CliMag

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In a changing world, what next for Managing Climate Variability?

Each of the four phases of research investment in Managing Climate Variability (MCV) has delivered positive economic, environmental, social and scientific returns.

According to a recent independent evaluation, MCV has delivered over 28 per cent return on investment for a net present value in excess of $350 million—certainly high economic values for any science program.

So, what next for a program that operates in a now crowded environment, where every public policy and research institution seems keen to demonstrate how they will respond to the topical climate change agenda?

'The first part of the answer to "what's next?" is to build on the strengths as detailed within the evaluation,' says Program Coordinator Colin Creighton.

To date, the principal strengths of the program have been economic. Benefits have included increased profit and reduced income risk for farmers who now use seasonal climate forecasts and the accompanying decision tools.

'Clearly, further investment is warranted in improving our seasonal forecasting capability and then application to various natural resource and agriculture decisions,' says Colin.

The evaluation has led MCV to define three closely linked themes in its draft Research and Development Strategy:

- seasonal forecasting
- water availability
- agricultural applications

There is much potential for MCV research to make a difference into the future. For example, based on the 2006 analysis of forecasting skill undertaken by Australia's leading climate scientists, major gains in seasonal forecasting for northern Australia are possible.

Australia's major urban water suppliers will make substantial economic gains if they can better predict runoff to dams six to nine years ahead of time. And, if MCV can build on the success of existing tools developed through program investments, such as AussieGRASS and Yield Prophet®, then the program can move even further toward its goals.

The evaluation shows that MCV investments have substantially raised awareness of seasonal climate forecasts and climate change. Flow-on social benefits identified include the increased capacity of land and water managers to manage risk, to understand climate variability and, consequently, to benefit from lowered levels of stress and uncertainty.

Dr Peter Hayman at the MCV parliamentary briefing, Canberra, 28 March 2007

The evaluation also shows that the investment has markedly increased Australia's science capability in seasonal forecasting and tools.

'Again, this is an important learning that will help shape the focus of the next three to five years of investment,' says Colin.

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MANAGING CLIMATE VARIABILITY R & D PROGRAM

Yield prediction tools

save input costs in extreme season

In 30 years, mixed farmer Tony Blake from Western Australia's northern agricultural region had never experienced anything like the conditions of 2006.

Soil sampling for a 'Horses for Courses' trial site at season's start

'We're in what we call a "safe" rainfall area. So before 2006, seasonal climate information was not all that important to us,' says Tony. 'But didn't that change in 2006!'

Tony, his wife Shirley and son Marcus farm their 2,000 hectare property west of Mingenew, 100 km south-east of Geraldton—one of the most reliable rainfall zones in the country. In late June with no opening rain, he was one of many Mingenew-Irwin farmers at a loss to know how late he could leave it to sow, or whether to sow at all. This was new ground and he made no hesitation in attending a workshop run by Cameron Weeks, a Planfarm consultant to the Mingenew-Irwin Group.

'We had people swinging from the rafters at the workshop,' says Cameron. 'A lot of growers were questioning how best to cope with and manage the late break and the very low rainfall. Everyone was stressed.

'We'd normally see crops sown around 15–25 May so we were five-six weeks late in a break and, by the weather forecast, looking at another 10 days with no sign of rain. Some farmers had sown dry but most were waiting on the break and wondering if it was ever going to come.'

By this time, Cameron had already been running the 'Horses for Courses' project for two years. Funded by Managing Climate Variability, the project has been trialling yield predictions based on Yield Prophet® and the Potential Yield Calculator (PYCAL) for 11 Mingenew-Irwin sites. Cameron had been publishing the predictions in a monthly bulletin along with rainfall updates, the climate outlook for the region and guidance on sowing decisions and fertiliser use.

Since the project started, growers from the eastern part of the region had found the yield predictions useful for helping them decide on a cut-off date for sowing and, in better years, to plan nitrogen requirements for optimum yield. In the western part, where rainfall is higher and soils are sandy, farmers like Tony Blake are used to "playing the weather" —holding back crop inputs until the latest possible time to gain as much knowledge of the season as possible without compromising crop yield. These farmers also tend to farm for the "average year" as crop yields tend to be quite stable.

