



An Australian Government Initiative



Multipurpose grazing systems using perennial woody species

Report of Workshop held 8-9
December 2004

A report for the RIRDC/Land & Water
Australia/FWPRDC/MDBC
Joint Venture Agroforestry Program,
together with
Meat and Livestock Australia
Australian Wool Innovations
CRC for Plant-based Management of
Dryland Salinity

by Dean Revell and
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Report prepared
June 2006

RIRDC Publication No 06/030
RIRDC Project No WS045-04

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ISBN 1 74151 293 X
ISSN 1440-6845

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Published in June 2006

Foreword

The aim of this workshop was to provide a venue for specialists in livestock production, agronomy, ecology, botany, and agroforestry to meet and discuss the current state of knowledge on the use of perennial shrub species in grazing systems. The outcome was to chart the future direction of research, with the goal of developing multipurpose grazing systems based on native perennial shrubs in mixed forage systems.

Woody perennial species have the potential to complement grazing systems utilising annual species, particularly at times of the year when the production and nutritive value of annual species is low. Many native or naturalised perennial shrubs and herbaceous species have been rejected as potential forage sources due to their inability to provide adequate diets when fed in isolation. However, little work has been done on more innovative, alternative systems that incorporate a mix of plant types and species and are better matched to our environment. To develop these systems we need to screen and trial a broad range of species and design sustainable polycultures which provide more diverse and profitable products, while contributing to natural resource management outcomes. System designs could include the management of mixtures of plants for different land types.

This workshop is an early step in developing a coherent national research program on the adoption of perennial woody species in grazing systems. A future project could design multifunctional systems that rely on the adaptability, potentially high feed values and diverse range of secondary plant compounds and products present in our native flora. The mixture of species selected would be based on a broad range of characteristics, including nutritive value and palatability, their capacity to function and persist in polyculture, and the presence of secondary compounds that alter rumen microbial activity (e.g. to decrease methane, nitrogen loss, lactic acidosis, or bloat) or reduce parasitic worm counts.

This workshop was co-funded by the Joint Venture Agroforestry Program (JVAP), Meat and Livestock Australia, CRC for Plant-Based Management of Dryland Salinity and Australian Wool Innovations. JVAP is supported by three R&D Corporations — Rural Industries Research and Development Corporation (RIRDC), Land & Water Australia, and Forest and Wood Products Research and Development Corporation (FWPRDC), together with the Murray-Darling Basin Commission (MDBC). The R&D Corporations are funded principally by the Australian Government. State and Australian Governments contribute funds to the MDBC.

This report, an addition to RIRDC's diverse range of over 1500 research publications, forms part of our Agroforestry and Farm Forestry R&D program, which aim to integrate sustainable and productive agroforestry within Australian farming systems.

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Peter O'Brien

Managing Director

Rural Industries Research and Development Corporation

Acknowledgments

We thank all of the participants (listed in Appendix 2) for their valuable contributions to the workshop, which includes producer experiences, researcher insights, industry and extension perspectives. The workshop enjoyed enthusiastic participation and open discussion and provided a sound platform from which to generate relevant research and adoption. We also thank the Joint Venture Agroforestry Program, Meat and Livestock Australia, Australian Wool Innovation and the CRC for Plant-based Management of Dryland Salinity for financial support and technical inputs.

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Executive Summary

A workshop involving specialists in livestock production, farming systems, agronomy/botany, plant ecology and agroforestry was held in December 2004 to discuss opportunities for developing new animal production systems that incorporate native or naturalised shrub species. The rationale for considering the potential role of shrubs included:

- (i) Natural resource management issues such as dryland salinity and soil erosion
- (ii) Enhancement of the feed base in southern Australia where the predominant annual species show distinct temporal gaps in production and quality
- (iii) The potential of shrubs to provide beneficial secondary compounds that alter rumen microbial activity, improve animal health and production, reduce greenhouse gas emissions, and reduce the reliance on chemicals to control gastrointestinal parasites
- (iv) The potential to use integrated processing of fodder shrubs to support animal production in combination with production of wood-based commodities.

