Program Management Report

A report of the Grain & Graze National Operations Coordinator

Dr Richard Price

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ACKNOWLEDGEMENTS

This report has been prepared by Richard Price, National Operations Coordinator for Grain & Graze over 2003-2008.

The content draws heavily on a number of other reports, including:

- the final reports of the nine participating regional teams
- the final reports of the five national project leaders, including by Nigel McGuckian, Andrew Moore and Michael Robertson, Andrew Bathgate, Kerry Bridle and Jim Scott
- the Grain & Graze Evaluation Reports preparaed by Viv Read of Viv Read & Assocs and Liz Petersen of Advanced Choice Economics
- the social and instituional review of the program prepared by Lauren Rickards of RMCG Consulting.

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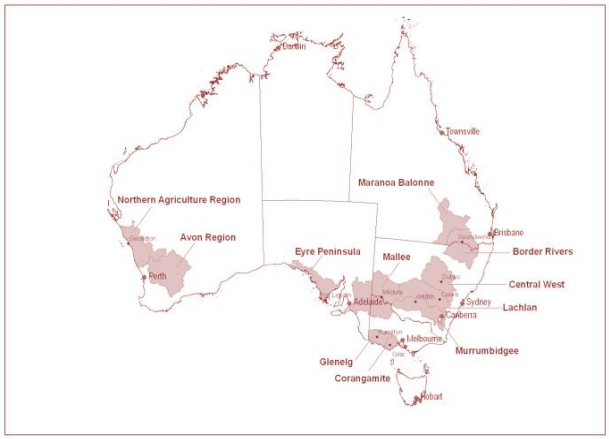


EXECUTIVE SUMMARY

The Grain & Graze program ran for five years over 2003 to 2008. Over 27,000 Australian farmers were aware of it, over 8,000 participated in it and over 4,000 got down and dirty trialling the kind of practices that are intended to provide benefits to both farm profitability and farm and catchment environmental health. Already 1,800 have adopted such practices as advocated by the program, with data suggesting even higher levels of adoption to come.

The program was conducted across nine regions spread throughout the medium rainfall zone of Australia. It has been considered a revolutionary experiment in combining bottom-up regional processes with complex interdisciplinary systems research processes, national triple bottom line targets and new methods of extension methods that focus on story-telling.

Improving farm profit and environmental health through a holistic approach to whole-farm vegetation management lay at the heart of Grain & Graze, whether through its focus on perennialising farming landscapes, identifying, understanding the role of and protecting biodiversity assets, or maximising groundcover through broadening the options to continuously adapt to the most optimal crop-livestock-pasture mix given the prevailing climatic, market and resource conditions.

The production focus that this suggests belies the enormous environmental benefits that Grain & Graze achieved – indeed, in some senses it represented environmentalism by stealth, as some of the participating farmers themselves have stated.

Grain & Graze by the numbers . . .

- 4 R&D corporation core partners
- 9 regions across the medium rainfall zone
- 13 participating catchment management groups
- ~15 farming systems groups
- 66 partners altogether at national, regional and local scales
- $31,000,000 budget

Summary of outputs and outcomes

- 278 demonstrations and trials
- 180 training courses
- >4,000 active participants
- >8,000 total participants
- >1,800 adopting (incl. making a decision not to adopt)
- ~200 publications, tools, manuals
- National database of R&D data
- A Banksia Environmental Award for the BiGG project
- 20 regions hungry to join up for phase II

The return on investment (ROI)

- 3:1 average ROI for the core partners
- 1.28:1 average ROI across all partners
- 9% average increase in profit for adopting farmers
- Improved farm and catchment condition through increased groundcover and improved soil health
- Increased confidence in farmer decision-making on mixed farms

The following is a synthesis of the many insights attained through Grain & Graze's research investments. Where possible, the synthesis combines lessons learnt from across several projects. These specific insights are discussed in detail this report, together with individual project and regional insights.

- **It is not the mix of pastures, crops, livestock and resource use that counts, but the flexibility to change the mix as required that is the key to profitable and environmentally sensitive mixed farming**
- **Decision making on mixed farms is more than complicated; it is complex**
- **Non-traditional extension methods are required to meet the demands of complex decision making**
- **A number of mixed farming strategies improve farm profit and sustainability under specific conditions**
- **There is no unique relationship between sustainability and enterprise mix**
- **Production risk is not a major influence on farmers' decision making – in fact, some practices increase risk**
- **The relationship between mixed-farming and biodiversity is integral to the productive and natural health and wealth of mixed-farms and across landscapes.**
- **Institutional arrangements still do not effectively support successful mixed-farming as well as they might otherwise, however, Grain & Graze teaches us much about the management of large, collaborative, complex programs**

PART ONE: CONTEXT

I thought we would never top the SGS Program, but here in this region Grain & Graze has been the best thing I've been involved in.

Peter Hirst, farmer, Corangamite Glenelg Hopkins

PROGRAM RATIONALE

"I pay levies to all three co-operating R&D corporations and spending my levies in a co-ordinated way is great!"

Robert Webb, farmer, Border Rivers

Until the advent of Grain & Graze, the sheep-cereal zone of Australia did not receive much collaborative attention from the various industry bodies that derived a significant proportion of their levy income from the 39,000 or so farmers who lived and operated there. Indeed, many of these farmers paid multiple levies, and as such held a stake in a number of these bodies.

The sheep-cereal zone held many attractions for joint research investment into profitable and sustainable farming systems. First, the zone accounted for more that 25% of all farms in Australia, 25% of total grain production, 30% of sheep and wool production and 10% of beef sales. Declining terms of trade remained a major issue confronting agriculture, and the cost-price squeeze was being felt hard throughout the zone.

Second, the National Land & Water Resources Audit's report, *Australian* showed the zone to be characterised by a number of land and water resource degradation issues, including dryland salinity, soil acidification, soil structural decline, erosion, loss of nutrients and surface water sedimentation among other problems. Few farmers in the sheep-cereal zone were immune to one or more of these issues. Increasing groundcover, introducing perennials and managing risk were advocated as means of dealing with many NRM issues, while promising to provide potential benefits to profitability.

Consultant processes with growers and researchers prior to the Program identified the following needs to improve mixed farming systems:

- How to increase productivity and enhance natural resources;
- Identify advantages, trade-offs and antagonism between enterprises;
- Regional performance benchmarks for farmers;
- Ability to achieve catchment and NRM targets;
- Co-investment opportunities with Commonwealth and State governments;
- Accelerate adoption of new and emerging technologies/practices.

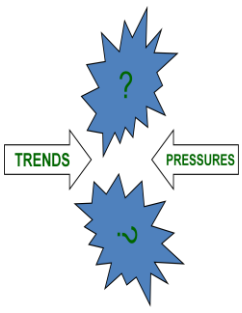
In addition to these drivers, the Grain & Graze program partners each had their own peculiar set of interests:

Meat and Livestock Australia (MLA)

At the conclusion of the Sustainable Grazing Systems (SGS) program in 2001, a number of pressures and opportunities became apparent to help focus MLA investment attention beyond the high rainfall zone where SGS had proved highly successful. Not least among these was pressure from the Sheepmeat Council of Australia to see its stakeholders' levies better reflected in the MLA research portfolio. This meant a greater focus on the sheep-cereal zone, where most sheepmeat production was produced from properties also involved grain production.

In seeing a significant investment opportunity to not only address sheepmeat issues in this zone but also to increase the total sheepmeat production, MLA took the initial steps to establish a joint-industry investigation to explore the feasibility of a program with a mixed farming systems focus.

Average per farm	Year		
	1991/92	1996/97	2001/02
Area operated (ha)	1776	1979	2078
Total area cropped (ha)	340	427	476
Wheat area cropped (ha)	153	224	248
Grain legumes area cropped (ha)	38	47	49
Oilseeds area cropped (ha)	8	17	29
Sheep and lambs shorn (no.)	1997	1770	1728
Beef herd (no.)	151	171	175
Number of farms	44052	41056	38600



Pressures
- Risk management
- Resource condition
- Herbicide resistance
- Changing attitudes
- Shifting economic winds

"We have needed something like G&G for decades. The old commodity approach is tired. The productivity gains in grain have really slowed down. We need to look at the interactions in mixed systems to take the next step forward."

Anon, farmer, Murrumbidgee

Grains Research Development Corporation (GRDC)

By 2001 GRDC had already started to develop stronger ties with MLA through joint investment in the National Dryland Salinity Program and the Cooperative Research Centre for Plant-based Management of Dryland Salinity among other initaives. The corporation had significant mixed-farming presence in the sheep-cereal zone through its investments in a number farming systems groups spread across the southern regions of the zone.

Until Grain & Graze, the major focus of GRDC's farming systems research was on crop and pasture interactions, salinity and soil health. A review of this work by Hassall & Associates in 2002 highlighted that the effort really only focussed on a portion of a farming system, and lacked the human and livestock dimensions proposed by Grain & Graze.

As with the other industry bodies that were subject to some degree of government direction in return for the government's levy-matching arrangements, the GRDC was keen to meet government expectations about investments in natural resource management. Remnant vegetation and biodiversity were two NRM issues the GRDC felt it should be seen to be investing in, and the approach by MLA to collaborate in the mixed farming systems program in the sheep-cereals zone provided that opportunity.

Land & Water Australia (LWA)

As a core partner in the SGS Program, LWA was keen to further influence industry investment in NRM through collaboration. It was also keen to see industries look beyond on-farm sustainability and address off-farm issues where the industries may have a duty of care to 'downstream' stakeholders. LWA was already involved in many catchment-based initiatives and was attracted to the notion of a post-SGS Program dealing not just with farmer productivity groups but also catchment and regional NRM groups.

Australian Wool Innovation (AWI)

Predecessors of AWI had been a relatively passive collaborator in SGS, taking an observer role at meetings of the steering committee but not investing directly in it. In 2002, the organisation emerged from significant institutional reform across the wool industry. At the time Grain & Graze was mooted, AWI had already committed itself to a major NRM initiative, *Land, Water and Wool*, in partnership with LWA, and was reluctant to invest further research in cross-industry NRM programs. Despite this, it joined with MLA, GRDC and LWA in the planning phase for Grain & Graze (see Part 4).

The priorities identified by AWI in the initial discussions on Grain & Graze related to very specific resource issues, in particular soil acidification, rather than whole-farm systems. Some producers participating in the discussions were wary about their investment funds becoming one-step removed from their control. Further internal reform placed on-going discussion on hold, and it wasn't until after two years that AWI joined the partnership. The impetus for this was the successful engagement the Grain & Graze had established with the regional and catchment organisations across Australia as well as the demonstrated emphasis the program had on sheep as part of the livestock equation.

Coordinator's summary:

A major rationale for investment in Grain & Graze was not simply the rigorous analysis that had been undertaken in the planning stage, although this was important in establishing a compelling investment case, but the strong desire to be seen to be collaborating as industry bodies. The commencement of the program was timely in that it met two increasing stakeholder pressures, first by government to see industry bodies collaborate and invest in NRM at the regional scale, and second by industry members to see an increase in the efficiency of levy expenditure, particularly where they were paying more than one levy.

PROGRAM GOAL

The Grain & Graze Program has been the largest single investment in mixed farming systems ever undertaken in Australia. The investment period covered July 2003 through to June 2008. A timeline of activities in establishing and implementing the Program can be found in the next section.

The defining characteristics of Grain & Graze were:

- Integration of large scale investment;
- Outcomes at national and regional scales;
- Delivery at a regional scale; adoption of a systems-based approach;
- Integrating knowledge developed by producers, scientists and advisors;
- Science-based knowledge support through national research;
- Profit-based change as the major driver for natural resource benefits;
- Development of social capacity as a driver for profitability
- Focus on mixed enterprise farming systems;
- Adoption of a practices change model; and
- Trialling of a range of different regional contract/institutional arrangement.

Program Stakeholders

From its inception Grain & Graze used the nomenclature of **Change Seekers** and **Change Supporters** to describe the various stakeholders in the Program.

The **primary change seekers** in Grain & Graze were those who sought information, tools and capacity to adopt management changes in mixed farming business. This included mainstream producers in the wheat-sheep zone.

The **secondary change seekers** were those seeking the information, tools and capacity to improve their services in support of the primary change seekers. These services included research, extension, professional advice and policy reform provided by a range of government, private sector and regional oraganisations.

The **primary change supporters** in Grain & Graze were those directly providing knowledge, tools or capacity to allow change seekers to adopt management changes. Primary change supporters included the RDC funding partners, regional contracting bodies and the various secondary change seekers.

The **secondary change supporters** in the Program included those not directly providing knowledge, tools or capacity but who indirectly facilitated adoption of management changes. These included farming systems groups, industry communication organisations and others who communicated the results of the Program without themselves being actively engaged.

Program Goals and Objectives

The goal of Grain & Graze was articulated in the initial Business Plan as:

> *"To provide mixed farming enterprises with new, whole farm knowledge, tools and capacity to adopt management changes that will increase production of crops,*

Program Challenges

The climate challenge: The Program was undertaken during the driest 5-year period on record for most of the participating regions

The institutional challenge: The research, extension and policy institutions associated with cropping, grazing and NRM tended to be separate with very little interaction between them.

The alignment challenge: Catchment management agencies in most regions were just developing and for most of them their catchment plans did not have well articulated targets for the condition of natural resources.

Coordinator's Comment:

Grain & Graze is sometimes sighted as the first major collaboration between MLA, GRDC, AWI and LWA. This is in fact far from true, with all four having made joint investments in the Managing Climate Variability Program, National Dryland Salinity Program and the Salinity CRC, all pre-dating Grain & Graze by many years in some cases. Combinations of two or more of these corporations have also been involved in many other collaborative ventures.

pastures and animals while maintaining, or enhancing, biodiversity in the catchment resources which sustain them".

This goal was later revised to reflect a specific target required to provide the investors with a 6:1 return on investment by 2015:

"To provide mixed farming enterprises with new, 'whole farm' knowledge, tools and capacity to adopt management changes that will lead to a 10% increase in profitability of livestock, crop, and pasture systems while maintaining, or enhancing, biodiversity and the catchment resources which sustain them. At least 6,800 farm businesses will introduce these new systems by 2008.

The specific objectives were to:

1. Build financial capital: At least 10% more profit for mixed enterprise producers
2. Build natural capital: Better water quality and enhanced condition and diversity of plants and wildlife by producers contributing towards the achievement of catchment targets
3. Build social capital: Increased confidence and pride among Australia's mixed enterprise producers

The expected outcomes and outputs from investment in the program were identified in the first Operational Plan (2003-04) as:

- A network of producer driven on-farm trials and research science;
- Forums, field days and farm walks for producers, researchers and catchment planners;
- Models and data bases to assist inter-regional analyses and learning;
- Industry and catchment programs delivering the knowledge and incentives needed for on-farm change;
- Decision support tools incorporating climate and commodity price variability;
- Fact sheets, training manuals and reference documents;
- Research articles and publications;
- Media releases and farm journal articles; and
- A website containing much of the above.

In addition to these tangible outcomes and outputs the evaluation project identified a range of such tangible program outcomes that were desired by the partners including:

- An enhanced co-investment culture;
- A demonstrated model for delivery of multiple benefit outcomes;
- New knowledge about agricultural practice change; and
- Increased capacity and partnership arrangements for investment delivery through NRM regions.

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Targets

By June 2008, Grain & Graze was expected to have attained the following targets

- 24,000 farmers aware of Grain & Graze activities
- 15,000 farmers having participated
- 6,800 farmers having adopted desired change-on-farm

PROGRAM TIMELINE

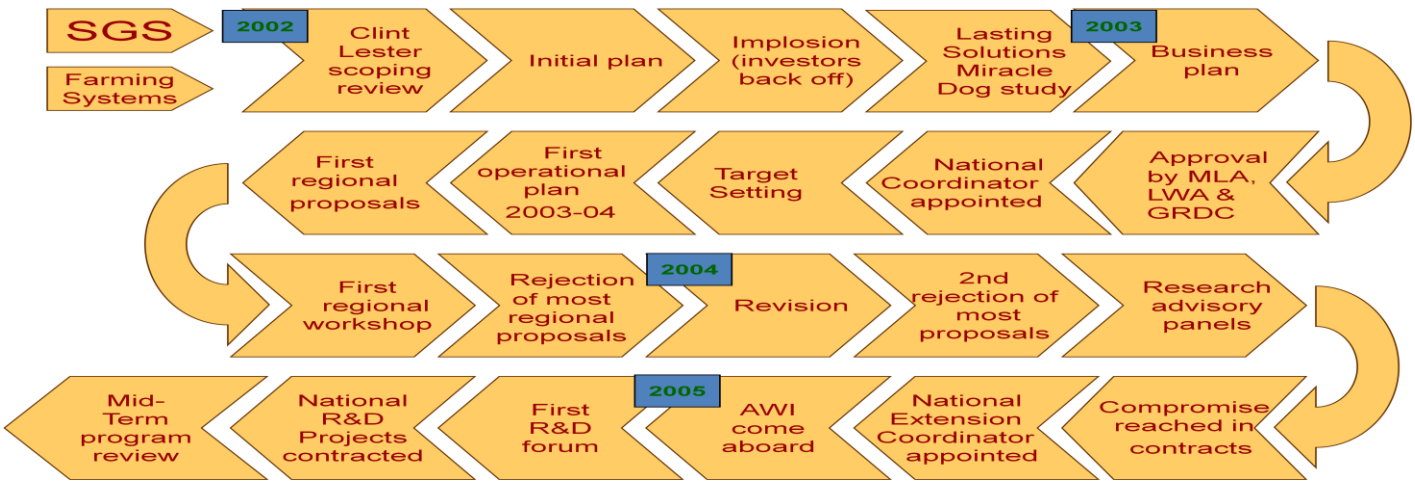
While Grain & Graze commenced in July 2003, it was preceded by eighteen months planning, followed by a further two years of refinement.

The following provides an unadulterated account of key events over the duration of the program:

1. A scoping study on the potential benefits from the proposed Grain & Graze Program was undertaken by the BDA Group in late 2002. This helped gain partner support for jointly investing in a planning process for the Program.
2. A prospectus for joint investment in farming systems research and development (Grain & Graze – Total System Health) was prepared by Clint Lester & Associates in early 2002. The preparation of the document included substantial consultation at the regional level. The consultants reported to a Steering Committee which was the precursor of the Program Management Committee. Ian Donges was the independent Chair of this Committee.
3. In late 2002, R&D Corporation consideration of the prospectus led to fundamental disagreement on the program approach, with AWI deciding not to invest in a program that potentially duplicated Land Water & Wool, and GRDC threatening to withdraw support as the prospectus did not clearly differentiate Grain & Graze investment from existing GRDC farming systems investment.
4. Lasting Solutions and Miracle Dog were commissioned by MLA, GRDC and LWA to prepare a business plan that would provide greater clarity of purpose and to structure an investment framework that would be satisfactory to the three partners. This Plan was accepted by the partners in early 2003.
5. With an agreement to use focus-regions as the basis for program investment, the partners commissioned Phil Price and David Sackett to assess the National Action Plan-defined NRM regions falling within the cereal-sheep zone to recommend up to eight regions to participate in Grain & Graze. These recommendations were accepted.
6. An initial Grain & Graze project implementation plan was prepared by Peter Day to further develop the strategic directions outlined in the Business Plan. This plan was forced to make a number of compromises to the Business Plan in order to meet the different operational cultures and processes of the partners. This included refinement of project objectives to include quantitative targets, including aspiration targets for adoption originally set for 2015.
7. Representatives of MLA and GRDC met with regional farming systems groups and catchment management authorities to commence the process of preparing regional project proposals. Proposals were to be completed by November 2003. Each of the eight regions that had been selected was provided with $20,000 to support a consultative process leading to the preparation of collaborative, systems-based project proposals.
8. A Program Management, Operations and Communications

"Creating a more direct relationship between the RDCs and the regions is a huge step forwards… This collaboration at the regional level is the most positive NRM outcome from the program."

Anon, Regional Coordinator



committee were established in June 2003 to oversee the strategic management of the Program (the Management Committee) and the operational aspects of its implementation (Operations and Communications teams).

9. The first annual operational workplan (2003-04), prepared by the Operations team, was agreed to by the Management Committee and this set out the annual planning and reporting approach that was adopted for the duration of the Program.

10. A benchmark project was commissioned in early 2004 in an attempt to provide baseline data against which the Program could assess its achievements upon completion. The project did not have the resources to undertake survey work tailored to the objectives of the program and instead had to rely on, and adapt, existing data.

11. The first National Forum was convened in Mildura in October 2003. Its main purpose was to provide feedback to the regions on the proposals they had prepared. None of the proposals had been approved, with the main weakness being their failure to adequately take a whole-farm systems approach or a comprehensive triple bottom line approach.

12. In January 2004 all regional proposals wee resubmitted. Only in the case of the Central West, Corangamite and Murrumbidgee were the proposals largely accepted in full. In the other regions some components of proposals were accepted while others were expected to be modified either substantially or in part. Again, a lack of systems integration was the major deficiency in these proposals.

13. Case studies of managing complex mixed farming systems were commissioned to RMCG (Nigel McKuckian) in the hope that this would reveal insights about how systems were being integrated on farm and how this could assist the regions consider ways of restructuring their research activities.

14. In June 2004 two Research Assistance Panels were established to help regions restructure their project plans (for a third time) so as to meet the expectations of the core program partners. The resulting proposals submitted in August 2004 were still considered to be deficient, underlying the fundamental challenge in undertaking complex systems research using regional bottom up process. So that regional activities could be contracted, the systems integration requirement was dealt with by requiring regions to report on insights arising from an aggregation of the different components in the context of whole-farm decision making.

15. A Monitoring and Evaluation Plan was prepared to enable the Program to continually monitor its progress towards achieving the goals and objectives of the Program. It was based on a Bennett's hierarchy approach enabling monitoring of inputs, outputs and outcomes at both national and regional levels.

16. A Program Extension Strategy (National Change On-farm Strategy 2005-08) outlined an awareness,

"I have learned a lot since joining the Grain and Graze team about managing projects and staff and sub-project leaders. I have also discovered the perceived complexities of integrating livestock into a cropping system. Coming from an agronomic background, I have found that there has been very little input from the animal sciences into farming systems. I have also learned that no matter what part of Australia we are from we still have the same issues to deal with such as drought, weeds, insects etc. I think this bonded the team at national forums and meetings to be able to help each other help farmers better manage their farms for environment and economic sustainability."

Stephen Ginns, QDPI

participation and adoption framework to assist facilitate the learning process in Grain & Graze that would help achieve the Program targets. The plan built on the concepts advocated by the Joint Venture Cooperative Program on Capacity Building.

17. In March 2005 the inaugural National Research Forum was convened to identify investment areas for national research projects. This identified the need to support national research projects dealing in social, economic and feedbase research. By this time, the NHT had already agreed to support a national biodiversity project (Biodiversity in Grain & Graze)

18. The Northern Panel of GRDC and Northern Program of MLA agreed to support the establishment of the Maranoa-Balonne as the ninth Grain & Graze region.

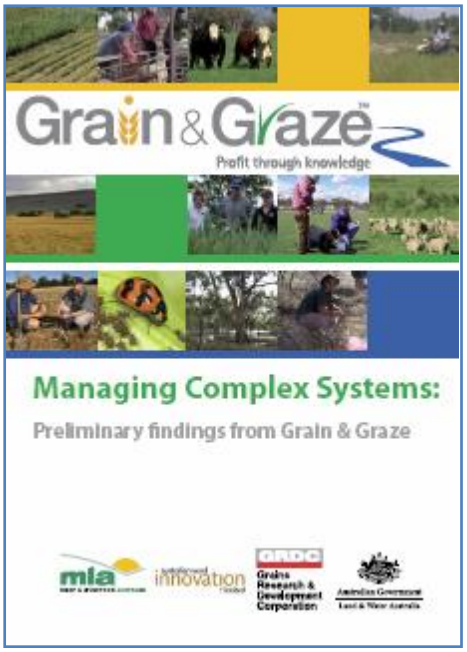
19. A mid-term review of the Program was undertaken by Agtrans Research in late 2005, resulting in 20 recommendations to refine program operations, including suggestions to concentrate only on the existing participating regions, to abolish the Operations and Communications teams and to establish a Stakeholder Working Group to increase regional representation in operational management.

20. In November 2006 regional success indicators were developed by the Stakeholder Working Group to better specify the expected adoption outcomes of each of the nine regional projects.

21. Peter Day was commissioned in September 2007 to prepare a report synthesising the findings from Grain & Graze projects. This resulted in the launch of the document "Managing Complex Systems" at the completion of the program in June 2008.

22. A final evaluation of the Program was undertaken between August 2007 and June 2008, and extended to August 2008 to take into account post-program survey results on participation and adoption.

23. A final national forum was convened in Canberra in June 2008 to celebrate the conclusion of the program.



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Coordinator's Comment:

A program as complex as Grain & Graze could have many different versions of a timeline, each reflecting the personal and institutional perspectives of those involved. All programs evolve during their course and the process of evolution reflects the unique set of circumstances and experiences that arise over time. While programs can learn from other programs about what helps ensure success, it is not desirable to bypass important stages of relationship building that come through experiencing new things together, as frustrating as that can be for investors.

PROGRAM MANEGEMENT

The inherent complexity of a program involving over 60 partners is reflected in the management structure of the Program. In its simplest expression this had two components: national and regional.

National

Grain & Graze was established as a joint venture partnership under a Program Management Agreement signed initially between MLA, GRDC and LWA, and then two years later by AWI. The model followed that of other nationally coordinated programs of LWA at the time.

Providing the overarching framework for the Program was a Program Management Agreement which was a legal agreement between the four partners outlining the terms and conditions under which the Program was to be carried out. This agreement delegated management responsibility to Land & Water Australia, including responsibility for contracting program activities, making payments on behalf of program partners, reporting on an annual basis to the partners and providing a secretariat function to the Management Committee.

Over the five-year duration, four national level bodies were responsible at one time or another for carrying out various functions associated with the Program:

Management Committee: Also known as the Program Management Committee, this Committee comprised representatives of the four core partners and was responsible for the strategic guidance and accountability aspects of conducting the program. The Committee had delegated authority to approve major Program investments and expenditure, without which approval LWA could not act to carry out certain tasks such as project contracting and activity expenditure.

The program management team originally comprised an independent farmer chair and a program manager and a farmer representative of each core partner. Following the mid-term review of the program in 2005, and the subsequent abolition of the Operations team, the Management Committee was increased by one technical staff representative per partner.

The formal terms of reference for the Management Committee were to:

1. Develop policy, strategies and priorities for the achievement of program goals and objectives as enunciated in the Program plans;
2. Approve and establish R,D&E activities and ensure that they satisfy program objectives;
3. Consider recommendations of the National Operations Coordinator on progress of the Program;
4. Facilitate the integration of program activities with other activities of partners, and act as a high level communication conduit;
5. Ensure that the program investments meet the needs of the program partners;
6. Monitor and evaluate the activities of the program;
7. Approve annual budgets;
8. Approve an annual report of the program; and

Program Management Committee, June 2005. From L-R: Mike Logan (LWA), Martin Blumenthal (GRDC), Rob Banks (MLA), Richard Price (National Coordinator), Ian Donges (Chairman), Lu Hogan (AWI), Ken Baldry (MLA), Anwen Lovett (LWA) and Melanie King (Executive Officer)

9. Appoint an independent chair as required.

Operations team: Sometimes referred to as a committee, this team comprised operational staff of the four partners and convened for the first 3 years of the Program until it was abolished following the mid-term review. The Committee assisted in the development of strategies for Management Committee approval as well as in the assessment of project proposals and milestone reports. Committee members were also expected to provide a link between Grain & Graze and other programs of the partners.

Communications team: Also sometimes referred to as a committee, this team comprised communication officers of each of the four partners. It was intended to provide communication support to the Program as well as guidance over contracted communication projects. In the first year of the program, the partners thought that this team would render the need for external communications support unnecessary, however it soon became apparent that the program's communication requirements were too significant for the time available of four busy communication managers. This team was also abolished following the mid-term review of the Program.

Stakeholder Working Group: The SWG was formed out of the recommendations of the mid-term review and combined the Operations and Communications teams with representation from each of the nine regions and the five national projects. This Group was intended to facilitate communication and knowledge sharing across regions as well as providing guidance on national level initiatives such as program evaluation and national forums. Its formal role was to:

1. provide a round-table for program stakeholders to monitor progress;
2. advise the Program Management Committee on issues that require a strategic response;
3. assist in the process of reporting to relevant stakeholder groups on the progress and outcomes of the program;
4. provide technical, practical and grounded advice on issues relating to the conduct of Grain & Graze research, extension and communication activities;
5. review project activities (but not milestone reports) as necessary;
6. facilitate sharing of knowledge and experience across Grain & Graze regions;
7. assist the coordination team in the implementation of the Grain & Graze monitoring and evaluation strategy;
8. assist regions in the process of meeting the systems integration challenge.

