CSIRO LAND and WATER News
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Land & Water Link

Photo: John Coppi

Home Grown

Australia has very often failed to make appropriate use of its own intellectual capital or indigenous resources. Israel, for example, dominates the world market in indigenous Australian flowers.

A new project underway in CSIRO Land and Water aims to make sure that something similar doesn't happen with the fledgling market in indigenous Australian foods.

According to Research Group Leader, Dr Maarten Ryder, there is plenty of international interest, particularly from North America, and Israel is learning how to cultivate 'bush tucker' from Australia for world markets.

Israel is already trialling quandongs and is looking for stocks of Australian native citrus to grow. It would be a shame for Australia to lose its competitive advantage through lack of knowledge.

'The native foods industry is in its infancy. It is currently worth an estimated $14 million annually, but its export potential is yet to be realised because it can't guarantee regular supplies of high quality produce. Until now, it has been marketed mostly to the gourmet end of the market, when in fact it has potential for much wider use', says Dr Ryder.

'To overcome these barriers, we have begun a four-year research trial to find out how to better commercially farm native foods,

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Photo: John Coppi

Above: 'Bush tucker' selection

Front page: Dr Maarten Ryder and Yvonne Latham

focusing specifically on quandongs, mountain pepper, bush tomatoes, muntries, riberries, two native citrus, and acacias from which wattle seeds are harvested.'

Five mini-orchards will be established at sites in South Australia and another in Victoria early in 2001. The researchers will use these orchards to collect world-first data on how native foods grow in different climatic environments, how best to grow and harvest them in order to lower production costs and increase quality, and whether or not there are any susceptibilities to pests and diseases.

Domestically, a number of groups are vitally interested in the results of the trials. Many farmers are curious to see whether bush tucker holds promise in the on-going battle to diversify and develop the sustainability of their farms. Some amateurs have been attracted to the romance of the bush tucker industry and are looking for the necessary scientific information to expand their hobby into a long-term and profitable venture.

Aboriginal communities seeking ways to become more economically independent are also keen to combine their existing knowledge of bush foods with the results of scientific trials into the commercial cultivation of such species. Members of the Namungga Aboriginal Progress Association, for instance, are already producing bush tomatoes and they are looking to expand their operation.

It is appropriate, therefore, that the research project incorporates an Aboriginal traineeship, to build in a more equitable approach, and also to ensure that Western-style research into native foods is shared with the Aboriginal community. The current trainee, Yvonne Latham, has already begun collecting information to help with selection of the trial sites.

The 'bush tucker' trial is funded by the Rural Industries Research and Development Corporation and the Aboriginal Employment Program of the South Australian Department of Education, Employment and Training.

The results of the research will be shared with all key stakeholders, including the Aboriginal community, the Australian native foods industry, Australian Native Produce Industries Pty Ltd (Renmark) and Primary Industries and Resources SA.

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Ecosummit – Grounds for Hope

In June 2000, the Elsevier group of science journals hosted an Ecosummit in Halifax, Nova Scotia. Its theme was integrating the sciences in order to understand and solve the environmental problems of the 21st century. Such rhetoric is common enough, but, according to Chief of CSIRO Land and Water, Dr Graham Harris, the Ecosummit offered real grounds for hope.

Dr Harris, who was the theme leader for Integrated Modelling and Assessment of Complex Adaptive Systems, believes the Ecosummit represented a 'sea change' in the thinking of the international ecological science community. 'They looked like out-doing David Suzuki at his own game', he remarked wryly. 'In other words, this group of eminent international scientists was, for the first time, speaking publicly of its belief that a global ecological crisis really exists.'

Far from being depressing, this willingness to admit the scale of the problem is essential if we are to move towards solutions. The other optimistic news, according to Dr Harris, was that Australia leads the world in integrated modelling and assessment – the key means for achieving such solutions. 'Integrated modelling and assessment brings together hard modelling and soft modelling to make natural resource management decisions based on the triple bottom line: environmental, social and economic impacts', explains Dr Harris.

Integrated assessment and modelling was a 'meta-theme'. There were five other themes:

- complex adaptive hierarchical systems
- ecosystem services
- science and decision making
- ecosystem health and human health
- quality of life and distribution of wealth and resources.

Each of these themes contains either the scientific or the social data that form part of an integrated assessment and modelling approach.

