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Investment Plan for natural resource management within livestock production systems of Australian rangelands

A Draft R, D & E Business Plan

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government to support the research and development detailed in this publication.

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Abbreviations

Abbreviation	Description
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACRIS	Australian Collaborative Rangeland Information System
Ag NSW	Agriculture New South Wales
AussieGRASS	Australian Grassland and Rangeland Assessment by Spatial Simulation
CDU	Charles Darwin University
CfoC	Caring for Our Country Program
CLMA	Centralian Land Management Association
CMA	Catchment Management Authority
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Commonwealth Department of Agriculture Fisheries and Forestry
DAFWA	Department of Agriculture and Food, Western Australia
DEWNR	Department of Environment, Water and Natural Resources
EBIT	Earnings before interest and tax
EMS	Environmental Management System
EMU™	Ecosystem Management Understanding™
FORAGE	Biophysical model of pasture growth
FTE	Full time employee
GfP	Grazing for Profit course
GLM	Grazing Land Management course
GLM-EDGE	Grazing Land Management course as part of Burdekin Rangelands Reef Extension Project
GPS	Global Positioning System
GRASP	Grass Production- Model of pasture growth in rangelands
ha	hectare or hectares
ILC	Indigenous Land Corporation
IUCN	International Union for Conservation of Nature
KTP	Key threatening process(s)
LSU	Large Stock Unit
MBI	Market Based Instruments
MLA	Meat & Livestock Australia
NABRC	North Australia Beef Research Council
NAILSMA	North Australian Indigenous Land and Sea Management Alliance
NGO	Non-government organisation
NRM	Natural resource management
NRRN	National Rangeland Research Network
N-S	North-South
NT NRM	Territory NRM
NTCA	Northern Territory Cattlemen's Association
NTDPIF	Northern Territory Department of Primary Industry and Fisheries
PaddockGRASP	PaddockGRASP is a spatial framework within which the GRASP pasture growth model can be run for polygons that represent pasture types within paddocks
PDS	Producer Demonstration Site
PPMS or PPMT	Precision Pastoral Management System, or Tools

Abbreviations

Abbreviation	Description
QDAFF	Queensland Department of Agriculture, Fisheries and Forestry
QDAFF	Queensland Department of Fisheries and Forestry
QDRM	Queensland Department of Natural Resources and Mines
R & D	Research and Development
R, D & E	Research, Development and Extension
RA	Rangelands Alliance
RCS	Resource Consulting Service
RNRMO	Regional NRM Organisation
SA MDB	South Australian Murray Darling Basin NRM
SABRC	South Australia Beef Research Council
SLATS	Statewide Landcover and Trees Study (Qld tool)
STOCKTAKE	Paddock-scale land condition monitoring and management package.
TGP	Total grazing pressure
UAVs	Aerial photography from unmanned aerial vehicles
UNE	University of New England
UTAS	University of Tasmania
VRD	Victoria River District, Northern Territory
WONS	Weeds of national significance
WUE	Water use efficiency

Executive Summary

MLA on behalf of industry contributors and government is primarily directed to invest in NRM to protect the resource base on which production is founded and to maintain that natural resource base and biodiversity values. This is undertaken to maintain the social license to use leasehold land for pastoral grazing purposes. There is also a policy advantage as it is considered more expensive, and arguable less effective, except in very specific circumstances, to isolate identified areas of biodiversity value and manage them separately. Benefit is seen in gaining suitable large-scale management of biodiversity values within a production system.

Demonstrating an economic benefit from managing rangeland towards an improved state at individual business level has been an objective of many R, D & E programs over recent decades, but it has been difficult to establish a robust and compelling case. There are no simple and general relationships between range condition, stocking rate and animal production such that a coherent, persuasive argument can be provided to landholders everywhere, that investment in the proper management of natural resources will yield sufficient production benefits.

There is consequently considerable difficulty in delivering programmes to service the multiple dimensions of rangeland management production, natural resource management and social objectives. There is a need to better engage with producers in the production-NRM domain through development of a compelling, economic-focussed value proposition, but also to recognise the tradeoffs between private and public interests in specific situations and the importance of public policy in reconciling these conflicts.

A review of current R, D & E program work relevant to the interaction between productivity and natural resource management indicates a considerable diversity of activity and that most relevant issues are being addressed to some degree. The program proposed is therefore more quantitative than qualitative in nature, aimed at increasing the specificity and precision of the information available to guide and support management decision-making rather than a radical new direction. However, delivery of acceptable technology to producers is constrained by inadequate coordination between activities (duplication, mixed messages etc.), insufficient linkage between productivity and NRM aspects in some mainstream activities, and in several cases, a lack of follow-up reinforcement of the message, and support for practice change.

This Draft R, D & E Plan was developed with the aim of improving both the coordination between all stakeholders in the production-NRM domain, and the content and delivery of products for land managers. It has sought to do so by using a set of guiding principles and objectives that arose from stakeholder consultation. These principles emphasise the interaction between production and NRM outcomes, and the importance of co-ordination and communication in achieving effective and consistent delivery. They include:

- Management and coordination would be centrally delivered, with advice obtained via Coordinating Committees, and via regional groups linked to NABRC.
- Effective integration across all parties (public and private sectors, NRM and production R, D & E ‘communities’) should be used to optimise use of scarce resources for rangeland R, D & E and ensure that synergies are achieved between contemporary programs;
- Empowerment of the R, D & E system through more effective networking initiatives, regional implementation strategies and greater involvement of women and youth.
- Effective internal collaboration, coordination and communication to ensure consistent delivery across all regions and projects.

- Effective external communication and collaboration to ensure that Plan activities are aligned with, and support, other 'third party' activities.

Key opportunities were identified to increase the profitability and productivity of businesses grazing livestock in the extensive native pasturelands in Australia, and the health and productivity of the lands being grazed, these include:

- Develop a coherent, well-structured and well supported network of learning opportunities available to all producers;
- Incorporate available environmental and economic information into an electronic 'knowledge system' that can provide real-time and predictive information to producers down to paddock scale;
- Increase basic ecological understanding across all regions and incorporate this information into progressively improving models of the grazing system;
- Determine how biodiversity can be sustained within land allocated for grazing;
- Identify constraints to the implementation of sustainable grazing and potential policy initiatives to reduce them. .

The goal and outcomes of the Plan are ambitious, envisaging over the next 20 years:

- A doubling of current levels of profitability (in real terms);
- Annual productivity growth reaching two per cent; and
- Measurable improvements in the condition of the land resource.

These ambitious targets are needed if the grazing industries in the rangelands are to survive financially and maintain a social licence to operate.

Delivery of the R, D & E activities will involve government and industry funding, and partnerships between organisations such as the Rangeland Alliance, Commonwealth and State Agencies, CSIRO, universities and non-government organisations.

The Draft R, D & E Plan presented in this report envisages an investment of $25 million[1] over 10 years to deliver on these objectives over 20 years.

Developing the Draft R, D & E Plan

Conversations were held with and/or written input was received from about 60 people in 36 organisations, across the categories below.

- State and Territory agencies responsible for livestock industry economic development in extensively grazed lands; and landscape-scale natural resource management (NRM) on extensively grazed lands;
- Commonwealth agencies with responsibility for agricultural industry development and regulation in the rangelands, and for investment in NRM in the rangelands;
- Individual producers and peak industry bodies;
- Member organisations of the Rangeland Alliance;
- CSIRO divisions involved in R, D & E in animal production, ecosystems sciences, and remote management systems in extensively grazed lands;

[1] Priced in 2013 dollars

- Other NRM organisations operating in the rangelands; and
- Specific researchers undertaking work closely aligned with the objectives of the project.

Input was sought on their issues and interest in the rangelands, their response to a draft R, D & E agenda developed by the project team, and their preparedness to be a funder, partner and/or provider. However, not all of these matters were covered with all organisations consulted.

The draft R, D & E Plan – opportunities

Developing a coherent, well-structured and well supported network of learning opportunities available to all producers.

There is a need for:

- Producers to see a clear pathway through learning opportunities to benefits for their own situation;
- Improved on-ground support for implementing changes introduced through training courses;
- Training to be focused around case studies and producer demonstration sites;
- Integration of the economic implications into grazing land management training;
- Learning opportunities to be presented in a manner that reflects the cultural context and operating environment of the participants; and
- Better learning opportunities in the southern rangeland areas.

Incorporating all available environmental and economic information into an electronic 'knowledge system' that can provide real-time and predictive information to producers down to paddock scale.

Real-time spatial and temporal information about estimated pasture condition (quantity and quality) and growth rates, predicted animal growth rates given the pasture information, market data, financial implications of different decisions, and seasonal forecasts is fast becoming available. Increasing the on-line availability and utility of relevant information will provide producers with a powerful tool to assist timely management decision-making. Providing analytical and interpretive support for the available information (e.g. through a consultant) will enhance its value.

Increasing basic ecological understanding across all regions and embedding this information into existing models of the grazing system.

Biophysical models (e.g. GRASP, PaddockGRASP, AussieGrass etc.) provide useful platforms for a range of information products targeted at supporting producer decision making. There is work required to improve their relevance in all rangeland regions, and to improve their utility in informing decisions down to paddock scale. Further basic research is required to develop the principles for the grazing management strategies required to maintain land condition or achieve transitions from lower to higher land condition classes.

Determining how biodiversity can be sustained within land allocated for grazing.

There is a need to determine the relationships between management for sustainable grazing off-take and the status of *in situ* biodiversity, and the trade-offs between biodiversity and production in re-designing production landscapes. Having a better understanding of these relationships will enable policy makers to implement more rational means of rewarding producers where they are managing for public good outcomes that may be in conflict with their private business objectives.

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The draft R, D & E Plan – goal and outcomes

The goal is ….. *Management systems developed and adopted that deliver sustainable business profitability and resource use in extensive grazing systems.*

The key objective is to ….. *Identify the conditions under which grazing management can deliver both improved economic productivity and NRM benefits and develop policy initiatives to address market failures that encourage grazing to the detriment of publicly desired NRM outcomes*.

The challenges facing rangeland managers are captured in this objective. While there is evidence that conservative grazing of extensive native pastures can be financially rewarding, it is also evident that managing for improvement in the condition of the resource can result in forgone income. The relationship between grazing activity and biodiversity on grazed land is not straightforward. The work done through the Draft R, D & E Plan will clarify the options for producers and policy makers in identifying what can be achieved in improved economic productivity and NRM benefits by producers acting alone, and where there is a case for public investment to address instances of market failure (as in best practice grazing management not generating publicly desired NRM outcomes).

The 20 year outcome is …. *100 per cent increase in grazing business profitability, rates of productivity growth in the extensive grazing industries of more than two per cent per year, with 90 per cent of grazed land having ground cover above regional erosion thresholds at the most vulnerable time.*

The rationale for the 20 year outcome is three-fold.

Average profitability in grazing businesses is insufficient to allow producers to make the necessary investments in infrastructure and grazing technology that will lead to improvements in the condition of the grazed lands. However, there is evidence that top-performing producers in all regions can generate good profits, and deliver NRM benefits. The challenge will be to take all producers to the standard of the top producers over the next 20 years.

The rate of growth in gross factor productivity over the period 1995-96 to 2006-07 in the northern Australian beef industry was 1.14 per cent per year. It is likely to have been lower in the sheep industry in the southern Australian rangelands. This rate of growth is insufficient to address long-term declining terms of trade, resulting in increased financial pressure on grazing businesses. A reasonable outcome for 2034 will be for productivity growth in the extensive grazing industries to be around two per cent per annum.

Ground cover is a recognised surrogate (one of 10 indicators) for the condition of biodiversity within grazed lands, and also for landscape stability and productivity. Its value as an indicator of productivity can be enhanced by refining the measure as the ground cover of 3P (palatable, perennial and productive) species. Ground cover needs to be measured at the time of year when it is most likely to be at its lowest (e.g. autumn in winter rainfall environments and spring or end of dry season in summer rainfall areas). It is important to note that this is a seasonal cycle not related to long droughts when ground cover may be below threshold regardless of management.

Four 'content' sub-programs are proposed with *15 year outcomes*:

- Sub-Program 1 – Adoption. *90 per cent of landholders in each Plan region have been involved in some aspect of the Plan by 2024*.
- Sub-Program 2 – Knowledge Systems. *Management to achieve joint productivity and NRM benefits is not limited by access to available information*.

- Sub-Program 3 – Perceptions and Policies. *The policy environment favours the delivery of socially desirable NRM outcomes through grazing industries that are recognised as legitimate and beneficial land uses*.
- Sub-Program 4 – Profitable grazing in healthy landscapes. *Regionally appropriate grazing management systems being adopted that deliver greater profits, productivity and NRM benefits including increased ground cover and biodiversity conservation in extensive grazing lands.*

A National Coordinating Committee will provide strategic advice to an overarching 'host' organisation and specific advice on that organisation's administration of national projects. A Northern Australian Coordinating Committee will provide strategic advice to the overarching 'host' organisation regarding the management of northern Australia-specific projects. A Southern Australian Coordinating Committee will provide strategic advice to a southern Australia 'host' organisation on the management of southern Australia-specific projects.

Recommendation

It is recommended the Draft R, D & E Plan as presented is accepted, and be further developed for implementation through a workshop of key players from relevant Commonwealth and state and territory agencies, the North Australia Beef Research Council, CSIRO and the Rangelands Alliance.

It is not expected that MLA will be able or indeed should fund this Plan in isolation of other investors. Shared investment is recommended. The Plan provides a basis to enable investors to provide funds in a value-adding fashion that addresses identified needs in delivering more coordinated R, D & E focusing on linked profitability, productivity and NRM outcomes.

1

Introduction

This Final Report presents an **Investment Plan for natural resource management (NRM) within livestock production systems of Australia's rangelands** in the form of a Draft Research, Development and Extension (R, D & E)Plan.

The Final Report has been prepared for Meat & Livestock Australia (Project ERM.0094).

The scope of this deliverable includes:

- achievement of each objective and completion of topics in the Additional Details of the Agreement section (shown in **Appendix A**) ;
- updated draft R, D & E plan following consultation;
- documented support in-principle for the plan received from stakeholders;
- recommendations to MLA on improving the development process of R, D & E programs; and
- recommendations to MLA on next steps.

This Final Report was prepared between October and December 2013.

1.1 Objectives

The objectives for formulating an Investment Plan for natural resource management (NRM) within livestock production systems of Australia's rangelands are as follows (*taken from the Agreement between URS and MLA*).

1. Develop a draft Research, Development and Extension (R, D & E) Business Plan to address NRM issues in Australia's rangelands that has sufficient detail to assist investment decisions in areas of mutual benefit to stakeholders and has the in-principle support of those stakeholders. The program should be based on a 10 year investment (2014-2024) in a rangelands program with specific outputs (at 2019 and 2024) and an overall outcome (2034).
2. Develop the R, D & E business plan in direct consultation with both the development, extension, communication and extension activities of the Australian Rangelands Initiative (via the Rangelands Alliance[2]), research organisations and livestock producers to address the NRM issues impacting on, and within a livestock production business context.
3. Develop a situational analysis that provides the business case for investment, collating information including the "health" status of the rangelands, natural resource and productivity issues faced by producers, and the strategic priorities of research and delivery organisations and the Federal government.

1.2 Methodology

1.2.1 Preparing the Situation Analysis

Review of documentary information

URS has reviewed and cited the recent literature that describes the state of the rangelands grazing economy. Included are reports related to northern Australia prepared for Meat & Livestock Australia (MLA) (e.g. McCosker *et al.* 2010) and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (e.g. Gleeson *et al.* 2012), and reports prepared by state agencies (e.g. Herbert 2009 in Western Australia).

[2] The Rangeland Alliance comprises 13 Regional NRM Organisations that are wholly or partly located in the rangelands.

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URS also reviewed and has cited relevant NRM literature including the Australian Collaborative Rangeland Information System's (ACRIS) *Tracking the Changes 2008* report (and component jurisdictional reports) which provide comprehensive information describing the environmental situation in the grazed rangelands; and the *State of the Environment Report 2011* which presents useful summary data. The references cited and reviewed are presented in Section 9.

Initial consultation

The initial producer and NRM group stakeholder consultation was undertaken by emailing a personal invitation and a briefing paper and questionnaire to a targeted group of some 50 producers, corporate pastoral businesses and NRM groups. Each member of the target group that did not initially respond was reminded with a personal email with a follow up request to participate in the survey.

The Briefing Paper, followed by a series of questions, related to (i) NRM and productivity issues and (ii) options for the structure of a R, D & E Program, is shown in **Appendix B**. The options posed by each question were developed from URS' review of the state of the rangeland economy and the team's own professional experience working with grazing industries in the rangelands. This process was designed to solicit suggestions, and test ideas for the structure of a R, D & E program that addresses natural resource management issues within the context of a livestock production business.

A total of 18 responses was received and analysed - eight from Regional Natural Resource Management Organisations (RNRMOs) and 10 from producers or producer organisations. These responses informed the design of the Draft R, D & E Plan. **Appendix C** provides a list of the stakeholders that responded.

Strategic priority areas – producers and R, D & E providers

MLA and the potential investment partners - Regional NRM Organisations, the Commonwealth Government (through programs including *Caring for our Country*), CSIRO and State agencies – have many options for investment of their limited R, D & E resources. URS reviewed the strategic plans of the North Australia Beef Research Council (NABRC) and the Rangeland Alliance (RA) members, and the investors listed above, to identify those challenges that are most closely aligned with the intent of the MLA Terms of Reference (ToR).

The approach to identifying the priority areas was targeted to those:

- contributing to 'rangeland health';
- related to or contributing to grazing productivity; and
- aligned with the objectives of MLA and potential investment partners.

Past and current R, D & E into productivity/NRM.

URS completed a 'R, D & E situation analysis', by documenting past (approx. last five years) R, D & E activities, and the current R, D & E activities of potential investors in the areas of mutual interest. The R, D & E situation analysis was undertaken primarily by reviewing the websites of potential investment partners involved in R, D & E in the rangelands, and programs and projects being operated by the 12 Regional NRM Organisations that comprise the Rangeland Alliance (RA). URS also reviewed the activities of Non-Government Organisations that receive external funds from potential investment partners. Finally, information was obtained on programs across the rangelands from proceedings of

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the biennial conferences of the Australian Rangeland Society over the last 4 years; and contacts in state agencies and CSIRO.

Some 214 projects or activities from 32 organisations were categorised (some representing components of larger, cross-agency programs). The list of R, D & E programs was sorted for those activities that are relevant to the Terms of Reference i.e. that have reasonable scale of applicability, address inter-linked NRM and productivity issues, demonstrate a capacity to influence management behaviour, and are based on sound experimental design or data collection and analysis protocols. Fire-related activities were not included given that this is the subject of a parallel MLA-funded project.

An effort was also made to summarise the activity and findings of each project, the length of each project, funding source and size, type of funding, the relative effort directed to research, development or education, and any evaluation process or measure of success that might have been indicated. While details on the activity and findings of most projects could be obtained, data for other parameters were largely incomplete unless assigned subjectively.

A 'gap analysis' between requirements and existing/ past work

Past and current R, D & E work was compared to the identified issues to define gaps in the past and current R, D & E – particularly those of most relevance to MLA and which are within the scope of other potential investment partners.

The list of 'gaps' or 'options' has been sorted according to those where investment is feasible. This required that:

- Options address issues relevant to and/or aligned with the objectives of MLA and potential investment partners;
- Outputs from a R, D & E program in the domain area will deliver beneficial NRM *and* productivity outcomes in industry sectors with a sound future;
- There is capacity/ alignment within R, D & E organisations in the rangelands to deliver a successful project/ program;
- There is no duplication of existing R, D & E; and
- There is likely to be support for the program from producer organisations and producers.

The assessment was done subjectively and qualitatively, based on the information gained in the steps above, and the team's knowledge and experience of what is likely to work in the rangelands. The preference is for an investment in technology that has the potential to produce a major, rather than incremental, improvement in productivity while facilitating restoration of the natural resource base. Further, if R, D & E organisations and producers are involved in research sites, case studies and demonstration activities, considerable emphasis will be placed in the planning phase on the type and quality of evidence that would constitute an acceptable measure of success.

Emerging issues around capacity, funding etc.

Information on the available capacity (human, financial) was assessed at desktop level by determining the staff numbers and funding allocated to rangeland R, D & E.

Annual Reports for the 11 members of the Rangeland Alliance with grazing activities within their boundaries provided information on the numbers of staff and the annual expenditure for these organisations. This was divided into core funding, and project-specific expenditure.

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NABRC has calculated the human resources available in state agencies, universities and CSIRO to support R, D & E in northern Australia. Information on resourcing for these organisations in the southern rangelands was obtained by direct inquiry.

The value of current investment by MLA in R, D & E related to natural resource management and animal production in the rangelands was estimated from the existing portfolio of investments.

1.2.2 Preliminary Draft R, D & E Plan

The Draft Situation Analysis and considerations for a R, D & E Plan were presented to MLA, and refined after feedback. A Draft Discussion Paper, based on the Situation Analysis was attached to a Preliminary Draft R, D & E Plan and presented to the Rangeland Alliance on 5 September 2013. After receiving general approval for the concept from the Rangeland Alliance members, a set of projects was outlined and added to the Preliminary Draft R, D & E Plan.

1.2.3 Stakeholder consultation

Consultation based on the combined Draft Discussion Paper and Preliminary Draft R, D & E Plan focused on organisations that are funders and/or providers of R, D & E in the rangeland grazing industries. The list of those organisations consulted is shown in **Appendix D**. The organisations were in the following categories.

- State and Territory agencies responsible for livestock industry economic development in extensively grazed lands;
- State and Territory agencies responsible for landscape-scale natural resource management on extensively grazed lands (note: where this responsibility is not discharged by the agencies referred to in the previous category);
- Commonwealth agencies with responsibility for agricultural industry development and regulation in the rangelands, and for investment in natural resource management in the rangelands;
- Member organisations of the Rangeland Alliance;
- CSIRO divisions involved in R, D & E in animal production, ecosystems sciences, and remote management systems in extensively grazed lands;
- Other NRM organisations operating in the rangelands; and
- Specific researchers undertaking work closely aligned with the objectives of the project.

In each case, feedback was obtained on the organisation's interest in the R, D & E agenda, the sub-programs/ projects of specific interest, changes/ additions to the R, D & E activities that could be considered, and preparedness to be a funder, partner and/or provider.

1.2.4 Finalising the Draft R, D & E Plan

The stakeholder feedback and input was analysed by the project team and amendments made to the goal, outcomes, structure and content of the Plan. A Plan Logic was prepared showing 20 year and 15 year outcomes, and 10, five and two year outputs. Projects were detailed in respect of outputs, methods, suggested investors and deliverers. An indicative 10 year budget was prepared.

1.2.5 Confirming stakeholder in-principle interest

The most important requirement for the Draft R, D & E Plan is in confirming interest in managing and coordinating Plan delivery. Three organisations were approached for their interest in undertaking this role. The responses are presented in Section 7.1.

1.3 Some important definitions

Some definitions of terms used throughout this Report are presented below. Although there are a number of definitions of these terms in the literature, the definitions presented are taken, where possible, from official Australian Government sources.

Rangelands

Two statements are presented below in defining the rangelands.

1. About 81 per cent of Australia is broadly defined as rangelands. This part of the country is known to most Australians as the Outback. The rangelands are home to many of Australia's Indigenous people and are culturally important for most Australians.

Rangelands extend across low rainfall and variable climates, including arid, semi-arid, and north of the Tropic of Capricorn, some seasonally high rainfall areas. They include a diverse group of relatively undisturbed ecosystems such as tropical savannas, woodlands, shrublands and grasslands. From an ecological perspective, 53 of Australia's 85 bioregions include rangeland ecosystems and 12 are located entirely within the Rangelands. Together, they cover a huge diversity of habitats and ecological communities (www.environment.gov.au/topics/land/rangelands).

2. There is no clearly defined boundary to the rangelands. Boundaries move according to climatic conditions. Many areas adjacent to rangelands should be managed in similar ways and indeed many of the ecological, economic and social issues of these adjacent areas are similar to those of the rangelands (Commonwealth of Australia 1999).

