

# CHAPTER 11

## COMMUNICATING SEASONAL FORECASTS

MIKE HARRISON  
*Independent Consultant*

JIM B. WILLIAMS  
*Consultant with the NRGroup*

Delivering, taking advantage of, and obtaining benefit from climate information, including predictions, are at least as substantial a challenge as producing the predictions in the first instance. It is also a challenge into which relatively limited resources have been invested so far by comparison to those devoted to the prediction problem. In part that contrast in resources use is underpinned by the relatively well-defined nature of the prediction problem as contrasted to the wide, multi-disciplinary issues raised in terms of taking advantage and receiving benefit from climate information. It is out of the question for this book to delve into all of the issues involved, so extensive are these in terms of different sectors, individual countries, levels of decision makers, concerns/constraints regarding specific decisions, and so on, that we have attempted to provide only an overview in the hope that this will provide context against which individual issues might be considered. Specific examples of the use of climate information, and of the benefits derived therefrom, are provided in Chapters 12 and 13, whereas here the focus is on some of the fundamental issues underpinning climate services. To a certain, but not exclusive, extent the authors of this chapter have taken a perspective related to issues in developing parts of the world, issues that are thought to require a range of additional approaches to the straightforward end-to-end model appropriate to business uses. Nonetheless much of the chapter is relevant to the delivery of business information. Examples are included in Chapters 12 and 13 of both business and development activities. Consideration is given to the context of climate services within international development, the physical delivery of information (including delivery to remote communities), and difficulties in presentational delivery of information. Presentational delivery remains a major impediment to extracting the benefit from climate services, yet remains one to which minimal consideration is given in many instances. The focus here is on the pitfalls of oral information delivery; space precludes detailed coverage of visual information delivery, a further critical area.

### 11.1 Learning to manage climate risk in development

Climate variability has received less attention than other development issues, in part because it has been considered one aspect of the environmental baseline that is not amenable to intervention. Climate clearly impacts development, for example on our ability to achieve the Millennium Development Goals (MDGs)<sup>86</sup>. If future management of climate risks is to be improved then the need is to understand reasons for the relative lack of progress to date, and to incorporate lessons learned into future strategies.

The impacts of climate variability on development are two-fold, direct and indirect.

1. **Direct:** Events such as droughts and flooding take a direct toll on lives, health, livelihoods, assets and infrastructure. Climate directly impacts food and fibre production, and the epidemiology of infectious diseases. Severe or repeated climate shocks can push vulnerable households into a persistent poverty trap when their individual coping responses usually involve divestment of productive assets, such as livestock or land. Without advanced warning, reactive societal safety nets are costly, and difficult to mobilize and target effectively (Benson and Clay 2004; this applies also in developed countries – Cutter et al. 2006).
2. **Indirect:** Although less visible than direct impacts, the indirect impacts of climatic uncertainty are equally serious impediments to development. Knowledge that a region is prone to climate events that endanger resources acts as a disincentive to investment, adoption of innovation and the success of other development interventions, particularly when approaches to the management and mitigation of those events are not available. For the risk-averse decision maker, climatic uncertainty necessitates short planning horizons and conservative risk management strategies that buffer against detrimental climatic events. But this is often achieved at the expense of inefficient resource use, reduced average productivity and profitability, and accelerated resource degradation due, for example, to under-investment in soil fertility inputs or conservation measures.

But in spite of its pervasive importance, and powerful new advances in climate-related science, opportunities have been largely underexploited in decision making not only in Africa, from where most examples are drawn in this chapter, but throughout the globe. Lip service is often paid to climate and its variability, but in practice, studies (Gibberd et al. 1995) have shown

---

<sup>86</sup> See <http://www.undp.org/mdg/abcs.shtml> for a full list of the Goals, the Targets used to specify each Goal, the Indicators used to measure achievement of each Target, and the organisations (mainly UN) with 'ownership' of each Indicator.

that climate information is rarely, if ever, incorporated into planning and management decisions as effectively as it could be.

Why should this be so? By far the majority of water supplies and agricultural production in Africa is dependent on rainfall, which fluctuates considerably from year to year. If water availability and food production are both in such short supply as to be a major brake on development, surely use of climate information to optimise use of these scarce resources should be a top priority?

Many reasons contribute to the low priority given to incorporating knowledge of climate variability into decision-making. It is most important that these be understood and addressed in concert because together they present a formidable obstacle to progress. Recognised reasons include:

1. **Whose responsibility?** In many instances the ability of national ‘resource management systems’ to respond to climate information is weak or non-existent. Resources are not so much ‘managed’ as collectively exploited. Such a system works adequately when population density is low in relation to the resource base, but as populations grow and resource use becomes more intensive, seasonal variation in water (rainfall) becomes ever more important to a growing multitude of stakeholders. Well-informed, coordinated and timely decision processes to proactively manage resources, involving meteorological services, disaster management organisations, agricultural departments and extension services, and so on, then become most important; but this is difficult if neither the information (in many cases in Africa due to collapse in observing and extension networks) nor the system and infrastructure and institutional architectures for making appropriate decisions exist, until an emergency is declared.
2. **Reluctance towards Risk Management:** In the past the occurrence of periodic drought was almost welcomed by mid-level government administrators. All sorts of project failures, from the colonial East African Groundnut Scheme onwards, were written off ‘because of the drought’, with no further questions asked (nevertheless it must be admitted that climate was far from being the only impediment faced by the Groundnut Scheme). It is important that collectively we become more proactive in resource management and include climatic risk in our calculations, amending management decisions as a continuous process rather than working to a fixed schedule. Of course one alternative to risk management is amelioration of resilience to climate variability (irrigation being one example); nevertheless risk management remains a major option in many parts of the world.

