



Part 2 - Low cost strategies to build the resilience of beef production systems in northern Australia

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Part 1 - Improving the performance of beef production systems in northern Australia

1. What are the strategies most likely to improve the profit and resilience of your beef production system?

2. How can you assess alternative strategies?

Estimating the change in profit is the only way of knowing whether you are improving performance

Part 2 considers low cost strategies focussed more on optimising the current production system than making significant change to production targets

Summary of the findings of Part 1

- Identifying the P status of the herd and addressing any P deficiency is the first priority
- Median rates of mortality are critical and need to be addressed with “whole of property” strategies
- Future investment in perennial legumes for steer nutrition is key
- Target low cost strategies when looking at the performance of the breeder herd in isolation



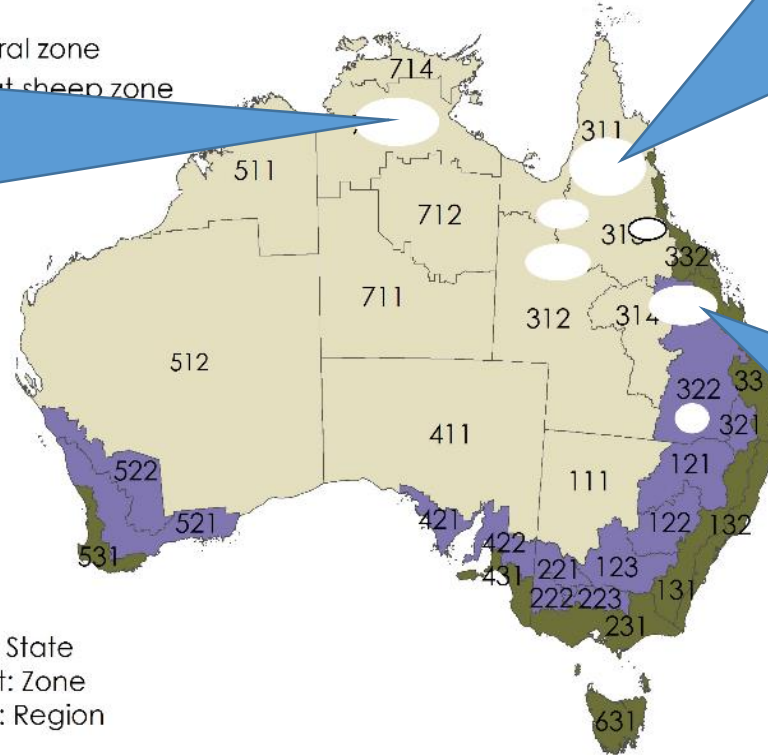
- PART 2 - Implement **low-cost strategies to aid resilience**:
 - ✓ body condition
 - ✓ herd structure
 - female cull age (effects herd profit and herd resilience)
 - age of steer turn-off (effects number of breeders in the herd)

Regional property models

Katherine /VRD/Sturt
Plateau
147,000ha
7,400AE
Live export steers

Australian broadacre zones and regions

Pastoral zone
Wheat sheep zone



1st digit: State
2nd digit: Zone
3rd digit: Region

NQ Gulf
30,000ha
1,500AE
Live export steers

Fitzroy
8,700ha
1,500AE
Feed on steers

The data

- We worked with about 30 property owners and managers across northern Australia to compile case studies looking at their options
- Key technologies were identified by industry participants and RD&E staff and combined with representative property models to look at expected returns.
- Regional, survey and research (response) data derived from:
 - *Cash Cow* project
 - *Determining property-level rates of breeder cow mortality in northern Australia* project
 - *High Output Forages* project
 - *Phosphorus supplementation of Brahman heifers in Phosphorus deficient country in the NT* project
 - Numerous research and extension publications

Low cost strategies that aid resilience

Managing breeder body condition



1



2



3

Body condition
scores



4



5

Modelling body condition and rates of mortality

How do you convert a picture of a cow into an economic model?

5 point scale description	9 point scale description	BCS value	Calculated BCR	Bodyweight
	Emaciated	0	0.50	225
1 Poor	Very poor	1	0.60	270
	Poor	2	0.70	315
2 Backward	Backward store	3	0.80	360
	Store	4	0.90	405
3 Moderate	Forward store	5	1.00	450
	Prime	6	1.10	495
4 Forward	Fat Prime	7	1.20	540
	Fat	8	1.30	585
5 Fat	Over-fat	9	1.40	630
			1.50	675

Standard reference weight

The fitted statistical equation for mortality (Mayer et al 2012) is

mortality (%) = $100/(1+e^{-\text{logit}})$, where

logit= $-21.3+40.7 \times \text{BCR}-24.2 + \text{BCR}^2 +1.05 \times \text{Age} -0.0255 \times \text{Weight change} -0.893 \times \text{Age} \times \text{BCR}$;

cohort-level data covering 17,100 cow-years from six sites across northern Australia

Predicted rate of mortality by class of female stock starting with a moderate BCS (3 or 5)

What are the mortality risks of females of different ages losing bodyweight (assumption = Body Condition loss)

