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LAND & WATER AUSTRALIA  
**INVESTING IN OUR  
LANDSCAPE**



*an assessment of the benefits of  
land & water research in Australia*

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# INVESTING IN OUR LANDSCAPE

## PREFACE

### A new era in caring for the land

Australians have never been more interested in their land, in finding better ways to manage and steward the landscapes and water which sustain life in this continent. At every level, from Federal to State, to regional and local and to individual landholders, great exertions are being made to apply new knowledge to restoring and safeguarding landscapes, water and biodiversity as well as ensuring the prosperity and sustainability of our industries and communities. It is becoming one of the most important investments the nation has ever made in its long-term prosperity and sustainability.

Since its inception in 1990, Land & Water Australia has been guided by a vision that investments in research and development will help Australians to respect and understand our unique and diverse landscapes and bring us to the point where sustainability is a daily reality of life and industry, not simply an aspiration.

In the past 15 years Land & Water Australia has invested a total of \$150 million of public money in over 1,600 research projects designed to forward this goal. This is one of the largest single investments in sustainability research in the national interest yet made in this country. It is entirely appropriate to ask what return Australia derives from it.

Land & Water Australia has evaluated the impact of the research it supports since the early 1990s. In recent years the organisation has evolved a more accountable way of measuring the return on investment (ROI) of public funds in land and water research. This seeks to define the economic returns against the costs of conducting the research, and also to identify wider benefits to the environment and to the community, at local, regional and national scales, which have flowed from its adoption.

This is the first time that Benefit Cost Analysis (BCA) has been applied to such an extensive portfolio of



public good research in Australia and represents the current state of the art.

Land & Water Australia would like to thank the numerous contributors to this evaluation achievement, particularly Dr Peter Chudleigh and Ms Sarah Simpson of Agtrans Research, who with associates have provided independent evaluations of 25 case studies incorporating 270 research projects. I would also like to acknowledge Dr Nick Schofield, Land & Water Australia's Science Manager who has been instrumental in developing this robust and transparent portfolio evaluation methodology, and Prof Julian Cribb who has summarised a large body of work in this short report.

**Andrew Campbell**  
*Executive Director*

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# INVESTING IN OUR LANDSCAPE

## A SOUND INVESTMENT

The findings of this evaluation are encouraging in terms of national benefit. Analysis of 25 separate innovations – which make up about one quarter of Land & Water Australia’s total portfolio – shows a return of \$1.5 billion against a research cost (present value) of \$392 million, or almost 4 to 1. If just the Land & Water Australia component of the research investment is considered, there is a return of almost \$300 million (present value) from a research cost (present value) of \$77 million. Among these projects, returns varied from as low as 1.1 to 1, to as high as 28 to 1. These estimates are conservative as some environmental and social returns are difficult to quantify and were therefore not counted.

These figures compare favourably with returns, for example, on medical R&D, which are generally of the order of 3.5:1, or with the 10 per cent return on bonds and the 7.5 per cent return on shares on Australian markets between 1900-2000.

The analysis was carried out independently, using the methodology developed by Land & Water Australia and Agtrans Research Pty Ltd.

Examples of Land & Water Australia investments which have changed or are changing the way Australians look after their land and water are:

- The National Dryland Salinity Program, which is expected to return a present value of benefits of \$297m over 25 years against total costs of \$111m

(present value), or 2.7 to 1. This included adoption of new technologies on 30,000 farms, extensive revegetation and bush restoration and a fresh outlook in affected communities.

- The release of Best Management Practices for pesticides in the Australian Cotton Industry gave an expected economic yield of \$206 million over 25 years for a total outlay (present value) of \$35 million (or 6 to 1), as well as cleaner rivers, safer food supplies and communities.
- Adoption of water use efficiency technologies has so far helped save 11 billion litres of water a year and is expected to generate returns worth \$84 million (present value) against a total R&D cost of \$15m (present value), or 6 to 1, with additional benefits to rivers and the community.
- More than 13,000 kms of river banks have been fenced off and more effectively revegetated as a result of the Riparian Lands Program, which is expected to deliver \$28m in benefits for a total investment of \$16m (present value), including improvements to water quality and wildlife habitat.
- Incentives to conserve native vegetation are estimated to return 18 times the value of the original \$1.3m (present value) invested in the research – about \$24m over 25 years – as well as benefits to landscape, conservation of endangered species and recreation.