3. **Research-Extension Gap:** The agricultural research literature is populated with studies demonstrating the importance of climate variability, and how best to cope with it in different areas. Converting climate information into actionable decisions is not, however, always straightforward. Research systems, in addition, are often isolated from the communities they serve, and beneficial outcomes are difficult to achieve when messages are over-complex for an inadequately trained (or non-existent) extension service to devise appropriate improvements to current practice in farming communities. New appropriate and user-friendly approaches to mass communication of such information are required avoiding the difficulties outlined later in this chapter.
4. **Insufficient Climate Data and Resources Available:** There has been a major decline in the number of climate observing stations, particularly but not uniquely in Africa, over the past 40 years. While this has been compensated, to some extent, by the development of operational weather satellites covering Africa, adoption and use of these new technologies in climate risk management has been slow in coming. In some areas the basic climate network has become so sparse that it will be difficult to detect and quantify climate change trends in these areas, let alone inter-annual variability. Improving the basic network in Africa is a current concern of the Global Climate Observing System (GCOS), based in WMO, among others. Additionally national weather services also often have limited personal and material resources.
5. **Institutional Obstacles:** Climate risk management is an interdisciplinary activity, affecting many economic sectors and aspects of life, but it has no effective champion. In many Meteorological Services in Africa the application of climate knowledge in agriculture, health, water and other sectors is a low priority activity, poorly staffed and weakly focused. Relatively few Meteorological Services in Africa are fully engaged in their country's own national development and disaster risk reduction agendas. Supporting civil aviation services and participating in the global meteorological agenda have for many years been much higher priorities for these Services. As a consequence many climate observing networks are badly run down, and the data that exist are of limited utility and are analysed in a fragmented way, if at all. Some view the introduction of policies to commercialise meteorological and climate services or to seek cost recovery for data collection as an unmitigated disaster with regards to promoting the overall beneficial use of these data.
6. **Farmers know best:** People who have been working their fields for years in traditional manners have usually developed more or less suc-

successful coping strategies based on managing risk. They often have traditional ‘seasonal forecasting’ methods based on bird, animal and plant observations. However while traditional practices may be resistant to change, experience often demonstrates farmers’ desires for ‘other’ knowledge systems that may be used alongside, and perhaps ultimately may displace, local practices. Complementary approaches, rather than replacement, offer a sympathetic way towards the introduction of new technologies, but in doing so it should be borne in mind that:

- Adaptation will be facilitated if new forecasts are treated synergistically alongside traditional methods;
- Traditional methods may not be able to cope with rapid population growth and land fragmentation, or systematic climate change (as in the Sahel during the 1970’s and 1980’s);
- Traditional farmers may resist change from a risk-reduction to a production maximisation strategy until they have an adequate safety net to support them through bad years; insurance safety nets are being piloted in several African countries.

**7. Negative perceptions regarding reliable climate forecast capabilities:**

For many people the very idea of long-term or seasonal climate forecasting is considered an unrealisable dream, or one that challenges a ‘divine prerogative’. While short-term weather forecasting has radically improved with the refinement of satellite coverage and global models, its forward view is restricted to a few days at most, so (they ask) how can one possibly give credit to a three-month forecast? There is thus a significant credibility gap to be overcome, one that will be assisted by providing evidence that the new technology offers effective risk management options.

**11.1.1 TOWARDS RESOLUTION: IMPROVED GOVERNANCE AND IMPROVED SCIENCE**

All problems as outlined above can and must be overcome. In parts of Africa they are reflections of a wider suite of compounding problems over the last 25 years, including weak governance in some cases. Yet, elsewhere, application of climate science is moving forward rapidly, stimulated both by practical everyday requirements to optimise resource management as well as by the urgent need to understand global warming and climate change impacts.

## 11.2 Seasonal to interannual prediction: An overview of its role in decision making

### 11.2.1 THE MANAGEMENT AND SOCIAL BACKGROUND TO APPLICATIONS OF SEASONAL TO INTERANNUAL PREDICTION

There are numerous reasons for using seasonal to interannual predictions in decision making. Planning business processes, both national and international, has provided the motivation in many countries, but equally there is a wide range of potential applications in terms of public good. Included amongst the latter are national and international resource management (including water and food security), disaster preparedness and response, poverty reduction, protection of biodiversity, and the frequently-discussed objective of sustainable development.

Sustainable development, with its agenda of maintaining and improving living standards in a sustainable manner, has been translated with respect to the developing world into actions codified as the MDGs. The underlying principle behind the MDGs is the generation of convergence of multi-country, multi-institutional activities and funding into defined and targeted, internationally-agreed, activities. Of the eight MDGs, most, probably all, have a dependency on climate variability. Even in MDGs such as No. 2, "Achieve universal primary education", for which the climate variability link might not be immediately evident, there are indirect dependencies for which predictions might provide guides. For example, primary education requires, amongst other things, appropriate levels of health, which in turn are dependent upon adequate food and water supplies, and thus on environmental sustainability. Further, social stress, caused by environmental degradation and/or natural disasters, or political stress induced, say, by drought, might undermine the structural basis on which education is dependent. For MDGs such as No. 1, "Eradicate extreme poverty and hunger", and No. 7, "Ensure environmental sustainability", the links with climate variability are more immediately transparent. The view that environmental sustainability, and through that climate variability, underpins all MDGs (which in any case are interrelated and thus interdependent on climate) has been stated in various assessments, including:

- "a healthy environment underpins human life and well-being by providing food, clean water, disease control, and protection from natural disasters – and is thus necessary to achieve each Goal" (UN 2005);
- "ensuring environmental sustainability and access to energy services is key to achieving all of the MDGs" (UNDP 2005);
- "the Millennium Ecosystem Assessment and other global and regional studies have established beyond doubt the linkages between poverty, se-

curity and the environment – achievement of the MDGs and eradication of poverty will not be possible without taking on the issue of environmental sustainability” (UNDP 2005).

