a Climate Clever Beef (CCB) case study

FutureBeef

Herd productivity and greenhouse gas emissions—Karma Waters, Mt Carbine

30 March 2015

Overview

Alan and Karen Pedersen purchased Karma Waters, located 65 km north-west of Mount Carbine, in 1991. While attempting to develop this totally undeveloped block of 45,000 ha, a Native Title claim was triggered. This saw property development frozen, with the State and the Pedersen family in Federal Court negotiations for the next seven years. A Perpetual Lease was granted in 1999 that lifted property development restrictions. For over five years off-property income was the only way to pay off debt accrued during the long period of court negotiations. Since this time the Pedersen family has steadily developed the property and slowly built stock numbers up to current levels. Now there is very good fencing and water (dams) infrastructure on 13,000 ha, with the remaining 32,000 ha of the property undeveloped and not carrying cattle. Karma Waters currently runs around 1,300 head and includes a breeding enterprise turning off four year old bullocks to the Mareeba saleyards or Townsville meatworks.

Image 1. The Pedersen family—Ian, Alan, Karen, Jack (at back) and Robert.

Queensland Government

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The level of development across the 13,000 ha has been funded mostly through off-farm income streams, with a “steady as she goes” mentality to minimise debt. Karma Waters’ land value has actually fallen in the last eight years, with the unimproved value dropping from $880,000 to around $600,000 and market value decreasing from $4.5 million to around $2.5 million today. The cattle business will continue to lose money until the property is 80% developed and stocked. The Pedersens could have borrowed money to complete this development more quickly, but this may have led to unstainable debt, like the situation across many northern beef enterprises. Alan and Karen believe equity is everything and ‘Steady, steady wins the race!’.

