PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE
Official publication of The Australian Rangeland Society

Form of Reference
The reference for this article should be in this general form;

Author family name, initials (year). Title. *In*: Proceedings of the *n*th Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).

For example:

Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite *(Prosopis* spp.) in the Pilbara. *In*: 'A Climate of Change in the Rangelands. Proceedings of the 15th Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

Disclaimer
The Australian Rangeland Society and Editors cannot be held responsible for errors or any consequences arising from the use of information obtained in this article or in the Proceedings of the Australian Rangeland Society Biennial Conferences. The views and opinions expressed do not necessarily reflect those of the Australian Rangeland Society and Editors, neither does the publication of advertisements constitute any endorsement by the Australian Rangeland Society and Editors of the products advertised.

The Australian Rangeland Society

Seeking sustainable productivity improvements in the northern beef industry

Leigh Hunt[A], *Andrew Ash*[A], *Cam McDonald*[A], *Joe Scanlan*[B], *Lindsay Bell*[A], *Robyn Cowley*[C], *Ian Watson*[A], *John McIvor*[A], *Neil MacLeod*[A]

[A]CSIRO Ecosystem Sciences; Leigh.Hunt@csiro.au
[B]Department of Agriculture Fisheries and Forestry, Toowoomba Qld
[C]NT Department of Resources, Katherine NT.

Keywords: beef enterprise modelling, beef production, sustainable development

Abstract
Economic pressures have challenged Australia's northern beef industry over the last decade. Productivity improvement has been slowing, costs of production have escalated rapidly and beef prices have not increased in real terms since 2004. Reversing these trends is imperative for a viable industry over the long term. We describe the approach we have taken in a new project that is exploring options for sustainable development of the industry as a basis for guiding research and development for the next 20 years. A range of development scenarios that offer potential to significantly improve profitability through productivity gains were developed in consultation with industry and technical experts. These scenarios are being assessed using a new simulation model of northern beef enterprises to explore their potential effects on productivity and economic and environmental outcomes in six regions.

Introduction
The northern beef industry has experienced some impressive gains in productivity since the 1970s as a result of technological developments including the introduction of *Bos indicus* cattle, the use of dietary supplements and improved grazing management (Ash *et al*. 1997). However in the last decade positive trends in key productivity indicators, such as turnoff percentage (Fig. 1) and per animal beef yield, have slowed. At the same time production costs have escalated rapidly, while beef prices have not increased in real terms since 2004. Consequently many northern beef enterprises are struggling financially, with McCosker *et al*. (2010) reporting that about 50 percent spent more money than they earned in six of the seven years to 2009.

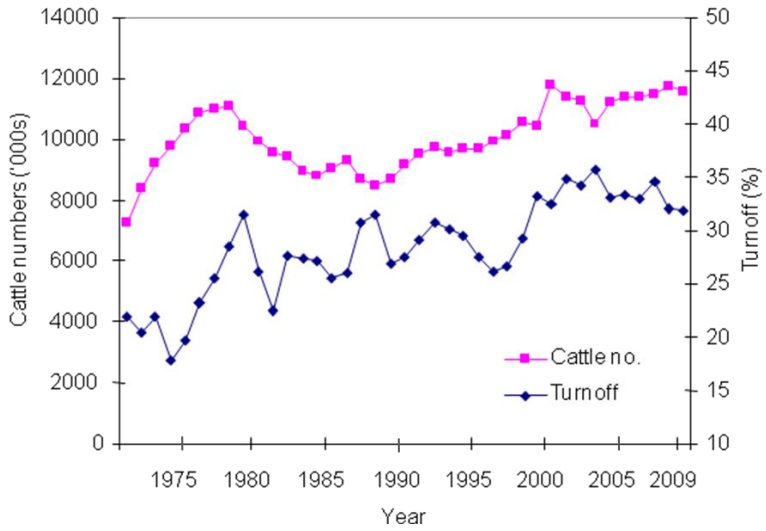

Fig. 1. Trends in cattle numbers and turn-off percentage for Queensland (Source: Australian Bureau of Statistics).

Productivity improvements that lift profitability are needed to ensure the industry remains viable over the long term. Here we describe a project that aims to identify potential options for sustainable development of the northern beef industry which will inform research and development needs for the industry for the next 20 years. This approach complements a broader futures scenario approach undertaken with the Northern Territory Cattle Association, in which preferred and likely future scenarios included a viable pastoral industry but in the context of an overall more diversified agricultural sector (Puig *et al*. 2009). While this project is focussed on the pastoral industry and its use of the grazing resources we recognise that many drivers will shape the future of the northern beef industry.