The first MDG provides a useful exemplar of the complexity of issues surrounding decision making within the contexts of climate variability and sustainable development. Within a study of the MDGs in relationship to climate variability, scientists commissioned by the IRI have identified aspects of climate variability that might adversely affect achievement of the Goals – the following examples are relevant to Goals to “Eradicate extreme poverty and hunger” and those regarding health (IRI 2005):

- National loss of agricultural production through drought and flood → lack of food security
- Drought or flooding can lead to poor water quality → increased morbidity and mortality from diarrhoeal disease
- Flooding, or return to normal after drought, create favourable conditions for the spread of mosquito-borne diseases → higher infection rates, such as for malaria, and a reduced work force
- Loss of infrastructure through severe climate events, such as floods and storms → removal of infrastructure necessary to achieve the goal, and diversion of funding to replace infrastructure
- Climate variability acting as a disincentive → might affect investment, intensification, technological adoption, fertiliser use, high value agricultural enterprises
- Repeated hydrological disasters → stagnated economic growth
- As a consequence the poor might be trapped in a downward spiral of increasing poverty and asset loss.

Accordingly information on climate variability, including predictions, might be used in a variety of ways to provide increased lead in early warnings relevant to the first MDG, and to manage opportunities and risks in years with both above and below-average agricultural production. It might also assist in stabilising crop stocks in terms of price and availability, and to adjust credit flows and production inputs to farmers. Insurance schemes designed to benefit poor farmers can also take advantage of the information. Further, advanced warning facilitates preparations for hydrometeorological disasters, and also helps in mitigating their consequences, through assisting planning to reduce losses in infrastructure and productive assets.

However, in order to achieve the above, climate information must be mixed appropriately with other information flows (as discussed in greater detail in Chapter 2), perhaps economic and productive assets, perhaps popu-

lation statistics, perhaps infrastructural distribution, perhaps relevant policies and statutes, perhaps cultural approaches to decision making, and so on, in a manner that assists final regional and local decision making at all levels. There is a growing body of evidence to suggest that optimal decision making based on climate information is achieved cooperatively, through participatory processes in both vertical and horizontal senses, rather than through independent actions of individual stakeholders, or even individual businesses despite the normal propensity to seek business advantage. Participatory processes also help guard against possible detriment to uninformed individuals and groups. Thus a further desirable attribute towards optimising benefit is some form of coordinated decision making leading to harmonised responses to all information streams, including climate.

A practical example of the multiple information sources needed in one specific activity, agricultural production in a developed country, Australia, has been examined in an extensive operational research programme at the Agricultural Production Systems Research Unit (APSRU) in Queensland. Historical and current information streams are made available via the internet to guide decisions at farm through to State levels. These information streams include (not a comprehensive list): local and national rainfall (in particular its stratification according to phases of the Southern Oscillation Index), soil conditions, local and national crop production and yields, fertiliser costs, and international crop prices. In order to combine all information streams with the aim of assisting decision processes at farm and higher levels, scientists at APSRU have developed a number of computer-based tools, including APSIM – the *Agricultural Production System Simulator*<sup>87</sup>.

Activities in Australia are greatly assisted by the availability of quality, well-distributed (spatially and temporally) data, not only on climate but also on the other information streams necessary for optimal decision making. Where certain data do not exist, such as some historical crop yield data, simulation techniques have been developed to fill in the record. Some transfer of the APSRU approach to other countries, under the *Res Agricola* (Farmers' Affairs) banner, including to some in the developing world, has been undertaken. But one problem in many countries is a lack of the data necessary to support relatively sophisticated approaches of this nature. Only proactive approaches will start addressing these fundamental data paucities.

Agriculture provides a fine exemplar of the various problems faced regarding decision making under the uncertainty imposed by climate variability. Decision making of this type takes place across a broad range of scales of various types and differing approaches, which include:

---

<sup>87</sup> See: <http://www.apsru.gov.au/apsru/>

- spatial
  - local cropping decisions
  - national/regional food stocks and trade
  - international food security
- temporal
  - short-term logistics, such as planting and harvesting
  - medium-term planning of crop types, sequencing and rotations
  - long-term industrial decisions and land use
- cultural
  - commercial through to subsistence
  - science-lead (based on ENSO predictions, for example) through to belief- or experience-lead (including indigenous knowledge)
- institutional
  - policies/regulations/statutes of any particular organisation or individual within those of each country.

Within agriculture alone there is thus a broad gamut of outcomes sought, one that extends when other sectors are included. It may be difficult, perhaps impossible, to provide a single stream of climate information that is optimally tuned for decision making across all scales, and more defined solutions by objective are likely to be needed. There is a further consideration in that risk often only makes sense within the culture and psychology of individual decision makers. In that regard the approach currently adopted in general of setting up specific pilot projects may be well founded in practical terms, no generic approach likely to be derivable at this stage. The downside of this approach is that portability is often problematic, as solutions developed for specific applications at particular locations on the different scales may not necessarily translate readily to other locations and scales. For example, outputs from local-scale pilot projects may be difficult to scale up to national level or to be transferred to a different country.