Mingenew-Irwin Group consultants Cameron Weeks, Richard Quinlan and Debbie Allen at a trial site

'At the workshop, we focused on crop input costs,' says Cameron. 'How much could you pull those back so that if you sowed you knew how much you were up for? And assuming a certain wheat price, what your break even point between input costs and income would be.

'With low rainfall, a grower can be left with very little to vary once the season is underway,' explains Cameron. 'When growers understand what expenses are effectively committed at seeding, they realise this.

'We showed growers how the tools could help them see what chance they had of getting break even. For most people this was 0.6–0.7 tonne/ha assuming fertiliser costs were pared right back.'

Tony Blake says the workshop helped him to quantify yields and know how late he could leave it to sow his crops.

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Farmers and scientists brief parliament on climate variability

Mixed farmer and Chairman of the Birchip Cropping Group Ian McClelland spoke to ministers and senators at Parliament House in March about climate variability and change.

'Farmers, like everyone else, are finding it difficult to cope with the uncertainty of climate change, particularly on top of 10 years of drought,' said Ian, from Victoria's north-west Mallee region.

'We can help farmers by constantly keeping them in touch with developments in climate science, tools and farming technologies.

Ian McClelland

'There are a number of innovations that will help counteract the different climate impacts that we may experience.'

Ian listed better long range forecasts; risk management strategies; yield prediction models; increased skills and knowledge for the farming community; and better adoption of new technologies such as biotechnology, bio-fuels and recycling carbon.

And in spite of gloomy yield predictions for the Mallee region by 2070, Ian remains focused on the positives.

'You have to remember, while predictions for climate change impact are useful, they're based on current science and technologies,' he said. 'What we do now in improving our tools, our plant varieties and technologies, has the potential to change these predicted impacts.'

The audience, including 14 MPs and six advisers, heard about the tools being developed and supported by Managing Climate Variability, including:

- better long-range climate forecasting tools and information
- decision support software such as Yield Prophet® which models wheat yields under different climate scenarios
- changed farming practices such as different plant varieties, stubble retention, grazing cereals, perennial pastures and rotational grazing

Dr Peter Hayman from South Australia's Research and Development Institute spoke about a recent shift in farmers' openness to learning about climate change.

'The emphasis of discussions in the agricultural community has shifted from "is climate change real?" to "what will the impacts be and what can we do about it?"'

'There is still a lot of uncertainty in climate change projections, both about the extent of the temperature rise and, more worryingly for many dryland and irrigated farmers, changes to rainfall. But there are consistencies in a warming and drying trend. We are more certain about our seasonal forecasts.'

Australia is considered a world leader in practical approaches to the risks of living with climate variability. Both speakers discussed how Australian farmers are already managing seasonal climate variability and how farming communities across Australia are preparing for more extreme changes in climate.

'This is an incredibly important issue for rural Australia,' says Dr Hayman, 'and it's encouraging that it's being discussed in parliament, in the pubs and at the dinner tables.

'It is critical that we realise the value of climate variability research in supporting farmers to adapt to climate change.'

Land & Water Australia, the managing agency for MCV, organised the parliamentary briefing.

Monsoon magic

Researchers are talking directly with landholders and industry groups in northern Australia to find out how they can better deliver forecasting of the area's wet season to meet rural management needs.

'We found landholders in northern Australia want to know when the onset of the wet season is going to be two weeks later or earlier than normal, for example,' says researcher Dr Matt Wheeler from the Bureau of Meteorology. 'This is rather than the probability of the three-month mean being above or below median that they are relying on now.

'Our work now gives them a forecast of the probability of onset by any date they desire. And we can provide that with a fairly high level of skill and reliability.'

The Managing Climate Variability (MCV) project, 'Improving prediction of the northern Australian wet season', is improving definitions of the wet season and providing forecasts for rainfall thresholds according to land types. The research is being jointly conducted by the Queensland Department of Primary Industries and Fisheries (QDPI&F) and the Bureau of Meteorology Research Centre. Forecasting active and break periods of the wet season, rainfall volumes and timing, and indications of the timing of the last wet burst are also part of the work.

