



GOOD PASTORAL BUSINESS

A case for protecting native vegetation and biodiversity within the Territory beef industry



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Landcare
Program**



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INTRODUCTION

Pastoral producers in the Northern Territory are operating in an increasingly competitive market environment. Despite live export prices for the northern herd remaining strong, high production costs have eroded margins, and heavy investment to support growth has meant that many producers now carry high levels of debt. Industry data shows that average farm cash incomes in the Territory have declined for two successive years from 2016-2018 as a result of reduced cattle turnover¹. However, while the majority of producers struggle with economic sustainability, data indicates that the best performing Territory beef enterprises have been able to achieve considerable growth. Therefore, it has never been more important for producers to determine and utilise best business practice².

What is good pastoral business?

Meat and Livestock Australia (MLA) highlight that while profit is commonly considered a measure for the short-term health of a grazing business, profit achieved at the expense of eroding the natural capital, or destroying the social structure that sustains it, will doom the business to failure. Therefore MLA proposes the 'Triple Bottom Line' as a basis for planning and assessing the long-term profitability and health of beef enterprise³. This concept encompasses the social and environmental dimensions of the enterprise as they relate to economic productivity. Good business decision-making, designed to position the business for long term growth and prosperity, must therefore account for its longer-term sustainability.

The MLA funded Northern Beef Report highlights that a primary barrier to sustained profit in the beef industry is lack of operating efficiency. This is cited as having a greater impact on long-term business viability than market conditions or prices. Key areas for improving enterprise sustainability are identified in Table 1.

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- 1 ABARES <http://www.agriculture.gov.au/abares/research-topics/aboutmyregion/farm-financial-performance-nt#performance-of-beef-industry-farms>, [Accessed February 2019]
 - 2 Holmes, P.R (2015) 'Rangeland pastoralism in Northern Australia: Change and sustainability' in *The Rangeland Journal* 37(6) 609-616
 - 3 MLA <https://www.mla.com.au/research-and-development/Environment-sustainability/Sustainable-grazing-a-producer-resource/running-a-sustainable-grazing-business/> [Accessed February 2019]

Table 1: Priorities for good pastoral business (derived from Northern Beef Report)

Herd productivity	Reproductive rate	<ul style="list-style-type: none"> • Increase rate of cow pregnancy • Increase calf survival to weaning • Genetic attributes of bulls • Seasonal mating management
	Mortality rate	<ul style="list-style-type: none"> • Improved nutrition • Diagnosis and treatment of disease • Reduced predation • Environmental conditions
	Turnoff weight	<ul style="list-style-type: none"> • Improved production environment • Increased rates of growth • Finishing weaners to the most profitable weight.
Social and Environmental sustainability	Quality of life and incomes for producers	<ul style="list-style-type: none"> • Beef enterprises structured to ensure owners labour compensated at market rate • Enterprise viability and quality of life attractive for successive generations • Adequate succession planning
	Appropriate stocking rates for long term carrying capacity	<ul style="list-style-type: none"> • Understand land and vegetation types and conditions • Water points, grazing preferences and stock movement • Set and implement goals for animal production and land condition
	Stewardship of natural assets	<ul style="list-style-type: none"> • Management of fire, weeds and ferals • Improved management of stock impacts • Sustain or improve habitats and biodiversity • Off stream water and water quality
	Climate risk management	<ul style="list-style-type: none"> • Improve husbandry and health • Access to cool clean water and shade • Manage risks of erosion and risk of fire • Build business resilience with strategic reserves of funds, forage and water • Diversification
Reduce production costs per animal	Increase labour efficiency	<ul style="list-style-type: none"> • Introduce labour saving technologies and practices • Improve training and capacity • Reduce staff turnover
	Reduce supplementary inputs	<ul style="list-style-type: none"> • Healthier environments for stock, fewer losses and health inputs • Better foraging environments to reduce the need for feed or nutrient supplementation.
	Financial literacy and managing debt	<ul style="list-style-type: none"> • Improve management of debt • Ensure debts earn more than they cost to service

The Territory Conservation Agreement (TCA) program

The Territory Conservation Agreement (TCA) program was established in 2011 following lengthy consultations to better understand the needs and aspirations of stakeholders. The program was designed to support land managers who wished to protect high value natural assets on their lands (such as wetlands, riparian areas or sites of significant natural habitat) and help bridge the gap between productivity and sustainability outcomes on working properties. TCAs are entirely voluntary, and are based upon management actions proposed by the landholder, then reviewed and discussed between landholders and program facilitators. Essentially, a TCA entails implementation of an agreed plan of management over a defined area of land for a specific period of time (usually 10 years).

The agreement is a contract, but it is not registered upon the title of the property or binding to future owners. Agreed management actions generally encompass a package of complementary measures intended to mitigate threats and enhance existing values at the site. These measures will be consistent with broader property management objectives and may be adaptively modified to respond to changing conditions during the period of the agreement. TCAs do not assume conservation is an exclusive form of land use, and the program was specifically

Indicative TCA Management Actions

- Stock/grazing management
- Fencing
- Off- stream water access
- Weeds management
- Feral animals management
- Fire management
- Erosion control
- Land condition monitoring
- Short annual reports

designed to demonstrate the potential for integrating conservation into sustainable productivity. Consequently, many of the agreements established allow for some level of grazing or stock access according to site-appropriate grazing plans.

Recognising the level of investment required to reconfigure TCA sites to conservation management, TNRM routinely makes a contribution to assist landholders with this transition. Furthermore the TCA program was designed to keep the process for reaching, administering and implementing agreements as simple and as straightforward as possible.

From the outset, the program found strong support within the pastoral community. With news of the program spreading word of mouth between beef producers, over twenty agreements were concluded in the first three years. By 2018, approximately 12%



of all Territory pastoral properties were participating within the program, (some having entered into multiple TCAs) and 56,555 Ha of pastoral lands were being managed under TCAs. The program has demonstrated strong growth, and the capacity of TNRM to deliver and provide ongoing support to producers has been the primary limiting factor. The growth trajectory of the TCA program is illustrated below (Figure 2).

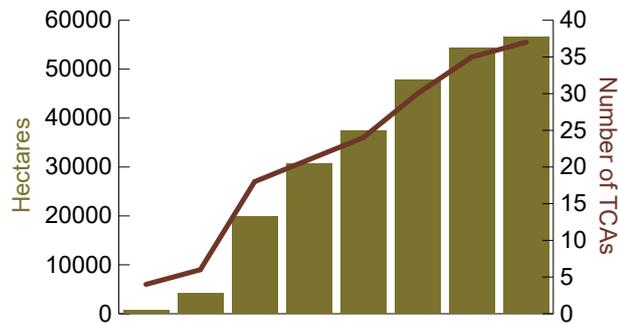


Figure 1: Growth of the TCA program on the pastoral estate (2011-2018)

Background to this document

This document forms part of the overall mid term review of the TCA program. This review comprises three major elements. First, commencing in 2017, a series of validation studies have been undertaken to gauge the impacts of TCAs in terms of ecology and land condition at seven sites established for three or more years. Second, there has been a survey of 17 participating pastoral landholders partnering in the program to assess overall impact and stakeholder satisfaction with the program⁴. Finally, this document considers evidence for the management and business viability of TCAs on Territory properties.

The following section highlights a range of ways in which conservation of native vegetation could theoretically strengthen production and business outcomes, while the third section focuses on the findings of three case studies to ascertain the actual outcomes of TCAs as reported by land managers.

4 Bubb, A. (2019) *Review of Territory Conservation Agreements*, Darwin Northern Territory





CAN CONSERVATION BENEFIT BEEF PRODUCTION?

Like all forms of agriculture, the performance of the livestock sector depends upon the key ecological processes that drive primary productivity. This is particularly true for the extensive production systems typical of the Northern Territory, within which cattle graze native vegetation.

Healthy rangelands systems compose both abiotic and biotic elements. These include geology and climatic processes, together with the micro-organisms and wildlife that are integral to the cycling of nutrients, capture and storage of water and production of fertile soils. Grazing land condition, encompassing forage production and other ecosystem services, is recognised to be a driver of economic performance of northern grazing operations⁵. Rangeland resources therefore constitute 'natural capital' for the northern beef industry⁶.

Accounting for grazing land condition and productivity

Native species such as Weeping Mitchell Grass, Barley Mitchell Grass, Bull Mitchell Grass, Curly Bluegrass, Queensland Bluegrass and Red Flinders Grass constitute key economic resources in the Mitchell grasslands while Ribbon Grass, Bottle washer Grass, Kangaroo Grass and Black spear Grass are important resources elsewhere on Territory Rangelands. The health and productivity of these pastures directly drives the production and turnover of beef. Protection of these native pastures and the ecosystems that support them are integral to business management.