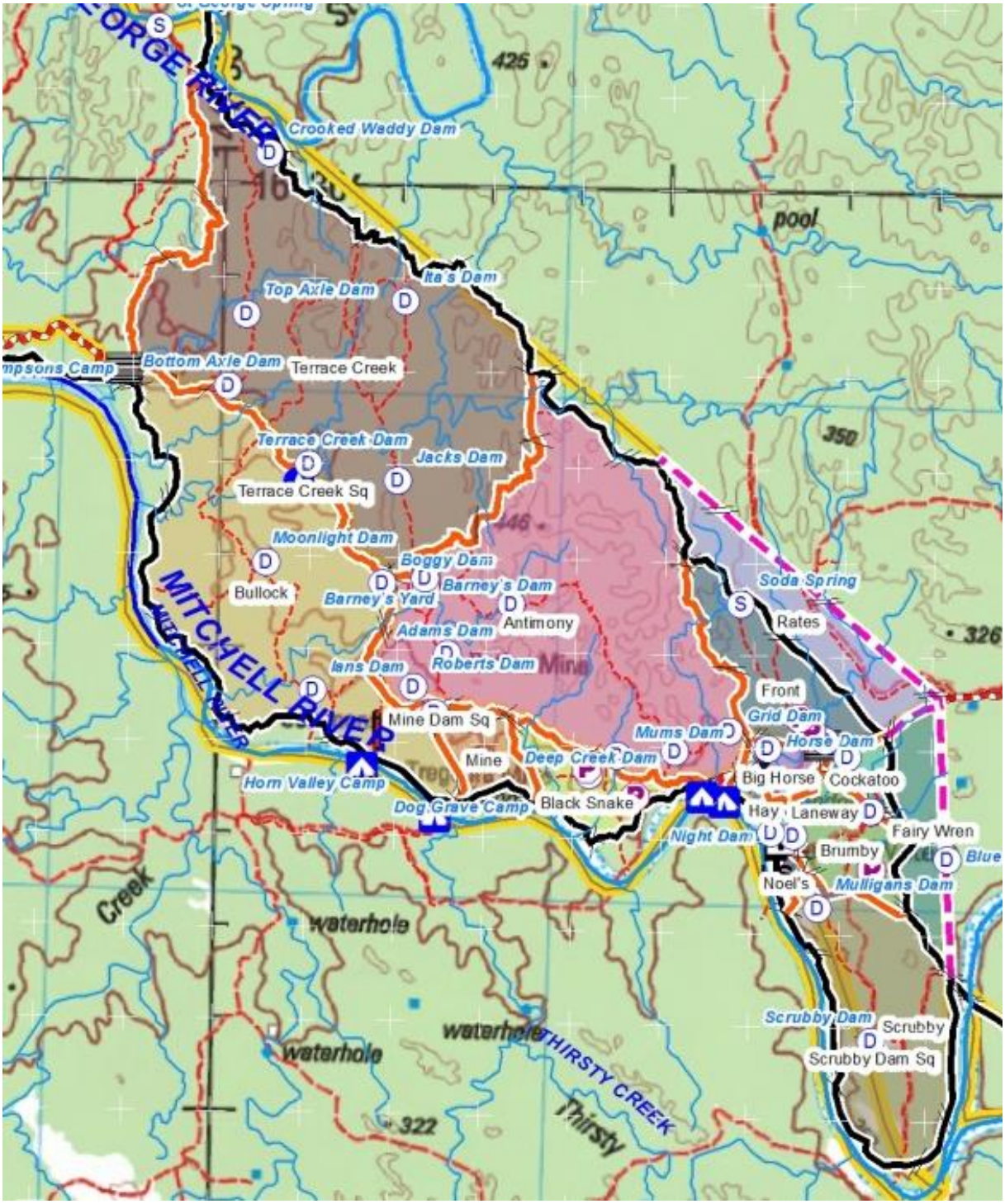

Image 2. Karma Waters paddock and infrastructure map (developed section of property only).

Alan and Karen are strong advocates for the beef industry and local community. Alan is very active in local government and has been a Councillor of Mareeba Shire for 10 years. Karen spent several years on the Cairns School of Distance Education Parents and Citizens Association and was a board member/treasurer of the Cairns to Karumba Bike Ride for over a decade, raising money for bush kids. Karen is also a member of the Cairns Radio Branch of the Isolated Children's Parents' Association and coordinates the "Australia's Biggest Morning Tea" at Mt Carbine. Alan (president) and Karen (secretary) are both involved with the Mt Carbine Rodeo Association.

Climate Clever Beef

Karma Water is typical of many family breeding operations in north-west Queensland in terms of scale, the grazing resource and herd productivity. Alan and Karen, as strong industry advocates, are very concerned about the social and financial well-being of many northern beef producers due to the sustained pressure of low profitability, debt and a series of poor or failed wet seasons. It is estimated the beef industry is contributing 79% of greenhouse gas (GHG) emissions produced by agricultural practices in Australia, mostly in the form of methane from livestock. The Pedersen family chose to participate in the Climate Clever Beef (CCB) project to, firstly, identify feasible and profitable herd and grazing practices on Karma Waters and, secondly, assess carbon farming options that may be available to extensive beef enterprises.

Grazing management

Land types on Karma Waters include the better alluvial soils on the Mitchell River and other watercourses, Ironbark gravelly ridges, Shale to Grey Wackie and steep Shaley hill country. Average rainfall over the last two decades on Karma Waters has been 838.5 mm, but it remains a challenge to manage for seasonal variability (Image 3).

