Research, Development and Extension (RD&E)

PRIORITIES PROSPECTUS

For the Northern Australian Beef Industry

Prepared by NABRC as part of the
National Beef Production RD&E strategy
March 2012

Mission statement:

The North Australia Beef Research Council (NABRC) is a collaborative forum for industry, funding bodies and RD&E providers to lead research, innovation and technology adoption to benefit the northern beef industry.

Vision:

NABRC's vision is for a competitive and sustainable northern beef industry, responsive and adaptable to a changing operating environment.

North Australia Beef Research Council

Contents

Foreword	**4**
Introduction	**5**
About NABRC	**6**
Executive summary	**8**
Strategic imperatives	**9**
RD&E priorities for northern Australia	**10**
Methodology and consultation processes	**26**
Capabilities	**27**
Conclusion: the way forward	**32**
Appendix 1: List of workshops for priority RD&E themes	**33**

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Foreword

The search for creativity – where has it gone?

By Ralph Shannon, Chair NABRC

This Prospectus aims to guide investment in Research, Development and Extension (RD&E) in northern Australia, and enhance the collaboration, coordination, efficiency and effectiveness of RD&E efforts nationally.

A continued and coordinated investment in RD&E provides Australia's primary industries with the necessary capability (people, infrastructure and information) to improve their productivity, sustainability and competitiveness.

Over the past 25 years, little has changed in RD&E priorities for northern Australia. However, caution should be exercised in drawing any premature conclusions around this fact.

Leading herds are now performing much better than 20 years ago, but there is still great variation. We are certainly now much better informed as to reasons for poor performance, with things like inter-calving interval now on everyone's lips, and sub three year old Jap ox being common.

Grazing systems are far better understood, and available legumes widely integrated into pasture systems. Notable, however, is the decline in RD&E funding and, therefore, the capability to deliver future innovation, in this space.

Productivity gains still have not kept pace with costs of production increases, and many producers are experiencing one of their worst financial times in memory, as testified by the McCosker et al Northern Beef Situation Analysis 2009.

There has been some discussion during the past 12 months especially, about the extent to which the RD&E project portfolio in northern Australia has been biased towards projects that are short term, narrow outcome, largely technical and low impact.

There is some sympathy for the view that the increase in accountability for research dollars over the past 20 years has biased the system away from more provocative, blue sky research into short-term projects. In addition, the aging researcher population working in the RD&E field may be seen to be less likely to take risks than a younger cohort – if a younger cohort was available. The search for the novel, however, cannot invalidate the need to continue RD&E in areas where only small gains are possible, as these are still important.

The challenge extends then to the implementation of the RD&E priorities in northern Australia and how an innovative approach might be possible within the collaborative framework of the national strategy. The imperative to preserve capacity in key RD&E areas and the need for generational refreshment of the RD&E population and RD&E system then emerges. In southern Australia, the ability of the private sector through consultants especially, has been a significant means of preserving capacity. In northern Australia, the lack of consultants results in a vacuum in many areas, and creates a reliance on state and territory government provision of these services.

Introduction

The North Australia Beef Research Council (NABRC) was approached by the Red Meat Co-investment Committee (RMCIC) in October 2010 to develop the RD&E strategy for Queensland, the Northern Territory and the northern pastoral zone of West Australia, as part of the National Beef Production Research, Development and Extension Strategy (2010) commissioned by the Primary Industries Ministerial Council.

The national strategy aims to promote continuous improvement in the investment of RD&E resources nationally by helping to ensure that they are applied efficiently, effectively and collaboratively, and to address capability gaps, fragmentation and unnecessary duplication in the national system for primary industries RD&E.

NABRC is the key industry-agency forum with the responsibility for determining and advising on strategic requirements for RD&E activities (including education and training) in the northern Australian beef industry.

This Prospectus is the formal summary of the RD&E priorities for northern Australia, as identified by NABRC and its collaborators, to contribute to the national strategy.

Total northern Australia herd numbers at 30 June 2010

State	Total herd	Percentage of national herd
Queensland	11,193,348	47%
Northern Territory	2,065,000	8.6%
Northern Western Australia	897,000	3.7%
TOTAL	**14,150,000**	**59%**

Source: Northern Australian beef industry - ABARES report to the Northern Australia Ministerial Forum, 2012

About NABRC

NABRC is an independent organisation that acts as the central consultative council comprising all major northern RD&E agencies and educational institutions (departments of primary industries, CSIRO, CRCs and universities) and producer representatives from states and territories.

NABRC's main role in implementing the national strategy is to provide a regular forum where participants can report activities and progress against the plan, and identify gaps. NABRC provides a collaborative and open environment for this to occur.

NABRC is represented at a regional level across northern Australia by 11 Regional Beef Research Committees – six in Queensland, three in the Northern Territory and two in Western Australia.

NABRC has a comprehensive membership of production RD&E providers in its target area. The network is stable and mature and there is a pre-existing culture of collaboration across northern Australia, and strong relationships amongst key players.

NABRC comprises:

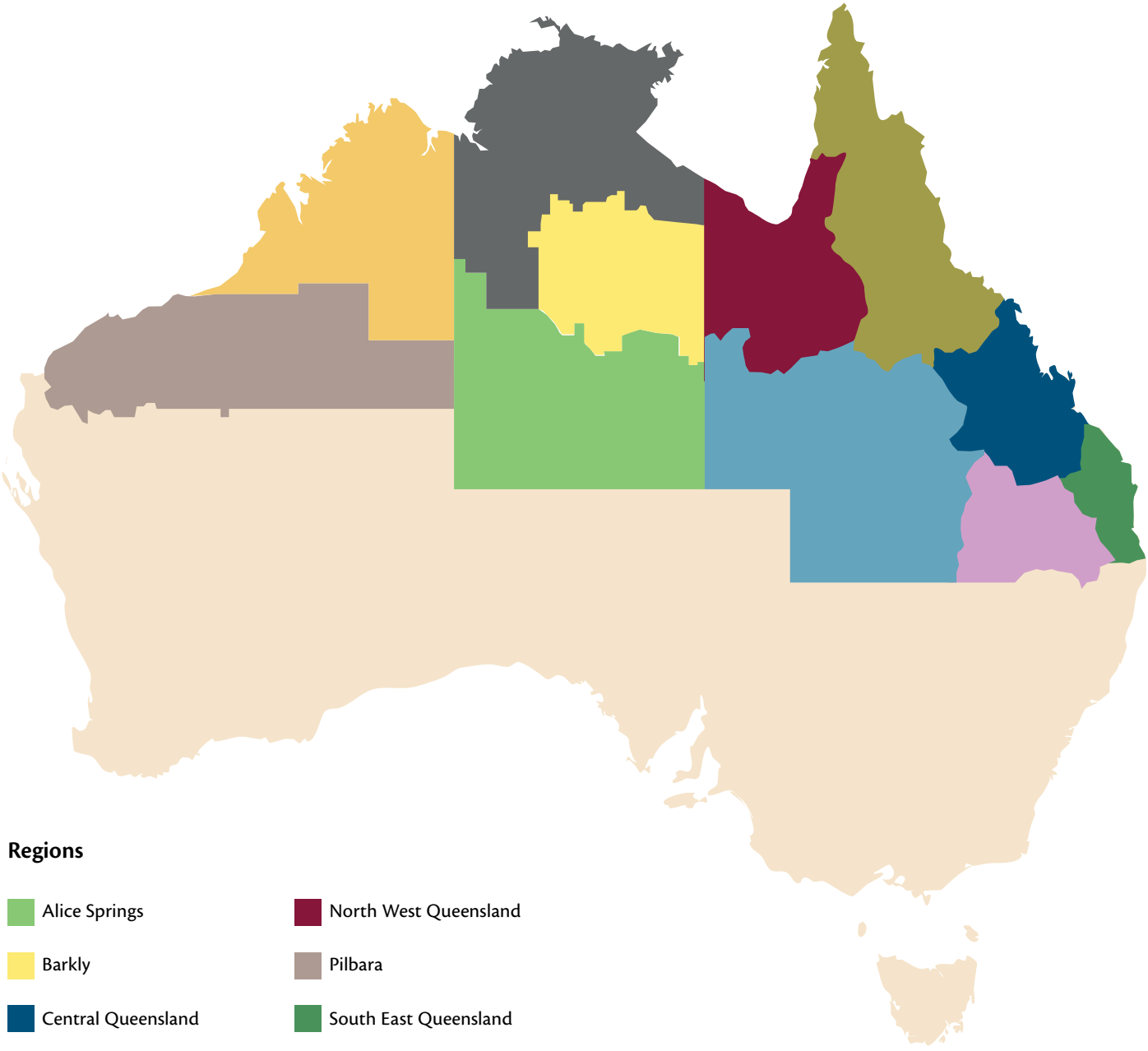
- Eleven Regional Beef Research Committees across northern Australia
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Queensland Alliance for Agriculture and Food Innovation (QAAFI)
- Department of Employment, Economic Development & Innovation (DEEDI)
- Department of Agriculture and Food Western Australia (DAFWA)
- Northern Territory Department of Resources (DoR)
- Meat and Livestock Australia (MLA)
- University of Queensland (UQ)
- James Cook University (JCU)
- Central Queensland University (CQU)
- AgForce
- NT Cattleman's Association (NTCA)
- WA Pastoralists and Graziers Association (PGA)

Rangelands Australia, a centre at UQ Gatton, attends NABRC meetings as an observer, as does the Northern Pastoral Companies Group.

The gross farmgate value of beef production in northern Australia is $3.7billion.

Source: *Northern Australian beef industry* - ABARES report to the Northern Australia Ministerial Forum, 2012

NABRC - Regional Beef Research Committees



Regions

- Alice Springs
- Barkly
- Central Queensland
- Katherine and Top End
- Kimberley
- North Queensland
- North West Queensland
- Pilbara
- South East Queensland
- South Queensland
- West Queensland

Executive summary

The RD&E system which NABRC seeks to represent approaches a crisis. To express it more lightly may not elicit the appropriate sense of urgency.

As NABRC seeks to define the future for RD&E in northern Australian, it is confronted by a continuing decline in funding of key provider members, and therefore a decline in available RD&E personnel. There appears little that NABRC can do to alter this trend.This decline provides a major rationale for the National Beef Production Research, Development and Extension Strategy approach, which promotes a greater collaboration amongst RD&E providers to drive the government dollar further.

NABRC outlines the following six steps to address the challenge reduced funding poses to the northern Australian beef industry, while noting that many of these issues are also relevant for southern beef production systems:

1. **NABRC to own and implement the RD&E priorities identified in this Prospectus**
   Addressing the RD&E priorities identified in this Prospectus will provide northern beef producers with the options they need (through new products and systems) to improve the productivity and competitiveness of their enterprises. NABRC can support this implementation of RD&E strategy in the north by fostering collaboration, industry validation of program content, and oversight of work conducted, in alignment with the regional NABRC framework. Expanding NABRC's role will involve a more formal documented agreement, but it will be worth the effort. A more engaged NABRC is a better investment for partners, and will be more attractive to potential future investors, such as private companies. Failure to take this step could threaten NABRC's existence, in an environment where member stakeholders battle to manage tight budgets and weigh their NABRC investment against competing priorities.

2. **Promoting generational change within the RD&E system**
   It is evident from the planning process that RD&E capability for beef production is at a critical level in northern Australia. There are fewer resources in key areas and an aging of the RD&E staff population. There is an urgent need to attract young RD&E operatives to generate enthusiasm and innovation, but also to allow for the transfer of experience from older operatives before they retire. The loss of knowledge is already dramatic due to the raft of early retirements in recent years. NABRC might reasonably support any project which seeks to address this issue.

3. **NABRC to drive further innovation**
   NABRC supports further innovation beyond the priorities identified in this Prospectus, by looking further ahead for greater transformation. There is interest amongst NABRC collaborators in a continuation of RD&E planning in future foresighting and scenario building, and using modelling to test scenarios for the industry. It will be appropriate to task a small group with this role and to develop this capability.