Land classes and farming systems that may benefit from the incorporation of fodder shrubs were identified, but a range of issues need to be addressed before successful adoption could be expected. These include:

- (i) Identifying the major limitations to the successful adoption of fodder shrubs, including social, economic and agronomic factors
- (ii) Screening plants on a broader range of characteristics than has previously been undertaken
- (iii) Establishing the most suitable shrub species in combinations with other plant species
- (iv) Designing new grazing management systems with mixed forage systems that include shrubs and conventional pastures.

A coordinated and collaborative research program that incorporates producer experiences and requirements, bio-economic modelling, agronomy and plant breeding, animal nutrition and behaviour, and pathways to adoption is necessary and, to this end, a full research proposal has been prepared and submitted to a range of potential funding partners; JVAP have agreed to support the project and other funding agencies (the CRC for Plant-based Management of dryland Salinity, Meat and Livestock Australia and Australian Wool Innovation) are currently considering the proposal.

Introduction

Current land use in many Australian rural landscapes is unsustainable and we are faced with such critical natural resource management issues as declining soil quality, diminishing water quality, loss of biodiversity and the need to adapt to climate change, particularly in marginal agricultural regions. Also, an increasingly important issue challenging livestock industries is the emerging market pressure to reduce the use of antibiotics, feed additives, hormones, and animal emissions (methane, nitrogen) while still providing affordable products. These challenges are substantial, but a key approach to addressing the current and emerging concerns is to complement the current (mainly annual) plant species with perennial species and thereby create more sustainable production systems.

Despite the challenges, important livestock production opportunities are emerging from a generally favourable world market setting, especially for meat products. This trend is likely to continue with real price increases for meat predicted for the next decade. This has provided challenges and opportunities to service growing and increasingly diverse livestock markets. Perennial shrubs have the potential to complement existing fodder sources and add value to the current feedbase, by increasing utilisation of low value feed sources and substituting for high cost supplementary feeds required in period of feed shortage.

Although widely exploited in rangelands, the rich biodiversity of our native flora has been largely ignored in domestication programs and consequently, the potential of this resource remains undeveloped in Australian agriculture. Little work has been done on more innovative, alternative systems better matched to our environment (reduced reliance on annuals), such as incorporating the screening of a broad range of species and the design of sustainable polycultures with more diverse and profitable products. A consequence of this has been minimal effort within Australia into the genetic improvement of likely perennial native species with the possible exception of ad hoc selection of *Atriplex nummularia* (Oldman Saltbush). A future project could utilise the natural diversity of native flora in multifunctional systems that rely on the adaptability, potentially high feed values and diverse range of secondary plant compounds and products present in our native flora.

A workshop was held in Adelaide over 2 days in December 2004 with an invited group of specialists in botany, plant ecology, agronomy, agroforestry and livestock production with an interest in the general theme of grazing system development using perennial species. The agenda (Appendix 1) included presentations from participants on topics including the selection and genetic improvement of new species, economic evaluation of farming systems, producers' experiences with perennial species and the development of new grazing systems. This led to the establishment of a common understanding of state of knowledge on the workshop topic, and was followed by a session with the aim of clarifying future research direction and critical topics. Important issues that emerged included:

1. Selection criteria for evaluating and collecting plants species to be investigated for their use in multifunctional land use systems for animal production. Efforts in this area should complement related screening work on non-grazing products now underway in projects such as Florasearch and mallee integrated processing.
2. Screening native flora for compounds that can replace chemical additives and provide natural ways to improve rumen function. This type of project has not been attempted in Australia but is underway in a multimillion-dollar program in Europe, which has already led to patents for several plants (European) with potentially beneficial and valuable effects on rumen fermentation.
3. Designing radically different grazing systems that (a) are built on the inherent capacity of ruminants to learn and select combinations of forages that optimise nutrient intake and avoid toxins, and (b) ensure persistence of the plant community.

4. Adapting the new integrated processing technology emerging for mallee in WA to include developing new biomass crops for new animal feed products. Integrated processing provides the option to add mechanical or chemical side streams for upgrading the quality of feed materials.