In support of the management arrangements outlined above, an Executive team was put in place comprising the National Operations Coordinator, the National Extension Coordinator and Communications Officer.

Regional

Each region was expected to establish a regional Steering Committee to oversee the implementation and reporting activities at the local level. The intention was for the Steering Committee to comprise a producer chair and a majority membership of producers. This

Coordinator's Comment:

The regional approach to Grain & Graze was just one of many experimental processes within the Program. In the case of the management structure across regions, a 3x3 institutional arrangement evolved. That is, in 3 regions catchment bodies were responsible for coordination, while elsewhere 3 State Departments and and 3 farming systems groups performed this role. My impression is that the choice of model did not prove to be the decisive success. In some cases the departmental model provided highly effective while in other cases not so effective. The same can also be said of the farming systems and catchment management based models. The crucial factor appeared to be the capacity of the individuals involved, including the regional coordinator in combination with the personalities either on the Project Steering Committee or in the key agencies. Commitment to improving the lot of the farmer rather than meeting the needs of the host organisations was also a telling factor.

requirement was by and large fulfilled, with all regional committees having a producer chair although with two committees not having producer majority representation.

1. provide strategic direction for Grain & Graze within the region and provide input into critical decisions affecting the implementation of regional Grain & Graze activities;
2. provide guidance and support to the regional coordinator, regional management team and regional researchers and extension personnel. This should include proving motivational leadership, maintaining high energy levels and developing a positive and constructive environment for Grain & Graze activities;

3. provide a monitoring and critiquing role. This should include initial assessment of milestone reports and adding value to them prior to their submission to the national Grain & Graze coordinator
4. act as advocates for the program. This should include promoting the benefits of the program and acting as ambassadors at regional and

Meeting of the Corangamite Glenelg-Hopkins Regional Steering Committee, 2005

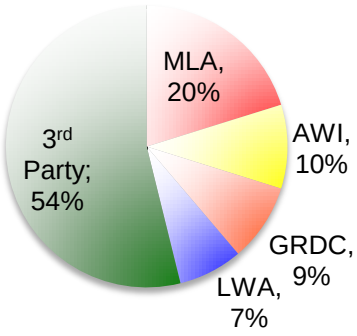
5. seek where possible to enlarge the investment pool in Grain & Graze activities at the regional level.

INVESTMENT STRUCTURE

The overall budget of Grain & graze was $31M over 2003-2008.

Source	Total
MLA	$6,300,000
AWI	$3,000,000
GRDC	$2,785,000
LWA	$2,300,000
3rd Party	$16,792,483
Total	$31,177,483

Partner Equity



In support of the Grain & Graze goal and objectives were five key investment strategies. These key investment strategies included:

Investment Strategy 1: Change On-farm in nine focus regions

Investment Strategy 2: Change On-farm through national extension support

Investment Strategy 3: Information management

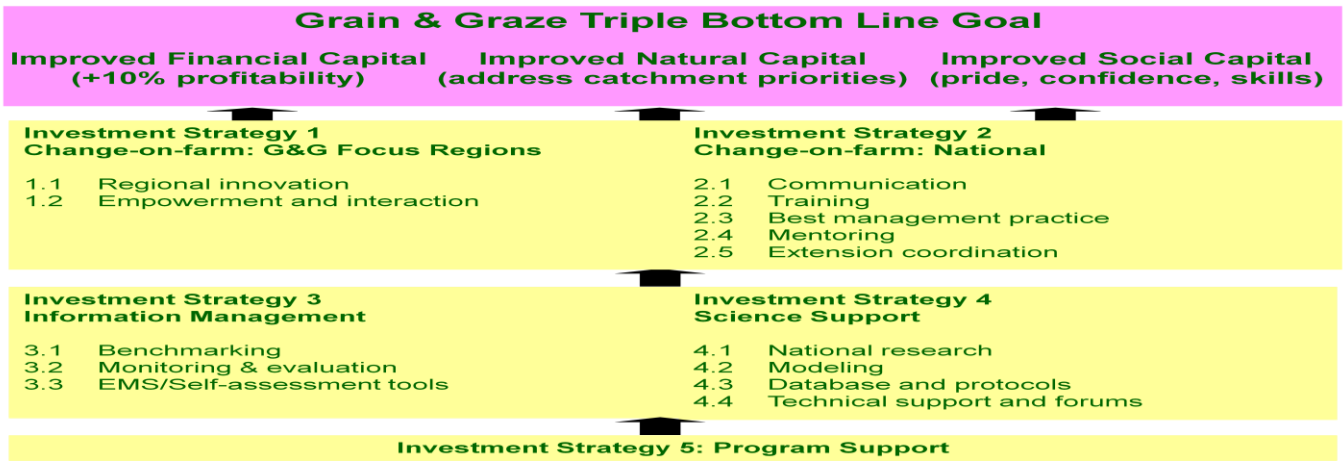
Investment Strategy 4: Sciences and research Support

Investment Strategy 5: Program support.

Investment Strategy	Total (current, $)	Total (%)
1. Change-on-farm: G&G Focus Regions	8,720,826	61%
2. Change-on-farm: National	1,854,249	12%
3. Information Management	560,396	4%
4. Science Support	1,844,174	13%
5. Program Support	1,412,274	10%
Total	14,391,918	100%

Significant points to note about the distribution of the investment against each of the strategies follow:-

Regional Change On-farm: A condition of proceeding with Grain & Graze by one of the Program partners was that approximately two-thirds of the budget



would be allocated to this strategy. The distribution of the funds within this strategy was also to be equal across each region.

An outline of the regional activities undertaken in this strategy features in Part 2 of this report.

Generic Change On-farm: It was envisaged that a National Extension Coordinator would be appointed to oversee this strategy from its commencement. However the position was not sought to be filled until the end of the second year of the program.

Originally funds allocated to this strategy were to include investments in non-Grain & Graze regions. However, the mid-term review refocused investment purely in the Grain & Graze regions.

The features of the change on-farm strategy which comprised most of the investments under this key investment strategy appear in Part 2 of this report.

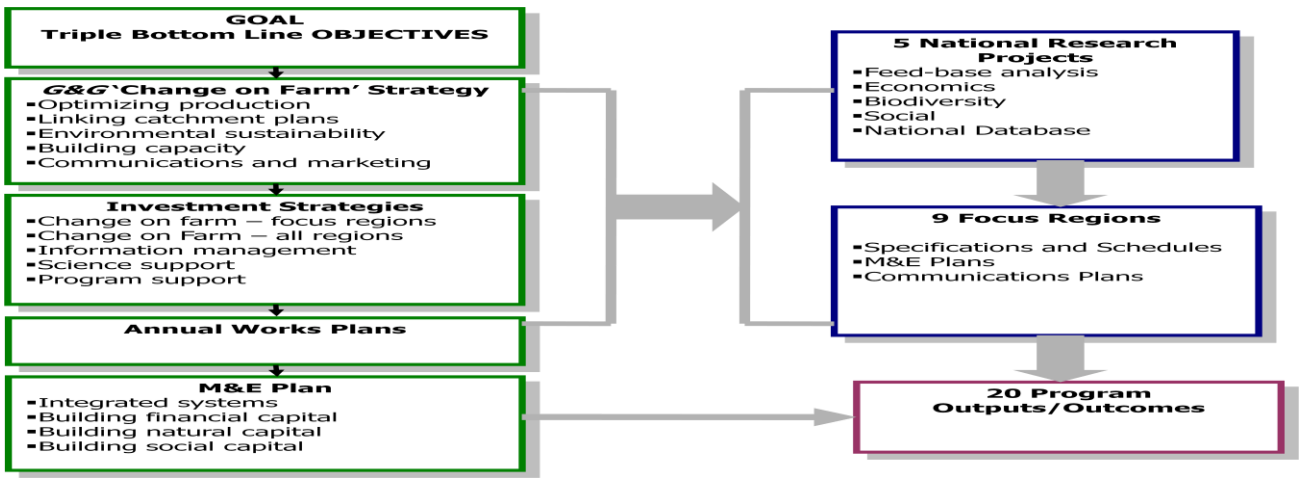
Information Management: Activities in this strategy dealt with benchmarking, monitoring and evaluation. The benchmarking project was compromised by instructions that it should not include new data collection.

Features and outcomes of this strategy are outlined in Part 3 of this report.

Science Support: This strategy comprised the five national research projects. While it was envisaged in the original Business Plan that these would commence in conjunction with the start of the Program, approval was not given to go ahead with these projects until the third year of the Program.

Features of this investment strategy are outlined in Part 2 of this report.

Program Support: The Management Committee was adamant from the commencement of the Program that program support would not exceed 12% of project expenditure.



CHANGE ON FARM STRATEGY

Without a cohesive and coordinated framework for supporting regional and generic change-on-farm activities, adoption of Grain & Graze results would have been left to chance. Not every farmer makes a decision in the same way. The change-on-farm strategy provided the necessary mix of activities that took into account the different contexts and experiences of farmers and the different ways in which they prefer to learn and do business.

The Change-on-Farm strategy sat within a three-pronged approach supported by Grain & Graze. The regional initiative and information management strategies of the program supported processes of research and innovation through regional and generic research, and monitoring and evaluation. Between them they attempted to take into account regional variability as well as commonality.

However, the process of change was more complex than merely doing different research relevant to different regions. 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 were not considered in isolation from research and development activities nor just tacked onto them in a linear fashion. The Change-on-farm strategy recognised the need for a participatory approach to regional RD&E activities that embraced local needs. It also recognised that there is a need to adopt different strategies for different farmers according to their stage along an adoption cycle. This understanding formed the basis for the adoption model that was used.

Summary of model stages

Motivation stage (Awareness): This stage of the model looked at opportunities to support people who indicated a genuine desire to want to change practice but needed support to work through associated issues with the proposed change. People at this point of the change cycle had usually been exposed to the opportunities that a practice change would provide and were wanting to capture a relative advantage by changing.

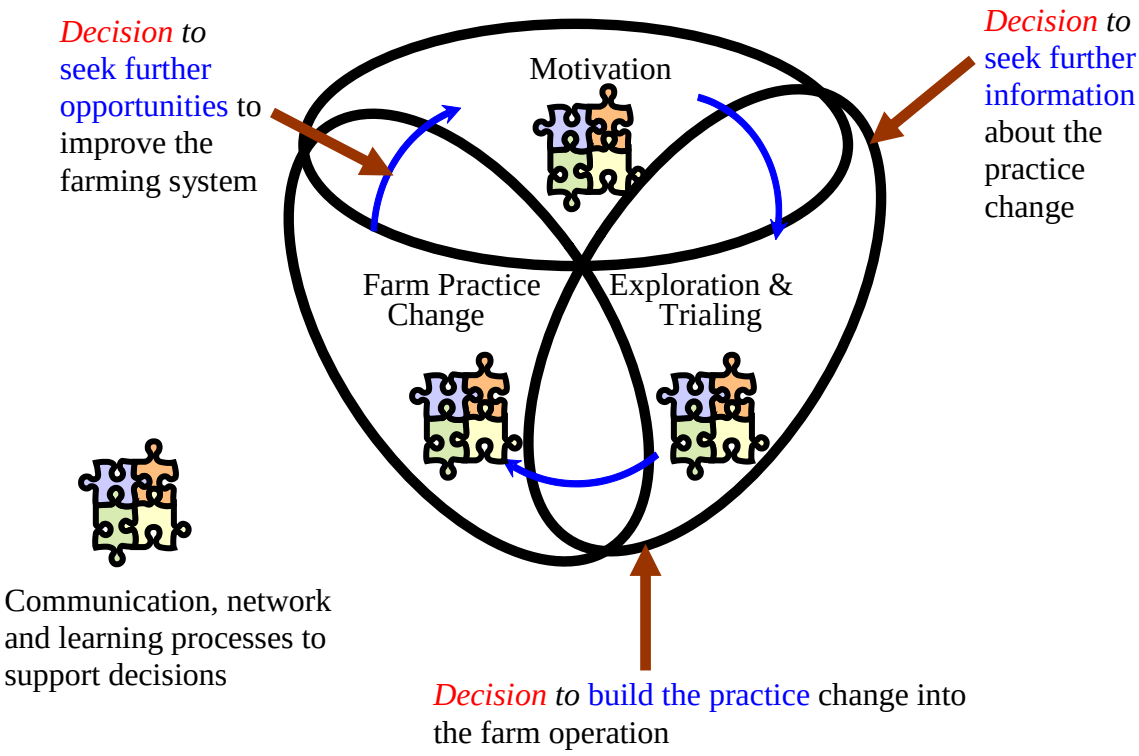
Examples of ways in which the Change-on-farm strategy assisted regions in the motivation stage included:

- providing budget support for farmer mentoring and exchange;
- development of tools for regional training; and
- production of support material to assist decision making.

Exploration & Trialling Stage (Participation): This stage involved planning what changes to make and how to make them. Enhancing skills and understanding was a crucial element of this stage because it reduces risks, the outcomes of adopting positive environmental practices may be slow; and common levels of knowledge help build relationships between participants (critical in later stages).

Coordinator's Comment:

The Change-on-farm strategy is to the knowledge of the National operations and National Extension Coordinators, the only formal extension program to have implemented the full array of strategies recommended by the studies of Jeff Coutts and Kate Roberts under the Joint Venture Capacity Building program managed by the Rural Industries R&D Corporation on behalf of a consortium of R&D Corporations.



Developing these skills required information, time, social support and inspiration (motivation). Early in this stage producers sought a range of solutions and wanted information free of judgement. Group networks were used to support this stage by providing options and helping individuals to filter solutions whilst minimising disruption to their current farming set-up and associated stress.

Trialling was a cheap means of gaining information and confidence through risk sharing, especially when discussed in a group context.

Farm Practice Change stage (Adoption): This stage looked at taking the trial results and adopting the practice across the farm. Some important points considered at this stage were that:

- wide scale adoption often leads to new questions about the technology, so if not answered effectively, the practice may be abandoned and the previous investment is lost;
- peer recognition, personal support and encouragement is needed to maintain commitment especially if results are below expectation or slower than expected; and
- non adoption at the time is legitimate.

Indicator	Overall Outcome	Avon	BR	CGH	CWL	EP	Mallee	MB	Murr.	NAg	Unallocated areas
Total number of mixed farming producers	39,672	2,494	1,882	2,726	3,308	1,351	5,186	2,206	7,173	978	12,368
% of producers aware of *G&G*	36	23	39	22	45	83	58	53	30	46	25
# of producers aware of *G&G*	14,388	574	734	600	1,489	1,121	3,008	1,169	2,152	450	3,092
% of producers who have participated in *G&G*	8	8	4	5	12	25	17	3	8	17	2
Total number of participants	3,083	195	66	123	387	338	902	77	581	166	247
% of participants who have adopted at least one *G&G* key farm practice	95	50	93	100	100	95	90	100	93	100	95
% of producers who have adopted at least one *G&G* key farm practice	79	69	89	42	96	72	75	76	77	107	79
# of producers who have adopted at least one *G&G* key farm practice	28,349	1,630	1,696	1,124	2,919	827	3,382	1,674	5,157	978	8,962
% of adopters attributing increased profitability to *G&G*	82	100	79	78	67	100	88	44	100	91	78
% of participants reporting increased NRM decision-making skills	33	0	40	11	33	32	20	56	33	42	33
% of participants who report increased confidence in making farming decisions	44	0	67	44	73	47	30	71	53	36	44


Useful tools provided farmers during the Gr and Graze Roadshow

PART TWO: FINDINGS

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What is the best mix of crops, pastures and livestock to achieve the Grain & Graze triple bottom line goal?

"It's kinda complex!"

It's not the mix that counts, but the flexibility to change the mix as required. There is no one right system from an economic, production, social or environmental perspective.

KEY INSIGHTS

The following is a synthesis of the many insights attained through Grain & Graze's research investments. Where possible, the synthesis combines lessons learnt from across several projects. Individual project and regional insights are discussed in later sections of this report.

1. It is not the mix of pastures, crops, livestock and resource use that counts, but the flexibility to change the mix as required that is the key to profitable and environmentally sensitive mixed farming

Whether from the social, economic, environmental or production research undertaken in Grain & Graze, a common message is that there is no one single farming system that delivers on the triple bottom line aspirations of either farmers or communities within any one region let alone across Australia.

From an economic perspective, similar profit levels can be derived from different crop/pasture/livestock mixes depending on the practices employed. From a social perspective, the practices employed will depend on individual, family and peer-group preferences. From an environmental perspective, they will also depend on individual farm resource condition, location within a catchment and climatic regimes. Finally, from a production perspective, these will depend on access to labour, availability of machinery, market conditions and access to markets.

While some of these conditions do not change markedly from year to year, some do, such as climatic and market conditions. As a consequence, these changes affect the opportunities available to farmers, sometimes closing off choices, sometimes broadening them substantially. For different farmers, the most appropriate choice will inevitably vary, but it is the capacity to respond to these opportunities that provides the basis for successful mixed farming.

2. Decision making on mixed farms is more than complicated; it is complex

The social research undertaken in the program showed that decisions on farms can be classified as simple, complicated or complex. Complex decisions are those that have no single answer and no single approach to determining a way forward. Mixed farming has an inordinately significant amount of complex decisions involved.

Every complex decision is unique, tends to be made by the farming family, and takes into account a lot of unmeasurable factors.

Intuition and experience are important factors in complex decision making, and these inextricably sit alongside more quantitative tools and forms of advice such as that provided by advisers, decision support systems, best practice guidelines and so forth. In many cases, intuition and experience help derive meaning from, and filter, these forms of advice.

3. Non-traditional extension methods are required to meet the demands of complex decision making

Despite what extension theory has taught us about good extensions practice, there is a dearth of expertise to implement the theory effectively. Linear extension methods are still all too common despite

the various garments they wear to suggest otherwise.
Much of the contemporary extension theory suggests that the solutions, if not answers, to complex decisions lie from within the farmers themselves. Coaching and mentoring farmers plays an important part of building their capacity to continuously learn and discover solutions tailored to individual circumstances, including physical, market, climatic, economic, emotional and social circumstances.

The social research in Grain & Graze has developed techniques to work with farmers to make complex decisions acknowledging key social factors. As past experience is important for establishing principles by which farmers like to operate, story telling becomes important to assist with making confident decisions in a complex environment. Story telling helps establish principles.

4. A number of mixed farming strategies improve farm profit and sustainability under specific conditions

From the low rainfall landscapes of the northern WA wheatbelt, the upper Eyre Peninsula, the Mallee and the western districts of NSW through to the medium rainfall landscapes of the Murrumbidgee, Lachlan and Avon, the higher rainfall landscapes of southern Victoria and the summer dominant rainfall landscapes of northern NSW and southern Queensland, Grain & Graze has refined mixed farming systems that suit the local environment and potentially provide increases in profit of between 2-19 percent.

These mixed farming techniques, outlined in following sections of this report, include:

- grazing winter cereals, forages, shrubs and crop stubbles;
- introducing perennial pastures into whole farm systems either in permanent plantings to match land use to land capability, in long or short-term rotations with crops, or in alley farm configurations;
- establishing crops directly into annual and perennial pastures; and
- matching feed supply to feed demand and managing livestock according to the feed on offer (which is also associated with local resource and climatic conditions, including drought).

Assessment of these practices indicate that if associated with good management, including good resource assessment, resource monitoring and adaptive management, benefits will accrue to the environment, including:

- Reduced soil erosion;
- Reduced water and nutrient loss;
- Reduced watertable rises and salinity;
- Reduced soil acidification; and
- Increased good soil structure and health.

5. There is no unique relationship between sustainability and enterprise mix

Notwithstanding the natural resource management benefits identified above, economic analyses undertaken for three of the Grain & Graze regions at both the farm and catchment scale showed that there are trade-offs between different sustainability indicators and between

sustainability and economic indicators. That is, while there may be benefits in respect to certain sustainability indicators, there are unlikely to be benefits against all sustainability indicators to the extent that they may address catchment targets. Indeed, reducing runoff and aquifer recharge, generally seen as a good thing for the environment, may result in reducing environmental flows in streams. These are issues that cannot be resolved at farm level, and challenge institutional processes at the catchment level.

Attempts by farmers to fully achieve NRM targets through altering enterprise mix are likely to result in large reductions in farm profit. The practices advocated by Grain & Graze do not exacerbate environmental problems, and in most cases do move towards achieving catchment targets. To achieve significant gains in environmental condition, effort and resources need to be concentrated in specific areas of a catchment. To justify the expenditure that is likely to be required, the natural assets that are being protected would need to be of high value.

6. Production risk is not a major influence on farmers' decision making – in fact, some practices increase risk

Mixed farming is often portrayed as providing the basis for better managing income variability associated with climatic and market variability. However, the economic work in Grain & Graze suggests that reducing the variability of income is not a primary factor in farmers' decision making. Indeed farmers are reluctant to trade-off farm income to reduce variability. Furthermore many of the innovations that have been adopted by farmers over the past few decades, such as herbicide use, have led to an increase in variability of farm income.

This should not imply that variability in production is unimportant, but rather that the response of farmers is influenced more by the profitability of a strategy rather than its impact on income variability. This reinforces the need for mixed-farming extension processes to include messages about profit hand-in-hand with other key messages.

7. The relationship between mixed-farming and biodiversity is integral to the productive and natural health and wealth of mixed-farms and across landscapes.

The Biodiversity in Grain & Graze project has established that there is a strong correlation between farm scale measures of biodiversity and agricultural production. The type and intensity of agricultural management can significantly influence biodiversity on farms. Importantly, the project has also shown that all farms can improve biodiversity outcomes even with small changes to management.

The suite of biodiversity projects, including work on soil biota and integrated pest management, has demonstrated that the good management and conservation of biodiversity on farms can contribute to an increase in production, a reduction in farm costs such as chemicals, and an improvement in farm safety.

8. Institutional arrangements still do not effectively support successful mixed-farming as well as they might otherwise, however, Grain & Graze teaches us much about the management of large complex programs.

Across Australia, at both State and national levels, many institutions that support the different farm commodity enterprises as well as natural resource management retain their historical separation. This makes it difficult to service mixed farming and systems-based research and extension as well as farmers demand.

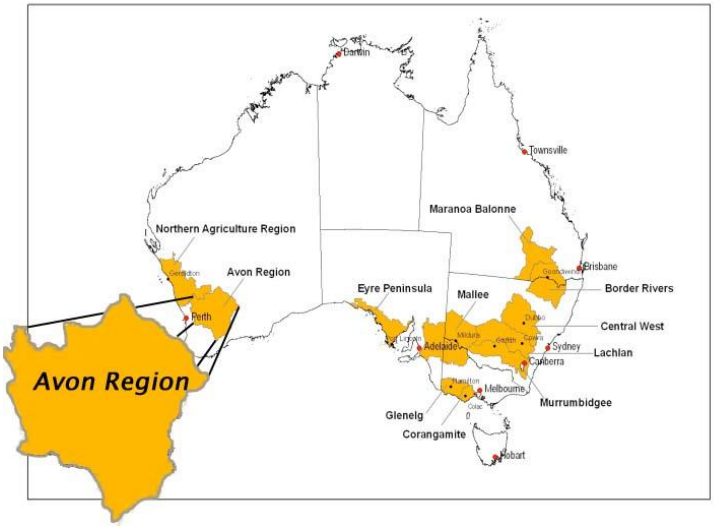
As an experiment in large-scale collaborative, mulit-disciplinary and multi-organisational research, operating at farm and catchment dimensions while balancing national and regional priorities, Grain & Graze has learnt a significant amount about the drivers and constraints of successful program management in relation to mixed farming initiatives. Some of the key lessons include:

- Having good, integrated management, scientific and performance frameworks established from the commencement;
- Engaging and rewarding excellent mixed-farming facilitation skills at the regional level to coordinate activities (local leadership is everything!);
- Demonstrating through differentiation in contracts and forms of engagement an understanding that different people, communities and organisations operate in different contexts and have different baseline capacities, knowledge, access to skills and social/biophysical/economic circumstances;
- Balancing national and local needs so that there is something for everyone;
- Investing in relationships, and making available opportunities to share tasks as well as to share time for stories, reflection and celebration.

Grain & Graze brought farmers, research investors and researchers together.

REGIONAL FINDINGS - AVON

The Avon is defined by the catchment of the Avon River and tributaries and has a total area of 120,000 square kms. The region's population is currently around 50,000. There is an increasing trend for people to move from the more remote areas to live closer to Perth. The major regional centre is Northam.



There are 2,500 mixed grazing and cropping farms in the region and a total of 76,000 square kms is farmed.

Main Issues

With most of the region under annual crops and annual pastures salinity is the significant issue across the Avon. Of all the Grain & Graze regions, this has the lowest proportion of grazing, which presents challenges to introducing mixed farming systems into the region. The level of animal skills is low among farmers and there is also a negative attitude about the role of sheep in farming systems.

Regional Projects

The Avon focused on four major areas of activity:

1. planning strategic, operational and family time on farms;
2. Use of seasonal climate forecasts;
3. using longer pasture phases in annual crop systems;
4. grazing cereals trials;
5. entry level sheep handling extension through Look 2 Grow workshops and Sheep Innovation forums

Key Messages:

- The social research (project 1) showed the lack of separation of the farm and home is particularly evident in mixed farms. "It has shown how 'all invasive' the farm is."
- Much of the management time of a mixed farmer is perceived as a personal issue and occurs in 'space' that is personal (e.g. driving, working on production tasks or in the office). This has important implications for the provision of information to assist or influence decision-making and potentially for the range of sources that are consulted prior to making a decision.
- Seasonal forecasts and yield forecasts (project 2) are tools that provide information on only part of the story on mixed farming – they need to be combined with further information on stored soil moisture

"I now know how much to feed my sheep and when – I was over feeding at inappropriate times previously, and underfeeding when I should have been feeding more. . .I feel more in control now. . . It has quantified my guesses of supplementary feeding I have done in the past. . . I feel I can have holidays now, because I have done the feed budgets and I know that my sheep will reach their targets even when I am not there."

Grower, Avon region

prior to planting and time of break to complete the picture.

- The currently available dual purpose wheat, Wedgetail, is not suitable for sowings after mid-May in a year such as 2007, but huge potential is likely to exist in the currently grown spring wheats to aid in covering a feed period that will allow valuable pasture deferment. Subsequent improvement in pastures from spreading livestock around the crops for short durations is highly likely. This in turn would improve profitability of both grain and livestock enterprises and should contribute additional NRM benefits through improved pasture density (ground cover).
- Establishing a pasture is as important as growing a good crop and the rewards follow in 3 to 4 fold increased production. It is best to establish one variety well first before introducing other varieties to the mix. Weed control is essential in first establishing the pasture and then maintain control through the life of the rotation. Livestock can be used to manage weeds but this takes time and careful hands on management.

Goal Attainment:

The most valued program initiatives in the Avon region were:

- "Look 2 Grow" Workshops
- Sheep Innovation forums
- The time and motion study

Indicators for Avon	
Total number of mixed farming producers	**2,494**
% of producers aware of *G&G*	**23**
# of producers aware of *G&G*	**574**
% of producers who have participated in *G&G*	**8**
Total number of participants	**195**
% of participants who have adopted at least one *G&G* key farm practice	**50**
% of producers who have adopted at least one *G&G* key farm practice	**69**
# of producers who have adopted at least one *G&G* key farm practice	**1,630**
% of adopters attributing increased profitability to *G&G*	**100**
% of participants reporting increased NRM decision-making skills	**Not reported**
% of participants who report increased confidence in making farming decisions	**Not reported**

The most common practices adopted as a result of producers participating in Grain & Graze activities were:

- Assessment of food on offer
- Increased use of condition-scoring
- Increased use of deferred grazing.