The research group is looking forward to a July meeting to determine how the research results can be packaged to meet the needs of each industry. The group will present to Meat & Livestock Australia, the Sugar and Grain Research & Development Corporations, and grower groups.

'This will be a very interesting two-day meeting,' says researcher Lexie Donald from QDPI&F. 'Representatives from these groups are coming from all over Australia—including some who don't normally have broadband access, which until now has prevented an in-depth visual interpretation of our research to improve its application.'

Photo: courtesy of Matthew Wheeler

Professor Holger Meinke, Lexie Donald, and Dr Matt Wheeler visit grazing industry experts in the Northern Territory

Following this meeting, Dr Wheeler will present his talk 'Monsoon Magic' to the 2007 Queensland Landcare Conference in August. The talk will be based on a soon-to-be published paper titled 'Probabilistic forecasts of the onset of the north Australian wet season' by the joint research group (Lo et al., 2007).

'In research for this particular paper, we didn't discover any new sources of predictability, or any new indicators of El Niño,' says Dr Wheeler.

'Instead, we worked with the grazing industry, who identified what they wanted information about and we went back to our offices and constructed a forecast scheme that provides the information they required. That is, information on the timing of the wet season onset. Now, by working with other industries, we can do the same for their needs.'

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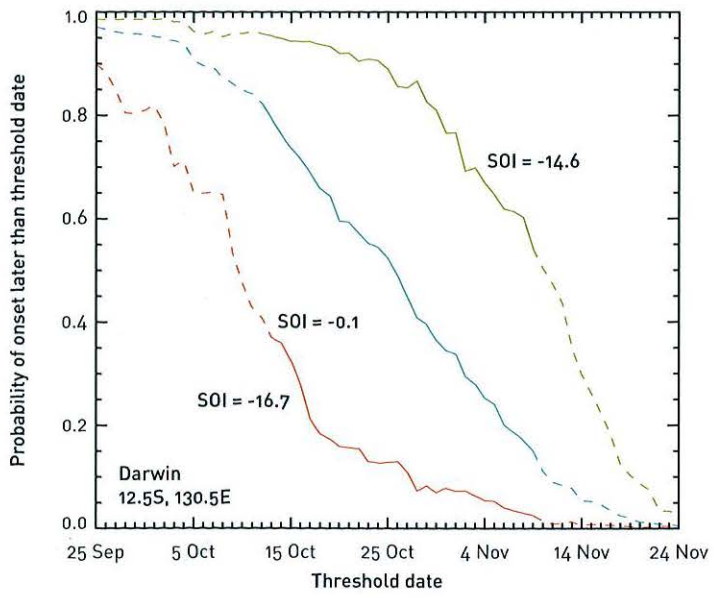
Lo et al (2007) downloadable from:
http://www.bom.gov.au/bmrc/clfor/cfstaff/matw/abstracts/LWMD07.html

Queensland Landcare Conference:
http://www.landcare.org.au/Conference.htm



Probabilistic forecasts of the onset of the northern Australia wet season from Lo et al (2007)

Building the kitbag of grazing tools

Tony Thompson in front of his remote animal monitoring system, which he uses conjunction with PaddockGRASP

Tools that can predict and monitor ground cover over large areas are becoming a fundamental part of farmers' and catchment managers' kitbag for preventing land and waterway degradation.

Building on the philosophies of AussieGRASS and other tools developed over the years through Managing Climate Variability (MCV) and the earlier Climate Variability in Agriculture program, researchers and graziers in New South Wales are linking seasonal forecasts to pasture, stocking rates and erosion control.

PaddockGRASP, being developed in western New South Wales, is a computer model that simulates pasture growth and ground cover within individual paddocks. Simulating ground cover up to 12 months in advance, this tool will improve farmers' ability to assess the numbers of stock placed on an area of feed to avoid overgrazing. If ground cover is removed by grazing beyond safe levels, resulting soil erosion can lead to both land and waterway degradation.

