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Review of the Wambiana Grazing Trial

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Abstract

Research has been conducted at Wambiana in the Burdekin catchment in Queensland since 1997 under MLA projects NBP.0318 and B.NBP.0379 to test (both ecologically and economically) how a range of grazing strategies (different both in terms of different stocking rates and variable stocking) coped with climate variability. Phase 1 of the trial was completed in 2011, Phase II commencing in 2012.

The objective of this project was to report on:

- The suitability of the Wambiana trial to achieve its objectives and the extent to which they have been achieved;
- Factors (internal or external) that are influencing or will influence the future conduct of the trial;
- Recommendations for the future of the trial and associated work including research focus and generation of output for producers.

The review concluded that Phase 1 of the trial had essentially achieved its objectives, with research questions and management issues raised in Phase 1 essentially addressed by the reformulated treatments implemented as Phase II. The project has increased the credibility of grazing management recommendations available to industry, has been well conducted, and should continue until at least August 2016. Associated trials, particularly those addressing the recovery of C-condition rangeland, should also continue at the site, as should the studies into faunal biodiversity.

However, a more comprehensive extension programme is warranted which incorporates the Wambiana trial results but addresses more broadly the barriers to sustainable grazing management in the whole property context. In addition, a review of the modelling capacity required to allow extrapolation of trial results (to other environments and to whole businesses) is required, together with an assessment of the requirements for, and constraints to, the development of an appropriate, ongoing modelling capacity in northern Australia. Continuation of the trial after mid-2016 should be considered in light of the modelling capacity developed to that time.

Analysis and publication of the results will require a 'harvest year' in which support for the Principal Investigator and a biometrician should be provided by MLA. In addition, MLA should consider support for multivariate analysis of the botanical data available, and an

economic analysis of the grazing system in the Burdekin Catchment that would identify privately optimal management strategies as a function of land condition.

Finally, given the investment to date and the positive response of industry to the trial, a full cost-benefit analysis should be conducted to assess the value of research trials such as this compared to other opportunities for funding.

Executive Summary

Sustainable management of cattle properties in northern Australia is difficult. In particular, the highly variable climate affects pasture quality and quantity throughout the year. There are significant opportunities to improve and stabilise individual animal and herd performance, and maintain and improve rangeland condition by the identification of optimum grazing management systems. To identify such systems, a grazing trial was initiated at Wambiana in the Burdekin catchment in Queensland in 1997, with financial support from MLA since 1 July 2002 under projects NBP.0318 and B.NBP.0379. Phase 1 of the project was completed in 2011 and Phase II was initiated in 2012.

This project (B.ERM.0099 and B.ERM.0100) was aimed at reviewing the research conducted at the Wambiana grazing trial. It was initiated to suggest a way forward for the site given not only funding conflicts arising from the present suite of projects, but also the substantial, long term investment already made, prospects for successful outcomes in the current phase, and priorities for future R, D &E.

The objectives were to report on Wambiana research with emphasis on:

- The suitability of the trial to achieve its defined objectives;
- The extent to which the defined objectives have been achieved;
- Factors (internal or external) that are influencing, or will influence, future conduct of the trial;
- Recommendations for the future of the trial and associated work including research focus and generation of outputs for producers.

To achieve the objectives the following activities were undertaken:

1. Review of agreements, relevant project documents and project technical reports and published papers.
2. Facilitation of a workshop in Charters Towers on 17 December 2013 with producer and technical representatives.
3. Interviews with key stakeholders.
4. Survey and/or interview of other stakeholders associated with the Wambiana site.

The review concluded that the outcomes of Phase I were satisfactory within the constraints of design, and the trial has substantially met its objectives of ‘improving the knowledge base between stocking practices, improvement in land condition, and reduced risk around soil loss, productivity and profitability’ or testing ‘how a range of grazing strategies cope with

climate variability'. Results were consistent with much international literature on grazing management systems.

While Phase 1 raised several questions as well as issues surrounding the formulation of the treatments themselves, these were addressed to a considerable extent by the reformulated treatments implemented as Phase II in 2012, and establishment of the sister project B.NBP.0555.

An over-riding impression gained by the review team is of the credibility of the project, and the high regard in which the research team is held both by producers associated with the project, and collaborators. Additionally, the Wambiana trial provides an excellent opportunity for additional and associated small plot studies, and assessment of grazing management on faunal biodiversity at a realistic scale.

The review generated the following recommendations:

1. Continue current funding of the trial, and the current data collection protocols, until current embedded projects are completed (31 August 2016);
2. Review the project again in late 2015 or early 2016 to decide on further funding;
3. Encourage establishment of appropriate collaborative arrangements to ensure adequate (multivariate) analysis of available data (particularly vegetation data), and ensure resources are available to complete this analysis.
4. Encourage establishment of appropriate collaborative arrangements such that an economic analysis is able to define privately optimal grazing management strategies as a function of land condition, and ensure that resources are available to compete this analysis.
5. Fund, in conjunction with QDAFF, a 'harvest year' to enable the research team to analyse and write up Phase II results.
6. Support development of an extension initiative aimed specifically at sustainable grazing management which incorporates the results of the Wambiana grazing trial and project B.NBP.0555 (spelling strategies), and which identifies and attempts to reduce barriers to adoption of sustainable grazing practices. This would require "embedding" specific extension expertise into the research group.
7. Initiate a modelling project (essentially Phase III) as soon as possible to identity the functions that need to be incorporated into GRASP, or upgraded,

to allow current deficiencies to be rectified and advise on when the trial in its current form could be concluded. This should include recommendations for maintenance of a substantial and relevant modelling capacity in northern Australia for at least the medium term. This project should include, in the short term, the use of the current GRASP model (in conjunction with appropriate climate files) to evaluate the Wambiana treatments in other regions across northern Australia.

8. Undertake a 'business case' analysis of the Wambiana trial, and alternative models of R, D & E, to assess their relative efficacy as means of achieving MLA objectives.
9. Improve site management efficiency by investing in remote monitoring equipment and/or negotiating with the Lyons family to assume greater responsibility.
10. Assess as soon as possible the attitude of the Lyons family to a long term R, D and & E commitment at the site.
11. Dependent on acceptance by the MLA Board of the recommendations of project ERM.0094, plan the transition of the site into the National Rangeland Research Network.

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Abbreviations

QDAFF – Queensland Department of Agriculture, Fisheries and Forestry

JCU – James Cook University

CSIRO – Commonwealth Scientific and Industrial Research Organisation

MLA – Meat & Livestock Australia, Ltd

DSITIA – Queensland Department of Science, Information Technology, Innovation & the Arts

DNRM – Queensland Department of Natural Resources and Mines

AGM – Annual gross margin

MSR – Moderate stocking rate

HSR- High stocking rate

VAR - Variable stocking rate

SOI – Southern Oscillation Index

R/spell – Rotationally spelled treatment

LTCC – Long term carrying capacity

GRASP – Grass Production (model)

GAC – Grazier Advisory Committee

Background

The QDAFF Wambiana grazing trial, south of Charters Towers, Queensland was established in 1997, initially with funding from the Commonwealth Government's Drought Regional Initiative. Further Commonwealth funding was subsequently provided from the Natural Heritage Trust. Funding has also been provided by Great Barrier Reef Marine Park Authority and the Tropical Savannas CRC. The latter collaboration reflects the importance of the Burdekin River catchment as a source of sediment for the Great Barrier Reef lagoon, and the perceived importance of the management of grazing in the catchment in determining the sediment load discharged.

Funding for the trial has been provided by Meat & Livestock Australia Limited (MLA) since 2002, in acknowledgement not only of the environmental significance of the catchment but also the economic importance of the beef industry in northern Queensland. This funding was provided initially under MLA projects NBP.0318 and B.NBP.0379 which supported the trial in 'Phase 1' during which the initial treatments were maintained from 1997 until 2011. A review of trial results in 2009 resulted in a proposal for the revision of some of the experimental treatments and the initiation of 'Phase II', funded as Project B.NBP.0635. Although this project provided funding for the period June 2010 – September 2014, the process of conversion to the new treatment schedule, involving a burn of the entire site and post-fire spelling, has meant that new treatments were not fully established until 2012 and will have experienced only two wet seasons by the time the current funding ceases.

In addition to the grazing trial, the Wambiana site currently hosts two additional projects whose funding times lines are not synchronous with the main trial. 'Spelling strategies for the recovery of pasture condition' (MLA Project B.NBP.0555) is a small plot study aimed at more closely defining (in terms of timing, duration and frequency) the wet season spelling strategies required for the recovery of pastures in poor (C grade) condition. This project is funded until 31 October 2015. The second project (MLA project ERM.0088) is based at James Cook University and aims to quantify the impact of the experimental grazing treatment on vertebrate biodiversity. This project is funded until 31 August 2016. These projects are dependent on the maintenance of the main grazing trial, the former because spelling treatments are imposed by erection of temporary fencing within the main treatment paddocks, and the latter in order the maintain the integrity of the experimental treatments over the course of biodiversity measurements.

The current review was initiated in order to suggest a way forward for the Wambiana site given not only the funding conflicts arising from the present suite of projects but also the substantial, long term investment that has already been made by the funding partners, the prospects for successful outcomes in the current phase, and the priorities for future R, D &E investment in the region.

Project objectives

The objectives of the project were to produce a report on the research conducted in the Wambiana grazing trial with particular emphasis on:

- The suitability of the trial to achieve its defined objective;
- The extent to which the defined objectives have been achieved;
- Factors (internal or external) that are and will influence future conduct of the trial;
- Recommendations for the future of the trial and associated work including research focus and generating output for producers.