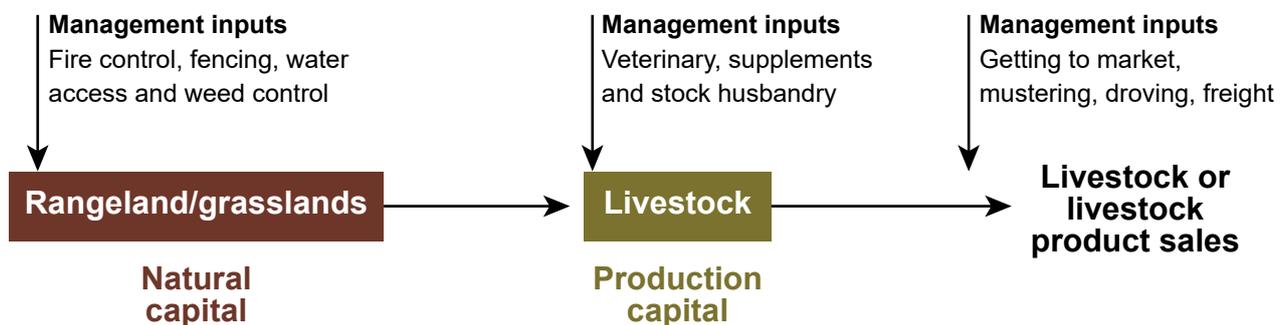


Figure 2: Rangelands as natural capital within pastoral operations

5 MacLeod, N. Ash, A. and McIvor, J. (2004) 'An economic assessment of the impact of grazing land condition on livestock performance in tropical woodlands' *The Rangelands Journal* 26, pp 49-71

6 Ogilvy, S. Mitchell, P. Obst, C. and Walsh, D (2017) *Natural Capital Accounting for Rangelands: Report and demonstration accounts prepared for the Australian Indigenous Agribusiness Company.*

Table 2: Overview Land Condition Classification (based on Pettit 2011)

	Attributes	Sustainable Carrying Capacity (% of maximum)
A (Good)	Good coverage of Productive Palatable and Perennial grasses (3P grasses) for the land system, <30% bare ground	100
B (Fair)	Similar to A but decline in 3P grasses, more less- favoured grass species ('increasers') and weeds, > 30% bare ground	75
C (Poor)	Similar to B but with more less-favoured ('increaser') grasses, weeds and susceptibility to erosion or woody thickening, >50% bare ground	45
D (Very Poor)	Few perennial grasses and forbs, severe erosion or scalding and possible woody thickening or weeds degrading pastures	20

The ABCD Framework for land condition provides a useful mechanism for pastoral land managers to understand the current status and trends of change in the health of their grazing lands through time⁷. Each condition standard (A-D) describes the capacity of a defined area of land to respond to rainfall, with 'A' representing the best condition, and 'D' the poorest.

Land Condition, along with the safe utilisation rate (the proportion of annual pasture growth actually consumed), is an important factor in determining sustainable Carrying Capacity for a given paddock or area⁸. Studies suggest that given the same land system and utilisation rate, land in condition 'A' will sustainably carry approximately 25% more cattle than land in condition 'B', and 80% more cattle than land in condition 'D', (Table2).

Land Condition frameworks are applicable across a wide range of Northern Territory land systems. A fundamental precept of these frameworks is that it becomes increasingly more difficult to restore land condition (in terms of labour, expense and time) the more it declines.

Land condition A is fairly stable, and the transition between B to A is straight forward to achieve with

improved management inputs (e.g. wet season spelling). Land in B condition is more susceptible to decline to C condition, and will be more difficult and costly to revert than B to A. Land in C condition can easily degrade to D condition. If this occurs, it will require much input of time, labour time and expense to improve it back to C condition (Figure 3). For low productivity land systems, restoration of small areas from D to B condition may not be practically or economically viable⁹. Therefore, across all land systems, it makes better business sense to conserve native pastures in good condition rather than to allow them to degrade through overgrazing or poor management and then attempt to restore them.

Management intended to sustain, conserve or improve native pastures on pastoral properties will have a direct economic benefit to pastoral businesses: Improving the condition of a paddock from B- A condition will achieve a 25% increase in sustainable carrying capacity and productivity, and improvement of a paddock from C-A condition could more than double its sustainable carrying capacity, with all the enterprise benefits that this would deliver.

7 Pettit, C. (2011) Victoria River District: Land Condition guide, DPI

8 Walsh, D. and Cowley, R. A. (2011). Looking back in time: can safe pasture utilisation rates be determined using commercial paddock data in the Northern Territory? The Rangeland Journal 33, 131–142

9 Donaghy, P. Gowen, R. Star, M. Murphy, K. Sullivan, M. and Best, M. (2011) The economics of land regeneration in Strategies to improve the profitability of extensive grazing systems in Central Queensland



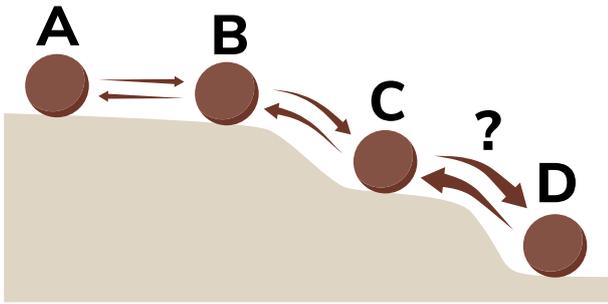


Figure 3: Transitions between land condition states

How native vegetation and ecosystems support beef production

Northern Territory grazing lands, particularly in the productive Savanna region are characterised by pockets and clusters of woodlands and riparian vegetation. Although woody vegetation and other non-pasture native species can compete with pasture species for key resources such as water, light and nutrients, they also play important functions in supporting grazing systems. Non-pasture vegetation contributes to landscape health through water and nutrient cycling, through the production retention and fertility of soils, the regulation of erosion and salinity and storage of carbon. Intact savanna woodlands provide habitat for a range of organisms critical to ecosystem function such as those that pollinate or promote decomposition of plants and material.

Forage

Woody shrubs and trees are often more resilient than grasses to drought, fire, compaction and erosion, owing to deeper, more permanent root systems. Although annual grasses constitute the primary and most nutritious sources of feed on Northern Territory rangelands, studies have shown that less palatable shrubs and forbs may constitute significant forage resources for cattle, particularly during periods of drought (Figure 4). Evidence from arid Central Australia shows that while browse species typically constitute less than 10% of cattle diet, under conditions of drought or resource scarcity, this may increase to over 25%¹⁰.

Native vegetation in riparian areas may constitute an enhanced forage resource, with green forage available perennially or for an extended season. Studies of cattle foraging on Canadian rangelands found that forage (palatable grasses, forbs and shrubs) production along riparian corridors was about 400% of forage production from the same unit area on adjacent upland areas, reflecting higher soil moisture. Forage productivity was found to differ between different types of water body, with the highest riparian forage production associated with sites where water flows. Despite this high productivity, riparian areas only constitute a small proportion of total rangelands area¹¹.

Study of cattle feeding and resting behaviour in the United States suggests that mobs prefer to feed and rest on upland areas during the spring seasons when annual grasses provide an adequate forage resource. Utilisation of low lying riparian pastures tends to occur as temperatures rise and upland forage dries and decreases in palatability. Consequently, while riparian corridors provide only a small portion of overall forage resources, they become seasonally important during the hotter months and particularly during periods of drought, when cattle may concentrate on water courses¹². Stands of healthy native vegetation, both riparian and otherwise will therefore contribute to the overall resilience of pastoral operations and constitute an 'insurance policy' against extreme events.

This pattern of stock behaviours (and its implications) closely parallels the situation on Territory rangelands.

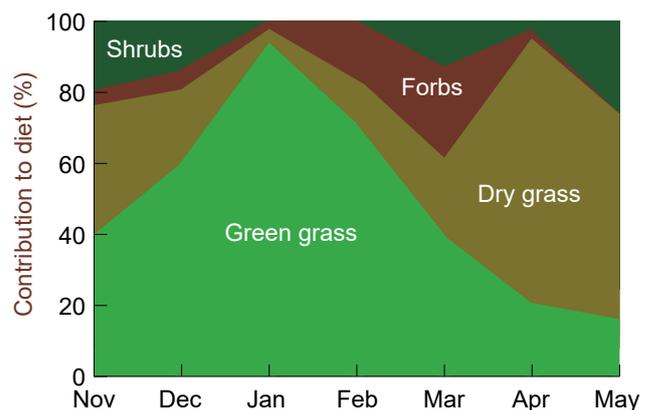


Figure 4: Composition of native vegetation in diet of steers foraging, Alice Springs (Squires and Siebert 1983)

10 Lefroy, E. Dann, P. Wildin, J. Wesley Smith, R. and McGowan, A. (1992) 'Trees and Shrubs as sources of fodder in Australia' *Agroforestry Systems*, Vol 20 pp 117-139

11 DeMaer, C. (2004) *A survey to determine forage production of Riparian Areas in the Central Parkland natural subregion of Alberta* Alberta riparian habitat management program.

12 Marlow, C. and Pogacnik, T. (1986) 'Cattle feeding and resting patterns in a foothills-riparian zone' *Journal of Range Management* 39 (3) pp 212-217

Shade

On north Australian rangelands, pockets of woodland also offer essential shelter and shade for cattle. Cattle primarily lose heat by respiration, but also through evaporation of water as sweat. Shade from direct sun reduces the heat load they take on by up to 30% and so decreases the risk of heat stress and exhaustion¹³. This is particularly important on Northern Territory rangelands where peak daytime temperatures may exceed 40o, and high humidity can limit evaporation. Cattle can experience heat stress from temperatures as low as 35o, if humidity is high.

Calves and pregnant cattle are most at risk from heat stress due to their lower heat threshold as are those with respiratory disorders that struggle to dissipate heat through panting. However, extreme temperatures and humidity will reduce appetite and Dry Matter Intake (DMI), so reducing daily weight gains and feed efficiency across all categories of stock: In a four year study conducted on United States rangelands, researchers found that steers with access to shade outgained those without shade by an average of 8.6 kg per annum. The margin of this improved weight gain correlated directly to the number of hot humid days experienced through the summer months¹⁴. Heat stress arising from a lack of shade has been associated with a number of other

productivity losses including reduced milk yields, lower fertility rates, lower and reduced calf birth weights.

In the absence of built shade structures on Northern Territory rangelands, trees and woody shrubland constitute primary environmental regulators of heat stress, so support herd productivity and health. Recognising the critical role of native vegetation and habitats underpinning pastoral productivity, across Australian rangelands, MLA promotes the need to find an appropriate 'Tree-Grass balance' to support grazing systems¹⁵.