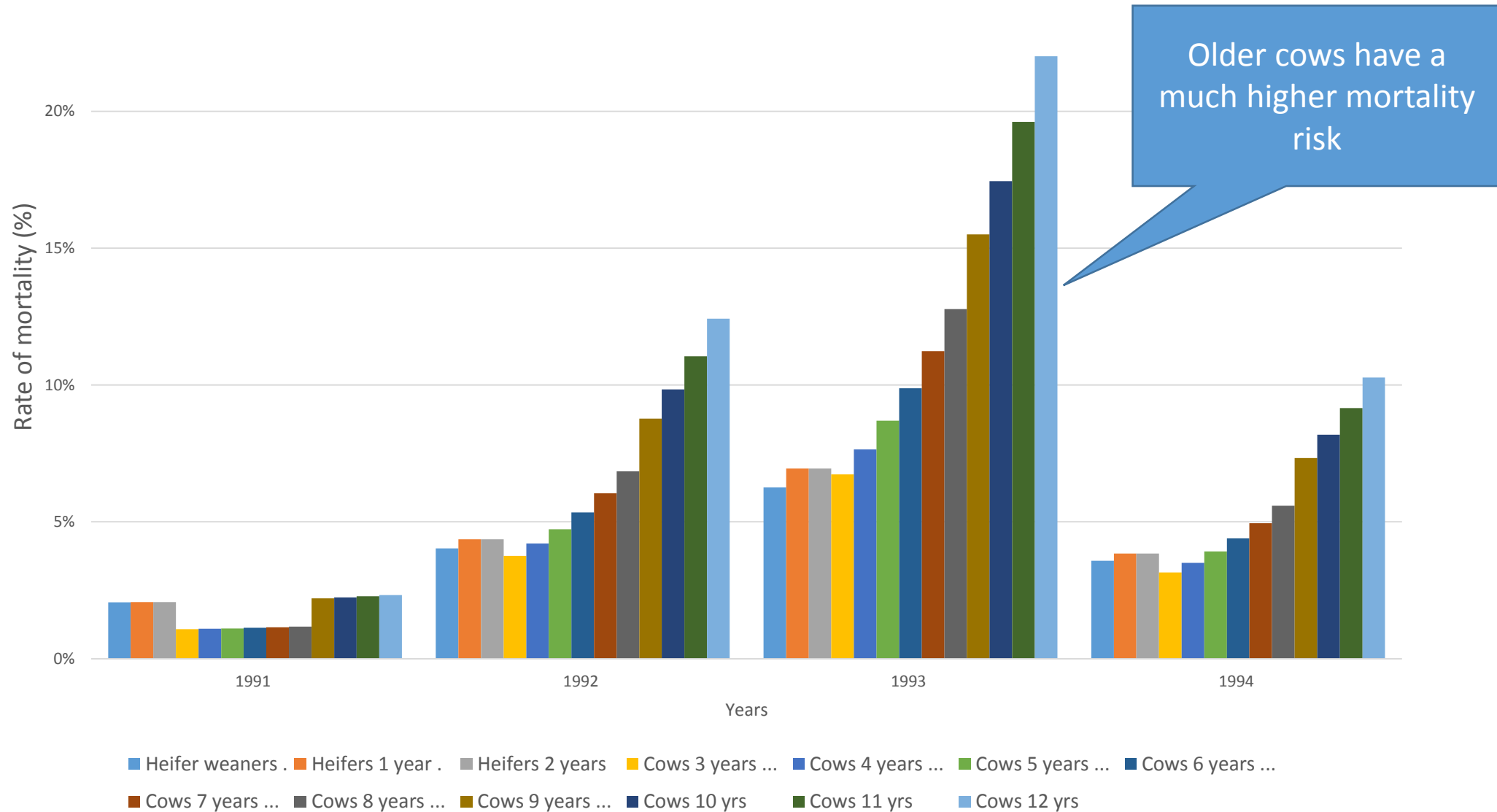
Description	Body weight loss (in kilograms)				
	-20	-40	-50	-60	-80
Heifer weaners.	1.58%	2.60%	3.33%	4.26%	6.89%
Heifers 1 year.	1.84%	3.03%	3.88%	4.95%	7.97%
Heifers 2 years	1.84%	3.03%	3.88%	4.95%	7.97%
Cows 3 years	2.15%	3.53%	4.50%	5.74%	9.20%
Cows 4 years	2.50%	4.10%	5.23%	6.65%	10.60%
Cows 5 years	2.92%	4.77%	6.07%	7.69%	12.19%
Cows 6 years	3.40%	5.53%	7.02%	8.88%	13.97%
Cows 7 years	3.95%	6.41%	8.12%	10.24%	15.96%
Cows 8 years	4.59%	7.42%	9.37%	11.77%	18.18%
Cows 9 years	5.33%	8.57%	10.79%	13.51%	20.64%
Cows 10 years	6.18%	9.89%	12.40%	15.45%	23.33%
Cows 11 years	7.16%	11.37%	14.21%	17.61%	26.25%
Cows 12 years	8.27%	13.06%	16.23%	20.00%	29.40%
Cows 13 years	9.54%	14.94%	18.48%	22.64%	32.76%

Predicted rate of mortality by class of female stock starting with a store BCS (2.5 or 4)

What are the mortality risks if we start with a slightly lower Body Condition Ratio?

Description	Body weight loss (in kilograms)				
	-20	-40	-50	-60	-80
Heifer weaners.	2.89%	4.72%	6.00%	7.62%	12.07%
Heifers 1 year.	3.66%	5.96%	7.56%	9.54%	14.94%
Heifers 2 years	3.66%	5.96%	7.56%	9.54%	14.94%
Cows 3 years	2.15%	3.53%	4.50%	5.74%	9.20%
Cows 4 years	5.86%	9.39%	11.80%	14.72%	22.33%
Cows 5 years	7.37%	11.71%	14.61%	18.09%	26.88%
Cows 6 years	9.24%	14.50%	17.96%	22.03%	31.99%
Cows 7 years	11.53%	17.83%	21.88%	26.54%	37.57%
Cows 8 years	14.29%	21.73%	26.37%	31.61%	43.50%
Cows 9 years	17.58%	26.21%	31.43%	37.16%	49.62%
Cows 10 years	21.43%	31.24%	36.96%	43.07%	55.75%
Cows 11 years	25.87%	36.76%	42.86%	49.18%	61.71%
Cows 12 years	30.87%	42.64%	48.97%	55.32%	67.34%
Cows 13 years	36.35%	48.75%	55.10%	61.30%	72.51%

The central Queensland drought of the 1990's



Herd structure and mortality risk - Fitzroy

Applying the median Cash Cow data values and long term prices in the herd model identifies an optimum cull age of 12-13 years.

