Inquiry into Government Drought Support

Bureau of Meteorology submission

The Bureau of Meteorology (Bureau) offers the following submission to the "Inquiry into Government Drought Support" of the Productivity Commission. The Bureau wishes to address principally parts 2 and 3 of the Inquiry's Terms of Reference:

2. Identify impediments to farmers, farm businesses and farm dependent rural small businesses improving self-reliance and preparedness for periods of financial difficulty.

3. Identify the most appropriate, effective and efficient Commonwealth, state and territory government response to build farmers', farm businesses' and farm dependent rural small businesses' self-reliance and preparedness to manage drought.

   The Commission may draw lessons from the broad range of support measures that are or have been available to farmers, farm businesses and farm dependent rural small businesses, or which are more broadly available to the Australian community.

Key Points:

Fundamental to the effective management of drought is the availability of a monitoring system that provides information on the state of the climate and is able to detect as early as possible the emergence of incipient drought conditions. The Bureau of Meteorology's *Drought Watch System* coupled with the more recently established *National Agricultural Monitoring System* provides the current capability for the nation as a whole. Two key areas for improving future response to drought are better seasonal to multi-decadal climate forecasting and the provision of information on climate change as it will likely affect agriculture and water resources. The relevance of these key areas to parts 2 and 3 of the Terms of Reference is outlined below.

A. A major impediment to farmers preparing for and dealing with drought is the limited scope and, in some cases, the availability of accurate, timely and readily useable drought monitoring and prediction information. Pertinent time-frames range from seasonal out to several decades, with the longer periods tightly linked with climate change projections that may vary in significance for specific rural regions and sectors. More accurate forewarning of likely climate outcomes from the medium to long term would allow farmers, farm businesses and farm dependent sectors to deal more effectively with drought and its consequences.

B. Government responses to drought management are similarly limited by incomplete or insufficiently detailed knowledge on the current state of the climate; how primary producers are being affected; and uncertainties about how future conditions may unfold throughout the current growing season and beyond.

There is increasing evidence that improvements in both areas are possible, which would lead to better informed decision making by farmers and government alike, and would lead to improved self-reliance and preparedness throughout the entire community to manage drought.

Background:

The recent report from the CSIRO and the Bureau of Meteorology "An assessment of the impact of climate change on the nature and frequency of exceptional climatic events" analysed

changes in area extent and frequency of exceptional drought circumstances. The report also identified the need for further information and more detailed assessments that could further inform the Inquiry into Government Drought Support. Included were:

- better drought monitoring capability through integration of data from a variety of sources;
- research to improve seasonal-to-interannual forecasts and longer term climate predictions, particularly with respect to specific rural sectors and at a localised scale;
- an online information system which readily interfaces climate change projections into the future with the historical climate database; and
- participatory studies to more accurately identify the climate change information needs of the different sectors of rural Australia;

The Productivity Commission may wish to make special note of the areas outlined below where the Bureau of Meteorology believes that some strengthening of activity, coupled with further investment in research and infrastructure, could better inform drought policy making, provide improved support to rural communities in managing drought conditions, and raise awareness of the potential for climate change to impinge on both drought policy and its implementation.

The need for improved drought monitoring:

Data from the Bureau of Meteorology's monitoring network – both real-time and historical – and the associated management of the data (e.g., quality control, archival and analysis) have been fundamental prerequisites to the implementation of current policies on exceptional circumstances and drought assistance.

Accurate and timely information on: the area extent of regions experiencing water stress; the timescale of the current rainfall deficiencies being experienced; the amount of rain needed to alleviate the deficiencies; and the placing of those deficiencies in a historical context, has allowed the government and the wider community to form an objective and knowledgeable assessment of an emerging or current drought event.

Meteorological observations and the information derived from them, when applied with care, have an enormous capacity to inform any drought assessment process that leads to the support of individual farmers, communities and rural industries according to a laid down drought assistance policy. It is essential therefore that the meteorological and related data that necessarily underpin any effective drought monitoring system are detailed and comprehensive. The more accurate and detailed the information, the better the basis for planning and decision-making.

The Bureau currently offers a suite of information on historical data directly through its website, including maps of historical analyses and trends of rainfall, temperature and drought areas. For examining local information, e.g. around a given town, the Bureau has implemented public access to the national climate database via the *Climate Data Information Online* project. With time, this project has the potential to deliver the entire historical national climate data record for use by agricultural and other climate sensitive communities, as well as a range of possible projections of climate into the future (see below). The Bureau of Meteorology is also a key contributor of climate information to the *National Agricultural Monitoring System* managed by the Bureau of Rural Sciences.

These developments would not be possible without the Bureau's climate monitoring networks and databases. The continuation of these monitoring networks and the maintenance of the historical database systems are therefore essential to the implementation of any drought policy that foresees the continuation of drought assistance based on the exceptional nature of a given drought event. More broadly, with weather and climate records extending back more than 150

years, the Bureau's monitoring network and associated database will provide a critical foundation for current proposals under consideration to establish a broadly based National Environmental Information System.

The need for improved drought predictions:

In addition to better monitoring of 'current' drought conditions, farmers and government alike will benefit from timely information on the risk of drought conditions in the future. Of interest to most farmers is the potential for accurate climate predictions on time scales that demand urgent decision making in order to reduce risks and enhance opportunities.

