‘Climate Connect 2006’

29 & 30 March 2006, Adelaide

Day 1 Speaker Bio Notes and Presentation Summaries

The Managing Climate Variability Program (MCV) is a collaborative program between the Grains, Rural Industries and Sugar Research & Development Corporations, the Australian Government Natural Heritage Trust and Department of Agriculture, Fisheries and Forestry, Dairy Australia, Meat & Livestock Australia and Land & Water Australia. The National Farmers’ Federation and Australian Wool Innovation Limited are associate partners.

MANAGING CLIMATE VARIABILITY
R & D PROGRAM

Keynote Speaker **Dr James L. Buizer, Arizona State University**
Presentation Title **Bridging the gap between science production and practical application through boundary spanning organisations**

Dr Buizer is Special Advisor to Arizona State University (ASU) President Michael M. Crow, and the founding Director of the *Office of Sustainability Initiatives* in the Office of the President. In addition to his advisory role to the President, he provides University leadership with strategic guidance regarding the design principles of the *New American University* and oversees institutional development of new degree-granting academic units and interdisciplinary research centers and institutes University-wide. The scope includes all aspects of the establishment of the *International Institute for Sustainability* and it's transformation to the *School of Sustainability,* to be launched fall 2006. A core component of the Institute is the *Sustainability Partnership Enterprise*, which is designed to bridge the gap between production of science and practical use for community planning, resource management and policy-making.

Dr Buizer represents President Crow on numerous boards, committees and councils throughout the University as well as outside the University, nationally and internationally. In his personal capacity he serves as Vice Chair of the Board of Directors for the Association for the Advancement of Sustainability in Higher Education and on the Board of Governors of the Arizona Academy of Arts, Science and Technology, where he is a Founding Fellow.

Prior to this, he served as Director of the Climate and Societal Interactions Program at the National Oceanic and Atmospheric Administration (NOAA) in Washington, D.C., where he was responsible for providing programmatic vision, design and leadership of NOAA's integrated, multidisciplinary research and applications program positioned at the climate and societal interface. While at NOAA he played leadership roles in the creation of a number of institutions that bridge science and society, including the International Research Institute for Climate Prediction, the Inter-American Institute for Global Change Research, and programs such as the Regional Integrated Sciences and Assessment (RISA) Program.

Dr Buizer's current research focuses on the role of institutions in knowledge systems for sustainability, and he is a member of a team led by colleagues at Harvard University's Kennedy School of Government and Stanford University's Center for Environmental Science and Policy. Dr Buizer is particularly interested in institutions that span the gap between the production of basic science and the practical application of research-based information products. He received his degrees in Oceanography, Marine Resource Economics, and Science Policy from the University of Washington, Seattle, Washington.

Summary of presentation

An essential component of effective science-based decision support systems is what the literature of science and technology studies has called "boundary organizations." These are entities that manage to position themselves with one foot in the world of research and the other in the world of application, where individuals act as intermediaries between nodes in the system—most notably between scientists and decision makers. These organizations are solution focused and integrative in nature. They also often need to perform translational and mediation functions, including convening user-producer forums, conversations, and training exercises, among others.

Where most effective, boundary organizations are the sites of co-production of knowledge—the act of producing information or technology through the collaboration of scientists/engineers and non-scientists who incorporate values and criteria from both communities. This is seen, for example, in the collaboration of scientists and users in producing models, maps, forecast products, etc. It has been observed that boundary organizations seem to work best when accountable to the individuals or interests on both sides of the boundary they bridge, in order to avoid capture by either side and to align incentives such that interests of actors on both sides of the boundary are met.

In short, boundary organizations serve to make information from science useful and to keep information flowing (in both directions) between producers and users of the information. They serve to foster mutual respect and trust between users and producers. Within such organizations there is a need for individuals simultaneously capable of translating scientific results for practical use and framing the research questions from the perspective of the user of the information. These key intermediaries in boundary organizations also need to be capable of integrating between disciplines and defining the research question beyond that which focuses on the disciplines.