4. **RD&E for productivity and a social licence**
   Ensuring a social licence is maintained for beef cattle production and marketing in northern Australia, by meeting community needs and expectations in the production RD&E space.

5. **Capturing and empowering a collaborative approach**
   NABRC is well on the way in this regard; however attention to this role will consolidate relationships, stimulate creativity and ensure the best use of available dollars.

6. **Piggybacking**
   Large amounts of discretionary funds are being allocated to issues of national concern such as climate change and carbon, issues which have direct effect on beef production. Inevitably, research organisations with capability to do so are diverting capacity to where the funds are. Increasingly NABRC members will need to, where possible, piggyback these funds to areas of production interest and gain, which may challenge traditional industry perceptions.

Strategic imperatives

The strategic imperatives identified in National Beef Production Research, Development and Extension Strategy, and their relationship to the Meat Industry Strategic Plan (MISP), Australian Government and northern Australia RD&E priorities are illustrated below:

Beef Production national strategic imperatives

Meat Industry Strategic Plan (MISP) and Australian Government priorities

Australian Rural R&D Priorities	MISP3 Themes	MLA Imperatives	Beef RD&E Strategic Imperatives	Industry Outcomes	RD&E Strategic Imperatives for Northern Australia
Biosecurity	Marketing and Promotion	Growing demand	Enhancing food safety, product integrity and biosecurity	Domestic and global recognition of best practice food safety and product integrity levels	**Enterprise viability:** Increasing cost efficiency and productivity and profitability
				Biosecurity practices and programs protecting the industry's reputation and animal health status, and maximising market access	
Supply chains & markets			Improving beef and sheepmeat eating and nutritional quality	Beef and sheepmeat eating and nutritional quality that meets target market specifications	**Enterprise sustainability:** Increasing natural resource use efficiency and managed environmental impacts
Productivity & adding value	Innovation	Increasing market access	Developing new and existing beef and sheepmeat markets	Diversified beef and sheepmeat markets that minimise risk and maximise industry prosperity	**Human capacity:** Enhancing human capital - producers, researchers, extension
			Increasing cost efficiency and productivity (including adaptability and risk management)	Profitability and productivity at the enterprise level	
Climate variability & climate change		Increasing productivity across supply chains	Enhancing integration and value adding in supply chains (including cost efficiency)	Integrated and responsive supply chains that add value to livestock, beef and sheepmeat products	**Preserving social licence to operate:** Practices and perception - animal welfare and resource management
				Beef and sheep production systems aligned with consumer and community expectations for environmental impacts	
Natural resource management	Environment & ethics		Aligning animal welfare practices with consumer and community expectations	Community recognition of industry custodianship for environmental protection, animal welfare and ethical behaviour	**Enhancing product** quality and acceptability
				Animal welfare practices aligned with consumer and community expectations	
Technology		Promoting industry integrity and sustainability	Increasing natural resource use efficiency and reducing environmental impacts	Beef and sheep enterprises that are resilient and adaptable to changing markets and operating	**Biosecurity**
Innovation skills	Our people	Increasing industry and people capability			

RD&E priorities for northern Australia

Six themes or broad areas of work were short-listed by NABRC as being the most important for planning of RD&E priorities:

1. **Reproduction**
2. **Grazing land management**
3. **Nutrition and growth**
4. **Human capacity and enabling change**
5. **Animal welfare**
6. **Information technology and Precision Livestock Management**

The methodology and consultation process for short-listing the six themes, and for identifying RD&E priorities within each, are described later in this report. The areas of work listed within the six priority themes are not necessarily numbered according to priority – numbering has been used to make the referencing of projects easier.

It is important to note that other broad areas of RD&E, such as business management and animal health, will likely have important needs and opportunities for RD&E but these have not been considered in this process.

Whilst this process has identified and progressed six priority themes, there were other issues and themes upon which it was decided to put a 'watching brief', to ensure that they were progressed outside this plan. These issues included biosecurity, animal health and disease management and business management - which are addressed by other initiatives or bodies. A strong engagement with Northern Regional Development was also seen as a significant function of the RD&E system.

The number of northern Australian beef producers with more than 100 head of cattle is 8,000.

Source: *Northern Australian beef industry* - ABARES report to the Northern Australia Ministerial Forum, 2012

1. Reproduction

PRIORITY THEME

Reproduction is a major driver of beef enterprise profitability in northern Australia. Recent advances in the understanding of means for improving reproductive performance of herds have been recently reviewed by McGowan et al (2011). The NABRC RD&E review process identified three priority RD&E areas for future investment:

1.1 Rapid dissemination of superior genetics

GOAL

Accelerate the dissemination of genetics that will improve the economic performance of beef cattle enterprises in northern Australia

KEY RD&E ACTIVITIES

Define the management systems

- Ensure herd biology is optimised so as to maximise the value of genetic gain
- Maximise conception rate from artificial breeding programs

Identify superior animals

- Define key economic drivers of reproductive performance
- Develop better methods (increased accuracy, lower costs) for:
  - Genetic markers
  - EBVs
  - Genomic prediction
- More efficient data structure such as the Tropical Genetic/Genomic Resource Herd structure

Increase intensity of selection for seedstock and stud herds

- Increase adoption of use of AI to improve genetic merit of herds
- Increase conception rates from artificial breeding
- Increase use of quantitative data to select sires and cows
- Decrease generation interval
- Develop/promote phenotypic prediction of more fertile males

Identify semen factors associated with fertility, including proteomic factors

Identify the key reproductive traits through economic evaluation

1.2 Reducing losses from pregnancy test to weaning

GOALS

1. Determine causes, timing and economic impacts of calf losses between pregnancy testing and weaning for different regions
2. Where calf losses are greater than acceptable, scope and implement RD&E strategies to reduce these losses