Workshop Discussion

Why consider changing

Producers in the crop-livestock zones of southern Australia have been required to continually improve productivity in response to declining terms of trade, emerging problems such as herbicide resistant weeds and declining soil quality, and have needed to adjust the mix of livestock and cropping in response to changing commodity prices.

As recently summarised by Ewing and Flugge (2004), the critical issues that face producers in the livestock-cropping zones are:

- The continuation of the declining terms of trade (currently at an average decline of 2.2% per year)
- An increase in the need to embrace management practices that provide more sustainable production systems (which include the management of soil salinity, acidity and erosion, and the management of herbicide-resistant weeds)
- Forecast changes in commodity prices that are likely to favour meat production
- Further development of 'phase farming' practices that allow for greater flexibility in pasture and cropping enterprises (since longer phases tend to allow mid-phase management that is more independent of the next phase).

The Fodder Shrubs workshop considered the merits and limitations of incorporating shrubs into farming systems of southern Australia. It was readily agreed that exploring the potential of fodder shrubs and identifying researchable issues must be based on sound data (actual or modelled), and a real need to change current production systems, not on a loose belief that 'shrubs for shrub's sake' will somehow improve our agricultural landscape, environmentally or economically.

The question we need to consider is this: Given the current economic, social and environmental framework, does the incorporation of fodder shrubs into farming systems offer a way forward to simultaneously (a) improve the sustainability of production, especially dryland salinity, (b) increase profitability and allow producers to capitalise on the changing economic conditions that appear to be more favourable to meat production (than was the case in the preceding decade) and (c) meet current and emerging consumer/market demands for 'clean, green and ethical' animal production.

Producer experiences

Saltbush and tagasaste have found a niche role in farming systems. There would appear to be real opportunities to enhance the productivity of the current systems and expand the areas in which they are adopted. For saltbush, most research and extension so far, has focussed on its use on salt land. There are opportunities to:

- Use this shrub on non-saline areas to broaden the feed base over summer and autumn.
- Use plant selection to improve nutritive value, palatability or other traits, including the incorporation of untested (possibly declining) genetic material from ungrazed sites.
- Improve our understanding of the value and management of inter-row pasture to complement saltbush.
- Improve our understanding of best grazing practice; ie, optimal rotations for animal productivity, and management of the shrub for regrowth.
- Reduce the risk of a grazing enterprise by providing a feed source when conventional pastures are insufficient to meet animal requirements.

Tagasaste's main niche at present is cattle production on deep sands, mostly in WA but also elsewhere. In these environments, tagasaste provides a feed base where other pasture options are too risky on the infertile sands that suffer wind erosion if there is inadequate pasture cover. However, the opportunities may extend beyond this particular scenario. For example, the combination of tagasaste with grain supplementation is proving a profitable enterprise for finishing cattle in WA, often with cattle reared in the Kimberley region and transported south for finishing. Similar models of 'standing feedlots' for finishing animals reared in other pastoral zones in Australia are an attractive proposition.

Not all producer experiences with shrubs have been positive. One example is the use of *Acacia saligna* in the south-east of SA, where its weediness is proving to be a problem. The weediness of a shrub will be influenced by the growth characteristics of the plant and the environment in which it grows, but also by how it is managed. In many cases, shrubs have been planted on farms in small areas and often on marginal land, and have not received adequate management. Consequently, the shrubs become rank and possess a low feeding value, are not incorporated into a profitable farm enterprise, and continue to provide poor 'publicity' on the potential value of shrubs.

Why fodder shrubs?