Approximately 3 million km^2 of the rangelands are allocated for grazing livestock. As noted in the second statement above, the boundary between rangelands and more intensively grazed/ farmed land is not clear. In Queensland and NSW in particular, the scope of this project includes those areas supporting mixtures of introduced and native pastures that lie outside the accepted rangeland boundary. In these states the term 'extensively grazed areas' encompasses these lands and the drier rangelands.

Natural Resource Management

The definition taken from the Caring for our Country website is presented below (see www.nrm.gov.au/about/nrm/).

The Departments of Environment and Agriculture, Fisheries and Forestry share responsibility for delivery of the Australian Government's environment and sustainable agriculture programs, which are broadly referred to as natural resource management (NRM).

Australia's environment is at the centre of our national identity and our economy. Australia derives a significant proportion of the nation's wealth from its environmental assets, including agriculture, mining and tourism.

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These environmental assets provide crucial ecosystem services such as regulating the climate, purifying water, absorbing and transforming wastes, preventing disease and providing the genetic resources that are the basis for many medicines.

There will be significant costs to the Australian economy and the welfare of all Australians if these assets are allowed to degrade. They are very expensive, and sometimes impossible, to replace.

Total grazing pressure management.

The accepted definition of total grazing pressure below comes from Fisher *et al.* (2004).

Total grazing pressure in the rangelands is the combined grazing pressure exerted by all stock – domestic and wild, native and feral – on the vegetation, soil and water resources of rangeland landscapes. Generally total grazing pressure has two components, domestic stock that is managed, and wild stock that is largely unmanaged (Fisher et al. *2004).*

In practice, total grazing pressure (TGP) Management is a loose 'catch-all' term, and it means different things to different people. For some it relates simply to the control of feral and native herbivory, without necessarily a concomitant emphasis on control of domestic grazing pressure. However, feral and native herbivory (by vertebrates) have limited presence in much of the grazed rangeland 'outside' the Dog Fence. For others it is about controlling all herbivory, but without reference to the decisions required. For yet others, it refers simply to the technology – as in self-mustering yards and fencing to exclude or contain feral grazers.

In this Plan, TGP management is interpreted as deciding the level of utilisation at any point in space or time – referred to in the Plan as the level and timing of grazing use – and the decisions or actions required to achieve it.

Northern and Southern Australia

The grazed rangelands can be broadly divided into those in northern Australia and southern Australia, with the Tropic of Capricorn being an approximate demarcation line. The former receive relatively reliable summer rainfall and comprise tussock grasslands and savannah eucalypt woodlands. They have relatively high productivity.

The southern rangelands have less reliable seasons and comprise a mixture of semi-arid shrublands and acacia/eucalypt woodlands. They are generally of lower productivity.

Administrative boundaries align only approximately with this demarcation. Hence, in this Report, 'northern Australia', or the 'northern rangelands' includes the whole of extensively grazed native and partially modified grasslands in Queensland, all of the Northern Territory and the Kimberley and Pilbara regions of Western Australia.

'Southern Australia', or the 'southern rangelands' includes the rangelands of western NSW, South Australia north and south of the Dog Proof Fence, and Western Australia south of the Pilbara, including the Upper Ashburton, Gascoyne, Murchison, Goldfields and Nullarbor regions.

1.4 About this Report

Section 2 summarises the situation analysis undertaken as background to the preparation of the draft R, D & E Plan. The analysis covered the financial health of grazing businesses in the rangelands, the state and trends of the land resource supporting livestock grazing, and recent and current R, D & E activities.

Section 3 presents the considerations in designing a new R, D & E Plan linking natural resource management and livestock production objectives, including issues, priorities and gaps identified by organisations and other stakeholders.

Section 4 summarises stakeholder feedback on the Preliminary Draft R, D & E Plan, and suggestions for changes and/or additions. The stakeholders consulted are shown in **Appendix D**.

Section 5 uses the material in the previous two sections in finalising the content of the Draft R, D & E Plan. The criteria for deciding what, and what not to include, and how priorities were set are presented.

Section 6 presents the Final Draft R, D & E Plan. This is designed to be lifted from this Report and read as a stand-alone draft document. It includes an Abstract, a Preamble, a review of past and current R, D & E activities, a revised goal, key objective and outcomes, process and content principles for the R, D & E, Plan structure, logic, justification and project detail. An indicative, estimated budget is presented for consideration by MLA.

Section 7 lists organisations that have expressed in-principle support for involvement in the management and delivery of the Draft R, D & E Plan.

Section 8 presents recommendations for how the Draft R, D & E Plan should be developed further, and also recommendations, based on the experience in developing this Plan, for developing future R, D & E Plans.

Section 9 lists all of the references that have been reviewed and those cited during the course of the project.

The **Appendices** provide supporting information about the processes and organisations involved in stakeholder engagement.

2

Situation analysis

2.1 Summarising the economic status of rangeland enterprises

2.1.1 Livestock numbers and distribution

The pastoral economy in the rangelands is increasingly focused in northern Australia, with the numbers shown in Table 2-1 and Table 2-2 presenting approximate cattle and sheep numbers being grazed in the Australian rangelands in 2012, based on the survey data presented by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). ABARES provides the standard errors around their estimates, which suggests that these estimates can be used to show the relative importance of the different rangeland regions in supporting livestock.

As shown in Table 2-1, over half of the rangeland cattle herd is grazed in Queensland, with about 90 per cent of the herd in the 'northern rangelands'. Cattle numbers have increased across northern Australia from about 6.7 million to 8.5 million since 2000. Cattle numbers have also increased more rapidly in the 'southern rangelands', especially in Western Australia and South Australia, although the total numbers remain relatively low when compared to northern Australian numbers.

Table 2-1 Approximate cattle numbers in the rangelands in 2012

Year	Total for the rangelands	Kimberley and Pilbara	Northern Territory	Queensland	Western NSW	South Australia	WA southern rangelands
2000	8,000,000	750,000	1,560,000	5,175,000	190,000	195,000	130,000
2012	9,125,000	800,000	2,100,000	5,600,000	200,000	250,000	175,000
		Total for northern rangelands			**Total for southern rangelands**		
2012	9,125,000	8,500,000			625,000		

Source: derived from ABARES survey data

As has occurred throughout Australia, sheep numbers have declined sharply across the rangelands since 2000, with very few now being grazed in some parts, especially in the southern rangelands of Western Australia. With the loss of sheep infrastructure, and reduced labour availability, this shift will be permanent. Hacker (2010) noted that within the last decade in particular, the rangeland sheep industry has been contracting into NSW and South Australia and that in the long run it may be confined exclusively to the area south and east of the Dog Proof Fence.

Table 2-2 Approximate sheep numbers in the rangelands in 2012

Year	Total for the rangelands	Queensland	Western New South Wales	South Australia	WA southern rangelands
2000	14,900,000	6,400,000	5,100,000	1,500,000	1,900,000
2012	6,900,000	2,300,000	3,000,000	1,500,000	about 200,000
		Total for northern rangelands	**Total for southern rangelands**		
2012	6,900,000	2,300,000	4,700,000		

Source: derived from ABARES survey data

In summary, over 80 per cent of the livestock (on a LSU basis) are grazed in northern Australia (Pilbara, Kimberley, Northern Territory and Queensland). This dominance has increased since 2000.

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2.1.2 Financial health of northern Australian pastoral businesses

Financial returns

Table 2-3 summarises financial performance for beef cattle businesses across northern Australia for three years to 2011-12 (taken from Thompson and Martin 2012).

Table 2-3 Business financial performance, northern beef industry

Item	2009-10 *	2010-11 p	2011-12 y*
Farm cash receipts			
Beef cattle	268 585	304 630	303 700
Total cash receipts	***371 459***	***407 870***	***404 600***
Total cash costs	***335 282***	***317 180***	***285 700***
Farm financial performance	36 177	90 690	118 900
Farm cash income	-9 976	43 580	90 900
Rate of return			
Excl. capital appreciation	0.6	1.6	2.5
Incl. capital appreciation	-1.7	-2.3	na

p Preliminary estimate y Provisional estimate na not available

* Source: Thompson and Martin 2012, p.12

In a separate study, McCosker *et al*. (2010) analysed the situation in the northern Australian beef industry, in a study funded by Meat & Livestock Australia (MLA). This work preceded the live cattle export issues that arose in 2011. Their findings for the northern areas were:

- The average return on assets across all areas in 2009 was between 0.3 and 2.0 per cent, with average beef producers spending more than earnings in 6 of the previous 7 years.
- Increasing land values have encouraged high debt levels, with debt levels doubling on a 'per LSU' basis over the decade to 2010. Finance ratios (finance costs/ gross product) have reached 20 per cent which given low return on assets, means the average (?) business was at risk (note – declining land prices since 2010 have resulted in negative returns on assets when change in asset values is considered).
- Queensland data show that the number of animals required to meet fixed (overhead) costs increased over the decade from 1,123 to 2,504.
- The poor reproductive (?) performance of the extensive breeder herd is contributing to poor business performance.
- Production (kg/ha) was approximately the same indicating that differences in profit originated more from the combination of number of animals/scale of operation, higher individual animal productivity and lower stocking rates, skills of the manager and associated running costs.

Better business performance was found to be related to the number of animals/ scale of the operation, individual animal productivity, skills of the manager and associated running costs. The quality of strategic and management decisions around overheads and scale was found to be paramount in determining profitability (adapted from McCosker *et al.* 2010, pp. 3-4.). Other observations were that more profitable operations utilised plant more effectively, contained overhead costs, and had higher output per animal (6.8 per cent more kg beef per LSU).

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Land values and debt levels in northern Australia

Land values across the northern rangelands increased by at least 250 per cent in the period from 1999 to 2008 (McCosker *et al.* 2010). This equates to an average of 14.7 per cent per year – well above annual inflation rates. Lesser increases occurred elsewhere in the rangelands (ACRIS 2008).

Generally, increases in land values were far more than could be accounted for by increases in productivity and financial returns. For established rangeland pastoral enterprises, the increase represented a substantial boost in asset wealth.

In the last two to three years, land values have fallen in the same regions, as result of lower cattle prices and market uncertainties. This has eroded equity, and resulted in negative returns on assets when change in asset values is included (see Table 2-3).

Business debt levels for family businesses across the northern live cattle export region increased from an average of $280,000 in June 2000 to $650,000 in June 2011. This represented an increase over the 11 year period of 232 per cent in real terms (Gleeson *et al.* 2012, p. 42). The rapid increase in average debt levels across the northern cattle industry suggests that many property transfers at the higher prices referred to in the previous paragraphs involved significant external funding, and these businesses may be under greater pressure to maintain a return on equity, and hence to overstock. However, it is worth noting that debt has increased across agricultural enterprises in most regions of Australia in the same period, although the northern live cattle export region experienced one of the largest increases.

Productivity growth

Estimates of total factor productivity (TFP) growth for the northern Australian beef industry over the period from 1977-78 to 2006-07 developed by Nossal *et al.* (2008) are reported in Gleeson *et al.* (2012) and presented in Table 2-4.

Table 2-4 Total factor productivity growth in the northern beef industry

Item	Number of businesses (% of total)	TFP growth (%)	Output growth (%)	Input growth (%)
All properties				
1977-78 to 2006-07	10,174 (100%)	1.05	0.71	0.34
1977-78 to 1995-96	5,696 (56%)	0	-0.94	-0.94
1995-96 to 2006-07	4,478 (44%)	1.14	1.90	0.76

Source: Nossal *et al.* (2008) reported in Gleeson *et al*. (2012), p. 63.

The results show no growth in productivity between 1977-78 and 1995-96, with 1.14 per cent TFP growth after 1995-96. The improvement in the northern industry was driven by relatively strong output growth (which may reflect the growth of the live export market) and modest input growth. Larger properties tended to have higher productivity growth than smaller businesses. Properties with more than 1,600 head had annual TFP growth of 1.88 per cent between 1977-78 and 2006-07, whereas properties with between 400 and 800 head had 0.24 per cent annual productivity growth over the same period (Nossal *et al*. 2008).

More recent information (Martin *et al.* 2013) reports average annual productivity growth in the northern Australian beef industry as 1.0 per cent, comprising average output growth of 0.6 per cent and input

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growth of -0.4 per cent. This compares unfavourably with cropping which experienced TFP growth of 1.9 per cent between 1977-78 and 2007-08 and general broad acre agriculture which experienced 1.4 per cent TFP growth over the same period (Nossal and Sheng 2010).

Future productivity growth in rangeland grazing industries will rely on technological developments that improve operating efficiency, the widespread adoption of existing technologies, and structural adjustment as less efficient businesses cease operations or are absorbed into larger enterprises.

2.1.3 Financial returns in southern Australian grazing businesses

NSW pastoral zone

The pastoral zone in NSW, which includes all of the Western Division of the state, mainly supports small stock enterprises with some opportunistic cropping at the higher rainfall margins to the south and east of the zone. In 2006, there were about 5 million sheep in the region. Over recent years there has been some shift from wool sheep to meat sheep and goats, with a modest increase in the number of cattle grazed.

ABARES survey data for key indicators were obtained for the period 2007 to 2012, and these are presented in Table 2-5. Although the standard errors (not presented) for some items are high, the data suggest that the financial situation for pastoral zone businesses improved in the years after 2008, presumably as a result of rising wool prices through this period and improved seasonal conditions. As a consequence, farm business profits have been positive over the three years to 2012, debt levels have declined, and the return on capital has been favourable. Of course, it is not possible to determine if this improvement in the operating environment is sustainable.

In particular, it is evident that there was considerable capital appreciation in the zone between 2009 and 2011. This capital appreciation occurred through a period of favourable seasons, which may have influenced investor decisions, coming as it did after a sequence of below average years.

Table 2-5 Performance of pastoral zone businesses in NSW 2009-2012

Item	2007	2008	2009	2010	2011	2012
Farm cash income ($)*	19 942	49 413	67 750	108 940	198 701	121 007
Non-farm income ($)	34 077	23 291	38 300	17 760	14 605	37 939
Equity (%)	iss	84	88	85	87	89
Debt ($)	670 683	486 137	341 558	558 366	452 419	334 000
Farm business profit ($)	-85 745	-23 990	-30 361	10 844	185 120	56 396
Profit at full equity ($)	-31 767	14 095	1 887	51 762	221 275	88 332
Return excl cap appreciation (%)	-1	0	0	1	6	3
Return incl cap appreciation (%)	2	1	2	11	8	3

* total cash receipts – total cash costs ** iss – insufficient sample size

Survey data from ABARES. All figures are in 2012-13 dollars

South Australian and Western Australian southern pastoral areas

Table 2-6 presents ABARES survey data for pastoral zone businesses in South Australia through recent years. The South Australian pastoral industry is divided between mainly sheep enterprises

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south of the Dog Barrier Fence, and solely cattle enterprises north of the Barrier Fence. Readily available ABARES data are provided for the whole of the SA pastoral zone and do not distinguish between the two types of operations. Hence the data presented in Table 2-6 are an amalgam of the two enterprise types. Although it is difficult therefore to interpret the data, it is evident that on average, South Australian pastoral businesses have enjoyed good returns since 2010, with high profits and returns on assets.

Table 2-6 Performance of pastoral zone businesses in SA 2009-2012

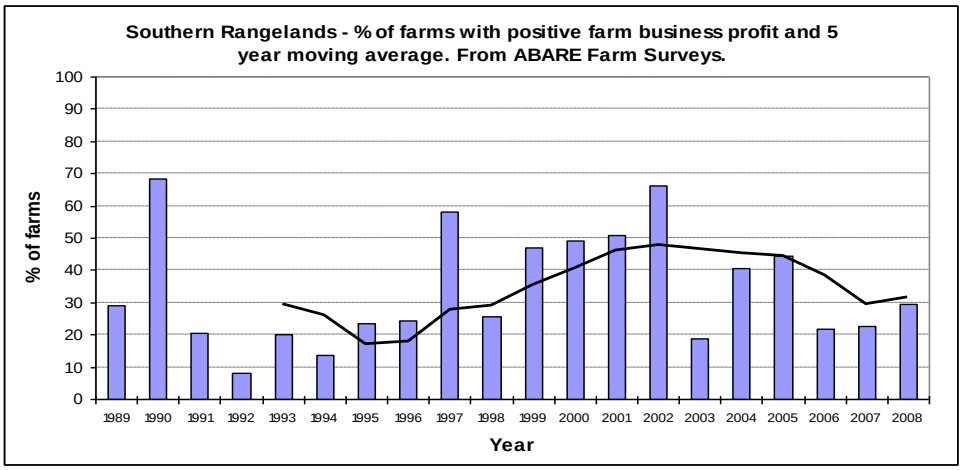
Item	2009	2010	2011	2012
Farm cash income ($)*	45 416	23 414	160 808	231 494
Non-farm income ($)	41 711	48 137	43 137	31 370
Equity (%)	90	84	86	90
Debt ($)	214 440	401 046	381 455	247 340
Farm business profit ($)	-95 605	9 155	206 919	219 345
Profit at full equity ($)	-68 719	44 552	241 977	246 507
Rate of return excluding capital appreciation (%)	-2	1	6	7
Rate of return including capital appreciation (%)	-2	5	8	7

* total cash receipts – total cash costs. Survey data from ABARES

The southern rangelands of Western Australia extend from the south of the Pilbara taking in the Gascoyne and Murchison regions and the western Nullarbor Plain. This large area (about 50 million ha) has a potential capacity to support about 3.7 million small stock units (SSU), or about 500,000 large stock units (LSU). Traditionally a sheep grazing area, there are now relatively few sheep remaining in the area, with cattle numbers increasing.

The most recent review of the financial situation of pastoral leases in this area in Western Australia was completed by Herbert (2010). Figure 2-1 is taken from that report.

Figure 2-1 Southern rangelands- percentage of businesses with positive farm business profit



Although the sample of businesses is not large, the data show that in nearly all years between 1991 (when the Wool Reserve Price Scheme collapsed) and 2008, less than 50 per cent of pastoral businesses have been delivering a positive profit from grazing activities. Anecdotal advice is that a

high proportion of pastoral businesses in the southern rangelands are now supported by income derived from non-pastoral activities (e.g. contract work for mining companies and local governments and 'station stay' tourism).

2.1.4 In summary

The most recent available data suggest that many pastoral businesses across Australia are generating low returns, are supporting high debt levels, and have declining equity. Returns on assets in recent years have been modest at best, with the average ROA across the last three to four years, and across all regions being 1.5 per cent, with a range of between -7 to +7 per cent. When recent declines in asset values are considered the returns are lower still. Not surprisingly, there is considerable variation evident in business performance within regions, with high performing businesses having advantages of scale, better management of the natural resource base and better cost control. However, increasing debt levels and declining equity are putting poorer performing businesses at risk of failure in the near future.

Northern Australia

Cattle businesses in northern Australia have been making poor returns on assets for many years. Recent returns on assets (ROA) in northern Australia have been modest at best, with the average ROA across the last three to four years have between -1.7 and 6 per cent, and mainly around one to two per cent. When recent declines in asset values are considered the returns are lower still. Debt levels are especially high in northern Australia where external borrowing was used to purchase high priced land in the period 1999 to 2010 (see McCosker *et al*. 2010).

Southern Australia

Businesses in South Australia and New South Wales appear to have fared better than those in other regions in the last three years, and debt levels are relatively low. Western Australian businesses in the southern rangelands have experienced a long period of poor returns, and many are looking for off-property income earning prospects.

2.2 State and trends of rangeland natural resources

2.2.1 The state of the rangelands

There is no argument that a substantial proportion of the land and vegetation resources of the grazed rangelands has been altered as a result of more than a century of grazing by domestic livestock, and related perturbations associated with fire frequencies, weed infestations, and feral animal grazing. Area-based quantitative data, as shown for Western Australia and northern Australia (including Queensland) shows altered vegetation and loss of landscape function across many rangeland areas (see for example *State of the Environment 2011* and Waddell *et al.* 2010).

Given that the baseline in the rangelands in most situations is a lower level of landscape function and altered vegetation composition, the national and industry objective must be an improvement in these characteristics.

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2.2.2 Recent trends

Valid commentary on trends at 'whole-of-rangeland' scale can now be provided via information from the Australian Collaborative Rangeland Information System (ACRIS) and its collaborating organisations. The most recent national report was *Rangelands 2008 — Taking the Pulse* (ACRIS 2008), which reported trends between 1992 and 2005 in a range of indicators across the rangelands.

A review of the available information from ACRIS (2008) and the supporting jurisdictional reports is that the rangelands are not highly dynamic. Expected rangeland improvement (as measured by change in landscape function) occurred on only a small percentage of sites through a generally favourable sequence of seasons between 1992 and 2005 in parts of many bioregions, although in some, this favourable situation has been accompanied by increases in stock numbers and the total area accessible to grazing. However, a favourable response to these good seasons was not observed in most areas (where 'no change' was reported) – highlighting the lack of dynamism referred to above – with a concerning decline seen in some situations.

The ACRIS Reports suggest a downward trend in biodiversity throughout the rangelands (citing declines in bird numbers as the main evidence), although this could result from many factors apart from grazing impacts, including weed and pest infestations and loss of habitat in some more closely settled areas. Effective monitoring of biodiversity remains a challenge. Ground cover is one of 10 indicators of biodiversity and it is regarded as an important measure of range trend by agencies of the Commonwealth Government. Both the ACRIS partners and ABARES are currently working to increase the capacity to measure and report ground cover at regional scales (Gary Bastin, *pers comm*.).

Fire regimes in northern Australia and in the areas affected by Invasive Native Scrub (INS) are not managed sufficiently at landscape scale to optimise either rangeland condition (including biodiversity status) or productivity outcomes.

In summary, the available data from the ACRIS and other investigations suggest that trends in the Australian rangelands are largely tracking along trajectories driven more by seasonal conditions and less by animal numbers and management, although there are exceptions. In short, current management will not support the achievement of the national and industry objective of range improvement.

2.2.3 Relating poor resource condition and productivity – a challenge

The relationship between rangeland condition and animal production is not straight-forward. There is conflicting information in the literature about how much livestock productivity is lost as a result of ecological rangeland deterioration; there is evidence that the relationships between range condition, stocking rate and animal productivity are not linear; with lags occurring between excessive grazing, and the resultant rangeland deterioration and any loss of productivity. Finally, rangeland deterioration often occurs as an un-costed externality to the performance of the grazing business. Further, based on the analysis of the northern cattle industry by McCosker *et al.* (2010), it is likely that business management factors are more significant in driving overall business performance than management of the natural resource base.

Therefore, while the ACRIS information discussed in the previous section is of great value to rangeland managers in government and Regional Natural Resource Management Organisations (RNRMO), it is unlikely to be of value to individual managers of grazing businesses. It is also unlikely

that the available information in the public domain will encourage changed management behaviour on the part of rangeland producers.

2.3 Past and current R, D & E

R, D & E projects and programs that relate to productivity and NRM were summarised. As shown in Table 2-7 some 214 projects were described and assessed, of these 115 (54%) target northern Australian issues, 73 (34%) address issues in southern Australia, and 26 (12%) are national programs.

Table 2-7 Summary of numbers of rangeland and NRM projects by zone and agency

Projects	Total	North	South	National
Total linked NRM / productivity projects	214	115	73	26
		54%	34%	12%
Projects conducted by:				
Regional NRM groups	67	35	32	0
		52%	48%	0%
MLA	26	14	5	7
		54%	19%	27%

The data in Table 2-7 is likely to underestimate the total activity in these domains, but the data provide an indication of the scale of the work underway.

Of all the projects identified some 67 programs/projects are delivered via the Regional NRM Organisations and 26 are MLA programs/projects. MLA projects appear to be more strongly aligned with northern areas and national coverage than do the NRM group projects. The Regional NRM Organisation projects are evenly allocated to northern and southern areas, which may reflect the geographic distribution of the groups. A summary of the activities is presented below.

2.3.1 Research and extension organisations

An assessment was made of the human resources available to support R, D & E that links NRM and grazing employed within State, Territory and Commonwealth agencies. In developing this list, attention was focused on agencies related to primary industry or agriculture.