KEY RD&E ACTIVITIES

Ensure appropriate research tools and methods are available

Clarify the extent and nature of the problem

- Timing
- Location
- Major causes
- Use existing knowledge and new tools

Economic analysis of problem

Develop RD&E projects based on findings

1.3 Develop producer's pathway to efficiency

GOAL

Increase producers' capacity to identify the impact of their enterprise's current reproductive performance on profit and implement the reproductive and turn-off strategies that will maximise profit

KEY RD&E ACTIVITIES

Develop and evaluate the prototype BRIC herd economic tool and its application for diagnosing issues and opportunities

Link the diagnostic analysis of the herd with suitable management responses (options and practices, based on existing knowledge and understanding which address the issues and opportunities)

Build capacity to provide the appropriate services and advice to industry using this and other appropriate tools (e.g. tools that take data on pregnancy diagnosis and body condition score and inform decision-making)

An additional area of work was identified under the heading of 'Dynamic real-time management', and this has the goal of providing the integrated technologies that would facilitate more timely and better-informed management interventions and decisions for improved reproductive performance. This area of work is more comprehensively covered under the theme of Precision Livestock Management.

2. Grazing land management

PRIORITY THEME

The native, naturalised and sown pastures of northern Australia provide the feedbase for beef cattle production. The ecological condition of these grazing lands is directly related to their carrying capacity, and their ecological condition is dependent on the management of grazing and fire. NABRC identified four priority RD&E areas for future investment:

2.1 Enhanced grazing management

GOALS

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

KEY RD&E ACTIVITIES

Identify and evaluate the compelling value proposition for changing grazing practices

- Analyse data and information into financial and land condition outcomes – including the win/wins and trade-offsMaximise conception rate from artificial breeding programs
- Fill key data gaps - ongoing experiments, new experiments, case studies

Develop package of tools and supporting information that delivers on the value proposition

- Scope the required specifications with producers
- Develop prototype package of tools
- Test and refine through case studies, demonstrations
- Campaign of delivery and follow-up support to achieve adoption

2.2 Weeds and feral animals

GOAL

Reduce the impacts of grazing land weeds and feral animals on profitability and resource condition

KEY RD&E ACTIVITIES

Identify the highest priority weeds and feral animals

- Document best management practices for these high priority weeds and feral animals (where not already available)Develop prototype package of tools
- Identify and implement key research activities for these key weeds and feral animals

2.3 Great producer decisions

GOALS

1. Assist producers to better assess and manage the opportunities and risks associated with managing grazing land for beef production
2. Assist industry as a whole to better assess and manage the opportunities and risks associated with use of grazing land for beef production

KEY RD&E ACTIVITIES

The two key drivers for this area of work are profitability and the social licence to operate. A 'forensic' understanding of the economic implications of management options and strategies is critical. Broad steps of such a program include:

- Develop capacity to report industry status and knowledge - define key practice sets, aggregate producer practice and synthesise threats, condition and trend
- Document practice sets on property - compile data
- Package practice sets and key messages from profitability perspective - region-specific; case studies
- Build capacity to improve profitability and improve decisions in context of key opportunities (tools, training, case studies)
- Policy scenarios and evidence: active assessment and situation reports
- Policy assessment and push back, or reasons for no adoption.
- Explicitly make the link between "Great producer decisions" and "Enhanced grazing management" especially in regards to the financial aspects of grazing management

2.4 Cattle, Carbon, and Catchments

GOALS

1. Optimise current and future income flows for producers including the carbon economy
2. Increase resilience of enterprises and regions

KEY RD&E ACTIVITIES

This program of work will need to engage producers, identify the true value and costs of potential income sources, and work through a network of case study sites. This work is not just about carbon – it also includes improved land condition, biodiversity and water quality and the opportunities that these may bring for current and future income flows. Activities include:

- Stocktake, review, synthesis and gap analysis
- Conduct integrated modelling and analysis
- Develop network of trial sites and demonstrations
- Engagement and collaboration and reality testing with researchers, producers, government, natural resource management organisations and advisors

An additional area of work was identified under the heading of 'Pasture legumes', and this has the goal to increase the pasture legume options available to producers for cost-effectively sustaining and improving beef production across northern Australia. This area of work is more comprehensively covered under the priority theme 3 – Nutrition and Growth.

3. Nutrition and growth

PRIORITY THEME

The native, naturalised and sown grass pastures of northern Australia provide the feedbase for beef cattle production, but their ability to support growth and reproduction are often constrained nutritionally through soil and/or seasonal factors. Recent advances in the understanding of nutritional means for improving growth and reproduction have been recently reviewed by McLennan and Poppi (2011). The NABRC process identified five priority RD&E areas for future investment:

3.1 Optimising production from the pasture base (or 'feedbase')

GOAL

Industry has options for optimising animal production from the pasture base

KEY RD&E ACTIVITIES

Activities to develop cost-effective options for optimising the growth, quality, reliability and utilisation of the feedbase include:

- More cost-effective ways to combat pasture rundown
- Greater use of pasture legumes
- Better location and management of water points, fencing and supplement sources
- Better growth and utilisation of fodder crops

Key decisions by producers revolve around the feed and nutrient requirements of different classes of cattle, the growth and quality of pasture and other sources of forage, and the target levels of growth and reproduction. This will be improved with:

- Better prediction and understanding of pasture supply
- Improved accounting for animal needs for pasture quantity and quality in relation to targets
- Developing better field-based, lab-based, and model-based tools, eg, a working, tropical version of GrazFeed or equivalent; more cost-effective interventions for N and P
- A campaign of activities for improved adoption, based on economic analysis and validation of options (including better 'confidence intervals' around cost-effectiveness) for matching nutrient supply and demand

3.2 Efficiency-at-pasture phenotypes

GOAL

Identify and develop cattle phenotypes with greater forage conversion efficiency

KEY RD&E ACTIVITIES

The inability to reliably measure intake of individual animals at pasture limits the ability to select for greater forage conversion efficiency (FCE). To overcome this requires the following activities:

- Develop methodology for assessing FCE phenotype(s)
- Apply and evaluate FCE phenotype methodology at increasing scale from small research to commercial herd
- Progeny testing of efficiency@pasture phenotypes