|                         | Land & Water Australia aggregate benefits against aggregate costs for the 25 innovations | Total benefits against costs for 25 innovations (Land & Water Australia and partner investors) |
|-------------------------|--|--|
| Present Value Benefits  | \$267 m  | \$1,520.5 m  |
| Present Value Costs     | \$77 m   | \$392.3 m  |
| Net Present Value       | \$190 m  | \$1,128.1 m  |
| Benefit/Cost ratio      | 3.5 to 1   | 3.9 to 1   |
| Internal Rate of Return | 19.7 %   | 24.1%  |

- Adoption of controlled traffic tillage on 100,000 ha of Queensland cropping country and benefits of \$65m are expected to result from an R&D investment of \$14m (present value) over twenty five years, with major savings in soil erosion, fuel costs, water quality and greenhouse emissions.
- The first-ever health check-up of Australia's rivers was provided by AusRivAS in 2001 at a total cost of \$22 million (present value). Benefits from the research are conservatively projected at \$23.4 million (present value), assuming that a tenth of the rivers needing restoration are improved by 2025.
- Nationwide improvements in climate forecasting and drought prediction delivered in a 10-year research effort are expected to yield benefits of \$20m over 25 years for a cost of \$10m (present value), and are expected to grow considerably as farmers gain confidence in them.

More details of these innovations appear later in this report, and in even greater detail in the background analysis available through [www.lwa.gov.au](http://www.lwa.gov.au). It should be noted that the benefits and costs presented for each innovation represent the total investment of all partners. In most cases, Land & Water Australia is just one of several partners contributing investment to the project.

## Trailblazing better impact measures

To account effectively and fairly for returns to the nation from publicly-funded research and development, Land & Water Australia has sought to:

- Understand the impact of its total R&D investment since 1990
- Identify environmental and social as well as economic returns
- Estimate returns conservatively
- Use consistent, independent benefit-cost analysis
- Understand how past innovations have performed
- Communicate the impact of innovations flowing from R&D
- Ensure its evaluation methods and analyses are fully transparent

- Allow for continuous improvement and regular updating of the ROI.

Full details of the 25 case study evaluations, their underpinning assumptions, and the consistent and transparent methods utilised are available at [www.lwa.gov.au](http://www.lwa.gov.au).

Both qualitative and quantitative analyses show that land and water research has proved a purposeful and successful investment for Australia, across 25 per cent of Land & Water Australia's investments and over the past 15 years.

A "good" investment in land and water science in terms of quantifiable benefits that are able to be valued, appears from this analysis to consist of programs which:

- significantly reduce unit costs, or future potential costs for industry;
- contribute to increased profits by landholders;
- are adopted extensively and quickly by land and water managers or policy makers; and
- achieve clear environmental and social as well as economic benefits.

Timing has a major influence on rate of return, especially for outcomes in natural resource management where the time scales can be long. This needs to be factored into evaluation. Adoption of knowledge produced from R&D investments for many of the innovations analysed here has sometimes been slow and often partial. Where the target audience is public managers or policy makers, the rate of adoption is often affected by wide variation in needs (or perceived needs), competing guidelines, models and methods, and the timing of research outputs to coincide with a receptive policy environment. Where there are clear private benefits to land and water managers, adoption of research outcomes tends to be more rapid – the greater the potential profitability, the faster the rate of take-up. Innovation in land and water is also greatly influenced by changing institutional structures and priorities.

Land & Water Australia has found that one of the keys to success has been to work closely with its fellow industry R&D Corporations, which has enabled it to couple work on resource sustainability with the wider goals of efficiency and profitability sought by industry.

## CASE STUDY 1

# HEALTHIER RIVERS

Australia received its first ever “medical checkup” on the health of its rivers in 2001, thanks to AusRivAS - a new system developed through investments by Land & Water Australia and its partners.

Today, AusRivAS is the gold standard used universally by Commonwealth, State and Territory agencies for measuring river ecosystem health at local, regional and national scales.

AusRivAS uses changes in aquatic insects, fish, plants, diatoms and riverbank vegetation as well as in the rivers’ physical condition, and their departure from the natural state, as indicators of overall waterway health. It employs standard national protocols for sampling and logging data on the condition of living organisms, vegetation and water chemistry. The technique was validated at 2000 reference sites and 4000 test sites across Australia from 1995-2000.

The first national checkup revealed that 30 per cent of river sites had lost up to half of their normal water

insects, and that their ecosystems were “significantly impaired”. Thanks to build-in diagnostics in AusRivAS, it was also possible, in many cases, to identify the causes. By late 2003 more than 70,000 kilometres of river had been checked.