Parameter	Number of females in each age class (1-13)												
Cow age start of calendar year	1	2	3	4	5	6	7	8	9	10	11	12	13
Cows/heifers available at start of year	242	234	110	82	69	57	48	40	32	25	20	16	13
Cows mated in each age group	0	144	110	82	69	57	48	40	32	25	20	16	0
Mated cows retained in each group	0	115	86	71	60	50	42	34	27	21	17	13	0
Calves weaned from each group	0	104	80	67	56	47	39	32	25	20	16	13	0

These cows are at increased risk of mortality in a drought. How much does it cost to remove them?

The cost of reducing the maximum culling age - Fitzroy

Parameter	Base herd with 13 year cull age	Base herd with 9 year old cull age
Total adult equivalents	1500	1500
Total calves weaned	498	497
Weaners/total cows mated	77.60%	77.23%
Overall breeder deaths	4.53%	4.36%
Female sales/total sales (%)	47.79%	47.89%
Total cows and heifers sold	210	211
Maximum cow culling age	13	9
Heifer joining age	2	2
2 year old heifer sales (%)	58.48%	47.75%
Total steers and bullocks sold	230	229
Maximum bullock turnoff age	2	2
Gross margin after imputed interest	\$249,098	\$248,384
Difference		- \$714

The cost of reducing the maximum culling age

NQ gulf

Comparison of 12-13 and 8-9 maximum cow cull ages	land condition +P (12-13 years)
Total adult equivalents	1500
Total cattle carried	1792
Total breeders mated	844
Total calves weaned	472
Weaners/total cows mated	55.89%
Overall breeder deaths	2.50%
Two year old heifer sales %	62.77%
Total steers & bullocks sold	223
Max bullock turnoff age	3
GM after imputed interest	\$164,921
Difference	

The cost of reducing the maximum culling age

NQ gulf

Comparison of 12-13 and 8-9 maximum cow cull ages	land condition +P (12-13 years)	Optimised (8-9 years)
Total adult equivalents	1500	1500
Total cattle carried	1792	1800
Total breeders mated	844	842
Total calves weaned	472	484
Weaners/total cows mated	55.89%	57.51%
Overall breeder deaths	2.50%	2.50%
Two year old heifer sales %	62.77%	38.06%
Total steers & bullocks sold	223	229
Max bullock turnoff age	3	3
GM after imputed interest	\$164,921	\$172,054
Difference		\$7,133

This is not part of the original benefits calculated for effective P supplementation.

It is due to optimising the herd at the new level of performance.

This was not included in the original analysis of benefits as we wanted to maintain the same maximum cow culling age in all of the scenarios to make sure the analysis of marginal benefits was consistent across the alternative strategies.

This benefit could be added to the combined benefits of P and land condition restoration.

Low cost strategies that aid resilience

Heifer culling strategy - Katherine

Culling heifers prior to mating Vs over mating and selling after mating

Culling heifers prior to mating

SECTION A: CALVING AND DEATH RATE ASSUMPTIONS

	1	2
Cattle age start year	1	2
Cattle age end year	2	3
Expected conception rate for age group (%)	0.0%	67.0%
Expected calf loss from conception to weaning (%)	0.0%	16.4%
Proportion of empties (PTE) sold (%)	0%	25%

SECTION E: FEMALE HERD STRUCTURE

	1	2
Cow age start year	1	2
Cow age end year	2	3
Cows/heifers available start year	1271	835
Sales unmated, % start yr cows	30.07%	0.00%
Sales after mating, % of number mated	0.00%	8.25%
Unspaved cows sold	382	69

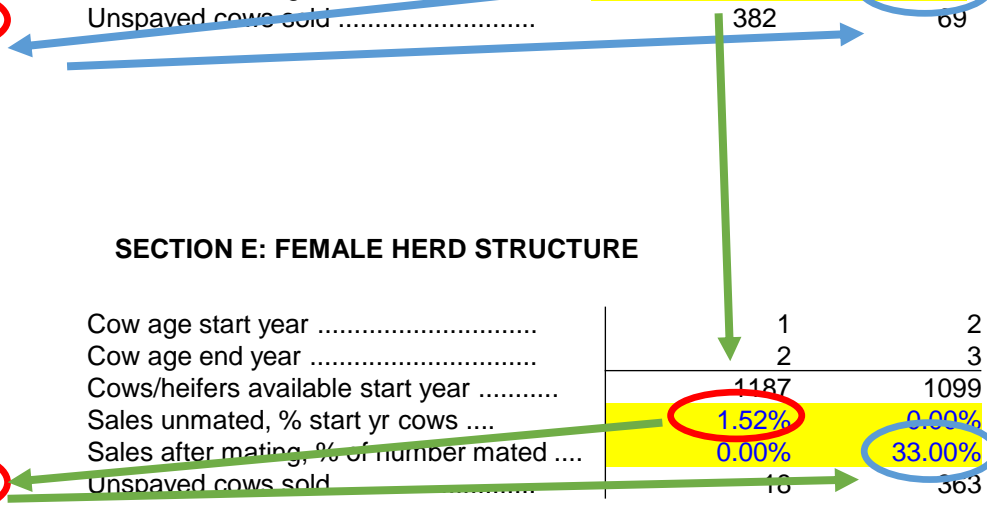
Over mating heifers and selling after mating

SECTION A: CALVING AND DEATH RATE ASSUMPTIONS

	1	2
Cattle age start year	1	2
Cattle age end year	2	3
Expected conception rate for age group (%)	0.0%	67.0%
Expected calf loss from conception to weaning (%)	0.0%	16.4%
Proportion of empties (PTE) sold (%)	0%	100%

SECTION E: FEMALE HERD STRUCTURE

	1	2
Cow age start year	1	2
Cow age end year	2	3
Cows/heifers available start year	1187	1099
Sales unmated, % start yr cows	1.52%	0.00%
Sales after mating, % of number mated	0.00%	33.00%
Unspaved cows sold	16	363