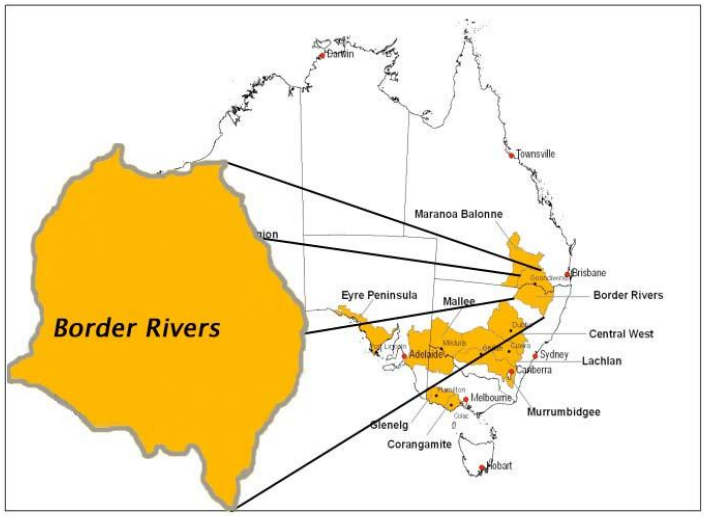
"The Department of Agriculture and Food Western Australia's site at Woolorama was this year visited by a mob of colourful, albeit very narrow bodied sheep from the Grain and Graze program.
The mob of sheep was used to demonstrate the ease of Condition Score monitoring to a range of farmers, consultants and general interest visitors alike. Sheep represented condition scores from 2 to 4, and had messages relating to the reproductive performance of each individual clearly outlined."

AgBrief, April 2008

REGIONAL FINDINGS - BORDER RIVERS

The Border Rivers is located on the Queensland/NSW border with an area of 50,000 square kms. It is one of the headwater catchments of the Murray-Darling Basin. Three rivers drain inland slopes of the NSW eastern highlands creating present day river channels and a drainage network throughout the catchment. The population is approximately 104,000 with the major regional centre being Goondiwindi.

There are approximately 1900 farms in the region, an increase of nearly 20% since 1990. Grains represent 42% of farm income, grazing 38% and off-farm income 20%.



The region is characterised by a highly variable summer-dominant rainfall. A high proportion of the rain falls as high intensity thunderstorms.

Main Issues

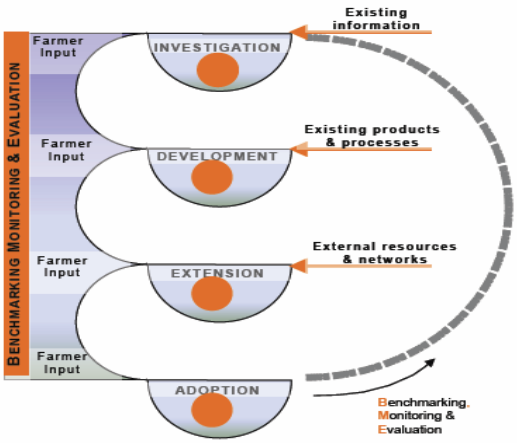
Since the commencement of farming 60-80 years ago in the region, all soils have declined in organic matter and overall fertility requiring an increase in fertiliser inputs to maintain crop production. Soil structure issues were also restricting water infiltration rates and crop establishment. Crop yields started to decline and it had become difficult to justify the inputs required to maintain crop production and economic returns in a variable rainfall environment on a deteriorating soils base.

Regional Projects

Within the context of the Grain & Graze goal the region identified its overarching investment question to be:
Is the introduction of a short or long term grazing phase in cropping systems in the Border Rivers catchment profitable and environmentally, financially and socially sustainable?

The main activities supported in the Border Rivers included:

1. development and refinement of the MLA feed demand calculator;
2. simulation analyses of grazing cereal crops and residues;
3. comparing wheat for grain versus oats for grazing;
4. short-term pasture phase impact on cropping soils;
5. performance of summer and winter pasture-legume mix on marginal soils'



Conceptual model adopted in Border Rivers for Grain & Graze

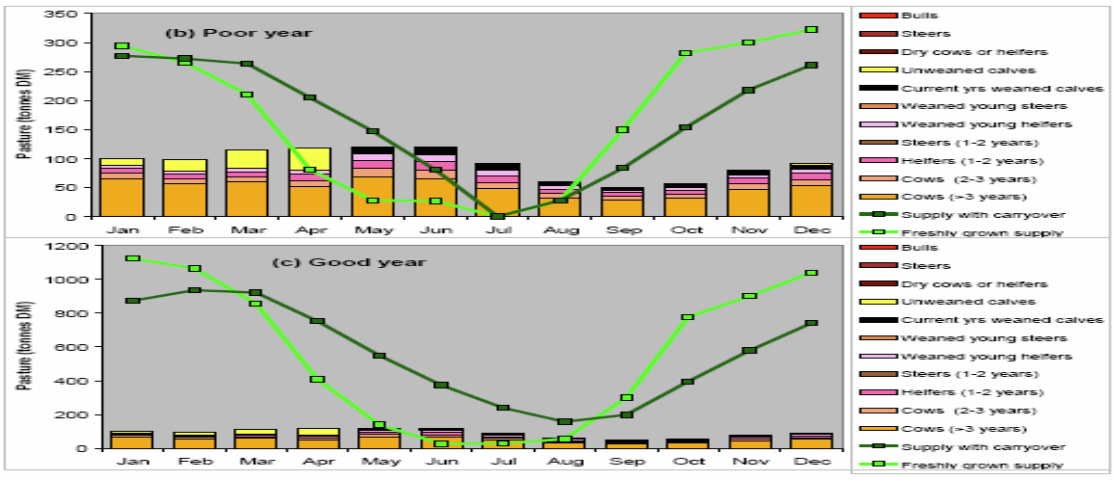
6. evaluation of the efficacy of inoculums and inoculation technology for sub-tropical legumes;
7. legume adaptability;
8. effect of livestock grazing and trampling on soil physical property;
9. phosphorus and sulphur fertility needs of native grass pasture/legume mixes;
10. pastures for dodgy soils;
11. pasture renovation trial;
12. role of pasture legume phase infertility maintenance;
13. to understand economic risks as they affect mixed farming systems enterprise decisions;
14. delivery of LeyGain;
15. simulation options for managing seasonal and annual variations in feed supply of mixed crop/livestock systems;
16. case studies of managing natural resource base risks on mixed farms; and
17. extension and communication activities.

Key Messages

- Use of feed budgeting tools will assist producers manage their livestock enterprise to better match the mix of feed sources on the property to the nutritional requirements of their stock at different times.
- Better understanding of pasture growth and its variability means that producers can ensure pastures persist and be productive for longer and so contribute to environmental outcomes such as improved soil fertility, increased soil organic matter, improved soil structure, week control, reduced drainage and nutrient loss and reduce losses of biodiversity.

- Research results mean farmers can be more confident about the critical yield below which they would gain more value from a wheat crop by grazing than harvesting the crop.
- Improving skills and knowledge in animal nutrition, feed budgeting and analyses of options on mixed farms allows producers to be more prepared and pro-active to climatic and price risks rather than be re-active to these.

Feed demand calculator output for Goondiwindi



Goal Attainment

The most valued program initiatives in the Border Rivers region were:

- LeyGrain workshops
- Sub-catchment planning and associated cost sharing arrangements
- Involvement by agribusiness and their ability to align with regional properties

The most common practices adopted as a result of producers participating in Grain & Graze activities were:

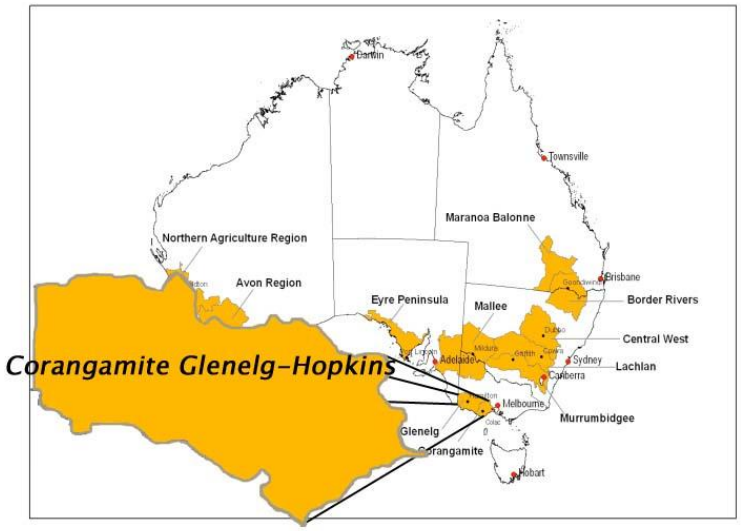
- Increased consideration of pasture persistence when selecting pasture species
- Changing enterprise mix to managing drought
- Increased grazing of crop and land

Indicators for Border Rivers	
Total number of mixed farming producers	1,882
% of producers aware of *G&G*	39
# of producers aware of *G&G*	734
% of producers who have participated in *G&G*	4
Total number of participants	66
% of participants who have adopted at least one *G&G* key farm practice	93
% of producers who have adopted at least one *G&G* key farm practice	89
# of producers who have adopted at least one *G&G* key farm practice	1,696
% of adopters attributing increased profitability to *G&G*	79
% of participants reporting increased NRM decision-making skills	40
% of participants who report increased confidence in making farming decisions	67

Richard and Janet Doyle inspect their crops of Burgundy Bean near Boggabilla on the Queensland-New South Wales border (Photo by Rachel Charles)

REGIONAL FINDINGS - CORANGAMITE GLENELG HOPKINS

The Corangamite/Glenelg-Hopkins area encompasses the entire coastline between Geelong and Hamilton in western Victoria. The total regional population is around 455,000. Wool production has historically dominated the region, although this has changed dramatically in the past decade with cropping and prime lamb production on the increase.



There are about 2,700 farms in the region. The two main regional centres are Geelong in the east and Hamilton in the west.

Main Issues

The overarching issue for mixed farming in this region is to find a balance to sustainably operate a cropping and grazing system when expansion of cropping potentially threatens remaining native grasslands, creates feed quality problems as well as exacerbates a winter feed shortage in the grazing enterprise. In response, this requires:

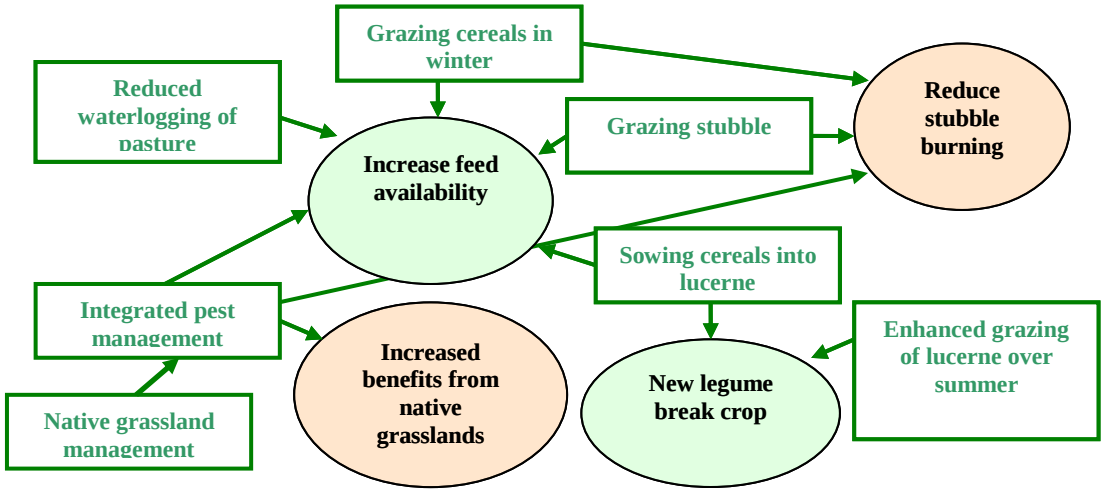
- an increase in the feed available for grazing over winter but also in late summer;
- introduction of a legume break crop, ideally a perennial crop that increases plant water use and reduces the retention of nitrogen inputs;
- development of practices that reduce the need to burn stubbles;
- creation of a clear production benefit from the remaining native grassland.

Regional Projects

To address the objective in increasing average gross margins by at least 13.7% through a combination of increased productivity and reduced costs, the following activities were supported:

1. Improved management of stubbles;
2. Developing a beneficial legume break crop;
3. Grazing stubbles;
4. Grazing cereals in winter;
5. Integrated pest management;
6. Sowing cereals into lucerne; and
7. Enhance grazing of lucerne over summer.

In support of the objective to improve catchment water quality the following activities were undertaken:



'Adoption of the Grain and Graze practices means greater resilience of farming in South West Victoria'

Regional steering committee member

'The regional Grain and Graze program has created tools and products to enable farmers to be more socially responsible'

Regional steering committee member

8. Reduced water-logging of pasture; and
9. Native grassland management.

Key Messages

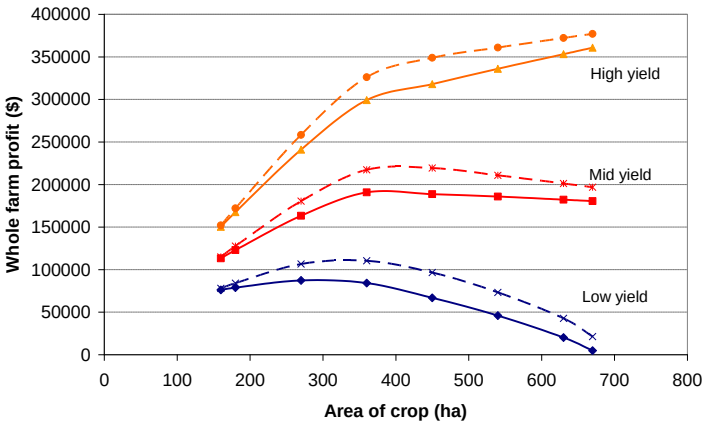
- Multiple enterprises increase flexibility on farms and the opportunities if used appropriately create greater stability in the farming operation;
- Grazing crops and stubbles can be done in a way that maximises the potential gains but in a way that also minimises damage to soil structure;
- Remnant native grasses can be grazed in a way that increases their diversity and persistence, achieving an important NRM outcome but also aiding pest management;
- Increasing the feedbase including through the grazing of cereals, allows existing pastures to be spelled, allows greater production and the likelihood of greater pasture persistence; and
- From a risk management perspective farms with approximately 360 Ha of crop (40% of the farm area) will maximise profit in all years except those with favourable climatic conditions. While greater profit will be achieved with a higher proportion of cropping in better seasonal years it will be worse in less than average years, and hence the profitability of a farming system over the longer term will be better served and more resilient with a mix of cropping and livestock.

Summary of Goal Attainment

Indicators for Corangamite Glenelg Hopkins	
Total number of mixed farming producers	2,726
% of producers aware of *G&G*	22
# of producers aware of *G&G*	600
% of producers who have participated in *G&G*	5
Total number of participants	123
% of participants who have adopted at least one *G&G* key farm practice	100
% of producers who have adopted at least one *G&G* key farm practice	42
# of producers who have adopted at least one *G&G* key farm practice	1,124
% of adopters attributing increased profitability to *G&G*	78
% of participants reporting increased NRM decision-making skills	11
% of participants who report increased confidence in making farming decisions	44

The most valued program initiatives in the Corangamite Glenelg Hopkins region were:

- The full range of on-farm trials
- IPM courses

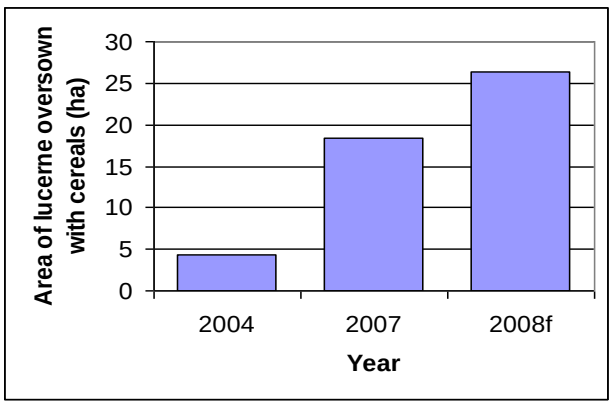


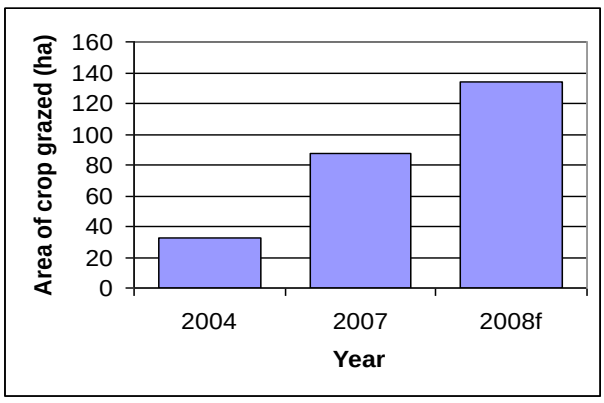
Farm profit with (dashed line) and without (solid line) grazing cereals at three grain yield scenarios

- Support for farm scale systems and developing stories to communicate systems management.

The most common practices adopted as a result of producers participating in Grain & Graze activities were:

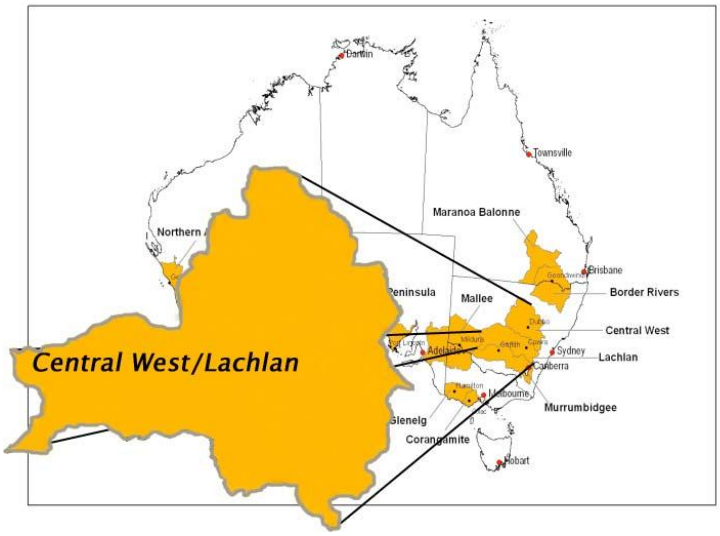
- Integrated pest management on broad acre farms
- Sowing of cereal into existing lucerne stands
- Cereal grazing in winter





REGIONAL FINDINGS - CENTRAL WEST LACHLAN

This region extends from the Great Dividing Range in NSW to the Riverine Plains with a total population of around 208,000. There are a number of large towns in the region, the largest being Orange on its extreme eastern boundary. The region spans medium to high rainfall areas in the east to low rainfall areas in the west.



There are 3,300 farms in the region with grazing of perennial pastures for wool, sheep-meat and beef production dominant in the east and mixed grazing enterprises with dryland cropping of winter cereals, oil seeds and pulses in the drier west.

Main Issues

The region identified the key issues for mixed farms to be to increase profitability in the face of declining terms of trade by more efficiently utilising available resources. The major threats to natural resources in the region include dryland salinity, degradation of riparian and wetland ecosystems, reduced biodiversity and deterioration of soil resources.

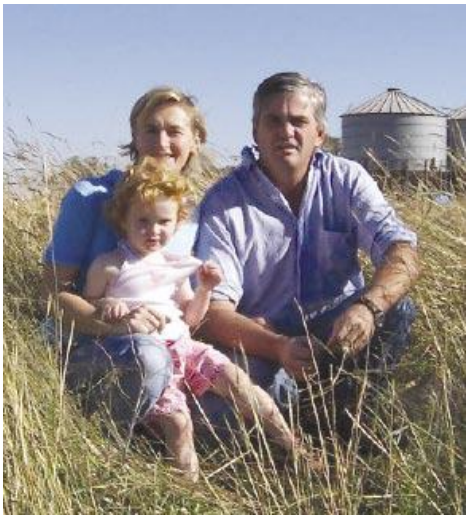
Regional Projects

The region identified 6 key investment areas where project work was undertaken:

1. Analyses of innovative mixed farm case studies;
2. Feed profiles and production options;
3. Biodiversity in mixed farming landscapes;
4. Eastern zone pasture cropping systems;
5. Western zone alley farming systems; and
6. Communication, education and extension.

Key Messages

- Well designed case studies that deal with the whole farming system are difficult and time consuming to compile but provide a resource that has proved of lasting interest to producers;
- Case studies are more valuable as stories about particular innovative systems than as a means of identifying issues for further research or extension activity;
- The miniMIDAS model demonstrates production options



Kylie and Matthew Barton with their daughter Sally

are available within the region that can lead to both economic and ecological benefits. Of the innovative farming systems envisaged by this project pasture cropping appears to offer economic benefits to producers in the high rainfall zone as well as biodiversity benefits;

- Alley farming with old man salt bush offers biodiversity benefits but requires a change to prime lamb production to realise worthwhile economic benefits;
- At moderate levels of public investment typically of current CAP-target, investment in salinity management should be preferred to direct biodiversity investment as the economic benefits are greater and the biodiversity benefit about the same;
- Substantial improvements in biodiversity across the catchment can only be achieved by incurring large reduction in farm profit, through revegetating a significant proportion of the catchment;
- Despite the previous point, farms can produce environmental and biodiversity benefits through well managed, profitable farm systems, without significant constraints in terms of the balance of farm enterprises. Further, changes in land use balance rather than enterprise balance are required to achieve major improvements in regional biodiversity;
- Alley farming used in mixed farming landscapes can increase perennial cover thus improving resource condition and providing better connected habitat for native biodiversity;
- Pasture cropping can produce crop yields similar to conventional cropping providing soil fertility, weed control and soil moisture are adequate;
- During the cropping phase pasture production may be reduced depending on pasture type, but can return to production levels similar to straight pasture after the cropping phase;
- The lack of fallowing in pasture cropping gives farmers more flexibility in making cropping decisions, improving their capacity to manage climate variability;
- Ground cover can be maintained under pasture cropping at higher levels than conventional no-till cropping, enhancing environmental outcomes;
- Establishment of alleys of old man salt bush on 20% of the area of a mixed farm can:
  - reduce variation in livestock condition during periods of average or below average rainfall;
  - increase weight of first cross lambs during periods of average or below average rainfall;
  - increase lamb survival when wet, cold weather coincides with lambing;
  - form an effective barrier to lateral flow of water and nutrients;
  - enhance biodiversity at paddock sale through improved structure and composition of the vegetation; and

Paul, Matthew and Stephen Cavanagh

- increase farm gross margin per hectare provided there is a change to prime lamb production.

Goal Attainment

The most valued program initiatives in the Central West Lachlan region were:

- IPM workshops
- Communication and awareness activities including case studies
- Pasture cropping research and extension

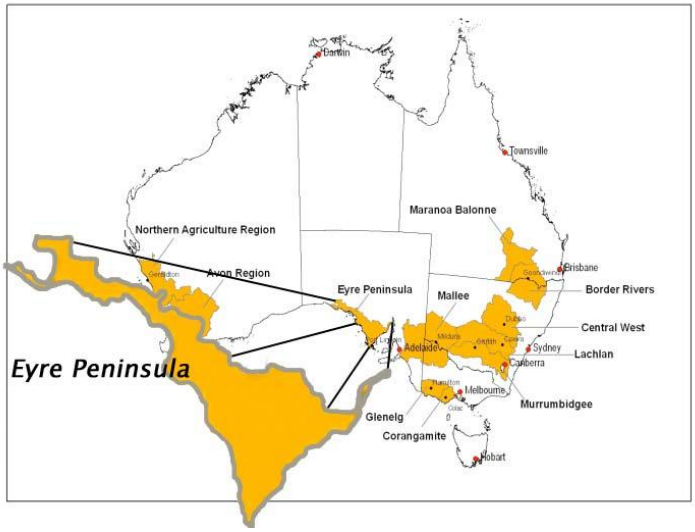
The most common practices adopted as a result of producers participating in Grain & Graze activities were:

- Increased use of alley farming using forage shrubs such as salt bush
- Increased use of pasture cropping
- Increased use of management techniques aimed at improving biodiversity outcomes

Indicators for Central West Lachlan	
Total number of mixed farming producers	3,308
% of producers aware of *G&G*	45
# of producers aware of *G&G*	1,489
% of producers who have participated in *G&G*	12
Total number of participants	387
% of participants who have adopted at least one *G&G* key farm practice	100
% of producers who have adopted at least one *G&G* key farm practice	96
# of producers who have adopted at least one *G&G* key farm practice	2,919
% of adopters attributing increased profitability to *G&G*	67
% of participants reporting increased NRM decision-making skills	33
% of participants who report increased confidence in making farming decisions	73

REGIONAL FINDINGS
- EYRE PENINSULA

The Eyre Peninsular covers 55,000 square kms at the eastern most edge of the Great Australian Bight. It has a population of 33,000 with one major city, Port Lincoln, which serves as the hub for most commercial and industrial activity in the region.



There are approximately 1,300 farms in the Eyre Peninsular and agriculture comprises 85% of the region's economic activity. This mainly consists of winter crops of wheat and barley, wool and livestock.

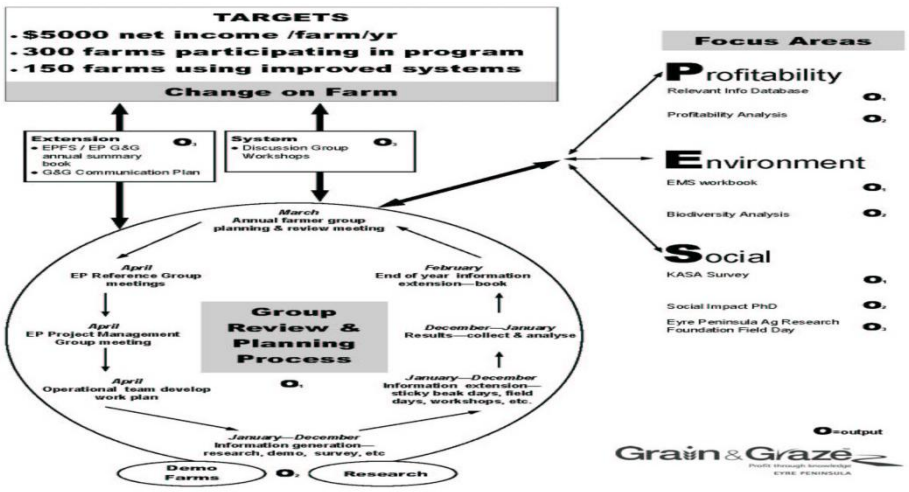
Main Issues

Prior to Grain & Graze many mixed farms in the Eyre Peninsular had been increasing their cropping programs over the past 15 years at the expense of livestock in the system. This was due to a range of seasonal, social and economic factors. With a fall in grain prices and drought, there was an urgent need to provide technical advice to farmers with limited livestock experience for those who had a desire to increase their productivity. While much work had been done on increasing cropping productivity in the region very little had been done with the livestock, particularly sheep, and increasing the profitability of livestock in mixed enterprise systems became a priority.

Major Projects

The region set about undertaking a range of activities in response to 3 research questions it identified within the context of the Grain & Graze goal:

1. What are the barriers to optimising the farming system considering the interactions between cropping and livestock enterprises?
   - KASA survey to benchmark and monitor farm practices among participating farmers;
   - Investigation of the practicality of developing an environmental management system for mixed farming in the Eyre Peninsular;
   - Development of an information database to capture farming system guidelines for Eyre Peninsular farmers.
2. How do a range of farming systems impact on the triple bottom line of Eyre Peninsular farms, catchments and the region?
   - Farming systems profitability assessment;
   - Farming systems biodiversity assessment.



The essence of risk management is maximising areas we have some control over the outcome and minimising areas we have no control over the outcome.

Producer, Eyre Peninsula

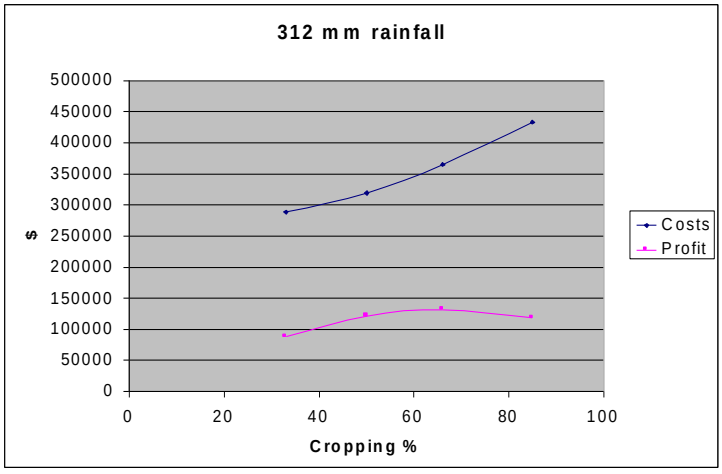
3. What combinations of livestock with existing cropping enterprises contribute to increased profitability of farm businesses on the Eyre Peninsular whilst enhancing the social and natural resources?
   - Livestock management research and demonstration including livestock nutrition, improving weaner development, increasing lambing percentage;
   - Feed-based management research and demonstration including grazing cereals, early feed strategies, pasture management and improving livestock performance on pure Medic.