The reasons to consider fodder shrubs as part of future farming systems include:

- To diversify and broaden the feed base, especially by filling a summer-autumn feed gap
- Provide a feed base that is productive in low-medium rainfall zones (250-550 mm) where other perennial options find it difficult to persist
- Improve water use in higher rainfall zones (>600 mm) where livestock currently represents the main land use, yet current pasture options are insufficient to control recharge (deep drainage)
- To provide a productive use of marginal landscapes, especially saline soils and deep infertile sands, and improve land management such as recharge control or minimising wind erosion
- Reduce the riskiness of mixed farming and grazing enterprises by providing a more predictable feed base in the typically variable climate of southern Australia
- Increase profitably on parts of a farm where economic modelling indicates profit maximisation is achieved with continuous pasture (eg, on 'poor sands', 'good sandplain' and 'medium heavy' soils in the central wheatbelt of WA; Ewing and Flugge, 2004)
- Improve the 'clean, green and ethical' approach to animal production by reducing chemical inputs by exploiting bioactive plant compounds, by providing shelter, and providing aesthetic value.
- Integration of biodiversity into farming systems and a move away from monoculture approaches.

These issues will become even more important in the near future as (i) legislative changes current in Europe and imminent in the USA, make a reduction in chemical use an imperative, and (ii) non-trade barriers based on, for example, animal welfare issues (eg, lamb deaths) become more likely in response to consumer concerns and free-trade agreements.

Potential species and necessary characteristics

There is potential to develop productive fodder systems utilising native and exotic species. Investigations into potential native species and leguminous species from South Africa were presented. The general selection criteria are:

- Plant height not exceeding 1.5 – 2.0 metres (for ease of management, as edible tall shrub and tree species which quickly grow beyond bite-height, may require expensive maintenance)
- High seed production (allowing for seed establishment) or ease of establishment
- High feeding value
- Moderate palatability (slightly unpalatable)
- Grazing and drought tolerant
- Productive capacity
- Persistent with a woody superstructure

- Persistence on non-saline soils

Other evaluation criteria are:

- Presence of anti-nutritive factors and toxins
- Impediments to successful establishment
- Assessment of risk of weediness. This is particularly so for spiny leguminous shrubs.
- Ability to be easily managed

Where might fodder shrubs fit?

1. Marginal cropping zones with low rainfall, 250-300 mm annual rainfall, and/or low fertility soil.

Historically the cropping zones in southern Australia expanded into lower rainfall zones and continue to do so in NSW where there has been little evidence of salinity or large-scale erosion risk (Milthorpe, pers. comm.). However recently there has been recent pressure to recede due to environmental constraints (salinity, soil erosion) and diminishing returns due to the trend of reduced rainfall. A large part of these 'marginal' zones are being used for continuous grazing and are becoming more like pastoral systems. Shrubs offer a potential feed base in these systems.

2. The wheat-sheep zone

During the past decade, when there have been strong returns for grain production and weaker returns from wool and meat, the cropping enterprise has dominated. In both extremes of annual rainfall in the 'wheat-sheep zone' (300 mm and 600 mm) livestock production currently dominates (Ewing and Flugge, 2004), but in other areas livestock may be retained largely to control herbicide resistant weeds and utilise crop stubbles and may not necessarily be a major focus of profit-making decisions. However, strengthening commodity prices in livestock and increasing sustainability challenges are redirecting attention towards considering profitable animal enterprises as a truly integrated component of the whole farm business.

The most likely land class where grazing enterprises will be considered, at least in the short term, will be the marginal soils where inputs costs for cropping are high, yet returns are unpredictable. However, if the evidence and experience of successful utilisation of fodder shrubs increases, they may have a role on 'better' soil types as well, especially in a phased-farming system where shrub establishment can be justified over a number of years of profitable use. Profitability and other performance measures of a farming system that incorporates shrubs may be higher on 'better' quality soils, yet most attention to date has focussed on shrubs in a remedial role for marginal soils. Thus the full potential of a system incorporating shrubs is yet to be determined.

3. Higher rainfall zones

In the 600-750 mm zones, specialist livestock enterprises dominate because it is too wet for cropping but not wet enough for profitable forestry. Therefore, fodder shrubs offer potential to:

- Improve water use in the landscape and thereby reduce deep drainage
- Improve animal productivity by providing shelter to susceptible animals, such as newborn lambs
- Broaden the feed base across each year. In this case, fodder shrubs would add another component to the feed base, to complement the existing system which uses more conventional annual and/or perennial pastures.