Cultural and institutional issues often present some of the major impediments to incorporation of climate information into decision making. It may be an oversimplification, but where climate is immediately identifiable as representing a control on an activity (for example, societies have long recognised this control in terms of food security), then the use of climate information and the desire to have more information of higher quality is usually incontestable. On the other hand where the role of climate has been

less well defined, or the perception exists that climate information is of insufficient quality to assist in decision making, as perhaps within the context of the education MDG mentioned earlier, then there may well be a relatively low, or even no, uptake of the information.

An excellent example of cultural/institutional impediments restricting the use of climate information is provided by the World Bank. The World Bank has just one major mission objective – to reduce global poverty. In doing that, issues of sustainable development, as now codified within the MDGs, loom large. Yet despite the fact that the Bank has played a major role in supporting international activities related to climate change, and is responsible for a major fund for activities in this area, climate does not yet appear within the guidelines for assessment of most projects to be funded by the Bank. Consideration of methodologies for assessing projects from a climate perspective, whenever appropriate, is now being made (Mathur et al. 2004; Burton and van Aalst 2004).

Thus if seasonal to interannual prediction, not to mention climate information in the broader sense, is to play a major role in decision making across the range of scales and potential sectors, then there is a need to mainstream the information into those organisations responsible for taking decisions. Mainstreaming is achieved through a sequence of approaches, amongst which needs to be the provision of convincing evidence that the information is credible, is relevant, and, most importantly, provides value. Or that, at the least, it has the potential to provide value. Demonstrating value is a complex task across the entire range of scales and sectors, and needs to be achieved from the perspectives of potential users with their individual needs rather than from the individual perspective of the climatologist. Without careful and sustained collaborative conversations there is the danger that the full benefits of the developing short-range climate prediction technology may not be attained.

One key issue is that any demonstration of value should be sensitive to existing and accepted decision processes – and that means that different approaches may be necessary for demonstrating value to subsistence farmers in Africa, to African national and regional bodies responsible for defining the institutional support and legal frameworks in which the subsistence farmers work, to the various NGO's, and to the World Bank in its activities to alleviate poverty in Africa. Any demonstration of value should also recognise that the time frameworks of decisions throughout all scales do not necessarily accord neatly with those common to current seasonal predictions, and that therefore climate information may need to be accommodated to each specific requirement. The current relative inflexibility of climate information, including seasonal predictions in terms of their somewhat fixed spatial and temporal scales, does little to aid the demonstration

of value in many cases. Climatologists face a major challenge in developing a technological package that better addresses the requirements of the decision-making community at all levels and across all scales, a challenge necessarily addressed cooperatively through expanding interdisciplinary activities.

### 11.2.2 DELIVERY OF SHORT-RANGE CLIMATE PREDICTIONS TO USERS

One of the keys in demonstrating the value of seasonal predictions lies in the manner forecast information is communicated to the decision making community. Given the variety of potential decision makers, as outlined above, it seems unlikely that any single communication approach may satisfy all decision makers, and that some level of customisation is necessary.

Delivery, a major element of communication, breaks down into two components, dealt with separately in the following. The first of these components, technical delivery, has proved to be rather easier to progress than the second, presentational delivery.

#### *11.2.2.a Technical delivery*

In principle it is now possible to deliver forecasts, and other climatological information, to potential users almost anywhere on the planet within a brief period after production. One of the vital components of the delivery system, the Internet, was just coming into widespread use at the time of recognition in early 1997 that a major El Niño event was likely to be on the way. Throughout the middle part of that year predictions and interpretations were distributed worldwide from numerous centres, including universities and research institutes, using the new tool of the Internet. In hindsight that explosive use was not necessarily beneficial, given that many of the interpretations broadcast were based on the expectation that the canonical consequences of an El Niño would occur, which did not always prove to be the case, particularly across some regions surrounding the Indian Ocean.

The Internet continues, alongside and through the media, to be one prime channel of distribution for prediction information, and no doubt will carry on being so for the foreseeable future. Numerous prediction centres, including national meteorological centres, universities, and research institutes, now provide open or subscribed access to their latest prediction information, created using numerous numerical and/or statistical modelling approaches, through this channel. But despite its immediate and obvious benefits, use of the Internet raises a number of issues that restrict its usefulness:

- In principle it permits access to forecasts for all, regardless of their appreciation of the information presented;
- It allows contrasting and contradictory information to be broadcast without consolidation or guidance;
- It makes available information in a variety of formats that the lay user may be unable to integrate with ease;
- It carries no guarantees concerning the quality of specific information;
- While potentially an invaluable opportunity for broadcasting educational material to users, there is no certainty that any educative information will be absorbed; in fact much, although not all, educative material available through the Internet is written from the perspective of climatologists rather than that of a user, and aids little in decision processes.

On the positive side the Internet has many potential benefits, not least regarding responsiveness and flexibility. Information may be tailored, for example, to aid specific decisions; in fact, in principle, information could be delivered in formats specific to individual decisions. One further undoubted advantage, amongst many, of the Internet is its ability to facilitate information exchange between climate centres, permitting them to integrate information in such a manner as to provide more focussed information for the user. Two major such integration initiatives are outlined below, but there are numerous other regional activities in various parts of the world. Regional Climate Outlook Forums (RCOFs) were a progressive development over several years, which culminated in the pilot series in southern Africa covering the 1997/98 rainfall season in that region. Originally RCOFs were conceived without the Internet, although that facility has significantly aided their development. RCOFs were designed to be an approach to bring the benefits of seasonal predictions to governments and a variety of recipients for whom those benefits might be substantial but who might not receive that benefit through insufficient resources. Thus RCOFs bring together, in meetings often exceeding 100 attendees from a number of countries:

- Climatologists, whose roles are to create consensus forecasts from all available inputs (of which there are usually numerous, including from international and national centres), to interpret that consensus for users, and to educate users on issues climatological;
- Numerous types of user, from high-level decision makers, through intermediaries, to those at the working levels, whose roles are to inform the climatologists of their views and issues, and to work with the clima-

tologists to understand the range of actions possible, given the consensus forecast;

- The media, in their role as essential intermediaries with users throughout the region.