Riparian vegetation and water quality

Riparian systems (including riparian vegetation) are critical for native vegetation and biodiversity habitat across pastoral landscapes. They provide multiple ecosystem services, most notably the provision of water, but also shade to moderate water temperature fluctuations and maintain dissolved oxygen to preserve water quality. Riparian vegetation also binds stream banks reducing erosion and turbidity while simultaneously filtering of surface and ground waters before these enter waterways¹⁶. As primary vectors for the spread of weeds, intact and healthy native vegetation along riparian corridors can help limit the incursion of weeds into properties.

13 Blackshaw, K. and Blackshaw, A. (1994) Heat stress in cattle and the effect of shade on production and behaviour: a review *Australian Journal of Experimental Agriculture* CSIRO .Vol 34 p285-295

14 McIlvain, E. and Shoop M. (1971) 'Shade for improving cattle gains and rangeland use' *Journal of Rangeland Management* 24 pp 181-184

15 MLA <https://www.mla.com.au/research-and-development/Grazing-pasture-management/native-pasture/tree-grass-balance/> [Accessed February 2019]

16 DENR https://nt.gov.au/_data/assets/pdf_file/0014/204206/sensitive-vegetation-riparian-english.pdf [Accessed March 2019]



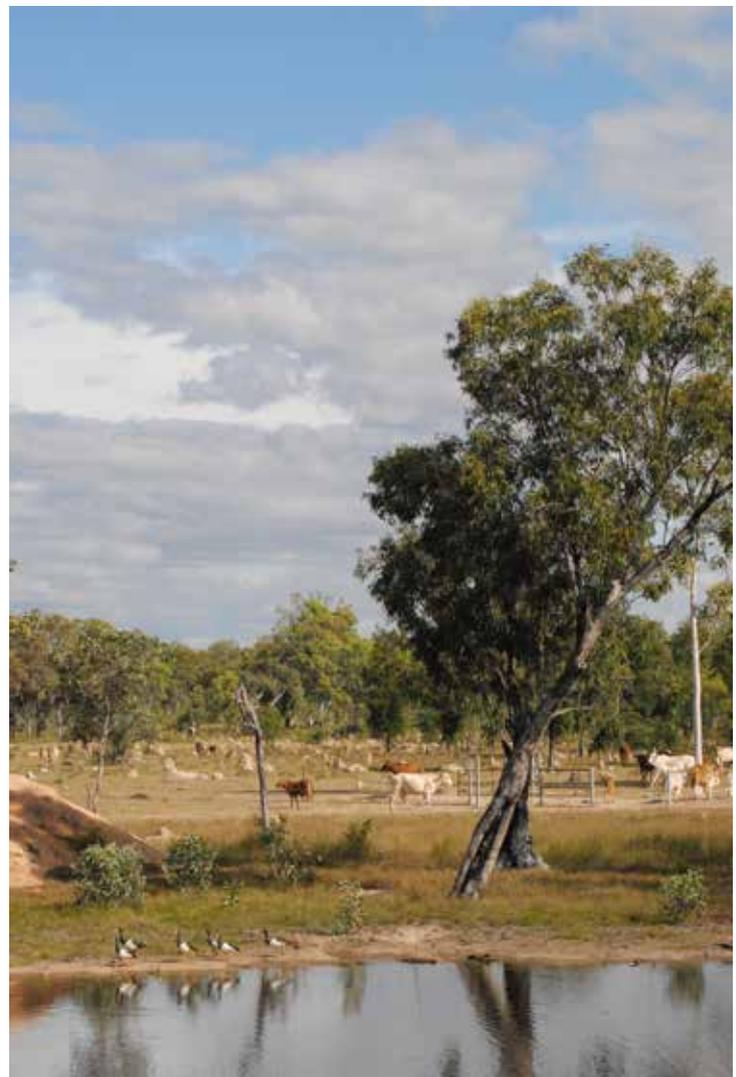
Water quality has important implications for optimising beef production. Like forage production and availability, maintenance of water quality is critical to achieve optimum production from rangelands. Murky, turbid or oxygen deficient water has been found to reduce live weight gains, and water sources contaminated with faeces can transmit disease-causing organisms such as *E. coli*. In one trial over five years, steers drinking clean pumped freshwater during the summer months achieved a 3% higher average daily weight gain than those with direct access to muddy, trampled waterholes. The trial showed that in hot years this difference was significantly greater¹⁷.

Demonstrating sustainable practises as good business

In recent years there have been clear indications for changing consumer preferences both in domestic and international markets for beef. According to MLA's head of marketing and communications, a growing demand from consumers for greater sustainability in beef production operations constitutes a 'Megatrend' impacting the industry. *"Consumers are shifting towards green-minded products.....so it's important beef producers profile their products and brand approach to sustainable production methods"*¹⁸.

In the face of consumer preference for beef produced utilizing sustainable practices, it is almost inevitable that forms of certification will be introduced and enable producers to establish provenance and demonstrate sustainable management of natural resources along value chains¹⁹. The Australian Beef Sustainability Framework already provides a basic template for achieving sustainable practices, and suggests these will include metrics to gauge the retention and sustainable management of native vegetation within productive landscapes.

As yet there are few precedents in the livestock sector to quantify the extent to which demonstration of sustainable practices may enhance market access or impart price premiums. However, recent



market research in the United States highlights that up to 44% of consumers are prepared to pay a price premium for food products that are identified as sustainably sourced, and in some food types up to 20% of products are now produced under a sustainability certification²⁰.

Globally, demonstration of food value chain sustainability is becoming increasingly mainstream, and Australia's beef exports have long benefited from the perception that they are product of 'natural' systems. Producers able to demonstrate their beef is product of landscapes that support native vegetation and biodiversity and promote ecosystem functions will be well-placed to engage with these emerging market opportunities.

17 Lardner, H. and Willms, W. (2005) 'The effect of water quality on cattle performance on pasture', *The Australian Journal of Agricultural Research* 56, pp 97-104

18 Queensland Country Life (2017) <https://www.queenslandcountrylife.com.au/story/4714103/beef-consumer-megatrends/> [Accessed May 2019]

19 Beef Central (2019) <https://www.beefcentral.com/news/sustainability-welfare-credentials-critical-to-austs-livestock-industrys-future-assistant-ag-minister/> [Accessed May 2019]

20 Marketing Charts (2017) What makes a premium product? <https://www.marketingcharts.com/industries/food-and-restaurants-73361> [Accessed May 2019]



TCA OUTCOMES: LAND CONDITION, COSTS AND BENEFITS

Healthy rangelands and natural assets underpin productive and sustainable beef enterprises. The previous section highlights some of the ways in which maintenance of, or improvement in, land condition (including native vegetation and the physical production environment for cattle) can improve productivity and so strengthen business performance.

This section of the report reviews the impact of management conducted in implementation of TCA agreements. It considers the evidence for whether TCAs are successful in maintaining or improving land condition at sites incorporated into the program, and relates this change to available property management and business performance metrics.

Tracking the status of TCA sites

As part of the process for establishing TCA agreements with landholders, all sites underwent a baseline survey. These surveys were designed to assess both the ecological and productive attributes of the site in terms of the abundance and composition of native vegetation and the identification of threatening processes. One or more reference points were established at selected locations within the site, and utilised as both photo-points and also markers for transects and sampling. Overall assessments of land condition are made for each reference point within the site.

In 2017, five years after the establishment of the TCA program, TNRM commenced a review of program outcomes. So far, ecological validation studies have been undertaken at seven sites which have been established as TCAs for three or more years. Repeated transect walks highlighted changes in

vegetation composition at reference points within sites. These have enabled direct comparisons between land condition at the outset of each studied TCA and in again in 2017.

A complementary tool utilised to gauge land condition change at selected sites was assessment of fractional ground cover, undertaken by the FarmMap4D Spatial Hub. The analysis at each site was structured as a 'double difference comparison', (before and after establishment of the TCA and both at the TCA site and another comparable reference site). Fractional ground cover was plotted for each of the case study and reference sites a for a period predating the establishment of the TCA by 10 years.

Another component of the TCA program review was a landholder feedback survey, engaging with pastoral land holders and managers of 17 sites during 2018. At 15 of these TCA sites, it was possible to again assess land condition at reference points²¹.

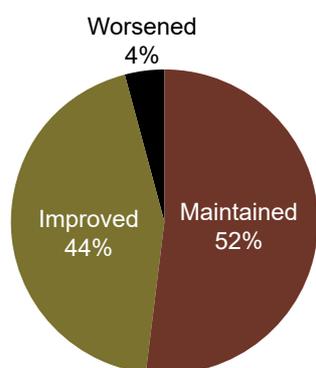
At the same time as data on TCA site condition was being collated, discussions were being held with the managers of three case study sites to assess how TCA management had impacted on property operations and business performance. Unfortunately there were significant limitations to the availability of this type of data. While land holders have a good knowledge of the economics of their stock operations, the temporary use of TCA sites, and the transfer of cattle across different parts of properties made attribution of achieved benefits difficult. Consequently rather than attempt a complex economic analysis based upon *per capita* stock benefits, case studies instead draw upon land holder recall to attempt a crude arithmetic assessment of cost-benefits associated with the sites.

21 Bubb (2019) *ibid*.

Overall directions of change

Assessments made during the TCA review indicate that land condition scores at 96% of surveyed reference points established across TCA sites had maintained or improved in condition since baseline surveys had been conducted (Figure 5). Given that sites accessed into the TCA program tend to be of high ecological value and good condition at the time of their accession, maintenance of condition (particularly if subject to grazing), constitutes a desirable outcome. While there is only a weak positive correlation between the last recorded land condition and the number of years under a TCA (Pearson $R= 0.3108$), the only TCA site where conditions had worsened was also the most recently established site, suggesting its condition was still stabilising. In 2018, land condition at 25 of the 28 sampled reference points was assessed as either Condition A or B²².

