a Climate Clever Beef (CCB) case study

FutureBeef

A Julia Creek beef trading enterprise

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Overview

A trading enterprise located at Julia Creek, in the Southern Gulf region, was used to analyse livestock data, land condition, soil carbon and fertility, and greenhouse gas (GHG) emissions of a typical beef trading enterprise on Mitchell Grass Downs (MGD) country.

The analysis was performed as part of the Climate Clever Beef (CCB) project, to assess the potential for the northern beef industry to minimise emissions from livestock and increase carbon sequestration in the soil through on-farm practices that also improve the productivity and profitability of the business. The trading enterprise was also compared to two breeding enterprises on MGD country.

The property owners are continually looking to improve their production capacity and efficiency of their land resources; which is being achieved through wet season spelling, pasture budgeting and woody weed control. Many of these production strategies and improvements also help to improve GHG emissions intensity and business outcomes, such as increasing kilograms of beef produced.

Image 1. Breeders grazing on Mitchell grass at Julia Creek, November 2014.

Queensland Government

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Land condition

Generally, land condition is in A to B condition across the main paddocks, indicating excellent productivity potential (≥ 75% of original carrying capacity). The property is predominantly MGD country on black soil with some creeks and also patches of prickly acacia. Woody weeds are well controlled with annual poisoning of new trees and fencing off of heavily infested areas to reduce seed spread by livestock. Pastures are generally dominated by Mitchell grass, which is a desirable 3P species (productive, palatable and perennial). Ground cover is excellent and there is little evidence of declining soil surface condition.

The property manager conducts pasture budgeting annually to ensure that adequate residual pasture and ground cover is maintained in the paddocks. A wet season spelling program has been implemented, with 20–25% of the property rested each year to allow pasture regeneration and to ensure the quantity and quality of pasture will be adequate for the year ahead.

Image 2. Mitchell grass paddock that was spelled over the wet season and kept for weaners in the mid year.

The Climate Clever Beef project

The beef industry contributes 79% of the GHG emissions produced by agricultural practices in Australia (with 67% being methane from ruminants). The CCB project, supported by the Australian Department of Agriculture, aims to assess the potential for the northern beef industry to minimise emissions from livestock and increase carbon sequestration in the soil through on-farm practices that also improve the productivity and profitability of the business. Project teams are working with properties throughout Queensland as well as in the VRD and Barkly regions of the Northern Territory.

Trials have included two properties in the Queensland Gulf—Oakleigh (Kidston) and Karma Waters (Mitchell River)—as well as Mitchel grass downs properties at Julia Creek, Boulia and Longreach. The focus on this property was to use the recorded liveweight, faecal NIRS and average daily gains (kilograms/head/day) data to analyse the GHG emissions from a trading enterprise.

Cattle enterprise

Soil carbon and fertility

Two sites were chosen on the property that reflect the soil type and pasture species seen across the property. Site 1 (see Image 3) represents MGD country that was cleared from prickly acacia (which the property manager estimates had had been there for 20 years) in 2011 and has since been relatively free of this woody weed. Site 2 (see Image 4) is MGD country with no history of prickly acacia infestation. Core soil samples were taken to measure the carbon content and fertility of the soils.

Soil fertility test results are summarised in Table 1. While differences can be seen in the amount of phosphorus and sulphur at both sites this is not influenced by the old infestation of prickly acacia at Site 1. The overall fertility at both locations was good, with the phosphorous level indicating supplementation would not benefit cattle during the wet season. This has also been confirmed through the faecal Near-infrared Spectroscopy (NIRS) analysis.

Table 1. Soil fertility test results.

	Site 1 ***Cleared Prickly Acacia Mitchell Grass Downs***	**Site 2** ***Mitchell Grass Downs, No Prickly Acacia***
Soil texture	Clay	Clay
pH (water)	8.60	8.00
Phosphorus (Colwell) (mg/kg)	9.50	20.00
Sulphur (mg/kg)	4.60	10.00
Calcium (cmol/kg)	34.00	29.00
Magnesium (cmol/kg)	2.80	3.40
Potassium (cmol/kg)	1.00	1.10
Zinc (mg/kg)	1.10	0.40
Copper (mg/kg)	0.58	0.70
Manganese (mg/kg)	8.80	13.00

The amount of organic carbon (OC) stored in the soil was also measured at two depths, 0–10 cm and 10–30 cm (see Table 2). There was no significant difference in OC levels between the two sites indicating that the presence of prickly acacia did not change the amount of OC held within the soil. The amount of OC at both sites is low (0.42% to 0.51%).

