the farmers. The challenge is to tap the indigenous knowledge and link it to contemporary forecasts. The report also recommended use of mobile libraries and farmer cooperatives.

Points Ensuing from the Discussions

Zimbabwe farmers get information from the Meteorological Department which is delivered by others, i.e. Agritex and NGOs. However, the panel indicated that little effort has been made to evaluate this information at the farmer level. Traditional information from the prophets is also provided to the farmers through the church.

Women use climate information, most of which is transmitted to them by their husbands. Moreover, the panel explained that men tend to be in favour of indigenous knowledge. This was especially true for Mozambique where most men work in the South African mines and women are responsible for most of the agricultural activities.

3. Farmers' Panel on the Use of Climate Information

The Farmers' Panel included Mrs G. Sibanda, Mr E. Chingwena and R.T. Chiwaridzo.

The Panel reported that several indicators are used by Zimbabwean farmers to predict weather and/or climate. These indicators are based on flowering and fruit production of certain plants, behaviour of certain animals, condition of the atmosphere and physical features.

Farmers associate heavy production of tree leaves with a good season while high fruit production is an indicator for a poor season. This belief is based on the argument that high fruit production is a sign that people will be living on fruits for lack of alternative foodstuff. The panel also reported that production of white flowers by a local tree called mukuu is a signal for a bad season while flower production on top branches of a tree called mukonde signifies a rainy season.

The panel provided information on good drought indicators such as heavy infestation of most tree species by caterpillars during springtime, late bearing and lack of figs in July to September of a tree called mukute and late maturing of acacia trees along valleys. Drying off of chigamngacha fruit between September and early November is also a good sign of an imminent drought.

When spiders close their nests, the early onset of rain is expected because spiders do not like any moisture in their nests. If numerous crickets are observed on the ground, a poor rainy season is expected. The sighting of high flying storks is associated with a good season. Observation of a bird singing while facing downwards from the top of a tree is a good indicator that it is about to rain, while observation of numerous birds is a signal for heavy rain. Westerly and northerly winds are associated with a good season as they are assumed to bring an abundance of moisture. Prevalent strong day and night winds from east to west between July to early November is an indicator of drought.

The Panel identified several drought survival strategies such as food storage and use of alternative foodstuff such as fruit. For instance, a tree called msika provides fruits which can be dried and stored in barns for use during the dry season. In certain areas, NGOs advise farmers on the selection and use of drought-resistant crops such as millet and sorghum. For example, the Panel mentioned a project where a few farmers were selected and provided with selected seed varieties for trial on their farms. The successful seed varieties were later distributed to other farmers.

In conclusion the Farmers' Panel informed workshop participants that although traditional systems of climate information are still common, farmers also listen to daily weather reports provided by the meteorological services.

Mr R.P. Tsikai (extension worker) reported that there is no formal programme to mitigate drought. The problem is exacerbated by poor communication and a lack of meteorological and hydrological data collection instruments. These deficiencies are common for both the farming community and the extension staff. He recommended that the elements of the programme should include expansion in meteorological observation posts, use of traditional indicators in contemporary forecasts, and coordination of seed producers and climate forecast staff.

Mr Tsikai further stated that most local people do not have radios, televisions or newspapers. Therefore, only about 3% of farmers have access to climate information; the remaining majority rely on traditional information.

In conclusion, he observed that the time has come for farmers to use climate prediction information in farm decision making to improve crop management and livestock rearing activities. He stressed the need for all institutions involved in climate information to become well coordinated so that farmers can get the information on time.

Issues for Further Investigation

Further investigation is necessary to elaborate or verify the use of traditional indicators by addressing critical questions as to whether indicators disagree and how farmers respond when they do disagree.

Future research could address the question "What are the farmers' primary priorities – is it access to seeds, fertilizer or climate information?" Workshop discussions on this question were not conclusive.

Recommendations from Country Reports and the Farmers' Panel

The country reports and the Farmers' Panel recommended improvement on timing of information in combination with spatial and temporal accuracy of the product. Moreover, farmer presentations indicated that the translation of forecasts into local languages with appropriate management options is critical. Farmers need help from extension services to understand climate information.

4. Climate Forecasting Services

NOAA African Desk

Dr Wassila Thiaw gave an overview of the role of the National Center for Environmental Predictions and Forecast System for the United States of America. He reported on the tools used in predicting seasonal rainfall for Africa and identified some of the difficulties encountered.

Dr Thiaw noted that the Sahel has had a great downward trend in rainfall. Some of the factors associated with Sahel rainfall include surface sea temperatures, atmospheric circulation and anticyclone systems. He explained that meteorological parameters are used in an integrated ocean model data assimilation system whilst surface temperatures and rainfall anomalies are obtained using statistical model tools like Canonical Correlation Analysis and ENSO.

According to his presentation, the main objectives for climate outlook fora in Africa are to resolve the dilemma for choosing among several climate forecasts from various national meteorological centres and world climate centres in order to produce consensus seasonal forecasts and a mitigation plan.

During discussions, Dr Thiaw, explained that the functional role of the NOAA African Desk office that was developed five years ago is to build the forecasting capacity of bodies such as ACMAD. They provide these bodies and other centres with information that helps their forecasts. The same information is made available on the Internet. However if specific information is requested by National Meteorological Services, the African Desk office refers them to regional bodies.

Drought Monitoring Centers (DMCs): Nairobi, Kenya, and Harare, Zimbabwe

Mr B.J. Garanganga (Harare Coordinator) reported on the impact of drought in southern Africa and the role of DMC Harare. Mr Joseph Kimani reported on the role of DMC Nairobi in the Horn of Africa.

Following the droughts of the 1980s, there were many meetings by various African governments, specialized agencies of the United Nations and other sub-regional institutions to address the problem of droughts and other adverse weather phenomena. These meetings led to the conception of a project on Drought Monitoring for Eastern and Southern Africa (RAF/88/044) funded by the United Nations Development Programme (UNDP) with the World Meteorological Organization as the executing agency. This resulted in the establishment of the DMCs, one located in Nairobi (Kenya) and the other in Harare (Zimbabwe). The Harare centre has now become a fully SADC project supported by funds from Belgium.

