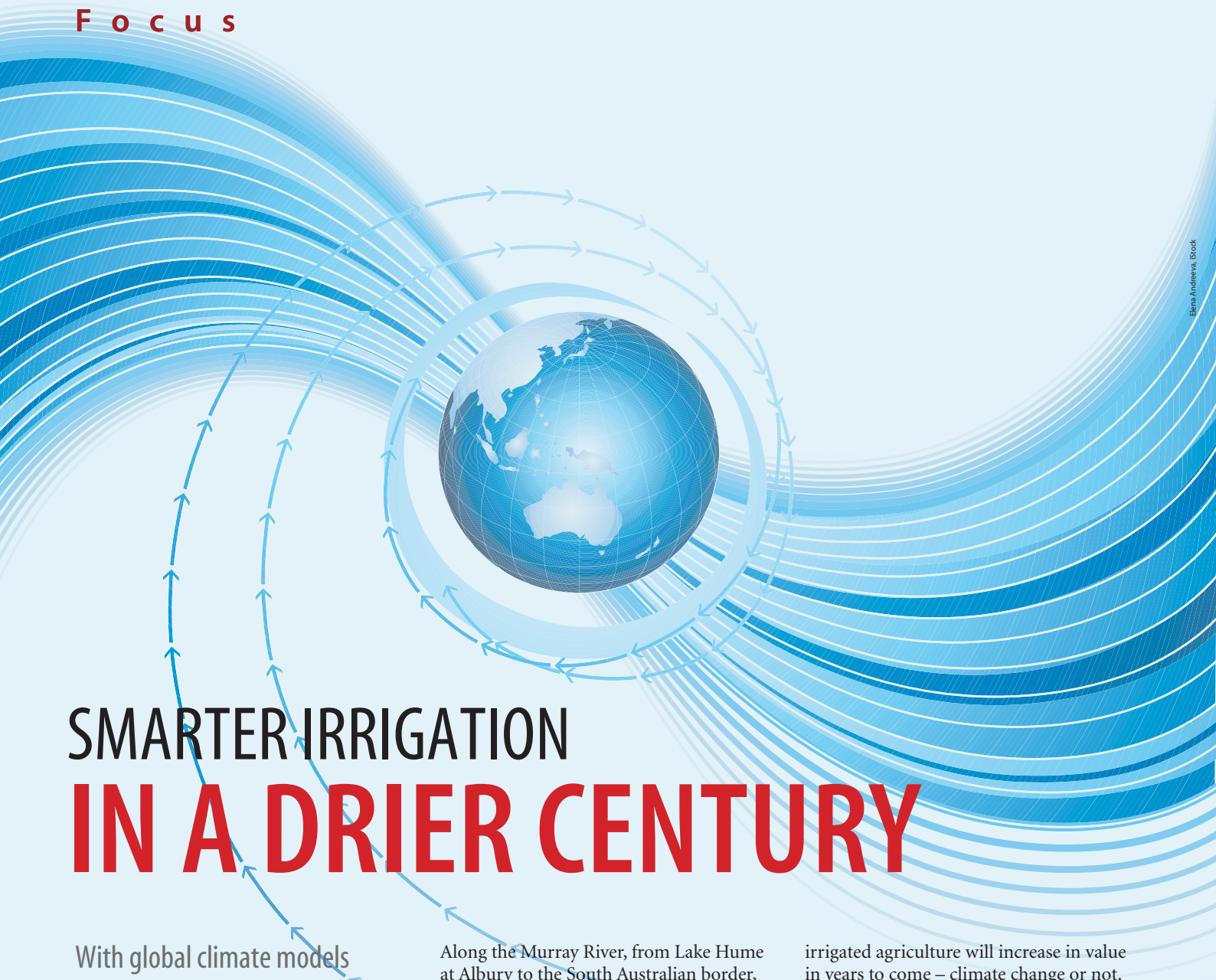
Focus



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SMARTER IRRIGATION IN A DRIER CENTURY

With global climate models indicating a further 20 per cent decline in rainfall across south-eastern Australia by 2030, irrigated agriculture, particularly in the southern Murray–Darling Basin, is suddenly facing an uncertain future. Now that the new COAG National Water Plan is signed, how might our irrigation systems be adapted for the 21st century? **Graeme O'Neill** provides some perspective.

Along the Murray River, from Lake Hume at Albury to the South Australian border, irrigators experienced an *annus horribilis* in 2007. By August, the worst drought since European settlement had reduced water storages on the Murray and Goulburn rivers to the lowest levels on record. Relative to long-term averages, rainfall in this heartland of irrigated horticulture had already declined by about 20 per cent.

Water authorities imposed draconian water restrictions on irrigated dairy farms, vineyards and orchards, and on Murray River cities and towns that had hardly experienced few more serious water shortages in over a century.