The information it has yielded has been used in the State of the Environment Report, the National Land & Water Resources Audit and the Snapshot of the Murray-Darling Basin. Among many local uses, Victoria has employed it for monitoring instream conditions, NSW to identify “stressed” streams, South Australia for pursuing polluters who injure river health and WA to assess the conservation status of river life. AusRivAS has also attracted overseas interest, and been trialled in Indonesia and New Zealand. Importantly, it is also being used to underpin environmental policy and funding decisions of the Commonwealth and States.

AusRivAS was developed by Australia’s leading aquatic ecologists in a collaboration with the UK’s Environment Agency. A funding partnership between





Land & Water Australia and the Department of Environment & Heritage brokered strong support from State agencies who took a primary role in implementation. Since 1996 AusRivAS has been managed by The Department of Environment & Heritage.

Key factors in the success of AusRivAS have been:

- its use of biological sampling to get a reliable readout of river health over time
- the remarkable level of co-operation among Federal and State agencies in developing it
- its rapid adoption for national, state and regional environmental reporting

- its efficient, low-cost methods for gathering and processing reliable data
- the fact that any well-trained community can use it to keep an eye on its local river.

Benefits from the wide use of AusRivAS so far are not easy to quantify, although it is widely agreed among officers responsible for river management that it has already made a valuable contribution to policy, management and action to improve river health. Its main product is knowledge, leading to a significant increase in national skills in bioassessment. The chief benefits of AusRivAS are expected to become visible after many years, as the health of the nation's rivers gradually improves.

A recent assessment (2005) found that AusRivAS had cost a total of \$22 million (present value). This compares to a projected benefit of \$23.4 million (present value), assuming that a tenth of the rivers needing restoration were restored by 2025. While these estimates are uncertain, they are also very conservative and could be much higher.

Key factors in arriving at this estimate of the value of benefits were:

- (i) the amount Australians are willing to pay for healthy rivers
- (ii) the length of Australian rivers likely to be restored by 2025
- (iii) the contribution that monitoring and evaluation of river health will make to the benefits of restoration
- (iv) the contribution that AUSRIVAS is likely to make to the national river monitoring and evaluation effort.

## CASE STUDY 2

# TIPPING THE CLIMATE



*And so around the chorus ran  
"It's keepin' dry, no doubt."  
"We'll all be rooned," said Hanrahan,  
"Before the year is out."*

*"The crops are done; ye'll have your work  
To save one bag of grain;  
From here way out to Back-o'-Bourke  
They're singin' out for rain."*

*(Extract from 'Said Hanrahan' by PJ Hartigan "John O'Brien")*

Dramatic improvements in drought and climate forecasting at the dawn of the 21st Century are significantly due to a national effort to take some of the sting out of Australia's notorious climate variability.

Research by the Bureau of Meteorology and CSIRO funded by Land & Water Australia and its partners (especially fellow R&D Corporations and the Department of Agriculture, Fisheries and Forestry) between 1992-2002 has led to a marked rise in confidence in seasonal forecasts, with benefits already flowing to agriculture, the water industry and other climate-critical activities.

Since Hanrahan (and his real-life predecessors) first lamented the harsh strokes of drought, generations of Australians have been hard at work trying to find ways to mitigate them. At long last their efforts appear crowned with success.

The key lay in building a model of the continental climate system that reflected, as faithfully as possible, what really happens. It had been known since the 1970s that the El Nino / Southern Oscillation (ENSO) was linked to patterns of drought and rain, but confidence in its use for predicting seasons was not high.



The new research focussed on improving atmospheric modelling, ocean modelling and coupling the two. In particular it covered:

- the link between winds and sea surface temperatures off northern Australia where major NW cloud bands are born
- the role of key currents, tidal mixing and sea surface temperatures around northern Australia and the Pacific
- the role of tidal mixing in cooling the sea surface off Australia, which reduces moisture transport to the continent
- building these processes into a new ocean model.

This work led to the creation of POAMA, a world-class coupled ocean-atmosphere model for predicting ENSO and providing a more advanced understanding of how Indian Ocean and northern influences affect Australian climate patterns. This led to a marked improvement in forecasting accuracy six months ahead. POAMA is now run daily by the Bureau and is a key ingredient in seasonal forecasts.