Session I Evolution of seasonal climate forecasting in Australia and the role of MCV
Convenor Dr Rohan Nelson

Presenter: **Dr Neville Nicholls, Monash University**
Presentation Title: **The development of the science of seasonal climate forecasting**

Dr Nicholls was, until December 2005, a Senior Principal Research Scientist at the Bureau of Meteorology Research Centre where he led the Climate Forecasting Group. Dr Nicholls started researching the impact of the El Nino – Southern Oscillation on the climate of the Australian region, and proposing its use in seasonal climate prediction, in the 1970s. He supervised the development of the Bureau's current statistical operational seasonal forecast system (partly funded by Land & Water Australia (LWA)). He led the Bureau's involvement in the Indian Ocean Climate Initiative (IOCI) study of southwest Western Australian rainfall (IOCI, 2002), and has also co-convened five multi-country workshops on climate extremes in the east Asia – west Pacific region. Dr Nicholls was a Convening Lead Author for the Intergovernmental Panel on Climate Change (IPCC) Second Assessment, and is a Lead Author of the Fourth Assessment (for the chapter "Understanding and attributing climate change"). He was an editor of the Journal of Climate published by the American Meteorological Society 1997-2003 (the first editor from outside North America), has published over 130 refereed journal papers and book chapters on the nature, impacts and predictability of climate, and co-edited three books. He is now a Professorial Fellow in the School of Geography and Environmental Science at Monash University. His main research interests are how climate change affects climate extremes, and the links between climate and health.

Summary of presentation
This presentation will provide a personal view of the development of operational seasonal climate prediction, based on the speakers involvement in the science of seasonal prediction since the 1970s, and understanding of how the field has developed in the previous 100 years. Dr Nicholls will also discuss why, despite research in the early decades of the 20th century indicating that seasonal prediction was feasible for Australia, operational forecasts did not commence until the late 1980s. He will also describe what lessons have been learnt about the content and presentation and communication of seasonal predictions, since the start of the operational service. One important lesson highlighted in this presentation is that climate change due to human activity is causing problems with the preparation and use of seasonal climate predictions. Unless forecast users and producers recognise the realities of climate change, they will almost certainly misuse seasonal climate predictions. Finally the presentation will reflect on the contribution MCV has made to the development of seasonal climate prediction in Australia.

Presenter: **Dr Roger Stone, Queensland Department of Primary Industries and Fisheries and University of Southern Queensland**
Presentation Title: **The development of seasonal climate forecasts for agriculture**

Dr Stone has spent the past 20 years closely liaising with industry, especially rural industry, and government in Australia and internationally on practical issues associated with adaptation and development of effective management systems that can be applied to better manage potential impacts of climate variability and climate change. Dr Stone currently has two main positions together with responsibility within the United Nations' Commission for Climatology. Dr Stone is currently Science Leader/Director, of 'Climate and Systems Technologies' within The Queensland Government (mainly Department of Primary Industries and Fisheries) and is also currently Associate Professor in Climatology at the University of Southern Queensland where he has established a full degree program in climatology within the Faculty of Sciences. Roger Stone also leads a number of 'expert teams' within the United Nations' World Meteorological Organisation Commission for Agricultural Meteorology and is also Rapporteur for agrometeorology within the Commission for Climatology. Dr Stone also serves as a reviewer for the Intergovernmental Panel on Climate Change (IPCC).

Summary of presentation

The Australian agricultural sector is particularly extensive and has a large degree of diversity by regions and industries. Both droughts and good seasons tend to be widespread and more continental than local phenomenon. Severe and widespread droughts have been a major catalyst for R&D in linking climate forecasting systems to agricultural decision-making (White, 2000). Importantly, Dr Neville Nicholls in 1985 showed the scope to predict the gross value of production of Australian crops using an ENSO indicator. The Bureau of Meteorology commenced climate forecast output in 1989 providing forecast product outputs, although not necessarily targeted to agricultural users or needs. In parallel, activity in some state agricultural departments attempted to develop climate forecasting systems that were somewhat more focussed on agricultural decision-making, at least in terms of targeting information to more regionally specific areas where farming occurred or to attempt to develop climate forecast systems had 'skill' for periods of the year of relevance for agricultural production (Hammer and Nicholls, 1996; Hammer et al., 1996; Meinke and Hochman, 2000; Nicholls, 2000; Clewett et al., 2000). Nevertheless, the application of seasonal forecasts to agriculture is a recent but rapidly evolving field where most of the applications so far have been in specific regions, largely where R&D development and associated funding has identified a regional or industry specific need (e.g. northeastern Australia; Liverpool Plains, NSW; Victoria/NSW cropping regions, cropping regions of South Australia and Western Australia).