Across all three broad categories above, there is an opportunity to expand or develop the regional trading of animals. Producers already move livestock within a farm as a matter of normal practice - there is capacity to develop specialist roles for breeding or finishing animals in specific locations based on the feed base available.

For example, breeding and lambing (or calving) animals on a feed base that involves fodder shrubs in a high rainfall zone may complement the finishing of animals elsewhere, and remove the need to maintain breeding flocks in the cropping dominant regions of the 'wheat-sheep zone'. Alternatively, finishing animals on a shrub-based system may suit other scenarios. Special management issues may arise with the use of shrubs in high rainfall areas in keeping the plants at a height suitable for accessibility to the animals.

Further development of farming system scenarios that involve fodder shrubs

The workshop identified a range of scenarios in which fodder shrubs may play an important role (previous section). The next steps may involve:

- Survey of existing farming systems that are effectively using fodder shrubs to quantify their strengths and limitations
- Whole farm bio-economic modelling to help identify the most suitable regions or land classes to target any future work
- Coordinate extension activities to provide producers with better information and support on managing fodder shrubs. Farming systems that incorporate shrubs will require different management approaches than conventional grazing systems.

Adoption

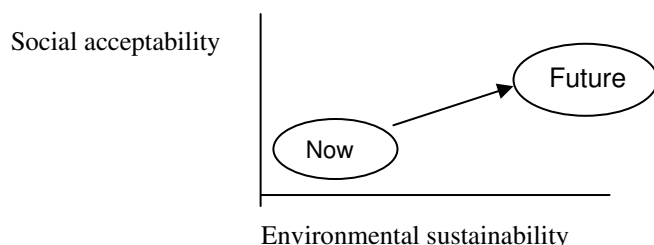
The issue of adoption frequently arose during presentations and discussion. Farmers do not like taking a risk on growing something different and changing management practices. Growing rows of shrubs is a major decision – how do we show farmers the long-term economic benefits? There is the need for researchers, extension specialists and producers to recognise that shrub-based systems represent a paradigm shift.

The main issues identified include:

- Social research – need to look at current farming systems including those which use fodder shrubs:
 - What has worked
 - What has not worked
 - Why haven't people adopted systems
 - What are the drivers for change
 - What are the issues faced by producers
- Making sure that research is responding to issues important to farmers. Ensure researchers are addressing issues of priority to farmers and are communicated in a manner that will assist in delivery of the research findings; this means that we need to characterise the motivating issues when presenting outcomes
- Skills and knowledge activities. Support farmer's networks to undertake on-farm change. Find out what skills, knowledge and activities are needed by advisers. Look at the delivery mechanisms in the context of a new paradigm, that is fodder shrubs in crop-pasture systems.
- Identification of research that will provide information to address known impediments, or motivate people more to take that first step. These research activities need to be rapidly followed by more extension activities to actually drive and reinforce. It will be critically important to utilise a feedback loop linking research activities with producers' adoption of, and experiences with, new systems.
- The question of disparity between the current level of adoption and the sense of what is possible. Are there present drivers for this wider array of possibilities and are they powerful enough to precipitate the changes and adoption? This is a researchable question.
- Shrubs have some common features, but the role of shrubs in a farming system will be regionally specific. We should not think of the southern Australian landscape as an homogeneous target for this type of technology, and we need to consider differences as well as similarities in shrub-based systems, and need to develop and use appropriate tools to analyse the systems.

Research needed to improve the profitable use of fodder shrubs

The overarching framework that was discussed at the workshop can be captured by the following schematic diagram:



The y-axis of 'social acceptance' may include profitability, ease of management, risk, resilience of the production system, establishment (infrastructure) requirements, or water use/leakage from the system. Research is needed to provide the means to move from the 'now' to the 'future'.

A general research aim that arose from the workshop discussions can be stated as:

Examine how shrubs can contribute to environmentally sustainable and socially acceptable farming systems, relative to the existing pasture-livestock-cropping systems.

