

CRC FOR PLANT-BASED MANAGEMENT OF DRYLAND SALINITY

[*Achievement Statement*]
2001–07



CRC FOR
PLANT-BASED
MANAGEMENT
OF DRYLAND
SALINITY

Established and supported under the Australian
Government's Cooperative Research Centres Programme.





[Overview]

Throughout its six-year lifespan, the Cooperative Research Centre for Plant-based Management of Dryland Salinity (CRC Salinity) created and implemented new land-use systems that will reduce the economic, environmental and social impacts of dryland salinity. These systems were created through innovative research that improved the understanding of natural and agricultural ecosystems and applied it to technology development.

CRC Salinity will have an enduring legacy on Australian agriculture. Benefit-cost analyses found that technologies and farming systems created by the CRC will be adopted across 7.3 million hectares of southern Australia delivering a value to the nation of \$1.1 billion over 20 years. An independent review panel, which confirmed this analysis, concluded that:

“ *The panel considers that the Centre is now firmly established on sound foundations with an important research program, high quality professionals, and impressive governance, management and accountability systems. Centre outputs are now starting to demonstrate the potential of what has been put in place. The panel’s view is that this organisation and its people will undoubtedly deliver on this potential.* ”

Key CRC accomplishments:

- At least 10 new perennial pasture cultivars will become commercially available in the next few years
- Our researchers made a significant contribution to the scientific community by publishing more than 600 publications, including technical reports, refereed journal articles, conference proceedings and extension products
- The CRC’s target of training 60 postgraduates for future careers in agricultural science will be exceeded.

In July 2007, the success of CRC Salinity led to the creation of Future Farm Industries CRC (FFI CRC). The new CRC will deliver perennial plant-based, farming systems to improve productivity, reduce environmental impact and make Australian farming systems adaptable to climate variability.

To ensure the technologies developed by CRC Salinity are utilised beyond its life, a *Harvest and Delivery Plan* was put in place during 2007. This plan paves the way for 13 technologies and farming systems ready for adoption now and seven to be taken forward under FFI CRC’s business plan.

CRC Salinity’s research achievements are highlighted in the following pages.

“ *A guiding principle for CRC Salinity has been the adoption of ‘profitable perennials’. Landscape-scale change in farm management practices will only be possible if it is practicable and profitable for the farmer.* ”

ALEX CAMPBELL, CRC SALINITY CHAIR 2001-07



[Program 1] Program 1: Education & Extension

Seventy-nine postgraduate students have been associated with CRC Salinity. To date, 29 postgraduates have completed their degrees and 26 of these graduates have progressed onto full-time employment at universities, state and commonwealth agencies, and the private sector. Within the first year of FFI CRC, the original seven-year target for CRC Salinity for postgraduate completions will be exceeded.

The CRC's Education Program has gained strong external recognition for its excellence when PhD student Dianne Mayberry won the Emerging Scientist Award at the 2007 Cooperative Research Centres Association Conference for her presentation entitled *Getting to the guts of a salty problem*. Dianne's presentation described her research into improving saltbush digestion in sheep.

Further recognition of the quality of the CRC's postgraduate research program was gained through the repeated success of CRC students winning the prestigious AW Howard Memorial Fellowship Award for tertiary studies in pasture development and management. Every winner since 2003 has been a CRC Salinity student.

2007 CRC Association Emerging Scientist Award Winner:

Dianne Mayberry, University of Western Australia (UWA)

AW Howard Memorial Fellowship Award Winners:

2007 – Margaret Raeside, Charles Sturt University (CSU)

2006 – Richard Bennett, University of Western Australia (UWA)

2005 – Natasha Teakle, UWA

2004 – Alison Southwell, CSU

2003 – Lindsay Bell, UWA

CRC Salinity has also taken advantage of the shift towards the privatisation of services in the agriculture sector through its hands-on training programs. During the past six years, more than 1600 Landmark agronomists, other extension advisers and farmers gained a greater understanding of how to tackle salinity problems by completing *Salinity Basics* or the more advanced *Salinity Management* training courses.





[Program 2] Program 2: Function of Natural Ecosystems

Program 2 provided a better understanding of how natural ecosystems operate in recharge and discharge zones. More specifically, the program has looked at the functional capacities of native plants in variable climates and diverse landscapes focusing particularly on water-use patterns and salt-tolerance. Identification of these capacities led to the development of new methodologies to make farming systems more productive and adaptable.