NABRC's *Research, Development and Extension Priorities Prospectus for the Northern Australian Beef Industry* (NABRC 2012) lists 78 people in different organisations working in the related areas of grazing land management, optimum feedbase management, precision grazing management, technology and empowered R, D & E networking across northern Australia. About half of these people are employed by the Queensland Department of Agriculture, Fisheries and Forestry (QDAFF).

In southern Australia, resources are fewer, with an estimated 20 people in state agencies working in these R, D & E domains.

A summary of the activities being undertaken by State, Territory and Commonwealth R, D & E agencies follows.

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- The ACRIS suite of activities (undertaken by State agencies and CSIRO) provides information on the state and trends in a variety of environmental, economic and social rangeland indicators. The information is usually presented at the scale of bio-geographical regions.
- Understanding the interactions between fire, grazing management, climate change, biodiversity and carbon stocks and flows, and the implications for rangeland trends, production economics and the resilience of grazing businesses features in work being undertaken in a number of locations and by a number of organisations in northern Australia.
- Defining better approaches to grazing management and incorporating the findings into 'best management practices' for improved animal productivity also occurs in northern Australia, including development of tools for precision pastoralism, and remote management technology. This work is linked to the economic interpretation of findings from major grazing studies in Queensland (Wambiana study) and the Northern Territory (Pigeon Hole study, studies at Kidman Springs). At least one new major grazing study is commencing, being established in central Australia.
- There are some case studies and a number of producer demonstration sites operating.
- In at least one case, the driver for R, D & E in better grazing management in northern Australia is linked to the need to manage an externality as in the impact of sediment run-off from grazed land on the health of the Great Barrier Reef.
- In the southern rangelands, R, D & E into feral goat management, total grazing pressure and new enterprises based on domesticated goats and new sheep breeds is being undertaken.
- Research into the long-term management of species that have both production benefits and invasive characteristics e.g. buffel grass (*Cenchrus ciliaris*) is being undertaken by CSIRO.

2.3.2 Regional Natural Resource Management Organisations

The Australian Government, in association with State and Territory governments, has identified 54 NRM regions, supported by Regional NRM Organisations (RNRMOs) covering all of Australia. Twelve of these include areas defined as rangelands within their boundaries.

The RNRMOs in Western Australia, Northern Territory and Queensland are incorporated bodies, without statutory responsibilities. These organisations, which are strongly supported by the Commonwealth Government have Boards of Management, permanent staff, and project-related staff. The non-statutory Regional NRM Organisations receive varying levels of cash and in-kind core funding support for corporate governance. Other than those sources, all funding is project-based via investments by mainly the Commonwealth Government, but also the State and Territory governments.

The RNRMOs organisations in NSW and South Australia are statutory. They have their own Boards of Directors, and report to responsible Ministers. As such they are more constrained in their activities than non-statutory RNRMOs, but have a more secure status and funding base.

All of the RNRMOs have done or are undertaking relevant activities on grazed rangeland. URS reviewed 67 projects being undertaken by the Regional NRM Organisations (RNRMOs) in the rangelands, with most of the investment supported by Commonwealth Government funding. A summary of the activities follows:

- All RNRMOs have projects directed at exotic weed control on grazed rangelands, mainly focused on weeds of national significance (WONS). Activities include mapping of weed infestations, development of weed control strategies, eradication of weeds from grazed lands and riparian zones. Weeds outside the WONS classification are also tackled where they are locally or regionally significant.

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- All RNRMOs are involved in aspects of biodiversity management on grazed rangelands. The activities vary according to regional priorities, and include mapping and planning for biodiversity conservation, segregating high value biodiversity terrestrial and riparian assets from grazing (by fencing), improving native habitat for endangered species, artesian bore capping (to ensure flows into mound springs), establishing agreements with landholders for biodiversity conservation, and strategic fire management. Most on-ground investment in biodiversity conservation occurs in segregating high value assets from grazing, with a lesser focus to how biodiversity can be maintained within a grazed environment.
- Nearly all RNRMOs are involved in feral pest management, with a wide array of species targeted for control including herbivores (goats, camels, horses) and predators (foxes, cats) and fish (carp). The purpose of controlling feral herbivory is total grazing pressure management to promote rangeland conservation, reduce competition with livestock, and less obviously, to reduce grazing in areas with high biodiversity values.
- Dingo control is supported in two regions with sheep enterprises, and kangaroo management is supported in areas where natural predators (i.e. dingoes) are not present.
- The Catchment Management Authorities (CMAs) in rangeland NSW are involved in Invasive Native Scrub (INS) control via property management planning for INS control and direct investment in INS removal.
- Fire management, in particular re-introduction of traditional fire management practices (patch burning in the early dry season with 'cool' fires') is being supported in some northern Australian RNRMOs (and one NSW CMA), in partnership with landholders, traditional owners and state agencies.
- Market Based Instruments (MBIs) for achievement of desired environmental outcomes that are incompatible with short term economic outcomes for grazing enterprises have been introduced by two NSW CMAs and one Queensland RNRMO, with some other RNRMOs negotiating voluntary conservation/ environmental stewardship covenants/ agreements with landholders for managing specific assets.
- Projects in carbon management are underway in several RNRMOs, with the support of the Commonwealth's Carbon Farming Initiative (CFI). Activities include establishing baseline levels of carbon in soils and vegetation, awareness workshops for landholders, development of a Discussion Paper as a precursor to strategy, and consideration of carbon sequestration/ storage as a diversification options for landholders.
- Landscape scale planning and management activities directed at joint productivity and NRM outcomes include planning using EMU™ and related landscape interpretation tools, Environmental Management Systems (EMS) approaches, total grazing pressure management, grazing land management courses, plans and implementation for weed and pest removal, rangeland restoration using engineering means (erosion control, water ponding), and fencing and water placement to improve animal distribution. Landholders can access funds for specific small projects in weed and pest control, and biodiversity protection and TGP management where RNRMOs operate devolved grant schemes.

In summary, this brief analysis suggests that on grazed rangeland areas, RNRMOs are mainly focused on control of weeds (WONS), animal pests, and protection of high value site-based biodiversity (e.g. TECs, Ramsar wetlands etc.). This is not surprising as the Commonwealth has directed funding into asset-based management. In short, RNRMOs are focusing on where the assets are most important, the immediate threats are greatest, and the immediate gains can most easily be achieved.

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There are abundant opportunities for landholders to involve themselves in land management planning, to learn about existing technologies for grazing management, and to obtain small grants for specific projects. However, resource constraints, and the sheer scale of the areas within their jurisdictions mean that RNRMOs are less able to address landscape-scale objectives in improving landscape function and in-situ biodiversity (such as micro-biota, species richness in grazed lands, and small bird and mammal habitat).

2.3.3 Meat and Livestock Australia

URS reviewed 26 projects commissioned by MLA. The list of projects is presented below according to the location of the project.

National

- VegMachine - Integrated Rangeland Monitoring.
- Review of the impacts of red meat production and alternative sources of protein on biodiversity.
- Biodiversity Condition Assessment for Grazing Lands.
- National Review of On-Farm Natural Resource Monitoring Tools for Red-Meat Producers.
- Review of GHG and Water in the Red Meat Industry - Report 1.
- Weed R&D Analysis and Prioritisation.
- Cost of Weeds, Ranking Weeds of Importance to the Grazing Industry.

Northern Australia

- Understanding producers' change to more sustainable grazing practices in the tropical savanna rangelands of North Queensland.
- Situational Analysis and Options Paper for RMCiC.
- What do cattle eat in tropical rangelands? – Implications for animal performance and grazing management.
- Managing grazing by alternating water points – determining the effect on grazing patterns, Rockhampton Downs [Managing water to manage grazing].
- Recovery of the water cycle on grazing lands – cumulative impacts of changing pasture condition on retention of water, sediment and nutrients on Burdekin hill slopes.
- Enhancing adoption of improved grazing and fire management practices in northern Australia: Synthesis of research and identification of best bet management guidelines.
- Volume III - Investigating Intensive Grazing Systems in Northern Australia Appendix 2 (Volume 1 also listed as a separate project - same summary).
- Kimberley and Pilbara R, D & E program: Phase 1.
- Sustainable development of VRD grazing lands.
- Developing improved industry strategies and policies to assist beef enterprises across northern Australia adapt to a changing and more variable climate. Component 2 of 'Beef Production Adaptation In Northern Australia'.
- Wild Dog Ecology, Impacts and Management in Northern Australian Cattle Enterprises: a review with recommendations for R, D & E investments.
- Best practice manual for cattle production in the Top End of the Northern Territory.
- Preliminary investigation into the development of an electronic forage budget and land condition application, for use on existing hand-held devices, for the northern grazing industry.
- Enhancing adoption of improved grazing and fire management practices in northern Australia.

Southern Australia

- Management Systems for Hardy Sheep Breeds in Pastoral Conditions.
- Scoping Rabbit R&D.
- Enrich - Multi-purpose 'healthy' grazing systems using shrubs.
- UAV Surveillance Systems for the Management of Woody Weeds.
- Understanding the interactions between biodiversity and the management of native pastures in the Murray Darling Basin.

2.4 Conclusions from the Projects data base

2.4.1 Activities underway

- Most areas of work relevant to the interaction between productivity and natural resource management are being covered to some degree and a new program will be quantitative rather than qualitative in terms of increasing the specificity and precision of the information available to guide and support management decision-making.
- Most of the current work in grazing management R, D & E is directed at the northern rangelands which support the majority of the livestock population. Some of this work is being informed by several large grazing studies in the Northern Territory (Pigeon Hole and Kidman Springs) and Queensland (Wambiana).
- There is a multiplicity of small case studies and producer demonstration sites covering a wide range of topics serving as a focus for extension activities.
- Cell grazing has been reasonably studied in the north with the general conclusion that stocking rate is more important than management system, although there is still a possible question over the effects of scale. There has been little if any study in the southern rangelands.
- The relationship between biodiversity and land condition has been studied in Queensland which has generated useful material but the works needs extension to other regions.
- The RNRMOs have a strong focus on biodiversity conservation within the pastoral land matrix, and feral animal and weed control across grazing lands, although the geographical spread of the activities is limited by the amount of external funding (e.g. treatment of many thousands of hectares in regions comprising millions of hectares).
- Much of the investment in biodiversity conservation is aimed at segregating high value assets from grazing land, and control of weeds and pests in these (and other) areas.
- Projects in fire management, covenanting biodiversity assets (including use of MBIs), erosion control/ rangeland rehabilitation, and carbon management are underway in a number of regions.
- Land management planning and landholder training in grazing land management occurs in many areas, sometimes with the aid of external funding.
- Overall, there are abundant opportunities for landholders to become involved in R, D & E (mainly D & E) projects throughout the rangelands through projects funded by the Research & Development Corporations (principally MLA), and State and Commonwealth agencies. Delivery agents include RNRMOs, State agencies, CSIRO, Universities, local and regional land management groups (e.g. NAILSMA, CLMA), and conservation philanthropic organisations. All activities are seen to have merit. However, several of those consulted suggested the opportunities available are not sufficiently effective because of poor coordination between activities (duplication, mixed messages etc.), insufficient linkage between productivity and NRM aspects in some mainstream activities, and

in several cases, a lack of follow-up reinforcement of the messages, and support for practice change.

2.4.2 Impact of the activities

There is limited information on the collective impact of the total R, D & E effort in the grazed rangelands. Regional NRM Organisations report metrics such as areas of weeds treated, areas fenced to protect biodiversity, numbers of feral animals destroyed, areas of land treated with earthworks and numbers of people attending NRM-based workshops. State and Territory agencies variously report on range trend and animal numbers, and describe outputs from R, D & E activities. Many of the outputs from these activities are presented in journal and conference papers and extension publications. Given the geographic extent of the rangelands, the high seasonal variability, and the heterogeneity of the resource and grazing management, attributing benefits at regional and industry scale to the R, D & E investment is difficult.

3

Considerations in designing the R, D & E Plan

3.1 Why invest in NRM within livestock production systems?

MLA on behalf of industry contributors and government is primarily directed to invest in NRM to protect the resource base on which production is founded and to maintain that natural resource base and biodiversity values in order to maintain the social license to use leasehold land for pastoral grazing purposes.

A key aspect of protecting biodiversity values is to do so within grazed areas not separate from it. This has a policy advantage to the community as it is seen as more expensive to isolate identified areas and manage them separately. Benefit is seen is gaining suitable management of biodiversity values within a production system.

Investment in NRM within livestock production systems is also undertaken to maintain the value of the productive resource base and the productivity of production systems themselves. Current management will not support the achievement of the national and industry objective of range improvement.

3.2 Relationship between resource condition and productivity

While of concern to scientists and rangeland administrators, poor range condition and declining trends in rangeland function (see ACRIS 2008) may not be an issue for pastoral businesses. Demonstrating an economic benefit from managing rangeland towards an improved state at individual business level has been an objective in many R, D & E programs over recent decades, but it has been difficult to establish a robust and compelling case. Indeed, Wang and Hacker (1997) have shown the opposite to be the case. Their study in the arid zone of Western Australia indicated that while there was no economic incentive (from a private perspective) to degrade range in good (i.e. productive) condition there was equally no incentive to restore rangeland that was already degraded and a positive incentive to degrade it further.

3.2.1 Poor range condition and animal productivity?

The relationship between measures of land condition and animal production is complex. Studies in the chenopod shrublands and herbfields at Deniliquin and Broken Hill, and in the mixed shrublands at Carnarvon, have shown that 'poor condition' rangelands, as defined in those environments by a loss of perennial shrubs remain capable of producing more forage and sustaining higher animal performance in all except well below average seasons, when those areas without shrubs 'crash'. However, some of the range management literature continues to present different recommended stocking rates for land systems in good, fair and poor condition, although the qualification is added that the recommendations are for defined 'average' seasons. However, that is not what producers are normally managing.

In the northern savannas, too, relationships between land condition, stocking rate and animal production are not intuitive. Land in poor condition (dominated by annuals) may have higher per head productivity than land in good condition (dominated by perennials) at low stocking rates but not at high stocking rates (Ash *et al.* 1995; McLeod *et al*. 2004)

For the vast majority of the rangelands, while substantial changes in vegetation and soil parameters have occurred, some capacity to produce forage remains. Almost any land is capable of supporting high levels of animal production both per head and per hectare under favourable seasonal conditions. Observations in the Western Division over the period from 2010 to the present, after the Millennium Drought, and in Western Australia after the 1968-73 drought in the Eastern Goldfields (and no doubt

other anecdotal observations) are that given the right sequence of seasons the growth on seemingly degraded country is phenomenal.

The key issue then is how well do landscapes use rainfall to produce forage and what is the temporal pattern of forage availability? It is here that one can understand the assumed ecological condition – animal production linkage because sites with higher levels of landscape function and more desirable perennials would be expected to provide a higher level of forage on average, and with less variability, across the long run of seasons, especially where seasonal variability is high. From a livestock production perspective, suitability of landscapes for livestock could be viewed in terms of the average level and temporal variability of forage production. This is largely a function of rainfall use efficiency which is determined by factors such as local topography and landscape function (essentially how much runs off), botanical composition and the characteristics of the rainfall events themselves. The point is that probably all land has the capacity at times to be used for profitable animal production provided the frameworks are in place – policy settings and transport for example – to allow the harvesting of forage to be matched to the temporal and spatial pattern of forage production – defined more simply as 'managing total grazing pressure' at any point in space or time.

In short, there are no simple linear relationships between range condition, stocking rate and animal production, with the nature of the relationships confounded by:

- immediate seasonal conditions;
- spatial diversity of the range resource in the area accessible to grazing;
- the capacity of the land to contain/ shed water which will influence water use efficiency;
- the parameter of animal production of interest (e.g. steer growth rate vs. reproductive rate); and
- the willingness/ ability of management to adjust levels of use quickly (see Ash and Stafford Smith 1996).

This makes extrapolating from stocking rate trials to landscape management situations dangerous in forming management strategies (see Ash and Stafford Smith 1996) and modelling the economic benefits complex and often inconclusive.

For some landscapes, opportunistic exploitation of seasonal forage may be the best use – i.e. there is no permanent livestock population at all only an influx of animals when forage is available – e.g. the Channel Country as in the 'Kidman model'. This is the antithesis of the sedentary pastoralism model that has traditionally operated in Australia – but it requires scale in business structure, or a preparedness to have no income for periods of time.

3.2.2 Range trend and animal productivity?

A consequence of the slow rate of change in rangelands (or periods of rapid change interspersed with long periods of very little change) is that there is a strong economic disincentive to give up short term economic gain for potential long term benefits in terms of landscape productivity. Short term exploitation is often optimal from a private perspective, and can more than compensate for loss of income in the medium to longer term. For example, rapid re-stocking after drought has been shown to be financially advantageous in the immediate term, although there may be longer-term environmental costs (Buxton and Stafford Smith 1996).

Deciding the level and timing of use is *the* crucial decision in managing rangeland, and avoiding downward trends. Using information on seasonal forage production, associated with evidence-based utilisation rates in setting stocking rates to achieve sustainable use is widely advocated (see Campbell

and Hacker 2000, Hunt 2008 and Walsh and Cowley 2011). However, the evidence of increasing animal numbers across many regions over the years since 2000 and an uneven trend in the rangeland resource over the last two decades suggest that many producers are either not convinced, or are not able to implement the practice changes advocated by the R, D & E outputs.

3.2.3 The challenges?

The challenges then for producers committed to adequate production from healthy, productive rangeland include the following.

- Deciding objectives for the business, the cattle enterprise and the resource being managed. Are the objectives in alignment and mutually achievable? Campbell and Hacker (2000) have suggested the 3Rs risk management framework, with producers needing to position themselves somewhere in a triangle whose vertices are risk, return($) and resource impact.
- Deciding an appropriate strategy for the business, with the options being largely confined to either 'conservative use' or 'opportunistic trading' (Foran and Stafford Smith 1991). Choice will depend on the nature of the resource, climatic variability, distance to market, personal preference for risk, and expectations of the business. In reality, a 'moderate trader' strategy is probably the most practical, given that strict tracking of seasonal conditions is difficult, but it is sensible for producers to take some advantage of above average seasonal conditions.
- Deciding whether to opt for a high input-high output system (e.g. rapid rotations, many paddocks, small distances between waters), or a low input-low output system (e.g. low stocking rates, acceptance of sub-optimal pasture utilisation at landscape scale, lower capital inputs).
- For the conservative users, selecting a level of use that is achievable in most seasonal conditions, but with sufficient knowledge of early warning signs to be able to adjust before drought.
- For the opportunistic traders, matching forage supply and demand at relevant spatial and temporal scales is critical, and having the capacity for rapid adjustments to stocking rates through stock movements either within the business (as in the corporate businesses) or into and out of the market.
- Making financial provision for periods of reduced income through any range of mechanisms, including Farm Management Deposits (FMDs), and off-property assets.

3.3 Issues, R, D & E gaps and priorities

3.3.1 From the literature

The R, D & E priorities developed by the North Australia Beef Research Council (NABRC) relevant to this study focus on improving the certainty in decision making in respect of pasture use (i.e. improved risk and opportunity management), being able to obtain more production from the available resource, reducing the impact of weeds and feral animals, and improving the cost-effectiveness of implementing innovations. They also recommended 'An empowered R, D & E system through more effective networking initiatives, regional implementation strategies and greater involvement of women and youth.' In particular, the Council advocates:

- Engaging many producers in grazing management through development of a compelling, economic-focussed value proposition.
- Providing tools that guide what should be changed or varied (where and when) to improve grazing management outcomes.

3 Considerations in designing the R, D & E Plan

In the light of previous commentary about the difficulty in demonstrating the economic payoff from grazing management that addresses NRM objectives, or alternatively the NRM benefits of grazing management that is privately profitable, the first of these specific recommendations is critical. It is URS' view that this R, D & E objective provides the key to achieving 'win-win' management that delivers improved NRM and productivity outcomes, and should be central to any production-NRM linked programs in the rangelands.

In their Key Result Area 2, the Rangeland Alliance's objective is developing programs for improving groundcover and biodiversity habitat values, with supporting objectives being:

- Address institutional barriers to land management.
- Implement appropriate grazing management practices.
- Develop climate ready actions for adaption and mitigation.
- Engage key players.

The McIvor *(*2010) review adequately identifies the R&D issues for grazing management and infrastructure development in the north with a focus on:

- determining the parameters for intensification of grazing through additional infrastructure;
- improving the precision in setting stocking rates to achieve desired outcomes;
- a better understanding of how to manage prescribed burning; and
- a better understanding of when and for how long pastures need resting.

McCosker *et al.* (2010) recommend case-study research in determining the impact of stocking rate on reproductive rate in northern cattle herds, the latter being seen as a key biological driver of business performance. Other recommendations for R, D & E either dealt with animal biology or business management practices. Stockdale *et al.* (2012) recommend more extension to deliver appropriate grazing land management strategies and improved animal husbandry.

It is worth noting that the documents and the associated R, D & E recommendations are confined to northern Australia. There is no similar set of recommendations for southern Australia.

3.3.2 From producers

Nine individual producers and producer organisations responded to the Briefing Paper presented in **Appendix A.** The producer organisations that responded are listed in **Appendix C**.

Key issues MLA should be considering in the R, D & E business plan

- How to manage natural resources to promote healthy landscapes and retain an acceptable biodiversity status at property scale.
- How to manage natural resources to maximise livestock productivity.
- Research into the use of technology that has potential to increase productivity and assist NRM.

Best balance between R, D & E

- More producer demonstration sites across the rangelands testing ideas developed by local producer groups.
- Detailed case studies of successful (in terms of both production and NRM) pastoral businesses.
- Industry scale extension programs.

3 Considerations in designing the R, D & E Plan

3.3.3 From Regional NRM Organisations

Eight Regional NRM Organisations and one non-government organisation responded to the Briefing Paper presented in **Appendix A.** Those who responded are listed in **Appendix C**.

Key issues MLA should be considering in the R, D & E Plan

- How to manage natural resources to promote healthy landscapes and retain an acceptable biodiversity status at property scale.
- Research into the use of technology that has potential to increase productivity and assist NRM.
- How to determine the value for livestock production and NRM of intensive grazing management regimes (e.g. short rotations) across rangeland areas.

Best balance between R, D & E

- Large scale sites demonstrating best practice grazing management across rangeland areas.
- Detailed case studies of successful (in terms of both production and NRM) pastoral businesses.
- More producer demonstration sites across the rangelands testing ideas developed by local producer groups.

3.3.4 Combined producer and NRM organisations

What a R, D & E investment program should deliver to maximise NRM and productivity benefits

The survey results highlighted four elements that a R, D & E program should deliver or include, in descending order of priority they are:

- The Plan should improve understanding of the costs of production, especially with a link to associated benefits and costs of NRM within a production system. Address socio-economic issues, and capacity building that influence sustainable management.
- The Plan must link production, NRM and business management outcomes.
- Use successful, practical region/producer case studies.
- Control of total grazing pressure and knowledge of sustainable grazing practices.

How a R, D & E investment program should be implemented

The survey results highlighted three elements that a R, D & E program should deliver or include, in descending order of priority they are:

- Have regional governance and decision making structures.
- Effective collaboration, coordination and communication to ensure consistent delivery across all regions and projects.
- Appropriate balance of R, D & E in all projects to meet the needs of end users and funders.

3.3.5 Alignment of R, D & E activities with producer and NRM priorities

The Project team compared how many or what proportion of projects/activities listed and summarised in Sections 2.3 and 2.4 relate to the issues described by questions 2-4 of the producer/NRM group survey. This was done using the project team's knowledge and experience and from the summary

3 Considerations in designing the R, D & E Plan

description from each project. The summation of project to issue was then compared against the issues priority as indicated by producers and Regional NRM Organisations.

How projects align with NRM issues limiting livestock production

Across all programs/projects some 31 per cent relate to forage availability, the majority (29%) of NRM group projects relate to weed infestation, whilst the majority (25%) of MLA projects relate directly to forage availability. The priority topic as indicated by the survey was forage availability. At least in terms of program/project number there appears to be an alignment of stakeholder priorities and the number of projects addressing key topics, given that this assessment cannot indicate how successful the listed projects are.

