Land & Water Australia

submission to the

House of Representatives

Standing Committee on Agriculture, Fisheries and Forestry

Inquiry into Rural Skills Training and Research

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Contents

Executive Summary

Land & Water Australia (LWA)* contends that the job of achieving landscape-scale adoption of more sustainable land management practices requires highly skilled intermediaries between science and practice. To grow the knowledge about what to do and how to do it in Natural Resource Management (NRM) requires a well-supported rural skills training and research sector supported by national institutions.

Changes in the way land and natural resources are managed, and major Australian government initiatives, are presenting new opportunities to regional and rural Natural Resource Managers and their organisations. To realise these opportunities they need the support of government and scientists. Land & Water Australia has been an active investor, broker and manager of research and development into critical Australian natural resource management and sustainable agriculture issues since 1990. Land & Water Australia is a Statutory Corporation established under the Primary Industries and Energy Research and Development Act of 1989. Research and development activity is defined by the PIERD Act to include the training of people to undertake R&D, the dissemination of information, the publication of reports and the provision of advice or assistance to enable the adoption of technical developments.

The users of Land & Water Australia research include: on-ground managers of natural resources such as farmers; organisations such as catchment and water authorities and river managers; local and state government agencies; policy makers at all levels; and education and training organisations.

A critical element of the national research and extension infrastructure is the capacity for people to find out what research has been done or is being done on any particular topic at any point in time. Across the large number of research and research training institutions in Australia, this is a considerable challenge.

Fortunately, Australia currently has one element of this – a world class research database, evolving from the mid 1980s into Australian Agriculture and Natural Resources Online (AANRO), that provides comprehensive links to current and past research through the agriculture and natural resources sector. This initiative of State and Federal governments working through the Standing Committees on Primary Industries and Natural Resource Management and in conjunction with most Rural Research and Development Corporations is an exemplar of the type of knowledge management tools that are needed.

However, Land & Water Australia has found that AANRO remains underused by the research and extension community. We are working with both the Primary Industries and NRM Standing Committees to ensure that AANRO is better marketed to potential users across Australia.

Like other R&D funders and providers in Australia, Land & Water Australia can no longer assume that the outputs of its research investments will be picked up by a well-structured, well-organised, well-trained and resourced rural extension system. In production agriculture, the decline in state-funded extension services has largely been offset by private advisory services through consultants and agribusiness firms. However

in natural resource management, public funding remains dominant and there has not been a similar emergence of private service providers.

There has been a marked shift in expenditure on extension (broadly defined) from the States to the Commonwealth over the last fifteen years. Commonwealth funding of facilitators and coordinators through Landcare, the Natural Heritage Trust and the National Action Plan has played important roles in facilitating community involvement and on-ground activities funded through these large national programs. However, there has been a gradual disinvestment in the underlying extension profession, and the infrastructure that supports it:

- training
- career paths for professionals, particularly those in NRM
- centre(s) of excellence to learn the lessons
- sharing of innovative use of new technologies, and
- clear and supported roles of the different tiers of government, NGOs and industry.

The remaining advisors and the new facilitators are often relatively young and even if well qualified in the sciences, they lack significant experience. Most are on short term tenure, suffer from inadequate professional support (there are very few experienced extension staff remaining within departments/agencies above them), have poor training opportunities (nowhere to go and little support for further education) and consequently, limited career paths. The predominance of short-term contract work, high levels of staff turnover and loss of good people from the sector results in institutional amnesia and lack of support for people in the field. It also means that it is not easy to find out what is being done/has been done elsewhere, and what lessons have been learned. Regional NRM staff feel as if wheels are being reinvented all over Australia.

Many Australian Universities offer undergraduate degree and postgraduate diploma and/or certificate courses in environmental management and some in NRM. Most of the postgraduate courses are generic course-work degrees aimed at graduates from other disciplines (from sciences, agriculture, engineering), and also environmental professionals, resource managers, and urban and regional planners. There needs to be a better matching between formal education and regional needs in NRM so that Universities can better respond to changes in workplaces and NRM organisations can better service their training needs. Land & Water Australia has a working example of building such bridges.

Research, extension and advisory services in Australia have been organised traditionally by commodity, principally within State Departments, but also within the CSIRO and Universities. Crop, livestock and resource management researchers and advisors often work within different Divisions and at different locations. The new growth in private sector advisors and technically qualified sales personnel have filled some of the gap left by the demise of much of the State-based advice network, but this too is primarily commodity focused. There is a dearth of expertise, training and institutional capacity to support whole farm system, multi-commodity and natural resource management advice to the rural sector. Australia lacks a world class centre of excellence for natural resource management research, extension and skills development within the tertiary education system. Land & Water Australia has collaborative programs with industry partners, such

as Grain and Graze, that combine the full range of NRM knowledge to make a sensible contribution to decision-making within a commercial farm business context.

In recognition of the need for research funders to invest further along the innovation spectrum than they used to, Land & Water Australia now invests almost 20% of its funds in knowledge and adoption activities, compared with less than 5% in 2000 – with a consequent reduction in corporation funds available to fund new research projects. Land & Water Australia has found, and this submission will outline, that success hinges on improving the relative "adoptability" of new knowledge, the need to be relevant to users and to use collaboration and teams to address the broader issues that tend to characterise NRM problems. To achieve these things a skilled and research competent rural and regional community is essential.

Land & Water Australia remains of the view that the job of achieving landscape-scale adoption of more sustainable land management practices requires highly skilled intermediaries between science and practice. There is a need to consider how some of the key issues can be addressed in a coordinated and integrated manner, perhaps through a framework for rural extension that examines and establishes:

- differences and similarities in drivers between extension for commercial agriculture and for natural resource management;
- the role of governments in extension and responsibilities between levels of government;
- supporting development of appropriate skills and training and competency standards for NRM extension;
- clarity and consistency in the role of universities and other training institutions and providers;
- career structures or other impediments to building and maintaining NRM extension capacity; and
- mechanisms to promote NRM delivery as part of commercial extension activities.

The objective of such a strategy may be to map out a long term plan for Australia to capitalise on the great work that is happening through NAP, NHT and Landcare, and to reinvest in some of the underlying support measures for a viable extension system.