Low cost strategies that aid resilience

Heifer culling strategy - Katherine

Culling heifers prior to mating Vs over mating and culling after mating

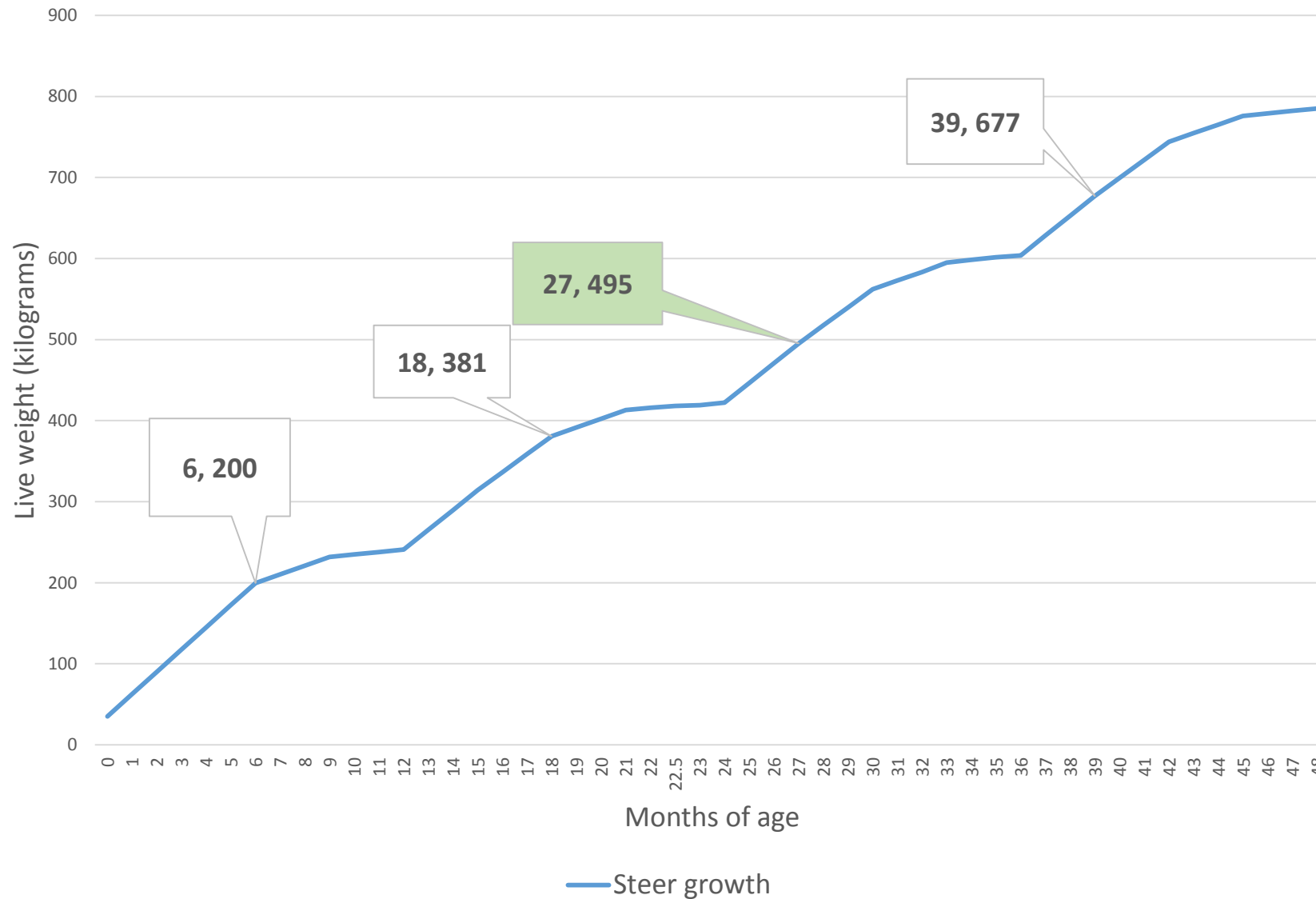
	Base herd	2-3 year PTE cull
Total adult equivalents	7400	7400
GM after imputed interest	\$558,661	\$590,808
Difference		\$32,147

This benefit is achieved even though the younger heifers sell for \$0.24 per kilogram live weight more than the 2-3 year old PTE and culled heifers.

Different regions / properties have different heifer culling strategies showing as the most profitable