Figure 5: Overall direction of change in land condition at reference points across 15 selected TCA sites (Bubb, 2019)



Stakeholder feedback from the TCA review has indicated high levels of satisfaction among participating landholders with respect to land condition outcomes. The evidence of independent observations undertaken during the review process seems to corroborate this.

The primary drivers of these observed improvements in land condition included increased ground cover, an increased proportion of palatable grass ('decreaser' species) cover, and reduction in the proportion cover of non-palatable species and weeds: While no direct measurements of water quality have yet been made, it is assumed that healthy native vegetation and reduced evidence for erosion along riparian corridors would be consistent with improvements in water quality. However not all observed improvement in land condition was sufficient to warrant a change in land condition classification (i.e. movement between A, B, C and D classifications) and likewise, where classification was recorded as having improved, this improvement had not necessarily occurred across every indicator: Recorded improvements in land condition classification reflect a significant overall positive trend in condition.

22 Bubb *op cit.*



Three case studies

To investigate patterns and drivers of change under TCA management, three case study sites have been selected from among the seven which have so far undergone validations. The sites were selected to represent properties with different management structures and operating at different scales of production. Four primary indicators are referenced:

- Fractional ground cover over a 17 year period (including comparison with reference sites)
- Cover of favoured palatable pasture species ('decreasers'). An increase in these is considered an indicator for healthy, productive grazing country.
- Cover of less palatable species which tend to increase in heavily grazed landscapes ('increasers'). These are considered an indicator for reduced productivity.
- Cover of invasive weeds species which can be detrimental to the health of native pastures and ecosystem function

The results reflect a diversity of outcomes:

Site 1 showed improvement in land cover and reduced seasonal variability in the years following the establishment of the TCA, maintaining an average of 94% cover. While weeds remain effectively controlled

at the site, there has been a small increase in low palatability 'increaser' species as a portion of total cover.

There is no significant change in ground cover at Site 2. Although the land under a TCA performs better than the reference site, this was also true before the TCA was established, by a similar margin. Ground cover is maintained at about 80%. There has been a small reduction in high value palatable pasture species, but no change in 'increaser' species. There has been no change in weeds at the site.

Site 3 represents the most evident improvement in land condition. It has a clear increase and less seasonal variability in, ground cover, a marked increase in favourable 'decreaser' species, and a reduction in weeds.

While each of these findings tells a story of either maintenance or improvement in land condition under grazing stock, the true enterprise value comes from achieving productivity without detriment to land condition. The following three case studies consider these land condition outcomes with respect to the production costs and benefits associated with them. They focus upon the production strategies implemented at the three sites and relates these to broader enterprise goals.





CASE STUDY 1

SUSTAINABLE MANAGEMENT DRIVING PRODUCTION EFFICIENCY

From its establishment, TCA Site 1 has been managed as an important productive asset within the 60,000 Ha Sturt Plateau property within which it is situated. The landholders have explored utilising the site for different purposes in order to improve overall business performance.

Prior to its establishment as a TCA, the 300 Ha wetland site had been degraded by heavy grazing and trampling because of unrestricted seasonal access to water and wetland forage. The property managers have taken a staged approach to rehabilitating the site, keeping off cattle for the first years and subsequently stocking and spelling the site to enhance its ecological and productive values (Table 3).

Reproduction rates

The primary enterprise goal at the station has been to improve efficiency through increasing the reproductive rate. The property owners have made considerable headway towards this goal, and won the 2014 'Innovation in Sustainable Farm Practices' Award after reducing the size of their breeder herd by 20% while maintaining the same output. Fewer cows producing the same number of calves to weaning has helped reduce production costs and methane emissions. Over a number of years, the property has increased fertility through to weaning from 52% to 68%.

Table 3: Utilisation strategy for TCA Site 1.

Year	Use	Duration (Weeks)	Stocking Rate (AE/Ha)
2011	Infrastructure works undertaken to configure the site	-	0
2012	Site left ungrazed for rehabilitation and improvement	-	0
2013	180 weaners	3	0.24
2014	Ungrazed	-	-
2015	Bull and 20 heifers through wet season	14	0.05
2016	60 cows with calves (early calves)	8	0.15
2017	40 cows with calves (early calves)	12	0.10
2018	200 steers fattened through the late dry	6	0.50

It achieved this efficiency by managing breeding, by reducing the age and weight of heifers at first calving, and also reducing mortality among calves born out-of-season and lactating cows. Between 2015 and 2017, the TCA site directly supported this efficiency drive.

Despite careful management of breeding, it is estimated that between 40-60 out-of-season calves are born annually on the property, as a result of bulls breaking fences and getting in among the cows. This would previously have resulted in mortality among both the out-of-season calves and their lactating mothers, or else require labour-intensive segregated management.

Holding out-of-season cows and calves in the TCA site during the dry season (July-October) gives lactating cows access to fresh forage and clean water which has increased the survival rate among both calves and cows by about 10%.

Finishing steers for market

The business's primary income derives from between 600-800 steers which are sold for export annually. The majority of these are sold in April-May after reaching sale weight through the wet season. Sale price for steers landed Katherine and Darwin is volatile, reflecting fluctuating overseas demand but also the condition and accessibility of steers locally. Typically steers are sold at the end of the Top End wet season after which they have fattened on wet season pastures. Many beef producers turning steers off at the same time can have the effect of depressing market value early in the Dry (Figure 6).

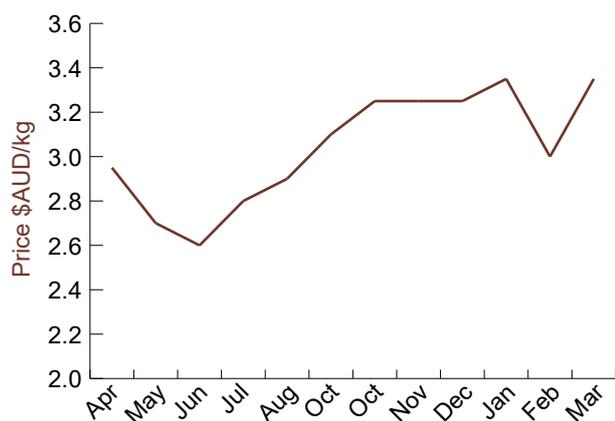


Figure 6: Reported 2018 prices for steers ex Darwin

In 2018, the owners of TCA Site 1 trialled holding back 200 steers through the early dry season, and in September placed them within the TCA site to 'finish' for six weeks. Over this period, with only mineral supplementation, the steers achieved daily gains of up to 0.6kg, with some individuals gaining 25Kg over

the period. It is estimated that outside of the TCA at that time, the steers would only have put on 0.3kg daily. Average sale weight for the steers in August was 315kg, and in contrast to the sales made in May which fetched below \$3.00/ Kg liveweight, the October steers benefitted from late dry season prices and fetched \$3.35/ Kg at market. This represents an improved sales revenue of approximately \$14,000.

Following the success of this trial, the landholders now identify the TCA site as a resource for out of season finishing, enabling them to achieve peak export market prices. On this point the landholder stated "if you have the luxury of waiting for the market you'll end up with benefit", and expressed his intention to continue utilising the site in this way.

Other business benefits

The owners of TCA site 1 point out that prior to the establishment of the TCA and enclosure of the wetland, they incurred 3-4 annual losses through cattle or calves becoming bogged. Since enclosure, and restricted of access during periods of inundation, this number has been reduced.

The owners view the conservation site as an emergency forage reserve. The wetland grows full leaf green grasses through the dry season until September. Even in years of low rainfall, the reduced area of inundation means that a larger area of vegetation isn't drowned and grasses grow more deeply into the lake bed and across a larger area. At current low stocking rates, land condition has consistently improved. However after four successive years of poor wet seasons on the Sturt, the landholders believe they may need to stock the site more heavily during 2019 to help them achieve their business objectives.

Direct costs and benefits

After three years of stocking TCA Site 1 with small mobs of out of season calves and lactating cows (Strategy 1, Table 5), the landholders have determined the site can be more profitably utilised for finishing steers for supply to market, while continuing to enhance its natural values and productivity (Strategy 2, Table 5). This is likely how the site will be continued to be utilised within the enterprise.

Table 4: Reported annual maintenance costs at TCA Site 1

	Units (hours)	Estimated expense (\$)
Fence repair and maintenance	12	600
Materials	-	600
Grader	5	1000
Weeds aerial treatment (Helicopter + Chemical)	3	1500
Ground spraying	3	300
Diesel and chemical	-	200
Mineral supplements		200
Additional management	10	500
Total		4900

Table 5: Reported direct values produced from TCA Site 1

		Annual Units	Estimated value (\$)
Strategy 1	Survival of out of season cows and calves	3-4	5000
	Reduction in losses through exclusion form wetland	2-3	2000
Total			7000
Strategy 2	Finishing steers in late dry season	200	14000
	Reduction in losses through exclusion form wetland	2-3	2000
Total			16000

Table 6: Projected Breakeven against initial investment

	Income (\$)	Costs (\$)	Margin (\$)	Balance (\$)
2011		100000	-100000	-100000
2013	2000	4900	-2900	-97100
2016	7000	4900	2100	-95100
2017	7000	4900	2100	-93000
2018	16000	4900	11100	-81900
Estimated years to Breakeven: 9.2 (6 years under Strategy 2)				

Breakeven

TCA Site 1 had a total establishment cost of \$100,000. According to landholders, the value of production from the site prior to the establishment of the TCA was marginal, and possibly outweighed by losses occurring at the site. Assuming all other factors being constant and following the current strategy of fattening steers for sale at better prices, initial establishment costs could be covered within 10 years (Table 6).