The DMC establishes and updates historical and near real-time regional, climatological, agrometeorological and hydrological data. DMC is also involved in the training of member countries' personnel as well as participating in international fora on climatological and environmental issues. Other roles of DMC include establishing linkages with existing food security and early warning systems in the sub-regions and collecting and processing available information on the status of vegetation. The DMCs assist in identifying vulnerable regions and assessing the probability of recurring droughts, contributing to planning and to the design of mitigation measures. Applied research is conducted and products and services are prepared and disseminated in a timely manner to contribute to early warning systems.

Support to disaster management is made through five phases: mitigation, preparedness, response, recovery and data bank updating. Generally, DMC support to early warning

encompasses contributions in all five phases. Products include dekadal and monthly bulletins, agrometeorological conditions, tables of monthly and tri-monthly rainfall amounts and anomalies etc. The bulletins contain monthly climate data, NDVI, temperature anomalies (maximum and minimum), climatological summaries, drought severity indices and weather outlook.

The information is available to the Internet community on the DMC home page at http://www.meteo.go.ke/dmc.

Zimbabwe Meteorological Services

Dr M. C. Zinyowera reported on weather observations conducted by the Zimbabwe meteorological services including rainfall, synoptic, climatic and agrometeorological. These observations use an extensive data collection network that includes 1,150 rain gauges, 14 synoptic, four agrometeorological and 63 climatological stations. Data are also obtained from regional stations. The purpose of the data collection system is to support the real-time weather analysis and forecasting programme and to create a climate database for agrometeorological and advisory work. The data are also used to provide derived statistics for specialized users and to respond to specific requests.

He stated that the most common user requirements are a 24-hour forecast of rainfall occurrence, site-specific seasonal forecasts and warnings of extreme weather conditions such as thunder storms, lightening, etc. Specialized users like the aviation and touring industries also require special forecasts. Unfortunately it is not economically feasible to expand the number of observation points to the level required for a geographically specific forecast.

The presentation identified other dissemination networks including the Drought Monitoring Centre, other national meteorological services, national users and research institutes, international users, Ministry of Agriculture and farmers. The forecasts are disseminated through radio, television, newspapers, telephone, Internet, personal visits and workshop briefings. Information products are in the form of weekly reports, ten-day reports, monthly reports, annual reports, etc.

The Role of the WMO CLIPS Programme

Dr Michael Harrison presented WMO's Climate Information and Prediction Services (CLIPS) which is at the interface between the development of climate products and their application. Its activities encompass training, demonstrations/pilot projects, research and networking. Dr Harrison acknowledged the user's need for reliable and accurate forecasts but explained that use of probability is consistent with the background science and the reality of the situation and it also provides the users with the best value possible.

Various systems of verifying information such as the WMO Standardized Verification System (SVS) were addressed. Through this system information is provided to users and subsequently it is observed whether the conditions forecast occur or not. If they do not, then the forecast is considered wrong. Contingencies are made to deal with wrong forecasts.

CLIPS is addressing the issue of what the meteorologists predict versus what the users wish to know. Dr Harrison noted that even when information is available, the way it is communicated to users can lead to misunderstandings. For instance, if users are told that there is a 30% chance of drought this coming season, they would react differently from the way they would if told that there is a 70% chance of no drought this coming season.

African Centre of Meteorological Applications for Development (ACMAD)

Mr M.S. Boulahya reported on the role of the African Centre of Meteorological Applications for Development (ACMAD), which serves as a regional data bank where data are processed and distributed to countries in order to build the capacity of National Meteorological Services to provide climate products. ACMAD also receives data from other countries after a protocol is signed.

Need for meteorological data and products is evident for all social and economic activities in Africa such as food security, malaria forecasting, hydrological management and early warning systems. In order to achieve its mission, ACMAD addresses the questions: “Which scientific strategy is best adapted for Africa?” and “Which delivery methods are the best?”.

Communication is a major emphasis of the ACMAD programme, particularly using inexpensive radios. The new information technology for rural communication that uses radios and the Internet (RANET) aims to strengthen the use of meteorological services. Information from WMO, NOAA, ACMAD, NMSs and universities is obtained from the Internet and combined with information drawn from ministries and NGOs. This information is synthesized and released to the rural community through the radio.

5. Application of Seasonal Forecasts

Peru Case Study (International Research Institute)

Dr Kenny Broad reported on a study involving a detailed assessment of the social impacts of forecasts, through a combination of interviews, participant observations, occupational/mixed focus groups and surveys. The environmental impact of the forecast is also assessed using parametric and non-parametric analysis of variance, contingency tables analysis, Monte Carlo simulations, optimal estimation, satellite observations and ecosystem modelling.

The main theme of the presentation is the implications of climate forecasts within the Peruvian fishery industry. The industry has several groups including industrial fishermen, artisanal fishermen, net fishermen, regulatory administrators and scientists, conservation groups, media, politicians and foreign interest groups. The reaction of all these groups to climate forecasts varies because they have different and sometimes conflicting interests. The conservation group would be interested in a sustainable fishery, the politicians' main interest is overall welfare and re-election, industrial fishermen would like a large profit while artisanal fishermen wish to maintain fishing traditions. The challenge is how to disseminate climate information in a proper format and in an equitable manner to all the groups.

Decisions on whom to give the best forecasts are based on the type of output being emphasized, e.g. GNP or resource sustainability, and on the status of regulatory power whether low or high. The assumption is that forecasts enable the anticipation of fish location and increased extraction (threatening future fish stocks) and that domestic regulators have a goal of resource sustainability (i.e. a desire for future fish abundance).

Zimbabwe Case Study (Resource Limited Farmers)

Jennifer Phillips reported on a study designed to delineate the potential role that seasonal forecasts could play in farm management for the small farm sector in Zimbabwe. A survey was conducted across a range of agro-climatic zones during the 1997/98 El Niño season (225 households) and the 1998/99 La Niña year (450 households). Specific objectives of the survey were: (1) to identify and catalogue the use of traditional climate forecasting schemes; (2) to assess access to seasonal climate forecasts issued by the Zimbabwe Meteorological Service; and (3) to evaluate current opportunities and constraints in the farming system which may limit the adoption of forecasts in decision-making.