Low cost strategies that aid resilience

Age of turnoff for steers - Fitzroy



Age of turnoff for steers - Fitzroy

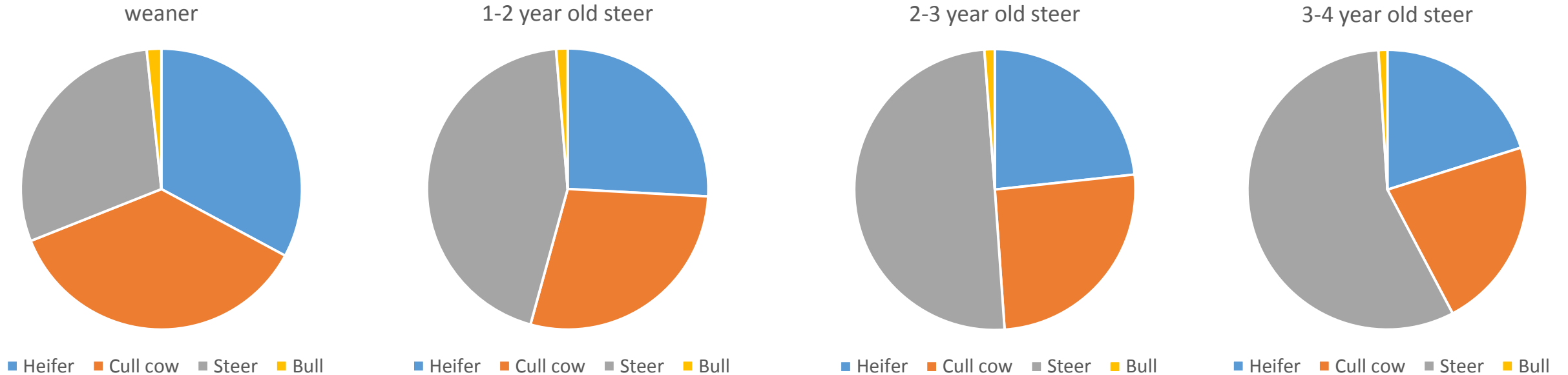
Base herd

Fitzroy age of steer turnoff	weaner steers	1-2 year steers	2-3 year steers	3-4 year steers
Total adult equivalents	1500	1500	1500	1500
Weaner heifers retained	306	276	249	210
Total breeders mated	791	715	644	543
Total calves weaned	611	552	497	419
Total cows and heifers sold	259	234	211	178
Total steers & bullocks sold	306	265	229	186
Max bullock turnoff age	0	1	2	3
Capital value of herd	\$816,362	\$825,857	\$895,990	\$910,427
Imputed interest on herd value	\$40,818	\$41,293	\$44,800	\$45,521
GM after imputed interest	\$191,134	\$248,955	\$245,375	\$236,377
Marginal profit	-\$57,821		-\$3,580	-\$12,578

Note the reduction in the number of breeders carried as the age of steer turnoff increases

What decides the optimum age of turnoff?

Proportions and Price?



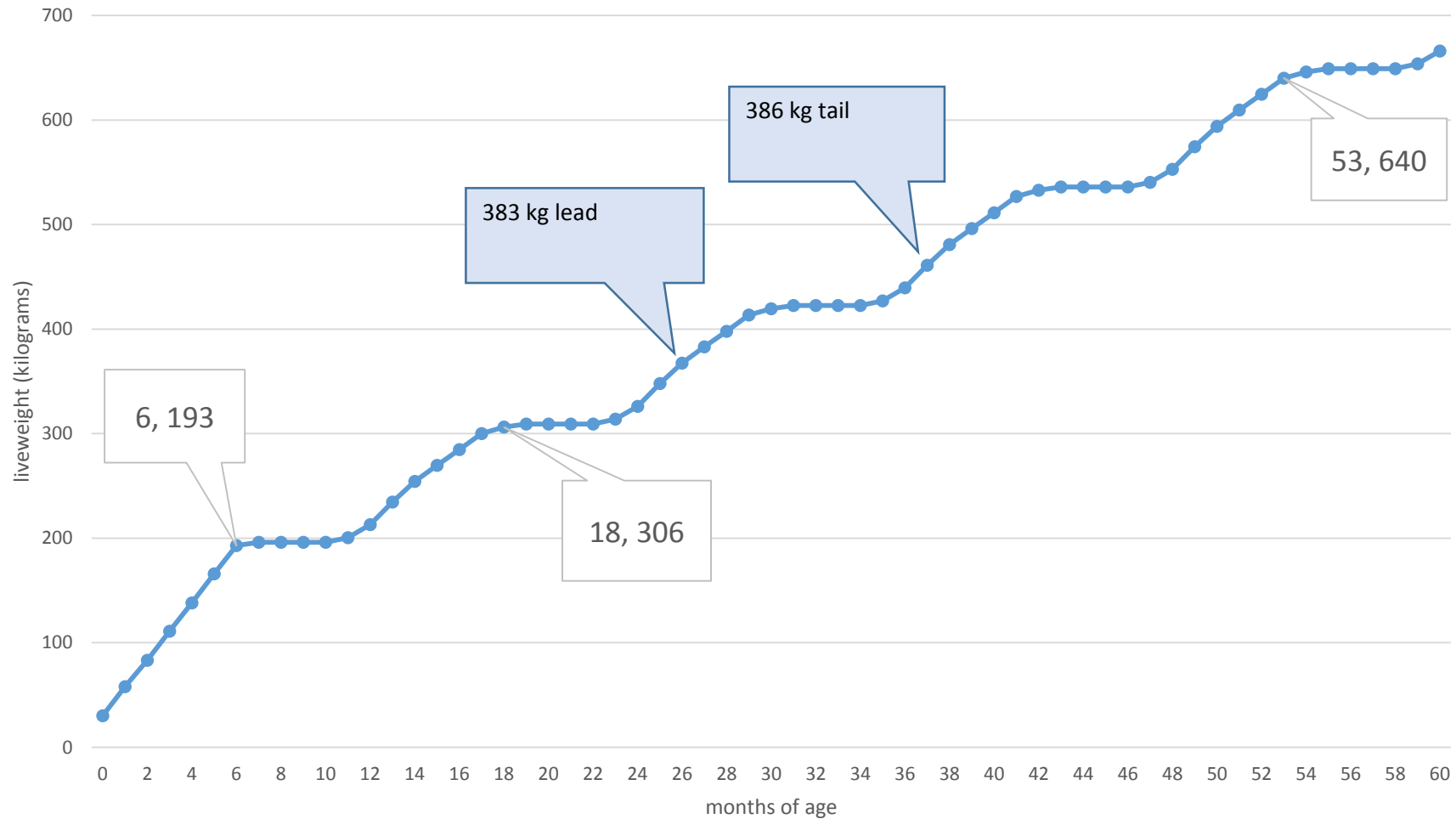
Passengers?