In the context of this report the 'defined' or 'overall' objective of the Wambiana project was 'improving the knowledge base between stocking practices, improvement in land condition, and reduced risk around soil loss, productivity and profitability'. The objective has also been stated as 'to objectively test how a range of grazing strategies cope with climate variability'[1]

Methodology

Broadly, the tasks undertaken to achieve the project objectives were:

- Review of agreements, relevant project documents and project technical reports for the Wambiana Grazing trial, supplied by MLA, and a compendium of published papers from the trial compiled by the Principal Investigator. The documents perused by the review team are listed in Appendix 1.
- Facilitation of a workshop with the key stakeholders in the project (producer and technical representatives, QDAFF, MLA) to overview past work, reflect on output and issues, and consider future directions;
- Interview with some key stakeholders present at the workshop;
- Compilation (by survey and/or interview) of input from other stakeholders not present at the workshop that utilise or are associated with the Wambiana site.

[1] O'Reagain, P.J. and Bushell, J.J. (2011). The Wambiana Grazing Trial. Key learnings for sustainable and profitable management in a variable environment. (The State of Queensland Department of Employment, Economic Development and Innovation).

These activities were aimed at addressing the following terms of reference provided for the reviewers:

1. Assess the technical output of Wambiana project and its contribution to the overall objective;
2. Assess the likelihood of the research work achieving the overall objective;
3. Assess processes in place to convert grazing trial output into recommended actions for northern producers;
4. Comment and make recommendations on the portability of the Wambiana output to other northern grazing regions;
5. Identify any internal or external factors that may impact or benefit the future conduct of the research and delivery actions;
6. Assess the efficacy and effectiveness of the program to deliver benefits to livestock producers;
7. Provide recommendations on future direction considering original project needs, production and NRM issues, and output from the MLA rangeland planning project ERM.0094.

The project review workshop was convened at the Charters Towers office of QDAFF on 17 December 2013 and was attended by 23 individuals (11 producers, 8 current or former QDAFF staff, and one each from CSIRO, JCU, MLA and Dalrymple Landcare) in addition to the reviewers. Details of attendees are given in Appendix 2.

The agenda for the workshop included:

- An overview of the development, implementation and key learnings of the project to date (Phase I and Phase II) by the Principal Investigator;
- Issues, questions and points of clarification arising from this presentation;
- Current projects 'embedded' at the trial site (presentations by Dr P Jones, Dr J Scanlan and Dr L Schwarzkopf);
- Participants' insights into trial results and issues for the northern beef industry;
- Producer involvement in trial design and oversight;
- Assessment of the results of Phase I;
- Future research questions;

- Extension requirements;
- Portability of results;
- Integration of the project with other initiatives;
- Small group discussions - researchers and producers separately;
- Closing plenary.

A summary of the workshop discussion, compiled from notes taken by both reviewers and Dr Nicole Spiegel, is given as Appendix 3.

Following the workshop, one or both reviewers conducted interviews with the following key stakeholders or workshop participants:

Dr Peter O'Reagain (Principal Investigator)
Principal Scientist, AgriScience Queensland
Department of Agriculture, Fisheries and Forestry

Mr Robert (Bob) Karfs
Science Leader (Beef), Agri-Science, Queensland
Department of Agriculture, Fisheries and Forestry

Prof. Lin Schwarzkopf
Deputy Head, School of Marine and Tropical Biology
James Cook University

Dr Ian Watson
Officer in Charge and Director, Tropical Landscapes Joint Venture,
CSIRO Ecosystem Sciences

A number of individuals who did not attend the workshop but who have an association with, or interest in, the project were also contacted and either interviewed personally or asked to provide a response by email to a set of questions. Fourteen individuals were contacted by email and one by telephone (Appendix 4). Twelve individuals provided detailed responses to the email questionnaire. The basic questions asked of those contacted in this phase of the review are given in Appendix 5.

Results and discussion

In this section the results of the review are described in the terms of the headings set out in the consultants' Terms of Reference. This structure has been maintained for the purposes of reporting even though the headings themselves are not mutually exclusive.

An over-riding impression gained by the review team is of the credibility of the project, and the high regard in which the research team (the Principal Investigator, Dr O'Reagain, and the Technical Officer, Mr Bushell) is held both by producers associated with the project, and collaborators. This represents a significant testament to the professional way in which the project has been conducted, and to the collaborative network that the research team has established. This situation represents an important if intangible outcome of the project with important consequences (discussed further below) for the future use of the site.

(a) Assessment of the technical output of the project and its contribution to the overall objective.

The treatments originally imposed in 1997 were:

1. Moderate stocking (MSR) – continuous stocking at approximately the long term carrying capacity (LTCC)[2];
2. Heavy stocking (HSR) – continuous stocking at about x2 the LTCC;
3. Variable stocking (VAR) – stocking rate adjusted annually based on total standing dry matter (TSDM) at the end of the wet season (May);
4. SOI-variable (SOI) – stocking rate adjusted annually at the end of the dry season (October-November) based on TSDM and the SOI-based forecast for the coming wet season;
5. Rotational wet season spelling (R/spell) – stocking rate initially about 50% above LTCC (but reduced after November 2003) with one third of the paddock spelled for the entire wet season (November to May) (i.e. a three paddock rotation for wet season spelling with continuous grazing during the dry season).

Treatments were implemented in paddocks of approximately 100 ha, with two replications. While the trial site is variable, including three major vegetation communities, the layout of fences, facilitated by the use of GIS facilities, has been very successful in balancing these

[2] Carrying capacity and stocking rates were always reported in terms of Animal Equivalents (AE) per unit area (or vice versa) with 1AE=450 kg steer. As actual stocking rates were always calculated retrospectively, based on observed weight gains, they may differ somewhat from the nominal values.

vegetation types across the paddocks. Animal numbers per paddock (Brahman cross steers 18-30 months old) varied from 11-35 depending on treatment. Animals remained on the trial for two years and were managed (e.g. in terms of supplementation, vaccination and use of growth promotants) according to industry standards, with considerable input from the Grazier Advisory Committee.

The design and management of the trial were therefore quite robust, within practical limitations, and capable of demonstrating statistically significant differences between the treatments imposed.

Measurements most directly related to the objective of the trial as stated above, and made either directly or by imputation, included:

Animal

- Cattle live weight, condition score and frame growth;
- Diet quality using faecal near infra-red spectroscopy.

Biophysical

- Pasture mass and species contribution;
- Species frequency (presence or absence in quadrats);
- Density (plants per unit area) of 3P (productive, perennial and palatable) grasses (from 2006 only);
- Ground cover;
- Fire effects on woody species;
- Land type selection by cattle and grazing distribution;
- Forage utilisation (calculated from modelled pasture growth);
- Rainfall, runoff and soil loss.

Economic

- Carcass weights, grades and meatworks prices;
- Supplementation and drought feeding costs;
- Gross margin per unit area, for individual years and accumulated over the trial.

It is in some respects unfortunate that the initial vegetation measurements included only a relatively insensitive measure of individual species abundance (frequency) and that

estimates of the density of the important 3P grasses - a more sensitive and informative (though also more time consuming) measure of abundance - did not commence until 2006. Nevertheless, the data available have proven adequate to reflect the major differences between treatments in term of impact on the land resource which, at the commencement of the study in 1997, was considered to be in fair-good (B) condition.

Various other measurements have also been made in the course of secondary studies embedded at the trial site, but these are not considered here.

In brief, the results of Phase I, from 1997 to 2011, can be summarised as:

- The MSR treatment resulted in the highest liveweight gain per head, returned the highest accumulated gross margin per unit area (AGM) over the course of the trial, and maintained the pasture in B+ condition.
- The HSR treatment resulted in the lowest liveweight gain per head, highest liveweight gain per hectare, returned an AGM that was markedly inferior to all other treatments[3], and resulted in substantial pasture degradation (to at least C condition).
- The VAR and SOI (i.e. variable stocking rate) treatments produced similar results with liveweight gains per head (on average over the years of the trial) slightly below MSR, AGM slightly below MSR but with greater variability in gross margin from year to year, and some decline in pasture condition.
- The R/spell treatment produced liveweight gains per head similar to VAR and SOI, AGM slightly below VAR and SOI, and maintained pastures in B+ condition.
- Reduced ground cover and landscape functionality in the HSR treatment resulted in a greater frequency and magnitude of runoff events, and greater loss of nutrients and sediment, than in other treatments which maintained higher levels of ground cover (although given the flat topography of the site sediment loads were not high in absolute terms).
- Fire was effective in maintaining an open woodland structure through a shift to smaller size classes of woody species rather than reduced density; post fire recovery was dependent on land type and seasonal conditions.

[3] Note that the HSR treatment (in keeping with other treatments) was implemented strictly according to experimental protocols. Cattle were not sold early in poor seasons and, according to some producers at the Charters Towers workshop, this may have negatively biased the AGM achieved. Nevertheless, the treatment as implemented was considered by the researchers and the GAC to be typical of many heavy stockers in the region.

Overall, the major feature of the results of Phase I is the contrast between HSR and all other treatments, in terms of animal production, ecological impact and economic performance.

The results are also consistent with much international literature on grazing management systems which in broad summary indicates that:

- continuous grazing at moderate stocking rates is a difficult standard to better in terms of individual animal performance;
- wet season spelling often (but not always) results in improved pasture condition[4].