Our approach was to identify new technologies and practices that may offer scope to increase industry benefits and to evaluate them in terms of their potential to increase beef productivity and enhance economic returns and effect on the environment in a number of regions across northern Australia. We consulted cattle producers (through the Regional Beef Research Committees), beef industry extension specialists, technical experts in reproduction, genetics and nutrition, and industry bodies such as Meat and Livestock Australia to identify new technologies and production issues where cutting-edge research may produce significant productivity improvements for the industry. The evaluation centres on the application of a new simulation model of northern beef enterprises.

Development options for the industry

The development options with a potential to boost industry performance span various aspects of the beef production system, including livestock reproduction, nutrition and growth, improved pastures and management aids. These opportunities were incorporated into development scenarios for evaluation in the enterprise model. For example, advances in understanding rumen microbial ecology may allow the development of improved rumen microorganisms or manipulation of the balance of microorganisms that increase the digestibility of forage, so this technology was incorporated into a scenario in which forage digestibility during the dry season declined at a slower rate and bottomed at a higher digestibility than is currently the case. Improved breeder genetics can be incorporated into scenarios involving better reproductive performance or growth, and improved pastures and new innovations in supplementation can improve animal nutrition or reduce associated costs. Examples of some scenarios are presented in Table 1.

The development scenarios are being evaluated for six broad regions which are generally characterised by similar production systems and environmental factors, including Katherine-Kimberley, Pilbara-Central Australia, Barkly-NW Queensland, western Queensland, north Queensland, and central, south and SE Queensland. Eighteen ‘representative properties’ are being modelled to examine the development scenarios across the different regions and land of contrasting productivity.

Table 1. An overview of the development scenarios being modelled for beef producing regions across northern Australia.

Technology/development	Scenarios
Mosaic farming/irrigation	**A:** Heifers/cows in calf grazed on high quality/irrigated pasture in late dry season, to reduce breeder mortality and increase subsequent pregnancy rates. **B:** Steers or weaners grazed on good pasture in late dry season to bring to market sooner
Better breeder genetics	**A:** Improved breeder conception rates at lower body condition and whilst lactating, resulting in improved calving, weaning and branding percentages **B:** Improved heifer reproduction – better re-conception rates/shorter inter-calving interval in second calf heifers **C:** Reduced time to first calf
Better genetics for growing	**A:** Improved efficiency of energy use
More efficient rumen (better rumen microbes, modified rumen ecology)	**A:** Increase in pasture digestibility
Improved pastures or supplement use	**A:** Improved pastures are introduced to areas where they have not been traditionally used, but where their growth is feasible. **B:** Oversow native pastures with legumes
Infrastructure development to improve landscape use	**A:** All large paddocks are subdivided and water points installed so that utilisation is more even.
Remote management technologies	**A:** All water points are fitted with remote water monitoring and management systems **B:** All water points are fitted with water medicators.

Northern beef enterprise model

The evaluation model integrates livestock, pasture and crop production with labour and land requirements, accounts for revenue and costs, and provides estimates of the expected environmental consequences of management options (Fig. 2). Animal growth from birth to turn-off is simulated based on energy and protein supply for regional forage conditions and changes in animal numbers and disposals are tracked.