Land & Water Australia would be pleased to discuss the Inquiry with the Committee at its pleasure. This submission reviews some of the knowledge LWA has that is directly relevant to the terms of reference with the committee

Introduction

This submission is made by Land & Water Australia (LWA) to the Inquiry into Rural Skills Training and Research by the House of Representatives Standing Committee on Agriculture, Fisheries and Forestry that has been referred by the Minister for Agriculture, Fisheries and Forestry, the Honourable Warren Truss MP.

Land & Water Australia is well informed by its corporate activity, contracted research and close regional and rural links. It is able to offer the Committee information about the issues of rural skills training and research. Land & Water Australia is able to comment on the adequacy of education, research and training particularly in the regional, rural and natural resource management (NRM) sectors. We have ongoing experience in managing the research, extension and performance monitoring of a portfolio comprising several hundred projects at any time, with a total investment exceeding $50 million.

Land & Water Australia is a Statutory Corporation established under the Primary Industries and Energy Research and Development Act of 1989. The Corporation's mission is:

"To invest in knowledge, partnerships, innovation and adoption to underpin sustainable natural resource management."

Land & Water Australia has been an active investor, broker and manager of research and development into critical Australian natural resource management and sustainable agriculture issues. Research and development activity is defined by the PIERD Act to include the training of people to undertake R&D, the dissemination of information, the publication of reports and the provision of advice or assistance to enable the adoption of technical developments. The outputs of the Corporation's activities are detailed in annual reports to Parliament and also the Corporation's industry stakeholders, which include the National Farmer's Federation and the Australian Conservation Foundation. The Corporation and its staff do not undertake research *per se* but have a key role in the organisation and funding of research activities and the adoption of the results of that research, including through education and training.

The users of Land & Water Australia research include: on-ground managers of natural resources such as farmers; organisations such as catchment and water authorities and river managers; local and state government agencies; and policy makers at all levels. As a consequence of this LWA is able to make important contributions to the Inquiry. The rural NRM operating environment is very complex and this context, in which people in regional and rural Australia work, needs to be understood for it justifies the need for skills and research. The education and skills training that is available in rural and regional areas needs to respond to the needs of sustainable communities within sustainable production systems. This is an enormous challenge and some examples discussed in this submission are pointers to meeting this challenge.

The Rural Natural Resource Management Operating Environment

The management of Australia's rich and unique endowment of natural resources has never been higher on the national agenda and the need to have skilled managers

gathering good information has never been clearer. Water resources – both surface water and groundwater – are under extreme pressure, as the majority of the Australian population experiences water restrictions and irrigators face severely reduced allocations. Australia has long had to deal with extreme climate variability, but it is now becoming clear that each drought is hotter than the last, and we seem to be in a more profound drying cycle, especially in south-western and south-eastern Australia. Climate is a fundamental driver of ecological processes in Australia, and a major shaper of production possibilities for Australia's primary producers. Australia is one of the most biologically diverse countries on the planet, and most of our native species exist in no other country, which means that responsibility for their management and future prospects rests with us. Research shows that the management of vegetation, both pastures and trees, is critical in achieving an appropriate hydrological balance, in managing carbon emissions, in minimizing further losses of biodiversity and in sustaining many of our grazing systems. Invasive introduced species, both plants and animals, continue to impose significant costs on agricultural production, and fierce competition and predation pressures on native species. Australian soils are the engine room of agricultural productivity. Soil management remains an important development opportunity for more sustainable production systems.

The uniqueness of Australia's landscapes, climates, soils and biota means that in the main we cannot import knowledge about management of natural resources from other places. We have to develop our own solutions for our own problems. Our agricultural production systems have to be smarter and more sophisticated to be internationally competitive. Our competitors enjoy younger, richer, more forgiving soils with more reliable climates. Australian agriculture is built on the resilience and adaptability of its social landscapes and these stay healthiest in healthy ecosystems.

The Australian Government, in collaboration with State and Territory Governments, has initiated major public investments in natural resource management exceeding $3 billion over the next five years. Chief among these are the National Action Plan for Salinity and Water Quality (NAP), the Natural Heritage Trust (NHT) and more recently the National Water Initiative (NWI). These major government programs have drawn in part on research funded by Land & Water Australia to understand the nature, extent and significance of resource degradation problems, and to identify and demonstrate potential solutions.

However the regional implementation of these programs is generating new questions related to prioritising investments, working out appropriate interventions and monitoring and evaluating progress. The challenge for Land & Water Australia is to develop effective means of engaging with the NAP and NHT initiatives, and in particular with the regional and catchment bodies through which most investment flows. We need to ensure that these major public programs are informed to the optimum degree by our research portfolio and that our research investments are informed by the questions they are generating.

Community expectations of agricultural and pastoral landscapes continue to change. Consumers demand healthy rivers and estuaries and viable populations of native animals and plants, in addition to cheap and clean food, fibre and water. Increasingly, the community wants a wider range of services from the countryside, which is becoming a place of consumption (of vistas, tourist, cultural and heritage experiences and lifestyle opportunities) alongside the traditional processes of food and fibre production. Demographic change, especially along the eastern seaboard, will intensify competition for

rural land and place pressure on the resource base, while opening up new opportunities through the influx of new capital and a wider range of people.

In response to the challenge of balancing the often competing demands on rural landscapes, governments across Australia have fostered the development of new organisations at catchment and regional scales. These new catchment bodies and regional committees are charged with important planning responsibilities, and often with the demanding task of prioritising and allocating public funding through large national funding programs such as the Natural Heritage Trust (NHT), the National Action Plan for Salinity and Water Quality (NAP) and complementary programs at State and Territory level. These organisations are becoming important players in the natural resource management knowledge system, and critical clients for NRM research outputs. Healthy regional organisations rely on skilled employees and good working partnerships with farmers and other resource managers. The ability to plan strategically and deploy resources (including knowledge and ways of learning) is fundamental to catchment level operations and the people doing this need training and research support.

Against this background, there is a greater need than ever for carefully targeted and well-managed research: to generate the uniquely Australian knowledge needed to improve Australian farming systems and consequent profitability; to manage our natural resources more sustainably; to inform large public investments in natural capital; and to help governments balance competing demands on natural resources and rural landscapes.