Unfortunately, the results of the VAR, SOI and R/spell treatments at Wambiana are all subject to some degree of qualification or counterfactual argument arising from the particular set of seasonal conditions experienced, and the formulation of the treatment prescriptions. For both VAR and SOI, the high rainfall and prolific pasture growth experienced in the early years of the trial allowed a marked increase in stocking rate, in the absence of any restriction specified in the treatments (which reflected recommendations for variable stocking at that time; P O'Reagain pers. comm.), which resulted in overgrazing of the pastures when this wet phase was succeeded by a prolonged period of low rainfall/drought, and stocking rate was not reduced as rapidly as would have been desirable. The effect of this transition on pasture condition persisted more or less for the remainder of Phase I.

The seasonal sequence also resulted in unfavourable impact on pasture condition in the R/spell treatment when recovery of sections burnt in an unfortunately timed fire was slowed by the transition to dry conditions. This necessitated two additional wet season rests for these sections and consequently an additional two wet seasons of heavy stocking for unburnt sections. The stocking rate applied to this treatment was reduced as a consequence from November 2003. Again, the impact on pasture condition was long lasting, even if the effect of this treatment (actually a combination of rotational spelling and reduced stocking rate post-2003) over the trial period was to maintain pasture in B+ condition. Overall, this treatment provided no convincing evidence that rotational spelling could support higher stocking rates without damage to the pasture, as had been expected on the basis of other research in the region[5]

[4] While rotational wet seasonal spelling is not identical with rotational grazing they both have the effect of increasing stock density above continuous grazing at the same stocking rate and providing rest for pastures.

[5] Ash, A., Corfield, J. and Ksiksi, T. (Undated). The Ecograze Project – developing guidelines to better manage grazing country. 44 pages. (CSIRO Sustainable Ecosystems. Meat & Livestock Australia, Queensland Government Department of Primary Industries).

Despite the questions raised by this discussion it must be concluded that, within the limitations of its design, the trial has substantially met its objective of 'improving the knowledge base between stocking practices, improvement in land condition, and reduced risk around soil loss, productivity and profitability' or testing 'how a range of grazing strategies cope with climate variability'. In terms of all the criteria except 'improvement in land condition' a clear answer has been given in favour of moderate, continuous stocking, and against what appears to be an industry tendency towards continuous, heavy stocking, *for land initially in good condition*. Because of the starting condition of the site the trial in Phase I could realistically address only the issue of maintenance of initial condition rather than 'improvement' in land condition.

That these findings have appeared in reputable peer reviewed journals[6] is adequate evidence that the first Phase of the trial has satisfactorily achieved its objectives, a view strongly supported by participants in the Charters Towers review workshop of 17 December 2013.

(b) Assessment of the likelihood of the research work achieving the overall objective.

The current research phase

While Phase I has produced a satisfactory outcome within the constraints of its design, it has also clearly raised a number of further questions as well as issues surrounding the formulation of the treatments themselves.

Important research questions raised by the Phase I results and experience include:

I. The significance for the project objectives of the recent invasion of *Bothriochloa pertusa* (Indian couch), particularly in the HSR treatment, but in all treatments to some extent, and widely throughout the region;
II. The grazing strategies appropriate to the regeneration of degraded land;

[6] See particularly:
O'Reagain, P.J., Bushell. J. and Holmes, B. (2011). Managing for rainfall variability: long-term profitability of different grazing strategies in a northern Australian tropical savanna. *Animal Production Science* **51**:210-224.
O'Reagain, P.J., Brodie, J., Fraser, G., Bushell. J.J., Holloway, C.H., Faithful, J.W. and Haynes, D. (2005). Nutrient loss and water quality under extensive grazing in the upper Burdekin river catchment, North Queensland. *Marine Pollution Bulletin* **51**: 37-50.
O'Reagain, P.J., Bushell, J., Holloway, C. and Reid, A, (2009). Managing for rainfall variability: effect of grazing strategy on cattle production in a dry tropical savanna. *Animal Production Science* **49**: 85-99.

III. The extent to which the results could be repeated with breeders rather than steers, and the implications for whole property profitability;

IV. The implications for grazing strategies of a more comprehensive understanding of the autecology of major desirable (i.e. 3P) species (e.g. *Bothriochloa ewartiana*, Desert bluegrass);

V. The appropriate integration of fire into grazing management for the control of woody species.

VI. Can closer tracking of stocking rates with available forage i.e. flexible stocking, allow production and profitability to be increased relative to moderate stocking while still maintaining pasture condition?

Issues surrounding the formulation of the treatments themselves include:

VII. The means of ensuring that stocking rate does not increase excessively in periods of favourable seasonal conditions, and can be reduced rapidly when dry conditions return;

VIII. The appropriate number of paddocks for rotational wet seasonal spelling to provide greater flexibility in the pattern of spelling and avoid high stocking rates in the wet season in the grazed (i.e. unspelled) paddocks.

These research questions and management issues have to a considerable extent been addressed by the reformulated treatments implemented as Phase II in 2012, and the establishment of the sister project B.NBP.0555.

The reformulation of the treatments incorporated in Phase II of the main trial is shown below (O'Reagain, pers. comm.):

Phase 1 Treatment	Phase II Treatment
HSR	HSR (unchanged)
MSR	MSR (unchanged)
R/spell (3 paddocks)	MSR + rotational wet season spelling (6 paddocks)
VAR	Flexible stocking + rotational wet season spelling (6 paddocks)
SOI	Flexible stocking – no wet season spelling

'Flexible stocking' involves four potential decision points throughout the year. The major decision point is the end of the wet season, but with potential to reduce stocking rate in the mid-dry season and at the end of the dry season, with a further 'check' point in the mid-wet season (mid-late February) which may signal a need to reduce stocking rate before the end

of the wet season. In addition, increases in stocking rate in good seasons are limited to about 25% of LTCC while decreases can be up to 30-40% of LTCC.

Provision of six paddocks for the rotational spelling system is not an attempt to determine the optimum number of paddocks for a spelling regime. Indeed such a question would be largely pointless and its pursuit a waste of scarce resources. Rather, the treatment represents a practical attempt to overcome deficiencies experienced in the original system and give greater flexibility (in area, timing and duration) to the application of spelling.

It should be noted that the conversion of the Phase I VAR and SOI treatments to the corresponding Phase II treatments has involved the balancing of the replicates of the new treatments across the replicates of the old so that the comparison of the new treatments will not be biased by their antecedent grazing history. This is a good example of the professional approach that has been applied to the design and management of the trial overall.

The Phase II treatments satisfactorily address the significant research questions and issues raised in I, VII and VIII above. They also provide the potential to assess if rotational wet season spelling can achieve the expectations in terms of productivity and resource condition held for it, if modest risk-averse flexibility in stocking rate can in fact provide the expected improvements in productivity compared with moderate set stocking while maintaining resource condition (research question VI above), and if there is a synergistic interaction between the two. Concurrently, the trial has the capacity to evaluate the productivity and landscape function of degraded range (though only at high stocking rate) following the incursion of *Bothriochloa pertusa*.

The research question identified in (II) above (grazing strategies appropriate for regeneration of degraded land) is being addressed by MLA project B.NBP.0555 (although detailed experimental preschedules for this project were not available to the consultants). Although working only (and necessarily) at small plot scale, this project will evaluate the effect of starting condition, timing and frequency of (whole of) wet season spelling on the condition of the land resource. More detailed treatments, differentiating between early and full wet season spelling, have been implemented as part of this project at Clermont in central Queensland, and any broad principles emerging from this phase of the work should be applicable to the Wambiana site. Overall, this project does have the potential to identify appropriate management strategies for the restoration of degraded (C condition) land, but any strategy identified will require demonstration at a larger scale before it is likely to be accepted by industry (notwithstanding the fact that wet season spelling in some form is intuitively essential for any land restoration in the seasonally dry savannas).

The studies currently established at the site (ignoring for the moment the biodiversity studies) thus address important issues for the northern beef industry, from both economic and environmental perspectives, in a way that has considerable potential to produce outputs that can be adopted by northern producers. For the main trial these outputs will be extendable within the region without further modification (although modelling of whole-property implications would be desirable - see below), while for the small-plot project a further period of large scale demonstration will probably be required.

Future research issues

Research question III above (can research results be repeated with breeders?) can probably not be directly addressed by the current project. While it would be possible to introduce breeders by replacing steers with pregnancy-tested cows that would calve down and be re-joined on the trial, it is doubtful if the resources would be available to support the additional work load involved (see further discussion under (e) below), or that the numbers of animals that could be supported on the site would allow significant differences in re-conception rates to be measured. Rather, the extrapolation of trial results to the whole property situation will need to be achieved by modelling (based on GRASP) in which steer growth rates are used to predict cow mortality and weaning rates[7], and research attention should be focussed on ensuring that confidence can be placed in the relevant relationships incorporated into the model.

Research question IV (grazing system implications of autecological studies of key species) could be addressed by small scale, plot-based research at the site which would provide information to complement that produced by project B.NBP.0555. Bartley *et al.* (2014)[8] have highlighted the need to increase the proportion of deep rooted native perennial grasses in Burdekin rangelands in order to reduce runoff and sediment concentrations, even in rangeland where ground cover is relatively high but dominated by *Bothriochloa pertusa*. Improved understanding of the autecology and grazing responses of these species, especially 3P species, is desirable to formulate feasible management strategies which, as noted above, will require demonstration at larger scales before adoption.