Benefits flowing from better seasonal forecasts include enhanced drought planning for the crop and livestock sectors, reduced land and water

degradation, higher farming profits, improved hydroelectricity and water resource planning, and timelier seasonal warnings to emergency services. These flow on as benefits to the environment and the wider community.

A conservative assessment of the expected benefits over 25 years from the first year of investment was made by Agtrans, who put it at \$20.5 million (present value), noting this was probably a substantial underestimate. The total cost of the 10-year research program was \$10m (present value), delivering a benefit-to-cost return of 2 to 1. As user confidence in the accuracy and trustworthiness of seasonal forecasts grows, these benefits are expected to multiply and to extend more widely across the economy, society and environment.

Key factors in this estimate of the value of benefits were:

- (i) the increase in profit for Western Australian and South Australian cropping farmers who adopt seasonal climate forecasting
- (ii) the rise in adoption of more efficient water storage strategies

Hanrahan may still find cause to complain, but at least he now knows what to grumble about next.

## CASE STUDY 3

# TREADING LIGHTLY

Australian farmers are treading more lightly on the landscape and doing better financially thanks to a new farming system that is delivering higher crop yields, better returns and reduced environmental impact.

Less than 10 years from the start of research, controlled traffic farming (CTF) was in operation on more than 100,000 hectares of commercial cropping country in South East Queensland – and today the system is used across Australia on around 1 million hectares.

In traditional farming systems, heavy tractors and harvesters compact the soil, limiting the crop's access to moisture, nutrients and air, which causes yields to fall. Compacted soils also shed water, leading to increased soil erosion and runoff to local rivers. The Land & Water Australia controlled traffic project, developed by Queensland Department of Primary Industry's Don Yule and Bruce Radford, enables heavy machines to run along 'tramlines' or set tracks, leaving the rest of the soil uncompressed.

This offers the farmer major benefits in the form of higher yields, more frequent cropping and a wider choice of crops, better use of rainfall and fertility, soils which are much healthier, and a reduced risk of soil erosion and degradation of waterways.

The research, which began in 1993, was urgently needed: a survey had found that every farm studied in southern Queensland was suffering from compacted soils. Australia-wide compaction losses were estimated to run as high as \$850 million annually, – as well as having a significant impact on the off-farm environment.

Yet, what started as a soil repair project rapidly paved the way for a productivity leap as farmers took to the new system of matching the wheel-widths on their equipment and running along permanent tracks, sparing the rest of the soil. In 1998, the system was in use across 20,000 ha of southern Queensland.



Five years later this area had increased fivefold – and word of the benefits of controlled traffic was spreading like wildfire.

The key to its popularity lay in the ability of CTF to reduce the variability in yields caused by factors such as erosion, waterlogging and uneven access to nutrients. But the biggest advantage lies in the fact that the crop can use a larger share of the rainfall which falls on the paddock.

Because the tractors and tillage gear run on regular, firm tracks, farmers can get on the ground quicker after rain, to sow or to control weeds – a saving

which converts into significant benefits to yield, or the opportunity to grow two crops a year in the same paddock.

CTF also reduce costs. Because the farmer does not have to plough up compacted earth, but only the loose, healthy soil, there are savings in tractor energy of up to 30 per cent which convert to lower fuel use and greenhouse emissions. There are also savings through better use of fertiliser and herbicides.

On average it was found to deliver benefits of \$100-150 per hectare, including \$18-40 in lower costs.

Benefit cost analysis of the project shows that the expected return over 25 years was a benefit of \$65

million (present value) for an initial total investment of just under \$14m (present value) – a ratio of 4.7 to 1 – on the area of CTF land in Queensland directly attributable to the project.

Key factors in estimating the value of CTF benefits were:

- (i) the increase in crop yield
- (ii) the growth in opportunity cropping
- (iii) reductions in soil erosion
- (iv) the area of controlled traffic farming in Central Queensland up to 2003.



## CASE STUDY 4

# COTTONING ON



In the summer rainfall regions of NSW and Queensland where Australia grows its \$1-2 billion cotton harvest, a book has worked a miracle – cleaning up rivers, improving profits, avoiding costly regulation and investing the industry and its product with a more caring, confident image.

In the early 1990s cotton farming was under the hammer, caught between the rising public concern about pesticides and the necessity of using them to protect its crops against voracious pests. This was driven by:

- detection of rising levels of pesticides in waterways in cotton regions
- community concern over possible contamination of air, food and water
- pesticide residues found in beef and other farm products
- chemical spills and accidents.