Key Messages

- A synthesis of the results of Grain & Graze activities show that well run stock enterprises have similar or better gross margins to break crops in all rainfall zones on the Eyre Peninsular, without incurring the same input costs and hence risk;
- The EP Farm Profitability analysis has shown that a mixed farming business is often more robust than a pure cropping enterprise.
- Profitability of a mixed farm enterprise peaks between 50–70% cropping depending on the rainfall received, while risk continues to rise as cropping percentage increases. In average yield years and at average grain prices, a reduction in crop area from the common area cropped of 80% to around 60% has little effect on farm profit, but it does reduce the financial risk in the event of a poor cropping season (yield and /or price falling away).
- Medic remains the best legume based pasture for much of the medium to low rainfall zones of Eyre peninsular. In these areas lucerne, forage brassicas and other alternative pasture species cannot be grown reliably;
- Farmers will continue to face a conflict that remains in mixed farming medic pastures, as more fibrous feed sources such as grasses need to be removed for disease management in the cropping program, reducing dry matter available and nutritive balance. For that reason, animal performance needs to be monitored and appropriate management strategies implemented.
- Cereals provide the best early feed option until Medic pastures bulk up.
- On EP grazing cereals (grazing cereals with intent for grain production) have a potential role on lower EP as spring conditions favour crop recovery for grain yield. This offers the benefits of increasing cropping area, increasing livestock production (through stocking rate) and improving pasture production and utilisation.

This graph highlights for the EP that there is a broad range of cropping and grazing mixes, from 50-80 per cent crop, that provide “near optimal” profit. “*So there isn’t a single ‘magic’ enterprise mix that delivers optimal profit.*”

Brain Ashton, Eyre Peninsula



Goal Attainment

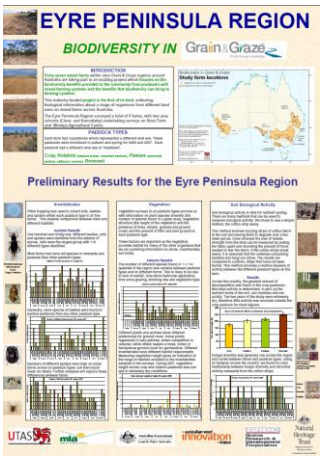
The most valued program initiatives in the Eyre Peninsula region were:

- Profitability study workshops
- Livestock nutrient management activities
- Feed gap assessment

The most common practices adopted as a result of producers participating in Grain & Graze activities were:

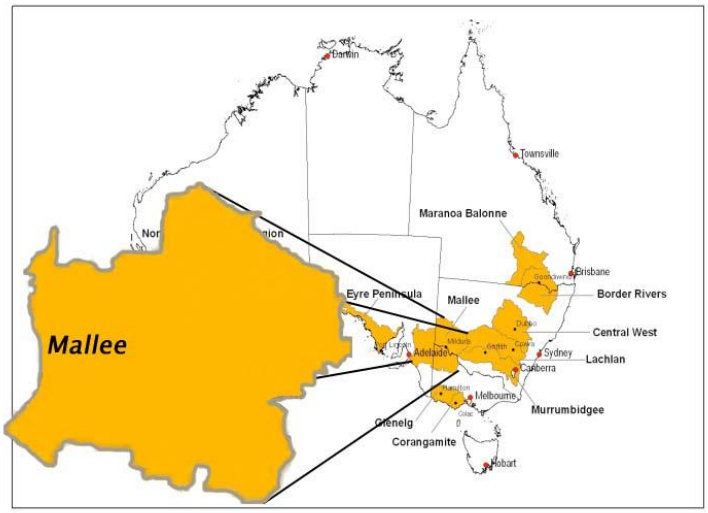
- Improved measurement of feed in the paddock
- Improved use of feed-lots
- Increased use of grazing cereals

Indicators for Eyre Peninsula	
Total number of mixed farming producers	1,351
% of producers aware of *G&G*	83
# of producers aware of *G&G*	1,121
% of producers who have participated in *G&G*	25
Total number of participants	338
% of participants who have adopted at least one *G&G* key farm practice	95
% of producers who have adopted at least one *G&G* key farm practice	72
# of producers who have adopted at least one *G&G* key farm practice	827
% of adopters attributing increased profitability to *G&G*	100
% of participants reporting increased NRM decision-making skills	32
% of participants who report increased confidence in making farming decisions	47



REGIONAL FINDINGS - MALLEE

The Mallee region spreads across 3 million hectares straddling the NSW, Victoria and South Australian borders. It has a population of 278,000 with Mildura being the major centre, although there are other large towns along the River Murray supporting both dryland and irrigated activities in the region.



There are over 5,000 farms in the region but many of these support irrigated horticulture. About 1,500 farms support winter cropping and wool and livestock enterprises.

Main Issues

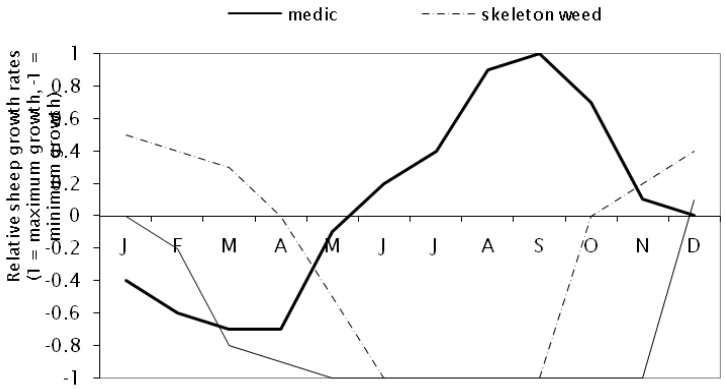
- In the decade prior to Grain & Graze Mallee farmers focused on intensifying their cropping activities to the point where the number of mixed farms was being substantially reduced;
- Climate variability, and in particular managing drought, is a significant issue for farmers in the Mallee;
- Continuous cropping in the region has caused concern for soil health;
- The performance of pastures within crop rotation was considered a catalyst for declining stock numbers, as was the perception that livestock do not fit with direct drill feeding systems.

Major Projects

An assessment of the priority needs in the region led to a conclusion that the biggest gains were to be made from extension of existing knowledge rather than the creation of new knowledge. This became even more apparent during the life of the Program when the Mallee suffered its worst drought period on record.

Major activities undertaken in the region included:

1. Monitoring and evaluation of 6 demonstration farms promoting salt bush, forage crops, grazing cereals, rotational grazing, perennial pastures and lucerne for summer feed;
2. High water use farming systems that integrate crops with perennial pastures;
3. New rotation for low rainfall environments including assessment of break crops grown in rotation with wheat;
4. Identify herbicide impacts on nitrogen fixation of pulses;



Relative growth rates of unmated ewes grazing different feeds in average years at Walpeup

5. Soil biodiversity monitoring and assessment; and
6. Regional extension activities.

Key Messages

- Grazing cereals offers better quality and quantity of feed, increases groundcover, increases soil biota, offers dual benefits of sheep feed and cereal production and can reduce recharge;
- Introducing lucerne in the low rainfall zone of the Mallee is technically possible and can reduce soil erosion, recharge and salinity, though is not without its risk.
- Grazing induces significant changes in the size, composition (catabolic diversity) and functional capability of microbial communities in Mallee soils. Pasture systems with increased above ground dry matter, i.e. 'double sown', seem to support higher levels of microbial functions involved in C and N turnover. N mineralization capacity was highest in soils under permanent pasture followed by Pasture-Crop rotation and lowest in Intensive crop soils.

Goal Attainment

The most valued program initiatives in the Mallee region were:

- Social research farmers forum
- General crop walks
- Lot-feeding demonstration days and workshops

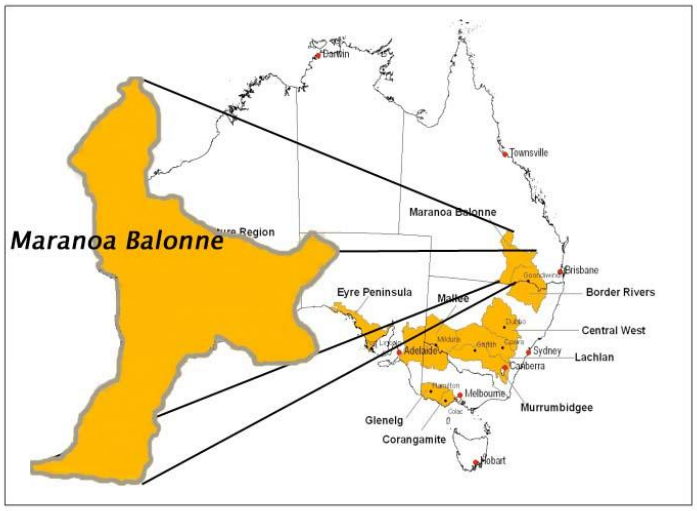
Indicators for Mallee	
Total number of mixed farming producers	5,186
% of producers aware of *G&G*	58
# of producers aware of *G&G*	3,008
% of producers who have participated in *G&G*	17
Total number of participants	902
% of participants who have adopted at least one *G&G* key farm practice	90
% of producers who have adopted at least one *G&G* key farm practice	75
# of producers who have adopted at least one *G&G* key farm practice	3,382
% of adopters attributing increased profitability to *G&G*	88
% of participants reporting increased NRM decision-making skills	20
% of participants who report increased confidence in making farming decisions	30

The most common practices adopted as a result of producers participating in Grain & Graze activities were:

- Containment areas for grazing sheep
- Increased sowing of pastures and forage crops
- Increased use of grazing cereals

REGIONAL FINDINGS - MARANOA BALONNE

This region covers an area of 110,000 square kms in southern Queensland immediately to the west of the Border Rivers region. It has a population of 30,000 with the largest towns being Roma and St George.



There are around 1,500 farms in the region with the main agricultural industry being wheat, sorghum and barley, with chickpea, mung-bean and canola also contributing to the cropping mix, while cotton and livestock contribute to agricultural production.

Main Issues

This region has one of the most variable climates of any cropping area in Australia creating a high risk environment for mixed farmers who face extremes of heat and cold as well as significant variability in rainfall.

Soil fertility has been in continuous decline since the establishment of cropping in the region. Water is also viewed to have been used inefficiently in the farming systems.

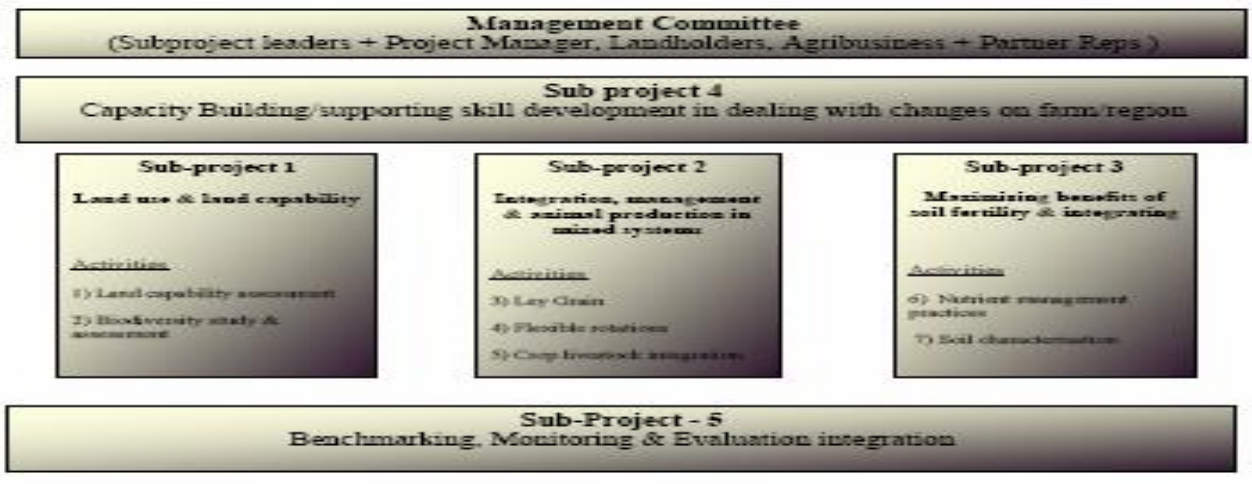
Adoption of pastures into cropping systems has been limited in the region due to:

- Poor understanding of the economic performances of pasture/livestock enterprises;
- Unreliable pasture establishment in the highly variable climatic environment;
- Time-based risk in moving enterprise between crop and pasture phases;
- A limited number of stable ley pasture species and cultivars.

Major Projects

Activities of this region came under 3 major themes:

1. Landuse and land capability
   - land capability assessment
   - biodiversity assessment
2. Integration, management and animal production in mixed system
   - LeyGrain
   - flexible rotations
   - crop/livestock interactions
3. Maximising benefits of soil fertility and integration
   - nutrient management practices
   - soil characterisation.



Key Messages:

Land Capability –

- Land capability processes require significantly detailed soil analyses at the farm level to improve validity and this is a high resource demand;
- Some landuse in the region is not used at the optimum level, e.g. cultivating land better suited for pastures;
- There is potential to improve efficacy of land suitability assessment by operating at a catchment level and integrating current soil data with farmer data and experiences as opposed to conducting additional soil survey work.

Biodiversity –

- To improve biodiversity there is a need to establish the production benefits resulting from increased biodiversity, and conclusions regarding this at present are inconclusive.

LeyGrain –

- Pasture species must be selected to fit the requirements of the individual paddock and the environment;
- It is essential that feed purchased meets germination requirements;
- Fertiliser can assist pasture establishment and persistence.

Crop Pasture Rotation Options –

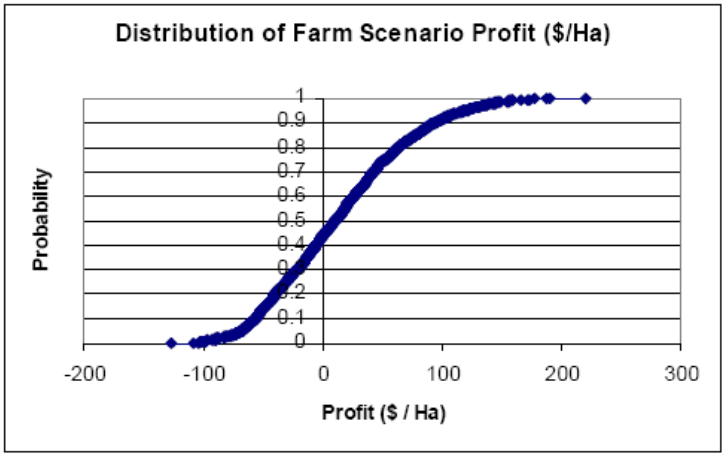
- Producers should prepare to take rainfall opportunities that arise after early December in less marginal environments or January in marginal areas;
- Sowing into winter crop stubble, preferably following the accumulation of fallow water, is an effective process for moving from a cropping to a pasture phase on arable soils;
- Under-sowing winter crops with Rhodes and Bambatsi grasses and the legumes Burgundy Bean, Desmanthus and Lucerne can be successful and provides a rapid and less risky transition from crop to pasture;
- If sown early in the spring/summer legumes (except Lablab) and grasses establish best when sown no deeper than 1 cm. If sown later when soil temperatures are higher, most can be sown at 1-3 cm depth;
- Sowing ley pasture species in winter and spring either with a winter cereal into the stubble of a winter cereal or alone can be successful and may be a means of reducing the unreliability of legume pasture establishment.

Crop/Livestock Integration –

- Lablab has shown that it is a very productive annual forage crop which can also contribute significant amounts of nitrogen for subsequent crops;
- Burgundy bean has shown to be persistent (up to 3 years) even in dry conditions;
- Grass pasture is more effective at providing groundcover then a legume only pasture. Thus mixed grass-legume pastures are likely to provide greater sustainability benefits than either alone.

Opportunistic Grain and Forage Cropping

- Biological drilling can influence the redistribution of soil nutrients and



The critical value for farming decisions is the probability of achieving a negative profit, as a negative profit means that the farm scenario is loosing money. From the example in this Figure, it can be seen that the probability of achieving a negative profit is 44%, which demonstrates the degree of riskiness that this farm scenario entails.

Rod Strahan, DPIF

improve the root growth and root distribution in the soil profile;

- Increased plant nutrition, particularly phosphorus concentration, has resulted in increased water use efficiency by 30-50% in other crops;
- Improving plant available water and water use efficiency through forage rotation options potentially can provide an additional option for better managing climate variability;
- Forage crop rotations can also support the reduction of inputs such as fertiliser and maintain strong enterprise gross margins by incorporating diversification at the enterprise and biodiversity level.

Soil Nutrient Imbalances –

- Improved soil fertility and plant nutrition improves water use efficiency thus reducing the risk of salinity in a mixed farming system;
- A 20 kg phosphorus supply in the region can increase grain yield by about .5 to 1.5 t/ha for wheat and 1.0 to 2.5 t/ha for sorghum and 2 t/ha for lucerne forage.

"…being new to the region, we now have a better understanding of our land and soil types and the know-how to monitor pasture yields and work out a forage budget."

Producer, Maranoa Balonne

Goal Attainment

The most valued program initiatives in the Maranoa Balonne region were:

- Use of silage for feed gap management
- Soil health research and extension
- Nutrient management workshops

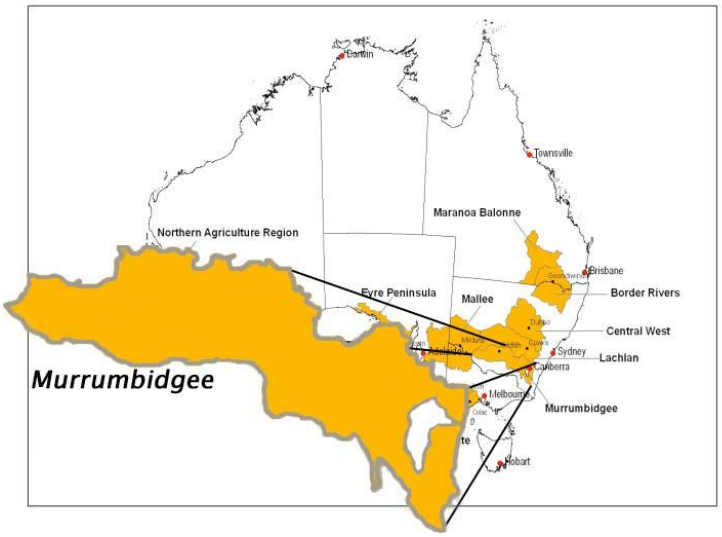
The most common practices adopted as a result of producers participating in Grain & Graze activities were:

- Consideration of pasture persistence when selecting pasture species
- Changing enterprise mix to manage drought
- Increase grazing of cropping land

Indicators for Maranoa Balonne	
Total number of mixed farming producers	2,206
% of producers aware of *G&G*	53
# of producers aware of *G&G*	1,169
% of producers who have participated in *G&G*	3
Total number of participants	77
% of participants who have adopted at least one *G&G* key farm practice	100
% of producers who have adopted at least one *G&G* key farm practice	76
# of producers who have adopted at least one *G&G* key farm practice	1,674
% of adopters attributing increased profitability to *G&G*	44
% of participants reporting increased NRM decision-making skills	56
% of participants who report increased confidence in making farming decisions	71

REGIONAL FINDINGS - MURRUMBIDGEE

The Murrumbidgee stretches from the Great Dividing Range of NSW to the Mallee region in the west and encompasses the Southern Tablelands, the Southwest Slopes and Southwest Plains. The total population is around 560,000 with the major centres being Canberra and Wagga Wagga.



There are around 5,000 farms in the region. The major production enterprises are wool, sheep-meat, beef, cropping and soft-wood plantations. There is also substantial irrigation production in the region.

Main Issues

A number of NRM issues are significant in the region including surface water quality, dryland salinity, water logging, soil and stream bank erosion, soil acidification, native vegetation decline, and weeds, pests and feral animals.

The farmers in the region identified the critical need to develop improved rotations for mixed farming systems that would provide both production and environmental benefits.

Major Projects:

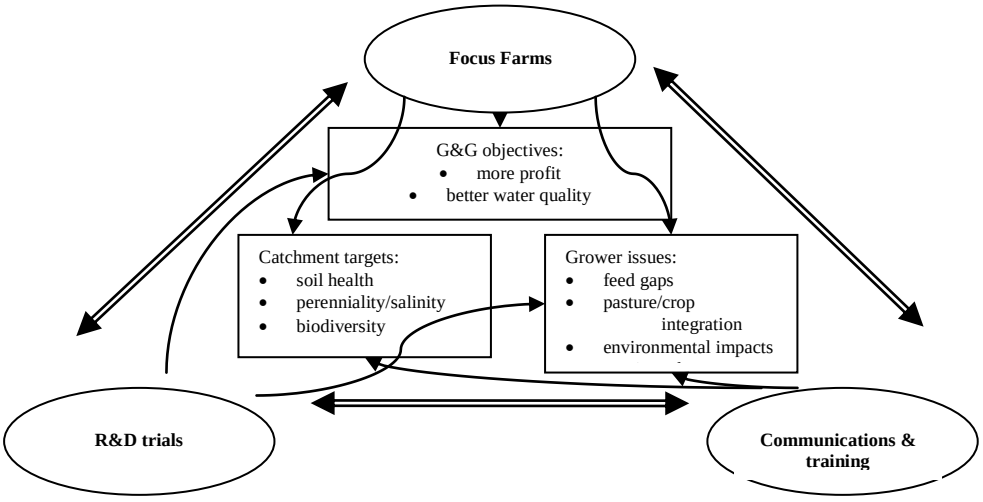
This region focused its efforts largely around 2 activities:

1. grazing wheats; and
2. focus farms exploring feed production, biodiversity and animal management.

Key Messages

A synthesis of focus farm activities highlights the following key points:

- Seasonal conditions are the most important driver of variability in groundcover in mixed farms in the region. Even conservative farming systems are likely to experience periods when groundcover declines below recommended levels;
- Not burning stubbles, reducing stocking rate and feeding stock in a "sacrifice" paddock all improve whole farm groundcover but reduce profitability. The trade-off was least strong for stubble burning.
- The scale at which groundcover is considered is important. Farm scale averages obscure important variation between different land-uses (rotation sequence).



"So what drove you to set your system up with regard to your lambing? Was it feed?"

Katrina Durham, Murrumbidgee Regional Coordinator

"I just don't like bloody feeding sheep!"

Derek Ingold, farmer, Dirnaseer, NSW

In the grazing cereals component of the project the following key points were made:

- Most farmers grazing cereals presently under utilise the available dry matter by farming too conservatively, and can produce higher gross margins without reducing the sustainability of the system.
- Delaying flowering later into the spring through grazing is a useful risk management tool for frost risk.

Goal Attainment

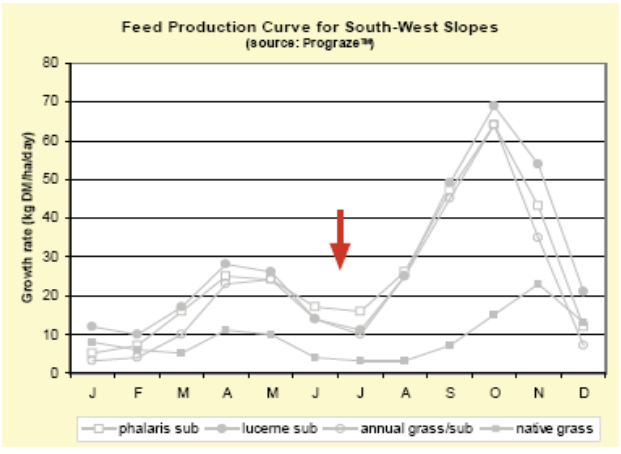
The most valued program initiatives in the Murrumbidgee region were:

- Feed supplementation
- Feed budgeting
- Communications focusing on mix farms

The most common practices adopted as a result of producers participating in Grain & Graze activities were:

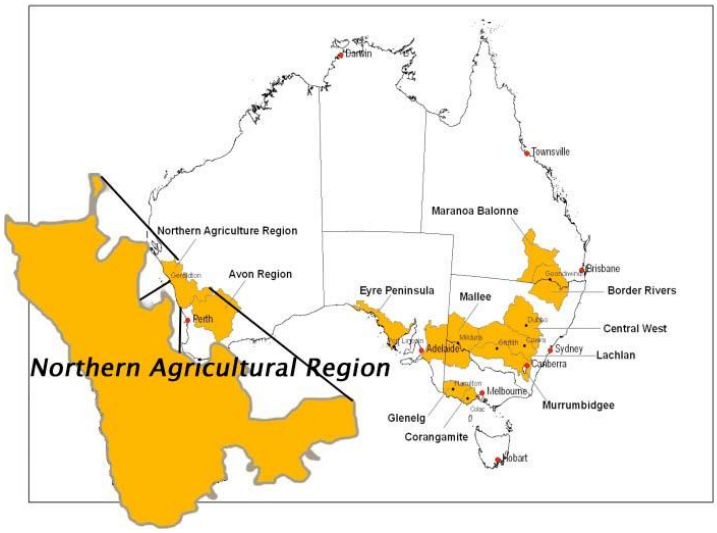
- Grazing of winter wheats
- Improved management of grazing wheats
- Increase use of fodder budgeting principles.

Indicators for Murrumbidgee	
Total number of mixed farming producers	7,173
% of producers aware of *G&G*	30
# of producers aware of *G&G*	2,152
% of producers who have participated in *G&G*	8
Total number of participants	581
% of participants who have adopted at least one *G&G* key farm practice	93
% of producers who have adopted at least one *G&G* key farm practice	77
# of producers who have adopted at least one *G&G* key farm practice	5,157
% of adopters attributing increased profitability to *G&G*	100
% of participants reporting increased NRM decision-making skills	33
% of participants who report increased confidence in making farming decisions	53



REGIONAL FINDINGS - NORTHERN AGRICULTURAL REGION

This region of WA extends from the Moore River catchment to Lake Moore in the east and the Murchison River at Kalbarri. It has a population of 72,000 with Geraldton the main service centre and an important port for grain and livestock exports.



There are just under 1,000 farms in the region. Grazing beef, cattle and sheep is the dominant farming system in the higher rainfall areas and in low rainfall areas cereal and legume production dominates.

Main Issues

The major issues in the region include soil acidity, rising groundwater levels and a steady decline of biodiversity. 2% of the region is salt affected and this is predicted to rise to as high as 20%. The region is also affected by exotic weed and pest incursions.

The major research questions in this region explored in Grain & Graze included:

- Which perennial pastures are best suited to the region and what are their likely levels of production?
- What are the best bet grazing management strategies for the major classes of livestock to improve the whole farm feed mix and profit through the use of perennials?
- How could perennial pastures be integrated into crop rotations?
- What impacts are perennial pastures likely to have on water use, salinity management, nutrient loss and soil erosion when they are incorporated into farming systems?
- What is the risk that perennial pastures could become farm and environmental weeds?
- What impacts are perennial pastures likely to have on whole farm biodiversity and health?

Major Projects

A range of specific activities were undertaken to address these questions including:

1. Perennial pasture trials
2. Grazing cereal trials
3. Demonstration farms
4. Whole farm economic analysis

	Energy (MJ)		Protein (%)	
	Low	High	Low	High
Annual	6	13	3	28
Perennial	9	11	12	25

5. Water use studies of perennial pastures
6. Studies on nutrient leaching below perennial pastures
7. Soil erosion studies in perennial pasture trials
8. Weed potential trials

Key Messages

Perennial Pastures

- Mild temperatures in winter enable sub-tropical grasses to continue growing throughout winter;
- Panic grass is the best performed species taking into account persistence and biomass production;
- Sub-tropical grasses have a long term role in the region (Buntine and Badgingarra) on deep sands which are marginal for growing crops;
- In the Buntine region sub-tropical grasses may not have a long term role taking into account their limited productivity;
- Well adopted sub-tropical grass pastures can improve the resilience of farming systems in years with difficult seasonal conditions;
- Feed quality of sub-tropical grasses is stable through the year with only small seasonal fluctuations. The feed quality is generally suitable for at least maintaining weight over the summer/autumn period;
- A rule of thumb for out of season production by sub-tropical perennial grasses has been developed:
    - 20 to 30 kgs/ha of dry matter will be produced per mm of summer rainfall (for rainfall evens > 20 mm)
- Sub-tropical perennial grasses will only partially fill the large autumn feed gap, and so other species (e.g. Tagasaste) or management practices (e.g. trading of stock) are needed.