Table 2. The amount of organic carbon (OC) stored in the soil was measured using core soil samples from both the cleared prickly acacia and Mitchell grass sites. These measurements were taken at two soils depths, 0–10 cm and 10–30 cm.

Site	Depth	OC
Cleared acacia patch	0–10 cm	0.51%
	10–30 cm	0.45%
Mitchell grass patch	0–10 cm	0.48%
	10–30 cm	0.42%

Image 3. Site 1—Cleared MGD. Prickly acacia, an exotic woody weed, was cleared in 2011.

Image 4. Site 2—MGD with no history of prickly acacia infestation.

Faecal analysis and feed quality

Monthly faecal sampling, including NIRS and wet chemistry phosphorus analysis, is used on the property to track pasture quality changes and refine dry season supplementation. Average monthly crude protein (CP), digestibility and faecal phosphorus (FP) are summarised in Image 5. The fluctuations in feed quality are typical of extensive beef operations with higher CP and digestibility values and, therefore, superior feed quality in the wetter months. Generally the soils on the trial property are considered to have adequate phosphorus levels and this is supported by the reported faecal phosphorus levels. As previously mentioned, soil sampling undertaken (see Table 2) suggests soil phosphorus levels are adequate and there would be no expected economic production response to feeding cattle wet season phosphorus.

Generally the NIRS data suggests that dry season feeding of a urea supplement would be economical in very few years, with the average dry matter digestibility to crude protein (DMD/CP) ratio being less than eight in most months (an economical response can be seen when this ratio is greater than eight). The average DMD/CP ratio for the four years in September rose to 8.1, which would suggest that there may be some economic benefit to feeding urea at that time.

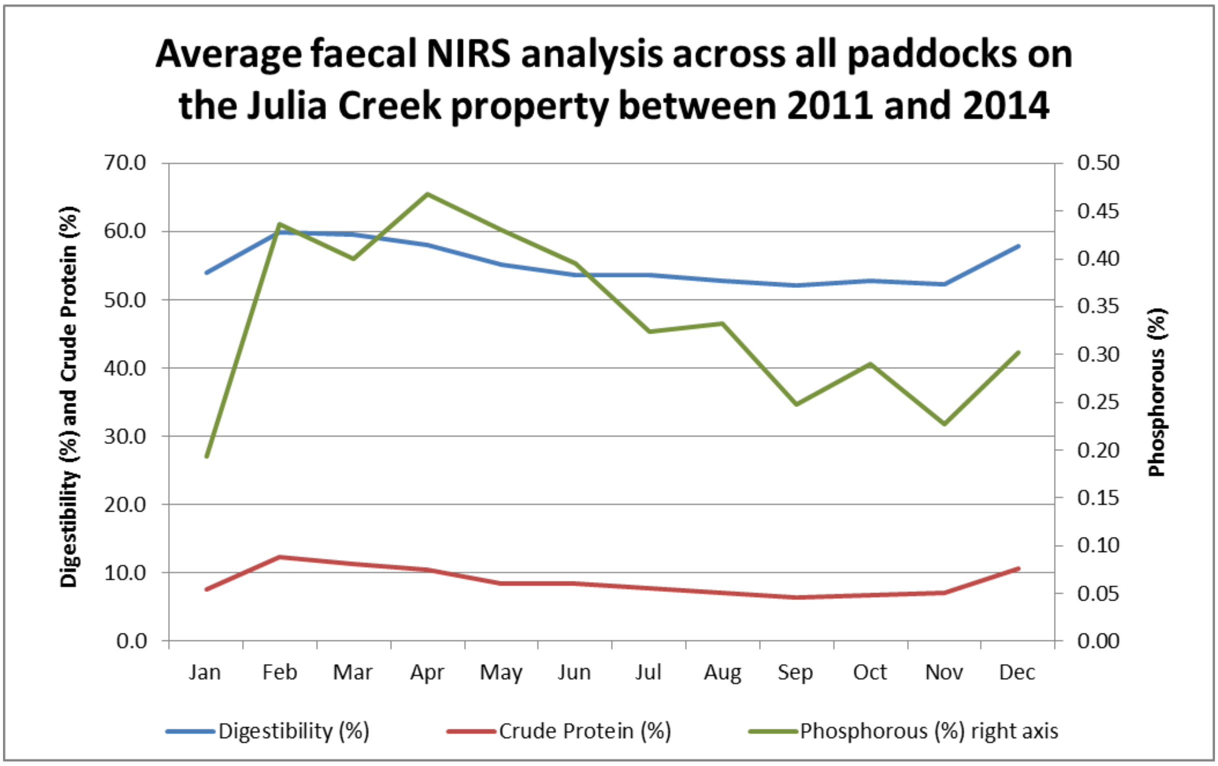

Image 5. Total average analysis across all paddocks on the Julia Creek property, 2011–2014.