In 1993 Land & Water Australia in collaboration with the Cotton Research and Development Corporation and the Murray-Darling Basin Commission commissioned research to pinpoint the various pathways by which pesticides can leak off-farm and find their way into the surrounding environment or food chain. This knowledge – revolutionary in world terms – supplied the basis for a farmer manual developed with the cotton industry (notably the Cotton R&D Corporation) on the best ways to prevent pesticide losses.

The manual was field-tested with 35 cotton growers in 1997, providing them with advice on desirable farm practices and an explanation of the thinking behind them. They quickly provided feedback that the advice was too prescriptive and not flexible enough to suit the needs of individual farms. The researchers took this on board and rewrote the manual to combine the best in scientific understanding with the most practical in hands-on farm advice.

The cotton industry Best Management Practices (BMP) manual covered:

- methods for safe application of pesticides
- safe storage and handling of pesticides and petrochemicals
- integrated pest management to reduce reliance on chemical control
- farm design and management to prevent pesticide leakage
- farm hygiene
- best practice land and water management.

An auditing mechanism was introduced in 1999 to see how widely the new advice was taken up by farmers, coupled with awareness campaigns for farmers, residents and consumers by the Australian Cotton Industry Council and Cotton Australia. The impact of the project has been profound, with more than 30 benefits identified by Cotton Australia.

These include:

- a change in industry culture towards the use of pesticides and the need to look after the environment
- a practical delivery method – the manual – which ensured adoption
- better environmental outcomes at a much lower cost than could be achieved by punitive regulation
- cost savings for farmers
- environmental management which can be tailored to individual farms, districts and farmer needs
- incentives for growers to innovate and try new methods
- reduced risk of contamination to other farm industries like beef and grain
- better communication across the industry on pesticide use, care and management
- a way to monitor industry standards and adoption of the latest techniques.

Benefit/cost analysis of Best Management Practice in the Australian Cotton Industry program shows an expected economic return to the nation of \$206 million (present value) over 25 years from the first year of investment, for a total outlay of \$35 million (present value) – a ratio of nearly 6 to 1.

Key factors in this estimate of the value of cotton BMP benefits were:

- (i) savings from not having to replace endosulfan



- (ii) prevention of contraction of the Australian cotton industry

- (iii) a willingness by farmers to pay for community peace of mind over the issues of pesticides in the environment

However there have also been wider benefits that we have not been able to quantify and value, but are nonetheless real, in the form of cleaner rivers, healthier and more prosperous communities and a fresh image for Australian cotton as an industry willing to set the world's highest standards in environmental care.

## CASE STUDY 5

# BUSH COMEBACK



The Australian native bush is on the comeback trail with more and more private land being set aside for conservation, due to incentives first proposed in a four-year study funded through Land & Water Australia.

In the mid-1990s it was seen that some of Australia's most threatened environments lay on private land – and that various government measures were either taxing or otherwise discouraging their conservation.

In 1996 Land & Water Australia and the Department of Environment & Heritage commissioned CSIRO, through Mike Young and Carl Binning, to investigate the issue. This led to a series of ground-breaking

reports which have since transformed the conservation landscape, highlighting to landholders, the community and governments the positive returns from investing in environmentally sound management.

The reports explored the roles of different levels of government, the private sector, philanthropists and landholders in conserving native Australian bush – and the discouraging effects which land taxes, rates, the existing tax regime and other measures can inadvertently exert.

Two major outcomes were changes to Commonwealth tax laws. The first made gifts of property tax deductible provided they were for conservation – so increasing the incentive for philanthropic set-aside of land. The second allowed landholders to claim a deduction for any fall in land values incurred as a result of their entering a conservation agreement.

However the six reports produced by the study also had a dramatic impact on the thinking of federal, state and local governments and conservation agencies, by raising awareness that many golden opportunities for conservation were being lost because of disincentives, taxes and barriers. In particular, these argued, there was market failure and policy failure which needed to be addressed at all levels of government. The reports identified many practical steps that could be taken, many of which were implemented through the Bushcare programme of the Natural Heritage Trust.

Ten years on, this is turning out to be one of Land & Water Australia's most successful R&D investments, delivering benefits including:

- more shelter and shade for livestock, leading to higher farm productivity
- windbreaks, leading to enhanced pasture and crop growth



- improved conservation of rare and threatened species of plants and animals
- reduced soil erosion
- increased CO<sub>2</sub> uptake by native vegetation
- improvements to water quality and salinity prevention

At the same time there has been a gain in social benefits in the form of a more attractive landscape, suitable for bushwalking, recreation and nature watching, and the benefit to the whole Australian community from enhanced protection of native biodiversity.