The farming systems found in communal areas in Zimbabwe are very much shaped by exposure to risk, much of this risk being related to climate variability. The use of credit, for example, is very low, especially now that the government has greatly reduced support for agricultural loan programmes. Until skill level and confidence in the forecasts is improved, increases in the extension and use of credit for purchased inputs to take advantage of favourable years are not likely to be felt among small farmers in Zimbabwe.

Although forecasts of the starting date of the rainy season were commonly cited as potentially helpful, it seemed that medium-term forecast information (7-10 days) would be more likely to be of value in helping farmers determine planting dates than seasonal forecasts, given the limitations in skill and temporal resolution.

This study found evidence that farmers do vary both crop and variety selections as a function of expectations for the season. For example, a 16% increase in the number of farmers intending to plant maize and an equal decrease in the number intending to plant pearl millet relative to

what they said they "normally plant" was found in 1998/99, given expectations of a good year. The percentage of farmers intending to add maize to their crop mix was even higher (35%) when restricted to the drier natural regions 4 and 5, where maize often fails even in ‘normal’ years and millet and sorghum are the dominant crops.

In 1998/99, the number of people who reported as having heard the official forecast dropped from over 90% to less than 40% as a result of the lack of media attention. Nonetheless, given the prevalence of traditional forecasting schemes, which are based on factors ranging from winds and flowering on trees to forecasts delivered via village spirit media, almost all farmers interviewed had some expectation of conditions for the season. In both 1997/98 and 1998/99, the majority of accounts of the traditional forecast were in agreement with the official forecast. A better understanding of local perceptions of climate phenomena and factors used in traditional forecasts would help in developing appropriate dissemination pathways and messages. Efforts are currently under way to develop a radio programme in collaboration with the Zimbabwe Meteorological Service and the Ministry of Agriculture's Extension Service to increase climate forecast awareness among the rural population with hopes of improved understanding and interpretation of seasonal predictions and potential applications.

There are opportunities for resource-limited farmers in Zimbabwe (and potentially elsewhere) to utilize seasonal forecasts to improve crop production and overall farm management if quality information is available. Attention to forecast accuracy and potential risks associated with forecasts need to be considered in defining what is meant by ‘quality’ information. Applications encouraged in this context should probably be limited to safe strategies such as shifts in the area planted to drought-tolerant and drought-vulnerable crops and changes in the total area planted, with the degree of alteration being defined by the degree of certainty in the forecast. Ultimately, communication efforts need to focus on the probabilistic nature of climate predictions and implications for impacts under a range of management alternatives, so that final management decisions are left to farmers themselves, given a clear understanding of the strengths and limitations of the forecast.

Australian Case Study

Dr David White presented the case study on Australia which is a predominantly arid country, with the highest variability in rainfall and runoff of any continent in the world. This is primarily because of the dramatic influence of ENSO, the El Niño-Southern Oscillation, centred in the Pacific Ocean, although Indian Ocean influences are also important in the south and west of the country. The soils are predominantly fragile and infertile and therefore easily eroded. Its agriculture is mostly extensive, low input and unsubsidized, the major products being sheep, cattle and wheat.

In the past, droughts were regarded as disasters even though they would occur time and time again within a particular environment. This required frequent government intervention. Drought is now recognized as a natural consequence of having a variable climate and must be planned for accordingly. The National Drought Policy, in place since 1992, emphasizes increased self-reliance and risk management by farmers and protection and maintenance of the natural resource base. Government funding has therefore been provided for these aims to be achieved, including improving the reliability and value of seasonal forecasts.

Seasonal forecasts are be based on statistical models, relating rainfall data to the Southern Oscillation Index (SOI) and Pacific (and Indian) Ocean Sea Surface Temperatures. Phases of the SOI are also being used extensively in north-eastern Australia. CSIRO and the Bureau of Meteorology Research Centre are also engaged in developing and testing General Circulation (Global Climate) Models (GCMs) as an alternative means of forecasting seasonal anomalies.

The value of seasonal forecasts depends on their accuracy and marginal value compared with other information (e.g. recent rainfall, status of soil moisture, pasture and crop biomass, or more traditional indicators). The value is also based on identifiable benefits in terms of productivity and protection of the soils and vegetation and the capacity of farmers to respond to the additional information within a particular environment and farming system. Some simulation studies with cropping systems have identified significant benefits of using seasonal forecasts, particularly in north-eastern Australia. However other studies, particularly with pastoral systems, have shown little financial benefit, though some environment benefits (e.g. more pasture biomass at critical times), from having even reliable seasonal forecast information. In part this is a consequence of insufficient lead times and decision opportunities (e.g. annual cattle muster in very remote areas). Consequently, farm surveys are being used to identify circumstances under which seasonal forecasts may be of value.

Seasonal forecasts in combination with agronomic, environmental, soil water and farm income data are used to determine areas for declaration as being in Drought Exceptional Circumstances. This is a prerequisite for financial intervention by the government, the severity of drought being beyond the bounds of normal risk management.

The meteorological criteria require that a drought be of at least 1 in 20 to 1 in 25 in severity and of more than 12 months' duration. Obviously an exceptional drought in the rangelands may require drought conditions over several years, compared with 15 months' duration in the higher rainfall zones. A national study has been conducted to identify the occurrence of the most important indicators of exceptional drought, the results having been published in a special issue of *Agricultural Systems*.

Other Applications of Climate Information

Mr Peter Chola (Zambia Hydrological Services) and Mr Owen Hughes (FAO, Zimbabwe project) discussed other applications of climate information. Mr Chola noted the close relationship between hydrological (surface/ground water) and meteorological (rainfall occurrence, location, intensity and duration and temperature) parameters. For instance, more rainfall can create floods, ground water recharge and poor water quality, while low rainfall is associated with drought and good water quality. High temperatures can result in high evaporation and aridity while the opposite is true for low temperatures.