More specific research issues, many of which are related, are:

1. Describe regionally-specific farming systems and predict, with the aid of appropriate models, the profitability of new systems that incorporate shrubs.
2. Identify the most suitable shrub options for particular land classes, including native and exotic shrubs. Currently only saltbush, tagasaste and lucerne have been widely adopted, and adoption is often regionally specific (eg tagasaste on the deep sands of the northern wheatbelt of WA). What are the important plant-soil relationships that will determine productivity? What benefits might be accrued by combining different species of shrubs on the one site?
3. Develop approaches and methodologies to screen potential candidate species to expand the range of potential fodder shrub species. This work should align with the FloraSearch project, and include screening for a broad range of traits.
4. Quantify the nutritive value, using appropriate techniques (which are likely to require modification of existing techniques such as NIR) and secondary plant compounds (toxins) across plant species, plant phenology and seasons.
5. Develop and implement *in vitro* assays to investigate the consequences of bioactive plant compounds on ruminal micro-organisms (eg, reduced methane production, lactic acid production, or proteolysis) and intestinal parasites.
6. Understand ruminant grazing behaviour and diet selection using a model of a mixed forage system that incorporates shrubs, pastures and/or supplements.
7. Improve our knowledge on how to use fodder shrubs, in terms of a) grazing strategies (high pressure-short duration grazing versus more conventional rotational grazing), b) feeding value of the accessible material, and c) shrub productivity (i.e. regrowth potential).
8. Overcome the perceived or actual low feeding value of shrubs through a) genetic improvement of the plants, b) altered grazing management strategies, c) other management approaches (eg, mechanical processing), or d) strategic supplementation.
9. Overcome the lack of knowledge on how to incorporate shrubs in the mixed diet of grazing animals; eg, a) adequate provision and management of the shrub inter-row, b) appropriate supplementation strategies, c) selection behaviour (preference or avoidance) of grazing animals and provision of complementary species.

10. Identify synergies between shrubs as fodder and shrubs (woody species) used in industrial processing.
11. Conduct social research, including identification of the drivers of change (NRM issues, legislative issues, familiarity with a particular production system) and why few producers have considered fodder shrubs and why the majority have not.

Conclusions

Perennial fodder species are currently a minor part of our farming systems but have the potential to play a much more central role. They can offer a relatively unique function within systems - this is to do with the way the plants function: providing natural resource management outcomes, improvements in livestock system productivity due to the timing of feed production, and resilience to climate variability.

Case studies presented during the workshop showed that these systems do work when well managed but can create a negative impression of shrubs when not effectively integrated.

There are strong prospects for the expansion in the use of forage shrubs and trees in the low rainfall mixed-farming systems, particularly in the 250 – 550 mm annual rainfall zone, compared with other perennial species alternatives. Established markets and industry infrastructure already exist for the end products (lamb and wool), making widespread adoption of forage shrubs into existing mixed-farming enterprises a feasible proposition. This contrasts with other prospective new farming industries that may take considerable time to establish market outlets and for a stable industry infrastructure to emerge.

The workshop recognised that adoption will require powerful drivers, and that there is disparity between the current level of adoption and the potential for successfully using shrubs in a farming system. Are the drivers present for this wider array of possibilities and are they powerful enough to precipitate the changes and precipitate adoption?

Reference

Ewing, M.A. and Flugge, F. (2004) The benefits and challenges of crop-livestock integration in Australian agriculture. 12th Australian Agronomy Conference (Brisbane 25 September-1 October, 2004).

Appendix 1

Workshop Agenda

Multi-purpose 'healthy' grazing systems using perennial shrubs

Wednesday 8 and Thursday 9 December 2004, Adelaide

Workshop sponsored by Joint Venture Agroforestry Program (JVAP), CRC Plant-Based Management of Dryland Salinity (CRC PBMDs), Meat and Livestock Australia (MLA) and Australian Wool Innovation (AWI)

Wednesday 8 Dec

- 9.00-9.20 Welcome and introduction; overview of the context and purpose of the workshop
Bruce Munday
- 9.20-9.40 Why woody perennials? The technical context of shrubs in the landscape and farming systems
Mike Ewing

Producer experiences with fodder shrubs: how this research might benefit us.