Towards the end of 2002 a total of 650,000 hectares of land had been placed under conservation covenants in all states, with a further 195,000 under negotiation. It is estimated at least a quarter of this is due to the introduction of incentives and removal of barriers, and the area is expected to grow steadily over time. A 1998 study found that average Australian household is willing to pay a one-off amount of \$38 to achieve a 20 per cent increase in land conserved in this way.

It is estimated the incentives to conserve native vegetation will return 18 times the value of the

original \$1.3m (present value) invested in the research – about \$24m (present value) – over 25 years. While the difficulty of making such estimates is considerable, they nevertheless reveal clear gains – economic, environmental and social – from wider conservation of the Australian bush.

The factors which influenced this estimate of the benefits were:

- (i) the amount Australians are willing to pay for land being covenanted
- (ii) growth in the area of land under conservation covenants
- (iii) the contribution of tax policy changes to the area under covenants
- (iv) the role of LWA's R&D investment in helping to bring about policy change.

No attempt has been made to quantify or value any additional benefits in terms of salinity prevention or mitigation, habitat improvement or sequestration of greenhouse gases.

## CASE STUDY 6

# WAR ON SALT

Dryland salinity is one of Australia's gravest environmental problems, potentially affecting 17 million hectares of productive farm land in six states by 2050.

The National Dryland Salinity Program (NDSP), a ten-year collaborative research partnership led by Land & Water Australia has shown conclusively that it is possible to understand and to do something about this intractable problem – and to generate triple bottom line returns from so doing.

Set up in 1992/3, NDSP was the nation's largest single research investment in the problem of salt. It was also remarkable for the nationwide partnership it welded together. Beside Land & Water Australia, partners included the Grains R&D Corporation, the National Land & Water Resources Audit, the Murray-Darling Basin Commission, Meat & Livestock Australia, the Commonwealth



Department of Agriculture Fisheries and Forestry, the Rural Industries R&D Corporation, CSIRO and the governments of all six States.

The first task was to understand the nature, causes and extent of the problem, and the second to produce management approaches at farm, landscape and regional management level that would help to deal with it. The program reached its climax in a 'harvest year', 2003/04, when all its findings were gathered together and made available to all who needed them, from farmers and advisers to planners and policy makers.

A major outcome facilitated by the program was the creation of the Cooperative Research Centre for Plant-Based Management of Dryland Salinity, which has brought together a fragmented research effort to develop and test innovative new farming systems designed to cope with or reduce the impact of salinity.

Among its most significant achievements were raised awareness across farming communities, landholders, planners and policy making bodies of the scale and seriousness of salinity and its potential solutions – and the remarkable level of goodwill and co-operation between community groups, researchers and government agencies which flowed from it.



Six key findings of NSDP were:

- salinity costs are likely to be high, so responses need to be strategic
- profitable ways to reverse salinity are under development
- there is no single salinity problem: it requires new policy approaches
- integrated catchment management is only one approach
- vegetation is the key to managing water in the landscape
- lack of capacity is an important constraint.

The program concluded that large-scale changes in landscape use will be needed if salinity is to be brought under control. These include extensive revegetation, recovery of native bushland, use of

deep-rooted perennial pastures, intercropping, phase cropping and opportunity cropping systems, farm forestry, strategic use of drains, banks and wells and use of salt-tolerant species.

These are now starting to yield significant economic returns, in the form of salinity costs avoided and income from new crops and new enterprises. An ABS study reported in 2002 that some 30,000 farms across Australia have changed management practices in response to salinity.

At the same time NSDP research is delivering environmental benefits by protecting native landscapes and their biodiversity, and social benefits in the positive response from communities affected by salinity to the new challenges and opportunities it poses.

Expected benefits from NSDP calculated over 25 years from the first year of investment were \$297m against costs of \$111m (present value), a return of 2.7 to 1.

Calculation of the value of these benefits is based on:

- (i) the cost of dryland salinity to Australia in 2000 and thereafter
- (ii) expected public and private expenditure on salinity interventions from 2001 to 2008
- (iii) avoiding the waste of public and private investment in salinity interventions from 2002-09
- (iv) future agricultural costs of salinity which have been avoided as a result of information provided by the program

## CASE STUDY 7

# BANKING ON RIVERS



Tens of thousands of kilometres of river banks across Australia are flourishing under a mantle of new growth and water conditions are on the up again thanks to widespread enthusiasm among landholders and also in part to a national program which has fostered revegetation and better riparian management.