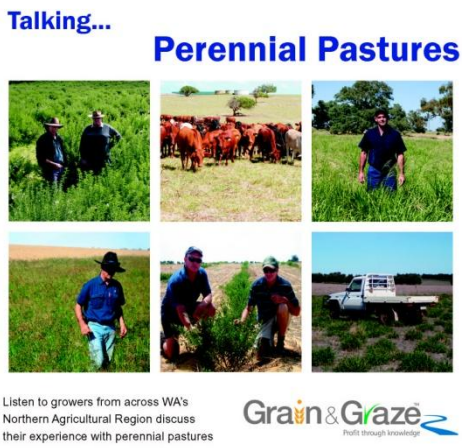
Grazing Cereals

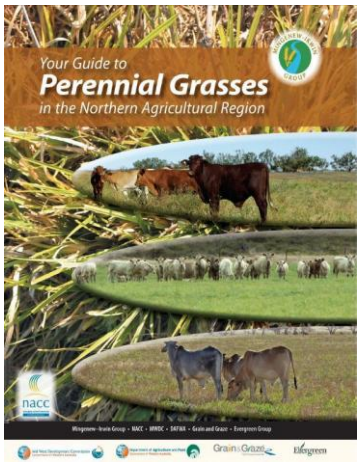
- Grazing cereals offer mixed farmers the chance to change crop/pasture mix within seasons. If pasture is in short supply, cereal can be grazed reducing the area of crop. If pasture is abundant, cereals can be taken through to harvest with nil or minimal grazing;
- The main benefit of grazing cereals is likely to be the improvement in annual pasture growth rate from the spelling they receive while the crop is being grazed;
- Grazing cereal in the region will often be more profitable than harvesting a crop on poor paddocks in low rainfall zones with the proviso that young fast growing trading stock is used.

Goal Attainment

The most valued program initiatives in the Northern Agricultural region were:

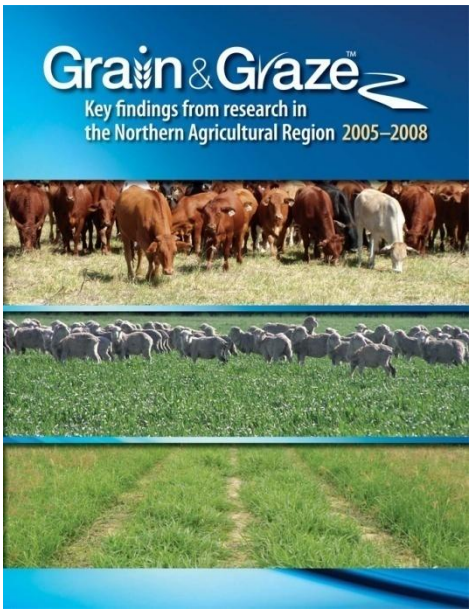
- All 18 demonstration farms
- Economic research on the profitability of demonstrated systems
- Perennial pasture trails



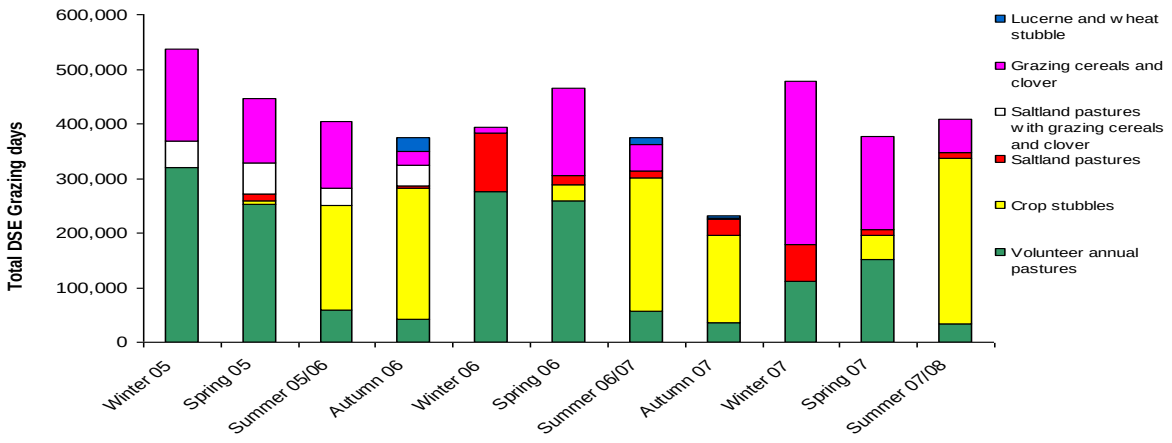


The most common practices adopted as a result of producers participating in Grain & Graze activities were:

- Sowing of sub-tropical perennial grasses
- Use of grazing cereals
- Sowing of fodder shrubs



Indicators for Northern Agricultural region	
Total number of mixed farming producers	978
% of producers aware of *G&G*	46
# of producers aware of *G&G*	450
% of producers who have participated in *G&G*	17
Total number of participants	166
% of participants who have adopted at least one *G&G* key farm practice	100
% of producers who have adopted at least one *G&G* key farm practice	107
# of producers who have adopted at least one *G&G* key farm practice	978
% of adopters attributing increased profitability to *G&G*	91
% of participants reporting increased NRM decision-making skills	42
% of participants who report increased confidence in making farming decisions	36



NATIONAL FINDINGS - SOCIAL

Decision-making on mixed farms is a complex process and many Grain & Graze stakeholders felt the need to explore the social dimensions of complex decision-making so that the implications could be taken into account to assist maximise the adoption of program results.

Project Objectives

The project objectives were to:

1. identify the factors influencing decisions to change practices and adopt different farming systems; and
2. ensure research and extension activities in Grain & Graze considered the social aspects of decision-making alongside economic and environmental factors.

Project Insights

Complex decision-making

- Recognise farmers have been making complex decisions for many years and have had a lot of experience. This experience needs to be acknowledged and advisors must accept when a decision is made it is likely to be right for them. The reason it sometimes doesn't make sense to the advisor is because the advisor isn't aware of all the variables.
- Advisors and researchers can help farmers make complex decisions by asking which parts of the decision (the complicated parts) can be clarified by a greater understanding of the interaction between variables.
- Farmers may be helped in making complex decisions, by providing a forum for "story telling". This forum could be assisted with a range of information (e.g. research results, demonstrations).
- Farmers will often delegate complicated parts of the complex decisions to advisors. For example, agronomy decisions are often made by a consultant agronomist with little input from the farmer. This allows farmers to focus on the complex decisions.

Advisor Influence

- Private sector advisors are an extremely important source of

Coordinator's Comment:

Many research programs struggle to find a place for social research for a number of reasons. Sometime it can be because a research management team will often view research issues through a biophysical lens, finding it difficult to see social research as a legitimate form of research in its own right – rather they may see it as a process of performing other forms of research, such as undertaking agronomic research using participatory methods. The choice of Nigel McGuckian, not a social researcher himself, to lead the national social research project was highly fortuitous. He was able to take the lessons from social research and apply them during the life of Grain & Graze in ways that were practical and demonstrated immediate benefit.

Now Nigel used questions to probe our ideas

And consider the options and not just the fears

To work out the strats when applied to our land

From the dream to the hope to the overall plan.

Roma Parker, Producer, Northern Ag region

advice to farmers. They are often a key mentor, sounding board, disciplinarian, researcher and confidant. The scope of their advice may often be outside their main discipline and they often hold strong personal and professional relationships with their clients.

- Most advisors would prefer to stick to their expertise but recognise the farmers need for systems advice. Some were not confident to assist with whole farm advice.
- In all regions, private agronomists had an influence over management decisions for a very large proportion of crops grown in the region. Most crops in major cropping areas are influenced by a cropping agronomist.
- Anecdotal evidence suggests advisors are biased by their professional relationship with their client. For example, advisors with sales targets are thought to "over sell" a product to achieve their targets. This is not supported by the social research of Grain & Graze. Advisors were committed to a long-term relationship with their clients and said they aimed to help their clients make profitable decisions.
- Some consultant agronomists were viewed as having a controlling relationship with their clients. This may be the case, however this is done in mutual agreement with the client and the client is delegating their decision making to the advisor because they have many decisions to make and trust the advisor.

Labour

- There is reluctance to employ labour on mixed farms due to the difficulty in finding skilled labour and the need to comply with OH&S regulations.
- Many mixed-farmers have a preference to reduce labour requirement on the farm through a choice of activities which require a low labour input. They are concerned about whether employing labour will actually leads to improved profit.
- The step to employing labour is very significant and farmers will avoid employing labour. In some cases a reluctance to employ labour will limit the scale of the business.
- Despite the reluctance to employ labour, farmers are concerned about declining rural communities.
- Skills in livestock management are becoming less available. This includes a range of livestock operations eg. Shearing, crutching, rouseabouts. There is strong competition for labour from the mining industry in some parts of Australia. This is a major challenge in promoting the benefits of programs such as Grain & Graze.

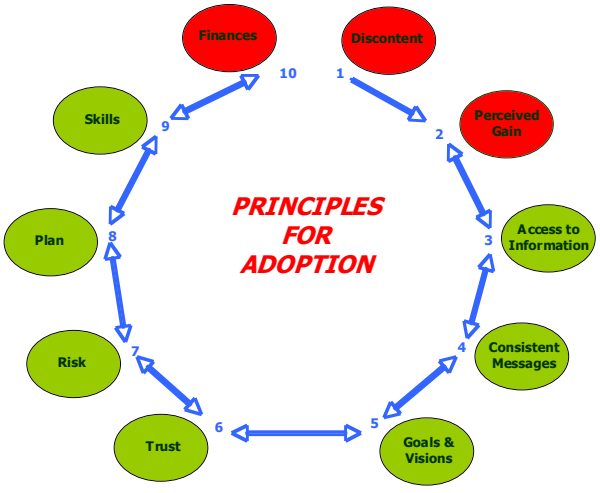
Extension

Because mixed farming decisions are complex:

- farmers will learn to make decisions or test out their ideas through story telling
- farmers will tend to rely on past experience and therefore tend to be conservative

When working with complex mixed farming decision making:

- advisors must recognise they are part of the decision making process and there will be many factors



considered by the farmer which they aren't aware of;

- research must inform the decision not recommend 'best bet' systems.
- advisers and researchers must provide or stimulate opportunities for farmers to engage in 'in depth'

discussions about their systems.

Technology

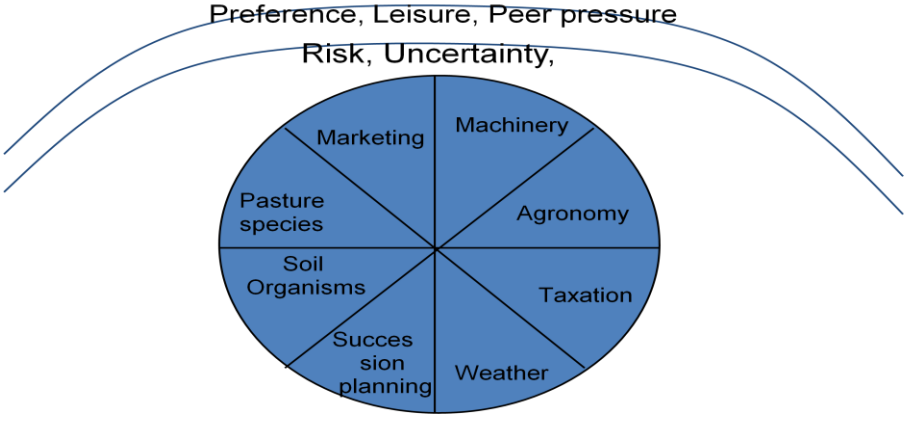
Farmers will consider any new technology in light of the wide range of other issues they must consider. New technology for mixed farming must:

- have significant financial benefits and/or reduce risk to compensate for the risk or change process.
- lead to a simpler or a more streamlined system.
- show how a whole system works or can be improved.

Integration

To effectively manage integration or 'take an integrated approach' in Grain and Graze, regions described how they did it. From this, a number of principles have been developed for discussion.

- Understand the system – Ensure the team understands the interactions, strengths, weaknesses and important elements of the system. Some regions presented their system in a series of diagrams to describe their system and the principles which make it work.
- Engage producers – Involve producers throughout all stages of research and extension. This engagement will ensure integration occurs throughout the project. Some regions have allocated resources to run a producer 'think tank' which guides R, D&E.
- Model important interactions – To understand the interaction between technologies or management changes and financial, environmental and social implications, modelling can be used. The national economics and feedbase projects provide important assistance.
- Encourage story telling – Describing how farmers integrate in their systems is an important tool to understand how integration is taking place and how technology is adopted in an integrated way. Also, enabling farmers to tell their stories to and with other farmers is a very useful activity.
- Use system experts – A range of experts within the region can be used throughout the research, development and extension process to highlight trade offs or interactions. These may be consultants, farmers, researchers, extension officers.



Components of systems are seen by farmers in the context of a broader environment of risk and uncertainty, which are themselves contextualised by farmers preferences and social environments.

NATIONAL FINDINGS - FEEDBASE MANAGEMENT

A common area for research exploration across the 9 regions of Grain & Graze related to matching the supply with demand for feed across whole enterprises. The opportunity opened to undertake research across the regional projects to derive generic principles about feedbase management and the consequences for profit, natural resources and social factors that would apply across the country.

Project Objectives

The project had the following overall research question:

How can improved feedbase utilisation and distribution contribute to reduced business risk and improve NRM outcomes?

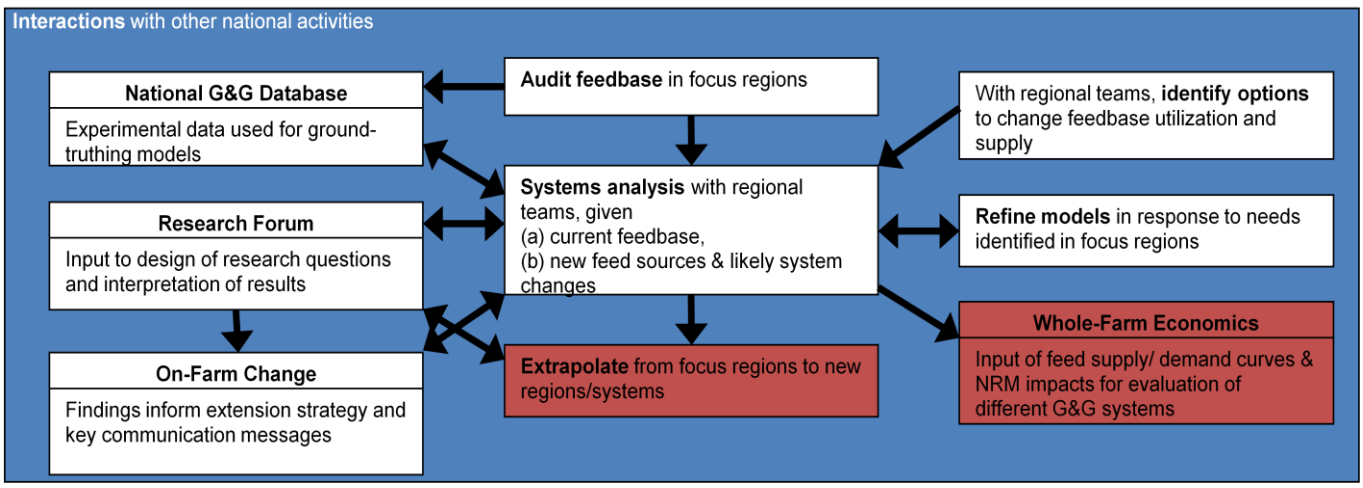
Within this context, the project had four objectives:

1. Identify and collate existing knowledge about the feedbase in Grain & Graze regions;
2. Identify regionally-specific opportunities for improving utilisation and management of the feedbase;
3. Gather targetted information to fill gaps in knowledge that relate directly to these opportunities; and
4. Use models to integrate the various sources of knowledge so as to assess the effect of management options on production risk, business risk and NRM.

Project Insights

Grazing of cereals appears to be the best new option for alleviating winter feed gaps across much of the cereal-livestock zone

- Experimental work in the Murrumbidgee and Corangamite regional projects has shown that dual-purpose cereal crops can support high growth rates in young stock.
- Economic modelling for the Avon region indicates that in the higher-rainfall parts of the Western Australian wheatbelt, this increase in livestock growth rate over that on pastures is likely to outweigh yield penalties to the grazed crops.



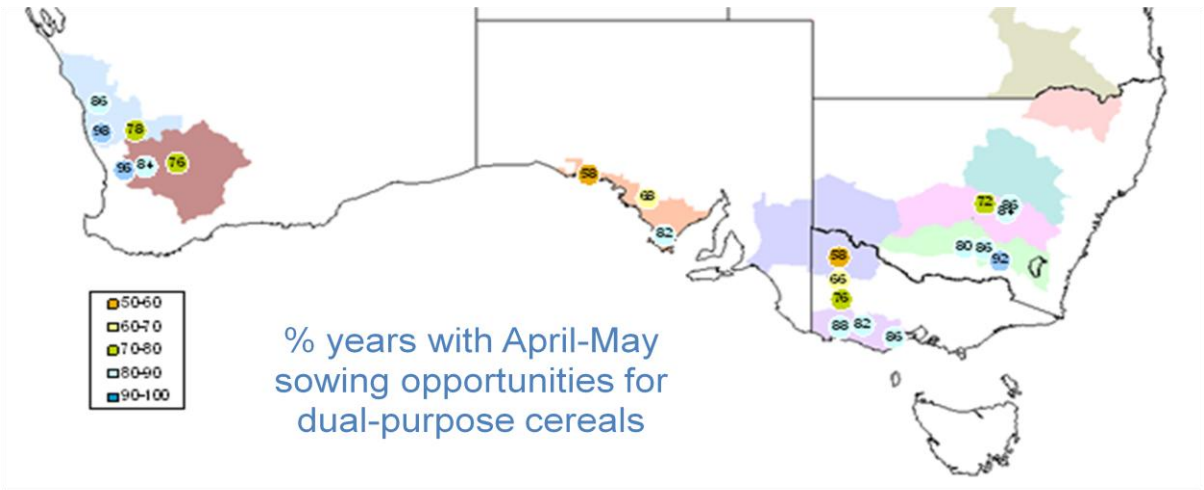
- The key benefits from grazed cereals and the tactics for exploiting them differ across the Grain & Graze regions. Forage oats can be used in the northern part of the cereal-livestock zone to replace native pastures and so reduce the month-to-month variability in green pasture supply.
- Sacrificial grazing of wheat crops will be a useful tactic more often in the drier parts of the cereal-livestock zone and on poorer soils.
- The cross-regional modelling of dual-purpose wheats concludes that in Western Australia most of the benefit results from cereal grazing permitting increased stocking rates, while in eastern Australia much of the economic return comes from shifting to higher-yielding dual-purpose varieties.

In general, options to close summer feed gaps will not be reliable, and will therefore require more flexible (and demanding) management of livestock.

- Analysis of the long-term patterns of growth to be expected from subtropical grass pastures in the Northern Agricultural region clearly showed that they should be thought of mainly as a way of extending the growing season in spring. While substantial growth during January and Februrary can be expected in some years, it cannot be relied upon.
- Summer growth by lucerne in the Avon region and lablab growth in the Border Rivers and Maranoa regions are similarly unreliable. Increasing stocking rates to exploit summer growth from these pastures will increase the year-to-year variability of returns from livestock. The study suggests that lablab pastures will extract water that can be used more profitably by the following crop.
- This unreliability of production arises directly from the variability of summer rainfall. In all these environments, too little water is stored at the end of spring to allow reliable growth of perennial pastures in the absence of rain. To make effective use of summer pasture production from perennials, therefore, livestock production systems will need to be based on trading livestock, or on careful calculations of the risks and returns involved in holding stock while waiting for summer production.

Viable ways of significantly increasing forage supply in autumn are unlikely to be found; it is better to minimize demand for feed in autumn and/or manage livestock to minimize the consequences of insufficient autumn feed.

- This conclusion is drawn from negative evidence: across the Grain & Graze program, the only intervention that aims to increase forage supply in autumn is the use of old man saltbush as a perennial forage in the Central West-Lachlan region.
- If this view is correct, it follows that the best management strategy in regions with significant feed gaps in autumn is to manage livestock to endure the gap, by seeking to ensure that they enter autumn in good body condition and by managing livestock numbers and



reproductive cycles to minimize feed demand at this time of year.

There is greater opportunity to modify the supply of livestock feed in wetter regions than in drier ones.

- In general, the positive effects of a range of feedbase management interventions on productivity were larger and the negative effects smaller at the higher rainfall gradients. This was especially the case where lagged effects of water use were apparent. Tactical sacrificial grazing was an exception to this general result.

Once a shift to minimum tillage has taken place, burning policy is likely to be the most cost-effective method of managing ground cover – but long-term average ground cover is difficult to modify. Averaging ground cover over farm or larger scales obscures important spatial and temporal variation between land uses.

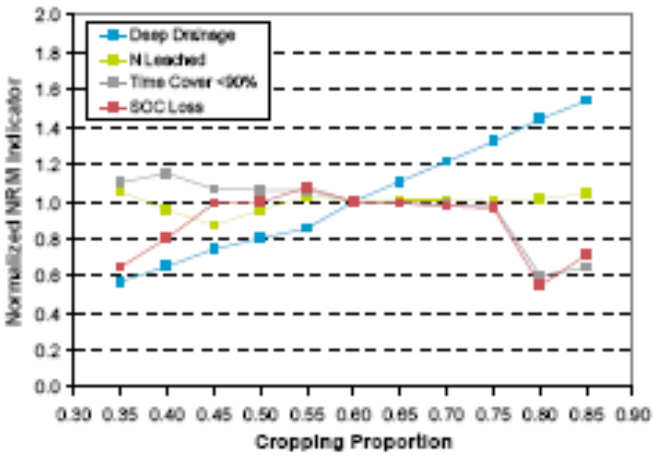
- When measured at the scale of the whole farm, periods of low ground cover were concentrated into times of drought, and these drought periods had low cover regardless of the stocking rate or whether stubbles were burnt. A long-term average value of 90% ground cover at the farm scale was achievable, but always having ground cover above 90% was not.
- Avoiding the burning of stubbles was easily the most cost-effective means of increasing long-term average ground cover, but in the autumn following high-yield cropping years this is likely to be impractical.
- Averaging ground cover over farm or larger scales obscures important spatial and temporal variation between land uses. Monitoring of ground cover therefore needs to focus on specific times and situations where erosion risk is enhanced.

Different natural resources will respond differently to shifts in land use on mixed farms. NRM is therefore a fundamentally multi-dimensional concept; tradeoffs between different NRM outcomes are likely to be the norm.

- A study on four NRM indicators for a farm in the Murrumbidgee region shows the farm has its own individual pattern of change as the area under cropping is altered. In particular, pure lucerne pastures will reduce deep drainage over the long term, but will also increase bare ground (and hence soil erosion risks).
- Managers of mixed farms, and of catchment management organisations, will therefore have to trade off between different NRM outcomes. Some of these tradeoffs will be profit-enhancing; others will come at a cost.

Changes to the pattern of feed supply can be expected to have significant lag effects on water availability to crops, especially when perennial forages are involved.

- This principle emerges from simulation analyses in both winter-dominant and summer-dominant rainfall regions.



This study reinforces messages from programs such as the National Dryland Salinity Program. That is, while some practices may have positive benefits in respect of specific NRM indicators, they may simultaneously have negative impacts against other indicators

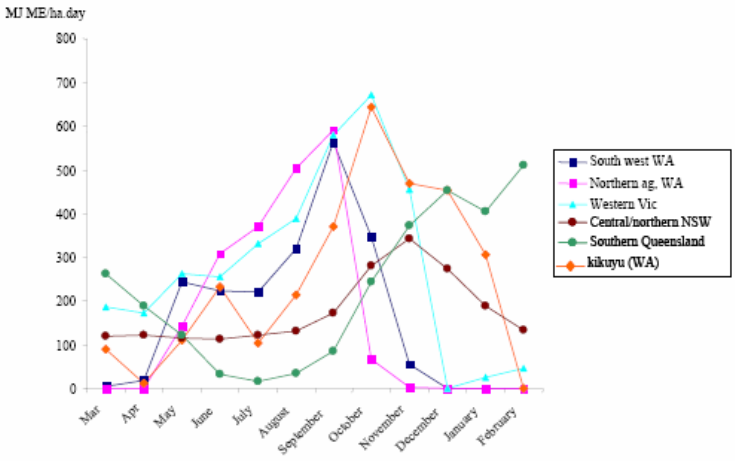
- Results show that introducing lucerne into cropping rotations in the Corangamite region will result in yield penalties for up to four years due to the drier soil profile at the end of the lucerne phase. Similarly, a lablab-wheat rotation in the Border Rivers and Maranoa-Balonne regions can be more water-use-efficient than a fallow-wheat rotation in terms of biomass grown, but water use by the lablab over summer is likely to substantially increase the risk of subsequent winter crop failure, with the result that the economic efficiency of water use is lower.
- Mixed farmers are therefore faced with a complicated temporal resource allocation problem each growing season, especially when considering special-purpose pastures or forage crops: should they use stored soil water (especially deep water) immediately, before it is pushed below the rooting zone as drainage by further rainfall events, or is there a more profitable use for the stored water in the next phase of the rotation? The answer will be highly context- and price-specific.

Changing the feed supply can also be expected to have lag effects on supply from other parts of the farm, and hence on subsequent animal production

- Effective deferment of grazing on the main pasture paddocks during the grazing of cereals results in higher pasture yields – and hence intakes – in the post-grazing period.

More efficient use of the feedbase generally comes at a cost in risk and/or management complexity and costs. The Grain & Graze goals of better feedbase management and "easy sheep" can therefore come into conflict.

- The alternative sources of feed supply under consideration in Grain & Graze are all intended to form only a relatively small proportion of the total forage resource. Using them will therefore increase the diversity of plant types that must be managed on a farm, and some of them (especially lucerne and forage cereals) must be grazed carefully if they are to yield well in the longer term. Many of these options will result in lagged impacts through the water balance.
- Overall potential profit gains from introduction of new elements to the feedbase will sometimes also result in larger livestock numbers on the farm with consequent demands on labour. With shortages of labour in many areas of the mixed crop-livestock zone this imposes a limit on the achievability of profit gains.
- When considering alterations to the feedbase, the marginal value of an hour of the manager's time and attention must be taken into account as well as the marginal value of a kilogram of extra feed. Diversifying the feedbase and simplifying the livestock enterprise can be economically incompatible goals.



Generalised pasture supply curves, expressed as MJ metabolizable energy (ME)/ha.day for five regions across Australia.

NATIONAL FINDINGS - ECONOMICS

While social factors are major considerations in the adoption of new farming systems, profitability remains a leading driver for change. Not many of the Grain & Graze regional projects included an economic component and show there was a need to address this important issue generically.

Project Objectives

The National Economics Project was established to provide information to help address the question:

What is the relationship between resilience of farming businesses and enterprise mix in different regions?

The three key objectives were:

1. To develop and implement a work-plan of research activity aimed at addressing the research question.
2. To become familiar with research activities in each of the Grain & Graze regions that have a bearing on the research question, and identify opportunities to add value to the regional research effort or to use regional data in the national project.
3. To establish a close working relationship with the other national research teams, establishing how and when data, information and advice can be exchanged between the projects as a means of maximising the potential for each to contribute towards achieving the Grain & Graze goal.

Project Insights

There is no unique relationship between enterprise mix and sustainability. Trends in individual indicators were not consistent as the enterprise mix changed. Significant changes to resource condition are likely to require a concentration of effort on key natural assets.

- This insight emerged from work in collaboration with the feedbase project and is outlined under the feedbase 'insights' section.
- It is apparent that changing enterprise mix is not the most

"Advisors were committed to a long-term relationship with their clients and said they aimed to help their clients make profitable decisions."

Nigel McGuckian, G&G Social researcher

effective means of altering the condition of natural resources.

