# Managing agricultural systems in a variable, non-stationary climate

March 2003 – May 2004

## Location: Toowoomba, Brisbane, Canberra, and Tamworth

## Principal investigator

Dr Holger Meinke,
Queensland Department of Primary Industries and Fisheries

## The need

Climate variability is the major risk factor for the agronomic and environmental performance of agricultural systems. There is now firm evidence that, in addition to year-to-year variability, there are also trends in climate factors that result in a non-stationary, i.e. changing, climate. The consequences are measurable and substantial. Good risk managers can no longer afford to dismiss this evidence—appropriate risk management strategies need to take both variability and change into account in order to achieve the best possible outcomes. Due to the long timeframe involved over which such climate trends manifest themselves (decades rather than years), current practices are to some extend 'self-adapting', whereby producers and policymakers modify behaviours based on most recent experiences. The masking effect of variability means that such subconscious self-adaptation is haphazard, non-specific and often involves considerable lag periods.

## How this project fits with MCV objectives

This project is aligned with the MCV objective to provide tools and services that help farmers and natural resources managers to better manage climate risks.

## Project objectives

1. Quantify historic trends in key climate factors such as changes in temperature extremes, frost and rainfall
2. Quantify the likely consequences of these trends on production, and NRM risk (erosion, deep drainage/leaching) via simulation modelling
3. Discuss possible management responses to these issues
4. Outline the approaches needed in order to assist industry in a well-managed transition towards more resilient agricultural systems that can accommodate such trends and variability in climate factors and hence cope with the possible effects of climate change

## Methods

Using a N-S transect through the northern cropping regions of eastern Australia, we documented evidence of climate trends in primary variables (i.e. rainfall, temperature) and secondary variables (integrated impact assessment via simulation models of variables such as crop yields, but also environmental indicators such as drainage and erosion). Locations along this transect—Emerald, Dalby, Goondiwindi, Inverell and Gunnedah—were chosen based on the availability of high-quality, daily, long-term climate records and their importance for crop production in north-eastern Australia.

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## Desired outcomes

- Understanding of the magnitude of non-stationarity of climate at key locations
- Ability to develop better mitigation options for NRM consequences of climatic trends
- Improved risk management of cropping systems by including climate trends in decision making, and by providing pro-active capacity to adapt to future climate changes
- Ability to better estimate magnitude and direction of impacts of future trends arising from climate change
- An approach and methodology that can be applied to cropping and grazing systems throughout Australia

## Achievements to date

The project achieved all its objectives. It clearly quantified climatic changes over the last century and their likely consequences on managing cropping systems such as changes in frost risk. Most importantly, project outcomes were used to proactively engage with government policy makers and rural industry groups and representatives about the future direction of rural industries in a changing climate.

The project also provided input into a Queensland Government discussion paper on climate change issues. Project staff also facilitated a roundtable on this issue for the Qld Farmers' Federation. This has led to an 'integrated assessment' process with the aim to inform policy makers and rural industries using the best science available.

Project outcomes have also been used to engage with stakeholders by demonstrating the policy AND management relevance of agricultural systems and climate science. This provided a platform to generate knowledge that is policy as well as response informing. The process is on-going.

The project also resulted in a substantial number of conference and journal publications, including:

Meinke, H. and Stone, R.C., 2005. Seasonal and inter-annual climate forecasting: the new tool for increasing preparedness to climate variability and change in agricultural planning and operations. Climatic Change, 70: 221-253.

Meinke, H., Donald, L., deVoil, P., Power, B., Baethgen, W., Howden, M., Allan, R. and Bates, B., 2004. How predictable is the climate and how can we use it in managing cropping risks? Invited Symposium Paper, Proceedings of the 4th International Crop Science Congress, 26 Sep – 1 Oct 2004, Brisbane, Australia, published on CD and <www.cropscience.org.au>.

Howden, S.M., Meinke, H., Power, B. and McKeon, G.M, 2003. Risk management of wheat in a non-stationary climate: frost in Central Queensland. Post, D.A. (ed.) Integrative modelling of biophysical, social and economic systems for resource management solutions. Proceedings of the International Congress on Modelling and Simulation, July 2003, Townsville, Australia, pp 17-22.

## What is left to do?

The project is complete.

MCV is a collaborative program between the Grains, Rural Industries and Sugar Research and 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.

For more information on MCV, visit http://www.managingclimate.gov.au
Land & Water Australia is the managing agent for MCV.
Land & Water Australia
Level 1, 86 Northbourne Avenue, Braddon ACT 2612
GPO Box 2182, Canberra ACT 2601
Phone: +61 2 6263 6000 Email: managingclimate@lwa.gov.au