Meteorological information can be used in the design of hydraulic structures like dams, weirs, wells, boreholes, bridges, river training, as well as for irrigation schemes. This information can also be used in Early Warning Systems for flood/drought, wave action (currents) and disaster management. The use of meteorological data in groundwater recharge and domestic and livestock watering cannot be over emphasized.

An integration of meteorological and hydrological information is required in designing drought and flood coping measures. In this regard, the Hydrological and Meteorological Services in Zambia have several collaborative links such as research, water assessment project/ programmes and integrated development planning.

Mr Hughes noted that the use of climate information must go hand in hand with farmer training so that small-scale farmers can improve their farm decisions. Although the speaker noted that the main interest of the FAO's work is in farm management and land use planning, climate information is compiled and distributed to farmers every month. The FAO has undertaken several pilot projects which apply adult learning principles and assist the farmers to understand their ecosystems better.

6. Working Groups

Session I: Needs, Gaps and Traditional Forecasts

The purpose of the working group was to identify the needs for climate information in the agricultural community, existing gaps in information services and the role played by local and traditional forecasting in sustainable agriculture and food security. Workshop participants were organized so that each of the three groups represented both the information providers as well as the information users. The following three questions were addressed:

1. Based on your perception of yesterday's discussions, what are the five most important needs of the agricultural community for climate information?
2. What gaps exist between climate information products and these needs? What are the principal measures by which these gaps can be addressed?
3. Country surveys identified traditional indicators as one of the primary means by which farmers make operational decisions on farm management. What measures should be taken to combine this traditional knowledge with contemporary climate forecasts?

Results

Farmers need access to timely and accurate climate forecasts. Specific information required by farmers includes length of the rainy season (beginning and ending dates of rains), short-range forecast (24 hours) for tactical decisions and medium range forecast (5-10 days) for strategic decisions. They also need information on expected total rainfall for the season and the occurrence of dry spells or any shortfall for crops. Information on extreme events, i.e. floods, droughts and hot winds is also necessary for risk aversion strategies. Furthermore, the forecast should be in a local language and packaged using locally understood concepts.

The main gaps in meeting the above needs are poor communication systems, general lack of communication/interaction between users, intermediaries and information providers and poor packaging of climate information for farm management decisions. The language used is too technical and sometimes in a foreign dialect. This problem is made worse by the limited training of users in interpreting and applying climate information. There is a general lack of confidence in climate information/forecasts. Farmers also have other weather-related problems such as lack of availability of inputs and credits.

In order to close these gaps, the quality of forecasts and their relevance to farming systems needs to be improved. There is a need to improve the understanding of the message among both mid-level users (agriculture extension people, teachers, seed suppliers, etc.) and end-users (farmers). Traditional or local structures to disseminate information need to be established. The implication to meteorological services is improved lead-time, more frequent forecasts and better spatial and temporal coverage.

Research to identify and catalogue traditional indicators that correspond to western scientific terms needs to be promoted. There is a need to integrate traditional knowledge into both forecast methods and dissemination. Traditional forecasters should be involved in product development and the dissemination of forecasts could also promote the use of traditional indicators.

Session II: Developing a Programme Action Plan

The purpose of the working groups in this session was to determine how to encourage cooperation on climate/drought information products, information delivery and training between meteorological, hydrological, and agricultural services, NGOs, donors and regional organizations.

The working groups were based on the findings of the discussions which took place during the first two days of the workshop. The objectives of those discussions were to provide guidance in formulating a programme to enable farmers make better use of indigenous and contemporary knowledge on climate and drought to make strategic and tactical on-farm decisions. The discussions on climate information products, services and users had identified the most important needs and gaps and the measures by which those gaps could be closed.

The specific tasks for the groups were to define and prioritize the expected outputs of a programme to tailor climate/drought information products, information delivery and training to meet user needs. The groups also identified key activities to achieve these output priorities. Where appropriate, timelines and inputs were included. Three working groups were formed based on western, eastern, and southern Africa regional representation.

Recommendations

The groups recommended a strong link between providers and users through the integration of contemporary and traditional indicators. This effort should be enhanced by establishing a network of providers and users and overcoming communication barriers such as languages. The groups recommended an improvement in the precision and quality of the products in response to farmers' needs. Farmers should access timely seasonal forecasts at appropriate scales for better tactical and strategic decisions. Furthermore, a user-focused system of evaluation and feedback needs to be developed.

Multiple communication and training systems should be identified that involve radio programmes, NGOs, governments, etc. The group proposed the recruitment of a communications specialist who would work on the dissemination of climate information and establish mechanisms of obtaining feedback from farmers.

The group recognized that research to identify decision-making options that are accessible to farmers in order to enhance the understanding of user needs should be a part of the programme and that user decision options have to be linked to indigenous knowledge as well as climate information.

7. Conclusions

The workshop results demonstrate clearly that action needs to be taken at the producer, communications and user levels to enhance the use of climate forecasts in farmer decision-making. These actions should be based on identified user needs and gaps. The user needs include short- and medium-term forecasts. General information on the length of the season and expectations on what the season is going to be like is also vital.

The main gaps in meeting these needs were identified as poor communication between producers and users which in some cases results in the distortion of the message given to farmers. These gaps are coupled with limited knowledge of biophysical implications of traditional indicators that are widely used by farmers. The farmers also reported that climate forecasts do not get to them in time to allow the farmer to alter his farm operations. In some cases the products are too technical and produced in a foreign language. It was apparent from the workshop that the value of contemporary climate forecast in farmer decision making has not been demonstrated, which is a real challenge to this programme.

Several options to address the gaps were discussed, including research in areas of traditional indicators, demonstrating the value of contemporary forecasts in the farmer decision making process and improving the quality of the forecasts. There is a great need to improve communications between producers and users, a challenge which calls for the engagement of a media group during programme implementation. The workshop output could be used to define the terms of reference for training experts whose tasks would be to provide better interpretation and understanding of climate forecasts by farmers and extension workers.

Partnership and collaboration by national, regional and international institutions and agencies that would support the implementation of training, research and demonstration projects within a few African countries was recommended by the workshop.