But despite continuing drought and the concerns of irrigators, Wayne Meyer, Professor of Natural Resource Science at the University of Adelaide, believes the future of irrigation in Australia is not in doubt. He predicts production from irrigated agriculture will increase in value in years to come – climate change or not.

'Australia is in a unique position,' Professor Meyer said. 'We have a full range of areas suitable for irrigation, from temperate to tropical.

'We will see a consolidation of irrigation in its traditional areas in south-eastern Australia, where there are already concerns about the impact of irrigated dairy farms on salinity.

'The value of water will rise, so dairy farmers in northern Victoria and the Goulburn Valley will find it worthwhile to trade it out for urban and industrial use. A relatively small amount will be taken out of the system for Victoria's proposed North–South Pipeline to supply metropolitan Melbourne.

'We'll see growers of fruit, vegetables, vines and tree crops such as almonds take more control of their water. The trend to

redevelopment and relocation is already underway, despite some institutional barriers.

'But', he points out, 'it makes sense to say that a certain area is not a good place to irrigate because of supply problems, or the potential impact on groundwaters.'

New directions

The man considered Australia's leading expert on water policy and management, the late Professor Peter Cullen, who was to have been interviewed for this article before his untimely death in March, observed recently, 'All the new irrigation action is on new greenfield sites, because layout is easier than refurbishing old, inefficient layouts.'

Professor Meyer agrees. 'We need to discourage further development in problem areas, and encourage relocation. With the changing climate, we should be phasing out irrigation in higher-risk areas with problem soils, and moving it back from the rivers so that high-saline groundwater discharges don't exacerbate water salinity.'

This has already occurred in the Sunraysia irrigation area around Mildura, where real estate values closer to the river now exceed the value of production.

Professor Meyer says the changing emphasis means there is likely to be some expansion of irrigated fruit, vegetables and high-value medicinal seeds in new areas, such as Tasmania.

The FullStop wetting front detector knows when soil is wet enough and shuts off irrigation. CRC Irrigation Futures/Measurement Engineering Australia

The future: IT for irrigation in field. A researcher from the CRC for Irrigation Futures runs Sentek soil moisture monitoring equipment. CRC Irrigation Futures

Meanwhile, the perennial dream of irrigating Australia's tropical north remains alive, but the reality is that the region's lack of deep, fertile alluvial soils constrains large-scale expansion. Professor Meyer says a mosaic of small, isolated irrigation developments is the likely future of irrigation in the tropics.

Other, lower-lying areas with potentially suitable soils flood during the Wet, so are unsuitable for irrigation, as rice growers on the Humpty Doo plains south of Darwin discovered.

'I've been to Western Australia's Ord River scheme a couple of times, and they've certainly got plenty of water,' Professor Meyer said. 'But there are high risks involved in Ord stages 2 and 3 expansion, because much of the land is only two or three metres above sea level – they're almost tidal areas.'

The water market invokes efficiency

As Chief of the former CSIRO Division of Irrigation Research in Griffith, Professor Meyer found rice growers in the Coleambally area of the Murrumbidgee Valley initially resented paying for new technology to monitor water use and water quality, as a condition of developing their farms on the Riverina plain.

'But after two years, they decided themselves to invest more heavily, because information was power in a system where there was a lack of information about how much water was going where. They put a lot of money into monitoring, and today rice growing is one of the few industries where we have very good data relating water use to productivity.'

The Murrumbidgee Irrigation Area (MIA) irrigators have since become highly efficient: most now laser-level their paddies and apply precisely metered quantities of water to rice, which allows them to sell off safely any surplus water for extra income.

Tradable water rights have seen water management move from inefficient to efficient high-value production. But an unexpected consequence is that almost all water allocated in the system, including unused water from 'sleeper' licences that once flowed down the river, is now traded and used.

Dr Wendy Craik, Chief Executive of the Murray–Darling Basin Commission, told a national press briefing in March that inflows into the southern basin are at the lowest levels since records began 116 years ago.

'We may well be in a different climatic arena to the one we've known in the past,' Dr Craik said. 'The drought has shown us that we can't rely on our storages to get us through to the future – we just haven't had the rain to fill them up.'

Last December, leading water economist Professor Mike Young, of the University of Adelaide, told Sunraysia irrigators it would take a large La Niña event just to bring major storages back to the official

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Water-driven branched irrigation lines can extend across hectares of crop and distribute high volumes of water. iStockphoto

status of 'empty' and restore some flows to the Murray. Torrential La Niña rains did flood northern New South Wales and Queensland in February, but didn't extend into the southern Murray–Darling Basin, where dams remained at record low levels in March.

The eventual signing of the Memorandum of Understanding on Murray–Darling Basin Reform (as part of the National Water Plan) in late March, however, has provided some new optimism, and hopefully unlocked the stalled investment in both environmental counter-measures and water-use efficiency technology.