- 9.40-10.00 Tagasaste in WA
Bob Wilson
- 10.00-10.20 Saltbush in western NSW
Andrew Sippel
- 10.20-10.40 Experiences in SA with various fodder shrub options
Graham Gates, Coorong and Districts LAP
- 10.40-11.00 General Discussion
- 11.00-11.20 Morning tea

Researcher experiences – the current state of knowledge

- 11.20-11.40 Shrubs and Biodiversity: Composition, Structure and Function
David Freudenberger
- 12.00-12.20 Summary of JVAP-commissioned review on fodder shrubs and experience of using shrubs in western NSW
Peter Milthorpe
- 12.20-12.40 Livestock nutrition, capacity to detoxify plants, and grazing habits
Dean Revell
- 12.40-1.00 General Discussion
- 1.00-1.40 Lunch

1.40-2.00	FloraSearch – development of woody perennial production systems: state of play and summary of economic analysis of shrub fodder systems <i>Mike Bennell</i>
2.00-2.20	Improving the nutritive value of saltbush: work with clones and grazing studies suggests a way forward. <i>Ed Barrett-Lennard, Hayley Norman and David Masters</i>
2.20-2.40	<i>General Discussion</i>
	<i>Current and proposed projects</i>
2.40-3.10	Overview of CRC Program 6 new project concepts <i>David Masters</i> ▪ ‘Evergraze’– grazing systems incorporating shrubs for the low-medium rainfall zones of southern Australia ▪ ‘Enrich’– secondary plant compounds for animal health and production ▪ ‘Precision nutrition’ – improving rapid predictions of nutritive value
3.10-3.30	Afternoon tea
3.30-3.50	Overview of current NSW project with grazing system utilising Oldman Saltbush <i>Peter Milthorpe</i>
3.50-4.20	Investigations into candidate fodder species – <i>short presentations and discussion of possibilities</i> ▪ FloraSearch <i>Mike Bennell</i> ▪ Exotic species <i>Ron Yates</i> ▪ Herbaceous perennials <i>Megan Ryan</i>
4.20-4.40	The PAPP project (“Profitable animal production from perennials”) approach to modelling both profitable grazing systems and hydrological outcomes <i>Angela Avery</i>
4.40-5.00	General Discussion
5.00-5.30	Perspectives from potential funders <i>JVAP –Rosemary Lott</i> <i>MLA – Cameron Allan</i> <i>AWI – Greg Bender</i> <i>CRC – Mike Ewing</i>
7.30	Dinner

Thursday 9 Dec

- 8.30-9.15 Review of the proceedings of day 1; knowledge gaps and research questions from two perspectives:
- Plant systems *David Freudenburger*
 - Animal production *Phil Vercoe*

9.15-2.40 **Discussion on identifying critical researchable issues and developing a project framework**

(includes morning tea and lunch breaks)

1. Identify component parts; eg,
 - Where we might be targeting the novel systems (bio-climatic zones)
 - What farming new systems might look like (landscape and livestock production)
 - Grazing systems – opportunities and risks for new systems that incorporate woody perennials
 - Selection of new species – native and exotic. Opportunities and risks, needs and selection criteria
 - Opportunities and risks for selection and breeding
 - Testing methodologies (NIR)
 - What impacts are possible/likely (hydrologically and economically)
 - Secondary plant compounds
 - Working with landowners
2. Defining ‘groupings’ of these component parts and interactions between them
3. Priority setting
4. Broad description of what the project/s might look like
5. How will this meet the needs of all interested parties; ie, producers, funders, natural resource managers etc.
6. Identify the resources, capabilities and capacities that we have
7. Mapping a project plan
 - Goal & objectives?
 - Activities
 - People
 - Milestones
8. Proposing a mechanism of managing the process
 - Do we develop a unified approach?
 - Key researchers
 - Grant writing and timelines

2.40-3.00 **Final summation – what have we achieved** *Mike Ewing*

3.00 Close of proceedings

Appendix 2

Participants

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