As the model is specific to individual paddocks, it requires input of information on the types of country within the paddock —particularly, how the soil holds moisture and the density of trees that compete for it. It also requires historical climate data and current growth conditions. Using these inputs the model can predict ground cover using stocking rates already defined for 'poor', 'normal' or 'good' seasonal conditions. These results can then be evaluated in relation to seasonal climate forecasts to help landholders and catchment managers determine stocking strategies.

Mixed farmer Tony Thompson from Bourke in New South Wales has set PaddockGRASP up on his grazing property as a pilot, working with the New South Wales Department of Primary Industries.

'It doesn't matter how experienced you are at making stocking estimates, they're still subjective and there is room for these sorts of tools,' says Tony.

Tony has four land types on his block, each requiring calibration. He's now waiting for rain to fine tune the model to the land types.

'Calibrating and setting up the model is a fairly intensive exercise,' says Tony, 'but it's generally telling us what's happening. It will be worth it in the end.'

Dr Ron Hacker, Pastures and Rangelands research leader with the New South Wales Department of Primary Industries, is leading the development of the model in New South Wales, working closely with Tony and colleagues from the Queensland Department of Natural Resources and Water.

'Refining the capacity of the basic growth model to monitor regional targets for ground cover is another part of our project,' says Dr Hacker. 'This development will give Catchment Management Authorities a capacity to issue regional warnings of potential degradation events.'

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Using soil moisture
to quantify drought

New South Wales landholder John Ive averages 214 mm of spring rainfall on his Yass Valley property, Talaheni. Last spring he got just 50 mm.

'Spring rainfall is vital for good pasture growth,' says John. 'We schedule lambing and calving to take advantage of the spring growth flush. Right now, although we've sold all non-breeding stock and culled heavily, Talaheni looks pretty stressed and winter is looking increasingly grim.'

With farmers and media repeatedly claiming 'the worst drought in 100 years,' John's scientific background had him wondering if there was an objective basis to that claim. Using the 118 years of weather records available for his area, he set out to discover whether any of those years came close to 2006 in terms of drought. But it was not just rainfall that interested John.

'I've always believed that soil moisture is a better indicator of drought than rainfall. You can lose a lot of rainfall through runoff and evaporation. Soil moisture also allows you to consider the effect of soil properties (wilting point, field capacity, hydraulic conductivity) and vegetation requirements.'

At Talaheni, John uses a simple daily soil water balance model to regularly track soil moisture. He adopted the same approach using the historical rainfall and evaporation records to find the years closest to 2006 in terms of available spring soil moisture.

The four years that came closest to 2006 (the 'analogue' years) were 1944, 1919, 1914 and 1895. Like 2006, all had barely ten per cent of average soil moisture for the spring window.

'All these years are longer ago than most of us can recall,' says John. 'And of recent droughts, the widely remembered 1982 ranks seventh in the 118-year series. It shows how hard it can be to remember and compare like seasons.'

In spite of having similar soil moisture to 2006, all four analogue years had nearly twice the spring rainfall of 2006. 'The relationship between rainfall and soil moisture is not straightforward. While 2006 was the driest in terms of rainfall for the window, 1944 was the driest in terms of soil moisture—despite twice the rainfall.'

So, what can these analogue years suggest about the future?

'We are desperately awaiting the autumn break,' says John. 'To get good pasture growth, we need above average rainfall between mid-February and the end of April.

'I'm encouraged to find that all four analogue years panned out quite well. The average rainfall over the four years was near the 118-year long-term average, and three times what we got in 2006. Soil moisture levels, although variable, averaged 93 per cent of the long-term average. Notwithstanding climate change, will history repeat itself? Time will tell!'

Late update

The above article was written in February. For the critical mid-February to April period, John received 111 mm, compared with 128 mm long-term average and 47 mm in 2006. Soil moisture for the period was a modest 368 mm. In summary, while the late April rains were welcomed, more rain is badly needed.

John Ive checking depth of soil sampling in a perennial pasture during summer. John has taken regular soil samples from here for more than five years.

Carolynn Ive (accompanied by Zac) taking soil samples last winter. Soil samples are used to reliably predict available soil moisture conditions.

Piecing together the climate and water puzzle

As climate change and the water crisis make top news stories most nights and the drought affects our cities, the greater community is becoming more aware of the variable climate conditions that Australian farmers have always worked around.