Land & Water Australia is well positioned to deliver advice and models that support the Australian Government's National Research Priorities, the first of which is "An Environmentally Sustainable Australia". One of three core strategies in Land & Water Australia's Strategic R&D Plan 2005-2010 is Knowledge into Practice – emphasising that we see adoption of research outputs as our ultimate objective. Land & Water Australia is developing a broad suite of methods to manage for adoption, from direct engagement or collaborative research through to tailored communication products and finally to indirect information provision. This reflects the enormous diversity of LWA work and client groups. These methods sit along a spectrum ranging from direct engagement through communication to information provision, with many possible methods available to use.

Education and Skills Training for Natural Resource Management

Education and training in NRM can be considered a subset of environmental education or training. The term 'natural resources' generally refers to a variety of *environmental* assets that humans rely on for a variety of needs. They can be separated into different categories (atmosphere, soils, minerals, energy, plants, animals etc.) and the systems they form (rivers, coasts, estuaries, landscapes etc.). A critical requirement for integrated NRM is to understand the interrelationships and connectedness of resources and systems. Learners also need to appreciate more than the relationships of elements in the biophysical world. Natural resources include parts of the biophysical environment where social interactions take place and which are often directly involved in these interactions, and parts of the environment that humans use and incorporate into their social systems (Clark et al 2000). Environmental and NRM education develop skills, knowledge and values that may help enable people to achieve more sustainable environmental and natural resource use (Environment Australia 2000).

Rural and regional communities value education and training that meets their needs. Rural people often make huge personal investments to achieve educational outcomes. There are a number of difficulties in providing for the present and future needs of these communities. One critical need is how the formal education and training system can build regional communities who are engaged in natural resource management. The successes in environmental education in the Primary and Secondary sectors have been achieved through syllabus development, resourcing and teacher training in Universities. The focus of LWA efforts has been in Tertiary education; while acknowledging that Primary and Secondary sectors benefit indirectly from NRM education (extension outcomes through teacher training and resources).

The two main types of post-secondary education are vocational education and training (VET), and higher or university-based education. Adult and community education programs are also offered by a number of institutions and complement the formal educational programs. Many Australian Universities offer undergraduate degree and postgraduate diploma and/or certificate courses in environmental management and some in NRM. Most of the postgraduate courses are generic course-work degrees aimed at graduates from other disciplines (from sciences, agriculture, engineering), and also environmental professionals, resource managers, and urban and regional planners. Overall, the provision of environmental and resource management education in Australian Universities has been poor, with many Universities rebadging conventional courses to have "environmental" titles.

In 2002, Land & Water Australia instigated a review of the skill and training needs of regional groups responsible for developing Integrated Natural Resource Management (INRM) plans under the National Action Plan for Salinity and Water Quality and the extension of the Natural Heritage Trust (Aslin et al, 2002). The subsequent report also considered the broader issues related to capacity building for INRM. The investigation identified two major approaches to learning: hard and soft systems approaches. The former tends to focus on the need for scientific and technical expertise (specialised knowledge), and often seeks universally generalisable laws and solutions. The second focuses on involving a range of players and different knowledge systems, and tends to emphasise that solutions are context-specific and may need to be re-negotiated over time. The choice of the most appropriate approach or mix of approaches varies according to context and it is reasonable to expect both are needed.

The environmental education sector has evolved significantly in recent years. There has been substantial growth in programs, projects and resource materials, as well as significant increases in environmental and NRM degrees offered by the tertiary sector. There is a wide array of environmental and natural resource management courses (approximately 622) on offer in the tertiary sector. In addition, the VET sector has study courses and training programs that cover natural resource management. Certificate and Diploma courses in Environmental Management and Natural Resource Management are offered through TAFE at various locations.

In 1997 there were 2,110 registered VET providers, which included government providers (operating in around 1,000 locations), commercial providers, community providers and employers. There are 3,009 registered provider locations, 33% of which are TAFE and other government providers, and 20% community centres. In addition to degree courses on offer in the tertiary sector, there are some short courses and training packages offered through the VET sector and other providers.

The Conservation and Land Management Training Package (CLMTP) is a response to the need for skills. It was developed after a Rural Training Council of Australia (RTCA) scoping project sought to address problems arising from the independent development of competency standards by a number of industries and sectors involved in conservation and land management. It is designed to provide qualifications for those seeking to work in sectors defined as: natural area restoration; vertebrate pest management; weed management; Indigenous land management; conservation earthworks; land, parks and wildlife; community coordination and facilitation; and general land management. It aims to support different learning pathways such as institution-based programs, workplace and school-based training, and other combinations of workplace and off-the-job training and assessment. Development of the CLMTP was led by ANTA and the RTCA with input from wide range of stakeholders including organisations such as DAFF; DEH; the Australian Local Government Association; State agricultural, land management and parks and wildlife agencies; TAFE; CSIRO; and several unions.

In the development process a range of players were found to have a role in NRM capacity building through education and training in Australia. They include agencies like Agriculture, Fisheries and Forestry and Environment & Heritage (both of whom have relevant programs and activities outside the immediate policy area dealt with here); the Department of Transport and Regional Services; Department of Education, Science and Training; Murray-Darling Basin Commission; State and Territory NRM and environmental agencies; Research and Development Corporations; and non-government organisations like Greening Australia. The formal education and training system, particularly its Vocational Education and Training sector, has a key role.

Land & Water Australia through the National Rivers Consortium (see also the enclosed case study), funded a project that approached the institutions below for information about their courses on, or related to, river management (Blacklow et al 2001). Specific advice was sought from those known to deliver short-courses for NRM professionals for example A/Professor Gary Brierley (RiverStyles), A/Professor Ian Rutherfurd (River Restoration Framework), and Professor Stuart Bunn (National Riparian Lands Program Workshops) and from the following institutions:

Curtin University of Technology
The University of Western Australia
The University of Newcastle
Deakin University
The University of Adelaide
RMIT University
Edith Cowan University
University of South Australia
Flinders University of South Australia
The University of Melbourne
Macquarie University
Murdoch University
James Cook University
Griffith University
University of Ballarat
Central Queensland University
The University of Canberra
CRC for Catchment Hydrology
CRC for Freshwater Ecology

The short courses that were identified provide a broad and generalised skill-set, a theoretical and practical basis for management, monitoring and conservation of freshwater and estuarine ecosystems. They include practical sessions, excursions and lectures. Typically, both compulsory core subjects and some optional units are included so those courses may be designed to suit individual interests.