How projects align with issues that should be part of sustainable production systems

Across all programs/projects some 38 per cent relate to maintenance of groundcover under poor seasonal conditions, whereas the majority (45%) of NRM group projects relate maintenance of biodiversity at landscape scales, and 50 per cent of MLA projects relate to maintenance of groundcover under poor seasonal conditions. The clear priority topic as indicated by the survey was maintenance of groundcover under poor seasonal conditions. In terms of program/project number there appears to be an alignment of stakeholder priorities with overall program/project number and with MLA projects in addressing key topics.

NRM group projects focus strongly on what is the second rated issue by producer and NRM group stakeholders. Overall there appears to be a reasonable alignment in project number by topic and stakeholder priorities, given that this assessment cannot indicate how successful the listed projects are. The number of MLA projects per topic aligns well with stakeholder priorities.

How projects align with issues that should be considered in the R, D & E business plan

Across all programs/projects some 45 per cent relate to ‘how to manage natural resources to promote healthy landscapes and retain an acceptable biodiversity status at property scale’. Similarly the vast majority (74%) of Regional NRM Organisation projects and 34 per cent of MLA projects relate to the same topic. The program/project work aligns strongly with the same priority topic as indicated by both groups of stakeholders, given that this assessment cannot indicate how successful the listed projects are.

The equal ranked priority for producer stakeholders is managing natural resources to maximise livestock productivity, and this seems to be reflected by MLA project numbers.

4

Stakeholder input to the Draft R, D & E Plan

Consultation based on the combined Draft Discussion Paper and Preliminary Draft R, D & E Plan focused on organisations that are funders and/or providers of R, D & E directed at the rangeland grazing industries. The 22 organisations that have provided input are listed in **Appendix D**.

In each case, feedback was obtained on the organisation's interest in the R, D & E agenda, the sub-programs/ projects of specific interest, and preparedness to be a co-funder and/or deliverer.

The Draft Discussion Paper and Preliminary Draft R, D & E Plan was provided to those consulted prior to the consultation.

4.1 General response

URS received a general endorsement of the Preliminary Draft R, D & E, with the initiative in developing such a Plan by MLA welcomed.

The scope – being the interaction of NRM and livestock industry objectives – is seen to be addressing a major issue of importance in the rangelands. The alignment with existing strategies and statements of intent in the rangelands was seen as sensible. Nearly all R, D & E organisations indicated an interest in partnering or collaborating where there are benefits in doing so. In particular, the response from the Rangeland Alliance suggested a willingness to become more involved in the production area. There is value seen in a 10 year R, D & E agenda with a 20 year pay-off period.

Given the vast array of other activities operating across the NRM/ livestock production interface (see Section 2.3), the Plan needs to mesh with, complement and extend these existing activities. Ensuring coordination and collaboration across the NRM/ livestock production interface will be a key function of the Management and Coordination Sub-Program (see Section 6.5).

Overall, encouragement for further development of the Plan was provided, although there were no specific commitments given regarding funding arrangements.

4.2 Other feedback and comments

4.2.1 Plan management and coordination

Feedback was generally that sound management and coordination of the Plan is essential, in particular given the array of existing and proposed other activities underway. It was also suggested that management input be kept at a low level, with the use of existing networks to provide input and advice through the course of the 10 year Plan.

4.2.2 Recognising the difference between southern and northern rangelands

Although the value of a national long-term R, D & E Plan is appreciated, several responses suggested that the Plan needs to recognise the differences between the northern and southern rangelands. As well as the biophysical differences between the more seasonally reliable tropical savannas and tussock grasslands in the north and the more arid shrublands and woodlands in the south, the differences extend to the nature of the grazing industry, and the relative maturity of the R, D & E situation in each area. This need for some separate activities in northern and southern Australia has been included in the revised draft R, D & E Plan.

4 Stakeholder input to the Draft R, D & E Plan

4.2.3 Refining grazing management decision-making at regional scale

Improved technologies are required to lift grazing management to a higher level, particularly if intensification is planned. Better knowledge of thresholds and trigger points for management decisions is required. Several of those organisations consulted referred to the need for regionally-specific information and prescriptions.

Although there is a lot of information already available, some of which comes from the long-running grazing trials across the north (e.g. Wambiana, Pigeon Hole), there was recognition that further basic ecological work is still required. This has been addressed in the Draft R, D & E Plan in proposed projects to address basic ecology of key species (especially grazing x climate interactions), soil biology and nutrient cycling, animal impact[3], and genetic plasticity of key species in relation to climate change.

To support this work, we propose establishment of the National Rangeland Research Network (NRRN) – being a set of permanent research sites – as the foundation of applied ecological research into the principles of sustainable grazing management systems. A useful suggestion was the allocation of post-graduate funds to support these basic projects (which can be undertaken at NRRN locations) and also to support future capacity building, lack of which is a threat in both northern and southern rangelands.

The array of biophysical and economic models available to support decision making can be further developed to increase their value – in a range of environments – in providing spatial and temporal information down to property and paddock levels. Being able to deliver timely output from models to producers, backed up by interpretative support in using the information in decision making, can be expected to improve NRM and productivity outcomes, with the former nicely summarised by the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) as being the amount and persistence of groundcover. The requirements have been addressed in the Final Draft R, D & E Plan.

4.2.4 The push towards intensification

There is interest and investment in intensification of grazing in the northern rangelands. This will have implications for NRM, as well as for the economic viability of existing properties. Producers need decision supports in planning (or not planning) intensification, with applicability in different regions and for different scales of businesses. A better understanding of the impact of intensification on a whole array of biophysical and economic aspects is needed. This is prompting considerable work in this area, with the results able to be extended through Plan activities.

4.2.5 Biodiversity management

Biodiversity conservation is a feature of Rangeland Alliance programs, with most investment aimed at segregating areas of high conservation value from grazed lands. Systems of stewardship payments are being used and developed, and research is underway to determine how producers might be involved in managing areas of biodiversity on their properties. A niche exists in understanding the relationship between biodiversity conservation on well managed grazing land, and this has been incorporated into the Plan.

[3] Animal impact is the term used by advocates of cell grazing to refer to the allegedly beneficial effects of high animal density on soil and vegetation.

4 Stakeholder input to the Draft R, D & E Plan

4.2.6 Addressing weeds

Weed control – particularly of weeds of national significance (WONS) – is a focus of the Rangeland Alliance, with significant investment by the Commonwealth Government. There is some suggestion that in the absence of more sustainable solutions, current weed control may not be cost-effective, and in CfoC investments, weeds are addressed independent of causal management factors. Further strategic planning is occurring in this area by CSIRO, with support from MLA.

It is widely recognised that good condition pastures are the only broad scale defence against rangeland weeds and hence it was suggested that management of weeds that cannot be handled by grazing management and fire should be dealt with in other programs.

4.2.7 Addressing climate change

Rangeland Alliance members are required by the Commonwealth Government to incorporate potential impacts of climate change within their Regional Plans, and they are receiving support in carrying this out by Ninti-One. Further considerable work is being done at an R&D level by research organisations. It was suggested that the R, D & E Plan could align itself with this work by investigating the extent to which important natural forage species are likely to handle anticipated climate change (under grazing) and the resulting implications for the grazing businesses dependent on these species (see also Section 4.2.3.above).

4.2.8 Capacity building activities

Considerable comment was received on the importance of information being available, and being used by producers in delivering better NRM and productivity/ profitability outcomes for their businesses and the public good. Producer involvement in designing and delivering 'capacity building activities' is seen as being important. These capacity building activities are presented under the four following headings, but are interdependent.

Coordinating and improving learning opportunities

Several organisations advised about learning activities they were involved in and the value of these activities. There are many activities, including Grazing Land Management (GLM) courses, Ecosystem Management Understanding (EMU)^{TM}, Soils4Grazing, Bestprac, Tactical Grazing, Holistic Management, Grazing for Profit (GfP), soil conservation courses, weed management courses, and benchmarking groups.

Some feedback suggested that the R, D & E Plan provided a good opportunity to review this array of opportunities, improve their content (especially in the southern rangelands), ensure culturally sensitive delivery, and provide additional on-going support for practice change after initial exposure to the information being provided.

Developing knowledge systems

Feedback suggested that given reduced on-ground personnel, and the increased sophistication of the information becoming available, the Plan should focus on design of knowledge systems as the key to improved decision making, by putting as much information as possible at the disposal of the producer; if necessary for interpretation with a consultant.

The information must be contextualised to the individual property as far as possible, must have both real time and predictive capacity, and must be integrated across the whole business to allow good economic decisions.

The information must recognise that producers operate in the risk, ($) returns, resource (condition) triangle and they need to determine their preferred compromise position. As advised by feedback, elements of all this are already there – it was suggested the R, D & E could look to combine tools like Digital Homestead, PaddockGRASP and economic models like Enterprise in a web based decision making tool for individual properties.

Economic tools should incorporate weed control costs and benefits for the business. Links to extension information and producer best practice experience through sites like FutureBeef would also be part of the knowledge system development.

Addressing cultural requirements

Feedback was received that in developing and delivering capacity building activities, the socio-economic situations of producers, the range of motivations for action, and the cultural operating environment need to be considered. In particular, in supporting Indigenous producers to engage in program activities, culturally sensitive approaches are required. Specific mention of the need to address the socio-economic and cultural context is included in the revised R, D & E Plan.

Maximising the value of case studies and PDSs

Feedback was received that sound case studies and PDSs are appreciated by producers, and are ideal conduits for learning and supporting practice change. Case studies can apply multiple, stacked technologies to get the whole system right. The case studies can then be used to analyse the impacts of particular technologies (and the synergies between multiple technologies) as a basis for extension activities. This approach to engagement is strengthened in the revised R, D & E Plan.

4.3 Emerging issues around capacity and funding

Most of the resources available to deliver projects that link NRM and production are in northern Australia, with QDAFF and CSIRO staff (located in Queensland and the NT) dominating. The Rangeland Alliance members have relatively large numbers of staff, but nearly all are committed to existing project activities. There are few people available for NRM/production R, D & E in SA and WA, with NSW having a modest number of staff.

While nearly all organisations overtly suggested partnering and collaboration around project activities, there was no commitment by any organisation to new funding. This is not surprising given that these organisations have their own priorities and imperatives, and were not able to make commitments at relatively short notice. Further negotiation is recommended.

5

Finalising the content of the Draft R, D & E Plan

5.1 Criteria for determining content priorities

The Discussion Paper and Preliminary Draft R, D & E Plan which formed the basis for the consultation with potential partners, funders and deliverers generated suggestions for topics to be included and topics to be deleted from the Draft Plan. It needs appreciating that the R, D & E Plan cannot be 'all things to all people', or to address every suggested area of activity.

Given the vast array of other activities operating across the NRM/ livestock production interface the Plan needs to mesh with, complement and extend these existing activities. Ensuring coordination and collaboration across the NRM/ livestock production interface will be a key function of the Management and Coordination Sub-Program.

A set of criteria was used in deciding what activities to consider, and what not to consider in the revised Draft R, D & E Plan, and the priorities for investment. These are presented below, not in order of importance:

- Is the suggested activity within the scope of the Plan objectives?
- Is the activity adequately covered by existing R, D & E activities outlined in Section 2.3?
- Has the activity been identified and justified in the suggestions presented in Section 3.3?
- Is there strong industry/organisational support and capacity for the suggested activity?
- Will the activity support and extend existing R, D & E activities into new areas of application and benefit?
- Will the activity address critical knowledge/ application/ institutional barriers and gaps that are limiting productivity/NRM gains?
- Is investment in the activity likely to deliver a major and not incremental benefit in productivity/NRM outcomes?
- How extensive (geographic, industry type and scale) will be the impact of a successful outcome from an investment in the activity?

At a whole-of-Plan scale, the following criteria were then considered.

- How well does the Plan as a whole address expressed industry, organisation and producer priorities?
- Does the content of the Draft Plan include a good mixture of research, development and extension activities, and is there are pathway for research findings to be carried through to development and adoption?
- Is there a reasonable distribution of activities across the regions in southern and northern rangelands, based on an assessment of regional pastoral productivity, rangeland area, and NRM issues and opportunities?
- How well does the Plan as a whole address the expressed need for producer participation in regionally-relevant R, D & E?
- Are the delivery mechanisms feasible and likely to deliver the intended benefits?

5.2 Addressed in the Draft R, D & E Plan

The suggested topics to be addressed in the Draft R, D & E Plan, and the justification for including them are presented in Table 5-1. Some of these (shown in *italics*) are drawn directly from the consultation reported above.

5 Finalising the content of the Draft R, D & E Plan

Table 5-1 R, D & E areas addressed in the Plan

R, D & E area to address	URS Response
Adoption of current and new knowledge – a need for revitalising rangeland extension at the production-NRM interface *The array of training opportunities available currently should be developed into a seamless program of structured learning for producers, with sufficient follow-up to achieve practice change.* *There is a case for very basic instruction in plant identification.* GLM courses need good follow-up, so that people can be encouraged into practice change that then evolves into a management system. *An observation was made that this is the key to the success of the Holistic Management and GfP delivery, where follow-up is part of the package.*	The project review completed for the MLA consultancy has revealed a large number of learning and training opportunities in NRM available to producers in the rangelands. These include Grazing Land Management (GLM) courses, Ecosystem Management Understanding (EMU)™, Soils4Grazing, Bestprac, Tactical Grazing, Holistic Management, Grazing for Profit (GfP), soil conservation courses, weed management courses, and benchmarking groups. While all have their merits, coordination of these activities is poor, and in many cases, there is a lack of follow-up to support transition from awareness through to practice change. While there are many learning opportunities in the northern rangelands, there are fewer opportunities in the southern rangelands and no equivalent to the GLM course available in the northern rangelands (note Tactical Grazing is the southern counterpart, but is not nearly as well developed).
Social profiling is needed to identify key drivers for change across the sectors that make up the livestock industries.	The design and provision of adoption support will recognise and address local socio-economic needs and motivations, drawing upon the existing body of knowledge about the social drivers of management behaviour in grazing businesses.
Specific approaches that encourage engagement by Indigenous producers.	The extension of grazing management technologies and provision of adoption support will include the development of culturally sensitive education/ training programs with adequate support. Models to align with or to build on include the Indigenous Land Corporation's (ILC) Indigenous Land Services and DAFWA's Indigenous Landholder Service.
Accelerated adoption of new technologies (remote monitoring of animal performance, pasture production etc.) that can increase decision-making certainty, improve management control and efficiency, and reduce costs. *There are innovative producers who are achieving the twin outcomes of profit and sustainability. These should be followed up as case studies with very detailed analyses of their businesses to identify the key principles and practices underpinning success.*	There is strong industry support for Producer Demonstration Sites and detailed analysis of Case Studies, and evidence that these provide effective learning opportunities. Can be linked to benchmarking activities.
Development of accessible and supported knowledge systems	There will be less public extension personnel. Producers need access to all available information, supported by interpretive services.
Addressing institutional and macro-economic barriers to sustainable rangeland use	External factors, either institutional or macro-economic (global trade factors) have the capacity to generate large shifts in local operating environments. These need to be understood to develop sound policy responses.

5 Finalising the content of the Draft R, D & E Plan

R, D & E area to address	URS Response
Defining the role for direct (i.e. stewardship payments) and/or indirect (e.g. tax concessions) public investment in rangeland management Better means to achieve change – use of Market Based Instruments (MBIs), definition of cost-sharing arrangements, policy changes.	While there are win-win situations in reconciling public and private objectives, there will also be a need to address situations where public and private objectives diverge. This will need public investment e.g. stewardship payments. A sound basis is required for any level of public investment.
Promoting the public benefits of sound rangeland management on privately held land	Following from the point above, public investment in rangeland management is required to achieve societal objectives. This requires public/ political support. This requires demonstration and promotion of well managed grazing as a valid land use in the win-win situation
Trigger points or thresholds in the pasture management envelope should be identified so that producers can know when they are near the operating boundary of the system. *Increased precision in setting stocking rates, and better understanding of thresholds for action in below average years. This needs to recognise climatic and land type variations*	Currently most producers either do not have the knowledge, are not able to access the information, or lack the skill and motivation to make timely decisions at trigger points. Information generated by the National Rangeland Research Network (NRRN) sites (as proposed in Section 6.5) will be one source of new data.
Evaluating the value of animal impact in resource management Apply grazing systems that assist with landscape maintenance or regeneration, and that can deliver economic benefit to business. Improving water use efficiency of production landscapes for both production and NRM benefits. *What are the most cost-effective ways of achieving NRM gains? What short-term return is foregone in managing for an increased long-term return.* *There will be variability according to region, seasonal conditions, land type etc.*	Regional, seasonal and land type variations will be addressed through the development of a network of permanent research sites (the National Rangeland Research Network). Need to have an economically viable means of using grazing management to transition land from lower to higher condition classes. Additional basic information is required on the response of rangelands to differing grazing regimes and animal impact. Information generated by the NRRN will be one source of new data.
How can NRM be related to the condition of the animals and then to the suitability of the animals for the market. Following from that, will improved NRM result in better condition cattle for longer through a season and then in greater market access. *As well as determining the relationship between stocking rate (SR) and reproductive rate (as recommended by NABRC), need to establish relationship between SR and liveweight gains.*	Issues of market access are not addressed directly. Some information is already available on the relationship between liveweight gain and stocking rate at different land condition levels but relationships established in small scale experiments are difficult to verify in extensive commercial operations. Information generated by the NRRN will be one source of new data.
How can cattle numbers be adjusted (e.g. agistment, sale) as required? There is a need to look at herd composition that can support adjustment.	Logistical barriers can be addressed as part of understanding and addressing the full suite of barriers to sustainable land use; advice, information and technologies will be provided via the extension activities of the Plan.

R, D & E area to address	URS Response
Managing climate change? *Climate change is likely to produce variable responses across northern and southern rangelands.* *Impacts of climate change will occur at the extremes not in 'average changes'.*	Other R, D & E programs will investigate response options for climate change at the strategic and tactical levels on-property. This project included in the Plan will assess whether major rangeland species are likely to be able to cope with the expected change under grazing and therefore if some areas will no longer be capable of supporting extensive grazing.
Managing biodiversity within grazed landscapes.	Biodiversity conservation cannot be adequately addressed by separation of grazing and conservation as discrete land uses. The Plan includes provision to assess the extent to which good land condition is compatible with desirable outcomes for biodiversity conservation.
Re-designing landscapes at regional scale to achieve an optimal (or acceptable) balance between production and conservation.	Understanding tradeoffs in biodiversity conservation associated with landscape design will be important in guiding investment decisions by RNRMOs and government agencies. Tools are required, and can be developed, to formalise the application of expert opinion to the issues. Needs to link with work being done by the Charles Darwin University choice modelling research and with other programs being undertaken by RA members.
Succession planning in research and extension staff.	Succession planning in research and extension staff is important over the life of a 10 year program, and particularly given the low number of people in rangeland grazing R, D & E, and the high age profile of many of these people. Provision of post-graduate scholarships to support basic research projects offers a practical means of within public sector organisations of nurturing the next generation of scientists.

5.3 Not addressed in the Draft R, D & E Plan

The suggested R, D & E topics that will not be addressed in the R, D & E Plan, and the justification for those decisions are presented in Table 5-2. This list includes some topics that were included in the Preliminary Draft R, D & E Plan, and others (shown in *italics*) that were raised in the consultation.

Table 5-2 R, D & E areas not addressed in the Plan

R, D & E area not to address	URS Response
Land management planning	Regional NRM Organisations are active in this area using techniques such as ESRM, EMU™, mapping weed infestations etc.
Large, long- running grazing trials	The Pigeon Hole study in the VRD has been concluded with findings being reported and disseminated and Wambiana (Burdekin River Catchment) is still underway and generating useful information to inform modelling. A new study is commencing at Old Man Plains near Alice Springs. In summary enough has been done, or is being done.
Determine the economic and NRM value of intensification in the tropical savannas and tussock grasslands.	Others are looking, or who will want to look at the implications of intensification in the north, as evidenced by feedback from Commonwealth DAFF and CSIRO. The Plan should link with them rather than try to duplicate.

5 Finalising the content of the Draft R, D & E Plan

R, D & E area not to address	URS Response
Further investigation of relationships between land condition, profitability and land prices.	Not a specific project objective.
Pest animals that impact NRM and production need to be considered (e.g. kangaroos, donkeys, horses, and wild dogs).	Wild dogs are not a NRM issue *per. se*. Further, there is evidence that dingo populations can exert trophic control on foxes and cats. The other pest animals only require coordinated (across properties) control programs that can be funded from improved returns from livestock grazing generated by outputs of the Plan. Feral animals such as rabbits and feral goats are subject to considerable R, D & E activity undertaken by other organisations. Benefits of exclusion fencing to control total gazing pressure in the southern rangelands has been included in the Plan.
Threats to biodiversity apart from grazing, such as feral cats – a useful output would be to better define what is impacting on biodiversity (good and bad) at the regional scale in deciding how to adjust grazing to conserve biodiversity.	Out of scope for this Plan.
Biological control of rabbits.	A national issue across many landscapes, and raised as a rangeland issue only in SA. Will be addressed by other national initiatives
Improved means for weed control (principally WONS) on grazing land (also raised in consultation).	Investment in weed management is the subject of a business case currently being developed by CSIRO with funding support from MLA. The current R, D & E Plan addresses weeds only to the (considerable) extent that they can be managed by best practice grazing management and judicious use of fire. It will therefore address those weeds that are symptoms of land degradation. Control of other weeds is beyond the scope of this proposal
Evaluation of virtual fencing in rangeland environments. Evaluation of transponder types, effective range in various country types, effectiveness, economics vs. conventional.	The development of commercial technology is likely to be at least 5 to 10 years away, which is outside the timescale for this plan. Some further R&D work being done by CSIRO.
Remote management tools. Development of drones, telemetrics, other labour saving devices, remote animal handling etc.	Development work is being done by CSIRO. Further investment is not required.
Further development of technologies for Total Grazing Pressure management.	Available technologies are adequate if applied properly. There are no likely technologies on the horizon.
Developing a carbon economy in the rangelands.	Already being addressed by several Regional NRM Organisations and other organisations. Support for Rangeland Alliance work by Ninti One. There may now be political uncertainty about the concept.
What is the role of regulation (and how effectively is it being used) across the Australian rangelands? *Review Rangelands Lease and policy frameworks to investigate new structures and more effective ways of delivering the public land management outcomes.*	This is important but is not within MLA's charter. Land tenure and regulation is a State/ Territory matter. Out of scope for this Plan.

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R, D & E area not to address	URS Response
The economic impact of predators versus their benefits in terms of managing alternate grazing pressure could be included, plus some work around grazing management to reduce impacts on native vertebrates co-located.	Direct R, D & E is out of scope for this Plan but activity included on the conservation of biodiversity on grazed land will address the latter part of this comment.
Fire management in grazing lands.	This is being dealt with in companion MLA project, and CSIRO and NGOs are very active in this area. This work may be further encouraged by companies looking for greenhouse gas (GHG) abatement credits (as in Western Arnhem Land Fire Management Project).

6

Final draft R, D & E Plan – 'Grazing Futures'

6.1 Abstract

MLA on behalf of industry contributors and government is primarily directed to invest in NRM to protect the resource base on which production is founded and to maintain that natural resource base and biodiversity values. This is undertaken to maintain the social license to use leasehold land for pastoral grazing purposes. There is also a policy advantage as it is considered more expensive, and arguable less effective, except in very specific circumstances, to isolate identified areas of biodiversity value and manage them separately. Benefit is seen in gaining suitable large-scale management of biodiversity values within a production system.

Demonstrating an economic benefit from managing rangeland towards an improved state at individual business level has been an objective of many R, D & E programs over recent decades, but it has been difficult to establish a robust and compelling case. There are no simple and general relationships between range condition, stocking rate and animal production such that a coherent, persuasive argument can be provided to landholders everywhere, that investment in the proper management of natural resources will yield sufficient production benefits.

There is consequently considerable difficulty in delivering programmes to service the multiple dimensions of rangeland management production, natural resource management and social objectives. There is a need to better engage with producers in the production-NRM domain through development of a compelling, economic-focussed value proposition, but also to recognise the tradeoffs between private and public interests in specific situations and the importance of public policy in reconciling these conflicts.