Rising public concern at the condition of rivers and a gap in detailed understanding of the streambank processes affecting them led in 1993 to the launch of Land & Water Australia's Riparian Lands Program. Over the ensuing ten years it hammered out and distributed vital facts and advice about better ways to care for lands along our waterways.

Early research confirmed that trees, shrubs and grasses play a vital role in stabilising Australian river banks against the erratic flood/drought cycle that is the hallmark of the continent. They can prevent both sediment and nutrients from entering the stream and degrading water quality. They also protect and encourage native wildlife and their shade keeps water temperatures livable for in-stream fauna.

This finding was quickly followed by detailed scientific advice on how to identify and curb sources of sediment, better designs for laneways and tracks to avoid runoff, improved control of livestock and nutrients, the importance of using shade, native vegetation and natural debris to maintain in-stream habitat, and various economical ways to protect streambanks.

The program's most important initial contribution was to spark national awareness among government agencies, regional communities and landholders of the fragile character and importance of river banks and their surrounding areas to overall river health and water quality.

Riparian management was a key focus in more than 530 projects run by the Natural Heritage Trust, Murray-Darling Basin Commission, the National Landcare Program and National Rivercare Program. A study in 2000 found that not only were land managers more aware of the need to look after riparian areas – they were also actively implementing measures to do so. Major changes recorded in recent years include:

- fencing-off of 13,000 kms of waterways in the first 5 years
- farmers establishing livestock watering points away from rivers
- protecting and replanting streambank vegetation.

The main benefits flowing from the program include improvements in river biodiversity, less sediment and

nutrients entering streams, less fouling by livestock, improved landscape aesthetics, better downstream water quality leading to reduced spending on remedial works, better pest control, better wildlife habitat and greater carbon storage.

Research also found that many land managers had achieved better livestock management and performance as a result of the program, along with lower mustering costs to offset the price of fencing-off.

All told, the expected benefits accruing from the Riparian Lands Program were cautiously estimated by Agtrans at \$28 million over 25 years, against a total cost of \$16 million (present value) – or 1.7 to 1. Most of these gains were in the form of better water quality, although 13 per cent were attributed to biodiversity benefits.

Key factors in this estimate of benefits were:

- (i) the amount Australians are willing to pay for improved water quality

- (ii) the length of waterways fenced off from 1996 to 2002

- (iii) the area of land protected per km of waterway protected

- (iv) the contribution that riparian land management and the LWA program have made to improved water quality

- (v) the value of biodiversity protected in riparian areas

- (vi) the contribution that riparian land management and the LWA program have made to the protection of biodiversity in riparian areas.

An outstanding feature of the program was its dissemination of scientific advice to government agencies, conservation bodies and landholders. This was achieved through the distribution of thousands of fact sheets, technical guidelines, web pages and newsletters and the holding of workshops across the country.



## CASE STUDY 8

# SMART WATER USE



Eleven billion litres of Australia's precious water a year are estimated to have been saved so far through a long-running research program designed to help irrigation farmers and managers improve water use efficiency.

Since 1993, the National Program for Sustainable Irrigation (NPSI) funded by Land & Water Australia and multiple industry and government partners has helped introduce a host of on- and off-farm improvements in technology, planning and management. These have led to more crops being grown with less water and reductions in wastage. In 2002/03 alone the program supported over 30 projects designed to improve irrigation efficiency.

These have delivered: better ways to monitor water flow, use and soil moisture levels; benchmarks for water use in irrigated crops and pastures; better control over groundwater recharge, automation and alternative irrigation methods; and ways to reduce losses in channels and storages. The program has also explored investment strategies, system-wide

management and institutional arrangements that will lead to more conservative use of water in irrigation.

Throughout the program, researchers worked closely with farmers and water managers to ensure a high awareness of and interest in the research findings so that they could quickly be applied to real-life situations on farms and in system management.

Benefits emerging from the program included:

- less water used by irrigators to achieve the same or higher crop and pasture yields, through new technology and better management;
- less waste of water through leakage and evaporation;
- less leakage of surplus water into groundwater (reducing the salinity risk);
- more water available for environmental flows in rivers;
- reductions in nutrient losses from farms to pollute waterways; and



- a high level of awareness, interest and enthusiasm across the irrigation community.