The short courses are typically aimed at a "certificate level". These are usually one semester full-time or one to three years part-time (*eg* four hours/week) costing from $500 - $4,000 for Australian students. The River Styles® Short Course (A/Professor Gary

Brierley, Macquarie University) is an example of a successful short course in River Restoration and Management. This course is a five-day option that was specifically developed to serve as training for postgraduates and river professionals. It has been successfully run three times, once in Northern NSW and twice in Goulburn. Over 90 individuals have participated in the courses to date. An accreditation procedure has been developed as part of this course, ensuring that individuals who complete the requirements are qualified to undertake River Styles® assessments.

Seminars, conferences, workshops and short courses are occasionally offered by Commonwealth-funded CRCs (Cooperative Research Centre for Freshwater Ecology; CRC for Water Quality & Treatment; CRC for Coastal Zone & Waterway Management) and by Research Centres (*eg* Applied Ecology Research Centre Canberra University; Centre for Water Research, UWA). These activities are usually offered in conjunction with Universities, Government agencies and industry. CRCs also provide some public and school-based education programs.

Models for rural skills training and research models and tools

The Cooperative Venture for Capacity Building of Innovation in Rural Industries

This cooperative venture was established by five of the R&D Corporations, the Murray Darling Basin Commission and the Department of Agriculture Fisheries and Forestry in 2001. Capacity building is about increasing the abilities and resources of individuals, organisations and communities to manage change. By working together, and combining their resources, the partners aim to enhance their ability to understand the learning pathways for the rural community, to improve organisational arrangements for rural human capacity building and to inspire innovative farming practices. The Cooperative Venture is managed by the Rural Industries Research and Development Corporation and will be making a separate submission to this inquiry.

B. Land & Water Australia PhD Scholarships and Fellowships

In addition to funding high priority research and development projects, LWA seeks to build Australia's capacity in NRM research through its scholarships and fellowships program. Key elements of this program include:

- Twenty three community fellowships, funded by a private philanthropist, to assist non-scientists with valuable knowledge and insights gained through their personal experiences in natural resource management to share their knowledge and learnings with a wider audience;
- The commencement of the new Graduate Certificate in River Restoration and Management at Charles Sturt University in Wagga Wagga as a pilot for strategically improving NRM. Already this has 'trickled down' into undergraduate teaching where 100+ students are taught using the best available science. This process of leadership in NRM education change could be repeated in other Universities,
- Award of four new PhD scholarships for cutting edge studies in natural resource management. Four previous recipients of LWA scholarships have recently been awarded their PhDs in fields that were relevant to NRM;
- Fifteen fellowships for travelling and visiting researchers which help Australian researchers to tap into leading international research, either by travelling overseas or by assisting leading international scientists to spend time in Australia. This builds the profile of learning in rural and regional areas;
- Land & Water Australia in 2004 initiated an exciting new Senior Research Fellowship program to provide outstanding NRM researchers with 'time out' to undertake seminal work within their fields of a reflective or synthesis nature.

Since 1990, LWA has sponsored 85 PhD and Masters students through its postgraduate scholarship and research project program, 47 travelling fellowships and seven visiting fellowships. This has helped to add skills and research experience to the rural and regional NRM landscape.

C. The Australian Agriculture and Natural Resources Online (AANRO) database

Information technology does help overcome barriers of distance and multiple access for people working in regional and rural Australia. The need for skilful and knowledgeable people to use the technology is a concern that should be addressed by the Committee. Australian Agriculture and Natural Resources Online (AANRO) is the most comprehensive national knowledge discovery service for Australian research and extension information on agriculture and natural resource management. AANRO is an initiative of State and Federal governments through the Standing Committees on Primary Industries and Natural Resource Management, in conjunction with most Rural R&D Corporations. It records Australian research projects (current and completed), research papers and extension publications. The AANRO service also provides a gateway to other trusted electronic information sources on Australian agriculture and natural resource management. AANRO is freely available (www.aanro.net). AANRO records link, where possible, to electronic copies of full text publications and provides the connection to the published science, disseminated instantly to the place it is needed. LWA surveys show the uptake of this technology is related to the skills training of the user. Statistics (at June 2004) show considerable use and potential for AANRO to be a major support tool for research and skilled workers

Average on-line searches per day on AANRO:	550
Current research projects recorded:	6,000
Completed research projects archived:	15,000
Publications recorded	150,000

Despite the recent organisational changes to develop a much more integrated and user-friendly 'front end' for this suite of electronic databases, Land & Water Australia is concerned that they remain underutilised by the research and extension community and unsupported by some key research groups. AANRO remains by far the most comprehensive, relevant and accessible on-line database for Australian natural resource management research and extension services. It forms an important lifeline for sharing scientific knowledge about rural NRM research. LWA's strategic vision out to 2010 is to build on that successful model.

Lessons from Land & Water Australia experience

LWA's research and close community links have identified the importance of managing the uptake or adoption of research done for rural and regional managers. The following factors are critical for the successful adoption of the results of natural resource management research:

1. the innate "adoptability" of the research or knowledge including:
    i. credibility,
    ii. relevance,
    iii. timing,
    iv. trial-ability and scalability,
    v. accessibility,
    vi. level of complexity,
    vii. flexibility,
    viii. compatibility to existing practices and values,
    ix. levels of additional learning required
    x. capital outlay required, and
    xi. levels of risk and uncertainty involved.
2. focusing the research effort on key clients/customers to deal with their strategic opportunities and/or critical problems;
3. recognition that social and economic factors are strong influences on NRM
4. putting end user adoption/commercialisation and communication strategies up front to reduce the uptake lag period and to maximise returns on research investment;
5. foresee and address the big national issues that exceed the capacity of any one funding agency or research team;
6. resourcing the teams with the right mix of skills and a willingness to involve users from the outset in finding their own solutions;
7. need for rural skilled people who are willing to develop research issues;
8. researchers who can engage with rural research issues;
9. researchers who are mindful of the needs of their communities; and
10. organisational frameworks.

Land & Water Australia remains of the view that the job of achieving landscape-scale adoption of more sustainable land management practices requires highly skilled intermediaries between science and practice. Research funding bodies, like Land & Water Australia, can no longer assume that the outputs of its research investments will be picked up by a well-structured, well-organised, well-trained and resourced rural extension system.