A review of current R, D & E program work relevant to the interaction between productivity and natural resource management indicates a considerable diversity of activity and that most relevant issues are being addressed to some degree. The program proposed is therefore more quantitative than qualitative in nature, aimed at increasing the specificity and precision of the information available to guide and support management decision-making rather than a radical new direction. However, delivery of acceptable technology to producers is constrained by inadequate coordination between activities (duplication, mixed messages etc.), insufficient linkage between productivity and NRM aspects in some mainstream activities, and in several cases, a lack of follow-up reinforcement of the message, and support for practice change.

This Draft R, D & E Plan was developed with the aim of improving both the coordination between all stakeholders in the production-NRM domain, and the content and delivery of products for land managers. It has sought to do so by using a set of guiding principles and objectives that arose from stakeholder consultation. These principles emphasise the interaction between production and NRM outcomes, and the importance of co-ordination and communication in achieving effective and consistent delivery. They include:

- Management and coordination would be centrally delivered, with advice obtained via Coordinating Committees, and via regional groups linked to NABRC.
- Effective integration across all parties (public and private sectors, NRM and production R, D & E 'communities') should be used to optimise use of scarce resources for rangeland R, D & E and ensure that synergies are achieved between contemporary programs;
- Empowerment of the R, D & E system through more effective networking initiatives, regional implementation strategies and greater involvement of women and youth.

- Effective internal collaboration, coordination and communication to ensure consistent delivery across all regions and projects.
- Effective external communication and collaboration to ensure that Plan activities are aligned with, and support, other 'third party' activities.

Key opportunities were identified to increase the profitability and productivity of businesses grazing livestock in the extensive native pasturelands in Australia, and the health and productivity of the lands being grazed, these include:

- Develop a coherent, well-structured and well supported network of learning opportunities available to all producers;
- Incorporate available environmental and economic information into an electronic 'knowledge system' that can provide real-time and predictive information to producers down to paddock scale;
- Increase basic ecological understanding across all regions and incorporate this information into progressively improving models of the grazing system;
- Determine how biodiversity can be sustained within land allocated for grazing;
- Identify constraints to the implementation of sustainable grazing and potential policy initiatives to reduce them. .

The goal and outcomes of the Plan are ambitious, envisaging over the next 20 years:

- A doubling of current levels of profitability (in real terms);
- Annual productivity growth reaching two per cent; and
- Measurable improvements in the condition of the land resource.

These ambitious targets are needed if the grazing industries in the rangelands are to survive financially and maintain a social licence to operate.

Delivery of the R, D & E activities will involve government and industry funding, and partnerships between organisations such as the Rangeland Alliance, Commonwealth and State Agencies, CSIRO, universities and non-government organisations.

The Draft R, D & E Plan presented in this report envisages an investment of $25 million[4] over 10 years to deliver on these objectives over 20 years.

6.2 Preamble

6.2.1 The challenge

Some 4,000 grazing businesses are based on the use of native pastures. They support about 25 per cent of Australia's livestock[5] which are grazed on roughly half of the continental land mass. Most of these livestock are now grazed in the extensive natural grasslands across northern Australia in the tropical savanna woodlands and tussock grasslands.

[4] Priced in 2013 dollars
[5] Determined at the proportion of large stock units (LSUs) grazed in the rangelands, with a large stock unit equal to 7 dry sheep equivalents.

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Producer grazing-land-management decisions (i.e. natural resource management) directly affect the state and trends in these important natural resources. Past over-use, sub-optimal control over the level and timing of grazing pressure, exotic weed infestations, uncontrolled feral and native herbivory and unmanaged fire regimes have depleted productivity and biodiversity. The available information on trends in these lands suggests that in most cases they have stabilised at a lower level of functioning, with relatively few areas showing either improvement or further deterioration. However, on-going declines in biodiversity within the grazed lands appear to be occurring across all areas.

All jurisdictions have general objectives about sustainable outcomes from grazing, and conservation of biodiversity in these lands. Achievement of these objectives will rely largely on the decisions made by producers in managing grazing activity, their resources in terms of human, physical and financial capital, the support received in terms of direct assistance (funding for biodiversity conservation, weed control etc.) and indirect support through information generated and provided by research, development and extension programs.

There are challenges involved. While of concern to scientists and rangeland administrators, poor range condition and declining trends in rangeland function may not be an issue for pastoral businesses. The relationship between rangeland condition, as measured by conventional indicators, and animal productivity is sufficiently complex and region/ site specific to make it difficult to demonstrate a generic case for a management focus on NRM improvement yielding a 'bottom-line' benefit to the business. Demonstrating an economic benefit from managing rangeland towards an improved state at individual business level has been an objective in many R, D & E programs over recent decades, but it has been difficult to establish a robust and compelling case.

Grazing business profitability is varied, with a significant proportion of businesses financially vulnerable due to a lack of size, poor animal and pasture productivity, limited human capital, poor business management, and excessive debt. It may be that businesses in some regions are experiencing negative productivity growth. Animal numbers and the effective area grazed are increasing in the northern rangelands, with numbers either declining or being maintained in the southern rangelands.

6.2.2 Past and current R, D & E activities

R, D & E activities have covered and are covering most areas documented in Commonwealth and state agency, Rangeland Alliance and industry strategic plans to some degree. Most of the current work in grazing management R, D & E is directed at the northern rangelands which account for most of the livestock population.

Considerable work has been done, and is underway in developing models of biophysical system functions (e.g. GRASP, PaddockGRASP, AussieGrass, FORAGE etc) although their applicability is mainly limited to the tropical savannas to date. Development of these models is being informed by findings from large grazing trials across northern Australia, in the Victoria River District (Pigeon Hole) and in the Burdekin River catchment (Wambiana). GRASP has also been used to predict the ecological impacts of climate change, but again, most of this work is being done in northern Australia.

There is a multiplicity of small case studies and producer demonstration sites covering a wide range of topics that serve as a focus for extension activities. These activities occur in all regions, and cover most topics. However, there is an unequal distribution of activities, with less activity in the Western Australian and South Australian rangelands.

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Work is underway to develop precision pastoral management tools which can collect data remotely and transmit them to a central point for analysis and decision-making. The tools include stock weight monitoring, water monitoring, forage monitoring and animal behaviour.

Much of the investment in biodiversity conservation in grazing lands goes into segregating high value assets from grazing land, and control of weeds and pests in these areas. Some of the investment in weed control is independent of a consideration of causal management factors. Management to support biodiversity (of soil organisms, vegetation, habitat, wildlife) is required on the larger area of grazed lands, but there has been limited investigation of how biodiversity can be retained on grazed land (i.e. defining the relationship between privately profitable grazing management and biodiversity outcomes).

There is considerable investment by the Commonwealth Government in feral animal and weed control which is delivered by the RNRMOs, although funding constraints limit the proportion of the rangelands where the issues can be addressed. Projects in fire management, covenanting of biodiversity assets (including use of MBIs), erosion control and rangeland rehabilitation, and carbon management are being delivered by some RNRMOs.

Land management planning and landholder training in grazing land management occurs in many areas, sometimes with an external funding injection for implementation. Although opportunities for learning are readily available, no general, compelling economic case for practice change has been made.

There are abundant opportunities for landholders to become involved in R, D & E (mainly D & E) throughout the rangelands through projects funded by the Research & Development Corporations (principally MLA), and State and Commonwealth agencies. Activities include Grazing Land Management (GLM) courses, Ecosystem Management Understanding (EMU)^{TM}, Soils4Grazing, Bestprac, Tactical Grazing, Holistic Management, Grazing for Profit (GfP), soil conservation courses, weed management courses, and benchmarking groups. Delivery agents include RNRMOs, State agencies, CSIRO, Universities, local and regional land management groups (e.g. NAILSMA, CLMA), and philanthropic conservation organisations.

Nevertheless, there is a widespread view that progress in grazing land management is occurring slowly, if at all in some areas. This is partly due to the complex nature of grazing management decisions which involve tradeoffs and affect the operation of the whole production system, and also to the uniqueness of individual businesses, their natural resource base and current seasonal conditions. While a considerable amount of knowledge is available, the conversion of that knowledge into 'management wisdom' that is relevant to the specific circumstances of the individual remains a challenge for both production and natural resource management.

6.2.3 The assumptions in designing linked NRM and production R, D & E

A set of underlying assumptions has guided the development of the Plan. These are:

- Informed and timely decisions on the grazing use at a location in space and time can be used to achieve levels of ground cover that maintain and improve landscape function, productivity and *in situ* biodiversity.
- The national aspirations for maintained or improved rangeland condition (including biodiversity) will be delivered *mainly* by producers making sound, well-informed decisions that address their own priorities and interests in operating productive and profitable grazing businesses. The converse is

that regulation, or direct investment by government will not, *on their own*, deliver the national aspirations for the environmental health of the rangelands, although there will be circumstances in which they are appropriate.

- Improved basic ecological knowledge can be interpreted into better grazing systems.
- The capacity to:
  - model natural pasture growth;
  - remotely sense biophysical states and trends at paddock scale;
  - monitor animal behaviour and infrastructure performance;
  - incorporate animal growth models and market information; and
  - design and support user-friendly, accessible knowledge systems

  will ensure producers have access to real-time and predictive information on the performance of their production systems that can be used to support sound decision-making.
- Integrating biophysical and economic parameters in the design of learning opportunities for producers will result in increased engagement, and providing support through the change process will increase adoption of new practices.

6.2.4 Influencing drivers and how investments were formulated

The pastoral economy in the rangelands is increasingly focused in northern Australia. Over 80 per cent of the livestock (on a LSU basis) are grazed in northern Australia (Pilbara, Kimberley, Northern Territory and Queensland). This dominance has increased since 2000. This gives weight to focus investment to production.

Contrasting this is an identified need to invest across rangelands to some degree based on the value of the natural resource and not just the current production value gained from the resource. This required judgement to achieve an appropriate balance between these contrasting objectives.

Some past efforts have attempted to piggy back NRM outcomes on the premise that improving NRM outcomes will be complemented by improved production. This relationship has been shown to be complicated and inconclusive. There is a need to make these relationships clear for specific circumstances and then use and implement technologies and policies to match circumstance. This is important to gain maximum leverage of co-investment for either NRM or production objectives.

6.2.5 The opportunities for this Draft R, D & E Plan

Based on the assumptions presented in the previous section, the opportunities for grazing management R, D & E that link NRM and production can be identified in the four following priority areas.

Developing a coherent, well-structured and well supported network of learning opportunities available to all producers

While there are many opportunities for producers to become involved in learning activities in grazing land management, feedback from those consulted is that coordination between many of these activities can be improved. Further, the reported gap between the financial and NRM performance of the top 20 per cent and average producers suggests that the activities being implemented are not effective enough. There is a need for:

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- Producers to be able see a clear pathway through the learning opportunities to benefits for their own situation;
- Improved on-ground support for implementing changes introduced through training courses;
- Training to be focused around case studies and producer demonstration sites;
- Integration of the economic implications into grazing land management training;
- Learning opportunities to be presented in a manner that reflects the cultural context and operating environment of the participants; and
- Better learning opportunities in the southern rangeland areas.

Incorporating all available environmental and economic information into an electronic 'knowledge system' that can provide real-time and predictive information to producers down to paddock scale.

Operating a grazing business in a complex environment, with tightening margins and internal (to the business) and external challenges makes the ability to access high quality and timely information an imperative.

The capacity to aggregate and transfer real-time spatial and temporal information about estimated pasture condition (quantity and quality) and growth rates, predicted animal growth rates given the pasture information, market data, financial implications of different decisions, and seasonal forecasts is increasing rapidly although prediction of animal growth rates at an appropriate time step remains a challenge. Estimates of the current, and expected future, pasture and animal status produced from models of the biophysical system (e.g. PaddockGRASP), if linked to economic models can support decision making from a whole business perspective.

Increasing the on-line availability and utility of this information will provide producers with a powerful tool to assist timely management decision-making. Providing analytical and interpretive support for the available information (e.g. through a consultant) will enhance its value.

Increasing basic ecological understanding across all regions and embedding this information into existing models of the grazing system

Biophysical models (e.g. GRASP, PaddockGRASP, AussieGrass etc.) provide useful platforms for a range of information products targeted at supporting producer decision making. However, these models are mainly operational in the tropical savannas of Queensland. There is more work required to improve their relevance in all rangeland regions, and also to improve their utility in informing decisions down to paddock scale. Defining the water use efficiency of landscapes in various land condition classes, in terms of both dry matter and digestible nutrient production, will further refine these models and enhance their capacity to generate the information referred to in the preceding section.

Further basic research is required to develop the principles for the grazing management strategies required to maintain land condition or achieve transitions from lower to higher land condition classes. This work includes investigation across a range of regions and key forage species, of the interaction of timing and intensity of defoliation in relation to growth, mortality and reproduction. It also includes evaluation of the role of animal impact in the management of native pastures. The capacity of key forage species to adapt to anticipated climate change may set limits on the long term capacity of some rangeland regions to maintain production. Understanding this capacity is thus fundamental to the future of rangeland grazing industries.

Determining how biodiversity can be sustained within land allocated for grazing

There is a need to determine the relationships between management for sustainable grazing off-take and the status of *in situ* biodiversity, and the trade-offs between biodiversity and production in re-designing production landscapes. Having a better understanding of these relationships will enable policy makers to implement more rational means of rewarding producers where they are managing for public good outcomes that may be in conflict with their private business objectives.

6.3 Goal, key objective and outcomes

Primary Goal

Management systems developed and adopted that deliver sustainable business profitability and resource use in extensive grazing systems.

The goal is a general aspirational statement of what is required to enable the grazing industries and businesses to be recognised as making a lasting, valued economic and social contribution to Australian society.

Key Objective

Identify the conditions under which grazing management can deliver both improved economic productivity and NRM benefits and develop policy initiatives to address market failures that encourage grazing to the detriment of publicly desired NRM outcomes.

The challenges facing rangeland managers are captured in this objective. While there is evidence that conservative grazing of extensive native pastures can be financially rewarding, it is also evident that managing for improvement in the condition of the resource can result in forgone income. The relationship between grazing activity and biodiversity on grazed land is not straightforward, with evidence of continuing declines in some indicators of biodiversity. The work done through the Draft R, D & E Plan will clarify the options for producers and policy makers in identifying what can be achieved in improved economic productivity and NRM benefits by producers acting alone, and where there is a case for public investment to address instances of market failure (as in best practice grazing management not generating publicly desired NRM outcomes).

20 year outcome

100% increase in grazing business profitability, rates of productivity growth in the extensive grazing industries of more than two per cent per year, with 90% of grazed land having ground cover above regional erosion thresholds at the most vulnerable time.

The rationale for the 20 year outcome is three-fold.

Average profitability in grazing businesses is insufficient to allow producers to make the necessary investments in infrastructure and grazing technology that will lead to improvements in the condition of the grazed lands. However, there is evidence that top-performing producers in all regions can generate good profits, and deliver NRM benefits. The challenge will be to take all producers to the standard of the top producers over the next 20 years.

The rate of growth in gross factor productivity over the period 1995-96 to 2006-07 in the northern Australian beef industry was 1.14 per cent per year (Nossal *et al.* (2008) reported in Gleeson *et al.* (2012), p. 63). It is likely to have been lower in the sheep industry in southern Australia. This rate of growth is insufficient to address long-term declining terms of trade, resulting in increased financial pressure on grazing businesses. Other agricultural industries are able to achieve productivity growth of over two per cent per year, and so a reasonable outcome for 2034 will be for productivity growth in the extensive grazing industries to be around 2.3 per cent per annum.

Ground cover is a recognised surrogate (one of 10 indicators) for the condition of biodiversity within grazed lands, and also for landscape stability and productivity. Its value as an indicator of productivity can be enhanced by refining the measure as the ground cover of 3P (palatable, perennial and productive) species. Ground cover needs to be measured at the time of year when it is most likely to be at its lowest (e.g. autumn in winter rainfall environments and spring or end of dry season in summer rainfall areas). It is important to note that this is a seasonal cycle not related to long droughts when ground cover may be below threshold regardless of management.

The ability to measure ground cover at regional scale is being developed by the Australian Collaborative Rangeland Information System (ACRIS) partners and ABARES. It is one of the few biophysical datasets directly related to NRM that can be analysed in a consistent way (i.e. no cross-jurisdictional issues associated with disparate datasets).

15 year outcomes

- 90 per cent of landholders in each Plan region have been involved in some aspect of the Plan by 2024 (*Sub-Program 1*).
- Management to achieve joint productivity and NRM benefits is not limited by access to available information (*Sub-Program 2*).
- The policy environment favours the delivery of socially desirable NRM outcomes through grazing industries that are recognised as legitimate and beneficial land uses (*Sub-Program 3*).
- Regionally appropriate grazing management systems being adopted that deliver greater profits, productivity and NRM benefits including increased ground cover and biodiversity conservation in extensive grazing lands (*Sub-Program 4*).

6.4 Principles for the draft R, D & E Plan

A review of the material in the previous sections suggests the following principles for a R, D & E Plan focused on the interaction between production and NRM outcomes. These are presented below not necessarily in order of importance.

6.4.1 Organisational principles

- Management and coordination is centrally delivered, with advice obtained via Coordinating Committees, and via regional groups linked to NABRC.
- Effective integration across all parties (public and private sectors, NRM and production R, D & E 'communities') to optimise use of scarce resources for rangeland R, D & E and ensure that synergies are achieved between contemporary programs;
- Appropriate balance of (R)esearch, (D)evelopment and (E)xtension in all projects to meet the needs of end users and funders.

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- An empowered R, D & E system through more effective networking initiatives, regional implementation strategies and greater involvement of women and youth (from NABRC).
- Effective internal collaboration, coordination and communication to ensure consistent delivery across all regions and projects.
- Effective external communication and collaboration to ensure that Plan activities are aligned with and support other 'third party' activities.
- Commitment to best practice monitoring and evaluation (M & E) at project and whole of program levels.

6.4.2 Content principles

- The Plan links production, NRM and business management outcomes. The assumption is that sound total grazing pressure management can deliver NRM, production and financial benefits.
- The essence of 'sound total grazing pressure management' is using valid information to make timely decisions about grazing use at any point in space or time. This can be termed as the level and timing of grazing use.
- The Plan is principally focused on restoration of land condition as a means of achieving NRM outcomes, including improved biodiversity status, on grazed land. Lesser attention is paid to landscape re-design for biodiversity management.
- Weeds are addressed to the (considerable) extent that they can be managed by best practice grazing management and judicious use of fire. Control of other weeds is beyond the scope of the Plan.
- The principal indicator of the state and trend in the resource is ground cover, which is a surrogate measure of productivity, landscape stability and biodiversity status.
- Recognition that the Plan is operating in a changing climate, with attention given to how key native pasture species can cope with a changing climate, and the implications for grazing use.
- The Plan will develop cost-sharing principles for public investment in achieving public outcomes on pastoral land where these cannot be achieved by grazing management that optimises financial returns to the landholder, consistent with duty of care obligations.
- Plan deliverables and delivery mechanisms to recognise and accommodate the heterogeneity in rangeland businesses, in size, capacity, cultural context, inherent productivity, general location (northern or southern rangelands), market access and ability to access resources (capital, intellectual property (IP), managerial resources).
- Additional basic biophysical information is needed to complement existing knowledge, if the Plan's goal and objective are to be achieved.
- The Plan recognises that new technologies for business management and information transfer are needed to increase productivity, and that new technologies require a supportive institutional and policy environment to deliver optimum benefits
- Given the increased sophistication of the spatial and temporal biophysical and economic information becoming available, the Plan focuses on design of knowledge systems as the key to improved decision making, and putting as much information as possible at the disposal of the producer; if necessary for interpretation with a consultant.
- The Plan commits to case studies and producer demonstration sites (PDSs) as 'nodes' for building commitment to learning and practice change, given producer preference for these approaches.
- NRM aspects, including engagement with producers includes cultural aspects.

- The Plan promotes the benefits of sound grazing management in the rangelands as an encouragement to increased investment in R, D & E and support for achievement of public good outcomes on privately held land.
- Implementation of the Plan will be used as a means of recruiting professional skills into the rangeland management and extensive grazing industries.

6.5 Draft Plan structure, logic, justification, projects and budget

6.5.1 Structure

Figure 6-1 shows the components of the 'Grazing Futures' Draft R, D & E Plan, with Figure 6-2 presenting how it is envisaged the Plan will be managed and coordinated, with a 'host' organisation responsible for overarching management and project management of national and northern Australia-specific Projects. Another 'host' organisation will take responsibility for the Projects specific to southern Australia. Organisations that have indicated an interest in these 'host' roles are the Queensland Department of Agriculture, Fisheries and Forestry (QDAFF) and Agriculture NSW (Ag NSW) respectively.

A National Coordinating Committee will provide strategic advice to the overarching 'host' organisation and specific advice on that organisation's administration of national projects. A Northern Australian Coordinating Committee will provide strategic advice to the overarching 'host' organisation regarding the management of northern Australia-specific projects. A Southern Australia Coordinating Committee will provide strategic advice to the southern Australia 'host' organisation on the management of southern Australia-specific projects.

6.5.2 Logic

Figure 6-3 presents the logic of the Draft R, D & E Plan, showing 20 year (2034) and 15 year (2029) outcomes, and 10 year (2024), 5 year (2019) and 2 year (2016) outputs. The outputs and outcomes are arranged in a vertical chronology.

An example of how the projects across the four 'content' sub-programs link to contribute to outcomes is shown in Figure 6-4. The example presented shows how effective extension in the northern rangelands is supported by sound coordination, the Grazing Futures Knowledge System, new information derived from basic and applied research, model development, case studies and PDSs, and information packages.

6.5.3 Justification

The justification for the 'content' Sub-Programs and their planned long-term (10 year) outputs is presented in Table 6-1.

The justification for the two year outputs to be delivered by the 'process' Sub-Program 5 is presented in Table 6-2. This 'process' Sub-Program is critical in ensuring consistency and coherence across the other Sub-Programs and their component projects.

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6.5.4 Projects

The suggested detail of the projects in the 'content' Sub-Programs 1-4 is shown in Table 6-3, Table 6-4, Table 6-5 and Table 6-6. The detail of the projects in the 'process' Sub-Program 5 is shown in Table 6-7.

6.5.5 Project Budget

An indicative estimated Plan budget for 10 years (in 2013 dollars) is presented in Table 6-8, which encapsulates the information contained in Table 6-3, Table 6-4, Table 6-5, Table 6-6 and Table 6-7 below. The priority of the projects for implementation is indicated by their sequence in the budget schedule. The estimated Plan budget is presented for review by MLA.