The quality of science in this program was outstanding and recognised in a series of international workshops. Presentations and papers given at these workshops have appeared in special issue volumes in highly-regarded international journals such as *Physiologia Plantarum* and *Plant and Soil*.

Key accomplishments and discoveries:

- A classification system for native plants according to their ability to exploit limited rainfall has informed farming systems design
- Waterlogging drastically reduces a plant's salt-tolerance except *Puccinellia ciliata* – a perennial grass with exceptional waterlogging- and salt-tolerance
- Three international knowledge-exchange workshops leading to special scientific journal issues.

[4]





[Program 3]

Program 3: New & Improved Plant Species

This program was the engine room of the CRC and assessed large numbers of woody and herbaceous perennial plants to identify a manageable group of species that could be exploited for future farm improvements. Breeding effort was also applied to commercially established perennials to allow wider exploitation. At least 10 cultivars of herbaceous legumes will become commercially available as a result of this work and the next generation of breeding opportunities for trees, shrubs and herbaceous perennials was identified. A standout feature of the program's efforts was the successful interspecific crossing of wheat with sea barleygrass to deliver the prospect of a truly salt-tolerant cereal.

Key accomplishments and discoveries:

- *FloraSearch* project identified 20 native woody species with high potential for industry development by FFI CRC from a starting list of 20,000 species
- Oil mallees identified as a suitable woody crop that can produce bio-mass energy, activated carbon, eucalyptus oil
- Breeding and selection of herbaceous perennials including legumes (birdsfoot trefoil), temperate grasses (tall fescue and cocksfoot) and sub-tropical grass (Rhodes grass and *Panicum maximum*) cultivars for usage in non-traditional areas
- Identification of next-generation pasture improvement opportunities particularly for lower rainfall environments likely to be impacted by climate variability
- Development of a salt- and waterlogging-tolerant wheat crosses suitable for livestock feed.





[Program 4] Program 4: New Farming Systems

Perennial plants and woody species have been successfully integrated into new and existing farming systems through this Program. In particular, research has determined that lucerne, which can be implemented through relatively straightforward management strategies, is the most widely suited perennial pasture for southern Australia. Economic analysis has shown that lucerne can increase profit on many mixed farms across southern Australia when used on 10-20% of the farm area.



Key accomplishments and discoveries:

- Summer-active grasses such as kangaroo grass (*Bothriochloa macra*) and agroforestry-based farming were identified as effective options to reduce water recharge
- Native pasture performed effectively in the Bet Bet Catchment – a typical high salt exporting catchment in north central Victoria
- Raised beds cropping systems were shown to be effective under field conditions when linked to good surface drainage
- Subtropical grass-based systems will be increasingly important in northern areas with a high proportion of summer rainfall.





Program 5

Program 5: People, Land & Water

Program 5 evaluated the economic performance of CRC Salinity research outputs so that public policy options to facilitate adoption of new land-use systems could be formulated. This was largely achieved through the analysis and modelling of spatial data coupled with the assessment of social and economic considerations (bio-economic modelling) to encourage the uptake of plant-based salinity management options. The program's *Salinity Investment Framework 3* model (SIF3) was successfully implemented in the North Central CMA in Victoria and trialled in the South Coast NRM region of WA.

The potential wider application of SIF3 has been recognised in the 2006 Commonwealth Senate Committee Report into *Living with Salinity – a report on progress (the extent and economic impact of salinity in Australia)*, in which Recommendation 22 stated:

“ *The committee recommends the Australian Government in cooperation with the states and territories keep a watching brief on the development of SIF3 with a view to potentially implementing it across the country.* ”

As a result of advocacy by CRC Salinity, supported by compelling evidence, the Australian Primary Industries and National Resources Management Ministerial Councils agreed to adopt a new set of principles to guide salinity investment in National NRM programs in April 2007.

Key accomplishments and discoveries:

- The value of Program 5 research recognised through its Program Leader, David Pannell, being awarded an Australian Research Council's Federation Fellowship in 2007 to further pursue research pioneered in the CRC
- Development of the Catchment Analysis Tool (CAT) that determines suitable locations for perennial pastures to reduce salinity impact
- Data contribution to the online Australian Soil Resource Information System (ASRIS).