In pursuing the development and application of seasonal climate forecasts for agriculture significant breakthroughs have occurred:

- The realisation of the need to understand and predict the responses of the target agricultural system through use of seasonal forecasting,
- Understanding that the application of climate forecasts in agriculture is about managing risks,
- Communication of probabilistic information has been important in climate forecast development for agriculture (but has been problematic),
- The key role of connecting agricultural and climate models has been critical to appreciating the potential role of climate forecasting in better managing risk in agricultural management in Australia,
- Simulation studies with systems models have been critical for examining possible scenarios for responding to climate forecast systems,
- The need to apply climate forecasting systems to address agricultural decision systems across the whole value chain,
- The concept of a general integrated systems approach to applying forecasts across a range of scales from farm to region (from Hammer *et al*, 2000; Stephens *et al*., 2000; Everingham *et al*., 2002; Potgieter *et al*, 2002).

Presenter: **Dr Bryson Bates, CSIRO**
Presentation Title: **The Evolution of Climate Variability R&D from the Perspective of the Climate Change Science Community**

Dr Bates is the Director of CSIRO's Climate Program and a Senior Principal Research Scientist with CSIRO Land and Water. He served as a Lead Author for the Second, Third and Fourth Assessment Reports of the *Intergovernmental Panel on Climate Change* on climate change impacts and adaptation. His research interests include: the effects of climate forcing on rivers, river health and the operation of water supply systems; downscaling numerical climate model simulations; interseasonal climate forecasting using statistical-dynamical methods; and hydrologic extremes. Bryson is an Editor for the international journal *Climate Research*. He is an invited member of the American Geophysical Union Surface Water Committee and the Steering Committee for International Meetings on Statistical Climatology. Bryson held the position of Visiting Research Scientist at the *International Research Institute for Climate Prediction* at the Earth Institute of Columbia University from June 2002 to March 2003. He was the research manager of the Indian Ocean Climate Initiative sponsored by the Government of Western Australia from 1998 to 2005.

Summary of Presentation

There is growing interest in physically-based seasonal forecast methods due to the perception that purely statistical methods may have run their course, widespread concern about the effects of increasing concentrations of greenhouse gases on the global climate system, and the growing evidence that Australia's climate is already undergoing change. Over the last 15 years significant progress has been made in our physical understanding of seasonal climate variability and predictability. This progress is due to recognition of the importance of the strong feedbacks between the atmosphere and the oceans in the tropics; the use of ocean data assimilation for initializing coupled ocean-atmosphere models for El Nino-Southern Oscillation forecasts; increases in model resolution; and improvements in the representation of sub grid-scale processes. Nevertheless the nature of seasonal forecasting is essentially probabilistic due to the uncertainties in the initial data and model formulations. Climate change projections are also probabilistic in nature due the uncertainties in: future levels of greenhouse gases; model formulations; our knowledge about the interactions between the atmosphere, biosphere and hydrosphere; and the likelihood of abrupt climate changes due to the crossing of thresholds that may lead to new climate regimes. While the time scales of forecasts and projections are quite different (seasonal to inter-seasonal versus decadal to centennial), the spatial scales of practical interest are essentially the same.

There is increasing recognition amongst scientists that climate variability and climate change are intrinsically linked. One of the problems in adapting climate forecasts and projections to natural ecosystems and agricultural systems is the memory that they carry forward from one season to the next through processes such as soil moisture and the accumulation of fire fuel loads. The ability of models to describe and predict the responses of these systems has improved markedly over the last 10 years. This advance has been driven by improvements in process-level understanding, the wide availability and high quality of remotely-sensed information, and increasing computing power. Given the high likelihood of future climate change, and the influence that the biosphere, hydrosphere and human activities will exert on its trajectory over the decades to come, there is a growing effort to develop 'earth system' models to investigate their mechanisms, processes, and linkages. Within this context the emerging Australian Community Climate and Earth System Simulator (ACCESS) initiative between CSIRO, the Bureau of Meteorology and Australia's Universities will be described, and its importance to the future of Australian seasonal forecasting research will be discussed.