'Such an approach is Mode 2 science – science in the context of its application – and CSIRO Land and Water have been operating within this framework on a daily basis since it was formed', adds Dr Harris. 'Certain structural features of Australian society foster our ability to negotiate complex issues. We have well-developed social and governmental processes for conflict resolution and we are not a particularly litigious society. It may even be that, despite justifiable criticism from some quarters, there is still a grain of truth in the national legend of the 'fair go'.

The United States is hampered by a litigious approach, and the European community is yet to free itself of the fruitless debate between the relative merits of hard and soft modelling, when it is quite obvious we need a combination of both. Our expertise in integrated assessment and modelling may well be something that Australia can export to the rest of the world, which is desperately seeking real solutions to the very real and pressing environmental problems of the 21st century.'

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Burdekin Groundwater Sustainability Initiative

An initiative is now underway in North Queensland to address current water management practices and their potential impacts on long-term sustainability of the Burdekin Delta groundwater systems.

The Burdekin Delta, a major irrigation area with more than 35,000 hectares of irrigated sugarcane and other crops, presents a unique management challenge. Not only does the system overlie shallow major groundwater supplies on which it relies heavily for irrigation water, it is situated close to environmentally sensitive wetlands, waterways, estuaries and the Great Barrier Reef. Local water pricing and water management practices are also critical.

The Delta Water Boards – the North Burdekin Water Board (NBWB) and the South Burdekin Water Board (SBWB) – have a charter that requires them to manage the replenishment of the groundwaters, which are subject to constant threat of seawater intrusion. Strategies currently employed include sand dams in the Burdekin River, and a series of distribution channels and natural waterways together with large recharge pits.

Farm practices such as 'recycling', 'water spreading', and more recently direct pumping from recharge channels to farms in some distal aquifer zones have also evolved to play an integral role in the management of the area's groundwater systems.

With 'recycling', irrigation water that is not used by the plants (excess irrigation) cycles through the soil back to the groundwater – a practice regarded as helpful to recharge and maintenance of groundwater levels. Under 'water spreading', water that is too turbid to be used for recharge via the recharge pits (because it blocks the pits making them ineffective) is made available across the scheme as surface water for farm irrigation. Because this helps spread the silt load across the farmland while keeping the silt out of the recharge pits, it is thought to benefit the soils and assist the replenishment process.

As Dr Keith Bristow explains, 'What is needed is more knowledge of the links between groundwater quality and current management practices at both the farm and irrigation scheme level. Only then will it be possible to say whether existing practices are indeed sustainable in the long term.'

Important questions relate to the impacts of current and improved irrigation efficiency on 'recycling' and 'water spreading', as well as to the subsequent interactions, if any, with the nutrient, salt and chemical loading of the groundwaters.

Farmers and scientists working together to improve water management in the Burdekin

Photo: Philip Charlesworth

Photo: Bill van Aken

Check valve to control the flow of irrigation water to a sugarcane crop in the Burdekin Irrigation Area

Dr Bristow says 'We need to understand how irrigation waters are stored and transported through the unsaturated zone. This is essential, as the fate of nutrients, salts and chemicals and their impacts on the groundwater systems will be integrally linked to soil type and water movement through the unsaturated zone.'

Improved understanding of these links, and if need be the development and implementation of improved water and irrigation management practices, would have long-term economic and environmental benefits to Burdekin delta farmers, the wider community and other irrigation areas in Australia.

This initiative is truly a co-operative undertaking – involving individual farmers and a range of organisations. These include NBWB, SBWB and CSIRO, together with the Bureau of Sugar Experiment Stations, Queensland Department of Natural Resources, James Cook University, Australian Centre for Tropical Freshwater Research, Australian Institute of Marine Sciences, Canegrowers, CRC Sugar, Burdekin Landcare, National Program for Irrigation Research and Development, and the Queensland Rural Water Use Efficiency Initiative.

Groundwater modelling, soil mapping, implementation of demonstration sites and selection of new field sites for experimental work are just some of the activities already underway.

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Environment + Economy = EMS

Photo: Bill van Aken

If we can use EMS to redesign agriculture in line with local environments, we stand to make huge economic and social gains

Can Australian farmers and businesses develop ecologically sustainable land management practices, at the same time as reaping economic benefits?

CSIRO Land and Water's Deputy Chief, Dr John Williams, says yes. Part of the secret lies in a land management tool called Environmental Management Systems (EMS), which encourages the development of best practices while preventing further degradation of our land and water resources.