In production agriculture, the decline in state-funded extension services has largely been offset by private advisory services through consultants and agribusiness firms. However in natural resource management, public funding remains dominant and there has not been a similar emergence of private service providers. This also reflects a market failure, where governments enter the 'market' to fund the research that would not otherwise be

funded by private individuals or firms. Once funded there is still a market failure in promoting the adoption of the results of research. LWA believes that this will not be undertaken to a significant extent by private commercial interests if based purely on the improvement of sustainability, but that uptake of NRM innovation can be enhanced by embedding it in activities with more commercial drivers (for example soil health within advice on higher production farming systems). This concept is also supported by experience of the Australian Government's FARMBIS program which found that NRM training was more likely to be accessed by primary producers when embedded in production and commercially-oriented training activities.

A key issue for future dissemination and uptake of NRM knowledge and innovation will be effectively generating demand for NRM advice that will allow entrepreneurial providers to establish themselves.

There has been a marked shift in expenditure on extension (broadly defined) from the States to the Commonwealth over the last fifteen years, as the Commonwealth has funded large numbers of facilitators and coordinators through Landcare, the Natural Heritage Trust and the National Action Plan. These people have played important roles in facilitating community involvement and some on-ground activities funded through these large national programs. But there has been a gradual disinvestment in the underlying extension profession, and the infrastructure that supports it: training, career paths for professionals, centre(s) of excellence to learn the lessons from all the good work that is happening, innovative use of new technologies, and clarity in the roles of the different tiers of government, NGOs and industry.

The remaining advisors and the new facilitators are often relatively young and even if well qualified in the sciences, they lack significant experience. Most are on short term tenure, suffer from inadequate professional support (there are very few experienced extension staff remaining within departments/agencies above them), have poor training opportunities (nowhere to go and little support for further education) and consequently, limited career paths. The predominance of short-term contract work, high levels of staff turnover and loss of good people from the sector results in institutional amnesia, and lack of support for people in the field. It also means that it is not easy to find out what is being done/has been done elsewhere, and what lessons have been learned – with the result that lots of wheels are being reinvented all over Australia. This knowledge, its procurement, advancement and retention needs to be diligently managed. Land & Water Australia is experienced in, and committed to, supporting research and knowledge management in NRM. It is also now investing almost 20% of its funds in knowledge and adoption activities.

In 2002 LWA commissioned a review of the skill and training needs of regional groups responsible for developing Integrated Natural Resource Management (INRM) plans under the National Action Plan for Salinity and Water Quality and the extension of the Natural Heritage Trust (Aslin et al, 2002). The subsequent report also considered the broader issues related to capacity building for INRM.

The environmental education sector has evolved significantly in recent years. There has been substantial growth in programs, projects and resource materials, as well as significant increases in environmental and NRM degrees offered by the tertiary sector. In addition to degree courses on offer in the tertiary sector, there are some short courses and training packages offered through the VET sector and other providers.

However, it is unlikely that many of these educational systems provide any significant skills and business knowledge that then generates entrepreneurialism in the NRM knowledge and adoption sector.

The following case studies outline in more detail some specific examples of Land & Water Australia R&D programs that illustrate the ways rural R&D Corporations are delivering innovation so as to involve and 'skill up' users of research, and to maximise the chances of research outputs being adopted on the ground. These case studies demonstrate that LWA is also working to direct research effort into adoptable science which is designed with management application more clearly in mind. Important features of these case studies include the integration of extension activities into the research process, and the engagement of industry in research that delivers public good outcomes as well as increases in productivity.

Case Studies

1. Riverine Management Education and Training

The National Rivers Consortium (NRC), an initiative of Land & Water Australia, was formed to facilitate improvements in the condition of Australia's rivers. The NRC identified that specialised, nationwide education and training in river restoration and management, offered at different levels of required expertise, has the potential to make a substantial contribution to the restoration of rivers and their catchments in Australia.

Fundamental to progress in River Restoration and Management (RRM) is the commitment of skilled people operating in Restoration Teams as described in the River Restoration Framework (Koehn *et al.* 2001). It was recognised that effective Restoration Teams require the building of capacity through training, education and research (Integra *et al.* 2000). There are numerous reasons for supporting training in RRM. Many providers are required to train volunteer groups; others provide training as part of the professional development of members of local and State Government agencies; Waterwatch/Ribbons of Blue Coordinators; other land and water managers.

In May 2001, the National Rivers Consortium initiated a project to survey training and education being delivered in Australia for RRM and, having consulted widely, to propose a national framework for two training and education programs including both a graduate diploma in river management and a community level course in on-ground river management

The magnitude of the demand for education in river restoration and management can be estimated by considering the needs of Restorations Teams. Given the number of Landcare groups and regional/catchment bodies across Australia, there are potentially many teams who would needs education and training to enhance their efficiency and effectiveness.

<u>The VET Sector</u>

A survey was carried out to assess the capacity and opportunity gaps in VET available in River Restoration and Management (RRM). The groups accessing or needing this training included volunteers, students, professionals, farmers, Catchment Coordinators, Landcare Officers, and Waterwatch/Ribbons of Blue facilitators. NHT funding has

invigorated the demand for RRM courses. The training is provided in a variety of formats. Some training, especially that provided by TAFE institutions, is provided over a semester or more, while the other training takes place in an afternoon or over several days. The trainers may or may not have qualifications for delivering training. A large percentage of the trainers are agency or industry professionals who are competent or interested in the particular content being delivered.

The survey results indicated that the majority of providers interviewed believe there is a strong demand for courses that cover a broad range of topics associated with RRM. This demand is manifest on several levels and is demonstrated through consistent requests from the groups and individuals mentioned. The preferred format for the delivery of RRM training is as short courses of three to five days delivered face-to-face and in the field with a mix of theory and practice (most suggest 50:50). All respondents indicated that the content, delivery and assessment of such courses would need to be flexible enough to enable them to provide a strong local and regional focus.

The survey followed an earlier report (Integra *et al.* (2000) that outlined the variable and sporadic character of training in river restoration. They noted workshops and training days ranging along a spectrum of very general non-accredited courses, through to accredited courses being run by qualified educators. The authors raised concerns about the lack of quality assurance and the disparity between the level of the expertise involved in delivering the training and the importance of the work. The results of the survey indicate that VET covers a wide range of topics and is delivered in a variety of ways - with or without certification or possible articulation to other VET

The providers of the VET training include TAFE institutions, Universities, environmental groups and some Government agencies. TAFE institutions, some Government agencies, and the larger environment groups (such as Greenskills) deliver accredited courses. Accreditation is based upon courses or training packages within the National Training Framework. Small environmental groups and community groups generally offer no form of accreditation, certification or acknowledgment of achievement.