Annex I: Opening Statements

Dr M.V.K. Sivakumar (Chief, Agricultural Meteorology Division, WMO, Geneva) welcomed the participants on behalf of the Secretary-General of WMO, Professor G.O.P. Obasi, to the International Workshop on Coping with Drought in Sub-Saharan Africa and thanked the Government of Zimbabwe for having agreed to host the workshop. He thanked Dr M.C. Zinyowera, Director of the Department of Meteorological Services of Zimbabwe and the Permanent Representative of Zimbabwe with WMO, and his colleagues who had been working hard to ensure that all arrangements for the Workshop were efficiently made on time. He conveyed his thanks to Dr Donald Wilhite from the US National Drought Mitigation Center, University of Nebraska. and Drs Peter Gilruth and Lucy Mwangi from UNDP, New York, who had been primarily responsible for the preparatory work prior to the Workshop.

He further elaborated on the close link between drought and household food security which is directly influenced by agricultural performance. He pointed out that through WMO there is global availability of real and near-real time weather and climate information, which are essential for a sound agricultural performance. In this regard, WMO and its 185 member countries operate a unique worldwide system for the collection, processing, distribution and exchange of weather information and warnings. For example, prediction of El Niño and the associated impacts are becoming possible, with reasonable skill. Such knowledge enabled WMO and NMHSs to successfully provide early warnings about the strong 1997/98 El Niño and the 1998/99 La Niña events and to contribute to the mitigation of their impacts in many parts of the world.

He reported on the institutional roles of the Climate Information and Prediction Services (CLIPS) project and the Agricultural Meteorology Programme (AgMP) of WMO, the African Center of Meteorological Applications for Development (ACMAD) and Drought Monitoring Centres (DMCs) in meeting farmer needs. He highlighted that the Commission for Agricultural Meteorology (CAgM) at its twelfth session in Accra, Ghana, in February 1999 recommended that weather forecasts should be tailored to the requirements of agriculture for better day-to-day tactical decisions by farmers, especially during the seeding and harvesting periods. Weather services should also provide strategic information on e.g. the onset of rains that could serve the needs of the farming community.

Dr Sivakumar was grateful that the Workshop included representatives from different countries in sub-Saharan Africa where farmers grow a wide range of crops and hence have a variety of requirements for climate information.

In his opening remarks **Dr Tijan Jallow (UNDP/UNSO New York)** pointed out that the Workshop marked a culmination of a year of planning. He observed that the Workshop context fitted well within the United Nations Convention to Combat Desertification (UNCCD) whose main focus is to build on local capacity and knowledge. He stressed that drought issues should be integrated in national development programmes. Furthermore, desertification programmes should include drought preparedness and mitigation, given its importance in poverty eradication and food security, and proactive initiatives should be undertaken in order to reduce vulnerability to drought.

He called on the participants to extend their collaboration beyond the workshop and to utilize the ensuing recommendations to shape their future initiatives. He observed that a demand-driven approach should be emphasized and used during the implementation of the UNCCD. Dr Jallow also stated that the outcome from the Workshop would be shared with a larger community of partners during the COP-3 Panel on Drought Preparedness and Mitigation (DPM) to be held in Recife, Brazil.

Mr Isaya Higa (Environmental Specialist, UNDP, Harare) stated that drought and desertification have a great impact on economic and social development of the world's drylands in which approximately 40% of the world's population live. He further pointed out that drought and desertification result in an economic loss of 42 billion dollars per year with additional impacts on the economics of people living in drylands through erosion of their ability to meet the basic necessities of life, e.g. food, water, shelter and clothing. He concluded by stating that in addressing drought preparedness and mitigation, we are aiming at fulfilling UNDP's mission of sustainable development.

Mr S. Marume (Permanent Secretary, Ministry of Transportation, Zimbabwe) welcomed the participants to the friendly town of Kadoma and, on behalf of the Government of Zimbabwe, officially opened the Workshop. Mr Marume observed that while significant progress had been made in keeping weather services in industrialized countries up to date with technology, most National Meteorological Services (NMSs) on the African continent still struggle to maintain an optimum observational network and data processing facilities. Therefore, African approaches to mitigating weather/climate-related disasters have been reactive rather than proactive.

He commended both the sponsors and the local organizing committee for working tirelessly to make the meeting a reality. He hoped that the workshop deliberations could result in a clear agenda on future cooperation in the use of seasonal forecasts, climate information and indigenous knowledge to support farm-level decision-making. He warned the participants not to despair if at the beginning the going gets tougher than anticipated because the Workshop goals were very difficult. He was encouraged that many users were present and participating in the Workshop deliberations. He pointed out that the Workshop was an excellent platform for them to express their views, concerns and requirements and to share their experiences. He concluded by wishing the participants a successful meeting and encouraged them to enjoy the hospitality of Zimbabwe.

Dr Peter Gilruth, UNDP/UNSO New York, and the Workshop Facilitator, Dr Donald Wilhite, US National Drought Mitigation Center (NDMC), introduced the Workshop background and objectives. They explained that UNDP/UNSO has the mandate to support dryland development in UNDP programme countries, particularly those affected by drought and desertification. UNDP/UNSO's focus has evolved over the years; in 1970s the main activities were feeder road construction, in the 1980s reforestation and fuel wood conservation projects and in the 1990s upstream projects with support to pilot activities through the NAP process. UNSO provides institutional support to affected countries for the process of developing and implementing the NAPs, as well as technical support for the creation and implementation of thematic programmes such as Drought Preparedness and Mitigation (DPM).

They further stated that the CCD supports actions at the local level and promotes the use of traditional knowledge through a bottom-up approach. The CCD is also a rallying point for dryland development, with concepts of popular participation in desertification control programmes. The majority of effort for the CCD implementation has gone into defining National, Sub-Regional and Regional Action Plans as the necessary frameworks for implementation of the convention. In many cases drought management has not received as much attention as expected. UNDP/ UNSO would provide support to countries which have identified drought preparedness and mitigation as a priority.

They identified the following as the expected outcomes of the Workshop:

(1) Better clarification of farmer/herder realities in regard to the use of climate information.
(2) Better clarification of farmer/herder needs in regard to climate information.