A recent discussion paper 'Credible Clean and Green' prepared by CSIRO Land and Water's Commercial Manager, Kathy Heinze, examines in detail the issues involved in developing EMS and environmental certification systems in Australia. Using EMS, farmers and businesses can identify and manage day-to-day environmental hazards that might occur, while demonstrating accountability to regulators, shareholders and the community under international standards such as ISO 14000.

CSIRO Land and Water is one of Australia's leaders in the movement to redesign Australia's agriculture, and to encourage adoption of EMS for the responsible management of environmental impacts. Through it, we can exploit growing consumer demands for environmentally sustainable products, ensuring continuing direct economic benefits for the country.

Australian agriculture has been very successful for over 200 years. Unfortunately, the increasing degradation of our land and water resources indicates that our commodities are being produced at significant cost to the environment, and this is reflected in declining trade.

Dr Williams observes 'It seems ironic that in Australian agriculture, where yield is restricted by shortages of both water and nutrients, it is the loss of water and nutrients from the pasture or crops that largely causes natural resource degradation.

'If we can develop farming systems that make full use of available water and nutrients, they may be both more productive and ecologically sustainable. Unfortunately, our farming practices weren't designed at the outset to operate in harmony with Australian ecosystems.'

According to Dr Williams, scientific research is the key to building new land use practices. 'CSIRO Land and Water is working alongside rural communities to develop new biophysical solutions that are benign to the environment. Without these scientific solutions, social and economic initiatives can do very little to address the fundamental cause of degraded natural resources.

'If we keep going without change,' adds Dr Williams, 'we will lose huge areas of agricultural land to degradation. We will face increasingly stiff penalties as environmental regulations get tougher and tougher. It won't be long before we are locked out of the world's best markets, which are increasingly driven by consumer demands for ecologically sustainable products.' Consumers expect goods to be produced in a responsible and

Photo: Bill van Aken

ethical manner, and major global retail chains impact on the ability of Australian producers to comply with consumer expectations. The finance and insurance sectors are increasingly being exposed to long-term liability issues regarding environmental impacts, and they now require their corporate clients to demonstrate evidence of effective environmental management procedures.

CSIRO Land and Water's Policy and Economic Research Unit (PERU) has been working with Dames and Moore on developing an environmental certification system that makes it easy for consumers and retailers to identify products from farmers and regions in the Murray-Darling Basin that are meeting sustainability targets. The merit of such a certification system in assisting the Murray-Darling Basin to achieve improved natural resource management goals is also a feature of the study.

PERU Leader, Mike Young, has proposed a five-star rating system for farm products. He explains, 'Points would be awarded to signal goods produced on farms that are working in compliance with regional and industry plans, and that these are consistent with regional and basin-wide plans.'

Dr Williams elaborates, 'If we can use EMS to redesign agriculture in line with local environments, we stand to make huge economic and social gains. By developing systems in which all the nutrients and water are used by crops, rather than migrating elsewhere and causing degradation, less land will be lost and far less money spent on unnecessary applications of nutrients and water.'

Today, EMS offers a big advantage in world marketing. Tomorrow, it will not be possible to enter the world's markets without such assurances of quality.

As Kathy Heinze says, 'EMS will also provide the foundation for one of the three pillars of triple bottom line (TBL) accounting reporting, which is increasingly being demanded by the world's major industry sectors and corporates'.

Together, EMS and TBL will determine a company's 'licence to operate' in the 21st century.

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A Full Stop for Irrigation

CSIRO Land and Water has developed an innovative and simple tool that can be used to improve irrigation efficiency.

Researchers, Dr Paul Hutchinson and Dr Richard Stirzaker, named their device the FullStop, because it does just that by indicating when the soil is 'full' and the irrigation should 'stop'.

Already key industry players have expressed interest. The FullStop has three key attractions:

- it automatically accounts for rain and water use since the last irrigation
- it stores a water sample which can then be analysed
- it is simple and inexpensive.

If current field trials confirm the initial success of the device, then it has the potential to improve irrigation efficiency and could even have a role in decreasing wastage in home gardens.

Each FullStop is a funnel-shaped container, which can be buried in the root zone. When an irrigation event takes place, a wetting front moves through the soil – the speed of which is determined by the moisture level in the soil. 'The moment the wetting front reaches the FullStop, water collects at the base of the funnel and an electrical float switch is activated', explains Dr Hutchinson.

The FullStop was developed for use in irrigated agriculture. By placing several devices at different locations within in a paddock, a farmer can tell when wetting fronts have reached the root zone in different areas. The detectors can be connected to a conventional irrigation controller, ensuring the water supply is switched off once the wetting front has 'triggered' a certain number of the FullStop devices. The information gathered can also be used to schedule irrigations, ensuring water wastage is kept to a minimum.