Graduate Studies

A survey of existing tertiary level courses found that many Australian Universities offer diploma and certificate courses in environmental management and some in NRM. However most of these are generic course-work degrees aimed at postgraduates (from sciences, agriculture, engineering), environmental professionals, resource managers, and urban and regional planners. However, very few specifically target RRM and on-ground work or projects. There were no known courses at a Graduate Diploma (GD) level on river restoration and management.

To explore the potential market telephone interviews were conducted with professionals involved in some aspect of RRM and who would be prospective graduate students in RRM. The majority of the professionals interviewed worked in the areas of environmental management, ecosystem restoration (Landcare), NRM, and community support. The main job functions were as program and project managers, with planners, policy officers and consultants being significant but lesser areas of work. The main work focus was at a local, regional and to a lesser extent state level and for these potential students the importance of a GD was rated as minor (21%) or substantial (29%), with none seeing the diploma as critical to their work. However, when broken up into

Government employees and private consultants, a large proportion of the former group saw a GD as being of substantial importance (40%), while the majority (56%) of the latter group considered it of moderate importance.

Charles Sturt University at the Wagga Wagga campus has been contracted by LWA to develop (and conduct) a Graduate Certificate Course in River Restoration and Management. It has been available by part-time or by distance study since Semester one 2004 (see attached brochure) and initial evaluations suggest this is a useful model for the Committee's consideration.

2. Sustainable Grazing Systems including PROGRAZE

Skills and research training is needed to enable training programs such as PROGRAZE to achieve their potential and build better rural industries. PROGRAZE was developed through the Sustainable Grazing Systems Program (SGS) – a Meat & Livestock Australia (MLA) initiative together with several partners including LWA, MDBC, State agencies and several universities. Large numbers of producers also contributed to the program.

SGS commenced in July 1996 to look at declining pasture productivity and sustainability in grazing systems of the higher rainfall sheep and cattle producers in southern Australia (>600mm annual rainfall). A 1994 producer survey had revealed mixed and varied levels of understanding among many southern high rainfall graziers about what constituted efficient and sustainable grazing management. Fertilizer applications were being reduced, pastures were becoming less persistent, pasture quality was declining, and in general a planned approach to grazing management was lacking on many farms. Advice on what was good pasture management was often divorced from what constituted good animal management and the integration between the two objectives was lacking.

SGS was developed in a cooperative framework between researchers, producers and extension personnel. The research or national experiment component spanned a range of sites across the high rainfall zone of Australia including Western Australia. The framework for SGS was developed by a producer planning group in order to maintain producer ownership of the program.

There were four components of SGS:

1. the National Experiment on principles, tools and indicators
2. a regional producer network with regional committees prioritising issues and managing responses
3. PROGRAZE, a training course for producers to teach skills for making the transition to sustainable grazing management (see below)
4. integration and management of the program, including the development of products such as Prograzier, Tips and Tools and benchmarking surveys to monitor changes in practices. The surveys were undertaken 1994, 1998 and 2001.

This has been a highly successful approach that has used scientific methods to quantify the relationships between management actions and production and sustainability outcomes, as well as to develop more profitable and sustainable production systems.

PROGRAZE had originally been developed by NSW Agriculture extension personnel with its application commencing in April 1994 (Bell, 2002). Bell and Allan (2000)

describe the development and delivery of PROGRAZE and one of the key aspects is the way it was adapted by other states. This illustrates an important aspect of any rural training – regional flexibility and sensitivity. The eight segment course was delivered concurrently with the SGS R&D program – and this provided primary producers with skills and knowledge likely to be produced from the research and provided producers with the confidence and language needed to actively participate in the producer networks. The course was based on the principles behind pasture and livestock management and in particular stressed:

- pasture and animal assessment (eg fat scoring)
- on farm grazing decisions and the integration of pasture and animal needs
- matching feed requirements to pasture production
- seeking profitable and efficient outcomes
- water management (introduced as a result of the LWA investment)

The National Experiment produced final reports for each of the six sites (Albany, Hamilton, Rutherglen, Wagga, Orange and Tamworth), and for each of the five themes (water, nutrients, pastures, animals and biodiversity). The reports provide relationships between the production and sustainability variables. An SGS database now holds data for all of the sites in a common format. As well, an SGS computer model was developed that incorporates the elements of high rainfall grazing systems. The outputs from the National Experiment contributed to further development of the PROGRAZE course in terms of both new knowledge and giving further confidence to principles being taught.

The PROGRAZE course provided technical information and assessment skills, used discussion groups, visits and revisits to grazing properties, and provided takeaway manuals and guidelines for use after the course. The course was based on learning from others, solution seeking and active learning with emphasis on building the capacity to make changes. It consisted of eight half-day segments each 2-4 weeks apart with about 15 producers in each course. This allowed various seasons of the year to be covered in the 8 month course.

The program was responsive for example as research identified the key role of water management in both production and sustainability outcomes, the revised course incorporated these key water management and sustainability messages. PROGRAZE Update was also developed later for delivering the new water messages to past PROGRAZE participants. This involved specific LWA funding via the National Dryland Salinity Program.

The wide distribution of the research and skills of the program reflects LWA's view that good learning and research models are transferable and therefore represent a sound investment. By the end of 1996 nearly 4,000 producers had undertaken the course. By 2002, some 8,500 producers had undertaken the course. These 8,500 (6,400 businesses) were all from the high rainfall zone of southern Australia. Communication outputs included the production and distribution of the quarterly Prograzier magazine to over 12,000 producers with special editions of such titles as "water" and "biodiversity", particularly relevant to NRM. Other communication products included a special series of SGS "Tips and Tools", sent to 11,000 producers.