[7] Scanlan, J.C. MacLeod, N.D. and O'Reagain, P.J. (2013). Scaling results up from a plot and paddock scale to a property – a case study from a long-term grazing experiment in northern Australia. *The Rangeland Journal* **35**:193-200.

[8] Bartley, R., Corfield, J.P., Hawdon, A.A., Kinsey-Henderson, A.E., Abbott, B.N., Wilkinson, S.N. and Keen, R.J. (2013). Can changes in pasture management reduce runoff and sediment loss to the Great Barrier Reef? The results of a 10-year study in the Burdekin catchment, Australia. *The Rangeland Journal* **36**:67-84.

Research question V (the integration of fire) is best addressed by a co-learning, adaptive management approach rather than formal experimentation. Because the impact of fire is heavily dependent on post-fire seasonal conditions, and can be long lasting (as already observed at the site), it is neither possible nor desirable to incorporate fire regimes as part of the treatment specifications. Moreover, introducing a burning treatment (or sub-treatment) into the trial at this stage would add a degree of complexity that would warrant a considerable extension in the trial duration for any meaningful results to be achieved. Burning of the entire site has been carried out twice to date, and some smaller scale burns have also been implemented in parts of the R/spell treatment. These have provided opportunities to observe the response of woody species and pasture recovery as a function of land type and seasonal conditions. Further opportunities will probably arise in the future. In addition, opportunities can be taken to observe, and if possible quantify, the response to fire on commercial properties.

Potential of the project to achieve its objectives

At the technical level there are no obvious constraints that would prevent realisation of the trial's potential to deliver important outcomes for the northern beef industry. Even if not all of the measurements described in (a) above can be maintained in the face of reduced staff resources (see further discussion in (e) below), we are confident that sufficient animal, vegetation and economic data will be collected to allow the effects of the current treatments to be evaluated in terms that are meaningful to industry.

The research team has access to excellent statistical support locally (a statistician will be based at Spyglass Research Station) and to a high level of expertise in biophysical modelling. While in-house expertise in economic modelling is now reduced, a number of successful collaborations (e.g. with CSIRO) indicate that such support should not be limiting.

Nevertheless, some limitations in the support available are worth noting. First, the statistical support available is basically of the 'traditional' type, focussing on conventional methods to detect statistically significant differences between treatments. While this is essential, the wealth of data available, particularly botanical data (e.g. frequency of species X treatment X time), is cumbersome to handle by conventional approaches alone, and its analysis would benefit from the application of multivariate, pattern seeking techniques that can summarise and display such complex data, possibly revealing new insights or leading to the formulation of hypotheses that can be tested using conventional means. The research team should be encouraged to establish collaborative relationships, outside QDAFF if necessary, to allow this form of analysis to be undertaken. Some limited investment by MLA (e.g. to provide part-

time salary support for a biometrician) is recommended as this form of analysis is considered essential if the full value of the available data is to be realised. We believe that the benefit of such investment would greatly outweigh the cost.

Second, the economic analysis that has been undertaken to date, based on gross margin per unit area, while providing a reasonable basis for comparison of the treatments *in the specific situation of the trial,* is potentially misleading in that it relates to only a single starting condition. It cannot be uncritically concluded, for example, that because moderate, continuous stocking provides the best economic outcome for land initially in good condition that this is also the case for land initially in poor condition. Nor can it be concluded that because the most profitable strategy maintained land in good condition, producers on degraded land should manage for an upward condition trend. To understand the effect of land condition on choice of management strategy requires a more sophisticated approach that accounts for the temporal trajectory of the ecological system under alternative management strategies applied to a range of starting conditions, and compares these combinations on the basis of the net present value of long term cash flow (thus accounting for the long term nature of benefits that may flow from strategies that seek to improve land condition). Such analyses have proved instructive elsewhere in the rangelands[9], especially in explaining the counter-intuitive persistence of heavy stocking or exploitative management.

The modelling capability available to the Wambiana research team should enable a similar approach to be implemented for the dry savanna beef production system and the establishment of collaborative arrangements with research economists familiar with this form of analysis is recommended. Such an analysis would need to be accompanied by a review of the available models (or just GRASP) to ensure that the temporal trajectory of the ecological system and the level of animal production, under alternative management strategies, can be confidently estimated. Further, it should be noted that the drought management strategy implemented at Wambiana (based on supplementary feeding) may not be relevant to many producers who may opt to sell or agist early in the dry season, rather than feed. Therefore, any analysis of optimal management strategies in relation to land condition would need to incorporate a range of drought management options.

The only constraint that we consider could prevent the realisation of the project's potential is the level of resources made available from the funding partners in terms of the time for which

[9] Wang K-M and Hacker R.B. (1997). Sustainability of rangeland pastoralism - a case study from the West Australian arid zone using stochastic optimal control theory *Journal of Environmental Management* **50** 147-170.

the current phase of the main trial is supported, and the modelling, analysis and reporting of results.

The question of how long the grazing trial should continue is a vexed one for which there is no simple answer. Neither researchers nor producers at the Charter Towers workshop were able to provide a concise answer to this question, although one researcher did make the interesting suggestion that it should continue until the original cohort of plants has been replaced. We suggest that any decision regarding the continuity of support needs to consider that:

- Realisation of the potential benefits outlined above depends on completion of the ancillary studies embedded at the site which in turn are dependent on the maintenance of the existing treatments. While project B.NBP.0555 could be argued to be of more direct importance to the stated objectives of the grazing trial, the biodiversity project ERM.0088 is also vital in terms of the wider issue of the industry's social licence to operate. As a minimum, therefore, the main study should be maintained until these studies have been completed (August 2016).
- A realistic evaluation of the Phase II treatments will require that they be maintained through a significant drought event and a period of post-drought recovery. Obviously this criterion cannot be specified in terms of a fixed time frame.
- Since extrapolation of the results to breeder operations, other regions (see discussion in (d) below), or to the more in-depth economic analysis discussed above will require confidence in the relationships incorporated into the GRASP (or some other) model, the trial should be continued until a reasonable level of confidence has been established in these relationships (not all of which will be derived from the Wambiana data itself).

This last criterion will entail a review of the critical relationships. In particular, attention will need to be directed to (a) refinement of the animal growth rate function and the relationship between steer growth rate and expected breeder performance (b) inclusion of multiple vegetation types and grazing selection patterns (among, rather than within, vegetation types) (c) the dynamic response of pasture condition to grazing pressure and (d) the dynamics of the link between the biological and economic models.[10]

[10] In part, J Scanlan (pers.comm.)

We therefore suggest that funding of field work in the trial should continue until at least August 2016, and that the current data collection protocols be continued during this period.

In the short term, MLA should commission the development of a modelling project which will review the critical relationships referred to above, develop and code the required algorithms, and make a recommendation by late 2015 or early 2016 on the need to continue the trial in its present form based on the range of seasonal conditions then experienced and the confidence then residing in the models produced. It may not be necessary to continue with the current treatments after 2016 in order to address knowledge gaps highlighted in the process of model development (e.g. animal selection between vegetation types; mixed vegetation types; breeder herds (whole property)). However, this judgement cannot be made at this time. An important aspect of this project should also be a consideration of the level of model complexity which is compatible with the computational requirements of the form of economic analysis discussed above.

Development of a modelling capability for extrapolation of trial site data should be considered broadly, as it also requires a process to determine the range of model users and who they are (e.g. model developers, model users, extension personnel requiring occasional use of a model). Such development should include succession planning (at each of the above levels) to ensure that an appropriate modelling capacity can be maintained in the long term. This will undoubtedly require some support from MLA, as it is a need of 'northern Australia', and not necessarily the task of any one jurisdiction.

In addition, publication of the results from the trial when finally concluded, or at least to August 2016, will inevitably require a 'harvest year' in which the research team are largely freed of other responsibilities and allowed to focus on this critical task. Support by MLA for this phase of the project is considered essential to a successful outcome.

(c) Assessment of processes in place to convert grazing trial output into recommended actions for northern producers.

A significant role of the Wambiana trial has been to provide specific information products and extension opportunities to both QDAFF staff and Queensland producers, and to individuals (both agency staff and producers) from other jurisdictions. Some of the outputs to date include:

- Development of specific information products on the results of the first phase of the Wambiana trial[11];
- Inclusion of trial findings in GLM courses and the development of Grazing Best Management Practices;
- Frequent visits, bus tours etc. to the trial site, with presentations by research staff and others;
- Championing of the trial and its findings by the GAC.

Despite the undoubted commitment of trial staff to communicating the Wambiana outputs, the extension output from the Wambiana trial could be improved. While some observations from both the Charters Towers workshop and responses to questionnaires suggest that stocking rates are being moderated in the region, this is by no means a universal view. Some producers and agency personnel have indicated that practice change has been limited and that a greater extension effort is warranted.

To achieve full benefit from the Wambiana trial results in terms of practice change amongst producers, a more comprehensive extension process is needed. This will involve more than simply the production of information products by the researchers, and the incorporation of the Wambiana principles into GLM packages and other extension media. Rather, what is required is a purpose-built extension program aimed not only at maximizing the capacity of existing Wambiana data to achieve practice change but also at identification and reduction of the barriers to adoption of sustainable grazing practices more generally. Incorporation of results from the companion project B.NBP.0555 (looking at recovery of 'C' condition country) will be part of this process. Such a development will require the introduction of specific extension skills to the project, and may require financial support from MLA. This should not be seen merely as a Wambiana extension activity, but as an initiative to identify broader issues associated with grazing land extension and the difficulties of achieving practice change. What should be aimed for is not only the promotion of general principles relating to stocking rate (e.g. increase slowly, decrease quickly) and the development of decision tools to assist in determining actual stocking rate, but also how and when these decisions should be made depending on the location under consideration (appropriate decision points, the potential magnitude of any adjustments to stock numbers etc), identification of barriers to adoption in specific situations and strategies to address these barriers where possible. Such

[11] See, for example, O'Reagain, P.J. and Bushell, J.J. (2011). The Wambiana Grazing Trial: Key learnings for sustainable and profitable management in a variable environment. Qld Dept. Employment, Economic Development and Innovation, Brisbane, Qld.

a programme would ensure that the full learnings from the Wambiana trial are captured in a manner relevant to industry.