Another FullStop feature is its ability to take samples of from wetting fronts. The water collected in the container can be withdrawn with a syringe after the irrigation. 'This water may contain salt and fertiliser', says Dr Hutchinson. 'Analysis of the sample can be used to help schedule an irrigation to leach salt or manage fertiliser applications.'

Since its initial development, Drs Hutchinson and Stirzaker have recognised the potential for the FullStop in domestic situations. In home irrigation systems, the FullStop can be wired in series with an electrical water solenoid. Dr Hutchinson explains, 'When the wetting front reaches the FullStop, the irrigation automatically stops. This not only saves people money because they are not over-watering, it also reduces their contributions to groundwater levels.'

The FullStop created a great deal of interest at the CSIRO Land and Water display at Irrigation 2000 in Melbourne and devices are now being trialled across Australia. CSIRO Land and Water has applied for patent protection on the FullStop and is currently pursuing commercialisation.

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Australia's Thirst for Water

At a time when there is increasing competition for water, it must be recognised that water savings flowing from improved irrigation efficiency will not be enough to provide all the water needed for Australia's environment.

This was the message CSIRO Land and Water's Dr Wayne Meyer delivered when giving the keynote address at the Irrigation Australia 2000 Conference in Melbourne.

'The notion that improved water use efficiency will free water for environmental purposes is simplistic and will not work. On the contrary, the demand for irrigation use is likely to increase with water savings unless there is some explicit mechanism to encourage saved water to be re-allocated', explained Dr Meyer.

Rivers can no longer be viewed simplistically as conduits - they are complex physical and biological entities

Irrigators are not only competing against ever-increasing demands from industrial, environmental and urban users but also against their own, with the movement of irrigation rights between irrigation districts in the Murray-Darling Basin.

'With trading in water now possible, we have seen water permanently transferred in the Murray-Darling Basin from extensive irrigation to more intensive use, namely to vineyard developments', Dr Meyer said.

The environment remains one of the key political issues and this will continue to impact on the irrigation industry.

'Rivers can no longer be viewed simplistically as conduits – they are complex physical and biological entities. Re-allocating some water from these over-allocated rivers to increase environment flows will increase variability of supply to irrigators.'

Irrigators will need to come to terms with a less secure supply and the sector must develop plans for managing its irrigation practices with increased variability.

The irrigation sector can also expect increasing pressure to become more efficient in delivery systems. Dr Meyer observed that less than 30 per cent of water stored in some farm dams is actually used by plants.

'Finding the balance between the need for certainty for irrigation volumes, and the need to increase water flow in our major southern rivers in a water-scarce environment will require some courageous and innovative solutions', Dr Meyer concluded.