3.3 Improved supplementation

GOAL

Increased profitability of northern beef enterprises through improved supplementation practices

KEY RD&E ACTIVITIES

The increasing cost of supplements, difficulty in delivery, and uncertainty over the net benefits are inhibiting current practice. We need to establish confidence in the recommended practices. This requires:

- Developing new supplements - new products which are more cost-effective
- Improving existing supplement strategies for growing and breeding cattle - improving timing and effectiveness
- Developing better delivery methods - more cost-effective; more reliable; use of remote management technologies

3.4 Accelerated growth pathways for lifetime productivity

GOAL

Optimise lifetime productivity (kg lwt/breeder/lifetime) through accelerated growth pathways

KEY RD&E ACTIVITIES

- Strategies for manipulating in utero nutrition (ovulation; pregnancy; lactation) to improve maternal nutritive status, growth rate of progeny, and fertility of progeny.
- Post weaning interventions (for early weaning; for later weaning) to improve % cattle meeting production targets and/or market specs
- Understanding interactions between growth path and cost of production to improve the price received and MSA compliance
- Develop new strategies, for example, manipulating skeletal growth

3.5 Optimised rumen function

GOAL

To increase profitability of beef cattle enterprises through optimising rumen function

KEY RD&E ACTIVITIES

- Characterise attributes of the rumen environment for optimal animal production, establishing a database of rumen attributes for representative grazing and finishing systems
- Develop tools for field monitoring of animal and rumen activity
- Develop rumen intervention strategies to optimise animal production, including the integration of relevant northern Australia nutritional studies with rumen microbiology discipline
- Test proof-of-concept for 'vaccination' approach – that is, test feasibility for increasing N efficiency through targeted manipulation of the balance of rumen organisms.

4. Human capacity and enabling change

PRIORITY THEME

People are the key to successful beef enterprises and to successful adoption and implementation of RD&E. In recent years, a recurring issue for northern Australia is the need to maintain and/or build capacity – both for managing beef enterprises and for undertaking RD&E. The NABRC process identified four priority areas for future investment, a significant portion of which is not strictly RD&E but is more about knowledge and skill development, institutional changes and initiatives, and adopting new and more effective RD&E approaches.

4.1 Facilitating continuous improvement of RD&E, education and training

GOALS

1. Industry needs for future success understood and addressed in RD&E and education programs
2. Refreshed extension, education and training products combining scientific with practical knowledge, distilling simple key principles and incorporating the latest market and adoption research

KEY ACTIVITIES

- Identify, understand and target the drivers for change, knowledge and skills shortfalls, and barriers to adoption by producers
- Improve current extension, training and education offerings by reviewing existing packages, new delivery options and ensuring alignment to industry needs
- Use market research approaches to increase understanding and to develop next-generation networks

4.2 Ensuring continuity of supply of skilled people

GOAL

Foster continuity of industry and RD&E capacity through greater recruitment, development and retention of staff.

KEY ACTIVITIES

- Encourage and facilitate a stakeholder coalition to develop clear career pathways, curriculum resources and a positive industry promotion package
- Establish mentoring and succession planning programs for producers and RD&E and education providers
- Develop new funding models to provide improved career security and opportunity and encourage cultural change

4.3 Understanding emerging people and social issues

GOAL

Greater understanding of producer decision-making and adaptation processes to improve the design of RD&E and accelerate innovation and adoption

KEY ACTIVITY

Implement a social research program targeting decision-making and adaptation in a changing environment (linked to understanding of industry needs, emerging opportunities and challenges)

4.4 Regenerating RD&E culture and learning

GOALS

1. Creating 21st Century institutions with capacity to address complex problems through structures and cultures that achieve 'best practice' in learning and collaboration
2. An empowered RD&E system through more effective networking initiatives, regional implementation strategies and greater involvement of women and youth

KEY ACTIVITIES

- Collate and distil experiential, traditional and scientific knowledge with a focus on developing the capacity to grow and adapt
- Understand organisational cultures and identify models of 'best practice' for inclusive decision-making, co-learning, effective collaboration and participatory R&D
- Promote 'shared learning' across institutions by facilitating networking and incorporating 'learning to learn' training into RD&E programs
- Strengthen the regional focus in guiding strategic planning, adaptation and implementation of RD&E and education
- Increase the engagement of women, younger producers and RD&E staff, and other relevant stakeholders in order to improve project design and adoption

5. Animal welfare

PRIORITY THEME

The welfare of beef cattle is a key concern for both producers and the wider community. The beef industry in northern Australia is generally extensive and low-input in nature and this context is critical to understanding the opportunities, needs and practical constraints with respect to the husbanding of cattle. Recent advances in the understanding of means for improving cattle welfare have been recently reviewed by Petherick and Ferguson (2011). The NABRC process identified three priority RD&E areas for future investment.

5.1 Improved husbandry practices

GOAL

Minimise the pain associated with husbandry practices and actively pursue non-surgical and pain-free options to these practices

KEY RD&E ACTIVITIES

- **For all practices**
  - Improve awareness of, and training for, best practice husbandry
  - Explore pain relief options (for short-term solution until alternatives developed)
- **For branding - explore ear implant and tag options**
- **For castration**
  - Develop vaccine (for long-term solution)
  - Fully explore the management, meat quality and marketing of entire males
- **For dehorning**
  - Promote polledness through the poll gene marker (e.g. Brahmans) and through cross-breeding (as prevalence of poll gene in Brahmans is very low) and, with Bos taurus herds, uptake of polled sires; need high-performing polled animals as sires
  - Exhaust efforts to discover tick resistance in currently available polled breeds
  - Develop effective tick vaccine (thereby allowing greater use of polled breeds)
- **For spaying**
  - Develop effective vaccine and/or pregnancy control drugs
  - IUD development for maiden heifers
  - Test current and new methods in different environments and production systems
  - Demonstrate 'spay-free' breeder management systems

5.2 Continual improvement in beef cattle welfare

GOAL

Industry is demonstrating continual improvement in beef cattle welfare through a whole-of-property, risk management system