A range of outcomes was reported by Hooper et al (2001) and others:

- A 2001 survey showed that 9,839 producers had engaged with or participated in some way with SGS. This represented 42% of the 23,688 producers in the southern high rainfall zone across Australia. A higher proportion of producers (60%) were aware of SGS.
- The 1998 and 2001 surveys reported producers making changes and reporting more confidence in decisions as a result of SGS.
- Participants in SGS were:
  - more likely than non-participants to rotationally graze;
  - have higher stocking rates;
  - more perennial pasture;
  - assess their pasture, dry matter and digestibility value;
  - calculate a fodder budget, weight and fat scores for livestock;
  - soil test and apply fertiliser and lime;
  - focus on specific markets; and
  - 81% (1998) and 85% (2001) stated that the changes they had implemented would increase profitability and sustainability.
- Producers said their involvement in SGS had:
  - assisted them in their management of animal, pastures, nutrients and water
  - help with sharing information among their peers,
- Producers who had participated in SGS were
  - more likely recognise environmental issues or problems on their properties and
  - adopt an appropriate or best practice response.
- A high proportion of producers said it helped then to
  - understand and manage water and nutrients (75%) and
  - environmental issues in general (80%).

Clearly the investment in rural training and research support has resulted in strong improvements in a challenging agricultural sector. LWA thinks that this experience is worthy of consideration by the Committee.

3. Grain and Graze

The collaborative Grain & Graze program is focused on mixed farming enterprises in the wool/cereal belt across Australia (Figure 1). The four partner R&D Corporations are aiming to have at least 6,800 farm businesses make changes on their properties that will see them more profitable, sustainable and socially rewarded. The program aims for a 10% lift in profitability in the livestock component of mixed farming enterprises, a 5% lift in the profitability of the cropping component, movement towards achieving targets set out in regional catchment plans, and improvement in the confidence and pride of the people and communities involved in and around mixed farming. It is funded by the meat, wool, grains and land & water R&D Corporations and has attracted $2.5 million of investment support over five years. It commenced in 2004, based on lessons learned from earlier R&D sponsored by each of the individual corporations – in particular SGS.

Figure 1 Map of Grain & Graze Regions

Six tactics underpin the Grain & Graze strategy:
1. Regional group facilitation/empowerment
2. Communication
3. Education and training
4. Mentoring and exchange (providing opportunities to share experiences)
5. Technology development (incorporating regional R&D and best practice guides)
6. Extension coordination (providing the thread between the fabric)

The program takes a regional approach to developing on-ground solutions to the mixed farming issues implicit in the program goal. The initial regions selected by Grain & Graze in which to concentrate investment are shown in Figure 1. These regions fall within the Wheat-Sheep Zone. Most are medium rainfall areas, although there is a low rainfall element to the Eyre Peninsula, Mallee and Central West-Lachlan regions and a high rainfall element to the Corangamite-Glenelg Hopkins region.

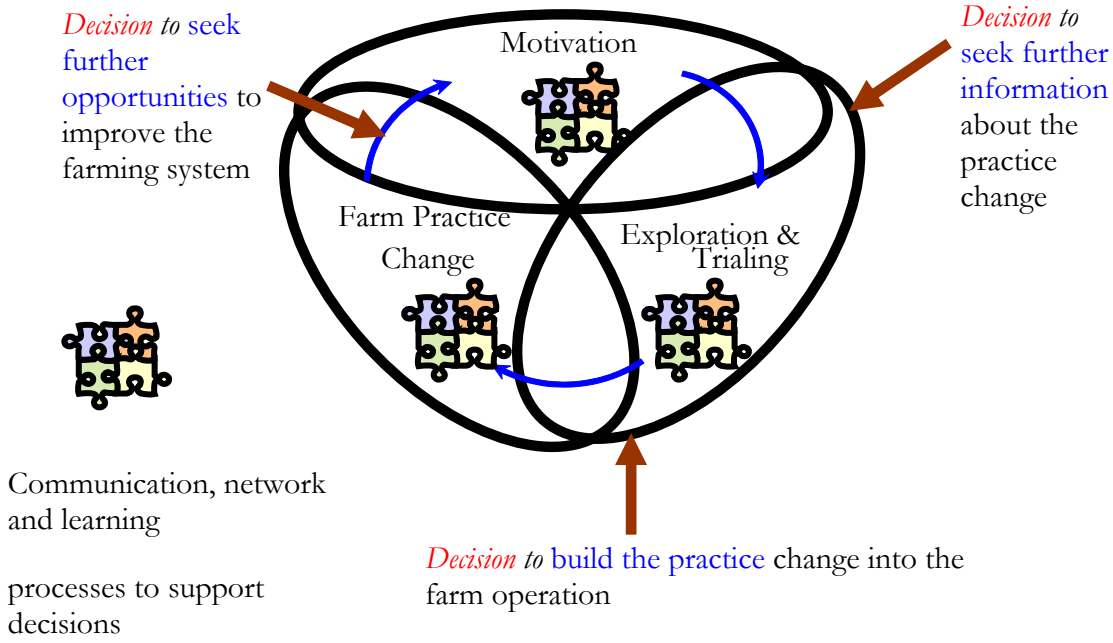
In this large area an initial benchmarking study showed there was tremendous variability within and across regions in terms of farm business mix, farm income, resource issues faced and demographic attributes regarding population density, age, education and access to public and private services. Moreover, access to scientific, extension and private advisory skills was also variable. Rural communities needed regionally tailored support and this presented an enormous challenge to the strategy dealing with change processes. LWA believes the Committee should carefully consider the variability within rural Australia as it considers different research and skill building plans.

The local means of determining priorities, the way research was undertaken and the ongoing engagement of stakeholders was as critical as the content of the research itself. Change processes such as extension, training and provision of information could not be divorced from research and development activities, or tacked onto them in a linear fashion. Hence the way Grain & Graze's Regional Initiative strategy and Information Management strategy was carried out was very much a part of the Change-on-Farm

strategy. Underpinning this is a practice change model based on stimulating motivation, facilitating trials, and demonstrating benefits from change (see below). It corresponds logically to the hierarchy of targets involving awareness, participation and adoption. It matches needs for education, research and monitoring skills development.

In short, the practice change model recognises that different participants in Grain & Graze will move through the cycle in different ways and at different paces. In response to this, the model established a framework by which Grain & Graze can deal with very different demands for specific kinds of information and activities when and as needed by different participants.