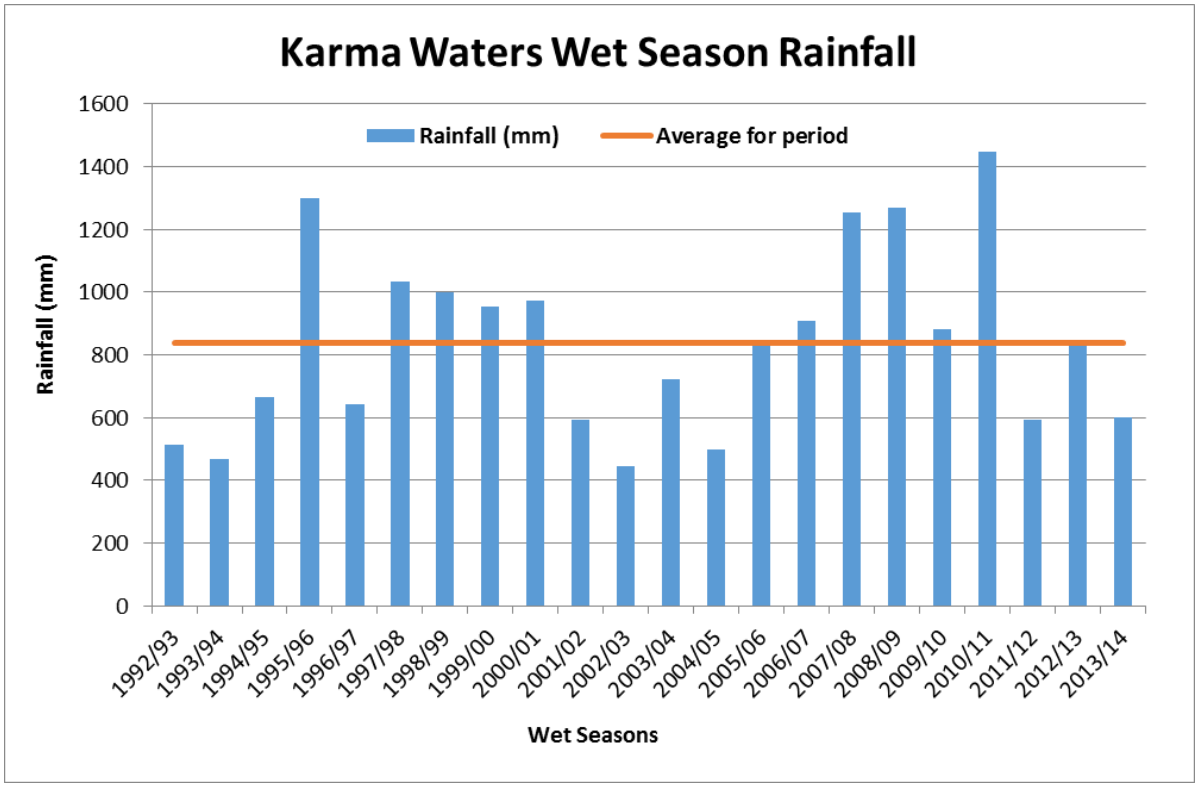

Image 3. Wet season rainfall on Karma Waters, 1992/93 to 2013/14.

Alan believes a stocking rate of one adult equivalent to 16 hectares (1 AE:16 ha) combined with wet season spelling and 20% Stylos will allow him to get through a run of dry years without major destocking. Most paddocks include a mix of land types and the ideal distance to water is around one kilometre (dams 2 km apart) due to the hilly country.

Image 4. Brumby paddock—Slashing fence lines where possible, rather than clearing with a blade, greatly reduces fence line erosion.

With around 2.5 metres of evaporation annually per year on Karma Waters, Alan prefers dam excavations of 4–5 metres to supply stock water for at least 18 months. There are 32 dams on Karma Waters, mostly located on shales. Dam sites are cleared to bedrock to eliminate cattle bogging. One breeder mob alternates between Terrace Creek and Antimony paddocks to allow a wet season spell every second year. A second breeder mob alternates between Black Snake and Front Dam, with each paddock often receiving a wet season spell every second year. The Bullock paddock includes some of the best country on Karma Waters and runs steers and cull or spayed cows. Weaners are generally run in Brumby paddock, where there is good Seca Stylo established.

Image 5. Wet season spelling in 2013 in Black Snake paddock (on the right with Antimony paddock on the left).

Image 6. Good Seca Stylo in Brumby paddock.

