



Rain coming: Cumulonimbus clouds at dawn.

Photo: CSIRO

Improving rainfall predictions

Factors that influence

extra-tropical rainfall depressions near Australia's east coast need to be given more attention in modelling of seasonal climate variability and long-term climate to improve rainfall predictions, according to Dr Mike Pook, a CSIRO Climate Adaptation Flagship scientist with the Centre for Australian Weather and Climate Research (a CSIRO and Bureau of Meteorology partnership).

"We know the benefits for cropping regions and catchments that come from these lows and their critical role in bringing substantial rains," Dr Pook said.

He specialises in understanding atmospheric patterns and processes that generate rainfall for southern Australia and has been researching rainfall systems during the winter cropping regions of the Australian mainland and Tasmania. He is based in Tasmania.

Dr Pook said climate modelling provided an insight into how extra-tropical lows would change in a warming world. He said the so-called 'east coast low', which brings gales, heavy rain and high seas to the heavily populated NSW and Queensland coasts, was an extreme example of a broader class of synoptic systems known as cut-off lows.

Such lows, caused by favourable conditions in the upper atmosphere, led to storms and rainfall.

Dr Pook said cut-off lows made a significant contribution to rainfall over much of southern Australia's agricultural districts and water

catchments but in Tasmania the proportion of rain attributed to these systems varied substantially from district to district because of their association with blocking highs and the complex topography of the state.

"For example, Tasmania's hydroelectric catchments can experience very low rainfall because of the influence of a blocking high while the normally drier eastern and midlands districts receive well above average rainfall if the associated cut-off low is in a favourable location," Dr Pook said.

"Weather forecasting models used by meteorological and research agencies can provide excellent forecasts of individual synoptic systems for up to 10 days. On seasonal time-scales and longer, climate models can only predict the average behaviour of weather systems because of computer and data limitations and the effect of chaos."

Dr Pook said these climate models were known to have problems in accurately simulating blocking location, frequency and intensity. Because of this, it was critically important to improve the way blocking and cutting-off mechanisms were treated in numerical models, if progress was to be made in seasonal climate and climate change.

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Australian agriculture needs to adapt now to climate change, according to a new CSIRO book entitled *Adapting Agriculture to Climate Change: Preparing Australian Agriculture, Fisheries and Forestry for the Future*.

The book's findings are based on the expertise of senior researchers from CSIRO, state government departments, universities and other research institutions. It explains how climate change is likely to affect Australia's primary industries and provides summary information on promising options for dealing with these challenges.

An article about the book's major findings will be published in the May edition of *Farming Ahead*.

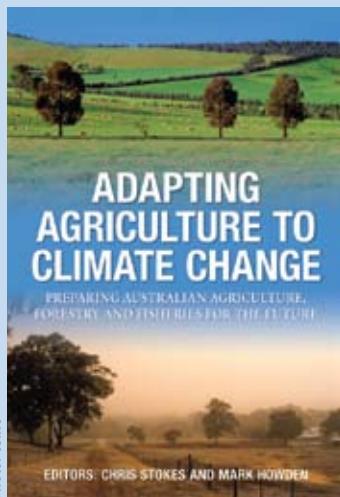


Photo: CSIRO

Rooster or hen?



Day old: Currently the poultry industry sexes chickens when they are a day old. The research into DMRT1 gene expression could make that a thing of the past.

Photo: CSIRO Livestock Industries

Researchers from CSIRO Livestock Industries' Australian Animal Health Laboratory (AAHL) and the University of Melbourne's Murdoch Children's Research Institute (MCRI) have solved the long-standing mystery of what determines sex development in chickens.

The collaborative effort is a scientific breakthrough which could have significant benefits for animal welfare.

The MCRI researchers first discovered the DMRT1 gene during 1999 and proposed its sex-determining role in birds.

CSIRO, in partnership with MCRI, showed that manipulating chicken embryos to silence DMRT1 caused testis to become ovaries — that is, to bring about male to female sex reversal.

According to CSIRO Research Group Leader Dr Tim Doran, the aim of this gene technology work was to determine if knockdown of DMRT1 in the egg, using the CSIRO-developed RNA interference (RNAi) technology, could induce the selective development of a female gonad phenotype.

"This research has demonstrated that there is potential to generate only female chickens through knocking down or silencing the DMRT1 gene," Dr Doran said.

The scientists are now attempting to hatch embryos in which the level of DMRT1 gene expression has been knocked down. If successful, the discovery could allow researchers to influence sex ratios in poultry.

Dr Doran said the research had major applications for the poultry industry, in particular the egg industry. There were animal welfare issues associated with the egg industry not requiring male chickens.

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FLECKTM technology: This CSIRO-developed remote sensor makes monitoring field trials easier and more efficient.

Photo: Carl Davies, CSIRO

Phenonet: big brother in the back paddock

Researchers at the High Resolution Plant Phenomics Centre are using the CSIRO-developed FLECKTM technology to remotely monitor and record environmental conditions and plant performance in field trials.

Plant phenomics is the study of how a plant's genetic make-up determines its appearance, function and appearance. It is a cross-disciplinary approach, studying the connection from cell to leaf to whole plant and from crop to canopy.

Smart sensor networks such as FLECKTM are becoming increasingly important in plant phenomics, where continuous analysis of plant growth and performance, matched with climatic conditions in the field, are mapped back to a plant's genetic make-up.

Analysing the size, growth and performance of plants in a greenhouse or field site can be time-consuming and laborious. When a field site is located in a remote area, it becomes quite expensive to send people out to the field.

The project is currently in its early stages with five FLECKTM nodes spread over a quarter acre field of sorghum, millet and soybean at CSIRO's Ginninderra research station in Canberra.

Each solar-powered node is connected to sensors measuring solar radiation, air temperature, soil moisture, soil temperature and an infrared sensor which measures canopy temperature.

Using this new technology, the researchers hope to be able to 'map' environmental variation in light, temperature and soil moisture across the field to better evaluate and compare crop species.

Small variations in light intensity or soil moisture, for example, can impact on plant growth and performance.

By mapping these variations and correlating them with each plant's genetic profile and performance, researchers may improve the accuracy and speed of plant breeding.

CSIRO research

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