Results from the program were spread across the irrigation industry round Australia, but are illustrated in two cases. In Queensland's Burdekin region, the research has reduced pumping costs to cane farmers by \$0.8 million a year since 1997 and saved around 1200 gigalitres (GL) of water.

In southern Australia, a total of 9,800 GL was conservatively estimated to have been saved, mainly in rice, cotton, horticulture and dairy farming – part of the overall saving of 25 per cent achieved by irrigators in the past decade. In turn, the NPSI is estimated

to have contributed at least a quarter of this saving – worth around \$5m a year.

In total the present value of expected benefits flowing from the NPSI program over 25 years was \$86 million, against a cost of \$15 million (present value). This represents a direct return on the research investment of 6 to 1.

The main factors used to calculate the value of these benefits were:

- (i) the volume of water saved nationally in 2002/03 and thereafter;
- (ii) the contribution that total R&D investment in water use efficiency has made to this water saving;
- (iii) the proportion of total R&D on water use efficiency funded by NPSI; and
- (iv) reduced groundwater pumping costs in the sugar industry.

However the program has had other benefits less easy to measure, including environmental gains from reducing the flow of irrigation water into groundwater and nutrients into rivers, and social gains from helping to instill the now widely-held ethos across the irrigation industry that it is essential to Australia's future to find better ways to save water and use it more wisely.

## INVESTING IN OUR LANDSCAPE

# FURTHER INFORMATION

The full set of 25 evaluation case studies, explanation of the methods used, their integrated return on investment, and interpretation of the results is available at [www.lwa.gov.au](http://www.lwa.gov.au)

*For additional information please phone 02 6263 6000  
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## INVESTING IN OUR LANDSCAPE

# APPENDIX

### Summary of steps used in case study evaluations

The following describes the standardised approach used in each case study. The result is a 10-20 page qualitative and quantitative analysis of each investment that addresses the rationale, the research undertaken, outputs, outcomes, costs, and benefits accruing to each investment. These analyses are consolidated in the much larger background report available at [www.lwa.gov.au](http://www.lwa.gov.au). The quantitative part of the analysis provides investment criteria for each innovation.

|  |  |
|--|--|
| <b>Investment Description</b>                  | The background and rationale behind the investment is described and the objectives for the projects or program defined.  |
| <b>Investment Costs</b>                        | The financial resources invested by Land & Water Australia, the researchers and funding partners are defined by financial year. In-kind resources are included.  |
| <b>Principal Outputs</b>                       | The scientific or technical outputs of research including products are identified and described.   |
| <b>Principal Outcomes</b>                      | A description is provided of when, where and how the outputs of the research have been applied to produce outcomes or expected outcomes.   |
| <b>Benefits Associated with the Investment</b> | Generic expected benefits from the research are identified and discussed. In addition, specific instances where the outputs have been adopted and where benefits have accrued or expected to accrue are identified. Where possible benefits are separated into economic, environmental and social benefits. Sources of information include project and program documents, interviews with researchers and key industry informants, and where appropriate, interviews and documentation from those that have adopted the outputs.   |
| <b>Quantification of Benefits</b>              | <p>The benefits are valued using a variety of assumptions specific to each case study. Benefits are valued over 25 years from the first year of investment.</p> <p>Actual adoption and benefit data is used where available, but this type of data is often lacking and conservative assumptions are made following discussions with researchers and other key industry informants. All assumptions are transparently described, and any reliability or accuracy concerns clearly identified. Environmental benefits are valued in the main through benefit transfer approaches from willingness to pay studies reported in the literature. Not all benefits are valued due to uncertainties in assumptions, causal relationships and valuation methods.</p> |

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**Results**

Investment criteria are calculated using a 6% discount rate and benefits and costs are converted to dollar terms for the year of analysis using the CPI index. Investment criteria reported are:

- Present value of benefits
- Present value of costs
- Net present value
- Benefit-Cost ratio
- Internal rate of return

Results are reported for benefits to date only, for all benefits over 25 years, and for benefits attributed to Land & Water Australia's investment only. Attribution to Land & Water Australia is based on the proportion of investment costs contributed by Land & Water Australia. Sensitivity analyses are carried out on one or more of the assumptions that are considered uncertain, or that contribute significantly to the benefits. Examples include adoption rates, time periods, and key assumptions for valuation of benefits.

**Summary of Adoption Information**

A summary is provided of the available adoption information that is presented throughout the report. Any gaps in information are highlighted and recommendations are made where collection of further data would be advantageous.



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