In 2006, the CAT Development Team won the Outstanding Achievement Award as part of the Victorian Department of Primary Industries Science Awards.





[Program 6]

Program 6: Grazing Systems

This program's research created innovative combinations of pastures plants, livestock and management strategies matched to land and climate capabilities. These best-fit grazing systems will improve meat and wool returns in the high-rainfall temperate areas of Australia, through the largest FFI CRC program being built on this work.

Two outstanding examples of CRC-industry partnerships developing adoption-ready projects in Program 6 have been the *Sustainable Grazing on Saline Lands (SGSL)* and *EverGraze* projects. In 2006, SGSL won a CRC Association Excellence in Innovation Award for its research into plant options and livestock production systems for salt-affected land. The research was conducted in partnership with an extensive producer network across Australia, about 1200 farmers and 140 producer 'proof' sites through the Land, Water & Wool initiative – a large-scale project rarely seen in participatory research.

EverGraze developed farming systems that improved profitability of meat and wool production enterprises and catchment health in the high-rainfall zone of southern Australia. It led the way in the use of exotic and native perennials to improve pasture quality and utilisation, increased animal production and reduced recharge to groundwater tables.

Key accomplishments and discoveries:

- Improved saltbush grazing management through a new understanding of livestock salt-tolerance and the dietary impact of salt ingestion
- Economic analysis confirmed that modified saltland livestock production systems are profitable with the greatest profit per hectare where salinity levels are moderate (typically \$60/ha)
- *EverGraze* field studies have shown that integrated herbaceous perennials can simultaneously deliver increased profit and reduced groundwater recharge. Even under drought conditions perennials such as lucerne and chicory demonstrated advantages including increased ewe ovulation rates
- The potential for fodder shrubs to become profitable elements of future farming systems identified by the *Enrich* project – a project focused on assessing the role and grazing potential of shrubs.

[8]





[Program 7]

Program 7: Biodiversity

The research focus of Program 7 was the restoration of natural biodiversity to land impacted by salinity and the improvement of biodiversity on non-saline land. The program played a crucial role in the development of new farming systems based on perennials and addressed the environmental risks of weed introduction, hybridisation with natural species and cultivar gene flow to native equivalents.



Key accomplishments and discoveries:

- Adopted a CRC-wide weed risk policy that sets a new benchmark for 'duty of care' in plant research, in collaboration with the CRC for Australian Weed Management
- Developed guidelines to protect and enhance the biodiversity of the Murray-Darling Basin grassy woodlands
- Created evidence-based guidelines for landscape intervention practices that preserve and improve biodiversity
- Identified oil mallee belts as contributing to greater diversity of fauna in farm paddocks.





[FFI CRC]

Future Farm Industries CRC

Future Farm Industries CRC (FFI CRC) will build on the research foundations laid down by CRC Salinity. Over seven years, FFI CRC will continue to develop innovative farming systems and set new standards for profitability and environmental protection through the sustainable use of perennial plants in dryland agriculture, including land affected by salinity.

Through the research, education, adoption and commercialisation activities set in place by CRC Salinity, FFI CRC will transform Australia's broadacre farming systems through the widespread adoption of Profitable Perennials™ technologies in grazing and cropping systems and new woody-crop industries. FFI CRC technologies will also play a crucial role in making Australian agriculture more adaptable to climate variability.

FFI CRC Ltd is a research company under the Australian Government's Cooperative Research Centre Programme with initial capitalisation of \$114 million. It will deliver at least \$1.36 billion of industrial and commercial growth.



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[Further information]

Further information

CRC Salinity: www.crcsalinity.com.au

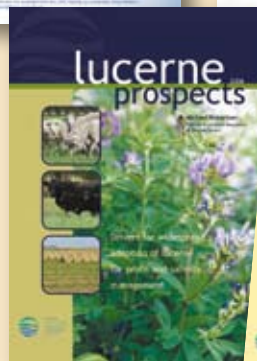
FFI CRC: www.futurefarmcrc.com.au

The University of Western Australia M081
35 Stirling Highway
Crawley WA 6009
Phone: (08) 6488 2505
Fax: (08) 6488 2856



[Key publications]

CRC Salinity Key Publications



[11]

[Partners]

CRC Salinity Core Partners



CHARLES STURT UNIVERSITY





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