GRAZING FUTURES

Goal (20 yr): *Management systems developed and adopted that deliver sustainable business profitability and resource use in extensive grazing systems*

Key Objective*: Identify the conditions under which grazing management can deliver both improved economic productivity and NRM benefits and develop policy initiatives to address market failures that encourage grazing to the detriment of publicly desired NRM outcomes.*

Outcomes (20 yr): *100% increase in grazing business profitability, rates of productivity growth in the extensive grazing industries of more than two per cent per year, with 90% of grazed land having ground cover above regional erosion thresholds at the most vulnerable time*

5. Plan management and coordination Sub Program

Output (Yr 5): *Effective and efficient delivery of the R, D & E Plan through collaboration and coordination of all parties.*

Projects

5-1. Plan contractual protocols
5-2. Management procedures
5-3. Internal and external integration
5-4. Engagement and communication
5-5. Succession and capacity building
5-6. Monitoring and evaluation

1. Adoption Sub-Program

Intermediate Outcome (15yr)*: 90 per cent of landholders have been involved in some aspect of the Plan.*

Projects

1-1 Adoption Sub-Program Coordination
1-2 Grazing management technology for the northern rangelands
1-3 Grazing management technology for the southern rangelands
1-4 Case studies and producer demonstration sites
1-5 Adoption support – northern rangelands
1-6 Adoption support –southern rangelands

2. Knowledge Systems Sub-Program

Intermediate Outcome (15 yr)*: Management to achieve joint productivity and NRM benefits is not limited by access to available knowledge.*

Projects

2-1. 'A 'one stop shop' for southern graziers
2-2. Grazing Futures Knowledge System' analysis and design
2-3. Institutional support for 'Grazing Futures Knowledge System'
2-4. Knowledge systems education and adoption
2-5. Model development and validation

3. Perceptions and policies Sub-Program

Intermediate Outcome (15 yr)*: The policy environment favours the delivery of socially desirable NRM outcomes through grazing industries that are recognised as legitimate and beneficial land uses.*

Projects

3-1. The real outback – food ,fibre and conservation
3-2. Barriers to sustainable land use
3-3. Defining the role for direct or indirect public investment in rangeland management

4. Profitable grazing in healthy landscapes Sub-Program

Intermediate Outcome (15 yr): *Regionally appropriate grazing management systems being adopted that deliver greater profits, productivity and NRM benefits including increased ground cover and biodiversity conservation in grazing lands.*

Projects

4-1. National Rangeland Research Network – establishment and implementation
4-2. GRASP for the southern shrublands
4-3. Adaptability of rangeland ecosystems to climate change
4-4. Productivity and NRM benefits of total grazing pressure control
4-5. Sustainable production systems for meat sheep and rangeland goats
4-6. Profitable and conservative management systems for the northern rangelands
4-7. Evaluating trade-offs in the re-design of landscapes for production and biodiversity conservation

Figure 6-1 The Draft R, D & E Plan – Sub-Programs, Outcomes and Projects

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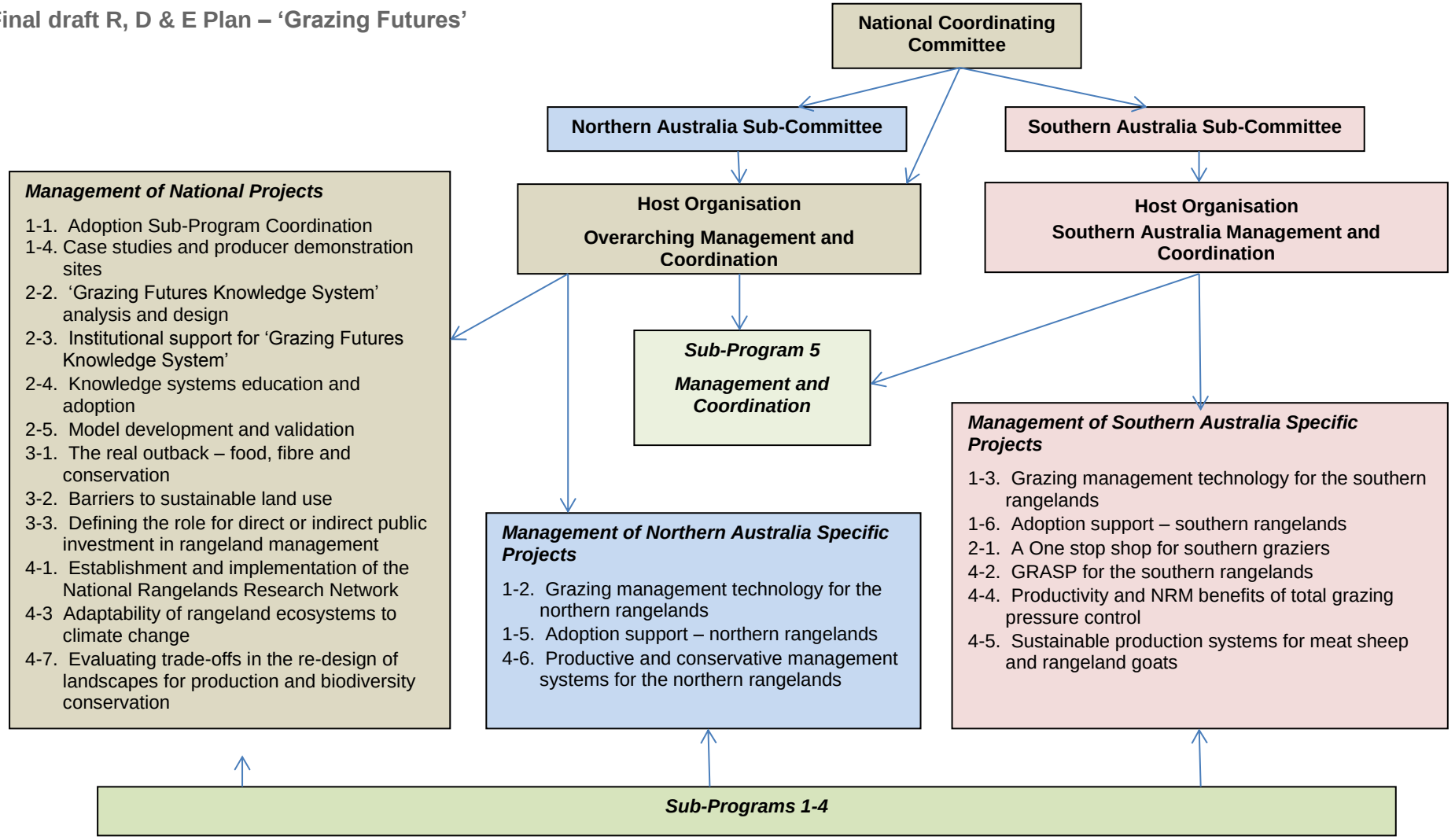

Figure 6-2 Organisation of the Plan

Goal

Goal

Goal *Management systems developed and adopted that deliver sustainable grazing business profitability and resource use in extensive grazing systems.*

20 year outcome

Long-term outcome: *100% increase in grazing business profitability, rates of productivity growth in the extensive grazing industries of more than two per cent per year, with 90% of grazed land having ground cover above regional erosion thresholds at the most vulnerable time.*

15 year outcomes

1. Adoption Sub-Program

Intermediate outcome: *90 per cent of producers have been involved in some aspect of the Plan*

2. Knowledge Systems Sub-Program

Intermediate outcome: *Management to achieve joint productivity and NRM benefits is not limited by access to available knowledge*

3. Perceptions and policies Sub-Program

Intermediate outcome:

The policy environment favours the delivery of socially desirable NRM outcomes through grazing industries that are recognised as legitimate and beneficial land uses

4. Profitable grazing in healthy landscapes Sub-Program

Intermediate outcome: *Regionally appropriate grazing management systems being adopted that deliver greater profits productivity and NRM benefits including increased ground cover and biodiversity conservation in extensive grazing lands*

10 year outputs

1. Adoption Sub-Program

Long-term outputs:

- Best practice technical information (from Sub-Programs 3 and 4 being incorporated in all material presented
- New and revised approaches to extending information embraced by producers
- User-friendly knowledge management systems resulting in improved decision making
- Enhanced public and private extension capacity at the NRM-production interface
- A network of case studies and PDSs facilitating practice change

2. Knowledge Systems Sub-Program

Long-term outputs:

- Processes in place to support long-term development and maintenance of state-of-the–art knowledge systems
- Knowledge systems, supported by interpretation, informing management decisions

3. Perceptions and policies Sub-Program

Long-term outputs:

- Understanding of the institutional, regulatory and economic barriers to sustainable grazing reflected in policy developments
- Public investment in rangeland management (e.g. MBIs) occurring on an informed basis
- An attractive economic argument for sound NRM delivering increased profitability – based on findings from work in Sub-Programs 3 and 4
- Benefits of sustainable pastoralism promoted to food and fibre consumers

4. Profitable grazing in healthy landscapes Sub-Program

Long-term outputs:

- Improved ecological understanding informing grazing management strategies and tactics in all regions
- Models delivering credible information in all regions
- Better known risks from changing climates
- Total grazing pressure management benefits defined
- Sustainable production systems for northern rangelands
- Sustainable production systems for meat sheep and farmed goats in southern rangelands
- Defined trade-offs in redesign of landscapes for production and biodiversity conservation

5 year Project outputs

Output 1-5. Adoption support for the northern rangelands established and effective

Output 1-6 Adoption support for the southern rangelands established and effective

Output 1-4 Case studies and producer demonstration sites accessible in all regions

Output 1-2. Grazing management technology packages for the northern rangelands being extended

Output 1-3. Grazing management technology packages for the southern rangelands being extended

Output 2-5. PaddockGRASP operational and upgraded GRASP versions being used in both northern and southern regions. (see also 4-2)

Output 2-4. Knowledge systems education and adoption program implemented; (50% of producers using the product)

Output 2-2. Grazing Futures Knowledge System is operational

Output 2-3. Institutional support arranged for the Grazing Futures Knowledge System

Output 3-3. Systems in place for rational investment (direct and indirect) of public funds on private landholdings to achieve public benefits

Output 3-2. Information provided to legislators and administrators to inform policy affecting grazing land use

Output 4-6. Parameters for profitable and conservative grazing in northern regions identified

Output 4-4. Improved information on benefits of total grazing pressure management

Output 4-2. GRASP adapted for southern shrublands (see 2-3)

Output 4-7. A more rational basis for identifying areas for biodiversity conservation

Output 4-5. Parameters for sustainable small stock grazing in southern rangelands identified

Output 4-3. Improved information on climate change impacts at regional scale

2 year Project Outputs

Output 1-1 Effective adoption coordination plan in place

Output 2-1 'One stop shop' in place for southern producers

Output 3-1. Credible, evidence-based material supporting grazing as a responsible and beneficial land use available in the public domain

Output 4-1 NRRN in place and generating valuable new basic biological information

Figure 6-3 Plan logic for the Draft R, D & E Plan

Table 6-1 Sub-Programs 1-4 – Outputs and justifications

Sub-program	What (10 year outputs)	Why (Justification)	Scale
1. Adoption Sub-Program	• Best practice technical information (from Sub-Programs 3 and 4 being incorporated in all material presented • New and revised approaches to extending information embraced by producers • User-friendly knowledge management systems resulting in improved decision making • Enhanced public and private extension capacity at the NRM-production interface • A network of case studies and PDSs facilitating practice change	• Current low Returns on Assets, inadequate investment in NRM, industry calling out for help to increase productivity • Need to reduce costs, and achieve greater productivity gains • Incorporate existing research and industry knowledge into workable systems • Need to consider socio-economic and cultural context is designing engagement means • Need for consistency in learning opportunities, with follow-up activities • Reduced on-ground public extension resources • Preference for case studies and PDS as means of learning new technology	Region and Industry
2. Knowledge Systems Sub-Program	• Processes in place to support long-term development and maintenance of state-of-the–art knowledge systems • Knowledge systems, supported by interpretation, informing management decisions	• Increasing array and quality of information becoming available needs to be matched with increasing sophistication in information delivery • Reduced on-ground public extension resources • Need to encourage private sector support for the industry	Regional and Industry
3. Perceptions and policies Sub-Program	• Understanding of the institutional, regulatory and economic barriers to sustainable grazing reflected in policy developments	• External factors (trade shocks, currency shifts, corrupted markets) have the ability to override sound on-property decisions • Government policies set for mainstream Australia may have unintended perverse consequences.	Industry
	• Public investment in rangeland management (e.g. MBIs) occurring on an informed basis	• It is likely that MBIs will be the most cost-efficient means of achieving a range of public objectives in the rangelands	Region
	• Benefits of sustainable pastoralism promoted to food and fibre consumers	• The social licence to operate must be justified and preserved • Support needed for public investment in the rangelands	Region and industry
4. Profitable grazing in healthy landscapes Sub-Program	• Improved ecological understanding underlying and informing grazing management strategies and tactics in all regions (based on work done on NRRN sites)	• Need for basic biological data to cover regional, climatic, seasonal and land type and condition variation • Enables producers to make decisions with more confidence • Will increase productivity (i.e. manage closer to the 'edge') • Impossible biophysically and logistically to conserve all biodiversity within reserves • Need to determine if public investment required to deliver biodiversity within grazing lands	Region and Industry
	• Models delivering credible information in all regions	• Required to enable sound and real-time spatial and temporal advice	Region
	• Better known risks from changing climates	• Climate change is real, will impact key pasture species south and north in different ways. Links with Commonwealth directives to RNRMO in regional planning	Region
	• Total grazing pressure management benefits defined	• Will support case for sound NRM • Will encourage increased productivity	Region
	• Sustainable production systems for northern rangelands	• Needs to address current push for intensification • Increasing animal numbers in northern Australia	Region
	• Sustainable production systems for meat sheep and farmed goats in southern rangelands	• Declining profitability of wool sheep in the southern rangelands • Current meat sheep and goat systems require improvement	Region
	• Defined trade-offs in redesign of landscapes for production and biodiversity conservation	• Significant current investment by RNRMOs in biodiversity conservation • Links with research work being done by CDU	Region and industry

Table 6-2 Sub-Program 5 – Outputs and justifications

Sub-program	What (2 year outputs)	Why (Justification)	Scale
5. Plan management and co-ordination Sub-Program	• Effective and efficient delivery of the R, D & E Plan through collaboration and coordination of all parties. — Development of shared investment arrangements — Agreed project design, management and M&E — Constructive industry and NRM participation, — Integration workshops between sub-programs — Succession planning to ensure resources available — Liaison with external stakeholders.	• Increase resources available to Plan delivery • Need for consistent, coherent delivery and accountability • Industry and NRM partners have expressed a desire for collaboration • To ensure cross-fertilisation • To address the skill/ experience decline in R, D & E capability for extensive grazing systems • To ensure external support for the Plan	Whole of rangelands

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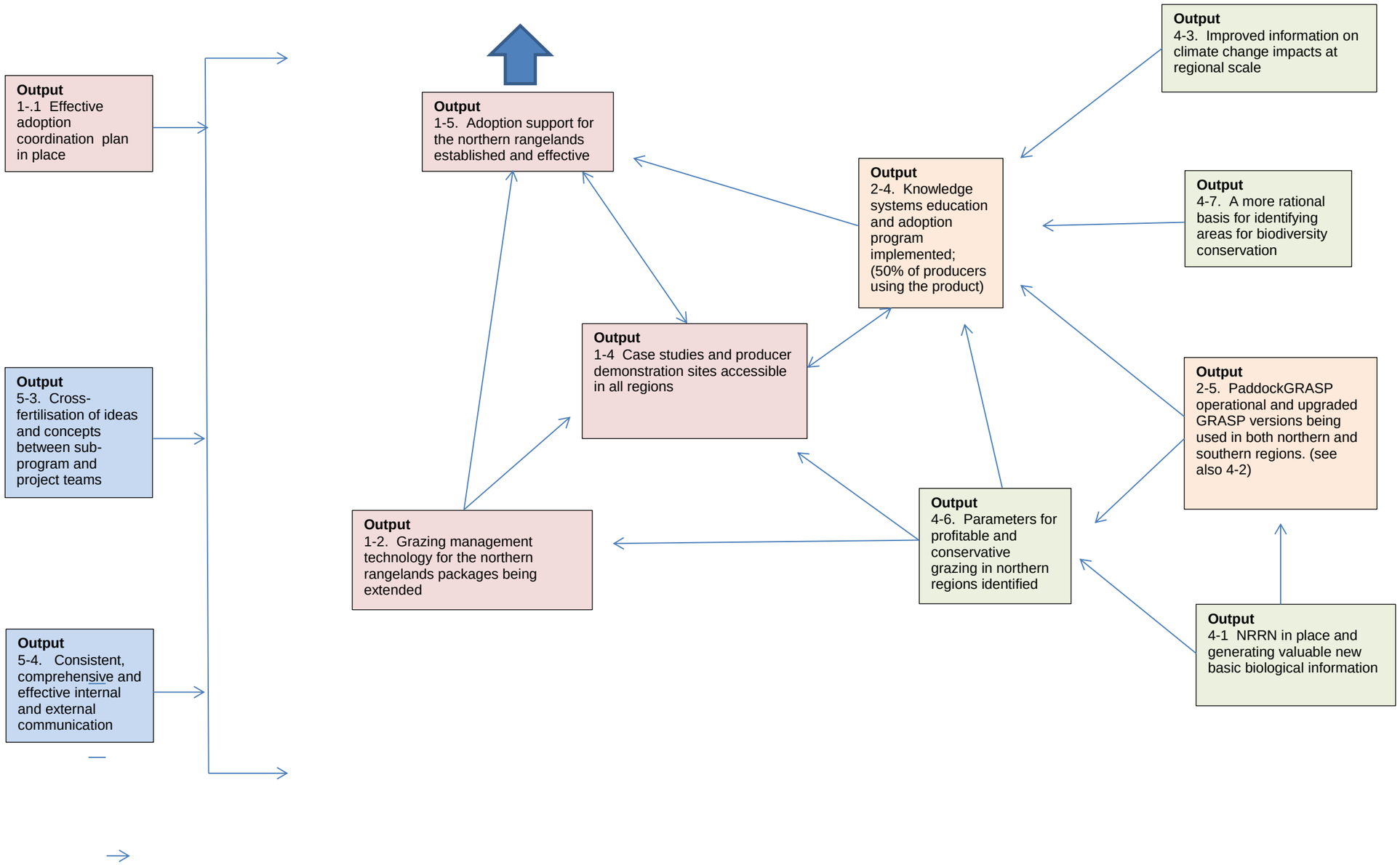

Figure 6-4 Linking project outputs to outcomes – an example

Table 6-3 Projects for Sub-Program 1 - Adoption

No.	Title	Region	Output detail	Methodology	Related projects	Indicative budget	Potential partners[6]
1-1	Adoption Sub-Program Coordination (undertaken by Grazing Futures Adoption Coordinator as shown in Project 5-1)	National	Well-coordinated extension and engagement plans in place and being implemented	Appointment of a Grazing Futures Adoption Coordinator to (1) oversight the implementation of projects within the Adoption sub-program (2) design, in association with project staff, targeted and culturally sensitive education programs to promote the outputs of other Sub-Programs (3) promote the results of Case studies and Producer Demonstration Sites and (4) oversight the M&E components of specific projects and regions.	All Projects in Sub-Program 1, Projects , 2-1, 2-2, 2-3, 2-4	$200,000 pa salary, on-costs and operating	MLA, State Agencies (initially QDAFF, NTDPIF, Ag NSW)
1-2	Grazing management technology for the northern rangelands	Northern rangelands	Seamless, coordinated packages that can be targeted at specific producer needs, and that have good follow-up support to encourage practice change Evidence-based' technologies that have productivity and NRM benefits included in the package Group exercises, partly cost-recovered. Involvement of private sector expertise in providing interpretation of materials from Sub-Programs 2-4, and benchmarking services	Review and revision of the GLM-EDGE course (including adaptation, as appropriate, of components of the Tactical Grazing course for southern Australia and inclusion of best practice experiential knowledge).	Projects 1-1, 1-4, 1-5, 2-2, 2-3, 2-4, 2-5	$100,000 consultancy for design of materials and delivery methods In-kind support for delivery by Rangeland Alliance and State Agencies	MLA, Rangeland Alliance, State Agencies (initially QDAFF, NTDPIF,Ag NSW)
1-3	Grazing management technology for the southern rangelands	Southern rangelands		Review and revision of the Tactical Grazing course offered by Agriculture NSW (including adaptation, as appropriate, of components of the GLM-EDGE course for northern Australia and inclusion of best practice experiential knowledge).	Projects 1-1, 1-4, 1-6, 2-1, 2-2, 2-3, 2-4, 2-5	$100,000 consultancy for design of materials and delivery methods In-kind support for delivery by Rangeland Alliance and State Agencies	MLA, State Agencies (initially QDAFF, NTDPIF, Ag NSW)
1-4	Case Studies and Producer demonstration sites	National	Case studies of typical operations identified and used to generate information that can be used locally and also incorporated in modelling activities in Sub-Program 4. A network of PDS that are the focus for learning by local and regional producers. Companion research activities being undertaken on case studies and PDS.	Case studies of more or less typical properties that are producing good economic and NRM outcomes will be developed by detailed analysis by a multi-disciplinary team to ensure that the basis for success, and the level of achievement, are identified. Implementation of PDS, with funds allocated on a regional basis that are planned cooperatively with researchers to deliver the most rigorous results possible from demonstration-style projects. Results to be subject to analysis for local and regional relevance Support for groups to form around case studies and PDSs and funds available to provide private sector consultants	All Projects in Sub-Program 1, 2-2, 2-3, 2-4, 2-5, 4-4, 4-5, 4-6	Estimate 20 case studies and 30 PDS. Case studies have no capital or operating costs. PDS costs estimated at $20,000 for set-up per site ($600,000) Other costs covered in Projects 1-5 and 1-6 with in-kind support for associated learning activities provided by Rangeland Alliance and State Agencies	MLA, Commonwealth DAFF, Rangeland Alliance
1-5	Adoption support – northern rangelands	Northern rangelands		Targeted support for existing delivery mechanisms including State agencies, FutureBeef, GLM courses and NRM organisations to deliver grazing technology courses.	Projects 1-1,1-2, 1-4, 2-4, 2-5, 4-1, 4-3, 4-6, 4-7	4 additional staff provided across northern Australia (estimate $600,000 pa salaries and operating In-kind support for delivery by Rangeland Alliance and State Agencies	Cost sharing between Commonwealth DAFF, MLA, State Agencies (initially QDAFF, NTDPIF, Ag NSW), Rangeland Alliance
1-6	Adoption support – southern rangelands	Southern rangelands		Targeted support for existing delivery mechanisms including State agencies, Bestprac networks and NRM organisations to deliver grazing technology courses.	Projects 1-1, 1-3, 1-4, 2-4, 2-5, 4-1, 4-2, 4-3, 4-4, 4-5, 4-7	2 additional staff provided across southern Australia (estimate $300,000 pa salaries and operating) In-kind support for delivery by Rangeland Alliance and State Agencies	

[6] The organisation(s) underlined is suggested as the initial 'driver' of the project

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Table 6-4 Projects for Sub-Program 2 - Knowledge Systems

No.	Title	Region	Output detail	Methodology	Related projects	Indicative budget	Potential partners
2-1	A one-stop-shop for southern graziers	Southern Rangelands	A one-stop shop in place for southern producers that is similar to Future Beef in structure and operation and that includes information contained in BestPrac and other sites	Develop a web-based tool similar to Future Beef that can provide a one-stop-shop for producers seeking information of NRM, animal production, and producer best practice in the southern rangelands	All Projects in Sub-program 1, 4-2, 4-4, 4-5 and 4-7.	$100,000 consultancy to establish, $20,000 pa maintenance In-kind contribution by CSIRO, and State Agencies	Funded by MLA, managed by Ag NSW, participation by other State Agencies, Rangeland Alliance
2-2	'Grazing Futures Knowledge System' analysis and design.	National	Initial components of the system will include real time animal liveweight and spatial distribution data (Digital Homestead, PPMS), current market conditions (Digital Homestead, PPMS?), current forage availability and ground cover (FORAGE),predicted (probabilistic) forage availability and ground cover by paddock (PaddockGRASP), and tools for whole–business economic analysis (e.g. ENTERPRISE), including evaluation of weed control options. Access to extension information and best practice producer experience will be provided either internally or by links to other sites such as FutureBeef.	Identify the preferred single platform for delivering spatially referenced information, both real time and predictive, for natural resources, livestock and market conditions, and for facilitating analysis and reporting of that information to assist management decision making. Potential platforms include Digital Homestead, FORAGE (part of LongPaddock) and the Precision Pastoral Management System (PPMS) developed by the DK-CRC and the CRC-REP and planned to be commercially available in 2017. Future development of the system will include predicted (probabilistic) animal growth and reproduction.	All projects in Sub-Program 1 and 4, Projects 2-3, 2-4 and 2-5	$200,000 set-up, $70,000 for major review in Yr 7	CSIRO, Commonwealth DAFF, State Agencies (initially QDAFF, NTDPIF, Ag NSW), CRC-REP, Rangeland Alliance Spatial Hub
2-3	Institutional support for 'Grazing Futures Knowledge System'	National	The 'Grazing Futures Knowledge System' is hosted by a single agency and managed collaboratively (ACRIS could be a useful model). Could be developed as a user pays services to support sustainability Support available for producers accessing the information	Determine and establish the institutional arrangements required between jurisdictions, and agencies within jurisdictions, to support the development and on-going operation of the preferred knowledge system and ensure cost-effective delivery of information to producers at a range of levels appropriate to individual needs.	All projects in Sub-Program 1 and 4, Projects 2-2, 2-4 and 2-5.	One salaried position ($150,000 pa salary plus operating) provided to hosting organisation. In-kind support provided by participating agencies Annual cost will decline as the system becomes self-funding through co-investment by States and producers	Hosting organisation to be decided. Rangeland Alliance and State Agencies as participants
2-4	Knowledge systems education and adoption	Northern and Southern Rangelands	Delivery to occur through Projects 1-4, 1-5, 2-1, 2-2 and 2-5.	Design and implement, in conjunction with the Grazing Futures Adoption Coordinator, on a regional basis, a targeted education program to inform producers and consultants of the knowledge system developed, and provide training in the use of the web interface.	All Projects in Sub-Program 1, 2-1, 2-2 and 2-3.	0.75 FTE northern Australia, 0.75 FTE southern Australia ($150,000 pa).	Funded by MLA and supported by hosting organisation for the Grazing Futures Knowledge System
2-5	Model development and validation	National	a) PaddockGRASP outputs available for individual properties via the 'Grazing Futures Knowledge System'. b) Increased availability of predicted animal performance (reproduction, growth) available from GRASP and accessible to producers via the 'Grazing Futures Knowledge System'. c) GRASP suitable for use in shrublands across southern Australia	a) Support the development of PaddockGRASP to full predictive (probabilistic) capacity for forage production and ground cover; develop protocols for incorporation of individual properties into the knowledge system, including standardised classification of pasture types and development or selection of appropriate GRASP parameter sets; develop protocols for input of data related to current local conditions (e.g. biomass, soil moisture, pasture condition class, presence of unpalatable species). b) Refine the animal production functions of GRASP, or an alternative model, to estimate animal growth and reproduction at an appropriate time step based on yield of dry matter and/or digestible nutrients (in conjunction with Sub-Program 4). c) Refine the dry matter production functions of GRASP to include a shrub component for southern rangelands (in conjunction with Sub-Program 4).	Projects 1-5, 1-6, 2-2, 4-1 and 4-2.	$50,000 pa cost, completed by Yr 6. In-kind contribution by CSIRO, and State Agencies	Commonwealth DAFF and MLA. Delivery by QDAFF, participation by CSIRO and other State Agencies