Focusing on south-east Australia around the Murray Darling Basin region, the South Eastern Australian Climate Initiative (SEACI) is piecing together research across science disciplines to create a clearer picture of climate change and variability and the potential impacts on farming and water flows.

The $7 million initiative is a partnership between Managing Climate Variability (MCV), the Department of Sustainability and the Environment of Victoria, the Australian Greenhouse Office, the Murray Darling Basin Commission, and science teams within the Bureau of Meteorology and CSIRO.

MCV is particularly interested in developing more reliable methods for forecasting climate three to 12 months out. MCV aims to find out how to best apply these forecasts to predictions of soil moisture, stream flow, and water availability to improve crop yield opportunities for both dryland and irrigated agriculture.

The research is progressing well, as demonstrated in the recent first year review of research findings, and is on target to produce:

- projections of water yield and runoff characteristics (by the end of 2007) and rainfall, temperature and evaporation (by the end of 2008)
- rainfall and climate patterns for 2030 and 2070 (by mid-2008)
- estimates of likely changes in the frequency of extreme rainfall events (by the end of 2008)

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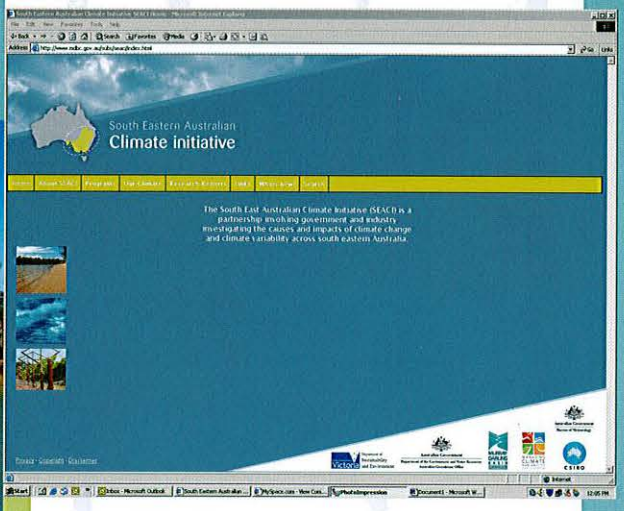
www.mdbc.gov.au/seaci



SEACI website

Pumping station on the Murray River at Curlwaa, New South Wales

Yield prediction tools save input costs in extreme season

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'One of biggest things for me was the rainfall charts,' says Tony. 'They pointed out that we were in a decile 1 year and it wasn't going to get better. So we knew our pastures weren't going to improve; our sheep had to go. And we knew that we weren't going to get 2 tonnes/ha but that we could break even if we could just cover the fixed cost'.

With likely wheat yields much lower than usual, Cameron recommended that growers hold off altogether on nitrogen —they didn't need anymore than what was already in the ground. This reduced the crop break even point substantially.

The predictions were right—two nitrogen rate trials (both at two of the higher yielding sites) showed there was no response to additional nitrogen. The entire cropping profit made by one farmer was what he saved by not top-dressing with nitrogen.

'The 2006 season showed one thing about yield forecasting,' says Cameron. 'In extreme circumstances, tools such as Yield Prophet® and PYCAL could at least put some rigour into yield calculations. And when everyone was asking the same question—how late is too late?—forecasts at or before seeding were really valuable.'

Tony Blake says he will definitely use the tools again, especially the long-term rainfall prediction. 'We had previously ignored all that. Farmers are the real optimists—next year's always going to be better! But here we are with one bad year and we're moaning! I'm very conscious that others out there have had it very hard.'

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In a changing world, what next for Managing Climate Variability?

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'Staying true to our goals around improved skill to predict and deal with climate variability, in a context of a changing climate, will ensure we continue to build science capacity in those areas of real time economic and social benefit for Australia.'

These are only some of the reasons why MCV needs to continue work, in partnership with agencies and agribusiness, to promote increased understanding of climate variability.

'This is probably even more important than ever with the multiple stories and spins now being put on climate change,' says Colin.

Contact Colin Creighton for a copy of the draft Research and Development Strategy.

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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.

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