Since 2003 the Pedersen's have established 16,000 hectares of Stylo pastures to improve diet quality, annual liveweight gain and carrying capacity. Seca and Verano were aerially sown at 0.5 kg after paddocks were burnt to reduce competition from the native pastures. Areas are burnt following 50–100 mm of rainfall, so Stylos were generally sown in December–January. As a general rule of thumb it took five years to properly establish the Stylos, with Seca being the standout performer. Seca Stylo has greatly improved dry season pasture digestibility and protein and has increased average annual liveweight gain on Karma Waters by 20–30 kg per head.

On the lighter country Seca can easily dominate the native pastures. Although more Seca means better herd performance the Pedersen family are not keen to see a pasture monoculture and prefer a mix of native pastures and Stylos. A burning program is in place to control woodland thickening and to maintain a healthy and productive grass–Stylo mix.

Approximately 200 hectares were cleared in Cockatoo paddock in December 2005 and Seca Stylo is well established. Recent soil tests indicate reasonable levels of phosphorus but very low sulphur, which is a concern for Stylo production. Granulate sulphur (90% S) was applied to 80 ha at 30 kg/ha in Cockatoo paddock in late 2014 to assess the production benefits and affordability of a fertiliser program for weaner or steer paddocks.

Herd management and nutrition

Low branding rates and low annual weight gains are the key herd productivity constraints on Karma Waters. Breeder mortalities combined with losing cattle to neighbouring properties during the wet season are also impacting on enterprise profitability. Alan and Karen believe the most important steps to lift lifting breeder performance and steer weight gain include good water development, wet season pasture spelling, Stylos, phosphorus supplementation and conservative stocking rates.

Image 7. Various wet season phosphorus feeding methods have been trialled on Karma Waters including blocks (above), uncovered bulk bags and loose lick under sheds.

Since 2011 the Pedersens have also focused on feeding wet season phosphorus and removing bulls at the second round muster (August/September) to reduce the number of second round weaners. Soil testing indicates phosphorus levels on Karma Waters are marginal (4–5 ppm), with some isolated frontage areas ranging from 8–10 ppm soil phosphorus. Wet season phosphorus is fed to all cattle and phosphorus is also added to dry season supplement while pasture quality holds.

Image 8. Feeding wet season phosphorus (13% P as fed) under lick sheds reduces rain damage and is the most cost effective delivery method. Some P blocks are still used in the hilly country.

Over many years Alan has observed poor growth rates in his steers, particularly during their second dry season. A new crush, load bars and indicator (Image 11) were recently purchased to improve herd recording and better monitor the impact of Stylos, phosphorus feeding, stocking rates and rotational spelling on weaning rates, as well as weaner and steer liveweight gains.

Faecal testing and pasture quality

A faecal testing program began in 2011 using Near-infrared Spectroscopy (NIRS) to assess diet quality (dry matter digestibility and protein) and faecal phosphorus levels. The Pedersens now have a detailed history of seasonal diet quality across the main breeder and steer paddocks over four years (Table 1).

Diet quality data collected every four to eight weeks highlighted the value of Stylo pastures coming into the drier months, with protein levels often at 6–7% and digestibility above 51% in November across several paddocks. This diet quality is above the maintenance levels of growing cattle and weight gain in steers would be expected. It is not uncommon to see native pasture protein and digestibility levels sink below 5% and 48% respectively this time of year on similar country, resulting in weight loss across all classes of cattle. Faecal phosphorus levels have helped refine the wet season phosphorus feeding program on Karma Waters. Regular dry season faecal testing has often indicated low phosphorus may limit production and weight gain in the Stylo paddocks where late season digestibility and protein is

above animal maintenance levels. NIRS also estimates the non-grass percentage in the diet, which generally indicates the level of Stylo and top-feed intake. Non-grass percentages are generally low in the wet season and high in the dry season, particularly in the Stylo paddocks.

Table 1. Faecal test results, October 2011 to December 2014.