Fitzroy	weaner steers	1-2 year steers	2-3 year steers	3-4 year steers
Total adult equivalents	1500	1500	1500	1500
Weaner heifers retained	306	276	249	210
Total breeders mated	791	715	644	543

Optimum age of steer turnoff

- Need to get the right balance between:
 - ✓ Prices
 - ✓ Proportions
 - ✓ Passengers
 - ✓ Treatment, and
 - ✓ Opportunity costs
- The optimum age will be impacted by steer growth rate and breeder herd reproduction efficiency
- Can only be identified by calculating the (marginal) change in profit for each age of steer turnoff at the herd / property level

Age of turnoff for steers – NQ Gulf



— Steer growth with effective wet season P and land condition improvement

Age of turnoff for steers – NQ Gulf Long term prices

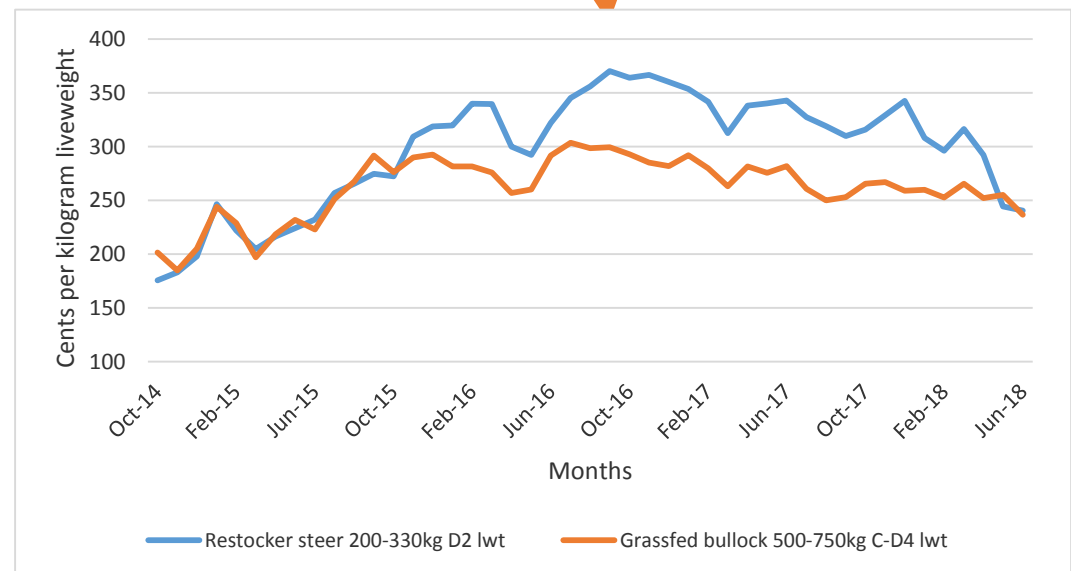
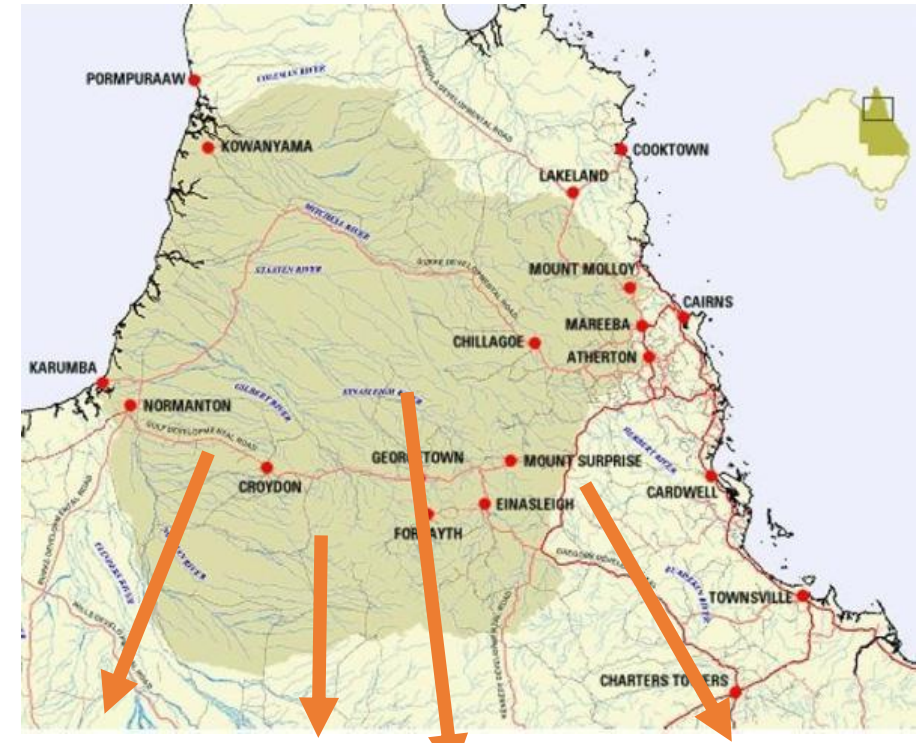
NQ gulf age of turnoff	weaners	18m old steers	base herd	bullocks
Total adult equivalents	1500	1500	1500	1500
Weaner heifers retained	282	258	236	178
Total breeders mated	1008	923	844	637
Total cows and heifers sold	244	224	205	154
Total steers & bullocks sold	282	251	223	161
Max bullock turnoff age	0	1	3	4
GM after imputed interest	\$138,674	\$159,893	\$164,921	\$184,102
Marginal change in profit	-\$26,247	-\$5,028		\$19,181

At long term prices, bullocks are more profitable than live export steers or weaners.

The relative profitability of weaner production sets challenges for producers who use the NQ Gulf as a “calf factory”. Efficiency may have to be optimised for each property over two or more properties.