Collateral benefits of the trial site include the capacity for the demonstration of strategies arising from small plot work. However, this opportunity requires an almost immediate contact with the Lyons family to broach the subject of the extended use of the existing trial site beyond the existing Wambiana Grazing Trial contract. The results of the small plot work will be very much predicated by seasons. They will not be achieved overnight and will need to be demonstrated at a much larger scale if they are to be acceptable to industry.

(d) Portability of the Wambiana output to other northern grazing regions.

Responses from both industry and agencies across northern Australia support the view that the main findings of the trial to date are portable. While the treatments imposed at Wambiana are not equally relevant everywhere in northern Australia, given differing markets, property sizes and seasonality, there is no doubt that the principles demonstrated at Wambiana – particularly the economic and ecological benefits of moderate stocking - are relevant well beyond the boundaries of the Burdekin catchment. In the short term, the use of the GRASP model with different climate files should allow the treatments at Wambiana to be evaluated at other sites across northern Australia, at least qualitatively. In the longer term portability will be strengthened by the model development and economic analyses referred to above, particularly when the interactions of treatments and climatic scenarios are fully considered.

Even some of the more general findings of the trial, such as the necessity for a number of decision points and limits to stocking rate change in the flexible stocking treatments, are outcomes that are relevant to the northern beef industry and should be promoted widely.

Findings from the spelling trial will probably also be portable, despite differences in species composition and, perhaps, the role of *Bothriochloa pertusa.* Observed relationships between spelling, season and the re-establishment of palatable, perennial grasses will probably reflect widely relevant and important principles, given the extent of rangeland in poor condition and the limited information available to guide its recovery. Again, modelling will play an important role, as will the extension activities associated with the findings of project B.NBP.0555.

(e) Internal or external factors that may influence the future conduct of the research and delivery actions.

The current development of research facilities by QDAFF at the Spyglass site in north Queensland will undoubtedly limit the resources available to Wambiana. The Wambiana research team (O'Reagain especially) will be expected to assume a larger role at Spyglass after 2016 at the latest, and probably earlier. In particular, there is an expectation within QDAFF[12] that O'Reagain will act as a mentor to new staff (three individuals are already nominated to work at Spyglass in roles associated with grazing land management).This, together with the logistical difficulties associated with the location of Wambiana relative to Spyglass, will restrict the time that the research team will have available for management of Wambiana. Additionally, QDAFF see their work focusing in the one location, adopting an integrated production system approach. The Wambiana trial site does not fit with this model.

This issue could be partially addressed to 2016 by the development of a capacity to manage the Wambiana trial in a manner that is less demanding of O'Reagain's time in particular. Use of O'Reagain and Bushell as stockmen, as at present, is a misuse of time. An improvement could be achieved if the Lyons family were willing to assume more responsibility for the day-to-day running of the trial (with commensurate financial compensation), by the use of remote technology (e.g. for monitoring of waters), or both. This would allow O'Reagain and Bushell to restrict their time at Wambiana mainly to data collection, and would release time for the extra responsibilities expected of them and for the multi-variate statistical analysis referred to above. Any improvement in the efficiency with which the trial is managed (in terms of staff time) will probably require additional investment by MLA (in addition to the investment required to support the multi-variate statistical analysis).

Some collateral benefits of the trial site have been noted above. In addition, the standing in which both the trial and the research team are held represents a significant asset for QDAFF and MLA that should not be lightly discarded. In the long term, Wambiana should have a place in the comprehensive extension initiative discussed above, as a site at which the results of management strategies (which would need to be maintained, even if no longer subject to detailed data collection) can be observed in the field, and regular field extension activities can be conducted. Further, the site has already demonstrated its potential to host a range of collaborative projects and this potential should not be lost (see discussion under g below).

[12] Bob Karfs, personal communication.

(f) Assess the efficacy and effectiveness of the program to deliver benefits to livestock producers.

The Wambiana trial addresses issues important for the northern beef industry, from both an economic and an environmental perspective, and has considerable potential to produce outputs beneficial to northern producers. The trial has been developed in conjunction with industry and the treatments discussed with and managed through a Grazier Advisory Group. While the scale of the trial (paddock size etc) will always be criticised by some, the trial is large by research standards, and the manner in which the individual treatments have been laid out to allow full expression of the differing vegetation types in each treatment has ensured that full confidence in the data is possible. The trial has been well managed throughout, the treatments are logical and well structured, and address the issues facing stock management in the northern beef industry. The involvement of other QDAFF activities (either with or without MLA support) and the range of ancillary activities that have taken advantage of the opportunities at the Wambiana site, clearly illustrate the value that the site provides to researchers, extension operatives and producers themselves, and the extent to which research conducted there is relevant across northern Australia.

Additionally, there appears from the Charters Towers workshop and from follow-up questionnaires to be a widespread view that the Wambiana trial provides a unique opportunity in the more general sense of a long-term, data rich experimental site, and that any decision as to its value and its continuation should include consideration of this fact, as well as the formal project objectives. Consequently, given the difficulties of developing such trials and the debates surrounding their effectiveness and geographic relevance, a full "business case" assessment of the Wambiana trial is warranted. This should include:

1. A statement of the objectives, target clients, anticipated outputs and products, strategies for achieving objectives, infrastructure costs, organizational structures, operational processes and the basis under which the trial was originally funded.
2. A discussion of the alternative business models for such trials, including the use of a commercial property rather than a 'research station' and the use of models in lieu of field trials, the anticipated value to both industry and MLA expected from the Wambiana trial, and the benefit/cost ratio of the trial as conducted.

3. Consideration of how "ancillary researchers" (CSIRO for example) fit into a trial jointly funded by MLA and QDAFF. While such groups have undoubtedly funded their own activities, they appear not to have contributed to the base running costs of the Wambiana trial, although some, such as the biodiversity research conducted by JCU, had MLA funding. Others could be considered "free-riders", and either accepted as such by the site funders (MLA and QDAFF), or required in future to make a contribution to the overall costs of the trial.
4. Consideration of the extent to which a "research trial" requires a purpose built extension programme. To a large extent, this aspect has been addressed in point 'c' above, where the need for a more comprehensive and explicit extension programme was outlined.

The Wambiana grazing trial provides a unique and contemporary opportunity for MLA (and government agencies) to assess resource use in an environment of increasing constraints. In particular, this analysis should work with the proposed extension program to determine what producers want and need, how they want it, and how an agency or producer group/funder such as MLA can best organize and manage to meet those needs.

(g) Provide recommendations on future direction considering original project needs, production and NRM issues, and output from the MLA rangeland planning project.

The future direction and role of the Wambiana grazing trial, and the trial site, have been outlined in the preceding sections. The views expressed there are consistent with the recommendations contained in the draft Grazing Futures R, D & E Plan produced by Project ERM.0094, being either elaborations of general components of the draft Plan in the specific context of Wambiana, or more detailed expositions of draft Plan components that relate specifically to the trial (e.g. Project 4.6 of the draft Plan – 'Profitable and conservative management systems for the northern rangelands' – includes provision for extension of the Wambiana grazing trial results by modelling….to evaluate the likely profitability and sustainability of the broad management systems … in other environments).

One specific recommendation of the draft R, D & E Plan deserves further discussion. Project 4-1 of the draft Plan recommended the establishment of a National Rangeland Research Network (NRRN) comprising 6-8 major study 'sites' encompassing the broad spectrum of rangeland environments and including examples of A, B, C and D land condition classes in

close proximity at each site. Sites were to be stock-proof fenced, able to support livestock through use of temporary watering facilities and equipped with meteorological monitoring equipment. The establishment of the NRRN was intended to provide a platform on which a range of studies (mostly small scale) could be conducted whose generality and relevance would be greatly enhanced by being conducted across environmental and /or land condition gradients. The Wambiana site clearly meets the criteria for inclusion in this network, being adequately fenced, instrumented, and above all capable of providing substantial areas of land in B and C condition classes within its boundaries. Other condition classes may be available in reasonable proximity but we are not able to confirm this. Incorporation of the Wambiana site within this network, should it be established, represents a long term future for this site which will capitalise on the outcomes of its use to date and the large data base of environmental and production data that has been accumulated.

In addition to the proposals for future activities developed by the consultants, the questionnaire respondents and the participants at the Charters Towers workshop provided some general ideas for new work, although no specific research proposal was put forward.

The suggestions raised at the workshop are listed in Appendix 3 (Section 3.1 The Future, Research Questions). These cover a wide range, and relate to both animal and natural resource issues.

In response to the opportunity provided for further research by an extension of the Wambiana trial, proposals from questionnaire respondents generally related to their area of interest. These proposals involved either a re-sampling of the site in a manner similar to previous sampling to provide further data (particularly to assist in modelling exercises), or the conduct of more detailed investigations by more intensive sampling. The latter ranged from repeat sampling several times in the one year to expanding the variables sampled to consider other parameters affected by the imposed treatments.