Professor Gary Jones, Chief Executive Officer of the eWater CRC, echoed other commentators, saying, 'The Victorian Government's decision to sign the rescue package will now enable the elements of the plan to proceed; $5.9 billion will be invested in irrigation supply infrastructure such as lining channels and piping water and improving farm irrigation technology. Fifty per cent of the water saved through these initiatives should flow to the environment.'

'An additional $3 billion has been allocated under the plan to buy back water for the environment from willing irrigators.'

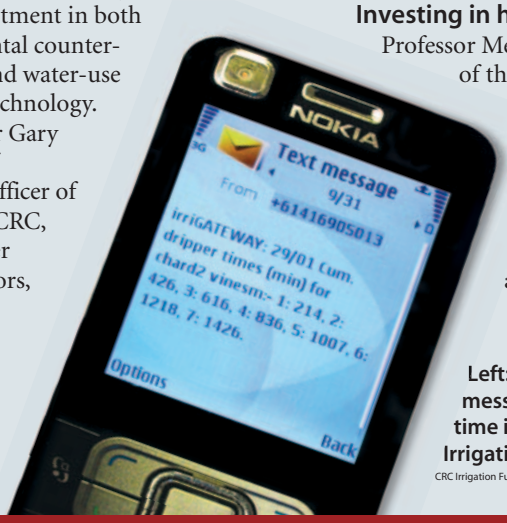
Investing in high tech help

Professor Meyer said the major lesson of the drought was that it was possible to maintain good yields with much less water than anyone had thought possible.

If the latest technology capabilities and efficiency measures are then overlaid on this observation, the future looks more positive.

Modern irrigation technology, including computer-controlled delivery systems, and soil-moisture monitoring devices, such as neutron capacitance probes, are already up to the task of improving irrigation efficiency.

But at $20 000, a capacitance probe is still beyond the means of most smaller



Left: A grower's mobile SMS message showing dripper run time information sent by the SMS Irrigation Scheduling Service.
CRC Irrigation Futures

A vegetation-index survey being conducted of a lettuce crop, Grafton, Queensland.
CRC Irrigation Futures

producers. However, a team led by CSIRO Land and Water researcher Dr Evan Christen, of the Cooperative Research Centre for Irrigation Futures in Griffith, is taking a simpler approach to improving irrigation efficiency: a mobile phone-based information service that could save horticulturists up to 30 per cent of their annual water use.

At last year's record price of $1100/megalitre for a temporary trade, a 10 to 15 per cent saving would have been worth $10 000 to $20 000 to a horticulturist with a 10-hectare vineyard and a 91-megalitre water allocation.

Dr Christen says Australian Bureau of Statistics data shows most growers 'guesstimate' when to irrigate and how much to apply, instead of relying on objective measurement of the crop's water needs.

The time, expense and expertise involved in measuring crop water consumption were impeding the uptake of new technology such as the capacitance probe.

These various devices measured soil moisture at a limited number of points and did not relate soil moisture levels to the crop's actual water consumption.

His research group concluded that a simple weather- and plant-based monitoring system could give growers greater control over water use.

'Such a system does not require a high level of knowledge or interpretative skill on the grower's part, and the information can be universally delivered to growers through the SMS system on their mobile phones,' he said.

Researchers in the US, Spain, Italy and Australia are experimenting with satellite images to derive a vegetation index: a computer-based estimate of a particular crop's canopy area.

An irrigated apple crop near Mildura. Dry times and set water allocations have made life tough for many growers. CRC Irrigation Futures

The index is used in conjunction with weather conditions at ground level, including sunlight hours and intensity, cloud cover, rainfall and wind, to calculate how much moisture the crop lost in the preceding 24 hours through evaporation and transpiration.

Alternatively, growers could take a digital photograph of a low-growing crop such as soybeans or tomatoes and upload it for automatic computer analysis to estimate canopy area.

'The other part of the system involves translating the crop water-use data into a recommendation of how long the grower needs to irrigate, to replace the water lost by the crop the previous day,' Dr Christen said.

'We provide the grower with a daily update, via SMS, of how many minutes he needs to run his pump to replace the water lost over the previous one to seven days.'

Dr Christen added the estimate of 10–30 per cent water savings was conservative – efficient growers might save only small amounts of water, less efficient growers could save more than 20 per cent.

A pilot group of 50 MIA horticulturists will trial the technology this year.

Eventually the system may factor in soil type, which influences the availability of soil moisture, and provide a forward-looking capability, based on a four-day forecast from the Bureau of Meteorology.

When fully developed in around three years' time, it could be licensed to private companies, such as irrigation suppliers, to provide an integral commercial information service to growers.

This article is dedicated to the late Professor Peter Cullen whose committed work has significantly contributed to recent water management reforms in Australia.

Open irrigation channels, such as these at Narrabri, lose great amounts of water to evaporation. CSIRO Plant Industry

More information:
Cooperative Research Centre for Irrigation Futures, www.irrigationfutures.org.au

eWater CRC, www.ewatercrc.com.au