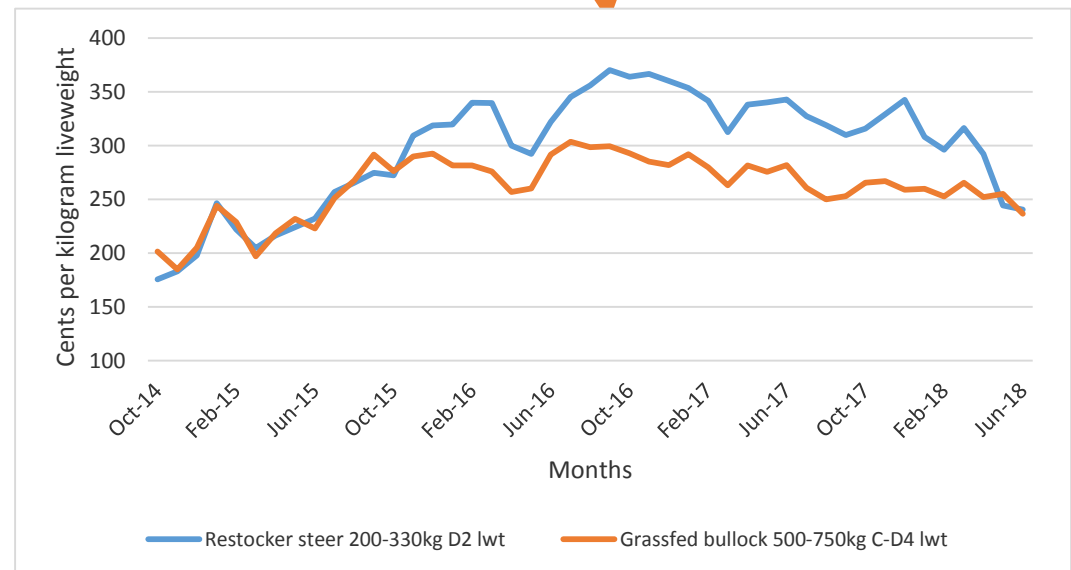
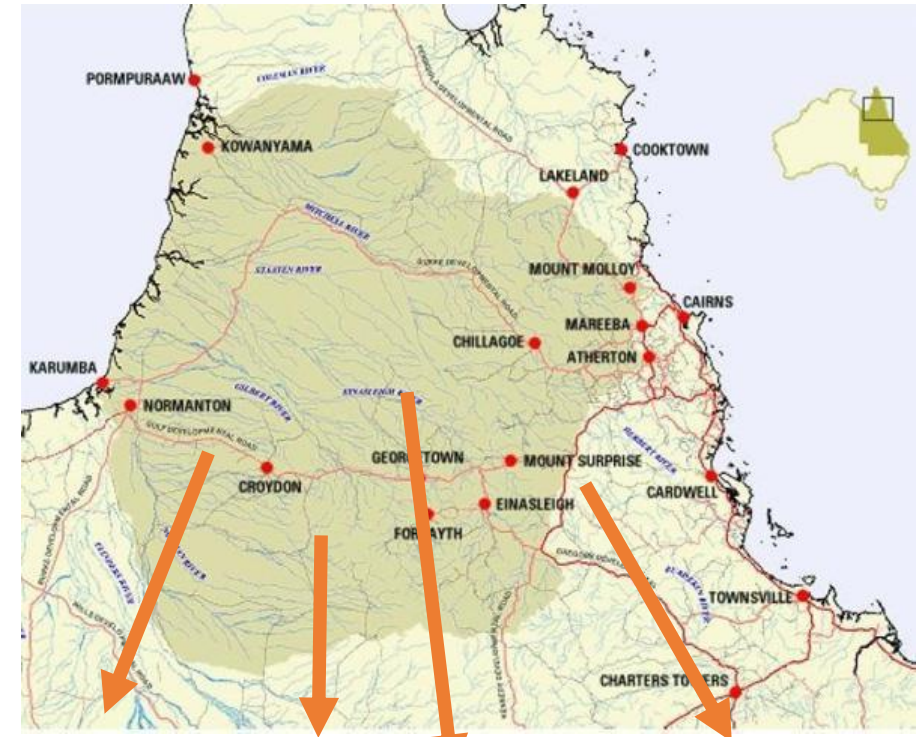
NQ Gulf calf factory

- There may be a significant **opportunity cost** when targeting the production of steer weaners (about \$45,000 per year at long term prices in our herd)
- What price should be received for weaners to be no worse off than targeting bullocks?
 - Long term prices were \$2.60 for weaner steers and \$2.20 for bullocks.
 - Average prices for the last 3.5 years were \$2.90 for weaner steers and \$2.60 for bullocks.



NQ Gulf calf factory

- To be no worse off, the NQ gulf property would need to receive:
 - Long term - \$3.55 per kg for weaners at the sale yards (Long term prices were \$2.60 for weaner steers and \$2.20 for bullocks).
 - Last 3.5 years - \$4.35 per kg for weaners at the sale yards (Average prices for the last 3.5 years were \$2.90 for weaner steers and \$2.60 for bullocks)
- Where weaner steers are being transferred to another property to grow out or fatten, it may be better to purchase weaner steers for that property than to supply them from the “calf factory”.



Moving from the current steer target to older steers NQ Gulf (Long term prices)

NQ Gulf	Annualised marginal NPV	Peak deficit	Year of peak deficit	Payback period (years)
Steers one year older	\$17,169	-\$125,169	1	3

This is not the deficit likely to be associated with moving from a weaner steer target to a heavy steer target. That will be much larger.

It is more profitable in the long term to get the age of turnoff about right; unfortunately a significant deficit can be encountered during any change over period

The agistment question

- Steers sent to the flood plains (Katherine) vs steers sent to the Downs (NQGulf)
- 80% of the Katherine steers were sent to the floodplains at their normal sale age so no real impact on herd structure;
- The NQGulf steers were sent as weaners; This -
 - Led to the retention of females to build herd numbers on the home property
 - Reduced the profitability of the home property (now a weaner steer producer)
 - Reduced the overall investment returns even though the weaner steer agistment exercise was likely to produce a positive gross margin
- This reinforces the need to do the analysis at the property level and identify the opportunity costs associated with steer sale age targets

Steer sale age in the Katherine region (long term prices)

- Issues of tight sale weight parameters, difficulty of moving steers during the wet season, price premiums for younger steers lead to many steers being sold at light weights at the end of the first wet season after weaning
- How much less could be received for steers (cents per kilogram live) to be no worse off if they were held for another wet season?

	optimised	12m later, less 10c/kg	12m older, less 20 c/kg	same price 12m older
Total adult equivalents	7400	7400	7400	7400
Total breeders mated	5145	4685	4685	4685
Total calves weaned	2825	2572	2572	2572
Total cows and heifers sold	816	743	743	743
Total steers & bullocks sold	1229	996	996	996
Average female price	\$494.09	\$494.09	\$494.09	\$494.09
Average steer/bullock price	\$681.88	\$897.57	\$863.70	\$931.44
GM after imputed interest	\$699,553	\$715,510	\$682,107	\$748,913
Difference		\$15,957	-\$17,446	\$49,360

The profit centre is always the steers?