Photo: Bill van Aken

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Keeping Customers Satisfied

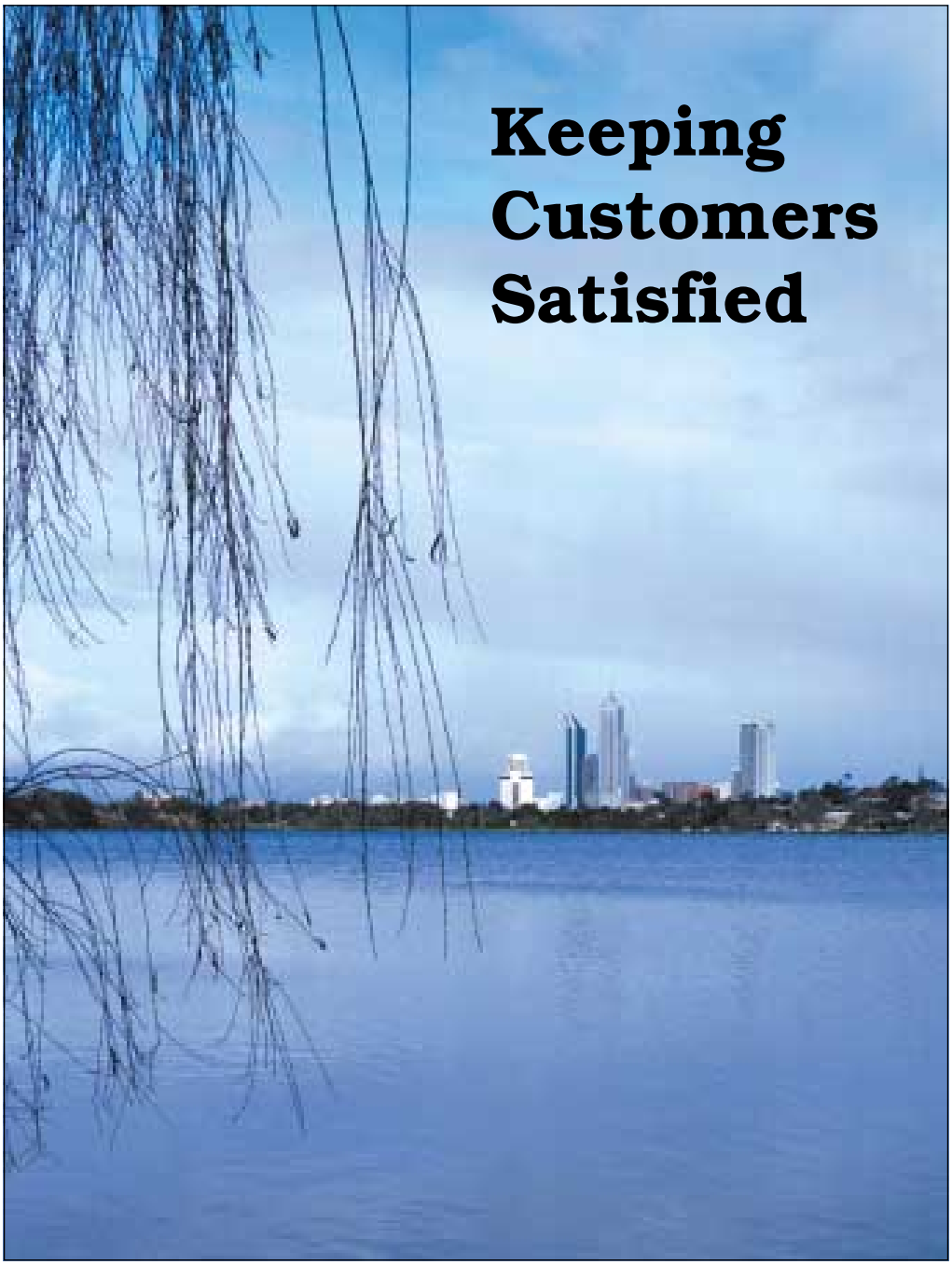

Photo: Bill van Aken

Many people throughout the world have little or no access to safe drinking water. Fortunately for us, Australians do. Our water supply is well regulated and meets strict health criteria.

Some people, however, still have concerns about the aesthetic qualities of their tap water – its taste, odour and colour, as well as its effects on household appliances and laundry.

The Water Corporation (WA) knew that it could invest in infrastructure to reduce and elimi-nate aesthetic problems – but at a cost. They wanted to find out whether such improvements in the water supply would be noticeable to customers. If they were noticeable, they also wanted to know how much money people would be willing to pay for these improvements. So they approached the Australian Research Centre for Water in Society (ARCWIS) and asked them to investigate.

Under the aegis of the Urban Water Program, a multi-divisional CSIRO project, ARCWIS produced

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a report summarising the results of their research. *Drinking Water Aesthetics: A Summary of an Integrated Methodology to Determine Community Preferences and a Policy Direction* was released in June 2000.

In a positive sense, the Water Corporation may have ended up with more than they bargained for! ARCWIS did provide them with answers to their specific research questions, but that information is commercial-in-confidence. The ARCWIS report does, however, provide the research community with a detailed and rigorous methodology that can be applied to similar questions in order to produce robust and reliable results.

Many things can confound the results of simple experimental preference research with limited samples. The thriving market in bottled water may influence people's perceptions of the water supply. Various factors are also at play in how the public views the supplier.

'Willingness to pay, technically known as contingent valuation, is frequently used to establish the possible economic benefits derived from water quality improvement', explains Blair Nancarrow of ARCWIS.

'Unfortunately, these types of questionnaire surveys do not always provide reliable data. For example, many people register protest votes, and contingent valuation questionnaires are very sensitive to the exact wording of the hypothetical scenarios.'

To deal with these difficulties, ARCWIS designed a research program comprising a series of four studies conducted at both an individual and policy level. The first three were large-scale taste panel experiments with general community participants, and the fourth was a city-wide survey.

Each study provided useful, stand-alone data, and correlating the combined results proved the robustness of that data. As a result, natural resource managers wishing to keep their customers satisfied now have a more reliable means of doing so.

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