Several of the other suggestions put forward were similar to on-going (and previously discussed) ancillary research (e.g. more detailed study into the impact of spelling and grazing intensity on the rehabilitation of 'C' condition rangeland). However, several new research concepts were mooted. These included:

- A greater focus on linking grazing treatments to water quality outcomes (and other environmental outcomes in general);

- The use of the trial site in conjunction with 'walk-over-weighing' technology to correlate grazing activity with animal production at a high level of spatial and temporal resolution;
- The measurement of greenhouse gas emissions at a herd scale in relation to the trial treatments;
- Trends in woody species density in relation to the grazing treatments;
- Testing of new *in situ* and ground-based technologies (such as terrestrial laser scanning) for mapping and monitoring vegetation structure and estimating gully erosion, and use of this information to better calibrate remotely-sensed data.

The extent to which these concepts could be developed and executed within the constraints of the existing grazing trial is unclear, as no real details were provided by the questionnaire respondents. However, they do highlight the interest in, and perceived value of, the Wambiana site as a research "asset" in its own right, and one that warrants on-going support.

Conclusions

- The Wambiana grazing trial has delivered against its defined objectives. Phase 1 of the trial, while conducted during a period of variable and restrictive (in parts) climatic conditions, achieved the outcomes desired to the extent possible. That the trial was conducted on A or B+ condition land did prevent it from addressing the objective of "improving the knowledge base between stocking practices and land condition"; however the modification of land condition over the course of Phase 1 did ultimately allow consideration of this point, while Phase 2 of the trial, and associated small plot studies, are currently addressing this aspect to a far greater degree. The trial has provided clear evidence in favour of moderate, continuous stocking and has clearly demonstrated the costs (both ecological and financial) of heavy stocking. Nevertheless, realisation of the full value of the data sets available will require additional analysis (particularly multivariate analysis of the vegetation data). A more comprehensive understanding of the economics of grazing in the region (particularly the effect of initial land condition) requires a more sophisticated approach to economic analysis than has been applied to date.

- The Wambiana grazing trial and the researchers associated with it have developed a reputation for scientific integrity, skilled research methodology, excellent communication and a commitment to maximizing, to the extent possible, the benefits from the trial. The trial and its processes (such as the GAC) have been very well accepted by industry both within the Burdekin catchment and in other jurisdictions. However, it should be noted that the involvement of the research staff in the day-to-day running of the trial is inefficient in terms of their time and abilities, and consideration should be given to a greater involvement by the Lyons family, or the use of remote technology or both, to free up research staff.
- The Wambiana trial has provided an excellent opportunity for additional and associated small plot studies, as well as providing the infrastructure for an assessment of grazing management on faunal biodiversity at a realistic scale. Such associated studies have been both MLA-supported, and conducted independently of MLA funding, indicating the wide interest and opportunities the trial site has generated.
- However, while the involvement of other researchers has certainly added value to the Wambiana trial, the base costs of maintaining the trial site need to be considered by the site funders with respect to equitably sharing the base operational costs among the users, including those who use the site for short term studies.
- The long term advantages of the site are numerous – the initial capital costs have been expended, and the trial site has been established and managed for a significant period of time, the treatment differences generated, and relatively long-term (at least within the history of most Australian grazing trials) datasets collected. This has created a substantial opportunity for follow-up research and demonstration, an excellent data base that links animal and vegetation data, and many opportunities for embedded studies even if the current intensity of data collection is not maintained in the grazing treatments themselves. In other words, the trial site itself and the community's ownership of and confidence in both the site and its findings are important assets that are now available to MLA and QDAFF at little additional cost (although future use needs to be discussed with the Lyons family).
- The extension benefit of the site as a demonstration of both land and animal management and the consequences of stocking decisions should not be underestimated. The scale of the trial, the involvement of the GAC and the widespread awareness and acceptance of the trial's findings all add to the relevance and confidence with which conclusions from the trial are seen. This, like the site itself

as noted above, is both a capacity and an opportunity that has been "purchased" by MLA and QDAFF, and one that should be utilized.

- There is a need for a modelling project to be formulated as soon as possible to evaluate, and if necessary design, the set of models required for extrapolation of trial results to other regions and to whole businesses, review the critical relationships that these models should contain, develop (or improve) the necessary algorithms, and advise on the future of the trial after August 2016 in light of the confidence then residing in these models. This project should also consider the needs of a range of potential model users and make recommendations for the maintenance of an appropriate modelling capacity for northern Australia.
- The investment to date in the Wambiana trial has been extensive and of long duration. Wambiana provides an excellent vehicle for the consideration of the "value" of such trials, their benefits and costs, and a consideration of the alternatives.
- Dependent on the acceptance by the MLA Board of the recommendations of project ERM.0094, given the importance of the Wambiana grazing trial, the site should be incorporated into the National Rangeland Research Network.

Recommendations

In light of the preceding discussion we recommend that MLA should:

1. Continue the current level of funding of the Wambiana trial, and the current data collection protocols, at least until the current embedded projects are completed (31 August 2016), and advise stakeholders of this commitment at the earliest opportunity.
2. Review the project again in late 2015 or early 2016 to decide on further funding for the current configuration based on results achieved to that time, the seasonal pattern experienced, and the recommendations of the project team established under recommendation 7 below.
3. Encourage establishment of the appropriate collaborative arrangements to ensure that adequate (multivariate) analysis of the available data (particularly vegetation data) can be undertaken, and ensure that resources are available to complete this analysis.
4. Encourage establishment of the appropriate collaborative arrangements to ensure that an economic analysis of the grazing system in the Burdekin catchment that is able to define privately optimal grazing management

strategies as a function of land condition can be undertaken, and ensure that resources are available to compete this analysis.

5. Fund, in conjunction with QDAFF, a 'harvest year' (probably 2016-17) which will enable the research team to analyse and write up the results of Phase II. This should include at least a negotiated level of salary support for O'Reagain and a biometrician, as well as any support required under items 3 and 4 above. This year should have specific requirements of O'Reagain, in particular the finalization of the multi-variate analysis of the vegetation data, as well as other datasets (which should be begun well before 2016), and the full write up of the trial.
6. Support the development of an extension initiative aimed specifically at sustainable grazing management which incorporates the results of the Wambiana grazing trial and project B.NBP.0555 (spelling strategies), and which (in conjunction with the analysis outlined in item 4 above) identifies and attempts to reduce the barriers to adoption of sustainable grazing practices in the context of the whole pastoral business. This would require specific extension expertise to be "embedded" into the research group to develop the most appropriate programmes to achieve industry change.
7. Initiate a modelling project (essentially Phase III) as soon as possible to identity the functions that need to be incorporated into GRASP, or upgraded, to allow current deficiencies to be rectified and advise on when the trial in its current form could be concluded (i.e. when the necessary functional relationships should have been reasonably validated). This project should include, in the short term, the use of the current GRASP model (in conjunction with appropriate climate files) to evaluate the Wambiana treatments in other regions across northern Australia.
8. This project should also include the development of recommendations for the maintenance of a substantial and relevant modelling capacity in northern Australia for at least the medium term.
9. Undertake a 'business case' analysis of the Wambiana trial, and alternative models of R, D & E, to assess their relative efficacy as means of achieving MLA objectives in production and natural resource management.
10. Seek to improve the efficiency with which the site is managed on a day to day basis by investing in remote monitoring equipment and/or negotiating

with the Lyons family to assume greater responsibility in return for financial compensation.

11. Assess as soon as possible the attitude of the Lyons family to a long term R, D and & E commitment at the site.
12. Dependent on the outcome of 10 above, and acceptance by the MLA Board of the recommendations of project ERM.0094, plan the transition of the site into the National Rangeland Research Network.

Appendix 1. Documents contributing to the review of the Wambiana grazing trial

Contracts and project documentation

Undated. Variation Agreement between Meat & Livestock Australia Limited and The State of Queensland through the Department of Primary Industries and Fisheries. Project No. NBP.318. Sustainable Grazing for Tropical Savannas – Wambiana.

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2010. Research Agreement between Meat & Livestock Australia and The State of Queensland acting through the Department of Employment, Economic Development and Innovation. Project No. B.NBP.0555. Spelling strategies for the recovery of pasture condition.

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Appendix 2. Participants in the Charters Towers review workshop

NAME	AFFILIATION
Joe Scanlan	QDAFF
Raymond Stacey	Landcare coordinator/producer
Paul Novelly	Consultant
Ron Hacker	Consultant
Andrew Ash	CSIRO
Bill Holmes	Formerly QDAFF
David Orr	Formerly QDAFF
Lin Schwarzkopf	James Cook University
Cameron Allan	MLA
Dan Goodwin	Producer
Dudley Leggett	Producer
Greg Brown	Producer
John Webb	Producer
Verna Webb	Producer
Peter Leggett	Producer
Robert Rebgetz	Producer
Roger Landsberg	Producer
John Lyons	Producer
Michael Lyons	Producer
Ronda Lyons	Producer
Bob Karfs	QDAFF
Joe Rolfe	QDAFF
Nicole Spiegel	QDAFF
Paul Jones	QDAFF
Peter O'Reagain	QDAFF

Appendix 3. Summary of Charters Towers workshop discussion. (Compiled from notes taken by R Hacker, P Novelly and N Spiegel)

1. PRESENTATION BY PETER O'REAGAIN

Dr O'Reagain's presentation included a PowerPoint presentation

1.1. Issues arising from the presentation

- Data modelling has become very important and there is still scope to increase this capacity.
- Effect of interest charges on profitability of alternative strategies; profitability of the strategies depends on the assumptions; HSR could be seen as the most profitable strategy depending on assumptions (e.g. interest rate, lack of price premium for animal condition) and management (in particular selling strategy and drought supplementation).
- Importance of adaptive management in applying the strategies
- Level of use going into drought critical factor determining impact of drought on grasses – confirmation of the 'death trap' model
- HSR treatment – P O'Reagain considers could still recover; has residual 3P population, low erosion (although Wambiana is a particularly flat site compared with much of the Burdekin catchment).
- There has been no measurable response of Soil C to the grazing treatments.
- How does woodland structure relate to carbon storage? There have been two major fires to-date which have impacted woodland structure.
- No decline in beef/ha in HSR; no decline in rainfall use efficiency for beef production (kg beef/mm rainfall) in HSR
- PHASE II commenced in late 2011 after whole of site fire and rest.