The notion of a feed gap is fundamentally and economic problem rather than a production problem. The means to fill the feed gap already exists (supplementary feeding) however the production benefits do not justify the expenditure. Production focussed R&D need to be cognisant of the costs and potential trade-off of feed gap strategies

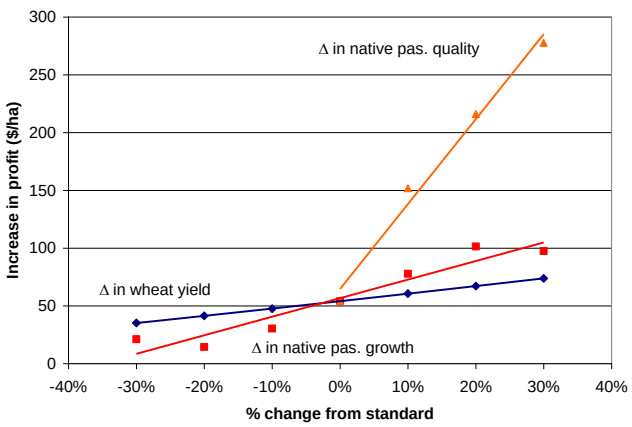
- The feed gap that occurs in most livestock production systems in agricultural region of Australia is a result of the difference between the cost effective supply of energy and the demand by livestock. There are a range of strategies that can be adopted to reduce the shortfall.
- The approach available to almost every mixed farming business is to feed supplementary grain. Whilst this is widely practiced, completely "filling" the feed gap is not an economic proposition due to the high cost of feed, the demand on labour at this time of the year when there are many competing labour demands, and the adverse economic impact of overgrazing in poor seasons. These high costs outweigh the production benefits of running high stocking rates and/or maintaining liveweight of stock throughout the year.
- In any new strategy or innovation there will almost always be costs (trade-offs) associated adoption. These trade-offs are important considerations when assessing the potential of the alternatives.

Grazing wheat is profitable under a range of production and economic conditions in a number of different environments. A number of factors can influence the profitability of grazing wheat, major factor being the yield loss after grazing.

- Grazing cereal was shown to be profitable in three of the four regions for which analyses were undertaken. A number of factors were shown to influence the extent to which profit is increased. These factors differed between regions.
- Of critical importance is the reduction in grain yield after grazing. Higher yield penalties require greater benefits to livestock to maintain the profitability of the system. In some regions this can only be achieved through increased stocking rates and increased supplementary feeding. Increases in production intensity may be limited by the availability of labour. The focus of management should therefore be to limit the potential for yield penalties, although this is likely to be less important in poorer years when grain yields are low.

Profitability of pasture depends on quality. Reductions in pasture quality, such as through poor grazing management, may render some perennial species (eg active grasses) unprofitable. Maintaining quality of feed need not be an important focus for management.

- The analysis of pasture cropping emphasised the influence of pasture quality on farm profit. This result is supported by a number of other analyses which show pasture quality has a major influence on the



Affect of pasture quality, wheat yield and production levels on the benefits of pasture cropping

benefits of new pastures species. Pasture quality, in relative terms, has a much greater influence on profit than production.

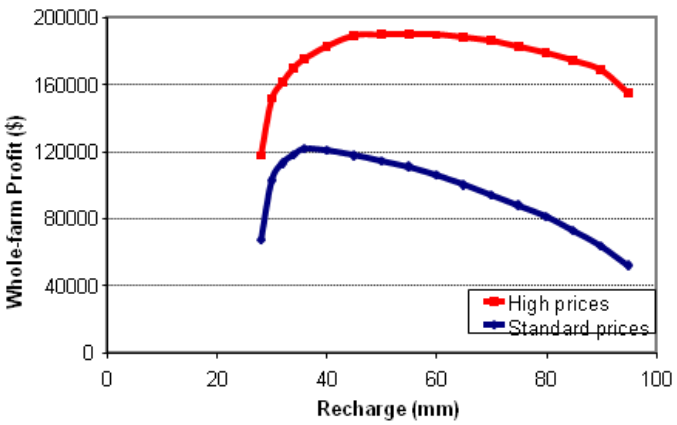
- This has important implications for the management of pasture generally, particularly perennial species. Deferment of pasture for extended period will eventually lead to a decline in pasture quality, thereby reducing the benefits to livestock.
- In the case of C4 grasses in the Central West of NSW any reduction in quality below that assumed in the analysis would lead to a reduction in farm profit. Successful integration of these pastures into the farming system will depend on good management which may increase the demand for labour input. The capacity of farmers to benefit from them will therefore depend on their ability to increase effort in this component of the system.

Labour scarcity may limit the capacity of farmers to intensify production, which may be necessary to capitalise on the opportunities presented by perennial pasture and grazing cereals

- Labour scarcity was shown to have a significant impact on the profitability of perennial pasture species. This occurred because of the high labour requirement of livestock, and that, in most cases, the benefits of perennial species depend on increasing the intensity of livestock production.
- This could be of added importance given the viability of perennial pasture may depend on maintaining pasture quality at a high level. Therefore, the shortage of labour in the agricultural sector may dampen the adoption rate of perennial pastures or other innovations that require more intensive management.

Reducing production risk is not a major influence of farmers' decision making. Empirical evidence suggests that farmers are generally unwilling to make production decisions that reduce the variability in income at the cost of reduced income

- Reducing the variability of income is not a primary factor in farmers' decision making. Indeed farmers are reluctant to trade-off farm income to reduce variability. Furthermore many of the innovations that have been adopted by farmers over the past few decades have led to an increase in variability of farm income. An example of such an innovation is the use of herbicides, which have been shown to increase risk in some cases.
- Whilst many analyses have shown that the variability in income is higher for crop dominant enterprises, these analyses often do not account for the tactical adjustments farmers can make in response to seasonal conditions, which can reduce the down side risk of production. A survey of a group of farmers in the Mallee region revealed that crop dominant enterprises could be more profitable than pasture dominant enterprise in poor years. So while the production risk of crop dominant enterprise may be higher it is possible for such businesses to be better off under a range of seasonal conditions.



"Changing the enterprise mix to achieve NRM targets was a costly means of achieving sustainability goals."

Andrew Bathgate, G&G economist

- This does not imply that variability in production is unimportant, but rather that the response of farmers is influenced more by the profitability of a strategy rather than its impact on income variability.

The capacity of farmers to respond to seasonal conditions through tactical adjustments to farm strategy has a major influence on farm profit

- Response of farmers to seasonal variability is focussed on making the most of the changed conditions through tactical adjustment to management strategies. A large proportion of profit in the long term is made in a small proportion of seasons that are highly productive.
- Farmers need to make the most of good seasons by adjusting crop and pasture area in response to soil moisture levels, the timing of the season start and expected commodity prices. Stocking rates and grain feeding also need to be adjusted accordingly. Whilst this may be considered by some practitioners as risk management, the farmers are not focussed on reducing risk (variability) but more on playing the season to increase profit.

NATIONAL FINDINGS - BIODIVERSITY

The partners of Grain & Graze were keen to explore biodiversity as a specific natural resource management issue associated with mixed farming. This project provided an opportunity to investigate biodiversity under four different management regimes across 47 farms in nine regions.

This project was awarded a Banksia Environmental Award under the 2008 Land & Biodiversity category.

Project Objectives

This project intended to answer four questions:

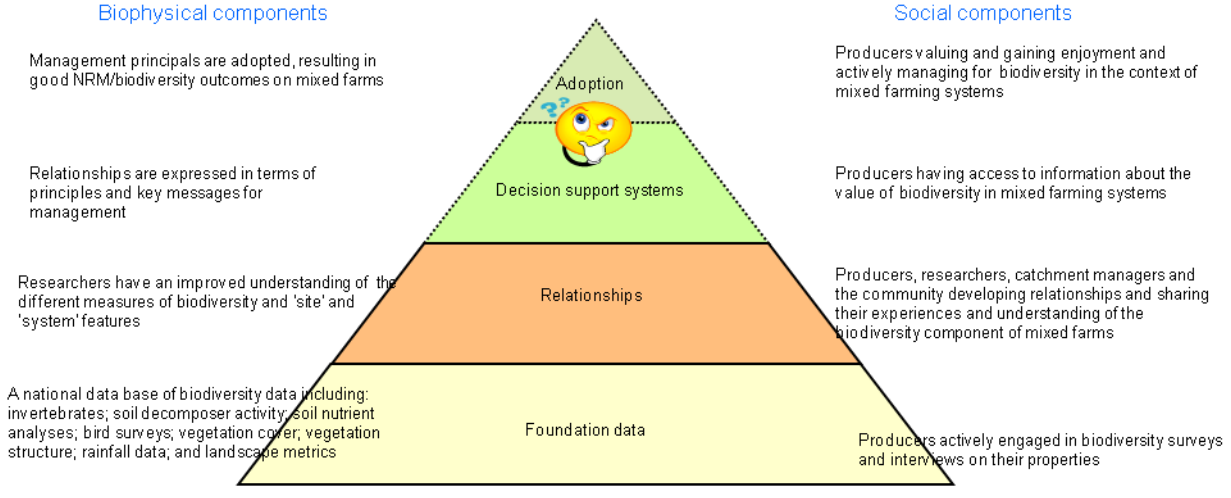
1. is there a relationship between farm scale measures of biodiversity and agricultural production?
2. does the type and intensity of agricultural management influence native biodiversity on farms?
3. which is more important : site (landscape context) or system (land management) factors on biodiversity?
4. how can landholders with mixed farming operations manage for profit and deliver the biodiversity improvements required by regional biodiversity goals and targets?

Project Insights

What mixed farming can do for biodiversity.

Birds

- Remnant vegetation on mixed farms provides important habitat for birds. In this first national bird survey carried out specifically on mixed crop and livestock farms, a total of 181 bird species were recorded on the 47 farms. Thirty three of these were priority or threatened species and 23 were recognised as nationally declining species.
- The number of species recorded on a farm was positively correlated with the proportion of remnant vegetation on a farm and the condition of vegetation as measured by its structural complexity (the number of vegetation layers). The



significance of vegetation condition for bird species diversity reinforces the importance of managing those forms of disturbance that reduce vegetation complexity, such as grazing and fertiliser application.

Beetles

- Mixed farms provide habitat for a great diversity of beetles, with 504 different taxa identified to the level of genus or species including several rare weevils not seen for decades. Similar numbers of species found on all land use types indicated the extent to which beetles have adapted to farming landscapes.
- Functional groups of beetles vary with land use type, reflecting variability between regions and land management practices.
- Carabid beetles may be useful indicators of environmental stress as their body size and relative mobility differs between disturbed (farmed) and relatively undisturbed (remnant) land use classes.

Ants

- Over 850 different ant taxa were found, with a clear distinction between eastern and western Australia in term of habitat preference. Little difference was observed between the number of ant species in each land use type in Western Australia and South Australia compared to the eastern states.
- In the east, ant species richness closely followed the level of disturbance, with most found in remnant vegetation, least in crop, and intermediate numbers in pasture and rotation. The dominance of particular functional groups varies between regions and land use types.

Spiders

- Three hundred and thirty species of spider were found. Most were ground-dwelling spiders, common in two-dimensional habitats. They were found to respond to the mix of land uses on a farm, with higher numbers of individuals found on farms with a higher proportion of land under crop and rotation.
- However, the higher the crop yield (wheat t/ha), the fewer numbers of different species recorded.

What biodiversity can do for mixed farming

Birds

- Sixty four percent of the bird species observed were known to eat insects, suggesting that further study might help to identify which birds species are predators of particular crop and pasture pests, providing production benefits (ecosystem service).

Beetles

- The data from this study suggests there is potential to develop a national IPM program on mixed farms on the basis that predatory beetles were found to occur in every region surveyed.

Ants

- In water limiting environments typical of Australia's mixed farming zone, ants and termites are known to play an important role in soil

aeration and nutrient cycling, the equivalent role that earthworms play in more humid environments.

- The high diversity of ant species found and their preference for least disturbed areas suggests their role as ecosystem engineers could be enhanced through a better understanding of the interactions between ants, tillage practices, fertilizer use and pesticides.

Spiders

- The relationships between land use types and crop yield suggest spiders are preferentially targeting crop pests. Further study is needed to confirm this tentative observation and identify particular predator pest relations that could be fostered through the adoption of IPM.

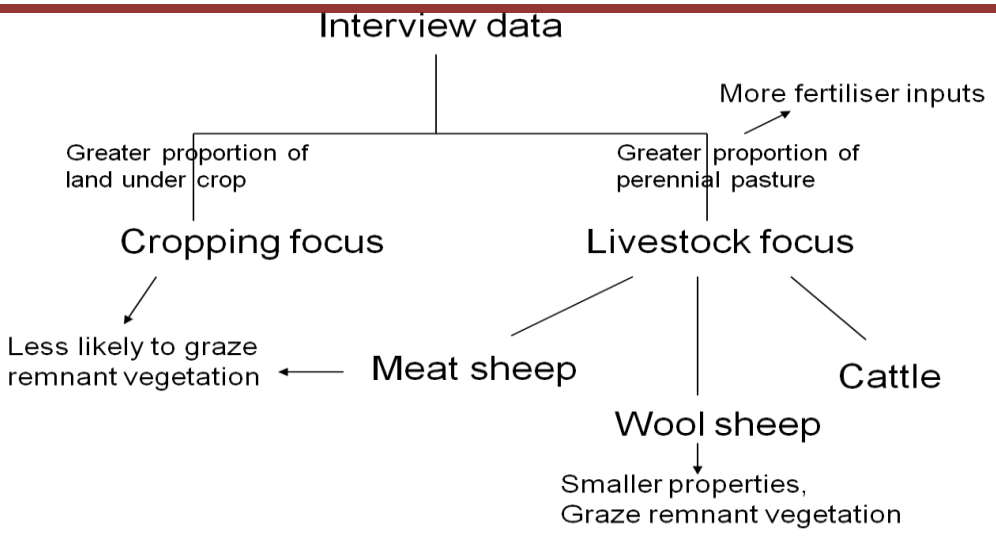
Management that benefits biodiversity and mixed farming.

Adoption of the guidelines below should provide enhanced biodiversity and long-term production benefits through the protection of beneficial predators (birds, invertebrates) and healthy soils (microbial diversity):

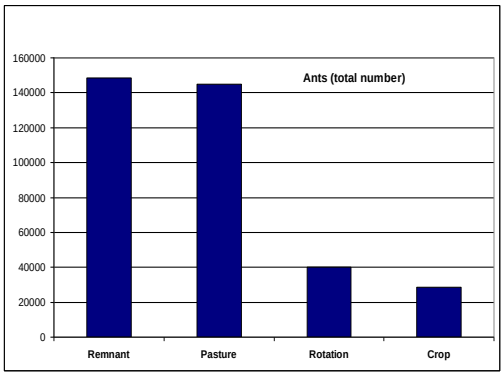
- Careful management of existing remnant vegetation to enhance structural complexity (i.e. number of vegetation layers; trees, shrubs, ground cover including litter) will provide more habitats for a range of plants and animals.
- Maintaining ground cover, particularly with perennial species, will increase biodiversity.
- Decreasing soil disturbance across land use types will maintain habitat for ground-dwelling species such as spiders, beetles and ants.
- Reduction of chemical inputs across the farm will increase biodiversity.

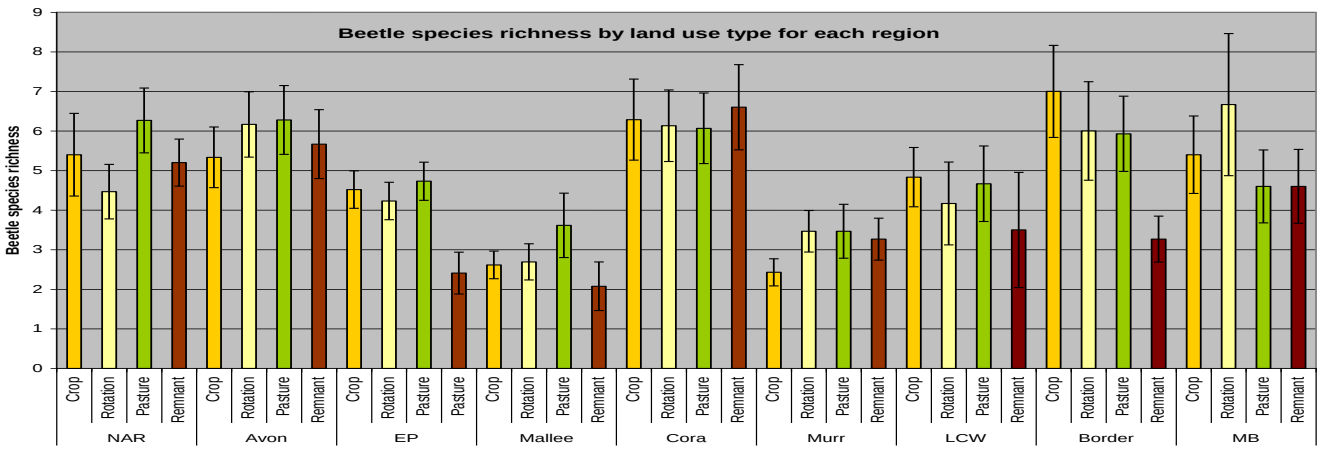
Grain & Graze biodiversity research has important implications for policy makers.

- Biodiversity does not start and end in national parks and reserves Considerable biodiversity exists on agricultural land and is affected by the management decisions and farming practices of farmers. This suggests that biodiversity considerations should be an important factor in the development of agricultural policy as well as environmental policy.
- Biodiversity does not start and end in the remnant vegetation patches on farms. Biodiversity in the agricultural components of farms can be significant as well as beneficial. It can vary from land-use to land-use, and so in mixed farms it is important that biodiversity across the entire farm be considered in farm planning and in the extension messages of agricultural, NRM and catchment management field staff. This on-ground action can be enhanced by recognition of the value of biodiversity in agricultural production at higher policy levels.
- Although biodiversity can be significant in the agricultural component of farms, it remains most significant, and possibly most vulnerable, in remnant vegetation. This reinforces the need for policies that provide targeted and ecologically-based incentives for the effective protection of remnant vegetation and rewards for practices that go beyond duty of care.



- Understanding of what constitutes native and remnant vegetation and 'good condition' varies markedly across Australia and suggests the need for closer links between catchment-based organisations and industry extension programs to improve the capacity of farmers to more accurately read their farming landscapes.
- Large biodiversity gains can be made by making changes to existing land management practices: improving the condition (structure) of vegetation across all land use types (including the retention of regeneration of paddock trees); minimising soil disturbance; reducing reliance on chemical inputs. Regional biodiversity planning at a landscape level will help to maximise public good investments into on-farm actions supporting biodiversity.
- Remnant vegetation covers an extremely small proportion of the landscape in some regions. In addition, patches of remnant vegetation on twenty of the 47 farms are less than the recommended 5 ha considered necessary for their on-going survival. It is possible that at an extinction debt exists at a landscape scale. These results suggest that the long term functionality of ecosystems within regions is unclear. While it is easier to retain existing patches of native vegetation, revegetation is an important land management action to redress the functional imbalance across the landscape.





PROGRAM LEGACY
- NATIONAL DATABASE

At the commencement of Grain & Graze it was known that the data sets to be collected at both regional and national levels would be substantial and that the data would provide an excellent basis for cross regional studies as well as farming system studies extending well beyond the life of the Program. This project commenced 2 years following the start of Grain & Graze and so was challenged by the lack of contractual obligations to provide data to the database team.

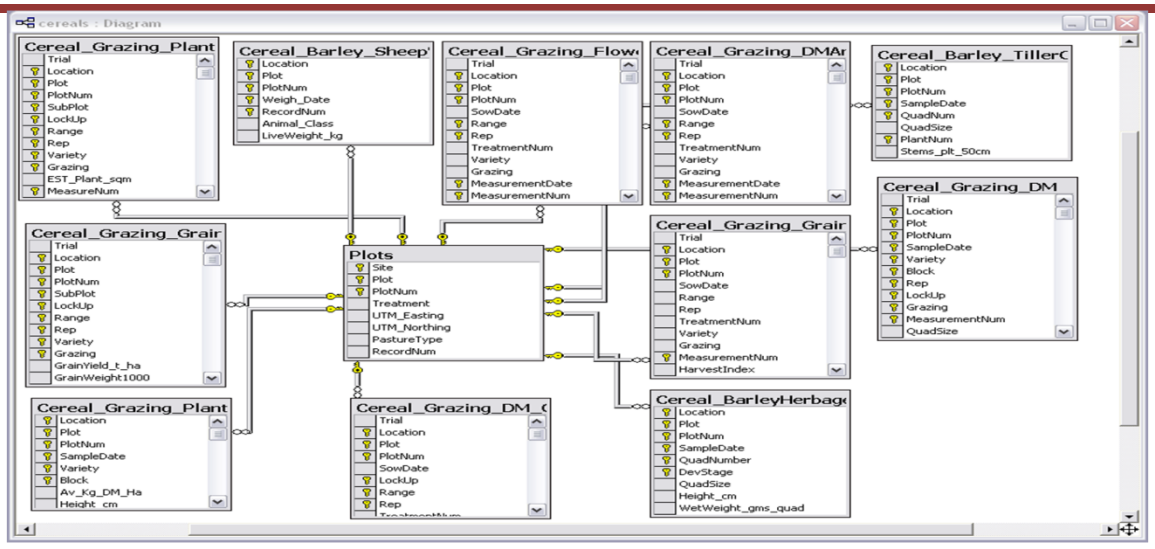
Project Objectives

The objectives of the project were to:

1. develop a database which would enable the capture, storage and access of Grain & Graze project data; and
2. enable monitoring and evaluation data from Grain & Graze to be accessible via the Grain & Graze website.

Project Outputs

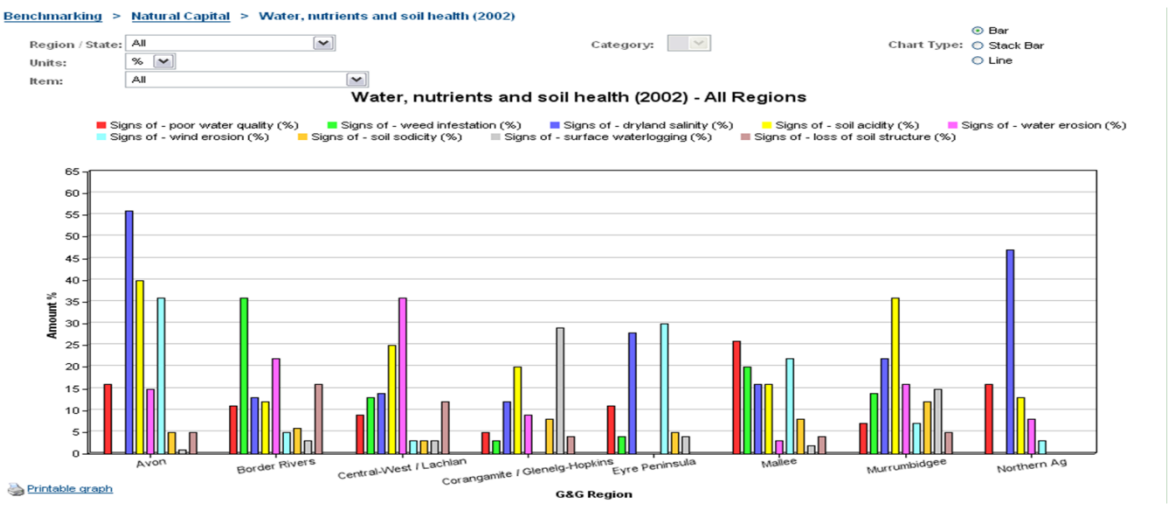
- As at June 2008, the Grain and Graze National Database contained 83 distinct dataset tables and 93 queries. While this amounts to a considerable dataset, it is only a relatively small proportion of the total amount of data collected during the program across the various regions.
- The dataset contains a range of data from various regions and on different areas of focus. The bulk of the data submitted consists of data from various pasture and cereal trials.
- The flexible graphing interface developed for the database enables users to interrogate multiple dimensions of each dataset including all possible combinations of X and Y axis and choice of Series.
- The monitoring and evaluation data accessible over the Grain & Graze website interface cover 2005-06 and 2007-08.



Relationship between the 83 tables of data

Population of the Grain & Graze National Database

Data from regions	Purpose	Table name	Number of data rows
All Regions	Biodiversity	Bio_Birds	768
All Regions	Biodiversity	Bio_Fungi	192
All Regions	Biodiversity	Bio_Invertebrates	576
All Regions	Biodiversity	Bio_SoilCottonStripTest	768
All Regions	Biodiversity	Bio_SoilTest	192
All Regions	Biodiversity	Bio_Vegetation	768
All Regions	Pastures	PlantSpecies	81
All Regions	Plots	Plots	481
All Regions	Regions	Regions	9
All Regions	Sites	Sites	75
Avon	Herbage	Avon_FeedOnOffer	941
Avon	Herbage	Avon_FeedOnOffer_Eqn	16
Avon, Eyre Peninsula	Sheep	SheepInfo	951
Avon, Eyre Peninsula	Sheep	SheepWeights	5583
Avon, Murrumbidgee	Grazing cereals	Biomass	1496
Border Rivers	Crop management	McMaster_tmp_CropRecs	64
Border Rivers	Fertilizer records	McMaster_tmp_FertRecs	100
Border Rivers	M & E forms	ActivityCode	12
Border Rivers	M & E forms	ActivityForm	9
Border Rivers	M & E forms	ActivityLocation	6
Border Rivers	M & E forms	ActivityOrg	6
Border Rivers	M & E forms	ActivityThemes	5
Border Rivers	Pastures	SpeciesTrial_FlowerPct	90
Border Rivers	Pastures	SpeciesTrial_PlantCounts	180
Border Rivers	Pastures	SpeciesTrial_Yield	360
Border Rivers	Soil	Soil_EM38	18
Border Rivers	Soil	SoilMoisture_Compaction	36
Border Rivers	Soil compaction	Pasture_Compaction	18
Border Rivers	Stock moves	McMaster_tmp_MobMoves	295
Central West	Botanical composition	BotanalData	376
Central West	Experiments	Experiments	78
Central West	Soil	SoilTestResults	153
Central West	Soil	SoilTestResults-Additional	90
Central West, Border Rivers	Botanical composition	BotanalQuadSpecies	1846
Central West, Border Rivers	Botanical composition	BotanalSpecies	906
Corangamite	Grazing cereals	Cereal_Barley_SheepWeights	290
Corangamite	Grazing cereals	Cereal_Barley_TillerCounts	124
Corangamite	Grazing cereals	Cereal_BarleyHerbage	20
Corangamite	Grazing cereals	Cereal_Grazing_PlantAnalysis	35
Corangamite, Murrumbidgee	Grazing cereals	Cereal_Grazing_DM	924
Eyre Peninsula	Economic indicators	Ec_BankRequestedIndicators	26
Eyre Peninsula	Economic indicators	Ec_CropCostOfProdIndicators	26
Eyre Peninsula	Economic indicators	Ec_EnterpriseRatios	26
Eyre Peninsula	Economic indicators	Ec_FarmAreas	26
Eyre Peninsula	Economic indicators	Ec_FarmFinancialIndicators	26
Eyre Peninsula	Economic indicators	Ec_GrainPrices	26
Eyre Peninsula	Economic indicators	Ec_GrainProdIndicators	26



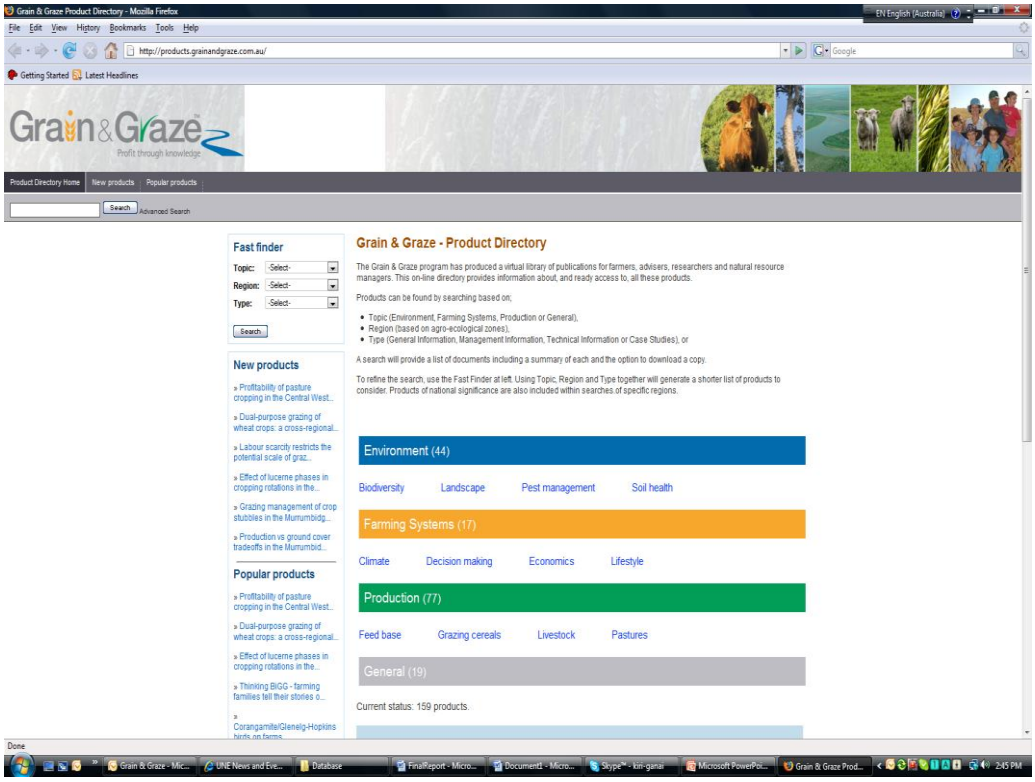
Eyre Peninsula	Economic indicators	Ec_GrainYields	26
Eyre Peninsula	Economic indicators	Ec_LivestockCostOfProdIndicators	25
Eyre Peninsula	Economic indicators	Ec_LivestockProduction	26
Eyre Peninsula	Economic indicators	Ec_RiskManagementIndicators	26
Mallee	Grazing cereals	Walpeup_Forage_DM	108
Mallee	Grazing cereals	Walpeup_Forage_GrainYield	15
Mallee	Grazing cereals	Walpeup_Forage_Plants	36
Mallee	Grazing cereals	WalpeupTrial_Yield07	24
Mallee	Pastures	WalpeupTrial_botanal	84
Mallee	Pastures	WalpeupTrial_Pastures05	72
Mallee	Pastures	WalpeupTrial_Pastures06	22
Mallee	Sheep	WalpeupTrial_Sheep05	72
Mallee	Sheep	WalpeupTrial_Sheep06	216
Murrumbidgee	Grazing cereals	Biomass_Anthesis	40
Murrumbidgee	Grazing cereals	Biomass_Cages	158
Murrumbidgee	Grazing cereals	Biomass_FlowerPct	111
Murrumbidgee	Grazing cereals	Biomass_GrainQuality	91
Murrumbidgee	Grazing cereals	Biomass_Quality	8
Murrumbidgee	Grazing cereals	Biomass_Quality_Grazing	6
Murrumbidgee	Grazing cereals	Biomass_SheepBloodAnalysis	23
Murrumbidgee	Grazing cereals	Biomass_SheepWeights	451
Murrumbidgee	Grazing cereals	Biomass_StockRates_GM_Wall	12
Murrumbidgee	Grazing cereals	Biomass_Supp	179
Murrumbidgee	Grazing cereals	Cereal_Grazing_DM_Quality	22
Murrumbidgee	Grazing cereals	Cereal_Grazing_DMAnthesis	128
Murrumbidgee	Grazing cereals	Cereal_Grazing_Flowerpct	124
Murrumbidgee	Grazing cereals	Cereal_Grazing_GrainQuality	156
Murrumbidgee	Grazing cereals	Cereal_Grazing_GrainQuality_Plot	120
Murrumbidgee	Grazing cereals	Cereal_Grazing_PlantEST	316
Murrumbidgee	Pastures	Pasture_Species_Biomass	115
Murrumbidgee	Pastures	Pasture_Species_BiomassQuality	28
Murrumbidgee	Pastures	Pasture_Species_PlantEST	376
Murrumbidgee	Rainfall	MonthlyRainfall	70
Murrumbidgee	Treatments	Trial_Treatment	11

Jim Scott ever present in the background (with Ian Johnston and Bob White). The Grain & Graze database had its background in the Sustainable Grazing Systems modelling and database projects.