(3) Recommendations and strategies on how to make better use of the complementarity of traditional and contemporary information.
(4) Recommendations and strategies on how to build capacity within extension systems to meet these stated user needs.
(5) Recommendations and strategies on how to focus information products to users as a function of the above.
(6) Components of a pilot programme that would bring the elements under (3), (4) and (5) together.
(7) Identification of possible partners and network members that such a pilot programme would draw upon for programme implementation.

Dr Gilruth and Dr Wilhite stressed the need to understand and present the information flow from a demand-driven perspective. They explained that the Workshop was to make use of plenary sessions, working groups and technical presentations to achieve the objectives. Identifying the user needs through the farmers' and livestock managers' panel and the national consultants' panel would be the first step. Once the needs were identified a panel of agricultural extension officers would be called upon to present the needs and constraints from their perspective and as a function of the needs expressed by the farmers. Finally, the technical presentations would follow to address the needs of the previous presenters. They urged the participants to be guided by the spirit of responding to user needs.

Annex II: List of Participants

NAME OF PARTICIPANT	ORGANISATION	CONTACT DETAILS	TEL/FAX/E-MAIL
Boulahya M.S. (Director General)	ACMAD	B.P. 13184 Niamey NIGER	Tel: 227-734992 Fax: 227-723627 Telex: 5407Ni Email:acmadem@acmad.ne
Broad K. Dr	IRI	Intnl. Research Institute for Climate Climate Prediction 61 Rt. 9W Palisades NY 10964 USA	Tel: 1-914-365-8762 Fax: 1-914-365-8366 Email: kbroad@iri.ldeo.columbia.edu
Chidzambwa S. (Meteorologist)	Zimbabwe Met. Services	Box BE 150 Belvedere Harare	Tel: 263-4-774894 Fax: 263-4-774890/774897 Email: wforecast@weather.utande.co.zw
Chingwena E. (Farmer/Chief's Messenger)	Drought Mitigation Project	Nyamanyanya School P. Bag 2088 Rushinga	
Chiwaridzo R.T. (Retired Agritex Officer)	Communal Farmer	Box 6 Murombedzi	
Chola P. (Deputy Director)	Dept. of Water Affairs	P.O. Box 50288 Lusaka ZAMBIA	Tel: 260-1-254715/751043 Fax: 260-1-250721/252589 Email: hydro@zamnet.zm
Diagne G.M. (Agrometeorologiste)	Meteo-Senegal	DMN BP 8257 DAKAR	Tel: 221-8200874 Fax: 221-8201327 Email: bamar_diagne@yahoo.fr
Diallo A.A. (Director General)	Agrhymet Regional Center	BP 11011 Niamey NIGER	Tel: 227-733116/733987 Tel: 227-732435 Tel: 5448NI Email: admin@sahel.agrhymet.ne Email: adiallo@sahel.agrhymet.ne Web:http://www.agrhymet.ne
Diarra B.	Meteorological Services –Mali	Direcction Nationale de la Meteorologie Chef Division Rechechet et Development Direction Nationale de la Meteorologic B.P. 237 Bamako MALI	Tel: 00-223-292101 Fax: 00-223-292101 Email: dmn@malinet.ml
Dube S.	Matopos Research Station	44 Churchill Road Bellevue, Bulawayo ZIMBABWE	Tel: 083-8256 Fax: 083-8253

Garanganga B.J. (Coordinator)	DMC-Harare	Box BE 150 Belvedere Harare	Tel: 263-4-774890 Fax: 263-4-774890 Email: dmc@weather.utande.co.zw
Gilruth P. (Technical Director)	UNDP/UNSO	304 E 45th St, Rm 916 New York, NY 10017 USA	Tel: 1-212-906-6622 Fax: 1-212-906-6345 Email: peter.gilruth@undp.org
Gning M. (Agronome)	Direction Agriculture	B.P. 486 Dakar SENEGAL	Tel: 822-01-00/8213250 Fax: 8220100
Gwata C. (Research Fellow)	University of Zimbabwe	Dept. of Agricultural Economics & Extension P.O. Box MP 167 Mount Pleasant Harare	Tel: 263-4-303211 Ext 1582 Fax: 263-4-303544 Email: cgwata@compcentre.uz.ac.zw
Harrison M. Dr (Chief CLIPS Project Officer)	World Meteorological Organization	7bis, Ave de la Paix 1211 Geneva 2 SWITZERLAND	Tel: 41-22-7308273 Tel: 41-27-7308042 Email: harrison_m@gateway.wmo.ch
Hughes O. (Int. Res. Mgmt. Officer)	FAO	Sub-regional Office for Southern and Eastern Africa Harare, ZIMBABWE	Tel: 263-4-791407 Email: Owen.Hughes@fao.org
Jallow Tijan	UNDP/UNSO	One UN Plaza New York USA	Tel: 212-906-6613 Fax: 212-906-6345 Email: tijan.jallow@undp.org
Kimani J.M. (Scientific Team Leader)	DMC-Nairobi	C/o Kenya Met. Department Dagoretti Corner Ngong Road P.O. Box 30259 Nairobi	Tel: 254-2-567864 Fax: 254-2-567888 Email: joseph.kimani@lion.meteo.go.ke
Leramo B.K. Dr	Min. of Agriculture	P.O. Box 62938 Addis Ababa ETHIOPIA	Tel: 251-1-18-3671/186872 Fax: 251-1-614996
Lucio F.D.F Mr (Agrometeorologist Researcher)	Instituto Nacional de Meteorologia	P O Box 256 Maputo MOZAMBIQUE	Tel: 258-1-493193 Fax: 258-1-491150 E-mail: flucio@zebra.uem.mz
Malusalila P.	Seed Co. Ltd. – Zimbabwe	Box WGT 64 West Gate, Harare ZIMBABWE	Tel: 263-4-308881 Fax: 263-4-308898 Email: percyma@seedco.samara.co.zw
Mdladla P. (Senior Economist)	SADC Regional Early Warning System for Food Security	P.O. Box 4046 Harare	Tel: 263-4-796847/8 Fax: 263-4-795345 Email: pmdladla@fanr-sadc.co.zw
Mamadou S. (ingenieur d'agronomie)	OHVN	Chef du Services de Vulgarisation Agucole- OHVN BP 178 Bamako MALI	Tel: 223-231019/223502/224069