Session 2 **Evolution of climate risk technologies in agriculture and NRM, and the role of MCV**
Convenor **Dr Scott Power**

Presenter: **Mr John Carter, Queensland Department of Natural Resources**
Presentation Title: **The evolution and application of climate risk technologies in pastoral industries**

After spending several years working on mining rehabilitation in central Queensland Mr Carter completed a Masters of Science at the University of Queensland. In 1986, on completion of his degree he joined the Queensland Department of Primary Industries in Brisbane. His first job was to develop an on line climate data bank which was the precursor to the award winning "Rainman" computer package. Following a stint in regional Queensland "Rockhampton, Julia Creek and Longreach conducting research on woody weeds and pasture growth, John returned to Brisbane in the early 1990's to join a newly formed Drought Group. This group had the role of producing quantitative drought analysis for Queensland. In recent years the group expanded to produce drought analyses and forecasts for all Australia and the Long Paddock web site. Mr Carter now runs an ecological model of Australia driven by daily climate data as well as attempting to quantify greenhouse gas emissions from the landscape. He is currently a program leader in CRC Greenhouse accounting.

Summary of Presentation
The presentation will follow the development of modelling for pasture and rangeland systems and how biology and climate science tools have evolved since the 1970s'. There have been several key drivers of "modelling technology" these have been (a) development of biological models of pasture systems, (b) increasing availability and usability of climate data, (c) increased computing power and (d) increasing knowledge of the climate systems affecting Australia and the development of statistical forecast systems for seasonal forecasts using the "analogue" year concept.

Many organisations and individuals have contributed to the development of climate applications for rangeland systems, however, much remains to be completed. The issues of quality data sets for modelling, and provision of easy to understand climate risk assessments, targeted to specific regional management systems remain as challenges.

Presenter: **Dr David Stephens, Department of Agriculture, WA**
Presentation Title: **The evolution and application of climate risk technologies in cropping industries**

Dr Stephens has been instrumental in the development of Agro-climatic index models that can operationally forecast regional crop yields and assess exceptional circumstances across Australia. In various projects he has incorporated seasonal outlooks into crop models and yield forecasts. He is presently working on a Grains Research and Development Corporation (GRDC)/MCV funded project: "Better long-lead seasonal and crop forecasts for southern Australia".

Summary of Presentation
In the context of climate forecasting in Australia, this presentation will focus on the evolution of climate risk technologies in the cropping industries. It will give an overview of key achievements in the development of cropping applications of seasonal forecasting and will endeavour to outline the role that MCV played in this. Work covered will range from the paddock to national scale, and will involve models that range from the complex simulation approaches to the relatively simple water balance models.

Presenter: **Mr Steven Crimp, CSIRO**
Presentation Title: **The evolution and application of climate risk technologies to natural resource management**

Mr Crimp has recently been appointed to the Agricultural Landscapes Program of CSIRO Sustainable Ecosystems as Climate Impacts Scientist to facilitate the application of climate risk technologies to natural resource management. Mr Crimp was previously employed by the Climate Impacts and Natural Resource Systems (CINRS) group of the Department of Natural Resources, Mines and Water (NRMW), during which time he has been involved in the study of both climate change and climate variability impacts on Queensland's natural resources. This has involved research assessing possible changes in rangeland productivity, commercial seedling establishment, grazing animal heat stress, catchment hydrology, coastal vulnerability and the interaction between climate variability and climate change on seasonal, decadal and multi-decadal timescales.
In addition he has been a contributing author and expert reviewer of the second volume of the Inter-Governmental Panel on Climate Change (IPCC) Third Assessment Report on Climate Change in 2001 and is currently involved in an expert review capacity for the IPCC fourth Assessment report.

Summary of Presentation

Climate has a large impact on the status of natural resources and their functioning. For example, key degradation processes such as erosion, percolation of water below root zones, species changes amongst others are most active in years of climate extremes. Similarly, particular climate conditions bring both risks and opportunities for activities trying to change the status of our natural resource base (e.g. tree establishment).