1.2. Questions and clarification

- Experience at Toorak is that long term apparently stable treatments may suddenly collapse so HSR may yet do so (D Orr)
- Animals in good condition do attract a price premium at the meatworks, can be turned off earlier and do not attract yard fees as for other markets (only the levy); turnoff to meatworks is much more profitable than other markets. (R Landsberg)
- Crash of LWG in all treatments in 2006-07 basically just the collapse of the system after 6 years of drought (P O'Reagain); may have also been affected by the pattern of rainfall distribution – most rain in February and then dry (A Ash); very poor pasture quality due to February rain and N leaching (R Landsberg).
- LWG data in 2006-07 and 2004-05 did not fit the GRASP predictions (J Scanlan); not clear what needs to be done to correct this; GRASP LWG algorithm is apparently only an annual figure based on relationship between pasture utilisation and LWG.
- Interest in application of results to breeders [and look at mortality rates, supplementation, to see if that would increase in breeders c.f. steers].
- Was plant available water measured? P O'Reagain - soil moisture content was measured.

- Decision making, what are the lead indicators/parameters to ramp-up or decrease SRs, such as seasonal forecasts? This is a new area which could develop more.

2. REVIEW OF CURRENT PROJECTS

2.1. Presentation by Paul Jones

- 5 year project- at Wambiana (HSR) and Montegal (Clermont; C condition); has run 3 years now at Clermont but only 12 months at Wambiana; too soon to make any judgment about treatment effects at Wambiana.
- Study aims to design spelling treatments for recovery of C condition land (NB – 40% of Burdekin catchment is in C condition);
- High rainfall at the Clermont site has not improved C-condition pasture (yield and composition); heavy wet seasons have disguised any response to spelling.
- Use of exclosures to achieve spelling on small plots – may lead to excessive use when fences are removed (B Holmes); but large number of treatments being tested means there is no alternative to small plots (D Orr)
- *B. pertusa* is now invading pastures that are not overstocked (R Landsberg); not being observed on experimental sites at Wambiana (P Jones).
- Rate of recovery will depend on the starting condition (A Ash) so long term observation may be required; fast recovery is possible on some degraded country with wet season spelling (Note: P O'Reagain notes (18/12/2013) that rates of recovery observed in Ecograze are faster than any he has experienced).

2.2. Presentation by Joe Scanlan

- Use of GRASP to scale up from plot level to whole paddock level, assuming paddock includes box land type only; Wambiana provides a good data set for this, permitting modelling of both different strategies and different stocking rates – reasonably good relationship between DM and LWG; grazing related to 3P content of pasture using McKeon/Ash variation of GRASP; predicted change at whole paddock level is slower than change observed on plots.
- Extrapolation to property level allows evaluation of different stocking rates and strategies relevant to businesses.
- Future model development requirements – more information is required on rates of change in condition (up or down; hysteresis effects; does it recover as fast as it degrades?); spatial analysis of vegetation change (mix of land types in paddock), how animals use different parts of the landscape and effects on LWG – seen as a big gap.
- Animal tracking studies at Wambiana in 2007-8 could be improved; GPS resolution was not sufficient to identify what land type animals were in; potential for use of higher resolution GPS collars on animals and more detailed soil mapping.
- Potential to develop a game similar to SQUATTER based on trial results as a training aid for younger graziers (M Lyons)
- Need capacity to analyse the other land types as well, not only the box.

- Work by L Pahl to determine the optimum degree of variation in stocking rate around the average indicates max. increase of 5% and max. decrease of 15% is a good rule of thumb if initial SR is reasonable.

2.3. Presentation by Lin Schwarzkopf

- A continuation of the CSIRO work of Kutt *et al.*
- Wambiana is a designed experiment and presents opportunity to analyse vertebrate responses to grazing strategy, not just presence/absence of grazing.
- Data collection focuses on vertebrate fauna – plant biodiversity and invertebrates not considered in these studies.
- Trial is an excellent means of communication between graziers/students.
- Trial provides capacity to link economics (of the grazing strategies) and biodiversity.
- Current project is funded (by MLA) for another 3 years (i.e. would thus end in 2016) – important for the project that Wambiana does not end in September 2014; long term observations are essential due to effect of inter-annual variation which swamps treatment effects.
- Fine scale effects are important for biodiversity; link with fine scale grazing effects (e.g. area and patch selective grazing).

Question from C Allan: Does improved biodiversity have a +ve or –ve impact on animal production systems (e.g. through improved habitat, increased vertebrate activity like digging, improved soil fertility? What is the value of biodiversity e.g. for diversification (tourism) and social licence to operate?

2.4. Producers' insights

- Trial has demonstrated that MSR is a good system
- Moderate stocking is a good system for both cattle production and biodiversity (R Landsberg);
- Social licence to operate may be linked to biodiversity conservation (C Allan).
- Breeder productivity is a key issue for economic performance; nutrition is the key factor determining reproductive efficiency; stocking rate that links cattle demand to grass availability is critical (J. Rolfe).
- Trial has been very successful in the extension process – many graziers have been involved, trial has attracted international attention (R Landsberg) but alternative view is that there has been little uptake by industry (G Brown).
- Confidence to make difficult decisions, especially in transition to dry years, has benefited from the project, as has the bringing together of both animal production and land management (M Lyons)
- Trial seen as a major factor underpinning public confidence in potential for sustainable land management (B Karfs).
- Need more prescriptive systems (i.e. well defined rules not regulations) that can be presented to landholders, especially late adopters (R Landsberg); must include advanced breeder management integrated with pasture management (P O'Reagain).

- Need triggers to deal with unusual circumstances (A Ash) (e.g. – 'when good decisions turn out to be wrong')
- What are the barriers to adoption or motivation for change? Should understanding this be part of the project?
- Lack of erosion in response to HSR at Wambiana will be partly due to flat landscape.

2.5. Producer involvement in trial design and oversight

- P O'Reagain has always had the final responsibility for trial management and maintenance of trial integrity.
- Producers very supportive of the level of engagement provided by the Grazier Advisory Committee (GAC); has been some change in membership but also consistency.
- Members of the GAC (10) were chosen on 4 criteria – age (range of); experience; geographical spread; ability to champion the trial.
- There have been some changes to the GAC, but also remarkable consistency in membership.
- Critical that the trial continues even though it cannot provide the answer to all questions (J Rolfe).

2.6. Achievement of the objectives of Phase 1

- General agreement that trial has achieved the objectives for Phase 1 as stated in the 2011 key learnings booklet.
  Question from CA: Should the GAC start shaping the extension program?

3. THE FUTURE – Requirements to produce change on-property (C Allan facilitator)

3.1 Research questions

- Infrastructure – design of fences and waters to allow flexible land management, and means of financing development
- Translation of results to breeder herd (substitute pregnant females for steers)
- Effect of utilisation level on:
  - diet selection (change from preferred species to less preferred)
  - diet quality
- Decision support based on pasture yield (remote sensing may provide the data)
- Management of C-condition land:
  - Application of recommended strategies
  - Ability to read the landscape and set management objectives for land in relation to condition
  - Is C condition country worth improving from an economic viewpoint?
- Woody thickening
  - How is it best managed?
  - Role of browsers (e.g. camels) in controlling Eucalyptus regrowth
- Fire management in relation to:
  - Woody shrub encroachment

  - Soil organic matter
- Biodiversity-production relationships:
  - Biodiversity value of land in good condition (for grazing)
  - Biodiversity benefit of good grazing management
  - Biodiversity markers for healthy landscapes
  - Social licence to operate
- Spelling guidelines
  - timing, frequency and duration of spelling
  - what to do with cattle from spelled paddock;
  - paddock priorities for spelling;
  - Bio-indicators for spelling
- What flexible stocking strategy will maintain a minimum ground cover in every year (at end of dry) for reef protection (60%)
- Thresholds for stocking rate decisions (rather than recipes)
- *Bothriochloa pertusa*:
  - incursion into good condition pastures
  - trigger for colonisation
  - production potential (and NRM outcome)
- Seedbank dynamics, seedling recruitment, seedbank longevity
- Soil health:
  - effects of seasonal cycles and Indian Couch invasion on N availability;
  - effects of N availability on pasture quality;
  - soil biodiversity;
  - influence of grazing management on the above.
- Introduction of legumes
- Management of patch grazing – to provide a compromise between short grass for cattle and long grass for pasture maintenance.
- Role of new technology in assisting change.