KEY RD&E ACTIVITIES

Develop program of work through which:

- Producers benchmark their welfare practices
- Producers develop enterprise-specific welfare risk and management plans
- There is integration with other relevant RD&E, e.g. for increasing animal control and management

5.3 Closing the gap between perception and reality for beef cattle welfare

GOAL

Greater adoption of practices leading to improved on-property animal welfare based on a commonly-agreed understanding of, and assessment method for, beef cattle welfare

KEY RD&E ACTIVITIES

- Develop integrated and applied animal welfare measures
- Improve adoption with producer input and ownership from the start
  - Demonstration sites
  - Training
  - Field days, etc
  - Biosecurity "networks"
- Public awareness and understanding of improvements in practical production systems

An additional area of work was identified under the heading of 'Adequate nutrition for beef cattle welfare', and this has the goal to 'Minimise, and ideally eliminate, the risk of inadequate quantity and/or quality of feed affecting the welfare and survival of beef cattle'. This area of work is more comprehensively covered under the theme of Nutrition and Growth.

6. Information technology and Precision Livestock Management

PRIORITY THEME

The emergence of technologies for remote monitoring and management of water points, and for remote weighing and drafting of cattle, heralds the potential availability of a wide range of technologies for monitoring, measuring and collation of data on cattle, pastures and their environment. A key question is how to harness the potential of these systems in ways that will improve cattle enterprise performance. The NABRC process identified three priority RD&E areas for future investment:

6.1 Finer scale management of animals, pastures and landscape

GOAL

To significantly improve the cost-effectiveness and environmental outcomes of interventions in animal and pasture management, through better spatial and temporal matching of animals with pasture.

KEY RD&E ACTIVITIES

The key questions are

- What is the variation in the quality of decisions currently made for intervention in animal and pasture management?
- What is the value of more timely and precise intervention in animal and pasture management? For example, labour saving, other reduced input costs such as supplements, greater efficiency of conversion of pasture to liveweight and/or rainfall to pasture
- How much additional precision is required to make a large difference? For example, individual animal versus sub-group; paddock versus sub-paddock; frequency; accuracy
- What can be achieved with technologies and, in turn, what are the practical technology solutions?
- What are the likely costs of the technology solutions?

The following technologies need further development and/or evaluation of value to the beef business

- Technology to monitor animal location
- Technology to monitor animal state - physiology, health
- Technology to control animal position
- Animal condition monitor
- Technology to monitor pasture quantity and quality

6.2 Agricultural services

GOAL

Timely provision of data, information and knowledge that drives reductions in cost of production (reduced costs, cost-effective productivity improvements) and improvements in work safety and natural resource condition.temporal matching of animals with pasture.

KEY RD&E ACTIVITIES

Optimal benefits for on-farm beef production from information technology will be generated by a user-driven strategy with three key elements:

1. Data collection, management and visualisation
2. Modelling and prediction
3. 'Expert' advice

The 'expert' advice or decision support will relate to the specific decision points or risk issues, and could include: timing of stock sale/purchase; supplementation; stocking rate change; animal location change; sub-group segregation; water pumping.

If such services were to be widely provided by an off-site provider(s), the following steps would be required:

- Review options for cloud computing data management
- Define and discuss data standards
- Determine decision making systems
- Develop a simulation environment for data management and decision making
- Study of machine/human interface

6.3 Technologies

GOAL

Develop, refine and integrate technologies that reduce input costs and/or accelerate cost-effective improvements in productivity

KEY RD&E ACTIVITIES

Improvements in profitability will be driven by factors such as increased carrying capacity, improved breeder and grower efficiency, and savings in fuel, labour (for example, remote management) and/or supplement costs. At the same time, there is pressure and need to improve environmental and health and safety outcomes.

Technologies to help achieve these various changes in a cost-effective manner need to be identified and evaluated:

- Thorough review of technologies across industries, including meeting of key people to share ideas, achieve a common understanding of what is already available or under-development
- Develop new functionality for an on-animal device: spatial location, contact logging, control (virtual fencing), retention for whole of life
- UAV development - mustering, remote sensing, weed treatment

Methodology and consultation processes

NABRC's regional committees undertook a strategic assessment of RD&E needs in 2010-2011.

NABRC then validated and expanded the imperatives and strategies from the National Beef Production Research, Development and Extension Strategy (January 2010), and developed a draft RD&E priority matrix which incorporated both regional committee and stakeholder perspectives. This priority matrix provided the raw assessment which guided the subsequent process in developing priority themes, areas of work and goals.

NABRC stakeholders met in Brisbane on 14 April 2011 to define the next step. This group became known as the Planning Group, representing all RD&E providers and MLA. Through discussion, the Planning Group refined the matrix to six priority themes that captured the RD&E priorities for northern Australia.

There was considerable discussion by the Planning Group as to whether the scoping of RD&E priorities should be based on priority themes – or imperatives which cut across Priority Themes. It was decided to follow the Priority Themes that would align best with existing research institution plans.

Accordingly, the Planning Group defined the following RD&E priority themes: reproduction; grazing land management; nutrition and growth; human capacity and enabling change; animal welfare; and information technology and Precision Livestock Management as the areas of highest RD&E priority.

Workshops

To describe more specific areas of work in each of the priority themes, NABRC convened an expert workshop in each, the outcomes from which would help inform the RD&E program for northern Australia. Convenors identified attendees with assistance from the Planning Group. Convenors also acted as champions for the priority themes in NABRC forums and throughout the process.

The workshop process was required to elicit three levels of detail in each priority theme – "areas of work", "goals" and "key RD&E activities". It was agreed that the workshop outcomes should be sufficient to inform a collaborative investment decision by the stakeholders. In addition to the workshop convenors, special mention should go to John James of DEEDI who used "open space" technology as a tool to facilitate the workshops and Mick Quirk from MLA who acted as scribe for each workshop.