Increased land and productivity values

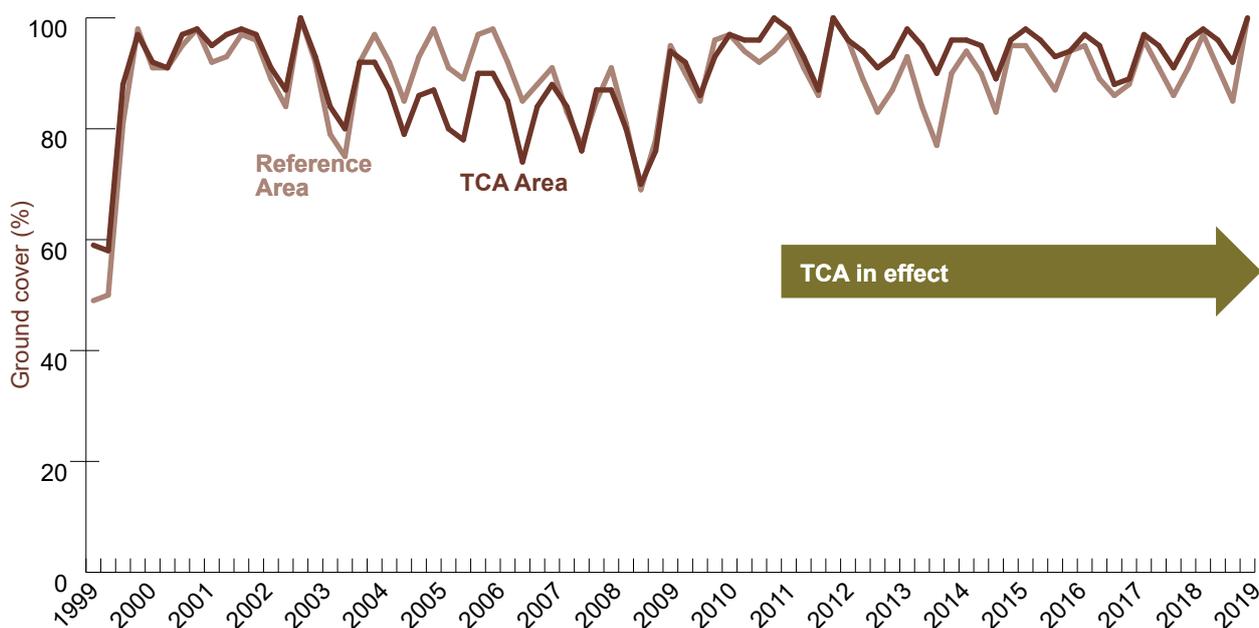
The property owners believe that aside from the direct productivity benefits arising from improved land condition, the TCA at Site 1 also adds to the market value of their property. They point out that many buyers in the market for Northern Territory Pastoral land are foreign investors from countries with high populations and degraded natural values. Consequently, verdant wetland lakes and riparian corridors have captured the attention of prospective buyers even more than productivity values.

Evaluation of reference points within TCA Site 1, together with analysis of change in fractional ground cover suggest an overall improvement in land condition: For the Larrimah Land System at condition 'B' a 10% increase in productivity can be equated to an additional 2AE's/Km² of sustainable carrying capacity. Therefore the site currently has the unrealised potential to sustainably carry 6 more AE's than when it was first established as a TCA (additional annual revenue of approximately \$6000)

While this unrealised productive value wouldn't alone justify the annual investment made into site management, it can be considered supplementary to other strategies which create revenues and continue to enhance site condition. Furthermore under current management, this additional productivity value should continue to increase.

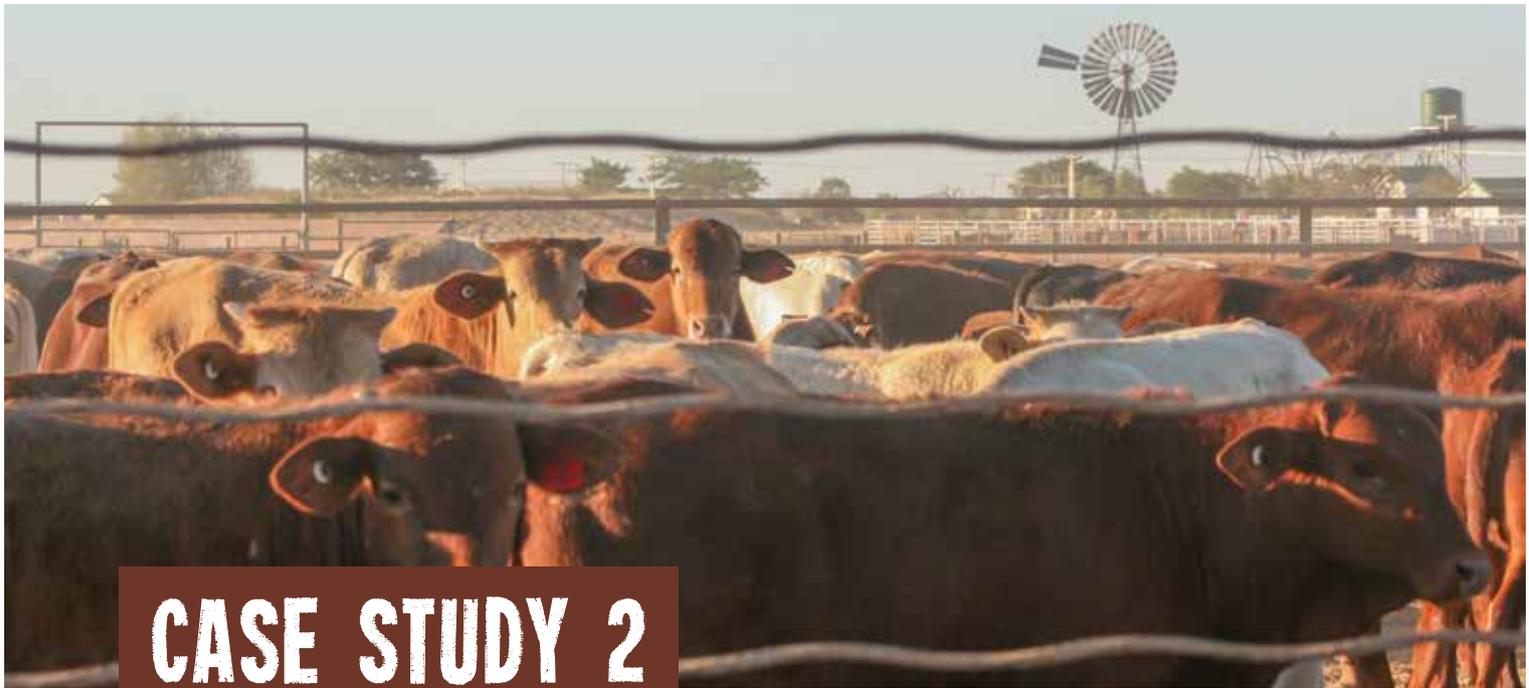
Land Condition assessment for Case study 1

Property description	A medium sized, family owned and managed property in the Sturt Plateau region
Site description	An area of 300 Ha, encompassing seasonal Coolibah wetland and surrounding open woodlands. Established in 2011 and subject to intermittent light grazing. Good diversity of 73 plant species recorded.
Land condition	Overall, some improvement in land condition at the site
What changed	Improvement in ground cover, a small increase in 'decreaser' species (Kangaroo grass) and but also a larger increase in 'increaser' species (Black Speargrass). No weeds or feral animal impacts were identified.



Ground cover					
		TCA area		Reference area	
		10 years prior to TCA	Period of TCA	10 years prior to TCA	Period of TCA
Mean	88.75	94.36	90.09	90.3	
St. Dev	7.62	3.42	7.00	5.37	

	Change in cover (%)	Assessed land condition	
Decreasers	+4	2011	2017
Increases	+6.6	B	B+
Weeds	0		



CASE STUDY 2

SUPPORTING BETTER STOCK MANAGEMENT

TCA site 2 is a fairly large site encompassing over 2300 Ha on a large 300,000 Ha corporately owned property in the Victoria River District. While the site is quite large for a TCA (it protects a 10Km section of irregularly flowing riparian corridor), it only constitutes a small area of a much larger production operation.

Prior to the establishment of the TCA at site 2, the area had been vulnerable to overgrazing and erosion damage by cattle congregating along the riparian corridor during the dry season. Unregulated cattle movement and disturbance to native vegetation along the riparian corridor was further enabling the introduction of weeds into the site. The TCA proposal was made with a view both to protecting land condition and also improving stock management on the property.

The manager describes the objective of the station being to breed cattle for the live export market, while managing land resources sustainably and introducing any management efficiencies that can be achieved to lower production and other costs.

From the outset, the managers of TCA site 2 have utilised the site as part of a rotational system within the property, whereby stock are collectively managed, but moved between paddocks to optimise forage utilisation and production. The establishment of the TCA in 2013 had “turned one large paddock into three”, enabling cattle to be run on an adjacent ‘harder’ paddock during the wet season, and then rotated across to the TCA site for two to three months immediately after the wet season (April-June), to utilise pastures and standing water.

Table 7: Utilisation strategy for TCA site 2

	Use	Duration (weeks)	Stocking rate AE/Ha
2013	Developing infrastructure		
2014	Spelling		
2015	600-800 (All categories)	10	0.3
2016	600-800 (All categories)	10	0.3
2017	600-800 (All categories)	10	0.3
2018	600-800 (All categories)	10	0.3

Production benefits

The property managers see the principle benefits arising from the TCA as being increasing ease of management, improved productivity outcomes (live weight gains, health and fertility) and sustainability in pastures and land condition.