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Table 6-5 Projects for Sub-Program 3 - Perceptions and Policies

No.	Title	Region	Output detail	Methodology	Related projects	Indicative budget	Potential partners
3-1	The real outback – food, fibre and conservation	All regions	1. Material in the public domain 2. Articles suitable for release as features for regional and metropolitan newspapers; and 3. Work books suitable for inclusion in primary or secondary school curricula Will replace the existing material much of which is rhetoric from producer organisations, with unsupported assertions; or 'hard luck stories'.	Develop credible evidence-based, material for regional and metropolitan newspapers, and workbooks suitable for primary, secondary and tertiary curricula, to support the case for grazing as a responsible and beneficial land use.	All Projects	0.5 salaried position ($50,000), plus $50,000 for materials and promotion	MLA, Rangelands Alliance, NABRC
3-2	Barriers to sustainable land use	National	Information and advice for Commonwealth and State/Territory policy makers about changes to public programs, fiscal regimes and regulatory requirements that can support the objectives of the Plan.	A study of barriers to sustainable land use including institutional or regulatory, economic (associated with business cycles, recognising that a large proportion of profits may be made in a small proportion of years), and logistical to inform subsequent projects dealing with roles of direct and indirect public investment in rangeland management.	Projects 1-2, 1-3, 1-4, 4-3, 4-5, 4-6 and 4-7.	Suggest the project would be suited to a specific project (perhaps a PhD?) conducted over three years, at a total cost of $300,000	Commonwealth DAFF, MLA, ARC, CSIRO, Universities
3-3	Defining the role for direct or indirect public investment in rangeland management	Northern and Southern Rangelands	Systems (i.e. MBIs, grazing rights 'buy-backs') for extension by RA and land administrators. Tax-effective systems for extension by RA and land administrators MBIs underway in Western CMA and Lachlan CMA. Other RA members have voluntary covenanting arrangements, with funding by CfoC. All will benefit from these outputs	Define, at regional scale, the means by which effective land stewardship (i.e. that goes beyond statutory requirements) may be demonstrated given the outputs from the 'Barriers' project above, and the appropriate means of rewarding land managers who deliver it either directly (e.g. incentives for achieving ground cover targets; grazing rights 'buy-backs') or indirectly (e.g. through taxation or regulatory arrangements).	Projects 1-4, 1-5, 1-6, 3-2, 4—5, 4-6 and 4-7.	Suggest the project would be suited to a specific project (perhaps a PhD?) conducted over three years, at a total cost of $300,000	Commonwealth DAFF, Commonwealth DoE, ARC, CSIRO, Universities

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Table 6-6 Projects for Sub-Program 4 - Profitable Grazing in Healthy Landscapes

No.	Title	Region	Output detail	Methodology	Related projects	Indicative budget	Potential partners
4-1	National Rangeland Research Network - establishment and instrumentation.	Northern and Southern rangelands	The NRRN will be in place and will be administered / ‘hosted’ by the Rangeland Alliance members. This will provide the RA with a buy-in to the research being done on the sites, which can also be used as foci for learning opportunities. The RA members will also be able to provide practical support and regional knowledge to researchers working in the NRRN sites.	Establish a National Rangeland Research Network comprising 6-8 major study ‘sites’ encompassing the broad range of environments (particularly with respect rainfall amount and distribution) across the rangelands, and including examples of A, B, C and D land condition classes of a dominant land type (sub-sites) in close proximity at each location. Potential site locations would include Charters Towers (Wambiana grazing trial and/or Spyglass research station), Longreach, Charleville, Broken Hill (Fowlers Gap Arid Zone Research Station), Lake Mere research site, Koonamore, Pigeon Hole, Fitzroy Crossing and Carnarvon. Sites would be leased for 10 years, fenced with stock proof fencing, and equipped with one or more automatic weather stations, (depending on the proximity of the sub-sites). Sites need not be provided with permanent stock water but should have the capacity to water stock from temporary facilities for short periods as required. These sites will form the basis for the research programs described below. Each sub-site would be approximately 40 ha to allow for a degree of genuine replication in these investigations. Not all sites or sub-sites need for used for each project.	Projects 2-2, 2-5 and all projects in Sub-Program 4	$50,000 capital cost per site, with $5,000 per site per annum for management and maintenance	MLA, location of sites will involve State Agencies. Rangeland Alliance as site managers
4-1a	Landscape water use efficiency*	Northern and Southern rangelands	Output from models extended via GLM courses. Models available for use by researchers, producers and advisers	Yields of dry matter and digestible nutrients recorded at each site and sub-site will be used to determine the water use efficiency of each landscape. Dry matter and digestible nutrient yields will be related to animal growth and reproduction through existing models or basic nutritional requirements and validated by reference to measured production data from surrounding properties. (In some instances e.g. Wambiana and Spyglass, experimental animal production data may be available to validate the models). Relationships between landscape WUE, yield/digestible nutrient production and animal production will be used to refine the GRASP animal production functions as part of the Knowledge Systems Sub-Program.	All other projects under 4-1, 2-2, 2-5	Post-graduate scholarship funding (mainly from ARC) for one or more specific projects located across sites in the NRRN $80,000 for materials and logistics to augment the post-graduate research funding In-kind support by Rangeland Alliance, State Agencies	Australian Research Council (ARC), Universities, CSIRO, State Agencies, MLA

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No.	Title	Region	Output detail	Methodology	Related projects	Indicative budget	Potential partners
4-1b	Role of animal impact in ecosystem function.*	Northern and Southern rangelands	Objective data on the value of high intensity rotational grazing systems.	The effect on ecosystem function (nutrient cycling, water distribution, net primary production and botanical composition) of intensity and frequency of surface disturbance by high animal density will be evaluated at each site and sub-site (or a selected sub-set) to determine the benefit or otherwise of animal impact as a component of intensive rotational (cell) grazing systems. Animal impact will be produced by periodic movement of livestock over the experimental area, under arrangement with surrounding properties.	All other projects under 4-1, 2-2, 2-5	Post-graduate scholarship funding (mainly from ARC) for one or more specific projects located across sites in the NRRN $80,000 for materials and logistics to augment the post-graduate research funding In-kind support by Rangeland Alliance, State Agencies	Australian Research Council (ARC), Universities, CSIRO, State Agencies, MLA
4-1c	Strategies for transitional grazing *	Northern and Southern rangelands	Although the economic benefits of conservative grazing on rangeland in good condition has been demonstrated (e.g. Wambiana grazing trial), there is little information on how producers can economically benefit from choosing to improve land from lower to higher condition classes (e.g. D to C, C to B). Outputs from this research will inform strategies and tactics for transitional grazing.	(a) Basic studies of the autecology of key grazing species, particularly the interaction of time and intensity of defoliation in relation to growth, mortality and reproduction, to provide principles for grazing management strategies aimed at transitions from lower to higher land condition classes, or for maintaining acceptable condition classes. This will be plot scale work, not grazing trials, with defoliation regimes imposed either by temporary exclusion of grazing (in the commercially grazed areas surrounding each site) or by short term grazing of sub-sites themselves. (b) Identification of thresholds for system response (and therefore appropriate grazing management objectives) by determining the relationship between rate of recovery following exclosure and land condition class and/or landscape function parameters.	All other projects under 4-1, 2-2, 2-5	Post-graduate scholarship funding (mainly from ARC) for one or more specific projects located across sites in the NRRN $80,000 for materials and logistics to augment the post-graduate research funding In-kind support by Rangeland Alliance, State Agencies	Australian Research Council (ARC), Universities, CSIRO, State Agencies, MLA
4-1d	Rangeland soil biology*	Northern and Southern rangelands	This will contribute to model developments.	Basic studies of soil biology and nutrient cycling to determine when, and to what extent , the production of forage and digestible nutrients is limited by soil nutrient availability rather than water availability.	All other projects under 4-1, 2-2, 2-5	Post-graduate scholarship funding (mainly from ARC) for one or more specific projects located across sites in the NRRN $80,000 for materials and logistics to augment the post-graduate research funding In-kind support by Rangeland Alliance, State Agencies	Australian Research Council (ARC), Universities, CSIRO, State Agencies, MLA

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No.	Title	Region	Output detail	Methodology	Related projects	Indicative budget	Potential partners
4-1e	Maximising biodiversity benefits in grazed landscapes*. *Suitable research domains for post graduate students	Northern rangelands, initially.	The outputs will provide producers and policy makers with information about long term utilisation and biodiversity status. This will be a precursor to development of programs that may provide stewardship payments (see Policies and Perceptions Sub-Program) for managing for biodiversity outcomes as a priority on some lands. This links with current work in Agriculture NSW and ABARES.	Determine the relationship between biodiversity status and long term pasture utilisation level by biodiversity assessments on and adjacent to National Rangeland Research Network sub-sites, and reconstruction of historic utilisations levels from stock records and pasture growth modelling. Use the relationship between long term utilisation and biodiversity status, and modelled economic results of a range of long term utilisation levels (e.g. by extrapolation from Wambiana) to identify tradeoffs between maximisation of biodiversity and profit on grazed land.	All other projects under 4-1, 2-2, 2-5	Post-graduate scholarship funding (mainly from ARC) for one or more specific projects located across sites in the NRRN $80,000 for materials and logistics to augment the post-graduate research funding In-kind support by Rangeland Alliance, State Agencies	Australian Research Council (ARC), Universities, CSIRO, State Agencies, MLA
4-2	GRASP for the southern rangelands	Southern Rangelands	A GRASP version that includes the contribution of shrubs to the forage availability.	Sites that form part of the National Rangeland Research Network, and others as available, will be used as calibration sites for the GRASP model, to develop parameter sets for additional pasture types and, in particular , to allow the development of a shrub biomass component in the model. The conventional SWIFTSYND methodology will be modified to incorporate measurement of shrub forage.	Project 4-1 (and component parts), 2-1, 2-2, 2-5, 4-2, 4-5 and 4-7.	Consultancy for design and development ($400,000), $10-20,000 pa for on-going maintenance and upgrading until Yr 6	Ag NSW, QDAFF, CSIRO, Commonwealth DAFF
4-3	Adaptability of rangeland ecosystems to climate change	Southern and Northern Rangelands	Better ability to provide information on climate change risks and opportunities (can link with RNRMO activities) Support for structural adjustment of pastoral industries if required (links to sub-program 3).	Basic studies of the genetic capacity of major rangeland forage species to tolerate grazing under anticipated climate change, based on transplant experiments in which local populations are transplanted to locations with likely future climates and subjected to artificial defoliation.	Project 4-1 (and component parts), 2-1, 2-2, 2-5, 4-5 and 4-6.	Specific post graduate projects conducted over three years, with material costs included for a total cost of $750,000.	Ag NSW, CSIRO, Commonwealth DAFF, Rangeland Alliance
4-4	Productivity and NRM benefits of total grazing pressure control.	Southern Rangelands	A better basis for extending the value of TGP management	Define the benefits of exclusion fencing combined with tactical grazing management for livestock productivity and NRM outcomes (especially groundcover).	Projects 1-3, 1-6, 2-1, 2-2, 4-5, and 4-7	Three year project for 1 FTE to analyse and disseminate results of case studies and PDS ($450,000)	MLA, State Agencies (mainly Ag NSW), Rangeland Alliance
4-5	Sustainable production systems for meat sheep and rangeland goats in the southern rangelands (inside the Dog Fence).	Southern Rangelands	Comprehensive systems for economically rewarding meat sheep and goat grazing enterprises. Domestication of goats is progressing; strong swing to meat sheep over the last decade; both goats and meat sheep pose potential issues for NRM that differ from traditional industries, especially due to capacity to maintain reproduction under poor seasonal conditions.	Develop grazing management systems appropriate for Dorper sheep and rangeland goats based on (a) development of forage budgeting systems including browse (b) understanding of grazing behaviour (spatial distribution; diet selection) (c) water requirements and appropriate DSE ratings and (d) production parameters (fertility, mortality, growth) under varying seasonal conditions (especially at low planes of nutrition).	Projects 1-3, 1-6, 2-1, 2-2, -4-4, and 4-7	Three year project for 1 FTE to pull together available information and undertake fieldwork for a total cost of $600,000.	MLA, State Agencies (mainly Ag NSW)

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No.	Title	Region	Output detail	Methodology	Related projects	Indicative budget	Potential partners
4-6	Profitable and conservative management system for the northern rangelands.	Northern Rangelands	Improved information to be included in learning products to be developed in the Adoption Sub-Program	(a) Collection of cost of production data for a range of pastoral operations in northern Australia (b) extension of the Wambiana grazing trial results by modelling using GRASP and ENTERPRISE to evaluate the likely profitability and sustainability of the broad management system applied at Wambiana in other environments.	Projects 1-2, 1-5, 2-1, 4-6 and 4-7	Two year project for 1 FTE to pull together available information into systems ($300,000)	MLA, State Agencies (QDAFF, NTDPIF), Rangeland Alliance
4-7	Evaluating tradeoffs in the re-design of landscapes for production and biodiversity conservation.	Southern Rangelands, initially, then northern rangelands	A more rational basis for identifying areas where management of biodiversity should be the objective.	Development of a practical tool, based on a Bayesian network model, to evaluate the economic and biodiversity consequences of alternative landscape designs to guide investment decision making by regional NRM organisations.	Projects 1-2, 1-3, 1-5, 1-6, 2-1, 3-3, 4-5 and 4-6	Six year project (3 years southern, followed by 3 years northern, for 1 FTE ($900,000)	Commonwealth DoE, Commonwealth DAFF, State Agencies, CSIRO

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Table 6-7 Projects for Sub-Program 5 – Management and Coordination

No.	Title	Output detail	Methodology	Related projects	Indicative budget	Potential partners
5-1	Plan contractual protocols	Agreed contracts for delivery over 10 years	MLA to contract with funding partners and Rangeland Alliance, QDAFF and Ag NSW for delivery	Project 5-2	$50,000 in kind	MLA, QDAFF, Ag NSW
5-2	Management procedures	Organisation structure and reporting requirements Sound project management and delivery	Appointment of Coordinating Committees and Executive Staff for National 'host' and Southern 'host' organisations Agreement on Project Briefs and reporting requirements	All Projects	5.0 per cent of annual budget (part funding of all positions)	MLA, host agencies
5-3	Internal and external integration	Regular meetings between sub-program and project teams Cross-fertilisation of ideas and concepts between sub-program and project teams	Development of plan for interaction between sub-programs and projects, and relevant external programs, using face-to-face and electronic means	All Projects	2.5 per cent annual budget	MLA, host agencies, State Agencies
5-4	Engagement and Communication	Sound internal communications across sub-program and project teams, and funders and partners Sound external communication within rangeland NRM and livestock industry stakeholders Sound external communication directed at policy and decision makers	Development of engagement and communication plan	All Projects	2.5 per cent annual budget	MLA, host agencies, State Agencies
5-5	Succession and capacity building	5 post-graduate students undertaking MSc and PhD studies at any one time Rangelands Australia accredits 20 rangeland managers per annum	Development of Post-graduate scholarships in rangeland livestock management Encourage re-launch of *Rangelands Australia* as a source of accredited courses in rangeland management for graduates and practitioners (i.e. rangeland managers)	Projects 1-1, 1-5, 1-6, 2-4, 4-1	Post-graduate studies met by Universities and ARC grants 1.0 per cent annual budget to promote *Rangelands Australia* to educational institutions	Universities, ARC, NABRC, MLA, CSIRO
5-6	Monitoring and Evaluation	Progressive M&E reports on Whole of Plan and Projects performance over 10 year period of Plan delivery M&E Reports on 10 year targets M&E Reports on 20 year targets	Development of Monitoring and Evaluation (M&E) Plan for use at Whole-of-Plan and project levels Assemblage of baseline data as required Implementation of M&E activities	All projects	1.0 per cent of total budget	MLA, State Agencies, Commonwealth DAFF

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Table 6-8 Indicative R, D & E Plan budget

Project	Item	Budget ($'000s) - 2013 dollars										
		Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Total
1-1. Adoption Sub-Program Coordination	Salary and operating (1 FTE)	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	**$2,000**
1-2. Grazing management technology for the northern rangelands	Consultancy	$100										**$100**
1-3. Grazing management technology for southern rangelands	Consultancy	$100										**$100**
1-4. Case studies and producer demonstration sites	$20,000 capital per PDS, no capital cost for case studies	$100	$200	$100	$100	$100						**$600**
1-5. Adoption support –northern rangelands	Salary and operating (4 FTE)		$600	$600	$600	$600	$600	$600	$600	$600	$600	**$5,400**
1-6. Adoption support – southern rangelands	Salary and operating (2 FTE)		$300	$300	$300	$300	$300	$300	$300	$300	$300	**$2,700**
2-1. A 'one stop shop' for southern graziers	Consultancy for design ($100,000), $20,000 pa maintenance	$100	$20	$20	$20	$20	$20	$20	$20	$20	$20	**$280**
2.2. 'Grazing Futures Knowledge System' analysis and design	Consultancy for design ($200,000), maintenance covered under institutional support. Review in Yr7	$100	$100					$70				**$270**
2-3. Institutional support for 'Grazing Futures Knowledge System'	Initially, salary and operating (1 FTE). Reduced support needed as system becomes self-supporting.		$150	$150	$125	$100	$75	$50	$50	$50	$50	**$800**
2-4. Knowledge systems education and adoption	0.75 FTE north, 0.75 FTE south			$150	$150	$150	$150	$150	$150	$150	$150	**$1,200**
2-5. Model development and validation	Cost of coordinator split with 4.2	$50	$50	$50	$50	$50	$25					**$275**
3-1. The real outback – food, fibre and conservation	Salary (0.5 FTE) and materials	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	**$1,000**
3.2. Barriers to sustainable land use	Three year project (PhD?)		$100	$100	$100							**$300**
3-3. Defining the role for direct or indirect public investment in rangeland management	Three year project (PhD?)			$100	$100	$100						**$300**
4.1. National Rangeland Research Network – establishment and administration	8 sites @ $50,000 ea. $5,000 pa maintenance ea.	$200	$220	$40	$40	$40	$40	$40	$40	$40	$40	**$740**
4.1a- 4.1e*. Component research in water use efficiency, effect of animal impact, soil biology etc.	On-ground support for post-graduate projects funded by ARC, universities etc.		$400	$400	$400	$400	$400	$400	$400	$400		**$3,200**
4-2. GRASP for the southern shrublands	Establishment and data collection from SWIFYTSYND	$90	$210	$210	$210	$170	$25					**$915**
4-3. Adaptability of rangeland ecosystems to climate change	Two three year projects (PhDs?) - one south, one north. Complex experiments need additional support	$250	$250	$250								**$750**
4-4. Productivity and NRM benefits of total grazing pressure control	Links with case studies and PDS. Salary and operating (1 FTE)		$150	$150	$150							**$450**
4-5. Sustainable production systems for meat sheep and rangeland goats	Three year project (1 FTE) - needs GRASP, plus field studies			$200	$200	$200						**$600**
4-6. Profitable and conservative management systems for the northern rangelands	Two year project (1 FTE)		$150	$150								**$300**
4-7. Evaluating trade-offs in the re-design of landscapes for production and biodiversity conservation	Six year project (3 years southern then 3 years northern)	$150	$150	$150	$150	$150	$150					**$900**
Sub-Program 5	12 per cent of total project costs	$185	$402	$410	$359	$322	$250	$232	$223	$223	$175	**$2,782**
Total		**$1,725**	**$3,752**	**$3,830**	**$3,354**	**$3,002**	**$2,335**	**$2,162**	**$2,083**	**$2,083**	**$1,635**	**$25,962**
* component projects funded ARC, CSIRO, Universities etc.												

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In-principle support for the Plan

7.1 R, D & E Plan Management and Coordination

7.1.1 Overall Management and Coordination

When consulted again (21 October 2013) about the possibility of NABRC being responsible for overall Management and Coordination of the Plan, Ralph Shannon, Chairperson of NABRC stated that on reflection, he felt that it is not appropriate for the Council to take on this role.

The URS team reviewed the options for overall management and coordination of the R, D & E Plan. The team envisages that overall coordination of the plan would be by a National Coordinating Committee comprising industry, agency and MLA representatives and chaired by an industry representative. This committee would exercise overarching supervision and directly manage projects that are national in scope. Projects that are regional in scope would be managed by separate Northern and Southern Sub-Committees, again with industry, agency and MLA representation.

Clearly, the organisation with the most human resources and the largest stake in terms of cattle numbers, property numbers, and external impacts (particularly on the Great Barrier Reef) in linked NRM / production R, D & E is the Queensland Department of Agriculture, Fisheries and Forestry (QDAFF). Further, the input to the design of the R, D & E Plan by QDAFF staff in Brisbane and Charters Towers has been considerable, and interest in the outlined R, D & E activities is high.

The URS team considered that QDAFF has the staff, expertise and stake to host both the National Coordination Committee and the Northern Sub-Committee, although additional resources provided by MLA may be required to facilitate these roles. The Southern Sub-Committee would most logically be hosted by Agriculture NSW (Ag NSW) which contains most of the relevant expertise available in the southern rangelands (see Section 7.1.2).

An approach was made to Dr Peter Johnston (General Manager, Animal Science, QDAFF, Brisbane) regarding the potential for an arrangement along these lines. Dr Johnston responded that QDAFF would be interested, in principle, in the suggested arrangement. He explained that there is potentially a good fit between the proposed R, D & E Plan activities, the existing and planned MLA/ QDAFF activities around 'Sustaining the Feedbase', and the activities in the Reef Rescue Program' which are generating a positive response within industry. He emphasised the 'in principle' nature of the interest in management and coordination, and would welcome further discussions with MLA on the detail of the arrangement after the completion of this URS project.

7.1.2 Delivery of specific southern rangeland activities

In the southern rangelands, Agriculture NSW is the logical entity to take on the role of managing and coordinating specific Plan activities in those regions, given that it has the most human resources working in the southern rangelands (in Western NSW) and the largest stake in terms of numbers of livestock and grazing businesses across the southern rangelands.

Having earlier indicated an interest in coordinating southern rangeland activities, Ag NSW was consulted again to confirm their position. Ms Delia Dray (Director, Livestock Systems, Orange) confirmed the Department's willingness, in principle, to lead and coordinate the Plan's activities across the southern rangelands if the Plan is approved. This would involve hosting and supporting a Southern Rangelands Sub-Committee overseeing the R, D & E Plan, and the management of specific southern rangeland projects. Ms Dray would welcome further discussions with MLA on the detail of the arrangement after the completion of this URS project.