Over time, much of the development and application of climate risk technologies has been to address specific issues related to agricultural production, with limited application to assist natural resource management. We discuss here the rationale for applying similar approaches to NRM issues at both the management unit and at policy levels. Arguments for inclusion of improved climate risk technologies in NRM include substitution (can this information replace existing inputs and policies which require outlays?), efficiency (can this information result in better, cheaper ways of meeting NRM outcomes?), monitoring (can the climate 'noise' be removed to reveal the management/policy 'signals'?) and adaptive management (can management/policy be better refined by taking into account variation in effectiveness resulting from climate variations?). We use results from recent MCV-supported studies to assess these questions. We also look at whether better climate risk management can change the nature of production: NRM trade-offs.

Session 3 **The evolution of climate risk extension and communication programs, and the role of MCV**
Convener **Dr Barry White**

Presenter: **Dr Peter Hayman, SARDI**
Presentation Title: **Communicating climate risk management and decision making under uncertainty**

Dr Hayman is the Principal Scientist in Climate Applications at the South Australian Research and Development Institute. He is an agricultural scientist who after working as an adviser and researcher in irrigated and dryland farming systems became more interested in climate risk. In 1994 undertook a GRDC/LWA PhD scholarship in agro-climatic risk management at the University of Western Sydney. Before moving to Adelaide last year he was coordinator of climate applications for NSW Agriculture.

Summary of Presentation
The Managing Climate Variability Program has always realised the importance of communication from climate science to decision-making and from decision makers to climate science. However, effective communication between climate science and agricultural decision makers is more difficult that first thought.

In a report to the US National Academy of Science, Easterling made the point that seasonal climate forecasts are ill suited to decision-making and decision-making is ill suited to seasonal climate forecasts. A common problem is communicating probabilistic information from seasonal climate forecasts. A further challenge comes from the way that the process of making risky decisions is often deeply embedded in the social and psychological context of the decision maker.

Success has come where climate science has been clear about the uncertainty and decision makers have incorporated seasonal climate forecasts into their risk management rather than replacing it.

Presenter: **Dr Robert Fawcett, National Climate Centre, Bureau of Meteorology**
Presentation Title: **Meteorology and communicating seasonal climate forecasts**

Dr Fawcett currently works in the National Climate Centre's Climate Analysis Section, in Client Support and Systems Maintenance and Development. Prior to this, he was heavily involved in the Centre's operational climate monitoring and prediction activities.

Summary of Presentation
The Bureau of Meteorology has been issuing ENSO-based seasonal outlooks since 1989. This presentation will describe some of the challenges faced in communicating seasonal outlooks to the general public, and changes made to method and style in consequence to feedback from forecast users and perceived communication failures. The presentation will conclude with a brief outline of some new approaches currently under consideration.

Presenter: **Mr Peat Leith, UTAS**
Presentation Title: **Insights from farming communities on the communication of seasonal climate forecasts**

Mr Leith is a doctoral candidate in the School of Geography and Environmental Studies, and the Tasmanian Institute of Agricultural Research at the University of Tasmania. Since his honours work in geographical climatology, he has shifted focus and discipline. His current research draws on a variety of biophysical and social scientific literature and in-depth interviews with rangelands graziers as well as researchers involved in climate risk management. Mr Leith is particularly interested in the nexus between scientific and local knowledge, the public understanding of science and how management decisions are influenced through various knowledges and types of information.

Summary of Presentation

Seventy graziers in the semi-arid rangelands of eastern Australia were interviewed in-depth about their views of climate science and their methods of managing for seasonal climate variability. From a qualitative analysis of these interviews some dominant themes surrounding issues of trust in science became apparent. In a variety of ways, trust was frequently mentioned as underpinning the application of scientific information in decision-making. In turn, trust was affected by the abilities of graziers to engage with the work of climate scientists (and vice versa), particularly in relation to three recurrent themes: lived experience of graziers, autonomy of graziers as decision-makers, and the negotiation of climate risk within social networks.