The Bureau's current seasonal outlook service for rainfall and temperature[1] uses statistical relationships between the Indian and Pacific oceans and Australian rainfall and temperature to make outlooks for the season ahead. Recent advances in the delivery of these outlooks have been made through the Bureau's *Water and the Land* project, but the most pressing additions to improved seasonal outlook services are better forecast skill and increased range of forecast products that can be readily used in a wide variety of practical decision-making contexts. Linked with these aims is the need to better understand the nature of climate variability over Australia and the extent to which it can be predicted - areas that require further research.

The future of seasonal prediction lies in a move away from statistically-based systems towards dynamic climate prediction models – similar to those used for weather forecasting. These models have the advantage of being free of the limitations that confine statistical models to limited realisations of variability within a relatively short record. They also offer the potential of a seamless forecasting system for time scales ranging from weeks to seasons to decades. Through continued research and development, the ACCESS model (see below) will provide advances in forecasting capabilities that will better inform users on upcoming seasonal conditions, as well as enabling climate prediction on decadal timescales and projections on even longer timescales.

The need for more detailed climate projections:

Those entrusted with implementing future drought policy will likely be key users of modelled information about Australia's climate. For instance, as drought assessment often relies upon historical return periods of low rainfall then it is of great importance to determine the probability of any changes to these return periods in the future. If, for instance, historical one-in-twenty year dry events might become one-in-ten year events, this potential change in risk could be of central importance to formulating future drought and drought relief policy.

The impacts of climate change on agriculture will, at least initially, be largely felt through the effects of the longer term trends on climate variability. Such effects are likely to be manifested in more frequent extreme events. For example, the background warming trend will almost certainly lead to heatwaves becoming more frequent and intense, with both aridity and floods increasing in some areas. Such outcomes might be characterised by events like the recent drought, which has seen record high temperatures compounding the effects of persistent rainfall deficiencies. The recent CSIRO and Bureau report for the Drought Inquiry gives details of the observed and projected changes in these extremes. Hot years will very likely rapidly increase in coming decades and some southern regions are projected to experience more frequent periods of aridity.

This interaction means that climate change is likely to reveal itself not merely as a rising trend in average temperature, e.g. of around 1°C by 2030, but also as a series of shocks during which systems experience new combinations of stressors. Without careful management such

[1] http://www.bom.gov.au/climate/ahead/

shocks have the potential to generate abrupt maladaptive responses from a natural, environmental perspective as well as a broad range of socioeconomic perspectives. The abrupt decline in rainfall in south-western Western Australia in the mid-1970s and its very large impact on streamflow is illustrative of rapid changes taking place in different parts of the globe; the decade long rainfall declines in parts of south-eastern Australia may also be relevant in this context. Monitoring and early warning systems that foster generally enhanced resilience could be a key factor in managing these shocks.

As part of a 2006 review of current gaps in research on climate change over Australia, senior researchers from the Bureau of Meteorology and CSIRO highlighted the urgent need to improve the simulations of the earth's climate system by advancing to new generation climate models. ACCESS[2] is therefore central to providing improved accuracy of regional climate projections, as well as the improved ability to feed into projections of direct relevance to agriculture, water management, and natural resource management, amongst others, which would be of direct concern to Australia's primary industries.

Ideally, the projections for Australia from the ACCESS model would be included in a proposed *Climate Projections Online* database. Such a database would have the ability to provide a wealth of information from several models, enabling better estimations of risk than by using one model alone, and hence improve risk management. Such a future climate database is a key to planning adaptation in the longer term for all primary industry and natural resource managers.

The need for better access to climate projections:

Further research into the possible changes in frequency and intensity of extreme events is required to reduce uncertainties in such assessments, and ongoing development of the ACCESS program is central to the Bureau and CSIRO's modelling of the future climate[3]. Routine and reliable climate predictions that draw on the fruits of the ACCESS research effort will provide stakeholders with the data and forecasts required to feed a wide range of agriculture, water management, and natural resource management models.

The *Climate Projections Online* database, proposed by the Bureau of Meteorology and the CSIRO, would provide the underlying infrastructure for both applied and basic research on climate change. The funding of the database is currently under consideration by the Department of Climate Change as a critical piece of infrastructure for the National Climate Change Adaptation Framework, and for responding to recommendations by the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) Independent Working Group report Climate change in Australia: Regional impacts and adaptation.

The Bureau's historical database contains the one realisation of the past climate record. A climate projections database would contain a number of future climate records based on different, emissions-based projections from several global climate models for periods up to, and possibly beyond, 2100. Downscaling technologies would provide data at high spatial resolution, and the historical data would be interfaced with projections to provide improved seamless information on past changes through likely changes over the next ten years and beyond.

Such a store of future climate information available in the one location and delivered in relatively simple formats via easy to use tools could easily be mined by researchers both

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[2] The Australian Community Climate and Earth Systems Simulator)

[3] Collaborative research is now undertaken through the Centre for Australian Weather and Climate Research (CAWCR) - a partnership between the Bureau and CSIRO.

internal and external to the Bureau to best inform processes such as the exceptional circumstances and drought assistance programs.

A database of future climate projections for farmers, their communities, and government would allow all to make objective plans for a future with a changed climate. Likewise, Australia's climate monitoring network and database of historical meteorological and related observations, and the associated Bureau programs to ensure the data's archival, quality control, analysis and dissemination, cannot be understated in their importance to Australia's understanding of, and ultimately response to, climate change.