Fitzroy	Whole Herd	Breeders Only	Steers All Ages
Total adult equivalents	1500	1029	471
GM/AE after interest	\$158	\$127	\$224

The profit centre is always the steers but:

- calculating the average gross margin for components of the herd does not reveal anything about where the next investment should be made
- the marginal return on extra capital indicates the relative value of alternative investments
- It is better not to guess where the next improvement is coming from but to assess all options on their merit within the context of your production system

Insights

Maintaining breeder body condition

- Key strategies
 - Grazing land management (grass)
 - Appropriate weaning strategy
 - Appropriate timing of calving (or segregation of breeders) to manage calving groups
- Supplements
 - Once P supplements, weaning and land management are sorted, it is difficult to identify an economic return for additional regular supplements (in most regions – parts of the Northern Forest may be an exception)
 - never replace grass with purchased feed

Insights

Herd structure

- female cull age (effects herd profit and herd resilience)
- age of steer turn-off

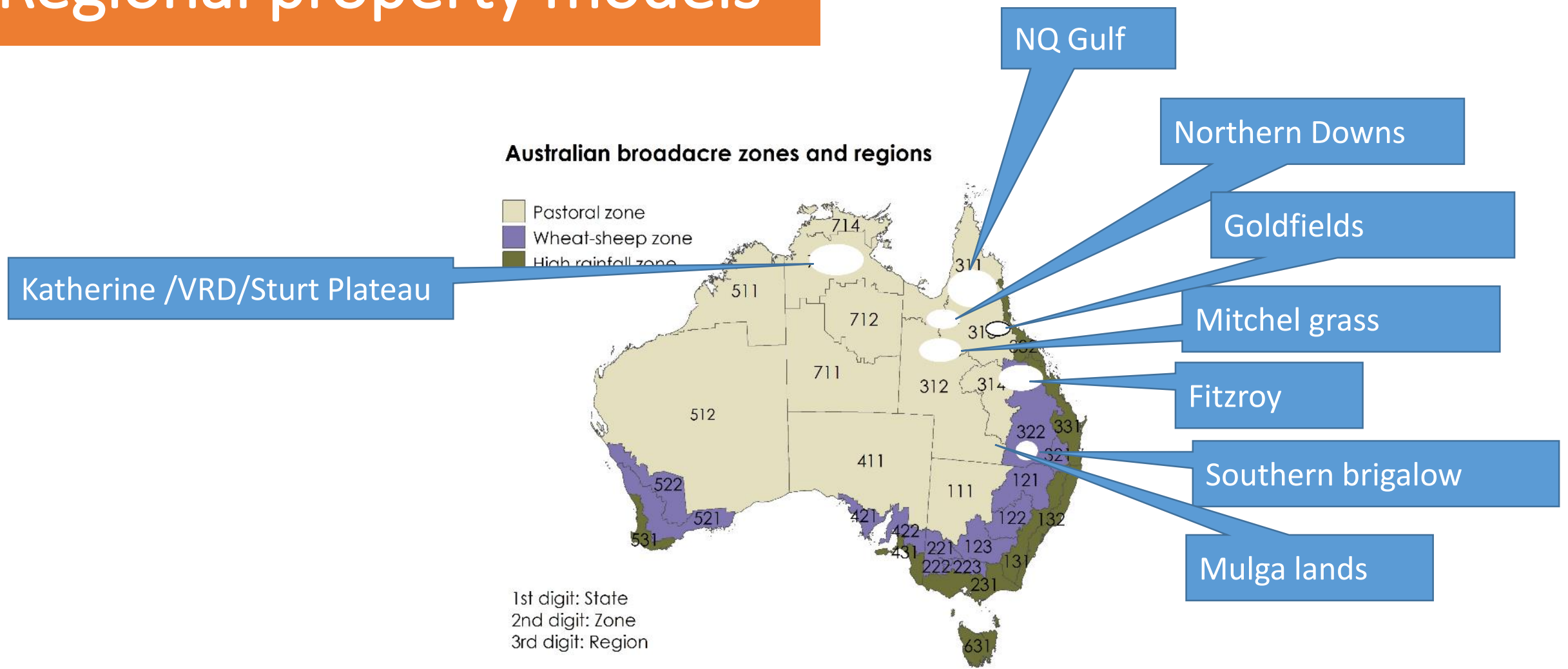
Management strategies aimed at building resilience can be low in direct costs but may incorporate substantial opportunity costs

- The focus therefore continues to be on identifying the relative efficiency (profitability) of alternative production systems; and
- The decision framework must still account for opportunity costs, the time value of money, finances (cash flow), economic efficiency (profit) and the goals of the manager

The framework

- All the analyses were compiled in the Breedcow and Dynama suite of programs
- Available (free) at: <https://www.daf.qld.gov.au/business-priorities/animal-industries/beef/breedcow-and-dynama-software>
- The project is - *'Delivering integrated production and economic knowledge and skills to improve drought management outcomes for grazing enterprises'*
- Led by Dr Maree Bowen, DAF, Rockhampton
- The project is funded through the Queensland Government Drought and Climate Adaptation Program

Regional property models



Fitzroy beef production systems

Preparing for, responding to, and recovering from drought

M. K. Bowen and F. Chudleigh

April 2018



This report has been produced as part of the project '*Delivering integrated production and economic knowledge and skills to improve drought management outcomes for grazing enterprises*'. The project was funded through the Queensland Government Drought and Climate Adaptation Program which aims to help Queensland primary producers better manage drought and climate impacts.

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Questions