7.2 Administration of NRRN Sites

The Draft R, D & E Plan includes establishment of six to eight National Rangeland Research Network (NRRN) study 'sites' to be located across all rangeland jurisdictions and in most NRM regions. The intent is to cover the main grazing regions and the diversity of climatic and vegetation types and include examples of A, B, C and D land condition classes of a dominant land type (sub-sites) in close proximity at each location ('site'). As such it is likely that the sites could be located within the boundaries of several of the Regional NRM Organisations that are members of the Rangeland Alliance.

Sites would be leased for 10 years, fenced with stock proof fencing, and equipped with one or more automatic weather stations, (depending on the proximity of the sub-sites). Sites need not be provided with permanent stock water but should have the capacity to water stock from temporary facilities for short periods as required. Each sub-site would be approximately 40 ha to allow for a degree of genuine replication in these investigations. These sites will form the basis for specific research projects funded and delivered by a range of parties. Not all sites or sub-sites will be needed for each project.

Regardless of the final location of the National Rangeland Research Network (NRRN) sites, the URS consultant team suggests that 'hosting' (i.e. administration and management) of these sites, on a fee-for-service basis, would provide an ideal way for involving the Rangeland Alliance in grazing-related R, D & E being done on the sites, and encouraging their participation in the Plan activities in general.

An approach was made to Ms Kate Forrest, Executive Officer of the Rangeland Alliance to determine if its members would be interested in undertaking this role nationally as a collective project, or if arrangements on a site by site basis would be more appropriate (i.e. negotiating arrangements with the individual RNRMO hosting each site). By 'management', the URS team means looking after maintenance of the site, promoting work underway, attracting research activities from third parties in addition to those proposed in the Draft R, D & E Plan, and hosting/ running extension activities at the sites etc. As noted above, payment for services for day-to-day administration would be provided as part of overall Plan funding.

The advice received from the Executive Officer of the Rangeland Alliance is that the proposition is of interest, in that it may link with the planned 'spatial hub' which will be a major information storage and sharing facility, and also with case studies and Producer Demonstration Sites being supported by RNRMOs. The proposition will be considered by the Rangeland Alliance members over coming meetings, which will involve discussions between the RA and MLA after the life of this (URS) project.

7.3 Partnerships in project funding and delivery

The organisations that have either indicated strong interest in participation and/or funding, or have significant delivery capacity or other capabilities to offer, are presented in Table 7-1 below, with comments.

In the table 'funding support' implies a cash contribution to the project. 'Participation' implies funding in-kind either through the provision of facilities, intellectual property, personnel time, or other forms of in-kind support. The Commonwealth Government contributions are assumed to be sought through the *Caring for our Country* Program, by agencies, the Rangeland Alliance as an entity, and by individual RNRMOs, as required.

7 In-principle support for the Plan

Table 7-1 Partnerships in funding and delivery

Organisation	Involvement details
MLA	Funding support for • Adoption Sub-Program Coordinator (Project 1-1) • Grazing management technology (Projects 1-2 and 1-3) • Adoption support (Project 1-4 and 1-5) • Case Studies and PDS (Project 1-6) • Model development (Projects 2-3 and 4-2) • One-stop shop (Project 2-4) • Knowledge systems education and adoption (Project 2-5) • The real outback (Project 3-3) • Set-up and maintenance of NRRN (Project 4-1) • Management for northern rangelands (Project 4-6) Participation in southern rangelands small stock R, D & E (Projects 4-4 and 4-5) Start-up funding for Management and Coordination Sub-Program 5. On-going funding to be negotiated.
Commonwealth DAFF	Funding support (via CfoC –sustainable agriculture) for • adoption support (Project 1-4) • case studies and PDS (Project 1-6) • Grazing Futures Knowledge System (with input from ABARES) (Project 2-1) • Contribution to model development via ABARES participation (Projects 2-3 and 4-2) • Investigation of institutional barriers (Project 3-1) Participation via ABARES in defining the role for public investment in rangeland management (Project 3-2) Participation in redesigning landscapes for biodiversity conservation (Project 4-7)
Commonwealth DoE	Funding support (via CfoC) for • defining the role for public investment in rangeland management (Project 3-2) • redesigning landscapes for biodiversity conservation (Project 4-7)
Rangeland Alliance (as an entity)	Participation in • development of 'Grazing Futures Knowledge System (Project 2-1) • institutional support (Project 2-2) Delivery of • A one-stop shop (Project 2-4) • The real outback (Project 3-1)
Regional NRM Organisations (as separate entities)	Leading delivery of: • Adoption support (Projects 1-4 and 1-5) • Case Studies and PDS (Project 1-6) • Maintenance of NRRN (Project 4-1) Participation in TGP (Project 4-5)
CSIRO	Funding support and leadership in development of 'Grazing Futures Knowledge System' Participation in model development (Projects 2-3 and 4-2) Participation (and supervision?) in • Barriers to sustainable land use (Project 3-1) • Defining the role for public investment in rangeland management (Project 3-2) • Projects 4-1a to 4-1e
QDAFF	Hosting of Plan, management and funding support of national projects Funding support and management of all northern projects

7 In-principle support for the Plan

Organisation	Involvement details
Ag NSW	Funding support for national projects Funding support and management of all southern projects
NT DPIF	Funding support and participation in all national and northern projects
DAFWA	Funding support and participation in all national and northern projects
Universities	Contribution to and supervision of Projects 4-1a to 41e
Australian Research Council	Funding (sought by universities and other partners) of research undertaken in Projects 4-1a to 4-1e
CRC-REP (Ninti-One)	Participation in development of 'Grazing Futures Knowledge System (Project 2-1)
NABRC	Lobbying for re-launch of *Rangelands Australia*, and increased post-graduate courses in rangeland management

8

Recommendations

8.1 Next steps for the development of this R, D & E Plan

It is recommended the Draft R, D & E Plan as presented by URS is accepted. It can be further developed at a workshop after the completion of this Project. Suggested participants are representatives of MLA, QDAFF, Ag NSW, Commonwealth DAFF (incl. ABARES), NTDPIF, DAFWA, NABRC, CSIRO and the Rangelands Alliance. These organisations are those that have responded most positively to the Draft R, D & E Plan, and/or have the greatest existing capacity (IP, personnel, political leverage) to offer Plan implementation.

It is not expected that MLA will be able or indeed should fund this Plan in isolation of other investors. Shared investment is recommended. The Plan provides a basis to enable investors to provide funds in a value-adding fashion that addresses identified needs in delivering more coordinated R, D & E focusing on linked profitability, productivity and NRM outcomes.

8.2 General recommendations for developing R, D & E programs

8.2.1 Testing the underlying assumption

As described in Section 2.3, the R, D & E 'environment' in rangelands and native pasture production systems is very crowded with a large number of programs, projects and activities being delivered by numerous organisations. Further, it is likely that the review undertaken for this Project has under-estimated both the number of projects and number of deliverers relevant to the Project objectives.

Despite this effort, the evidence presented in the Situation Analysis in Section 2 is that the grazing industries and many of their constituent businesses are performing poorly financially, have low productivity growth, and are not able to meet their duty of care in managing the resource.

This should give cause for R, D & E investors and deliverers to reflect on the value of the work, as follows.

Are the current approaches ineffective, either because:

- they tackle the wrong issues? or
- there has been poor delivery? or
- there has been inadequate investment?

Conversely would the situation be significantly worse without the past and current effort, implying the approaches have been effective to a degree, although:

- More of the same is required? or
- *Existing approaches need to be complemented with new and different approaches?*

The implicit assumption underlying the Project objectives is the last statement (shown in *italics*). The Project scope did not require the testing of this assumption, which would have required an 'R, D & E rangeland portfolio' evaluation of the past and current work, or a review of the available evaluations conducted. This would have added substantially to the Scope but may have allowed a better assessment of the gaps and opportunities for further work.

8.2.2 Obtaining direct input from industry

The Project was not successful in obtaining support from a wide cross-section of industry (grazing businesses and peak industry bodies) and NRM organisations. Of the 50 surveys dispatched, 18

responses were received, and only after a lot of follow-up contacts. This retarded Project progress and increased costs.

The information obtained largely mirrored that available from NABRC, the Rangeland Alliance and State agencies. As such it confirmed information available from these sources, rather than adding to it. It is recommended that in future, input be sought from peak organisations only that have established R, D & E strategies and objectives.

8.2.3 Reviewing draft R, D & E suggestions with stakeholders

Most stakeholders commended MLA for its collaborative approach to working with potential partners in designing the R, D & E Plan and contrasted this to some other experiences. This approach is recommended.

In terms of process, stakeholders were provided with adequate background material providing the background and Preliminary Draft R, D & E Plan details prior to consultation. The response to this information varied widely. One organisation has not responded at all. At the other end of the scale, some stakeholders provided feedback at the level of individual project detail, including suggestions for additional activities. In between, stakeholders gave varying levels of attention to the detail in the Draft Plan, some preferring simply to query administrative or policy matters relating to R, D & E generally, or advise URS of their own related activities. Further, in some cases URS was queried as to why this work was not being done by MLA directly.

This less than complete attention to detail has made it difficult to reflect stakeholder priorities in the final Draft R, D & E Plan, requiring more judgement on the part of the Project team than is perhaps desirable.

For a R, D & E Plan of the scope and magnitude developed (about $2 m per year for 10 years), a more thorough approach to obtaining stakeholder feedback should be considered, with more direct MLA involvement.

8.2.4 Securing stakeholder buy-in for funding and delivery

The Project scope required URS to obtain ‘in-principle’ support from potential investors.

During the consultation, URS was advised that public resources for R, D & E in agriculture, especially in the rangelands, are scarce in all jurisdictions. This is an issue that it is attracting attention nationally (Mick Keogh *pers. comm*.). The Project team found that there was interest from most parties in being involved in the R, D & E Plan, and appreciation of the opportunity to be involved in the planning.

However, there was no specific commitment offered in respect of funding, even at an in-principle level. This is not surprising, as the timing of the Project may have not been aligned with a budgeting cycle for the organisations contacted, the proposal does not account for organisations’ own priorities and imperatives which need to be considered first, and it is unrealistic to expect an organisation to declare their interest or intentions to a third party (i.e. URS).

It is recommended that in future that the organisation sponsoring the development of Plan (in this case MLA) take over the responsibility for negotiating participation and funding directly with organisations involved.

9

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A

Appendix A Additional details for Project ERM.0094

Additional details

The component of the projects (situational analysis/ update; RD&E plan and BCA) form a R,D&E business plan that should help each participant evaluate the issues, opportunities, and areas of mutual interest for investment in an R,D & E program focused on meat production systems in Australia's rangelands.

This project will interact with MLA project NBP.0755 "Develop a fire x grazing RD&E plan for northern Australia" to minimise duplication of effort when seeking information from research agencies and stakeholders. . The interaction is to:
- share details of proposed stakeholder meeting and information that will be required by the stakeholder.
- identify what information will sourced from the consultation
- exchange the consultation output where it relates to the other project

The Rangelands Alliance is a key stakeholder for continued engagement so that the proposed program is best placed to leverage multiple funding sources and activities to mutual benefit.

Scope
The project is to be focussed on all rangelands of northern and southern Australia that supports livestock production.

Stakeholders to be consulted, plans reviewed (as per EOI):
- Livestock producers
- Research organisations (CSIRO, primary industries and conservation agencies, private sector researchers)
- NRM bodies and advisors, specifically the Rangelands Alliance
- AWI
- Federal Government (DAFF, SEWPaC)
- NGOs

The RD&E business plan should:

- focus on NRM issues for meat producers within the context of profitable grazing systems;
- have livestock producers engaged in development and delivery of the RD&E to ensure compelling, economic-focussed, value propositions are generated;
- identify synergies - linking the NRM activities with production RD&E initiatives;
- incorporate initiatives to be progressed by the Rangelands Alliance to address the issues of mutual interest;
- outline a logical framework for the program including SMART objectives and specific, measurable and logically linked performance indicators, critical to success the program's objectives and intended outcomes;
- describe the research program structure to maximise utility of the data generated, that maximises end user participation in shaping, implementation, and interpretation of research as well as stimulating delivery and adoption, works directly with the activities undertaken Rangelands Alliance partners

TASKS
PHASE 1 – Background investigations and initial consultation

- Develop a situational analysis for the rangeland, including "health" status of the rangelands, contribution to the livestock industries, natural resource and productivity issues faced by producers.
- During initial stakeholder consultation, solicit suggestions from, and test ideas for the structure of an RD&E program that addresses nrm issues within the context of a livestock production business inventory of past work.

9 References cited and further reading

- Identify the strategic priority areas that are of mutual interest to the potential investment partners
- Situation analysis, what RD&E activities are underway by potential investors in the areas of mutual interest
- Relevant outputs, outcomes and performance indicators of existing initiatives and a general inventory of past work – lessons/ research knowledge gaps from former work
- a "gap analysis" comparing previous and current R&D with strategic priority areas and identified nrm issues.
- Synthesis of the above, and outlining a candidate ("strawman") RD&E program (potentially what, where, who, focus) that becomes a basis for consultation

Output
A discussion paper (max 20 pages), that captures the information described above and outlines a specific plan for developing the "strawman" program into a prospectus for investment. Additional details should be included as appendices.
Agreement will be required from MLA and other key partners to proceed with the development of the RD&E plan (Phase 2).

PHASE 2
Detailed consultation, testing and refining the draft plan with candidate partners

Output
A draft R,D&E plan for a 10 year investment (2014-2024) in a rangelands program with specific outputs (at 2019 and 2024) and an overall outcome (2034) in sufficient detail to finalise development and commence implementation, with documented in-principle support from potential investors. It will describe:

- targeted areas (geographic and research focus)
- priority research questions, generalised methods (design, measures) and outputs
- research implementation processes to increase utility of the research output
- extension outputs by region to promote awareness, and develop of skills, knowledge and confidence for adoption of improved practices
- indicative budget
- potential investment partners
- an administrative structure (and mode of operation) to oversee the R,D&E
- benefit cost analysis of the investment

Appendix B Briefing Paper for Industry Stakeholders

R, D & E Investment Plan for natural resource management within livestock production systems of Australia's rangelands

A Briefing Paper for Industry Stakeholders

Introduction

Meat & Livestock Australia has contracted URS Australia to prepare an "*Investment Plan for natural resource management within livestock production systems of Australia's rangelands*".

The purpose of this Briefing Paper is to advise industry stakeholders about this project, and to obtain suggestions for what rangeland livestock industries and their RD&E partners should do to improve the development of management systems that generate environmental and productivity benefits.

Key objective

The key objective of the project is to develop a draft R, D & E investment plan that addresses NRM issues in Australia's rangelands. The Plan should provide sufficient detail to ensure that R, D & E investment decisions by organisations with interests in the rangelands and their livestock industries are mutually beneficial. These organisations include the regional rangeland NRM groups that form the Australian Rangelands Alliance (ARA), Commonwealth and State governments, Research & Development Corporations and livestock producers. The investment plan will be designed in consultation with these stakeholders with an aim to attract their in-principle support. We anticipate a 10 year investment plan (2014 - 2024) with specific outputs (at 2019 and 2024) and an overall outcome by 2034.

The background – why MLA and why now

MLA's strategic priority in the rangelands is to improve the long-term profitability and sustainability of livestock production systems. In part, this will be achieved by development of profitable and resilient pasture and animal management systems that conserve or, where necessary, restore natural resources. There is an opportunity to link MLA's strategic priority with the emergence of the ARA which collectively supports a range of NRM programs in the rangelands including total grazing pressure management, fire management, weed and pest control, and a range of innovations in grazing management. These sub-programs overlap with MLA's strategic plans for livestock production and environment. MLA wishes to advance any opportunity to develop an integrated R, D & E program that is attractive to investors, and which meets the needs of the rangeland grazing industry.

Our approach

The requirements for achieving NRM and productivity gains from a R, D & E program include:

- A sound understanding of the environment facing rangeland producers and R, D & E investors. There is a need to document the range of NRM issues that are limiting the long term productivity and profitability of livestock enterprises operating in the northern and southern rangelands;
- Optimising the investment of scarce financial and human resources by targeting R, D & E to address issues that add most value. We will rank issues on a whole-of-rangelands and on a regional basis in consultation with producers, funding agencies, research providers, and NRM bodies.

9 References cited and further reading

- Stakeholder engagement to improve programme adoption. Through consultation we can compare identified needs with current activities and look at how any gaps can best be addressed with an investment program that will operate for the next 10 years.

We value your contribution

We are seeking your advice about which NRM issues are most limiting the long term productivity and profitability of livestock enterprises operating in the northern and southern rangelands. There may be many; for example woody weed infestation, uncontrolled fire, competition from feral and native animals, undesirable long-term changes in pasture composition, and inefficient use of available forage by livestock. However, other issues such as maintenance of biodiversity in grazed landscapes and the capacity of natural resources to support grazing under climate change will also impact on the long term future of the rangeland grazing industries.

The questions/statements below are a first attempt to define the issues that will be central to the development of the R, D & E investment program. We would appreciate your response to these, together with any additional comments that you consider relevant.

What is happening in the rangelands?

1. ***In your opinion, or on behalf of your industry organisation's members, is the productivity of the rangelands for livestock production: increasing; decreasing; or much the same?***

Please expand or give reasons for the response?

2. ***What do you think are the main natural resource management issues limiting livestock production?***

Please score the following from 1 – 5 (with 1 as highest priority etc.):

▪ Forage availability	
▪ Forage quality	
▪ Weed infestation (woody and others)	
▪ Competition with feral and native animals	
▪ Uncontrolled fire	
▪ Changing climate	
▪ Poor pasture utilisation	
(your suggestions)	

3. ***What do you think are the main NRM issues that the livestock industries should address as part of sustainable production systems?***

9 References cited and further reading

Please score the following from 1 – 5 (with 1 as highest priority etc.):

▪ Maintenance of biodiversity at landscape scales	
▪ Maintenance of ground cover under poor seasonal conditions	
▪ Maintenance of wetlands and riparian zones	
▪ Maintenance of high conservation value areas	
▪ Maintenance of heritage sites (Indigenous and non-Indigenous)	
(your suggestions)	

Some considerations for the R, D & E business plan

4. What issues should MLA be considering in the R, D & E business plan?

Please score the following from 1 – 5 (with 1 as highest priority etc.):

▪ How to manage natural resources to maximise livestock productivity?	
▪ How to manage natural resources to promote healthy landscapes and retain an acceptable biodiversity status at property scale?	
▪ How to determine the value for livestock production and NRM of intensive grazing management regimes (e.g. short rotations) across rangeland areas?	
▪ Research into the use of technology (e.g. remote monitoring of livestock or watering points, drones etc) that has potential to increase productivity and assist NRM	
▪ The production and NRM aspects of new sheep breeds in the southern rangelands	
▪ The resilience of the rangeland pastoral industries and their natural resources under expected climate change.	
(your suggestions)	

5. What do you think is the best balance between R, D & E – what should we be doing?

Please score the following from 1 – 5 (with 1 as highest priority etc.):

▪ More basic research into livestock grazing and NRM undertaken on research sites.	
▪ Large scale sites demonstrating best practice grazing management across rangeland areas.	
▪ More producer demonstration sites across the rangelands testing ideas developed by local producer groups.	
▪ Detailed case studies of successful (in terms of both production and NRM) pastoral businesses.	
▪ Industry scale extension programs.	
(your suggestions)	

9 References cited and further reading

6. What should a R, D & E investment program deliver to maximise NRM and productivity benefits?

7. How do you think a R, D & E investment program should be implemented?

This is the first stage in the development of the R, D & E investment program. More consultation will occur before the final plan is agreed and we would be pleased to receive further input from you at any time during that process, quite apart from any opportunity for more formal input at a later stage.

We look forward to your response and appreciate the time that you have given to consideration of this important issue.

Please return your responses to Bruce Howard or contact Bruce if you wish to discuss.

Yours sincerely

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Appendix C Organisations responding to the Briefing Paper

Peak industry organisations	Landholders	Regional NRM Organisations	NGOs
AgForce Qld	5 individual landholders (not named for privacy reasons)	Central West CMA - CWCMA	Bush Heritage Fund of Australia (BHA)
North Australia Beef Research Council (NABRC)	Northern Australian Indigenous Land and Sea Management Alliance (NAILSMA)	Coordinator	
PGA of WA		SA Murray Darling Basin NRM Board - SA MDB	
		Desert Channels Group - DCG	
		Western CMA - WCMA	
		Rangelands NRM Co-ordinating Group - WA	
		Southern Gulf NRM - South Gulf	
		Northern Gulf Natural Resource Group Pty Ltd - North Gulf	

9 References cited and further reading

Appendix D Organisations consulted regarding the draft RD&E Plan

Consultation based on the combined Discussion Paper and Draft RD&E Plan focused on organisations that are funders and/or providers of RD&E directed at the rangeland grazing industries. In each case, feedback was obtained on the organisation's interest in the RD&E agenda, the sub-programs/ projects of specific interest, and preparedness to be a funder and/or provider. The Draft Discussion Paper/ Draft RD&E Plan was provided to those consulted prior to that consultation.

Those consulted face to face are shown by [a].

Organisation	Outputs
Rangeland Alliance[a] Representatives of 13 Regional Natural Resource Management Organisations that make up the 'Rangeland Alliance'	Presentation of First Draft Discussion Paper and feedback. Support for the approach presented in the Discussion Paper/ draft RD&E Plan. Indicative commitment to delivery.
Desert Channels Inc.	Feedback on suggested research directions.
Rangelands NRM WA	Feedback on suggested research directions.
SA Murray-Darling NRM	Feedback on suggested research directions.
CSIRO Alice Springs [a]	Feedback on suggested research directions. Suggested spatial variability may prevent achievement of overall objective. Not able to comment on commitment
	Review of ACRIS information and feedback on suggested research directions. Not able to comment on commitment.
Centralian Land Management Assoc [a]	NRM issues and activities and feedback on suggested research directions. Indicative commitment to delivery where objectives aligned
Northern Territory Cattlemen's Association [a]	NRM and productivity issues and feedback on suggested research directions. Suggested social research should be included. No commitment
Northern Territory Department of Primary Industries and Fisheries [a]	NRM and productivity issues, current RD&E activities and feedback on suggested research directions. Indicative commitment to delivery
Northern Territory Department of Land Resource Management*	NRM and productivity issues
Charles Darwin University [a]	Research into biodiversity management behaviour and feedback on suggested research directions. Keen to see choice modelling in biodiversity management considered in project design.
Territory NRM [a]	NRM issues and activities and feedback on suggested research directions. Indicative commitment to delivery
Queensland Department of Primary Industries, Fisheries and Forestry [a]	NRM and productivity issues, current RD&E activities and feedback on suggested research projects
Queensland Department of Natural Resources and Mines[a]	NRM and productivity issues, current RD&E activities and feedback on suggested research projects
Queensland Department of Science, Information Technology, Innovation and the Arts	Discussion about model development for the rangeland grazing systems
North Australia Beef Research Council [a]	Proposed RD&E activities and feedback on suggested

9 References cited and further reading

Organisation	Outputs
	research projects
CSIRO Townsville, Brisbane and Pullenvale [a]	NRM and productivity issues, current RD&E activities and feedback on suggested research projects
NSW Department of Primary Industries [a] (Ag NSW)	NRM and productivity issues, current RD&E activities and feedback on suggested research projects
Department of Environment, Water and Natural Resources SA and SA Arid Lands Board	NRM and productivity issues, current RD&E activities and feedback on suggested research projects
Ninti 1 (incl. CRC for Remote Economic Participation) [a]	Current R RD&E activities and feedback on suggested research projects
Department of Agriculture and Food WA [a]	NRM and productivity issues, current RD&E activities and feedback on suggested research projects
Commonwealth Department of Agriculture, Fisheries and Forestry [a] including ABARES	NRM and productivity issues, current RD&E activities and feedback on suggested research projects
Commonwealth Department of Environment	NRM and productivity issues, current RD&E activities and feedback on suggested research projects

* Feedback sought but not yet provided