Appendix 1: List of workshop dates, locations and attendees held for priority RD&E themes

Producer input

Attendees were selected from within the NABRC area and group in the main but with some out of area experts included. Each workshop included two RBRC Chairs, except for the IT & PLM theme, where only one was available to attend. This has provided a continuing thread of producer input throughout the process and has provided accountability to identified regional priorities in northern Australia. Convenors identified attendees with assistance from the Planning Group. Convenors also acted as champions for the priority themes in NABRC forums and throughout the process.

Capabilities

The *National Beef Production Research, Development and Extension Strategy* will be implemented through multi-agency RD&E processes and programs overseen by RMCIC, with agency and industry direction through NABRC and the Southern Australia Meat Research Council (SAMRC) with additional consultation and policy oversight through the Cattle Council of Australia.

In consultation with providers, NABRC has identified the following existing resource capabilities for northern Australia. It should be noted that the tables below may not recognise all of the RD&E capability existing in northern Australia but is a representation of the capabilities of NABRC members. The group also acknowledged that capacity exists in northern Australia in research support networks, such as biometricians, but these capacities have not been included in the totals.

Northern Australia accounts for 85% of Australia's beef exports.

Source: *Northern Australian beef industry* - ABARES report to the Northern Australia Ministerial Forum, 2012

Capabilities

PRIORITY THEME 1: REPRODUCTION								
State	CSIRO (whole of agency)	CQU	NT DoR	DAFWA	UQ	QAAFI	JCU	DEEDI
Rapid dissemination of superior genetics	4		2	0.5	2	3	1	5
Reducing losses from pregnancy test to weaning			0.2	0.1	1	0.5	1	1
Producers' pathway to efficiency			0.5	0.1	0	0.5		
Dynamic real-time management	0.5	0.5			0.2			
TOTAL	**4.5**	**0.5**	**2.7**	**0.7**	**3.2**	**4**	**2**	**6**

PRIORITY THEME 2: GRAZING LAND MANAGEMENT								
	CSIRO (whole of agency)	CQU	NT DoR	DAFWA	UQ	QAAFI	JCU	DEEDI
Enhanced grazing management	1.5		3	1.5	0.8			18
Weeds and feral animals	2			4	0.5			8
Great producer decisions	0.5		2	2	0.4			8
Cattle, carbon and catchments	6		1.5	2	0.4			1
TOTAL	**9.5**		**6.5**	**9.5**	**2.1**			**35**

PRIORITY THEME 3: NUTRITION AND GROWTH								
	CSIRO (whole of agency)	CQU	NT DoR	DAFWA	UQ	QAAFI	JCU	DEEDI
Optimising production from the pasture base	6			0.1	0.5	1		7
Optimising the feed base	0.8		0.5	0.5	0.2		1	11
Efficiency at pasture phenotypes	0.6		0.5	0.5	0			
Improved supplementation					0.5			
Accelerated growth pathways for lifetime productivity			0.5		0.5	1	0.5	2
Optimised rumen function					0.9			
TOTAL	**7.4**		**1.5**	**1.1**	**2.6**	**1**	**1.5**	**20**

PRIORITY THEME 4: HUMAN CAPACITY AND ENABLING CHANGE								
	CSIRO (whole of agency)	CQU	NT DoR	DAFWA	UQ	QAAFI	JCU	DEEDI
A more empowered RD&E system	1	2						
Regenerating culture and learning				0.2	2			
Ensuring continuity				0.1	0.5			
Achieving continuous improvement				0.2	0.2			2
TOTAL	**1**	**2**		**1.4**	**2.7**			**2**

Capabilities

PRIORITY THEME 5: ANIMAL WELFARE								
	CSIRO (whole of agency)	CQU	NT DoR	DAFWA	UQ	QAAFI	JCU	DEEDI
Improved husbandry practices	1		0.5	0.25	0.6	1.5	1	
Adequate nutrition for beef cattle			0.5	0.25	0.5		0.2	
Continual improvement in cattle welfare					0.5			
Closing the gap between perception and reality for beef cattle welfare					0.2			
TOTAL	1		1	0.5	1.8	1.5	1.2	

PRIORITY THEME 6: INFORMATION TECHNOLOGY AND PLM								
	CSIRO (whole of agency)	CQU	NT DoR	DAFWA	UQ	QAAFI	JCU	DEEDI
Agricultural services	2	2	2	1				
Finer scale management of animals, pastures and landscape	3			1				
Technologies	3	1		0.5		2		
TOTAL	8	3	2	2.5		2		

SUMMARY TABLE: NORTHERN AUSTRALIA RD&E STAFF CAPABILITIES (FTE EQUIVALENT) BY PARTICIPATING AGENCY – FOR IDENTIFIED RESEARCH PRIORITY THEMES

	CSIRO (whole of agency)	CQU	NT DoR	DAFWA	UQ	QAAFI	JCU	DEEDI	TOTAL CAPABILITY
PRIORITY THEME 1: **REPRODUCTION**	4.5	0.5	2.7	0.7	3.2	4	2	6	22.4
PRIORITY THEME 2: **GRAZING LAND MANAGEMENT**	9.5		6.5	9.5	2.1			35	61
PRIORITY THEME 3: **NUTRITION AND GROWTH**	7.4		1.5	1.1	2.6	1	1.5	20	33.5
PRIORITY THEME 4: **HUMAN CAPACITY AND ENABLING CHANGE**	1	2		1.4	2.7			2	6.4
PRIORITY THEME 5: **ANIMAL WELFARE**	1		1	0.5	1.8	1.5	1.2		5.2
PRIORITY THEME 6: **INFORMATION TECHNOLOGY AND PRECISION LIVESTOCK MANAGEMENT**	8	3	2	2.5		2			17.5
TOTAL	**31.4**	**5.5**	**13.7**	**15.7**	**12.4**	**8.5**	**4.7**	**63**	

Conclusion: the way forward

The future of NABRC and the beef production RD&E system in northern Australia are inextricably linked.

Increasing agricultural productivity continues to be a core objective of rural industries, yet growth in agricultural research investment has slowed, and it has been spread across a wider variety of areas (food safety, environmental management, biosecurity and climate change). Spreading resources more thinly reduces the effect of research outputs on productivity growth.