Paddock Description	Faecal Phosphorus (mg/kg)		Protein (%)		Digestibility (%)		Non-grass (%)	
	High	Low	High	Low	High	Low	High	Low
Brumby Poorer country with good Seca	3,205	1,336	11.03	5.20	59.41	49.40	76.57	13.50
Terrace Creek Some good creek frontage, some Seca	3,760	1,505	11.10	5.72	56.95	51.31	35.00	3.00
Black Snake No creek frontages, good levels of Seca	5,170	1,343	11.33	4.30	58.77	51.10	75.90	5.80
Bullock Two creeks, good open country, good 3P grasses, some Seca	3,690	1,264	11.04	3.10	59.90	48.55	47.00	5.92
Antimony Grey Wackie Shale ridges, good Seca	2,964	1,213	11.72	6.56	58.39	49.76	79.00	26.25
Front Grey Wackie Shale ridges, good Seca	1,712	1,250	9.81	7.56	54.06	50.45	67.74	37.08

Pasture monitoring program

A pasture monitoring program has been in place on Karma Waters since 2005, with two sites in Black Snake and two sites in Front Dam paddock. Breeders are rotated between these paddocks to allow a wet season spell every second year. Spelling duration, rainfall and burning details are recorded each year as well as ground cover, native pasture composition and density of Seca and Verano. The photos series in Images 9 and 10 show an increase in both 3P pastures and Stylos from 2008 to 2013.

Image 9. Black Snake paddock near dam, April 2008.

Pastures

- Ground cover 70%
- 55% fire grass
- 10% black spear
- 10% giant spear
- 10% fire grass
- 10% Verano
- 5% native sorghum
- Blue tipped grass evident also—very palatable

Season

- 50" of rainfall from November 2007 to April 2008

Comments

- Destocked over the wet
- Not burnt
- Aerial seeded with Verano/Seca January 2008

Image 10. Black Snake paddock near dam, April 2013.

Pastures

- Ground cover 80%
- 50% Verano, Seca
- 30% black spear, native sorghum, fire grass
- 10% weeds
- 10% herbage

Season

- Late start to wet; 26" of rainfall from mid-January to April 2013

Comments

- Locked up since September 2012, unburnt

Herd productivity and emissions

Annual liveweight gains in growing cattle range from 60–90 kg/head and female deaths combined with losses to neighbouring properties is high at 8% each year. Given the topography and watercourse network on Karma Waters, flood gates and paddock security are very difficult to maintain during most wet seasons. Long-term branding rates were estimated to be 45% up until 2012, but are now approaching 60% due to a combination of key pasture and herd management practices.

Image 11. Newly installed vet crush. Weaner, steer and sale cattle weights are now part of the herd recording program on Karma Waters.

Low branding rates (45%) and a high breeder death/loss rate contributed to historically low annual female sales, with cows and heifers making up only one third of the total turnoff from Karma Waters each year (Table 2).

Herd analysis, conducted in 2012, compared the current bullock turnoff at 4–4.5 years with a range of younger steer and weaner turnoff strategies. Gross margins per Adult Equivalent (AE) steadily declined as turnoff age decreased, with weaner gross margins estimated to be nearly $15/AE behind the current bullock operation.

Image 12. Bullock turnoff is more profitable on Karma Waters than selling younger cattle.

Table 2. Karma Waters age of turnoff and gross margins (2012).

	Turnoff 4.5 years	Turnoff 3.5 years	Turnoff 2.5 years	Turnoff 1.5 years	Turnoff Weaners
Total adult equivalents	1,000	1,000	1,000	1,000	1,000
Total cattle carried	1,113	1,062	1,045	1,009	930
Total breeders mated and kept	487	487	530	575	606
Total calves weaned	222	222	242	262	276
Weaners/total cows mated	45%	45%	45%	45%	45%
Overall breeder deaths and loss to neighbours	8%	8%	8%	8%	8%
Female sales/total sales %	38%	38%	38%	37%	37%
Total cows and heifers sold	64	64	69	75	79
Total steers and bullocks sold	101	102	113	124	132
Average female price	$385.03	$385.03	$385.03	$385.03	$385.03
Average steer/bullock price	$674.39	$594.00	$480.00	$330.00	$250.00
Net cattle sales	$94,763	$87,100	$83,114	$72,423	$66,319
Direct costs excluding bulls	$29,562	$28,392	$28,810	$28,884	$25,579
Gross margin for herd	$65,393	$58,900	$54,514	$43,767	$40,979
GM per adult equivalent	$65.39	$58.90	$54.51	$43.77	$40.98

Image 13. Ironwood posts and Leichhardt Pine bearers are used for lick sheds on Karma Waters. Each shed costs around $600, including corrugated iron and labour, when 12 sheds are built at one time.