Following the serendipitous initiation of the southern African pilot coincident with the 1997/98 El Niño event, RCOFs were constituted rapidly in other parts of the globe in order to help address expected forthcoming major climate anomalies. RCOFs continue to be held on regular schedules in various regions, have become valued components of the annual calendar by all involved, but are threatened in some locations through the high costs of holding these events; virtual forums, in which most information is transferred via the Internet, have been tested in some regions as a direct approach to restricting costs (IRI 2000).

The second initiative is the Regional Climate Centre (RCC) programme, a project of WMO. No formal RCCs have been instituted as yet, although proto-RCCs exist in a number of regions, such as ACMAD<sup>88</sup> for Africa, AGRHYMET<sup>89</sup> for West Africa, ICPAC<sup>90</sup> for East Africa, and SADC-DMC<sup>91</sup> for southern Africa. Recognising that climate expertise is often limited, especially in developing countries, RCCs have been designed to provide a regional expert resource base on which national meteorological services from all represented countries can call for advice on climatological matters. In regard to seasonal predictions the design of RCCs tasks them with creating consensus predictions from all Global Prediction Centres<sup>92</sup> as well as local sources, and to interpret and provide that prediction information through national institutes, such as the National Meteorological Services within the region.

Through a combination of the Internet, RCOFs and RCCs, information on climate variability can be transmitted to and received by a majority of individuals and institutes globally. But in the developing world that set of delivery approaches omits to include many who do not have access to the facilities of modern communications. An approach to conveying information to these populations, particularly those in rural locations, has been developed, originally around the distribution of wind-up radios that require no energy sources other than muscle power<sup>93</sup>. Satellite technology in the

---

<sup>88</sup> See: <http://www.acmad.ne/>

<sup>89</sup> See: <http://www.agrhymet.ne/eng/>

<sup>90</sup> See: <http://www.icpac.net/>

<sup>91</sup> See: <http://www.dmc.co.zw/>

<sup>92</sup> See: [http://www.wmo.int/pages/prog/wcp/wcasp/clips/producers\\_forecasts.html](http://www.wmo.int/pages/prog/wcp/wcasp/clips/producers_forecasts.html) for the full list of Global Producing Centres

<sup>93</sup> The original wind-up radio, Freeplay, was designed by Trevor Baylis and initially manufactured in South Africa, later China

form of the RANET project<sup>94</sup> built around the First Voice International facilities using the Worldspace system of geostationary platforms<sup>95</sup>, tied in with relatively cheap digital radio receivers that include modems permitting data to be downloaded directly into personal computers, have now been combined with the use of radio broadcasts to deliver climate information into remote areas of Africa, Asia and the Western Pacific. RANET, in principle, permits the reception of timely seasonal prediction and other climate information over large parts of the globe that otherwise would have no access.

Other delivery systems not yet considered are possible. Prominent amongst these are the use of mobile telephones, a technology that has expanded rapidly in many developing countries. Innovative use of existing social structures, often untapped as yet, would assist with information delivery and education.

#### *11.2.2.b Presentational delivery*

Far more complex than physical delivery of information, and more important in determining the value of the transmitted information, is the communication of that information in the most effective manner for decision making. From the recipient perspective, whether an international manager or a subsistence farmer, optimising the input of climate information into decision making is the prime objective. It is not enough, therefore, merely to provide predictions, with related validation and verification information, but it is a responsibility to ensure that the entire package is presented such as to facilitate the decision processes of the ultimate recipients. Few of the current delivery channels offer information organised from the decision making perspective.

Communication separates into two aspects – visual and oral/written, both with their own specific pitfalls. The focus in the following is on oral/written, but first consider the presentation of predictions from RCOFs as an example of one issue of visual communication. The RCOF consensus predictions take a probabilistic form not purposely designed to assist any specific decision process, and are presented in tiered probabilities for each sub-region (Figure 11.1). Yet in the background each region is coloured with an indication of the most probable outcome, an indication that readily may be taken to indicate a deterministic prediction. As an exercise, consider what message would be taken from this display by those unversed in its interpretation. Then consider how an untrained individual might interpret the

---

<sup>94</sup> See: <http://www.ranetproject.net/>

<sup>95</sup> See: <http://www.firstvoiceint.org/> and <http://www.worldspace.com/>