Figure 2 Grain & Graze Practice Change Model



This schematic model is successfully used in a range of programs such as the Sustainable Grazing System Program and Land Water & Wool. It captures the components of communication, learning and networking needed to support decisions. It is transferable to the building of rural skills and NRM research.

4. Integrated Knowledge Systems for Irrigation

The irrigated cotton and grains industry in the Summer Rainfall Zone of northern NSW and southern / central Queensland are highly productive but also key users of national water resources. They will invest some $500 million in new irrigation related technology over the next 10 years. The rate and effectiveness of this investment will be strongly dependent upon the Knowledge Exchange System in place over this time period. This project involves collaboration between LWA's National Program for Sustainable Irrigation, Cotton CRC & CRC Irrigation Futures, Cotton RDC, Grains RDC, NSW DPI, Qld Rural Water Use Efficiency program and the irrigation industries.

A core need identified in Phase 1 was for an integrated system that combines multiple learning and information avenues. This project will develop and pilot an irrigation

knowledge services model, comprising a number of interdependent components including:

- an understanding of the knowledge needs and learning styles for irrigation management from the perspectives of growers, consultants, irrigation suppliers, research and extension. It captured an understanding of irrigators' decision-making processes and influences. This study identified a wide range of sources and mechanisms from where irrigators and their advisers learn skills, seek ideas and innovate. It highlighted the need for an integrated package of knowledge mechanisms to manage existing and future learning needs.

- partnering public and private sectors to build demand for (awareness and value of improved water management), and supply of irrigation services (specialised training and accreditation for skilled consultants).

- an irrigation "one-stop-shop" for information, interaction and training called an "Irrigation Knowledge Centre" to provide:
  i. easy access and coordinated approaches to information,
  ii. training as a integral component of the knowledge system
  iii. accessible to irrigators, consultants, suppliers
  iv. venue for extension staff doing regional delivery
  v. the structure for skills building and research sharing such as:

- Training

  A series of training modules will be adapted, developed, delivered and evaluated with irrigators and consultants. These will take a stepwise approach, adapting NSW DPI's WaterWise course as the base level with more detailed training modules building on these. Higher level course will be primarily targeted towards upskilling agronomic consultants to deliver irrigation advisory services. Highly specialised irrigation consultants will also need to be trained – this is the role of other educational courses developed by CRC IF and Cotton CRC.

- Knowledge management

  Knowledge for irrigation management decisions includes codified information (that which can be printed or clearly recorded) and tacit knowledge (in people's heads). Codified information will be made readily accessible through printed materials, a website and general media. This includes WATERpak for cotton irrigation, which will be supplemented for grain irrigation and a series of information updates. Economic analysis and practical examples will be included. Opportunities for sharing of tacit knowledge and generation of new ideas and learning will include readily accessible and promoted "*first points of call*" that include the knowledge broker – who will in turn provide linkages to researchers, irrigation extension staff and information resources.

- Field days and training also facilitate the generation and sharing of tacit knowledge.

- Decision support tools provide access to both codified information and experiential learning. DSS such as HydroLOGIC will be promoted as a part of

the knowledge system – and a greater understanding of what activities or support are needed to incorporate these tools into learning systems will be developed.

- Case studies of how irrigators have implemented water efficient practices will aim to record some of the tacit knowledge of irrigators to illustrate and promote practical application of new technologies and practices. These resources will be distributed to all on the irrigation mailing list, managed by the Cotton CRC TRC.

- Continuous Improvement Ethos. There was in the community a strong culture of continuous improvement, experimentation and learning. This project aims to drive demand for new knowledge on irrigation management through:
    - showing the value of adoption and investment in irrigation technologies
    - stimulating the desire for change,
    - identifying and promote the benefits accruing to early adopters.

- It will also develop systems to meet this demand based on practical application and experiential learning.

- Building capacity

  A core element of the project is to effectively partner public and private sectors to build both the supply of and demand for irrigation advisory services. Training as described in 1) will also build capacity. A critical issue with respect to capacity development within the Private Sector will be the facilitation of a sustainable business model for the provision of high quality professional irrigation management advice on a consultancy basis. If this can be shown then the consultancy community will actively pursue the skills to deliver the latest R&D outputs to their client base.

- Certification System

  Accreditation may be attached to training programs (Waterwise is an accredited training course) or through skills based certification systems. The project will work closely with the IAA and Cotton Consultants Australia to explore opportunities for accreditation of irrigation consultants, suppliers and irrigators. The IAA is currently developing accreditation for irrigation suppliers. This project will enable the IAA Certified Irrigation Designer Surface to be Australianised.

- Regional Trials

  Whilst this project will not conduct regional trials, it will assist by *facilitating linkages* between irrigators, consultants, regional extension staff and research. It will identify priority issues for research trials in each region and enhance communication between irrigation sectors.

- Validation of on-farm research

  The project will work with research and extension to develop trial protocols for growers, consultants or extension to use to explore their priority issues. Regional trial data will be collated, peer reviewed, interpreted and communicated where relevant.

- Best Management Practices

  The project will link with the Cotton Industry's BMP delivery process through supporting regional extension staff, growers services managers, growers and consultants with technical information, linkages and training. The project will aim to develop cotton industry wide comparable WUE indices for both farm (low input) and field level (high input).

- Irrigation Knowledge Broker has been appointed
  i. Coordinates and lead the irrigation knowledge "virtual" centre and act as a first point of contact;
  ii. Lead the development and delivery of irrigation training courses for all industry sectors;
  iii. Liaise with IAA and CCA to develop an accredited irrigation consultant program;
  iv. Prepare or link information resource development, including print, electronic and web formats.
  v. Facilitate linkages between researchers (cross agencies and CRCs), irrigators, consultants, suppliers and extension agents.

This case study shows the detailed program of skills development that is possible with industry support in highly productive regions. This regional variation in community capability requires additional sensitivity in the planning of regional training and resource allocation.

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Terms of Reference

The committee is to inquire into and report on:

The availability and adequacy of education and research services in the agriculture sector, including access to vocational training and pathways from vocational education and training to tertiary education and work.

The skills needs of agricultural industries in Australia, including the expertise and capacity of industries to specify the skills-sets required for training, and the extent to which vocational training meets the needs of rural industries.

The provision of extension and advisory services to agricultural industries, including links and coordination between education, research and extension.

The role of the Australian government in supporting education, research and advisory programs to support the viability and sustainability of Australian agriculture.