The arrangement of the TCA paddock has significantly reduced the time and expense required for mustering cattle. What previously required two days annual mustering, can now be achieved in one day. This has reduced required inputs of a mustering ground crew, helicopter time and fuels an estimated cost saving of \$5625 per annum, and so also

improved work health and safety outcomes, another important consideration.

Access to fresh, ungrazed forage and abundant clear water in the early dry season results in good live weight gains and productivity among all categories of cattle. It is estimated that breeders within the paddock gain at about 0.6kg/daily as compared with an average of 0.4kg/daily on paddocks that haven't been spelled through the wet. Grazing of cattle within the TCA site therefore delivers an additional ten and half tonnes of live weight compared with other locations. Although this gain is not translated directly to market sales, it drives better growth and healthier cattle. Intensified management has considerable improvement in weaning rates across the property with the average reportedly rising from about 60% to 69%. Despite the success of the TCA Site 2 in improving gains, it is not utilised for finishing steers, as the property has even more productive paddocks for that specific purpose.

Finally, by managing the TCA site 2 as part of a rotational system, with special recognition of its attributes as a riparian corridor, the land managers have been able manage grazing pressure upon the site to maintain land condition values while achieving improved productivity from within during the short periods cattle are grazed within it. Likewise land condition has been maintained or improved on neighbouring paddocks that form part of the same rotational system.

Direct costs and benefits

Land managers of TCA site 2 report achieving consistent business benefits from incorporation of the site into the broader property management strategy: In addition to achieving improved productivity from the site, managers have also been able to accrue considerable savings over previous management, while at the same period demonstrating sustainability in land condition. It is expected that the TCA will be continue to complement station operations in this way.

Table 8: Reported annual maintenance costs at TCA Site 2

	Units (hours)	Estimated expense (\$)
Fence repair and maintenance	16	1000
Materials	-	1000
Grader	8	1500
Ground treating weeds	8	400
Diesel and chemical (Graslan)		2500
Mineral supplements		5000
Mustering helicopter	1	1125
Mustering ground crew	10	3000
Total		13525

Table 9: Reported benefits from TCA Site 2

Strategy	Annual Units	Estimated value (\$)
Live weight gain improvement	10.5 tonnes	31500
Reduced days mustering (savings)	1 day	5625
Total		37125

Breakeven

TCA Site 2 had a total establishment cost of \$150,200. The site had previously constituted part of a much larger grazing area within the property which had not been subject to specific management actions or quantified outputs. Consequently it is hard to assess the productivity values of the site prior to establishment of the TCA, but they are assumed to be significantly lower. With all other variables assumed to remain constant, and following the current management strategy of short-duration stocking through the early dry season it is estimated that initial establishment costs could be covered within 8 years (Table 6).

Table 10: Projected Breakeven against initial investment

	Income (\$)	Costs (\$)	Margin (\$)	Balance (\$)
2013		150200	-150200	-150200
2014	37125	13525	23600	-126600
2015	37125	13525	23600	-103000
2016	37125	13525	23500	-93000
2017	37125	13525	23600	-79400
2018	37125	13525	23600	-55800
Estimated years to Breakeven: 8				

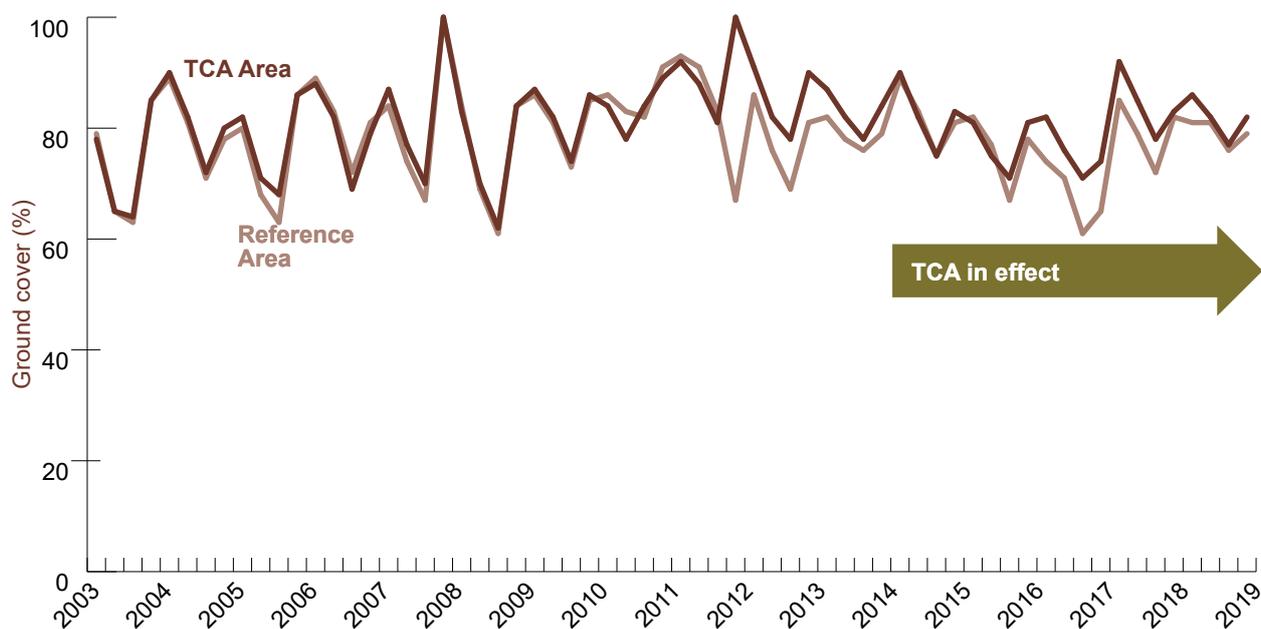
Land productivity values

Evaluation of reference points within TCA site 2, together with analysis of change in fractional ground cover suggest little overall change in site condition has occurred following the introduction of the TCA and improvement in stock productivity. While maintenance of pre-TCA site conditions suggests the current use strategy is sustainable, there remains room for improvement.



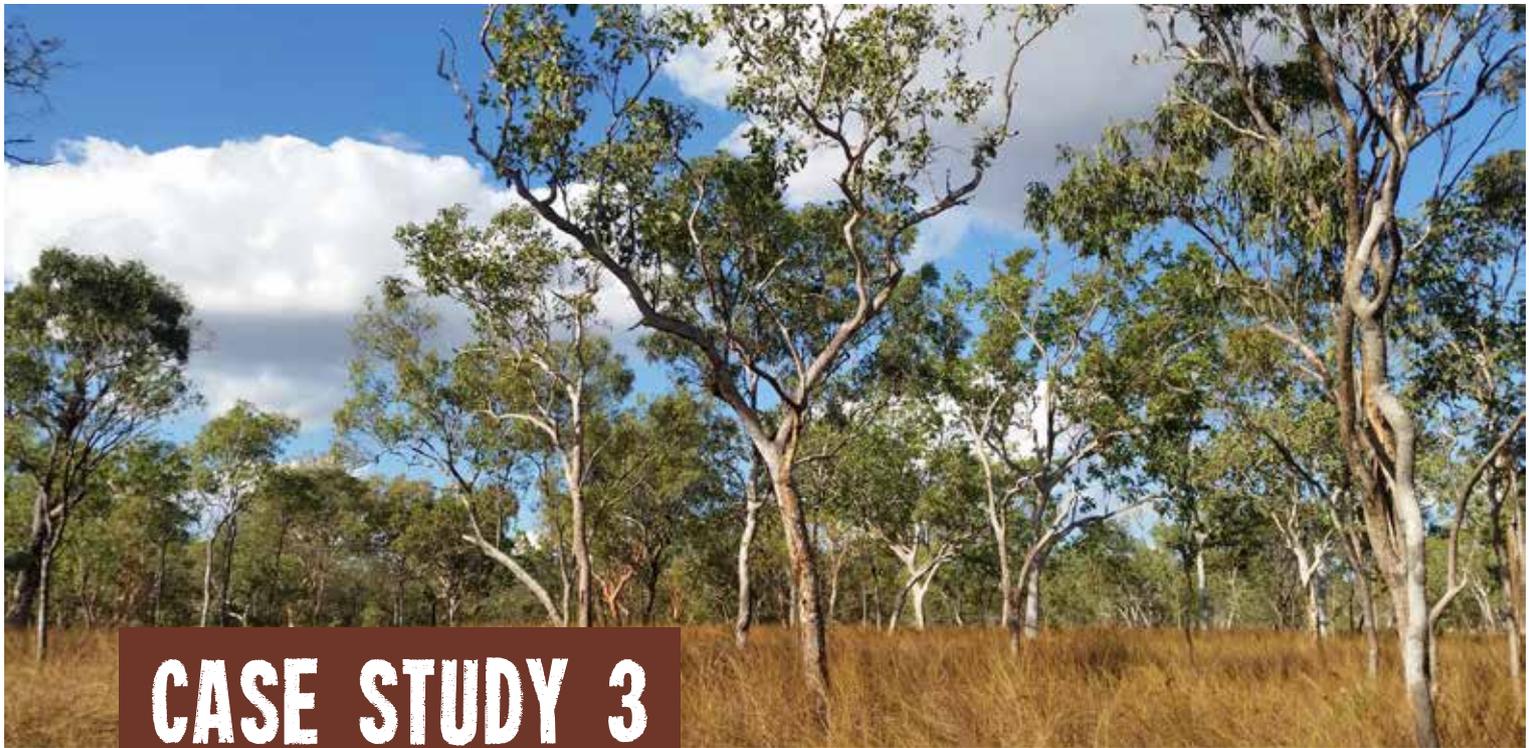
Land Condition assessment for TCA site 2

Property description	A large property under corporate management situated in the Victoria River catchment
Site description	An area of 2360 Ha encompassing a lengthy section of seasonally flowing riparian corridor with adjacent areas of open woodlands and grasslands. Established in 2013 and subject to seasonal grazing.
Land condition	Overall, little change at the site although some visible signs of grazing pressure
What changed	Little change in ground cover, some losses and gains in 'decreaser' species (Golden Beardgrass), with little change in 'increaser' species (Black Speargrass and Feathertop). Some erosion and trampling along riparian corridors and small patches of Parkinsonia persist within the TCA.