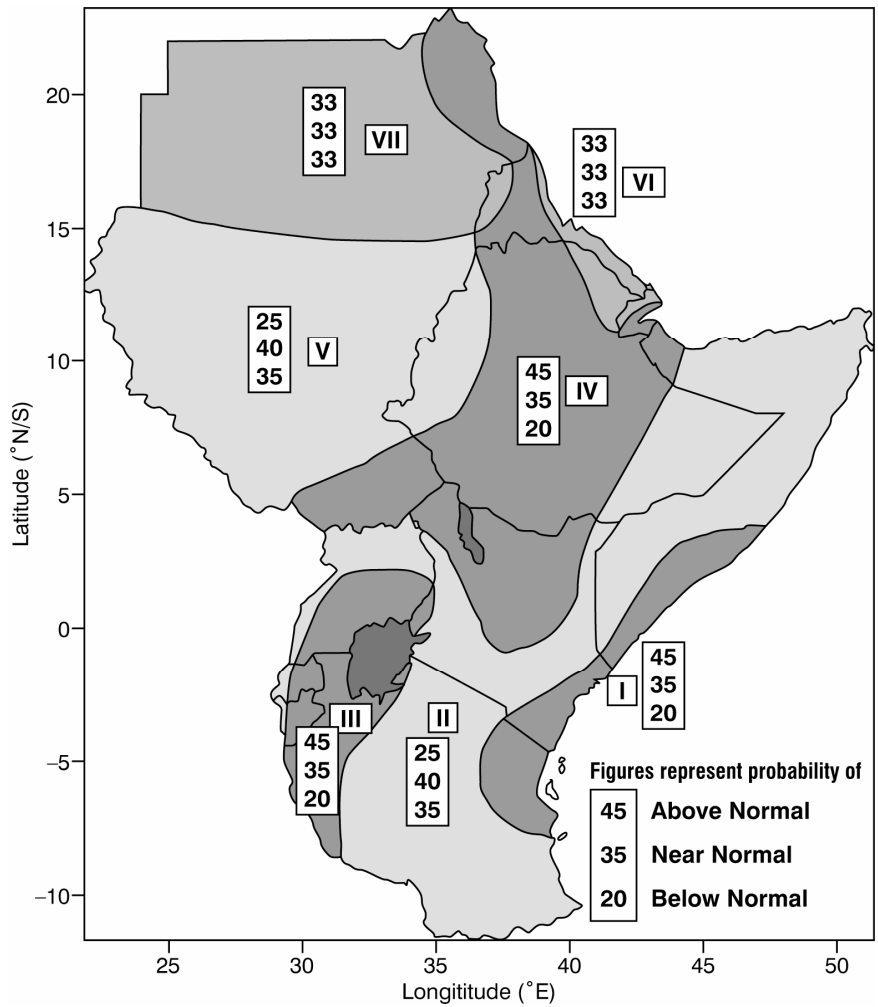


Figure 11.1 - Example of consensus prediction, for September to December 2006, from one of the East African Regional Climate Outlook Forums (courtesy of ICPAC). For each region tercile probabilities are indicated by figures, with wettest terciles at top. Background colours in the original, here converted to grey scale (for colour version see: <http://www.icpac.net> under "Forecasts"), indicate the most probable outcomes. Although present, but not clear in grey scale, these colours, which are prominent, often combine two similarly-likely terciles into the form, say, "unlikely to be driest tercile".

visual information offered by the various alternate web sites providing predictions, each with their own visual presentational characteristics, for the same region. Finally, consider how that untrained individual might interpret the validation information presented on the various web sites, with their wide variations in selected metrics. The opportunities for delivering unintended messages through ill-considered visual presentations are endless, and, as is discussed further in Chapters 12 and 13, ideally all such presentations should be considered in full in collaboration with all recipients.

Written and spoken communications, as visual communications, offer climatologists numerous opportunities to fail in exchanging information with stakeholder communities. Perhaps one of the simplest examples is given by use of the word “normal”, a word that occurs frequently in the languages both of climatologists and of stakeholder communities, but one that translates imprecisely between individuals on numerous occasions. In fact during an RCOF in Kenya a few years ago there was most animated discussion of the interpretation of the word “normal” amongst over 100 delegates, with no consensus achieved. What might seem to be a “normal” rainfall season to a climatologist may appear anything but to, say, an agriculturist whose concerns extend well beyond rainfall totals themselves. Equally a “normal” agricultural season may be anything but in climatological terms. These two examples fail to illustrate by far all the contexts within which the word “normal” might lead to misinterpretation. Other apparently simple words may be equally readily misconstrued – “extremes” is a further example that arises regularly.

More complex miscommunications occur in a number of ways (affecting visual as well as written communication), including through the psychological processes that are sometimes referred to as ‘cognitive illusions’. The ‘framing effect’ offers a straightforward example – the two statements “there is a 30% chance of a drought this coming season” and “there is a 70% probability that rainfall will be adequate for cropping this coming season” effectively provide the same information, but the manners in which the statements are stated, or *framed*, invite possibly diverse decisions, a defensive approach against drought in the first case and a positive response to take advantage of possible beneficial climate conditions in the second. Further cognitive illusions are listed in the table below (based on Nicholls 1999), with examples given relating to events and experiences in RCOFs during 1997 and 1998 in southern Africa (when, given the impending substantial El Niño event, many presumed that rainfall-season drought, perhaps severe, was inevitable, although in reality adequate rain fell in many areas):

<b>Cognitive Illusion</b>	<b>Brief explanation</b>	<b>RCOF example</b>
Framing effect	Framing of the same information in different ways invites dissimilar decisions. For example, ‘40% probability of above average rains’ vs. ‘60% probability it will be average to dry’	1997/98 worded forecasts were framed more from the perspective of drought (because of the <i>over-confidence</i> of some involved - see below) than from the perspective of possible average to above-average rainfall
Availability	Biases originating either in information readily brought to mind or experienced recently, or in the relative availability of information, say through the media or Internet. More weight is given to recent or readily-remembered information and/or to widely-available information than to easily-forgotten information or that with more restricted availability, however valid	Media focus, often concentrating on the 1982/83 El Niño-related drought, preconditioned many to expect dry conditions in southern Africa because of the upcoming El Niño. Contrasting information that El Niño events are not always related to droughts in the region was not readily available. Many RCOF delegates made frequent reference to the 1991/92 drought, an event then clearly remaining in numerous minds
Anchoring	Decisions may be based on, i.e. anchored to, familiar but perhaps unrelated and/or irrelevant information. On occasions this may be completely disconnected information, even if it is not perceived as such. But more often it may seem to be related but in reality offers limited benefit regarding current decisions	Interpretation of the likely outcomes of the 1997/98 El Niño were frequently anchored on the 1982/83 and, especially, 1991/92 droughts. As background there was a ‘weak’ El Niño during 1991/92. The drought that year was one of the worst on record and was fresh in memory at the time but gave little or even no pertinent information regarding conditions in 1997