Following from these findings, extension and communication strategies could be augmented such that climate information can be better embedded in the social landscape of the rangelands, particularly by: 1) linking people's lived experience of places, signals, patterns, and climatic events, to scientific climate information; 2) acknowledging that climate risks are assessed by graziers in a complex, contingent and usually intuitive manner; 3) bridging social networks by better linking research and grazier communities via individuals (e.g. researchers, consultants and graziers); and 4) developing ways of talking about climate that integrate scientific and local representations of seasonal variability.

Session 4 Future directions for climate risk management in Australia, and the potential role of MCV
Convenor Dr Rohan Nelson

Presenter: **Dr Scott Power, Bureau of Meteorology Research Centre**
Presentation Title: **The future of climate forecasting and the role of GCMs**

Dr Power's 15 years at the Bureau of Meteorology, has encompassed 11.5 in research and a further 3.5 in climate services. He is the Former Head of Operational Climate Monitoring and Prediction and Former Acting Head for the National Climate Centre. Currently Dr Power is the Coordinator for Climate Change Research at the Bureau of Meteorology. His areas of expertise are: Climate modelling, interannual and decadal climate variability, ENSO, climate change, climate prediction, climate services, use of climate science in wider community, oceanography. Dr Power is a member of WMO International CLIVAR Pacific Panel; member of WMO CLIVAR WG on seasonal to interannual climate prediction; and was also a contributor to the IPCC Chapters 8 and 10 (climate model evaluation, climate change detection and attribution).

Dr Power led the development of the Bureau of Meteorology's first coupled general circulation model (CGCM). He and his colleagues then used this CGCM to conduct Australia's first transient global warming experiment. He then led the development of the Bureau's second CGCM, which was subsequently used by his colleagues in BMRC to conduct Australia's first CGCM-based seasonal predictions. This same CGCM was also used to conduct the first ever CGCM-based "Climate Change, Detection and Attribution" study for Australia. He has published extensively in the international literature. In recent years he and his co-authors have made several discoveries by analysing the observational record and climate variability in the second CGCM. This includes:

- the remarkably large magnitude of decadal fluctuations in the impact that ENSO has on Australia, and its strong coherence with changes in decadal ENSO-like patterns;
- the unexpected weak relationship that exists between All-Australia rainfall during El Niño and the "strength" of the El Niño event;
- a new theory for ENSO-like decadal patterns like the Interdecadal Pacific Oscillation;
- the presence of ENSO-driven multi-year predictability in some parts of the ocean; and
- the exciting possibility that changes in the ocean's thermohaline circulation might help to make decadal fluctuations in southern Australian climate partially predictable.

Summary of Presentation
The future of climate forecasts and the role of climate models.

Presenter: **Ms Melissa Rebbeck, SARDI**
Presentation Title: **The future of climate risk communication – opportunities for national cooperation**

Ms Rebbeck (B.App.Sc.Nat.Res., Grad.Dip.Ag.), Senior Research Officer (Climate Risk) at SARDI has 8 years' experience in climate risk management research and extension. She achieves this through working on approximately 12 research projects in that time. Currently she works across 5 projects and at the same time has developed a successful commercial delivery program now launched as Climate Support. Ms Rebbeck has strong collaborations nationally with many industry and government stakeholders and has a successful relationship with consultants and primary producers. She has been instrumental in developing a formal framework for two way delivery of climate risk management information in southern Australia.

Summary of Presentation
Ms Rebbeck will talk about the processes involved in forming a framework for delivering climate risk management information to producers. She will also talk to you about the opportunities for national cooperation.

The history of the SARDI Climate Risk Management Climate Support program for primary producers followed the process of

- identifying the messages producers want delivered by engaging with them one on one and in groups
- identifying methods of delivery
- market research
- communication with the market
- developing an awareness program
- delivery of the messages
- tailoring the budget

and then evaluation of

- the messages delivered
- the method of delivery
- the effectiveness of the market used

and creation of flexibility to deliver new research information

As organisations, we can learn from each others mistakes and successes to build a process for delivering climate risk management information. Ms Rebbeck will lead a discussion on what opportunities there are for organisations to cooperate and then adapt delivery frameworks for implementation into individual niche areas.