Greenhouse gas emissions

Liveweight and production data over two years was used from the trading operation to analyse the greenhouse gas (GHG) emissions of the herd and enterprise. Analyses provided a number of emissions outputs for a typical trading enterprise on MGD country (Table 3). GHG modelling has also been used on two breeder blocks located on MGD country at Longreach and Boulia. These results (Table 4) indicate emissions from a breeding operation are far greater than those from a trading enterprise.

Table 3. Greenhouse gas emissions data modelled for the trading enterprise using the property's liveweight, average daily gain and livestock number (sales, purchases, keepers) records.

Greenhouse Gas Emissions	Trading Enterprise	
Source of Emissions (Type)	Year 1	Year 2
Total livestock emissions	**3,085**	**2,178**
Turn-off (kg)	519,231	777,298
Average number of AE	1,522	1,060
Emissions per hectare (t CO_2e per ha)	0.06	0.04
Emissions (t CO_2e) per t of beef produced	**5.94**	**2.80**
Emissions per AE	2.03	2.05

From Table 3 it can be seen that the trading enterprise (mainly steers) has an average emissions per adult equivalent (AE) of 2 t CO_2e. On a per hectare basis emissions were lower in the trading enterprise (0.06 and 0.04 t CO_2e/ha) when compare to the breeder block at Longreach (0.15 t CO_2e/ha), which is due mostly to the decreased stocking rates associated with the steer operation and overall efficiency of a trading enterprise. The breeder block at Boulia runs at similar stocking rates to the trading enterprise, hence why the emissions per hectare (0.04 t CO_2e/ha) are similar.

Table 4. Greenhouse gas emissions data modelled for two breeding enterprises run on Mitchell Grass Downs country at Longreach and Boulia.

Greenhouse Gas Emissions	Breeding Enterprises	
Source of Emissions (Type)	**Longreach**	**Boulia**
Turn-off (kg)	236,300	238,000
Average number of AE	1,750	1,842
Emissions per hectare (t CO_2e per ha)	0.15	0.04
Emissions (t CO_2e) per t of beef produced	**14.9**	**15.3**

When assessing emissions it is important to assess gross enterprise emissions and emission intensity per tonne of liveweight sold. When compared to breeding enterprises a steer or trading operation has a greater annual turnover of kilograms of beef and, therefore, the GHG emissions per tonne of beef sold are much lower (5.94 and 2.80 t CO_2e per tonne of beef produced, compared to 14.9 and 15.3 t CO_2e per tonne of beef produced in the breeding enterprises).

The GHG emissions reflect both the changes in total stock numbers on the property and the difference between breeding and trading enterprises. There was a large difference in total emissions between Year 1 and Year 2 in the trading enterprise, reflecting the much lower cattle numbers in Year 2 (Table 3). More kilograms of beef were turned off the property in Year 2 making the total emissions per tonne of beef produced much lower (2.8 t CO_2e in Year 2 compared to 5.94 t CO_2e in Year 1). It is difficult, however, to fully compare breeding and trading enterprises in this way as this analysis does not take into account the emissions to produce the animals in the trading enterprise before they are brought onto the property.

Conclusion

Through modelling the MGD property at Julia Creek has been able to assess the GHG emissions of the trading enterprise that was run there in Year 1 and Year 2. This data was compared to two breeding enterprises also run on MGD country. While it may not always be possible to decrease total emissions from the herd, it is often possible to improve emission intensity. Improving emission intensity ensures that the greatest production is gained for each tonne of CO_2e output and the business is therefore more likely to be operating at maximum potential. Many of the production improvements that improve emission intensity are seen as industry best practice and often also work to improve business outcomes, such as increasing profit. Therefore, focussing on implementing strategies that will improve the productivity and profitability of the beef business in the long-term is a win–win scenario.

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