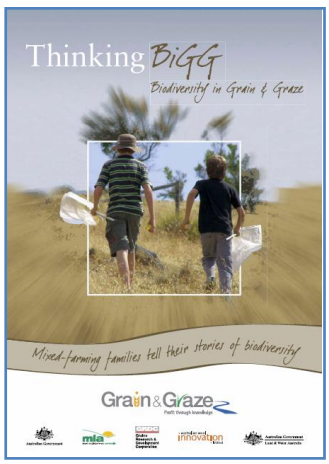
PROGRAM LEGACY - PRODUCTS

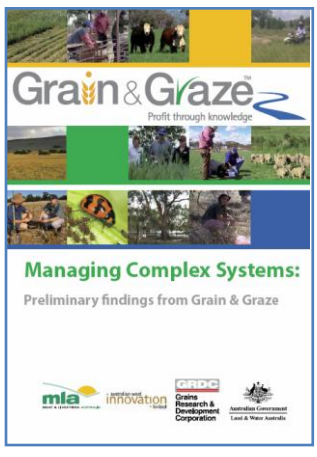
Communication activities and product development played a vital part of the success of Grain & Graze. Over the five year duration of the program, approximately 200 tools, books, manuals, guides, factsheets and other materials relevant to mixed farming decision-making were generated. These are all accessible via the program's product database, accessed by the website: www.grainandgraze.com.au.

or resource management issue. At the program level, all results of the program known to December 2007 were encapsulated in the keystone document, *Managing Complex Systems: Interim findings of . Grain & Graze.* The National Coordinator's Program report complements this document by updating the key program insights to June 2008.



Appendix 1 provides a full list of the products. These range from generic regional products to specific production





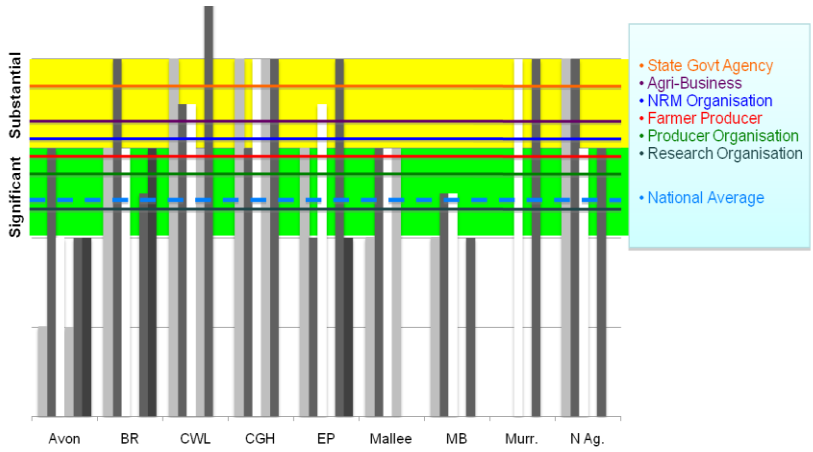
PART THREE: OUTCOMES

PROGRAM EVALUATION

A final evaluation of Grain & Graze was undertaken during the final year (2007/8) of the Program to measure the processes of on-going change. It was based on five Key Evaluation Questions:

1. Was the Grain & Graze Program successful at national and individual regional levels in meeting the key stakeholder needs?
2. Has the Grain & Graze Program achieved the national and regional triple-bottom-line (TBL) goals, objectives and targets?
3. To what extent has the Grain & Graze Program achieved sustained practice change by producers, researchers and research managers?
4. What has been the return to investment in the Grain & Graze Program?
5. How effective has the design, management and administration of the Grain & Graze Program been?

Extent to which stakeholder needs were met



Meeting Stakeholder Needs

The needs of all key stakeholders, including investing organisations and regional partners, were adequately although not completely met.

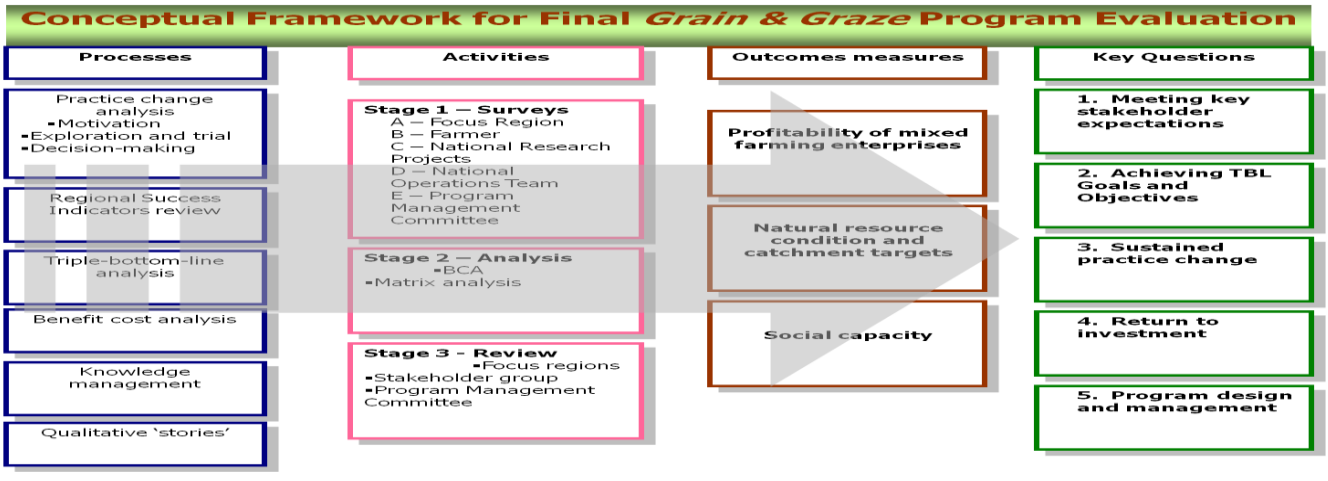
Individual Research and Development Corporations (RDC's) indicated moderate satisfaction that their expectations of achieving targeted outcomes have been met based on recorded information at the time of the Final Evaluation. It is noted that further and ongoing targeted benefits are likely to accrue to the Program in time to come and this will potentially enhance the satisfaction level of these core partners.

Collectively, the RDC's recognise a higher level of achievement through unintended outcomes. These include enhanced partnership arrangements, a developed platform for co-investment and collaborative initiatives, and a share-values culture that is appropriate to efficient development of systems-based management for sustainable mixed enterprise farming.

There is considerable variation in the extent to which regional stakeholder needs have been met. Some were not well satisfied but others were surprised as to how well their needs have been met (e.g. farm consultants).

Regions generally identify the short amount of time to deliver the Program and the prolonged drought as key factors that limited achievement of outcomes meeting stakeholder needs.

Grain & Graze was a large, complex Program developed to meet a wide range of stakeholder expectations. A few large successes, intentional or not, may rationalise the Program in the face of many identified deficiencies. The G& program achieved sufficient large



successes in practice adoption, partnership development and capacity-building to have adequately met key stakeholder expectations at both national and regional levels of the Program.

Triple-Bottom-Line assessment

The evaluation found that 100% of the awareness target, 28% of the participation target and 26% of the adoption target had been achieved during the period of assessment for the program. This does not account for adoption levels likely to occur into the future and also assumes that adoption includes a conscious decision either not to adopt a practice or to cease a practice as a result of following advice from Grain & Graze. The business plan assumed 100% adoption by 2015, and so adoption to date is commendable.

Assessment of the achievements against the triple bottom line objectives of the program follow.

Objective 1: More profit for mixed enterprise producers (building financial capital)

Grain and Graze achieved increased profit for mixed enterprise producers by almost the targeted amount (9%, where the targeted amount was 10%) but not for as many producers as initially expected (1,800, rather than the targeted 6,800). The increase in profit varied across regions, from 2% in the Avon to 19% in the Murrumbidgee

Objective 2: Better water quality and enhanced condition and diversity of plants and wildlife (building natural capital)

Achievement of this Objective cannot be inferred quantitatively from the data available, however, significant benefits to the environment are accrued from nearly all of the practices advocated by Grain & Graze. In particular, the top three key farm practices adopted, described later, suggest that it is likely water and soil quality have improved, together with the condition and diversity of plants and wildlife on many mixed farms. The Biodiversity in Grain & Graze project alone covered farms aggregating 172,000 hectares.

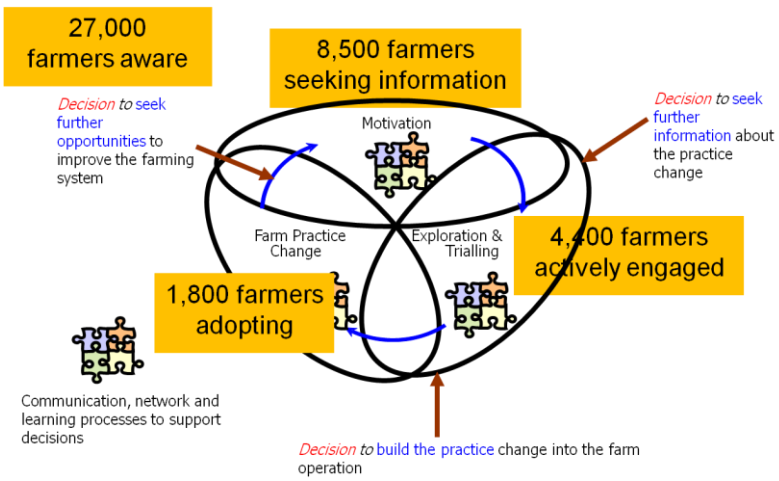
Participating catchment management organisations have recorded a reduction in soil erosion and dust-storm events in most Grain & Graze regions despite the occurrence of significant drought conditions when such degradation events are most common.

Objective 3: Increased confidence and pride among Australia's mixed enterprise producers (building social capital).

Grain and Graze has achieved increased confidence and pride among Australia's mixed enterprise producers. Confidence has increased for approximately 1,800 producers. Pride was found not to be a good indicator of the program's success against a social objective due to already high levels of pride amongst producers for many differing reasons.

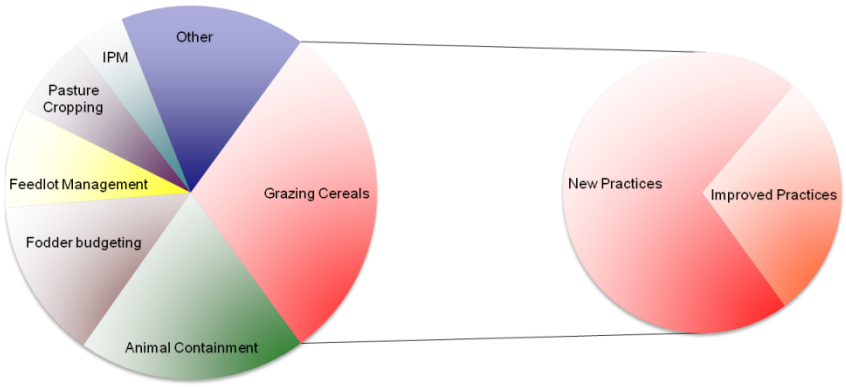
Region	Avon	BR	CWL	CGH	EP	Mallee	MB	Murr.	N Ag
Profit increase	2%	8%	7%	4%	10%	6%	12%	19%	3%

An overview of awareness, participation and adoption achievements against the change-on-farm extension methodology adapted by Grain & Graze.



Achievement of Sustained Practice Change

There are a large number of farm practices recommended by Grain & Graze. There has been significant adoption of a small number of effective farm practices. The program has effectively achieved further adoption of existing practices, more than adoption of new practices.



The most successful adoption was achieved for grazing cereals, adopted by 386 producers across five Regions due to Grain and Graze. The second most successful level of adoption was for containment areas for grazing sheep, (361 producers, largely confined to one region). The practice is being adopted primarily to protect the condition of soil resources.

The increased decision-making capacity of producers about adoption is considered to be as important as the levels of new practice adoption. Some are making informed decisions to increase the extent of a currently adopted practice. Others are making decisions to not adopt. This provides benefits attributable to the program by preventing financial loss (rather than achieving financial gain).

Return on Investment

There has been a good return to investment in Grain and Graze, especially given the short time-frame and that many regions only commenced extension activities following a concerted focus on research.

The present value of total costs of the program is estimated to be over $31 million. The investing RDC's had 43% equity in the total cost structure.

The estimated monetary benefits of Grain and Graze are derived from estimates of increased profitability of farming enterprises of participating farmers. Assuming that the benefits last for a 10-year period from the start of the Program, the present value of the benefits is estimated to be $39.8 million.

Overall, the Program has been cost-effective. The net present value of the Program (the difference between the present value of the benefits and the present value of the costs) is estimated to be $8.6 million. The benefit cost ratio of the Program (the ratio of the present value of the benefits and the present value of the costs) is estimated to be 1.28, indicating that for every dollar spent on the program there has been a $1.28 return.

The Benefit Cost Ratio based on RDC investment alone is estimated to be approximately 3.0.

	MLA	AWI	GRDC	LWA
Total investment ($, 2007/08)	$6,059,210	$2,794,449	$2,668,653	$2,137,298
Benefit attribution (%)	34%	35%	12%	19%
Benefit attribution ($, 2007/08)	$13,525,134	$13,922,932	$4,773,577	$7,558,163
BCR*	**2.23**	**4.98**	**1.79**	**3.54**

Program Efficiency

The Evaluation Team found that considering the ambitious scale and complexity of the Grain & Graze and some adverse conditions (especially the prolonged drought), the program design, management and administration were very effective in delivering expected and unintended outcomes of the program.

Most involved considered that the delivery model was of appropriate scale and complexity to deliver the outcomes required. Many operational problems identified were addressed and resolved during the course of the program.

There was an almost competitive process between regions to demonstrate a high level of participation but there was a more limited focus on understanding and applying processes for sustained adoption. The links between participation and adoption are apparent when the outcome is economic but less apparent for environmental and other social outcomes.

The most efficient delivery processes have occurred where the Regional Coordinator, the Steering Committee and partner organisations had a well developed understanding of these adoption processes appropriate to their Region.

A deficiency in the Program was with the national research projects. While the projects were well selected, and had significant impact in their own right, their timing was not well dovetailed to maximise their interaction with the regional projects.

Conclusion

Achievement of targeted outcomes during the period of investment has been substantial although not complete. It is expected that further benefits from the Program will continue to accrue. In addition, there has been a range of unexpected beneficial outcomes, including partnership development, increased management capacity and new co-investment opportunities that add value to the monetary benefits identified from the total program investment.

Summary of outputs and outcomes

- 278 demonstrations and trials
- 180 training courses
- >4,000 active participants
- >8,000 total participants
- >1,800 adopting (incl. making a decision not to adopt)
- ~200 publications, tools, manuals
- National database of R&D data
- A Banksia Environmental Award for the BiGG project
- 20 regions hungry to join up for phase II

INSTITUTIONAL EVALUATION

This evaluation is based upon social research applied by Lauren Rickard as part of the Social Dimensions project. It involved analysis of interviews with over 80 participants in Grain and Graze, as well as consideration of the social and institutional literature relating to the management of complex research programs.

Emerging from the analysis was the identification of two distinct narratives taking place within the program. These narratives describe the program from particular perspectives; perspectives which sometimes comfortably ran in parallel, and sometimes came into conflict.

Narratives of Grain and Graze

Narrative One: Grain and Graze as a Professional Organisation

At one level, the success of Grain & Graze is as a matter of its coherence, efficiency and professionalism. From this angle, the program is viewed as a kind of professional organisation – a purposeful, bounded structure, impressive in its scale, coordination, outcomes and basis in scientific knowledge. Represented in and by the official documentation about the program and adhered to in part by all stakeholders, this narrative is constructed through managerial discourse that makes explicit, among other things, that the purpose of the program is to achieve certain highly specified and contracted outcomes. These ambitious content-based outcomes are only part of the story, though. For those who aim for the program to perform as a "quasi-organisation", the program's success consists not only of its fulfilment of its stated objectives, but whether it appropriately identifies and communicates such objectives, puts in place coordinated plans, structures and processes for pursuing them, and adequately measures and publicises the program's success in achieving them. That is, true success is seen to be the extent to which the program adheres to – and is recognised by outsiders as adhering to - the norms of a well-run and effective organisation.

Much of the managerial discourse generated about G&G attempts to construct the program as a coherent bounded entity. It is designed to create a certain image of the program in the eyes of external observers and an associated sense of identification with and response to the program among its many disparate stakeholders. Descriptions of the program on the official website, for example, emphasise the coordination and scale of its investment and reach.

References on the website to the program's overseeing management committee and national projects further serve to emphasise the organization-like cohesiveness of the program at the national scale.

Documentation aimed at the internal Grain & Graze audience adds to the above image by making explicit expectations about the program's internal alignment, logic and professionalism. The program is rich with documents setting out structures for planning and reporting and has a bounty of subsequent documents reporting on the milestones, targets, deliverables and indicators that have been set. Not only does the production of such reports help the program to achieve its on-ground outcomes for mixed farmers but it serves to make the program and especially individual components of it appropriately

Creating a more direct relationship between the RDCs and the regions is a huge step forward… This collaboration at the regional level is the most positive NRM outcome from the program.

Regional producer

accountable. In other words, the discourse and processes that construct Grain & Graze as an organisation are not only a means to the end of a more profitable and sustainable mixed farming sector, but are – at least in the eyes of some - an important end in their own right.

Being able to construct an image or certain discourse about something – to control how something is perceived and understood - is a type of power. Two other types of power of relevance to Grain & Graze are: inscribed power (power that someone gains by virtue of their higher level position within a hierarchical structure); and resource power (power that someone gains by virtue of what resources, such as money or physical might, they have at their disposal) (Allen 1999).

The idea of Grain & Graze as a professional organization is part of the official narrative about the program that is constructed by those with the inscribed power to do so: those in some kind of overseeing or managerial role at the national level. In the G&G 'organisational' structure - where the national management committee consists mainly of representatives of the research and development corporations (RDCs) - this group overlaps to a large degree with a subset of those who ultimately hold the resource power in the program: the national investors.

Over the life of the program, arguments arose between stakeholders about the organisational 'rules of the game' laid down for Grain & Graze and about whether these rules had been properly adhered to by various players.

Other arguments about the program represent fundamental disagreement with the need for any such rules at all. As the second narrative makes apparent, some stakeholders take issue with the very existence of organisational expectations in Grain & Graze and see the attempt to make the program into a professional organization as a basic misunderstanding of its true 'revolutionary' potential.

Although made up of diverse regionally-specific projects, a key element of Grain & Graze, particularly in its later stages, had been the bringing together of research results into a neat program-wide package for distribution under the Grain & Graze label. The aim of this integration is five-fold.

One: It addresses the program's task of demonstrating the growing professionalism of mixed farming by highlighting the universalised scientific knowledge produced by Grain & Graze research. Key to professionalism is a basis in scientific, rational, values- and context-free knowledge, as distinct from 'local' knowledge (Boshuzien et al. 2004, Derkzen and Bock 2007). By abstracting the results of various regional projects from their regional context and presenting them as general scientific insights into mixed farming, Grain & Graze helps to fulfil its implicit role of professionalising the sector.

Two: Some stakeholders sought a definitive answer on mixed farming that would emerge from the sum of the results. This approach implies a certain understanding of the farming system as a neatly bounded, replicable whole, as opposed to those who see the systems thinking element of the program as a radical acceptance of flux and uncertainty.

Three: Drawing on the synthesising role of the national projects, substantial work went into producing 'integrated' Grain &

The influence of farmers on the program has not been as strong as it should or could have been. We've had a lot of turnover in farmer reps [on the PMC] because they are doing it in their own time. They get a sitting fee but we should make it easier for them to be involved because they have a very important role.

Regional coordinator

Graze 'products'. One of the most obvious examples of how the program was constructed as an organization, the creation and dissemination of integrated products was seen to be an essential part of representing the program's legacy to the wider world.

Four: The combination of Grain & Graze outputs was seen as essential for the completion of the national-level evaluation of the program. Key to fulfilling the organisational expectations of the program and providing a satisfying sense of completion, the formal evaluation of the program was designed to measure and report on the program's success in achieving its overall objectives (listed above). It required that the disparate activities and results of the program were brought together into an overarching assessment of tangible and quantifiable outcomes and investors' return on investment. To be able to do so would not only demonstrate that due process had been appropriately followed, but would demonstrate the program's success as an integrated whole.

Five: All of the above was intended to help the program achieve the very organization-like goal of promoting its brand name. Efforts to market the name were initiated early in the program's history in order to establish the program's name amongst competing programs in the minds of farmers and other potential supporters, as well as to help fulfil the program's role of professionalising the image of mixed farming in the eyes of its potential critics.

Overall, the structure, processes and content of Grain & Graze were shaped to a large extent by organisational norms. Pragmatic to a degree, the pursuit of such norms also had an idealistic edge. The program was envisaged in this narrative as a cohesive, efficient, effective entity, well-recognised and respected among its counterparts.

Part of the reason that organisational expectations had been strongly imposed on the program and so difficult to fulfil, however, was that a competing ideal has also been at work, posing a major challenge for the coherence of the program.

Narrative Two: Grain and Graze as a Revolution

Grain & Graze is a mix of closed and open-ended elements. The organisational narrative encapsulates in general what is close-ended and contained about the program. The revolution narrative focuses instead on what is open-ended about it. From the partial devolution of power from the national to the regional level, to the crossing of traditional disciplinary boundaries, Grain & Graze has been designed not only as a professional quasi-organisation but as a new and exciting direction in agricultural RDE. This latter ideal is endorsed to an extent in the official documentation about the program.

The idea of Grain & Graze as a new and experimental approach was embraced enthusiastically by many of its stakeholders, who had been drawn to the program for the way in which it represented a kind of revolution against old ways of thinking. The program represented a revolution in the sense that it attempted to escape from numerous divisions that have shaped and continue to shape agriculture and agricultural RD&E:

- Divisions between the different commodities or enterprises on mixed farms;

I love starting with a blank sheet and I got to do that in this project

National project leader

- Divisions between academic disciplines, including the natural and social sciences;
- Divisions between academic and practical/local knowledge;
- Divisions between production and natural resource management; and
- Divisions between State and other jurisdictional boundaries.

As much as Grain & Graze has been constructed as a neatly bounded, hierarchical entity by those who interpret its success in terms of organisational norms, it has also been proclaimed for its unstructured and innovative 'community of practice' characteristics. 'Communities of practice' are loose groups of people brought together by a shared interest in, and often passion for, a particular topic. The 'community' they form is informal and non-hierarchical in structure, crossing traditional organisational and disciplinary boundaries to provide a forum for the open-ended cross-fertilisation of ideas. Driven by the voluntary commitment of their members and not restricted to predetermined outcomes, communities of practice are often highly productive centres of innovation and learning (Wenger 2000, Wenger and Snyder 2000).

Many characteristics of the Grain & Graze structure and processes gave the program a community of practice – rather than a formal organization - feel. To start with, there are the informal relationships formed between often disparate groups, including

- researchers and farmers;
- those in different regions;
- those operating at the national and regional levels;
- those operating in different academic disciplines; and
- those within production or natural resource management focused organizations.

These relationships were fuelled by the sense of shared endeavour and discovery that the bottom-up design of RD&E projects in Grain & Graze created. Sharing the Grain & Graze journey gave stakeholders – often for the first time - a reason to engage each other in context-rich conversations, learning from each other and working together on the program or simply gaining a broader understanding of each others' perspective. Irrespective of role or region, some stakeholders reported being energised and excited by the networks they have made through the program and the broader worldview they have developed as a result.

Just as the informal relationships enabled by the program were seen by some stakeholders as its greatest success, some viewed failure to fully embrace its potential as an innovative learning network as a source of frustration. The main frustration was that, relative to more tangible outcomes, the substantial progress that had been made in the program in building a kind of community of practice had not been adequately recognised and valued by all program partners.

Another element of Grain & Graze's structure and processes that had important similarities with a community of practice was its experimental feel. Not based on any precedent, the program was an attempt at a new approach to agricultural RD&E. For some stakeholders, one of the most significant things about the program was that it represented a new way of doing things.

'Mentoring across the regions is big now. It is one of the best parts of the program. It's really helped to build staff capacity'.

Anon, Regional Coordinator

We have to acknowledge that we don't need to have change on-farm because they [farmers] might explore an idea and decide not to adopt it or that they can't adopt it. But they still will have learned from the process. They will know the options available and where the information is

Regional coordinator

Regardless of whether this way was deemed fully successful, they saw it as an important and courageous attempt to break new ground. In this view, Grain & Graze is an experiment that's success is not dependent on any particular outcome but on its very existence as a new sort of program.

The need to inform but respect farmers' decision making, combined with the impossibility of specifying research and development results at the start of the program, meant that particular practice changes could not be established as desired outcomes for the program. This also meant that, relative to other extension programs where there is often a clear agenda to institute a certain practice change, Grain & Graze was fundamentally open-ended.

That said, on-farm change had been presumed and pursued in the program. The programs' objectives aimed for 'management tools which sustain production and promote biodiversity' and specified other on-ground changes, including a 10% increase in profitability. To some stakeholders, the specificity and linearity of these predetermined objectives – which presupposed a certain kind of research outcome and a certain sort of practice change response - was at odds with the elemental open-endedness of research and extension. Frustration was expressed at the regional level that the potential significance and insightfulness of Grain & Graze had been devalued by the imposition of inappropriate targets that made it more like 'every other RDE program'.