<b>Cognitive Illusion</b>	<b>Brief explanation</b>	<b>RCOF example</b>
Asymmetry between losses and gains	Related to <i>framing</i> , the perception gained that a particular line of action will yield the best outcome in terms of balancing possible losses and gains. Decisions tend to be made in either the most favourable or the most defensive manners according to individual perceptions of risk	Wording of 1997/98 RCOF predictions, while carefully prepared, nevertheless promoted the concept of impending severe drought. This lead some to take drastic actions, such as not planting or selling/slaughtering all cattle, in the belief that such actions would minimise overall losses
Ignoring base rates	Neglecting prior probabilities in coming to a decision – they can have considerable effects on decision processes based on a prediction. A classic example is for the UK 24-hour forecast, which has a claimed ‘accuracy’ of 83%. Given that, and assuming rain is predicted (deterministically), then the probability of <i>no</i> rain falling within any particular hour is not 17% but 70%. This offers a rather different perspective on the original forecast. The figure of 70% may be calculated (an enlightening exercise to undertake) using the base rate of 0.08 for hourly rainfall, i.e. the prior probability of rain in any hour is 0.08 (Matthews 1996)	The prior probability of below-average rainfall across the full October to March rainfall season in South Africa, given an El Niño event in train, is only about 60%. This fact was usually ignored during 1997/98 when many scientists and others unconditionally linked El Niño events with drought (the quoted figure of 60% is a ‘guestimate’ derived from the South African Weather Service web site)

<b>Cognitive Illusion</b>	<b>Brief explanation</b>	<b>RCOF example</b>
Overconfidence	<p>Everyone tends to be overconfident in their beliefs and predictions, and climatologists, farmers, health practitioners, etc., are no exceptions. Only through regular critical feedback might overconfidence become less prevalent. Overconfidence tends to be greatest when accuracy is near chance levels</p>	<p>Overconfident predictions for an El Niño-forced drought in southern Africa were made by many climatologists and others in 1997/98. Related equally-overconfident expectations of drought impacts on farming and water resources in 1997/98 were assumed unconditionally in several southern African countries. Forecasters of necessity create individual seasonal forecasts relatively infrequently, and thus receive feedback equally rarely, leading to the potential for overconfidence</p>
Confirmation and hindsight bias	<p>Biases that result from overconfident and imprecise recalls of past events (for example, forecasters tend to recall and promote preferentially their perceived previous accurate predictions while tending to discount or even ignore those ‘less accurate’). Or biases based on presumed correct knowledge. The overconfidence is such that information that might disconfirm the bias is often not sought or is rejected</p>	<p>Bias that El Niño events inevitably result in drought over southern Africa was widespread in 1997/98. Disconfirming evidence demonstrating that there is not a one-to-one association between drought and El Niño events was either discounted or, more generally, simply ignored or not even sought</p>

<b>Cognitive Illusion</b>	<b>Brief explanation</b>	<b>RCOF example</b>
Decision regret	Stronger potential regret in hindsight over decisions that lead to loss than those that lead to benefit. Thus there is often an irrational bias towards taking decisions so as to minimise possible regret should those decisions prove wrong	Given that the 1997/98 southern African rainfall season was anticipated so negatively in deterministic terms by many, it is perhaps not surprising that no examples of decision regret immediately stand out from that RCOF experience – options simply did not appear to have been available <i>at the time</i> . Note that this is distinct from the regret felt <i>in hindsight</i> in southern Africa around decisions based on expectations of a drought some believed had been forecast unequivocally
Inconsistent intuition	A preference to base decisions on personal intuitions rather than on objective methods. The former tend to be inconsistent while much evidence suggests objective approaches tend to produce the best results overall. In part this results from a lack of trust in automation and an inclination to make own judgements	Intuitive modification by experts of probabilities when combining various numerical and statistical predictions during the course of agreeing a RCOF consensus forecast likely resulted in sub-optimal consensus predictions of probabilities
Belief persistence	Either a) first impressions are recalled preferentially over later ones, or b) inertia in changing beliefs on the basis of later information received	As an example of a): the perceived ‘failed’ first RCOF forecasts for 1997/98 lead to later persistence of the belief that seasonal forecasts are ‘poor’ as a general rule (this perception required subsequent management attention). As an example of b): the first forecast seen during the RCOF prediction consensus-building process is often weighted more highly than later-seen forecasts – in RCOFs these first forecasts tend to be each cli-

Cognitive Illusion	Brief explanation	RCOF example
		matologist’s ‘own’, which that climatologist then tends to over-weight against other forecasts
Group conformity	Group dynamics may lead to an erroneous biased consensus, perhaps through the dominance of one individual or of one well-presented opinion	The process of producing an RCOF consensus prediction by a group of experts through subjective interpretation of various individual inputs usually results in a fine example of group conformity, as does the interpretation of that prediction by groups of users

All of the above cognitive illusions may afflict both climatologists and stakeholders in a variety of manners, and all may lead to sub-optimal information delivery and processing, and hence decision making. Noting that the manner in which prediction information is employed may substantially affect the ultimate value obtained for any application, value that is often assumed, incorrectly, to be dependent upon prediction skill alone, then it becomes clear that there are numerous impediments to demonstrating, and maintaining, the value offered by a prediction service. Forecast quality, approaches to information delivery, and the manner in which information is processed and in which decisions are made, all influence separately but substantially the final outcome value achieved.