Masamvu K. Dr	SADC/REWU	P.O. Box 4046 HARARE	Tel: 263-4-736051/2 Fax: 263-4-795345 Email: kmasamvu@fanr-sadc.co.zw
Masikati C. (Meteorological Engineer)	Zimbabwe Met. Services	Box BE 150 Belvedere Harare	Tel: 263-4-774891/2/5 Fax: 263-4-774890/774897 Email: engineer@weather.utande.co.zw
Masundire R.T.	SADC/REWU	P.O. Box 4046 Harare	Tel: 263-4-736051 Fax: 263-4-722715 Email: rmasundire@fanr-sadc.co.zw
Mckay V. (Administrator)	Zimbabwe Grain Producers Association	P.O. Box WGT 390 Westgate Harare	Tel: 263-4-309800/19 Fax: 263-4-309849 Email: zgpa@cfu.co.zw
Morris D.W.	Dimon Zimbabwe P/L	1 Moss Close Northwood Mount Pleasant Harare	Tel: 263-4-301415 Fax: 263-4-301415
Mukajami J.T. (Statistician)	Central Statistical Office	P.O. Box CY 342 Causeway Harare	Tel: 263-4-706682/8
Mutikani V. (Senior Agronomist)	National Early Warning Unit	Box CY 639 Causeway Harare	Tel: 263-4-794601/707311 Fax: 263-4-730525 Email: zimnewu@gta.gov.zw
Mwangi Lucy Dr	UNDP/UNSO	UNDP/UNSO 432 College Drive Edison, NJ 08817 USA	Tel: 212-9065724/732248 7765 Fax: 212-9066345/732248 7765 Email: mwangiza@juno.com Lucy.mwangi@undp.org Lucymuhoro@hotmail.com
Ngugi R. K. (Lecturer)	University of Nairobi	P.O. Box 34336 Nairobi KENYA	Tel: 254-2-246818/223624 Fax: 254-2-223624 Email: modern@insightkenya.com
Oduor J.O.	SAO/Early Warning Unit	Min. of Agriculture Kilimo House Crop Development Division P.O. Box 30028 Nairobi	Tel: 254-2-719013/718871 Ext. 48075 Tel: 254-2-713901 Email: ma@edc.or.ke
Patt A.	Harvard University	BCSIA 79 John F. Kennedy Street Cambridge MA 02138, USA	Tel: 1 –617-5102340 Fax: 1-617-4958963 Email: patt@eps.harvard.edu
Phillips J. Dr (Research Scientist)	Center for Climate Systems Research Columbia University	NASA/GISS 2880, Broadway New York, NY 10025 USA	Tel: 1-212-678-5572 Fax: 1-212-678-5552 Email: jphillips@giss.nasa.gov
Sahanga M.V. (Principal Met. Officer)	Zimbabwe Met. Services	P.O. Box BE 150 Belvedere Harare	Tel: 263-4-774891/2/5 Cell: 011-605266 Fax: 263-4-774890/774897 Email: stn_manager@weathet.utande.co.zw

Shoko M. (Technical Advisor)	UNDP	NAP Project P.O. Box A1524 Avondale, Harare	Tel: 263-4-705671 Fax: 263-4-737953
Shumba O. Project & Research Section Head	SAFIRE	SAFIRE 10 Lawson Avenue Milton Park Harare	Tel: 263-4-795461/794333/091 339 161 Fax: 263-4-790470 Email: owen@safire.co.zw
Sibanda G. (Farmer)	Drought Mitigation Project	Mlambapele School P. Bag 188 Gwanda	
Simela D. (Publications Officer	Agritex	Box 1927 Bulawayo	Tel: 263-9-67161/3 Fax: 263-9-77258
Sivakumar M.V.K. (Chief, Agricultural Meteorological. Division)	World Meteorological Organization	7bis, Ave de la Paix 1211 Geneva 2 SWITZERLAND	Tel: 41-22-7308380 Tel: 41-27-7308042 Email: sivakumar_m@gateway.wmo.ch
Stewart M.M.	NOAA Office of Global Programs	1100 Wagne Ave Suite 1210 Silver Spring MD 20910, USA	Tel: 1-301-427-2089 Ext 144 Fax: 1-301-427-2082 Email: stewart@ogp.noaa.gov
Thiaw W. Dr (Director African Desk)	Climate Prediction Center NCEP/NOAA	5200 Auth Road Camp Springs, MD 20746 Washington DC, USA	Tel: 1-301-763-8000 Ext 7566 Fax: 1-301-763-8125 Email: wthiaw@ncep.noaa.gov
Tsikai R.P. (Extension Worker)	Nyanga Agritex	P. Bag 2052 Nyanga	Tel: 385 Nyanga
Unganai L.S. (Principal Meteorologist)	Zimbabwe Met. Services	Box BE 150 Belvedere Harare	Tel: 263-4-774891/2/5 Fax: 263-4-774890/774897 Email: advisor@weather.utande.co.zw
White David Dr (Director)	ASIT Consulting	P.O. Box 328 Hawker ACT AUSTRALIA 2614	Tel: 61-2-62545936 Fax: 61-2-62552455 Email: dwhite@acslink.aone.net.au Web:http://www.acslink.aone.net.au/asit
Wilhite D.A. Dr (Director)	University of Nebraska	National Drought Mitigation Center Intl. Drought Information Center Professor, School of Natural Sciences 241 L.W. Chase Hall Lincoln, NE 68583-0749	Tel: 402-472-4270 Fax: 402-472-6614 Email: dwilhite1@unl.edu Web: http://enso.unl.edu/ndmc
Wodajo T. Mr	Ethiopia NMSA	P.O. Box 1090 Addis Ababa ETHIOPIA	Tel: 251-1-519441/251-1-512299 Fax: 251-1-517066 Email: nmsa@telecom.net.et

Zinyowera M.C. Dr (Director)	Zimbabwe Meteorological Services	Box BE 150 Belvedere Harare	Tel: 263-4-774893 Fax: 263-4-774890/774897 Email: zimmeteo@weather.utande.co.zw