The FarmGas Model was also used in 2012 to estimate the emission of carbon dioxide equivalents (CO_2e) from the herd and the overall beef enterprise on Karma Waters. Total CO_2e emission each year steadily decreased from 1,764 tonnes with the current bullock turnoff to 1,525 tonnes if the Karma Waters production system moved to selling weaners. However, emission intensity improved, with CO_2e per tonne of liveweight sold increasing from 23.2 tonnes for bullock turnoff to 28.7 tonnes for a weaner operation.

Table 3. Impact of turnoff age on gross margins and GHG emissions.

	Turnoff 4.5 years	Turnoff 3.5 years	Turnoff 2.5 years	Turnoff 1.5 years	Turnoff Weaners
Gross margin for herd	$65,393	$58,900	$54,514	$43,767	$40,979
Gross margin/AE	$65.39	$58.90	$54.51	$43.77	$40.98
Greenhouse gas (GHG) emissions					
Total GHG emissions (t CO_2e/year)	1,764	1,652	1,587	1,560	1,525
GHG emissions/AE (t CO_2e/AE)	1.76	1.65	1.59	1.56	1.53
GHG emissions/turnoff (t CO_2e/t liveweight sold)	23.2	23.2	24.6	26.6	28.7

Soil carbon

In June 2013 two 1 ha sites were selected for a soil carbon study. The aim was to compare soil carbon accumulation under native pastures with Stylos (Site 1) with the soil carbon stocks under native pastures (Site 2). The native pasture–Stylo paddock received a spell every second year and was in A- condition while the native pasture paddock was continuously grazed and in poorer condition (B–C). Soil carbon was examined at depths of 0–10 cm and 10–30 cm. There was no significant difference in stored carbon (tonnes per hectare) between the two sites at either depth (Table 4).

Image 14. Site 1, native pasture plus Stylos.

Image 15. Site 2, native pastures, poor condition.

Table 4. Stored carbon (tonnes/hectare) at 0–10 and 10–30 cm.

Depth	Stylo	No Stylo
0–10 cm	18.71	16.63
10–30 cm	6.38	6.91

There was no significant difference between the two sites for nitrogen (tonnes per hectare) at 0–10 cm; however, there was a significant difference between the two sites at 10–30 cm, with Site 2 (native pastures) considerably lower than Site 1 (native pasture–Stylos).

Table 5. Stored nitrogen (tonnes/hectare) at 0–10 and 10–30 cm.

Depth	Stylo	No Stylo
0–10 cm	1.69	1.64
10–30 cm	**1.21**	**0.92**

Conclusion

Based on herd and FarmGas modelling, the GHG emissions from Karma Waters and other Gulf breeding enterprises ranges from 11.7 to 23 tonnes of carbon dioxide equivalents (CO_2e) to every tonne of liveweight sold off the property. Branding, growth and death rates are not only the key profit drivers of any breeding business but directly influence total GHG emissions as well as emission intensity. Due to the extensive nature of northern breeding enterprises and the accuracy of herd recording systems, it is very difficult to, firstly, identify exact emissions each year and, secondly, to validate reduced emissions or lower emission intensity.

Claiming emission reductions and subsequent income is subject to a detailed “integrity” test and must:

- Go beyond normal practice
- Be measureable
- Be conservative
- Be based on peer review
- Be internationally consistent
- Avoid carbon leakage

The Karma Waters CCB case study clearly outlines how difficult it would be for extensive beef producers to participate in Carbon Farming Initiatives and Carbon Trading schemes.

Acknowledgements

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