Ground cover					
		TCA area		Reference area	
		10 years prior to TCA	Period of TCA	10 years prior to TCA	Period of TCA
Mean	81	80.70	79.22	79.22	77.20
St. Dev	9.02	5.43	9.28	9.28	6.44

	Change in cover (%)	Assessed land condition	
Decreasers	-8.6	2013	2017
Increasers	-0.3	B	B
Weeds	0		



CASE STUDY 3

RESTORING LAND CONDITION

TCA Site 3 is a very large site encompassing 9000Ha on a small family owned property in the Katherine region. The TCA site is a large paddock accounting for approximately half of the total area of the property and covering a diverse array of land types including creeks, springs, rugged outcrops and flood plains.

Given its size and significance, the TCA paddock constitutes a key productive asset on the property. However, under previous management, the site had been increasingly degraded by cattle, especially along riparian corridors and in rainforest areas, leading to soil erosion, increasing weed infestations, and reduced productivity of native grasses.

Consequently, the landholders of TCA site 3 identified the restoration of the productive values of the site as a property management priority. This rehabilitation is to be achieved through spelling its pastures from grazing, protection of its fragile waterways, control of ferals and systematic treatment of weeds. They consider the restoration of this part of their property as a worthy long-term investment.

Key among measures for this rehabilitation have been restricting stock access to reduce grazing and other pressures. Following site preparations and the installation of infrastructure, the landholders have established and maintained a pattern of lightly stocking (approximately 200 AE) the TCA area through the dry season with 'dry' cows (non-lactating cows and heifers). This has ensured only negligible stock impacts within the TCA site and has

also supported the producer's segregation strategy, managing their breeding cows and calves in a separate (more accessible) paddock.

Table 8: Utilisation strategy for TCA site 3

	Use	Duration (weeks)	Stocking rate AE/Ha
2013	Developing infrastructure		
2014	Spelling		
2015	200 (Dry cows)	16	0.02
2016	200 (Dry cows)	16	0.02
2017	200 (Dry cows)	16	0.02
2018	200 (Dry cows)	16	0.02

Production benefits

The landholders are not utilising the TCA site to achieve any immediate production benefits: In current use, the site supports non-productive cows through the dry season at a negligible stocking rate. These cows will maintain or improve condition through access to an enhanced grazing environment, which may enhance future fertility and lactation, however

this has not been tracked. However segregation does enable targeted management for groups -for example in application of feed supplements. The landholders have chosen to prioritise the longer term benefits of improved land condition over achieving short term outputs from the site.

Direct costs and benefits

Since establishment of TCA site 3, ongoing annual maintenance costs have been estimated at about \$16,000 per annum. A significant proportion of this management expense is the cost of an annual pre wet-season muster (Table 9). The first muster conducted at the site harvested a mob of ferals which were subsequently sold on for \$27,000, which has helped to offset overall establishment and maintenance costs.

Table 9: Reported annual maintenance costs at TCA Site 3

	Units (hours)	Estimated expense (\$)
Fence line grading, repair and maintenance		1800
Weeds management (Ground spraying)	30	1500
Weeds management (Chemical)		700
Mustering paddock (Helicopter)	5	4000
Mustering paddock (Ground crew)	30	6000
Feed supplements		2400
Total		16400

Breakeven

TCA site 3 had a total establishment cost of \$201,566. The landholders are continuing to annually invest in improving the site without generating significant returns (except for a one off sale of mustered ferals). Assuming no other opportunity costs are incurred elsewhere in the business by the reservation of the TCA paddock, the cumulate costs associated with the TCA are described in Table 3.

Table 10: Cumulate costs of TCA Site 3

	Income (\$)	Costs (\$)	Margin (\$)	Balance (\$)
2013	0	201566	-201566	-201566
2014	27000	16400	10600	-190966
2015	0	16400	-16400	-207366
2016	0	16400	-16400	-223766
2017	0	16400	-16400	-240166
2018	0	16400	-16400	-256566

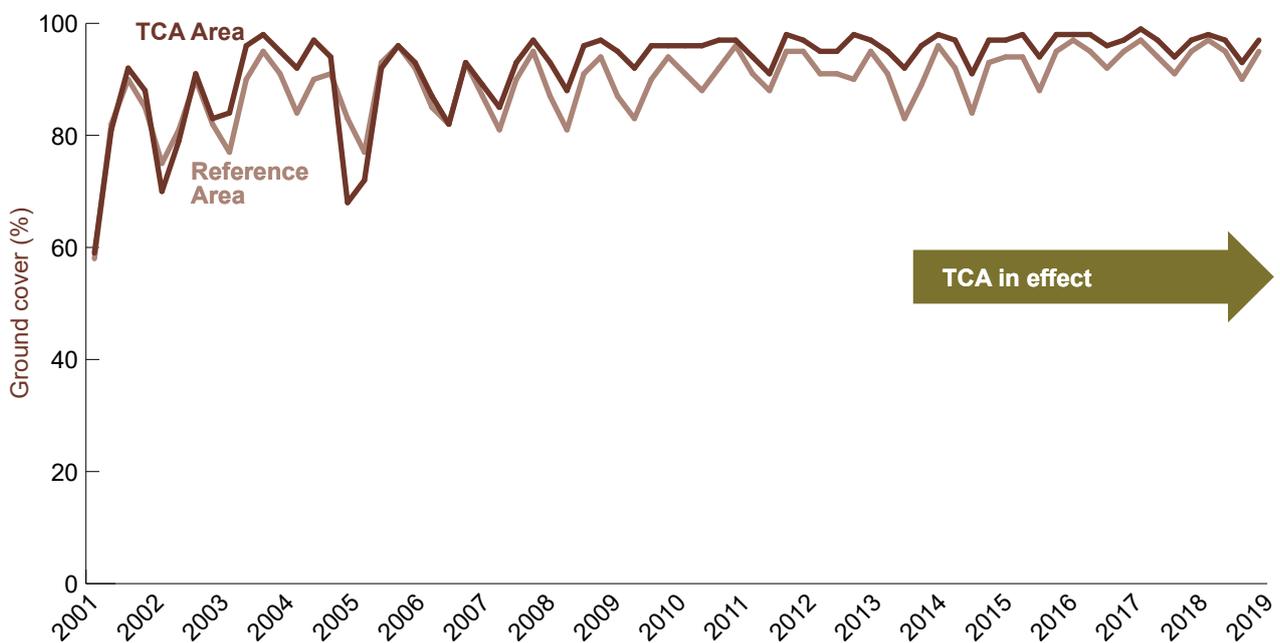
Land productivity values

Evaluation of reference points within TCA site 3, and analysis of change in fractional ground cover indicates that between 2014 and 2017, land condition was assessed as improving from condition 'C' to condition 'B'. On the Northern Tall Grasslands, productivity improvements associated with this change have been estimated at an additional 400Kg/ Ha pasture production or 2AE's/Km² of sustainable carrying capacity²³. Over 9000 Ha, this equates to increasing sustainable carrying capacity by 180 AEs – with a potential turnoff value of \$180,000. While the current land management trajectory is maintained land condition will likely continue to improve and potential productivity values will increase. When the site reaches a condition that meets landholder expectations and they phase stock back into the paddock, the higher sustainable stocking rates should ensure that investments are quickly recouped over two or three years, and the TCA site begins generating clear income for the business.

23 Pettit, C. (2011) *Victoria River District: Land Condition guide*, DPI

Land Condition assessment for TCA site 3

Property description	A small family owned and run property in the Daly bio-region
Site description	An area of 9000 Ha encompassing the catchment of a creek system flowing into the Katherine River. The large site contains a diversity of land types including creeks, springs and rugged outcrops and is characterised by open woodlands and grasslands with denser vegetation along riparian corridors. The TCA was established in 2013.
Land condition	Marked improvement of land condition.
What changed	An overall increase in ground cover, markedly through a large increase of palatable 'decreaser' species (Kangaroo grass). The overall proportion of perennial grass cover has also significantly grown, despite an expansion in the cover of some 'increaser' species (Black speargrass and Kerosene grass). The extent of Hyptis and other weeds has reduced across the site.



Ground cover				
TCA area			Reference area	
	10 years prior to TCA	Period of TCA	10 years prior to TCA	Period of TCA
Mean	91.97	96.52	88.84	93.23
St. Dev	6.72	1.96	5.18	3.31

	Change in cover (%)	Assessed land condition	
Decreasers	+14	2014	2017
Increasers	+7.5	C	B
Weeds	-8.75		



CONTRASTING APPROACHES AND STRATEGIES TO UTILISING TCAS

These case studies highlight the very different ways in which TCAs can be utilised, with strategies reflecting the diverse enterprise objectives of individual properties.