Annex III: Workshop Agenda

Kadoma Ranch Hotel and Conference Center, 4-6 October 1999

Monday, 4 October

0800-0900	Registration
0900-0930	Welcome PS Ministry of Transportation (for) Dr S. Mayume Mr Isaya Higa, Environmental Specialist, UNDP Harare Dr M.V.K. Sivakumar, Chief, Agrometeorology Division, WMO Mr Tijan Jallow, Deputy Director, UNDP/UNSO
0930-1000	Coffee Break (and Group Photo)

SESSION I: INTRODUCTION AND BACKGROUND

1000-1030	Background and Workshop objectives Don Wilhite, NDMC and Peter Gilruth, UNDP/UNSO
1030-1130	Presentation of Country Case Studies (Moderator: Dr Lucy Mwangi, UNDP/UNSO) Country consultants (10 minutes each**)** Dr Robinson Kinuthia Ngugi-Kenya, Mr Diarra Birama-Mali, Mr Filipe Domingos Lucio-Mozambique, Mr Gorgui Bamar Diagne-Senegal, Mr Owen Shumba-Zimbabwe, Ethiopia (to be confirmed).
1130-1200	Discussion
1200-1330	Lunch

SESSION II: CLIMATE INFORMATION, PRODUCTS, SERVICES, AND USERS

1330-1500	Users of Climate Information: Farmer and Agricultural Extension Panel (Moderator: Mr Malich Gning, Dept. Agriculture, Senegal) Farmers: Mrs C. Clark, Mrs G. Sibanda, Mr E. Chingwena, and Ms W. Waboda Extension Officers: Mr R.P Tsikal and Mr M. Chiwaridzo
1500-1520	Wrap up session (Jennifer Phillips)
1520-1540	Coffee Break
1540-1610	Interactions between Meteorological Services and Users in the Provision of Climate Information (Moderator: Joseph Kimani, DMC/Nairobi) M.C. Zinyowera, Director, Department of Meteorological Services
1610-1640	Use of Seasonal Climate Forecasts by Resource-Limited Farmers Jennifer Phillips, Center for Climate Systems Research, NASA/GISS and Columbia University
1640-1700	Discussion
1700-1715	Wrap-up Session, Day 1 (Donald Wilhite, Peter Gilruth)

Tuesday, 5 October

SESSION II: CLIMATE INFORMATION, PRODUCTS, SERVICES AND USERS (continued)

0800-0815	Plenary session (instructions to working groups)
0815-0930	Climate/Drought Information: A Review of Meteorological, Hydrological, and Agricultural Products and Delivery Services (Breakout Sessions) Purpose of breakout session is to identify the needs and constraints in climate information delivery from the perspective of the extension systems.
O930-1030	Plenary Session: Summary of Breakout Group Discussions (Moderator: To be announced) Chairs or rapporteurs from each group session summarize results with discussion.
1030-1100	Coffee Break
1100-1130	NOAA's Long-Lead Forecasts for Africa (Moderator: Macol Stewart) Wassila Thiaw, Africa Desk, Climate Prediction Center/NOAA.
1130-1200	Constraints and Challenges of Climate Forecast Applications Kenneth Broad, International Research Institute for Climate Prediction
1200-1230	Discussion
1230-1400	Lunch
1400-1430	Application of Seasonal Forecasts and Other Climate Information by Farmers in Decision-Making: An Australian Case Study (Moderator: TBA) David White, ASIT Consulting, Canberra, Australia
1430-1445	Discussion
1445-1515	Building a Partnership with Climate Information and Prediction Services (CLIPS) Programme Michael Harrison, Chief, CLIPS Project Office, WMO
1515-1530	Discussion
1530-1600	Coffee Break
1600-1730	Climate-based Products and Services: Panel (Moderator: Dr M. Zinyowera, Zimbabwe Met. Dept.) M.S. Boulahya, Directeur ACMAD, Owen Hughes, FAO, Peter Chola Hydrological Services, Zambia, Brad Garanganga, DMC Panel will describe their experiences with climate forecasts and information products
1730-1745	Wrap-up (Don Wilhite and Peter Gilruth)
Evening	Reception

Wednesday, October 6

SESSION III: TOWARDS A PROGRAMME ACTION PLAN

0800-0815 Plenary Session (Instructions to break out sessions)
0815-0945 Breakout Group Sessions
Purpose of breakout session is to determine elements for a programme to strengthen the orientation of climate/drought information products, information delivery, and training to meet user needs.
0945-1015 Plenary Session: Summary of Breakout Group Discussions (Moderator: Tijan Jallow)
Chairs or rapporteurs report results of their sessions with discussion.
1015-1045 Coffee Break
1045-1200 Breakout Group Sessions
Purpose is to identify key players and actions at target levels (regional and national/local as priority)
1200-1230 Plenary Session: Working groups report (Moderators: Macol Stewart and Peter Gilruth)
1230-1400 Lunch
1330-1500 Discussion on Next Steps (Moderators: Tijan Jallow and M.V.K. Sivakumar)
1500-1530 Coffee Break
1530-1600 Workshop Wrap-up

Annex IV: Acronyms

UNCCD	United National Convention to Combat Desertification
CLIPS	Climate Information and Prediction Services
WMO	World Meteorological Organization
DMC	Drought Monitoring Center
UNDP/UNSO	United Nations Development Programme, Office to Combat Desertification
NAP	National Action Programmes
DPM	Drought Preparedness and Mitigation
NDMC	US National Drought Monitoring Center
IRI	International Research Institute for Climate Prediction
NOAA/OGP	National Oceanic and Atmospheric Administration, Office for Global Programs
IFAD/GM	International Fund for Agricultural Development, Global Mechanisms
NMHS	National Meteorological and Hydrological Services
AgMP	Agricultural Meteorology Programme
CAgM	Commission for Agricultural Meteorology
COP-3	Third Conference of Parties for UNCCD
ACMAD	African Center of Meteorological Applications for Development
SADC	South African Development Cooperation
SVS	WMO Standard Verification System
NGOs	Non Governmental Organizations
GNP	Gross National Product