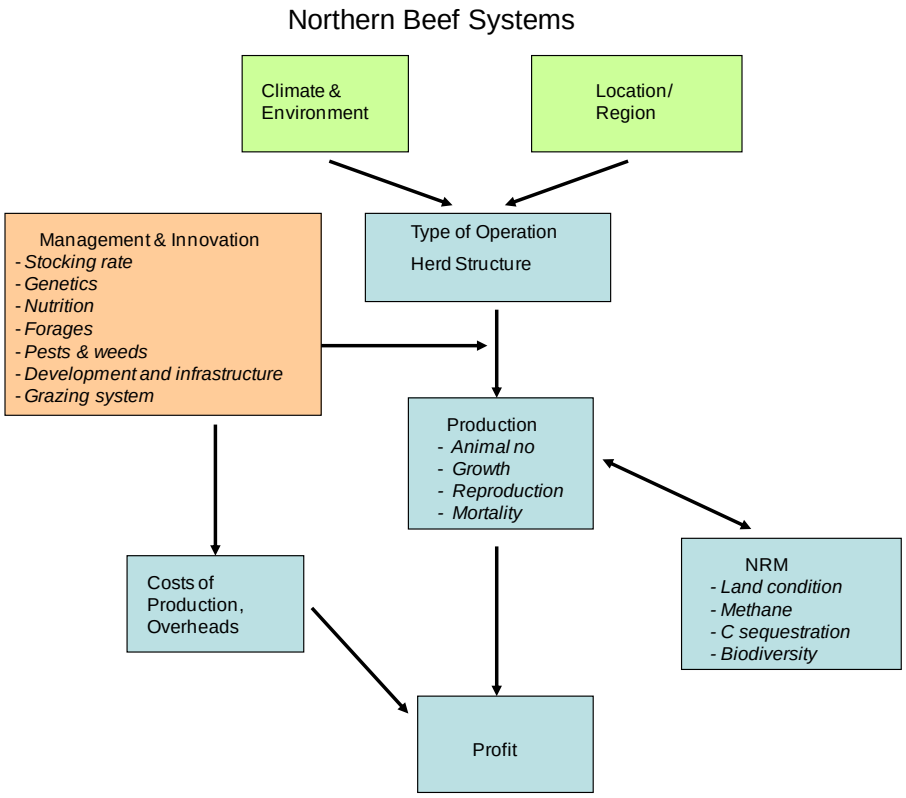

Fig. 2. The conceptual model of northern beef systems on which the enterprise model was based.

Relationships drawn from the literature (e.g. Nutrient Requirements of Domesticated Nutrients; PISC 2007) and from research within northern Australia drive livestock growth, reproduction and mortality relative to body condition. A range of different supplements or hay can be fed to different animal classes in different months of the year.

The model is flexible, being able to accommodate both extensive production systems on unimproved native pasture and mixed enterprises with improved pastures and cropping. Data on forage and crop production are derived from the GRASP and APSIM animal and pasture yield simulation models based on the historical climate record for a given location and the appropriate stocking rate, land/soil type and land condition. A range of forage crops (e.g. sorghum, lablab, lucerne, oats) can be simulated for a range of environments, as dryland or irrigated crops, to accommodate scenarios that involve special purpose forage crops.

The model uses a Microsoft Excel® platform and a monthly time step. It generates output for livestock production, enterprise economic performance (including direct and overhead costs and gross margins) and the environmental effects of different management options. Environmental performance is assessed against attributes of soils and hydrology, vegetation and the atmosphere (i.e. greenhouse gases) using quantitative and qualitative indicators.

The model is parameterised for each region using typical or benchmark data on the characteristics and management of enterprises for the region (e.g. Stockdale *et al*. 2012 for the Kimberley-Pilbara). Testing of the model for these benchmark conditions suggests the output for key livestock production and economic indicators is consistent with current performance data from other sources (e.g. Holmes *et al*. 2011, McCosker *et al*. 2010).

Conclusions

This project will provide insights into pathways for improving productivity in the northern beef industry and identify areas for promising research investment. Importantly, the industry is involved in the assessment of the findings and will provide feedback on their value to the industry.

Acknowledgements

This project is funded by Meat and Livestock Australia and the CSIRO Sustainable Agriculture Flagship, in partnership with the Queensland Department of Agriculture, Fisheries and Forestry and Northern Territory Department of Resources. We thank the producers who contributed to scenario development and provided feedback on model output. The participants in technical workshops are thanked for their insights, as are members of the project steering committee.

References

Ash, A.J., McIvor, J.G., Mott, J.J. and Andrew, M.H. (1997). Building grass castles: Integrating ecology and management of Australia's tropical tallgrass rangelands. *Rangeland Journal* **19**, 123–144.

Holmes, W.E. et al. (2011). 'Representative herd templates for northern Australia'. (Beef CRC).

McCosker, T., McLean, D. and Holmes, P. (2010). 'Northern beef situation analysis 2009'. Project report B.NBP.0518. (MLA).

PISC (Primary Industry Standing Committee) (2007). 'Nutrient Requirements of Domesticated Ruminants'. (CSIRO Publishing).

Puig, C.J., Huchery, C., Greiner, R., Collier, N., Garnett, S. and Perkins, I. (2009). 'NTCA Futures Project: Scoping Future Scenarios and Building Innovative Partnerships for Northern Territory Pastoral Lands'. Report to the Northern Territory Cattleman's Association.

Stockdale, M., Huey, A., Dray, R., Holmes P. and Smith, P. (2012). 'Kimberley and Pilbara RD&E Program: Phase 1'. Project B.NBP.0628 Final Report. (MLA).