A third verbal issue, that stands alongside the interpretation of words and the manner in which words are used to communicate information, is the issue of the language used itself, often referred to as jargon. Normally – and that word is used according to this particular author’s normal manner! – climatologists and stakeholders use language in their own accepted community-wide ways, but with, unfortunately, limited overlap between those language groups. Effective communication is most assured when similar language is used on both sides, and in principle in order to feed the information most efficaciously into decision making the language used primarily should be that of the stakeholder rather than that of the climatologist. Climatologists thus face the extensive challenges of understanding the languages of the stakeholders they are attempting to serve and of focusing their information into the decision models of those stakeholders.

The policy and development community, for example, tends to use words such as ‘vulnerability’, ‘resilience’, ‘capacity’, ‘development’, ‘poverty’, ‘equity’ and ‘adaptation’. Each of those words originates in conceptual models widely accepted and understood within the recipient

community. These communities are seeking assistance and insights from climate experts that will directly help resolve issues as they interpret them, and it is into these models or issues that climatologists ideally should be projecting their information. Using language such ‘El Niño’, ‘drought’, ‘above average cyclone frequencies’, and the like, tends primarily to maintain, or even build, barriers between climatologists and recipient communities. Climate change jargon provides some excellent examples of the possible language/conceptual barriers raised between communities (adapted from Mathur et al. 2004):

- the IPCC considers climate change a pollution problem whereas the development community is concerned with the practical implications in terms of development, poverty and equity, and, in particular, with their management – information provided by the IPCC in general offers little to resolve the issues of the development community;
- while the climate community looks at science, scenarios and impacts, the development community is concerned with priorities, assistance strategies, and reductions in vulnerability;
- climatologists discuss ‘future adaptation’, ‘top-down perspectives’ and ‘global assessments’, whereas the development community is concerned about ‘baseline adaptation’, ‘bottom-up perspectives’ and ‘national assessments’.

There are some fundamental disconnects in the above list, disconnects that apply in both directions between the development and the climate variability communities. Disconnects of this type need to be addressed if the full potential of seasonal prediction, and of climate information in general, is to be achieved.

It is not only with policy and development activities that language barriers exist, these barriers also being present in communication with expert sectoral forecast users, including those working within commercial contexts. The following table summarises language/perceptual barriers with regards to water management that need to be overcome to achieve maximum communication and information transfer and optimal decision making<sup>96</sup>:

---

<sup>96</sup> Adapted from a personal communication from Pulwarty R. (2003).

<b>Factor</b>	<b>Scientist’s Perspective</b>	<b>Water Manager’s Perspective</b>
Identifying a critical issue	Based on a broad understanding of the nature of water management	Based on experience of a particular system
Time frame	Variable	Immediate (operations) Long-term (infrastructure)
Spatial resolution	Defined by data availability or funding	Defined by institutional boundaries or authorities
Goals	Prediction Explanation Understanding of natural system	Optimisation of multiple conditions and minimisation of risk
Basis for decisions	Generalising multiple facts and observations Use of scientific procedures and methods Availability of research funding Disciplinary perspective	Tradition Procedure Professional judgement Training Economics Politics Job risks
Expectation	Understanding Prediction On-going improvement Statistical significance of results Innovations in method/theory	Accuracy of information Appropriate methodology Save money and time Protect the public Project jobs, agendas or institutions
Product characteristics	Complex Scientifically defensible	As simple as possible without losing accuracy Importance of context
Frame	Physical (atmospheric, hydrologic, etc.) conditions as drivers Dependent on scientific discipline	Safety and well-being Profit Consistency with institutional culture, policy, etc.
Nature of use	Conceptual	Applied

The list in the above table extends the issue from language representing a barrier simply in terms of disciplinary outcomes and objectives to the institutional and cultural impediments built into language and communication. For example, as taken from the above table, any scientist might consider data issues primarily in terms of availability and funding while the water manager might be considering the specifics for a given system regardless of data availability. Similarly, while the scientist might be concerned with the

statistical minutiae of predictions and their verification, the water manager would be most concerned with receiving and using accurate information that helps him/her meet his/her objectives.

Any ideal delivery system would overcome all visual, language, cognitive and psychological barriers discussed in this section – word selection, word usage/cognitive illusions, and disciplinary/cultural/institutional language use – and deliver information as required by each stakeholder ready for their processing directly into their particular decisions. To date, consideration of this objective within the context of seasonal to interannual prediction, an issue of far greater immediate importance than improving forecast quality *per se*, has been limited, and predictions continue in general to be provided in the eye of the climatologist rather than in the eye of the recipient. Focussed attention to the issue of communication is necessary if seasonal prediction is to deliver full benefit in all contexts; options raised frequently recently include the creation of ‘bridging institutes’ and the training of a cadre of communicators able to bridge the gaps between climatologists and recipients.

## **ACKNOWLEDGEMENTS**

The authors would like to thank Ms. Benedict Owuor (ICPAC) for kindly providing the original figure used to generate Figure 11.1.