A greater problem lies in the effect this decline has on the energy and innovation of its people, and it is in this area that urgent intervention is required.

Many key researchers are approaching the last quarter of their careers, and many of their peers have recently retired. Some have sought engagement as private consultants in the same field of work. Urgent action is required to attract young RD&E operatives and to allow for the transfer of experience from older operatives before they retire. Opportunities to collaborate in carbon and climate funded projects and support for innovation may help address this issue.

Until now, NABRC has claimed to drive innovation in the northern Australia beef industry. It has done so by acting as a forum for discussion of strategic issues between not for profit institutional RD&E providers and MLA as the key funder. It has promoted a three yearly conference and a biennial awards initiative. The opportunity to set the RD&E agenda for the northern Australian beef industry as part of the National Beef Production Strategy has engaged NABRC in a more formal planning process. In doing so, this has set the scene for a more expanded role for NABRC in the future.

Inevitably however, the result is less than perfect, but is a major milestone in NABRC's life. The most obvious deficiency arises from our inability to sufficiently challenge existing paradigms and to suggest a more challenging and inevitably risky way forward for the RD&E system. This issue remains on the agenda as we search for innovative solutions to traditional and emerging problems. NABRC supports further innovation beyond the priorities identified in this Prospectus, by looking further ahead for greater transformation.

NABRC has a number of major strengths. It has a comprehensive membership of beef production RD&E providers in its target area, and provides possibly the most constructive forum for industry/provider interaction of any beef related RD&E effort in the country. In addition there is a pre-existing culture of collaboration across northern Australia, and strong relationships amongst key players.

NABRC struggles, however, to establish appropriate links to private RD&E providers and in so doing has perhaps impeded their development. Northern Australia suffers in this regard in comparison to southern Australia in beef industry RD&E. The southern network of good consultants, and the producers' acceptance of them and in paying for their advice, is the envy of the north and an issue NABRC needs to address.

NABRC is well-placed to support implementation of the RD&E strategy in the north through the fostering of collaboration, industry validation of program content, and oversight of work conducted, in alignment with the regional NABRC framework.

A more engaged NABRC is a better investment for partners, and will be more attractive to potential future investors, such as private companies.

NABRC must continue to push the boundaries of the RD&E system and broker new projects, new collaborations and new approaches to the discovery and application of new technologies and systems to benefit the northern Australian beef industry. It must provide the environment to scrutinise the current and future RD&E investment to achieve an efficient and effective RD&E system. This research prospectus provides the rationale and framework to do this.

Appendix

Appendix 1. List of workshops for priority RD&E themes

Priority RD&E theme	Date	Workshop convenor	Attendees
1. Reproduction	22/09/11	Lee Fitzpatrick, JCU	Lee Fitzpatrick, Michael McGowan, John Cavalieri, Michael D'Occhio, Tim Schatz, Sigrid Lehnert, Dan Lynch, Brian Burns, Ian Watson, Wayne Hall, Geoffry Fordyce, Stephen Moore, Andrew Gray (SQ RBRC), Geoff Niethe, Ralph Shannon (NABRC), Mick Quirk (workshop recorder), John James (facilitator).
2. Grazing and Land Management	11/10/11	Ian Watson, CSIRO	Ian Watson, Chris Chilcott, Ken Day, Chris Gardiner, Peter O'Reagain, Joe Scanlan, John McIvor, Dionne Walsh, Robyn Cowley, Bob Karfs, Ed Charmley, Wayne Hall, Peter Day, Mark Silburn, Colin Creighton, Andrew Gray, Michael Lyons, Linda Hygate, Ralph Shannon (NABRC), Mick Quirk (workshop recorder), John James (facilitator).
3. Nutrition and growth	25/10/11	Stu McLennan, QAAFI	Dennis Poppi, Neil MacDonald, Rob Dixon, Ed Charmley, Joe Rolfe, Dale Miller, Ian Lane, Geoff Niethe, Richard Routley, Matthew Callaghan Desiree Jackson, Wayne Hall, Paul Greenwood, Chris McSweeney, David McNeil, Dianne Sorley, Cam Hughes (Chair, SEQ RBRC), Stu McLennan, Ralph Shannon (NABRC), Mick Quirk (workshop recorder), John James (facilitator).
4. Human capacity and enabling change	10/11/11	John Taylor Rangelands Aust; Dale Miller Agforce/ UQ	Keith Holzwart (Chair, Katherine RBRC), Michael Lyons (Chair, NQ RBRC), Krista Cavallaro, Gerry Roberts, Trudi Oxley Sue Dillon, Lauren Williams, Anne-Marie Huey Karen Bond, Piers Harper , Nadine Marshall, Liz Allen , Dale Miller David Pietsch, John Taylor, Bob Shepherd, Ralph Shannon (NABRC), Mick Quirk (workshop recorder), John James (DEEDI, facilitator).
5. Animal welfare	15/8/11	Wayne Hall, MLA	Caroline Lee, Carol Petherick mClive Phillips , Drew Ferguson, Jim Rothwell, Geoff Niethe, Wayne Hall, Justin Toohey, Kylie Schooley (SEQ RBRC), Fleur Winter, Keith Holzwart (KPIAC), Melina Tensin, Steve Banney, Felicity McIntosh, Ralph Shannon (NABRC), Mick Quirk (workshop recorder), John James (facilitator).
6. IT and Precision Livestock Management	18/8/11	Dave Swain, CQU	David Swain, Mark Trotter, Peter Corke , Ali Goktogan, Dave Henry, Don Menzies, Greg Bishop-Hurley , Thomas Banhazi, Cameron Allan , Libby Homer (CQ RBRC), Warren Mason, Tim Wark, Neil McLeod, Daniel Gregg, Ed Charmley, Geoff Niethe, Ralph Shannon (NABRC), Mick Quirk (workshop recorder), John James (facilitator).

Notes

Research, Development and Extension (RD&E)
PRIORITIES PROSPECTUS
For the Northern Australian Beef Industry

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