The regional and farmer relevance of Grain & Graze was strongly supported by a diverse array of stakeholders in the program. However, frustration was expressed that although the Program Management Committee initially gave the regions a very broad brief in constructing their specific RD&E projects, '*they then got angry if the regions didn't comply with their very strong mental picture of what they wanted*'. That strong mental image was encapsulated in the program-level goals and objectives. The bottom-up character of research questions meant that the intended systems perspective of Grain & Graze research, another of the 'revolutionary' characteristics of the program, was not as dominant as it could have been because a number of regions instead chose to study "technical components".

'The regional approach is challenging… You have to accept the issues they identify… But they weren't all systems based. There was a lot of technical research'.

Program Management Committee member

What distinguished Grain & Graze from other RD&E programs more than anything else is that it is about mixed farming systems. Although a substantial proportion of farms in Australia are mixed, this focus on mixed farming and the needs of mixed farmers was highly unusual – revolutionary even - because of the dominance in Australia and other 'advanced' nations of specialised, single commodity RD&E and associated efforts to 'professionalise' agriculture. The focus on mixed farming systems in Grain & Graze stands in contrast to decades of agricultural RD&E.

Another way in which the content of G&G rejected established, bounded notions of what is relevant to agricultural RD&E was its inclusion of "social factors". Like environmental factors, social factors featured in the program as one of the three "bottom lines" the program sought to address and as the focus of a specific national project. The main social outcome desired of the program – the only one specified in the program objectives - was the confidence of mixed farmers, particularly in respect to dealing with change.

Helping people to manage change by better understanding how they tend to go

At the end of the day, wheat, canola, sheep - they are not the client. The *farmer* is the client. Our job is to do what is best for them, irrespective of what enterprise is involved…. We need to help people manage change, even if that means they leave our commodity area and even if they leave farming altogether

PMC member

about it was the focus of the national social research project. This project introduced some radical new ideas into the conventional agricultural RD&E arena, complementing "hard" scientific research in production, financial and environmental aspects of the mixed farming system with information about the role of personal preferences, local knowledge, gut feelings, intuition and story telling in farmers' decision making.

By bringing farmers more fully into the spotlight – even if as "passive" research participants – and by defending the "irrational" way in which they make decisions, the social research project added an unexpected and valued angle to the content of Grain & Graze.

Conclusion

Perhaps more than anything else, Grain & Graze was a field a contestation as two idealised views, or narratives, of the program competed for expression. Differences in interpretations of what the program did well or could have done better pointed to the value individuals placed on the organization and revolution narratives in different aspects of the program. The very existence of hierarchical levels in the program and the distribution of power between them were themselves an expression of the two narratives playing out in the program's structure.

The coexistence of the organization and revolution narratives in Grain & Graze emerge in part out of the multiple roles the program played. The program was both a celebration and defence of mixed farming and an implicit criticism of it. It was both a symbol of agriculture's voluntary embrace of a science-intensive professionalism and evidence of the sector's need for more work in this area.

In a sense, the program has been part of agriculture's efforts to 'self-regulate' in the face of external criticisms about its economic and environmental credentials. The revolution narrative encapsulates the critically voluntary nature of such change, while the organization narrative points to the national-level and sector-level image management that is also at work.

At many levels G&G is a great success. In addition to the research findings, education and practice changes it led to, some of its most positive features and achievements were:

- its recognition of the importance, benefits and needs of mixed farming;
- its informal 'Community of Practice' characteristics, including the interpersonal relationships it encouraged;
- the collaborations it encouraged at the regional level and the relevance of the program to regional issues;
- the influence and involvement of farmers in the program;
- its efforts to overcome boundaries within conventional agricultural RDE, including its cross-disciplinary content, systems approach and integration of environmental and production concerns;
- the open-endedness of its approach to extension; and
- its acceptance and better understanding of social factors in farming.

Going forward, the fuller realisation of these aspects of the program is an important goal. In addition, the following challenges need to be addressed:

- Explicit recognition of the two ideals at work in the program and how they clash;

- Constructive, shared discourse around what aspects of the organization and revolution narratives are ultimately most important for the program;
- Constructive, shared discourse around what different stakeholders understand profitable, sustainable mixed farming systems to look like, in order to create a stronger sense of the purpose of the program;
- Constructive, shared discourse around the needs of and demands upon different stakeholders;
- Recognition and acceptance of how much work is involved in creating shared understanding and the allocation of resources to ongoing work in this area,
- The reduction in discrepancies between the design of the program – as determined by the shared discourse mentioned above – and its actual implementation;
- The need to match clarity and purpose with flexibility, as demonstrated by mixed farmers.

NATIONAL COORDINATOR'S PERSONAL REFLECTIONS

I suspect most people who have had any interaction with Grain & Graze will remember it for a long time. For some it may have been the first time they were involved in a complex national program. For others it may have been the first time they dealt with issues beyond their own expertise or field of interest by the very nature of the program being interdisciplinary and dealing with the difficult aspects of the triple bottom line. For me Grain & Graze has been an exhausting adventure and one which has brought me a great deal of satisfaction. I strongly believe it has been good for agriculture in general and mixed farming in particular.

My first memory of Grain & Graze was as a member of the Steering Committee that presided over the Sustainable Grazing Systems (SGS) Program. It was in the final year of that program, known as the 'Harvest Year', that the SGS Steering Committee was broken into several sub-committees – one of which was responsible for considering options of life beyond the SGS Program. In the first year or two of Grain & Graze there was no doubt tension existed between the partners about how to run a program and there were accusations made that Grain & Graze was being biased towards MLA's interests by replicating the SGS Program. This is quite understandable given a combination of the success of SGS and the pressure MLA was under to extend it into the medium rainfall zone.

It is testament to the goodwill of the partners involved in the program, however, that Grain & Graze was able to take on its own shape and develop its own characteristics and culture.

As a Sociologist, I recall distinctly making notes about the cultural differences between the partner organisations and how this affected their approach to the planning of Grain & Graze. MLA and LWA had already adopted a program approach to many of their investments, while GRDC and Wool tended to invest in individual projects that in some cases were loosely aggregated into programs by name only. I cannot find these notes now, but I remember they dealt with the cultural, historical and technological drivers behind the differences. They were, and continue to be, quite profound (the differences, not my notes!!), but do, I believe, add value to collaborations more so than hamper them.

The planning phase of Grain & Graze was an interesting one given that it was driven by a unique combination of technical, economic, environmental and political drivers. The opportunity to work at the regional level was ideal but on reflection may have been somewhat ahead of its time given the immaturity at that stage of the regional approach. To a great extent the Grain & Graze program was experimenting with a number of new approaches to program management simultaneously, and perhaps there were too many experiments going on at one time for some of the stakeholders to cope with. Taking a regional approach at the same time as taking an interdisciplinary approach had already proven a difficult challenge in the National Dryland Salinity Program, but when combined with a multi commodity approach and a triple bottom line approach using a Bennett's hierarchy for monitoring and evaluation, the management challenges become staggering.

The most significant manifestations of the impact of meeting the challenges posed by Grain & Graze are captured

ideally in Lauren Rickard's social and institutional evaluation, summarised in the previous section. The two narratives at play in the program - one representing an algorithmic, well structured, professional and largely top-down perspective seeking value for money, return on investment and an answer to an almost unanswerable research question; the other representing a revolutionary, nebulous, locally responsive and largely bottom up perspective seeking localised solutions to compartmentalised problems – do not represent black or white, right or wrong, but rather the reality that with multiple organisations and individuals come multiple perspectives.

There is much about Grain & Graze and its multiple perspectives of which we can all be justly proud. Adoption did occur, and it occurred during the driest five-year period on record across all regions. Staff turnover at the regional level was surprisingly low, and this kept growers, researchers and managers engaged and focussed. Problems encountered were largely resolved. We are in a better position now to deal with systems issues than we were before. We learnt something!

A test of a good program is whether it engenders a camaraderie that goes beyond contractual obligation and relationships based on mechanisms of accountability. That the regional coordinators conceived, worked together on and rolled out across Australia the hugely successful grazing cereals roadshow speaks volumes for their commitment to something bigger than their regional affiliation.

The Banksia Award winning work in the Biodiversity on Grain & Graze project, and the social dimensions research and extension work were truly groundbreaking and resonated with farmers across the country. It belittles the significance of the achievements of the program to dismiss the work on grazing cereals, integrated pest management, stock confinement, pasture management and easy stock handling as not breaking new research ground. For farmers trialling IPM in the Central West, grazing cereals in the Northern Ag region and performing the most basic of stock and feed-on-offer assessments in the Avon for example, the practices extended by Grain & Graze are new and novel and subject to the same challenges presented by the most cutting edge of technologies. Not all farmers can be at the leading edge, and thankfully the change-on-farm strategy of Grain & Graze acknowledged this. If it hadn't, then achievements against the targets set would have been dismal. Moreover, the two narratives outlined previously would have been expressed as two diametrically opposed, immutable and antagonistic stances that would have seen the program implode.

But that, thankfully, was not the case, and despite the occasional bumps along the journey, nearly all who were involved are not averse to subjecting themselves to more.

In closing, and in response to a comment made that industry may have better served by seeing the investment in Grain & Graze go into marketing campaigns to break into new markets (where the return on investment is measured in weeks), I maintain my belief that programs like Grain & Graze do make industries competitive, they work to increase the base-line volume and quality of product available to market, and they maintain the human and natural capital upon which production, marketing and celebration rely.

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APPENDIX ONE- BUDGET

Income							
Source	2003-04	2004-05	2005-06	2006-07	2007-08	Total	
MLA	1,176,396	1,223,604	1,300,000	1,300,000	1,300,000	6,300,000	(43%)
AWI	0	750,000	750,000	750,000	750,000	3,000,000	(20%)
GRDC	406,000	517,000	813,000	496,000	553,000	2,785,000	(19%)
LWA	278,000	300,000	400,000	500,000	822,000	2,300,000	(16%)
Interest	4,685	56,750	91,455	79,000	75,000	306,890	(2%)
Total	1,865,081	2,847,354	3,354,455	3,125,000	3,525,000	14,691,890	(100%)

Expenditure									
Investment Strategy	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	Total	
1. Change-on-farm: G&G Focus Regions	0	383,526	1,977,808	2,041,692	2,067,200	2,129,600	121,000	8,720,826	(61%)
2. Change-on-farm: National	0	51,833	206,450	288,990	466,976	840,000	0	1,854,249	(12%)
3. Information Management	0	104,085	159,977	59,007	47,327	190,000	0	560,396	(4%)
4. Science Support	0	0	178,554	486,142	587,737	591,741	0	1,844,174	(13%)
5. Program Support	10,727	286,693	239,310	240,061	264,483	351,000	20,000	1,412,274	(10%)
Total	10,727	826,136	2,762,099	3,115,892	3,433,723	4,102,341	141,000	14,391,918	(100%)

Regional Budgets including all contributions										
	Total	Avon	Border Rivers	Central West/Lach	Cor G-H	Eyre	Mallee	Maranoa / Balonne	Murrum-bidgee	Northern Ag
PV Costs	24,891,123	1,808,657	2,624,371	2,613,295	2,244,995	2,472,107	3,155,655	2,902,828	3,135,944	3,397,589
- G&G contributions	7,619,302	696,761	931,120	983,337	948,778	927,344	790,735	555,121	947,255	838,851
- Other contributions	16,736,140	1,111,896	1,693,251	1,629,958	1,296,217	1,544,763	2,364,920	2,347,707	2,188,689	2,558,738
- G&G Equity	31	39	35	38	42	38	25	19	30	25

APPENDIX TWO - PROJECTS

Project code	Project title	Principal Investigator	Organisation	G&G Budget
Strategy One: Regional Change on Farm				
NOR1	Northern Agricultural Region	Phil Barrett Lennard	Northern Ag Catchment Council	875,000
DAW46	Avon Region	Linda Lennard	Dept of Agriculture, WA	763,493
UAD20	Eyre Peninsula Region	Sam Dordle	University of Adelaide	990,871
MAL1	Mallee Region	Lance Brown	Mallee Sustainable Farming	842,800
SFS1	Corangamite Glenelg Hopkins Region	Cam Nicholson	Sothern Farming Systems	1,000,000
FAR1	Murrumbidgee Region	Katrina Dunham	Farmlink	1,000,000
DAN21	Central West Lachlan Region	Ron Hacker	Dept of Agriculture, NSW	1,055,000
QMD2	Border Rivers Region	Bob Walker	Qld Murray Darling Committee	1,000,000
QPI61	Maranoa Balonne Region	Nick Christodoulou	Dept of Primary Industries, QLD	600,000
Strategy Two: National Change on Farm				
CUR5	Communication coordination 2002-03	Mark Paterson	Currie Communications	80,000
SFA7	Communication coordination 2006-08	Robbie Serfon	Serfon & Associates	211,000
PNS6	Communication coordination 2006-08	Janice Hoad	Porter Novelli	80,000
SFA6	Media Campaign	Robbie Serfon	Serfon & Associates	56,530
SFA4	Program Launch	Robbie Serfon	Serfon & Associates	49,258
QPI58	Regional adaptation of LeyGrain	David Lloyd	Dept of Primary Industries, QLD	112,000
RST13	Integrated Products manual and database	Peter Day	Resource Strategies Pty Ltd	190,000
Strategy Three: Information Management				
URS4	Benchmarking	Martin Andrew	URS Australia	99,095
RMG4	Case study analyses	Nigel McGrickan	RMCG	140,000
AGT24	Mid-term review	Peter Chudleigh	Agtrans Research	50,000
UNE48	Monitoring & Evaluation database	Jim Scott	University of New England	14,591
VRA4	Program evaluation	Viv Read	Viv Read & Assocs	195,000
Strategy Four: National Research Support				
RMG5	Social dimensions of mixed farming	Nigel McGrickan	RMCG	254,000
FSS1	Economic dimensions of mixed farming	Andrew Battigate	Farming Systems Analysis Services	240,000
CWE43	Whole-farm feedbase analyses	Michael Robertson	CSIRO	614,370
UTA17	Biodiversity in Grain & Graze	Perry Bridle	University of Tasmania	184,000
UNE55	National database	Jim Scott	University of New England	120,000
Strategy Five: Management Support				
DAR1	Business plan for G&G	Andrew Parratt	Lasting Solutions	69,014
CIE10	BCA for Business plan	Jenny Gordon	Centre for International Economics	10,000
KIR2	National Operations Coordinator	Richard Price	Kirrgaural Research	689,000
URS13	Planning for Phase II	Martin Andrew	URS Australia	50,000

APPENDIX THREE - PRODUCT LIST

Product No	Type	Region
EF040819	General - Document	National
Title: Grain & Graze Communication Guidelines and Protocols		
EF04820	General - Factsheet	South-east temperate
Title: Murrumbidgee G&G		
ER020958	General - Document	National
Title: Grain & Graze Communication Strategy		
EF050959	General - Document	National
Title: Grain & Graze National Change on Farm Strategy 2005 – 2008		
PB030542	General - Brochure	National
Title: Grain & Graze – Profit Through Knowledge		
PB040750	General - Brochure	National
Title: Grain & Graze – Better returns now & Better in the long run		
PB061144	General - Factsheet	National
Title: Grain & Graze – Getting Involved		
PF030599	General - Factsheet	National
Title: Grain & Graze – Fact Sheet		
PF061147	Biodiversity - Factsheet	National
Title: Biodiversity in Grain & Graze		
PF061148	Feed base - Factsheet	National
Title: Feedbase Management in Grain & Graze		
PF061149	Lifestyle - Factsheet	National
Title: Social Research for Grain & Graze		
PF061150	Economics - Factsheet	National
Title: Economic Analysis in Grain & Graze		
PF071391	Pest Management - Factsheet	Wet temperate
Title: Integrated Pest Management		
PF071392	Biodiversity - Factsheet	National
Title: Biodiversity and Productivity		
PF071393	Feed base - Factsheet	National
Title: Feedbase Management		
PF071394	Grazing Cereals - Factsheet	National
Title: Grazing Cereals		
PK061195	General -Booklet	National
Title: A Guide to Grain & Graze Projects		

Product No	Type	Region
PK071331	Decision making - Booklet	National
Title: Insights into mixed farming in Australia		
PN20043	Feed base – Case study	South-east temperate
Title: Coolamon Focus Farm		
PN20059	Feed base – Case study	South-east temperate
Title: Euroley Bridge Focus Farm		
PN20087	Feed base – Case study	South-east temperate
Title: Sebastapol Focus Farm		
PN20089	Feed base – Case study	South-east temperate
Title: Tarcutta Focus Farm		
PN20091	Feed base – Case study	South-east temperate
Title: Tootool Focus Farm		
PN20094	Pastures – Case study	Western temperate
Title: Joe and Jane de Pledge - Badgingarra		
PN20096	Feed base – Case study	Western temperate
Title: Graham and Helen Lethlean - Badgingarra		
PN20098	Pastures – Case study	Western temperate
Title: Aubrey and Lisa Panizza - Badgingarra		
PN20100	Pastures – Case study	Western temperate
Title: Bob and Anne Wilson - Lancelin		
PN20102	Livestock – Case study	Western temperate
Title: Gary and Kerry Butcher - Pithara		
PN20108	Pastures – Case study	Western temperate
Title: Keith and Rosemary Carter - Wubin		
PN20110	Pastures – Case study	Western temperate
Title: Ross and Lyn Fitzsimons - Buntine		
PN20111	Pastures – Case study	Western temperate
Title: Tony White and Julie Symons - Miling		
PN20114	Pastures – Case study	Western temperate
Title: Craig and Donelle Forsyth - Irwin		
PN20115	Pastures – Case study	Western temperate
Title: Rob and Sally McTaggart - Mingenew		
PN20118	Livestock – Case study	Western temperate
Title: Alan and Joy Heitman – Mingenew		
PN20120	Pastures – Case study	Western temperate
Rob and Ros Gillam – Irwin		

Product No	Type	Region
PN20122	Pastures – Case study	Western temperate
Title: The Lefroy Family - Round Hill		
PN20124	Grazing Cereals – Case study	Western temperate
Title: The Brennan Family - Calingiri		
PN20126	Pastures – Case study	Western temperate
Title: Tim Nixon - New Norcia		
PN20129	Livestock – Case study	Western temperate
Title: Don and Ann Nixon - Gillingarra		
PN20131	Feed base – Case study	Western temperate
Title: The Sadler Family - Wongan Hills		
PN20133	General – Case studies	Western temperate
Title: Grain & Graze, Northern Agricultural Region – Western Australia		
PN20135	Pastures – Case study	Western temperate
Title: Evergreen Farming Group Badgingarra, WA		
PN20137	Pastures – Case study	Western temperate
Title: Liebe Group, Buntine, WA		
PN20139	Pastures – Case study	Western temperate
Title: Mingenew-Irwin Group, Mingenew, WA		
PN20143	Pastures – Case study	Western temperate
Title: Victoria Plains, WA		
PN20145	General - Document	Western temperate
Title: Grain & Graze, Northern Agricultural Region – Literature Review		
PN20147	Pastures/Grazing cereals – Case study	Western temperate
Title: Rotational grazing on sown ryegrass and grazing oats compared to self regenerating annual pasture		
PN20149	Pastures - Factsheet	Western temperate
Title: Quality and Quantity Warm Season Perennial Pasture Trail		
PN20151	Pastures - Factsheet	Western temperate
Title: Determining Optimum Grazing Rotations to Maintain Perennial Pastures		
PN20153	Grazing Cereals – Case study	South-east temperate
Title: Low risk farming in a variable climate – The James Family, Condobolin		
PN20155	Pastures - Factsheet	South-east temperate
Title: Pasture cropping as a whole farm system – Matthew and Kylie Barton, ‘Baragonumbel’, Gollan via Wellington, NSW		
PN20157	Pastures - Factsheet	South-east temperate
Title: Mixed farming with Old Man Saltbush – Geoff, Di and Stephen Chase, ‘Waitara’, Trangie, NSW		

Product No	Type	Region
PN20159	Biodiversity – Case study	South-east temperate
Title: Intensive conservation farming – Richard Langley, 'Homestead View', Greenethorpe, NSW		
PN20161	General -Factsheet	South-east temperate
Title: Conventional farming with an eye to effective succession – Craig & Liz, Barry & Jan Tanswell, 'Milpose', Goonumbla via Parkes, NSW		
PN20163	Decision Making - Factsheet	South-east temperate
Title: Intensification and diversification in a mixed farming system – The Cavanagh Family, 'Asbury', Young, NSW		
PN20165	General -Factsheet	South-east temperate
Title: Central West/Lachlan Project Overview 2006		
PN20167	Pastures - Factsheet	South-east temperate
Title: Central West/Lachlan Perennial Species Fact sheet		
PN20169	Pastures - Factsheet	South-east temperate
Title: Central West/Lachlan Native Perennial Grasses Fact sheet		
PN20171	Pastures - Factsheet	South-east temperate
Title: Central West/Lachlan Introduced Perennial Grasses Fact sheet		
PN20197	Pastures - Factsheet	South-east temperate
Title: Central West/Lachlan Old Man Saltbush Fact sheet		
PN20200	Pastures – Technical report	South-east temperate
Title: Grain and Graze: Pasture Cropping Sub Programme		
PN20203	Pastures – Technical report	South-east temperate
Title: Central West / Lachlan Grain & Graze Program –Saltbush Alley Farming Trial, Condobolin NSW		
PN20205	Biodiversity – Technical report	South-east temperate
Title: Biodiversity in Mixed Farming Landscapes in Central Western NSW		
PN20207	General – Technical report	Wet temperate
Title: Grain & Graze in South-Western Victoria		
PN20209	General – Technical report	Wet temperate
Title: Corangamite/Glenelg-Hopkins Region – GRAIN & GRAZE TRIALS		
PN20211	General – Technical report	Wet temperate
Title: Grain & Graze: How the components are anticipated to enhance the farming system in the Corangamite / Glenelg Hopkins region		
PN20213	Biodiversity – Factsheet	Western Temperate
Title: Avon Biodiversity in Grain & Graze		
PN20235	Pastures - Technical report	Western Temperate
Title: Awareness and adoption of lucerne in the Central Wheatbelt		
PN20260	Livestock - Technical report	Western Temperate
Title: Analysis of sheep stocking rates in the Avon Region		

Product No	Type	Region
PN20285	General - Brochure	South-east temperate
Title: Grain & Graze Mallee		
PN20301	General – Technical report	South-east temperate
Title: Mallee Grain & Graze Project Results May 2006		
PN20304	Biodiversity - Technical report	South-east temperate
Title: Grain and Graze Mallee – Soil Biodiversity Monitoring Results 05		
PN20306	Feed base - Technical report	South-east temperate
Title: Grain and Graze Report June 2005 – Managing sheep production from a changing feed base in the Mallee		
PN20310	Social - Technical report	National
Title: Social Dimensions of Managing Mixed Farming Systems Discussion Papers		
PN20312	Systems - Technical report	National
Title: Integration within the Grain & Graze Project		
PN20314	Social - Technical report	National
Title: Discussion Paper - Making Confident Decisions in Drought		
PN20319	General - Technical report	National
Title: Tip Sheet for Regional Research and Extension		
PN20321	Social - Technical report	National
Title: Farmers and the Triple Bottom Line		
PN20356	Climate - Technical report	National
Title: Tips and Tools for reflection and evidence of IMPACT of Change on Farm activities		
PN20358	General - Technical report	National
Title: A National extension approach supporting regional paradigms – lessons from the Grain & Graze program		
PN20360	General - Technical report	National
Title: Tips for designing effective learning activities and products		
PN20369	Feed base - Technical report	National
Title: Sacrificial grazing wheat – a cross-regional simulation analysis		
PN20374	Cereal Grazing – Case study	Sub tropical
Title: Douglas McMaster Research Station		
PN20376	Feed base - Technical report	Sub tropical
Title: Douglas McMaster Research Station – Warialda		
PN20379	General - Technical report	Sub tropical
Title: Grain-Graze as a sustainable farming system in sub-tropical Queensland		
PN20389	Environment – Case study	Sub tropical
Title: Scenario Analyses of Grain-Grazing Enterprises		

Product No	Type	Region
PN20391	Economic – Technical report	Sub tropical
Title: Simple steps to analyse farm business profitability		
PN20393	Cereal Grazing – Case study	Sub tropical
Title: Simulating the options of sacrificial grazing of crops – wheat in the sub-tropical cereal-growing regions		
PN20395	Pastures – Case study	Sub tropical
Title: Border Rivers Grain and Graze – Kioma Station		
PN20397	Pastures – Case study	Sub tropical
Title: Grain & Graze Border Rivers Case Study – 'Lush Farm'		
PN20404	Pastures – Case study	Sub tropical
Title: Grain & Graze Border Rivers Case Study – McMaster Research Station University of New England		
PN20407	Pastures – Case study	Sub tropical
Title: Grain & Graze Border Rivers Case Study – 'Malgarai'		
PN20409	Pastures – Case study	Sub tropical
Title: Grain & Graze Border Rivers Case Study – 'Maneroo'		
PN20411	General – Case study	Sub tropical
Title: Grain & Graze Regional Report & Case Studies – Border Rivers Region		
PN20413	Biodiversity – Technical report	Sub tropical
Title: Biodiversity and Ecosystem Benefits of Short and Long-term Pastures		
PN20415	Biodiversity – Technical report	Sub tropical
Title: Border Rivers Biodiversity in Grain & Graze – Preliminary Results for the Border Rivers Region		
PN20418	Biodiversity – Technical report	Sub tropical
Title: Border Rivers Beetles and Ants		
PN20420	Biodiversity – Technical report	Sub tropical
Title: Project Scope- Biodiversity in Grain and Graze (BiGG)		
PN20422	Biodiversity – Factsheet	Sub tropical
Title: The BiGG (Biodiversity in Grain and Graze) Project		
PN20424	Soils – Technical report	Sub tropical
Title: Capturing Legume Derived Nitrogen in the Variable Climates of the Northern Australian Grains Belt		
PN20426	Soils – Technical report	Sub tropical
Title: Compaction trial at McMaster		
PN20428	Soils – Technical report	Sub tropical
Title: Legumes and Soil Fertility in Ley farming Systems		
PN20430	Soils – Technical report	Sub tropical
Title: Should grazing animals be allowed on good cropping soils		

Product No	Type	Region
PN20432	Pastures - Factsheet	Sub tropical
Title: Fact sheet – Macroptilium bracteatum (burgundy bean)		
PN20434	Pastures - Factsheet	Sub tropical
Title: Fact sheet – Vigna unguiculata (Cowpea)		
PN20436	Pastures - Factsheet	Sub tropical
Title: Fact sheet – Lablab purpureus (Lablab)		
PN20438	Pastures - Factsheet	Sub tropical
Title: New Pasture Legumes for Grazing, Forage and Crop Rotations		
PN20440	Pastures – Technical report	Sub tropical
Title: Pastures for the Border Rivers catchment		
PN20442	Pastures - Manual	Sub tropical
Title: Grain & Graze LeyGrain workshop manual		
PN20444	Feedbase – Technical report	Sub tropical
Title: Balancing feed supply and animal demand in the Border Rivers and Maranoa-Balonne regions		
PN20446	Feedbase – Factsheet	Sub tropical
Title: Project Scope- Feedbase Theme		
PN20454	General - document	Sub tropical
Title: Review of the Literature for the Grain and Graze project in the Border Rivers		
PN20456	Grazing Cereals – Technical report	South-east temperate
Title: Cereal grazing on Eyre Peninsula		
PN20458	Livestock –Technical report	South-east temperate
Title: Sheep nutrition		
PN20465	General - document	Sub tropical
Title: Priority issues identified by stakeholders (Maranoa Balonne)		
PN20468	General – Technical report	South-east temperate
Title: Eye Peninsula Farming Systems 2006 Summary		
PN20685	Grazing Cereals – Technical report	National
Title: Grazing winter cereals in high rainfall regions		
PR081446	Grazing Cereals – Technical report	National
Title: Free Food for Thought – Grazing Winter Crops Roadshow Workshop notes		
PN	General – Technical report	South-east temperate
Title: Farmlink Research Report – G&G 2005		
PK071331	Decision making – Case studies	National
Title: Insights into mixed farming in Australia		

Product No	Type	Region
PN	General - Weblink	National
Grain and Graze National Benchmarking project		
PN	IPM - Factsheet	South-east temperate
Integrated Pest Management Finds its Place at 'Nandewah'		
PN	Pastures - Factsheet	South-east temperate
Pasture Cropping a Fundamental Part of Holistic Management at 'Taroona'		

APPENDIX FOUR - PUBLICATIONS

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