Site 1 is a small site on a medium sized family operated property. The landholders have invested heavily in its establishment and management of the TCA as a productive asset, facilitating more effective engagement with markets. This innovative approach is possible due to the producer's capacity to make intensive labour and management investments into the TCA, and it is yielding significant returns while simultaneously supporting a marked improvement in land condition and value at the site. This strategy could be described as a 'high input-high output', and has been enabled by the specific natural assets available to the property, together with the socio-economic resources and business acumen of the operators.

As a large corporate property, management of Site 2 has occurred under a very different set of parameters and management goals. The site has been developed as part of the overall property management system, and due to its scale and resource limitations, there

is less intensive management than is occurring at TCA Site 1. While the TCA reduces production costs, contributes to the overall output of the property and generates returns, these are not commensurate with those achieved at TCA site 1. One of the primary benefits from the TCA is that the degradation that had previously occurred at the site now seems to have been arrested. The strategy employed at Site 2 can be described as a 'low input-low output', and it sits well within the operations portfolio on a large corporate property.

Management at TCA Site 3 represents an entirely different set of priorities. As a small family property, where grazing lands had previously been degraded, TCA Site 3 has offered an opportunity to rehabilitate a significant area of the property and so underpin the restoration of natural capital upon which productivity depends. Overall levels of investment and management inputs have remained quite low and as yet, no returns have been realised. However, given the size of TCA Site 3 and the evidence for improvement in land condition, it is likely that once realised, the value of productivity improvements will represent a very substantial boost to enterprise margins and sustainability.

Table 11: TCA management approaches contrasted

	Establishment cost per Ha (\$)	Annual investment per Ha (\$)	Annual return per Ha *	Estimated years to breakeven*	Land condition change
TCA site 1	333.33	16.33	53.33	6	Positive
TCA site 2	65.30	5.88	16.14	8	Neutral
TCA site 3	22.39	1.82	0	8-10	Strongly positive

*Under current management

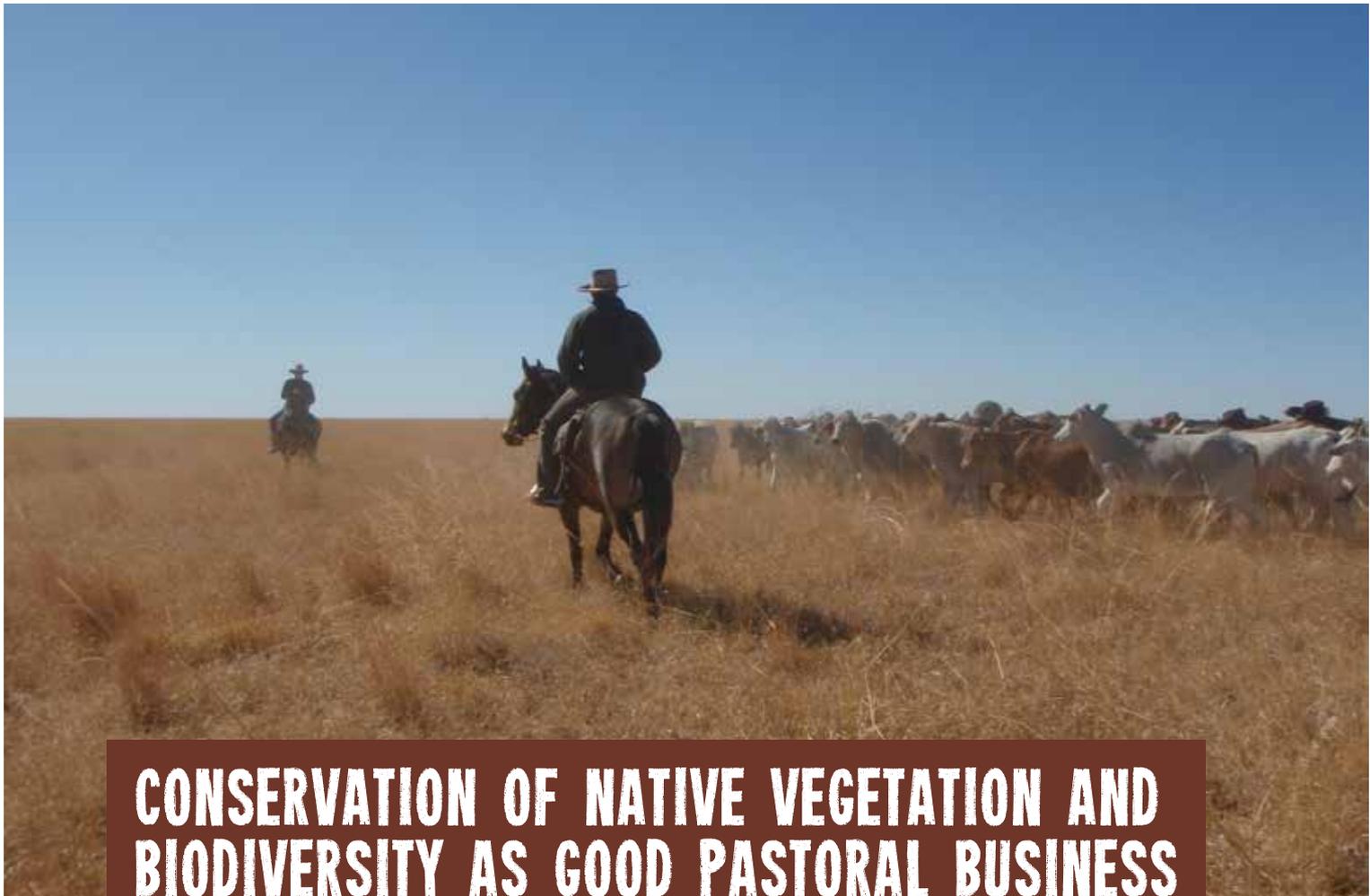
These findings highlight how producers have engaged with TCAs in different ways to suit their own business goals and priorities. Evidence suggests that the more landholders invest into TCAs, the greater the potential to generate immediate returns from their management. But in addition to realised values generated through production, values arising from enhanced land condition may remain unrealised or under-realised. The necessary tradeoff between realised production values and long-term improvement in land condition constitutes an important consideration for all TCA managers, but at all three case study sites, landholders have identified a balance appropriate to their own respective goals. Overall, each of the case studies provides evidence that the implementation of a TCA is good for business (as defined by their respective criteria for business success).

The case studies illustrate how TCAs and conservation management practices have potential application to a broad range of the pastoral business priorities highlighted by the Northern Beef Report and set out in the introduction of this document. Specifically, with appropriate levels of management and resource inputs, conservation of native vegetation can support increases in herd productivity, strengthen social and environmental sustainability and increase efficiencies to reduce production costs (although maybe not all of these things simultaneously).



Table 12: Potential application of TCAs to support pastoral business goals

		How TCAs can be used
Herd productivity	Reproductive rate	<ul style="list-style-type: none"> • Access to higher value forage helps to increase breeder fertility and increase calf survival rates
	Mortality rate	<ul style="list-style-type: none"> • Provide access to higher value forage to vulnerable animals during dry season (such as out of season lactating cows and calves) • Reduce occasional losses through bogging in open swamps and wetlands • Feral animal (predator) control
	Turn off weight	<ul style="list-style-type: none"> • Finishing steers during the dry season to achieve high turnoff weights • Improved lactation and early growth of out-of-season calves resulting in improved growth
Social and Environmental sustainability	Quality of life and incomes for producers	<ul style="list-style-type: none"> • Landholders appreciating the amenity of conservation sites on their properties • Potential for increased incomes through targeted finishing and sales of animals • Potential higher asset value and increased attraction for prospective property purchasers
	Appropriate stocking rates for long term carrying capacity	<ul style="list-style-type: none"> • Increase landholder understanding of productive potential of land under altered stocking rates and management • Better understanding of how to deploy short duration grazing pressure for improved economic and land condition outcomes
	Stewardship of natural assets	<ul style="list-style-type: none"> • Sustain or improve habitats and biodiversity to improve ecological function across surrounding rangelands .
	Climate risk management	<ul style="list-style-type: none"> • Improved stock access to cool clean water and shade • Build business resilience with strategic reserves of funds, forage and water • Increased potential for diversification
Reduce production costs per animal	Increase labour efficiency	<ul style="list-style-type: none"> • Reduce mustering effort and costs • Increase work health and safety
	Reduce supplementary inputs	<ul style="list-style-type: none"> • Better foraging environments to reduce the need for feed supplementation
	Financial literacy and managing debt	<ul style="list-style-type: none"> • N/A



CONSERVATION OF NATIVE VEGETATION AND BIODIVERSITY AS GOOD PASTORAL BUSINESS

The evidence of this document suggests that the implementation of conservation (specifically TCAs) on pastoral properties can support and strengthen business outcomes in diverse ways: It highlights how conserved native vegetation and ecosystems can drive increased productive performance and sustainability, with this potentially translating to monetary revenues and helping to buffer against climatic variation or market disruptions. It further notes the opportunity for the industry to respond to evolving consumer preferences and better engage with markets by demonstrating sustainability along value chains.

Three distinct case studies were undertaken to explore the implementation of TCAs under different production and management environments. These case studies have demonstrated how the TCA mechanism has been utilised in different ways to meet diverse producer goals. Overall, they reveal that conservation management of high value sites has been used to enhance production efficiencies, to support improved stock management and invest in the unrealised value of productive natural capital. Although the outcomes achieved through individual programs of conservation management broadly reflect the level of producer input, all participating producers report that TCA implementation has been beneficial to their business, with tangible (or intangible) benefits expected to outweigh costs in the long term. All TCA investments were expected to breakeven and starting making clear profit within the 10 year timeframe of the original agreement. Producer consensus on the business viability of TCAs reflects the broader feedback obtained from 17 pastoral land managers interviewed for the TCA program review²⁴.

24 Bubb (2019) *ibid*