3.2 Extension requirements – what would a successful extension program look like?

- Demonstrations of success relevant to local, parochial groups, by respected producers who are adopting improved management (R Landsberg)
- 'Decision Day' field days at Wambiana, possibly twice per year.
- Animal health issues may present extension opportunities
- Need to address various learning styles – on-line information; webinars (good for follow up after field days) etc.
- Need to contextualise information for the individual producers
- Focus on the risk inherent in alternative management systems

3.3 Portability of the trial results

- Fallacy of numbers (B Holmes) – belief that more is better (tends to be believed everywhere); Wambiana basic finding (about benefits of moderate stocking) can be applied anywhere
- Land types may restrict extrapolation (i.e. result may be specific to land type)
- Economic optimum (e.g. stocking rate) is always less than the production optimum – a principle that is generally applicable (B Holmes)
- Basic principles of conservative stocking and benefits of rest must be transportable.
- Principles from Wambiana need to be collated/ integrated with results from other grazing trials across the north.
- Principles are transportable – the application of the principles in other locations is the challenge.
- Is the benefit (of moderate stocking) compelling enough to stimulate change? Requires modelling and sensitivity testing.
- Rates of degradation or improvement need to be better quantified in the model (for extrapolation)
- Risk is the key feature of any management system, not the quantitative outcome measured in the trial (P O'Reagain)
- Use of steers rather than breeders – could limit portability
- With the HSR strategy – could possibly improve the economic performance with with a sell and buy back strategy rather than feed (A Ash). The practices adopted may limit portability.

3.4 Integration with other initiatives

- How do various trials fit together? (i.e. confirm each other or produce different results e.g. relationship between utilisation and LWG at Wambiana compared to Pigeon Hole). Greg McKeon has drawn on available trial data to develop the relationships in GRASP (NB John McIvor (2010) report summarised results from grazing trials across the north).
- Grazing impact on broader NRM outcomes.
- Ruminal micro flora – GHG emissions. Work at JCU.
- Wildlife Biodiversity CRC – proposal pending.
- Beef producers need 30-40% improvement in productivity to survive; must have increase in animal productivity through a range of technologies. What technologies are available to increase profit if moderate stocking is the best we can do?
- Northern Beef CRC
- Grazing BMPs – Wambiana is a major source of input to development of BMPs.
- Digital Homestead - individual animal management.
- Wambiana is a good experiment that needs to be maintained or if replicated elsewhere, then implemented with a similar design and conducted with a similar degree of scientific rigour.
- Still a lot of information to be gathered and analysed; MLA should continue to fund; degradation issue is one of many issues

- Models need to be upgraded to incorporate better understanding of ecological processes and allow new strategies to be tested.
- What are the major drivers of change (e.g. woody encroachment, triggers etc.) (R Landsberg)
- Complimentary grazing systems (e.g. camels and cattle (for woody shrub control) (J Lyons)

4. PRODUCER GROUP DISCUSSION

Questions from earlier discussion

4.1. What is the importance (for the extension message) of the assumptions used in evaluating the grazing strategies and of broadening the consequences of management?

- Including all costs (e.g. interest in livestock capital) is not relevant to producers but should be known.
- Alternative strategies other than feeding can be applied to deal with feed shortages (sell or agist).

4.2. How important is 'fine scale' animal grazing on different land types in determining LWG and ecological responses?

- A 3rd order issue that will be overcome by infrastructure development (e.g. fencing to country) and other management strategies (e.g. rotational grazing)

4.3. How can we develop more prescriptive information for producers (i.e. contextualise the information to the individual situation?)

- Concept of producing grazing management prescriptions for properties in various categories – good idea but not supported by all participants
- If attempting to contextualise must consider – property size, land type(s), land condition, current infrastructure, production system (management and target market).

4.4. How would you know the trial has run long enough?

- Has covered a good range of seasons
- Just know
- Trial will not finish but undergo evolutionary change
- It's cheap extension so why not keep it running?

4.5. Has the trial led to any change of practice?

- Yes (among the group present)
- Have greater confidence in decisions
- Good to have numbers to support decisions
- Industry is becoming more intensive – rotational grazing is the next step in the intensification of the industry (R Landsberg);
- 'Change from heavy grazing would be a paradigm shift' (R Landsberg)

5. RESEARCHER DISCUSSION GROUP

5.1 Trial length; criteria for a decision

- How do we monitor at least cost; what is the point of diminishing returns?
- See Toorak paper for insights on how long the trial should run
- All original plants have died

- Climate variability overrides treatments
- Relevance of output to investors

5.2 How influential has the trial been; how would we know?

- People in Central highlands know about it; also NT producers 'right way to do things'
- GLM workshops in Burdekin – hundreds – Wambiana results featured
- About 400 university students have visited the site
- Number of people exposed to the trial (P O'Reagain- probably >1000)
- Producers are now coming up with real questions and show good understanding
- Lots of analysis has been done and publicised
- Has put the economic data out there for scrutiny
- Has given confidence to advisers
- The message that moderate stocking rate is best may be depressing for anyone wanting to increase profitability; what else can we do to increase profitability?

Question from CA: is there any counterfactual opinion of the trial?

5.3 Adequacy of support services

- Dedicated people are limited (resources available mainly for data collection)
- Need to develop spatial aspect of grazing and modelling; note that biodiversity data has been collected for different soil types at Wambiana – so opportunity to integrate this work and demonstrate the benefits of grazing strategies for ecological and economic gain.

5.4. Management/governance of the trial (needs, who, what else is needed?)

- More frequent reviews with peers

5.5. What is the capacity and how would one assess the 'fine scale' grazing among land types.

- Not discussed (but see above under support services)

5.6. Quantifying rates of ecological change in models

- Time, degree of difficulty, 'Stomach' to support? [sic]

Appendix 4. Other individuals (not attending the workshop) interviewed or contacted by email.

Name	Position	Organisation	How contacted
John Bushell	Senior Technician (Wambiana)	QDAFF	Telephone interview
Bob Shepherd	Senior Extension Officer	QDAFF	Email
Brigid Nelson	Senior Extension Officer	QDAFF	Email
Jon Brodie	Scientist	TropWater, Townsville	Email
Dan Tindall	Science Leader	DSITIA	Email
Steven Bray	Scientist	QDAFF	Email
Greg McKeon	Scientist, retired	ex-DSITIA	Email
Ken Day	Chief Scientist	DSITIA,	Email
Scott Crawford	Director	NQ Dry Tropics,	Email
Ben Hoffman	Scientist	CSIRO	Email
Diane Allen	Scientist	DSITIA,	Email
Mike Cannon	Senior NRM officer	DNRM	Email
Neil MacLeod	Economist	CSIRO	Email
Nigel Tomkins	Scientist	CSIRO	Email
Terry Beutel	Scientist	QDAFF	Email

Appendix 5. Questions for individuals contacted by email

Name:
Affiliation:

Q1. How did you become aware of the Wambiana grazing trial, and have you had any personal involvement in the trial since its inception?

Q2. What is your main area of professional activity? (Please tick or highlight the relevant item)

1. Beef industry extension –animal production focus
2. Beef industry extension – grazing management/natural resource management focus
3. Research - Animal production
4. Research – Biodiversity-grazing interactions
5. Research – plant ecology/grazing management
6. Research – modelling
7. Research – other (please specify)
8. Regional NRM organisation
9. Other - please specify

If you ticked 1 or 2, please answer the following questions:

1. What value is the presence of the Wambiana grazing trial as an extension aid? Does it provide a focus for your grazing land management extension activities?
2. In talking to producers, how confident are you about the findings from the Wambiana grazing trial? Do you believe the conclusions to date are sufficiently robust for your purposes?
3. Is the trial providing information on the key issues for your clients, or are producers more focussed on issues that are not being assessed at Wambiana?
4. Has the Wambiana grazing trial led to practice change amongst the producers you deal with? Could you explain why and how?
5. Would modification of the focus or treatments of the Wambiana trial better assist you in achieving practice change amongst producers? If so, what changes would you suggest?
6. How relevant do you believe the treatments and findings of the Wambiana grazing trial are outside the Burdekin region of Queensland?
7. What impact would the termination of the trial have on your activity, or extension activity in the northern beef industry generally?

If you ticked 3, 4, 5 or 6 please answer the following questions:

1. Do you have on-going research work at the Wambiana grazing trial site? If so:
    a. Would you research be underway if the opportunities provided by the Wambiana trial were unavailable?
    b. Under current contracts / plans, when will the field component of this work be completed?

   c. What would be the implications for your research if the trial design was changed in 2014?
   d. What would be the implications (research programme, contractual agreement with funders etc) of a cessation of the Wambiana trial in 2014?
   e. Are there alternative locations where you could conduct your research?
2. How aware are you of the findings from the Wambiana grazing trial?
3. Have the findings from the trial assisted you in interpreting your own research or in developing new research proposals? If so, how?
4. If you were advised that the Wambiana grazing trial was to continue in its current form for a period (say 3 years) beyond 2014, would you be interested in initiating a new research activity *in situ* to take advantage of the existing research infrastructure and grazing treatments? If yes, please provide some information on the type of research you would conduct and the required duration.
5. Would modification of the focus or treatments of the Wambiana trial better assist you in achieving your research goals? If so, how?

If you ticked 7 or 8, please answer the following questions:

1. How important are the results produced to date by the Wambiana trial, or from the Wambiana trial site, and in what way are they used?
2. How would your area of activity be affected by the termination of the trial in 2014?
3. Are there any modifications of the trial design, or type of data collected from the site, that would improve its utility for your area of activity?

Final question (please answer no matter what box you ticked).

Do you have any other comments you would like to make about the Wambiana grazing trial?