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ECOLOGICAL AND ECONOMIC RENEWAL OF RANGELAND PRODUCTION SYSTEMS

T.H. McCosker, R.J. Bartle, and D.J. Carney

RCS, PO Box 633, Yeppoon, QLD 4703

ABSTRACT

One of the main challenges facing graziers is to manage their land in such a way as to achieve ecological renewal while at the same time maximising productivity of their livestock, looking after the people resource and maximizing the profitability of the business. This paper demonstrates that while possible, this is by no means easy.

Ecological renewal is a function of animal control and effective rangeland management. Both are capital and skill intensive. However the links between property development, improved livestock control and management, improved profitability and ecological renewal are quite strong. Ecological health and profits go hand in glove. Lowering margins on extensive properties will eventually force change in this direction and the innovators are already on this path.

AN OVERVIEW

Using data from the RCS benchmarking and business analysis software, ProfitProbe™, we firstly propose to provide an overview of key performance indicators in the rangelands. Firstly it is instructive to look at the Top 20% (T20) compared to the average (AV).

Table 1. The Percent Return on Assets (ROA) in three seasonal conditions from the Top 20% and Average Producers.

	N. Forest (Qld)			**N. Speargrass (Qld)**			**Coastal Forest (Qld)**		
	00-01	**01-02**	**02-03**	**00-01**	**01-02**	**02-03**	**00-01**	**01-02**	**02-03**
Season	good	avge	poor	good	avge	poor	good	avge	poor
AV	8.9	4.0	-0.3	8.0	2.6	-2.4	3.1	1.6	-2.4
T20	16.4	13.5	5.3	12.9	8.0	7.0	10.1	8.3	4.4
	Gascoyne Murchison (WA)			**NSW Rangelands**			**Mitchell Downs (Qld)**		
	00-01	**01-02**	**02-03**	**00-01**	**01-02**	**02-03**	**00-01**	**01-02**	**02-03**
Season	good	Poor		good	poor	bad	good	avge	poor
AV	11.7	3.7		6.5	0.1	-0.3	6.1	4.8	1.1
T20	23.0	14.6		26.1	9.8	6.3			

Table 1 illustrates several key points. Firstly there is a substantial difference between the two sets of data, with the T20 group being very profitable. Secondly, the T20 group made a profit even in the worst year, compared to losses for the AV group. Thirdly, the AV group was only as profitable in a good year as the T20 group in a poor or bad year. Fourthly, even average graziers can make reasonable profits when all the stars line up as they did uniquely in 00-01. Finally it illustrates how significantly rainfall effects profitability in the rangelands. This raises the question - "What causes the difference between the two groups?".

Figures 1 and 2 (following page) cast light on this question. Figure 1 illustrates the strong inverse relationship between ROA (%) and Cost of Production (CoP $/kg LW) for Queensland Beef Producers in 2002-03. Each point (on the x axis of Figures 1 and 2), represent a producer and the data shows that those with the highest CoP have the lowest ROA and vice versa. Similarly the sheep data from the

WA rangelands in Figure 2 indicates that ROA is more a function of CoP than of price. Our data show that CoP is the largest driver of profitability in the grazing industries.

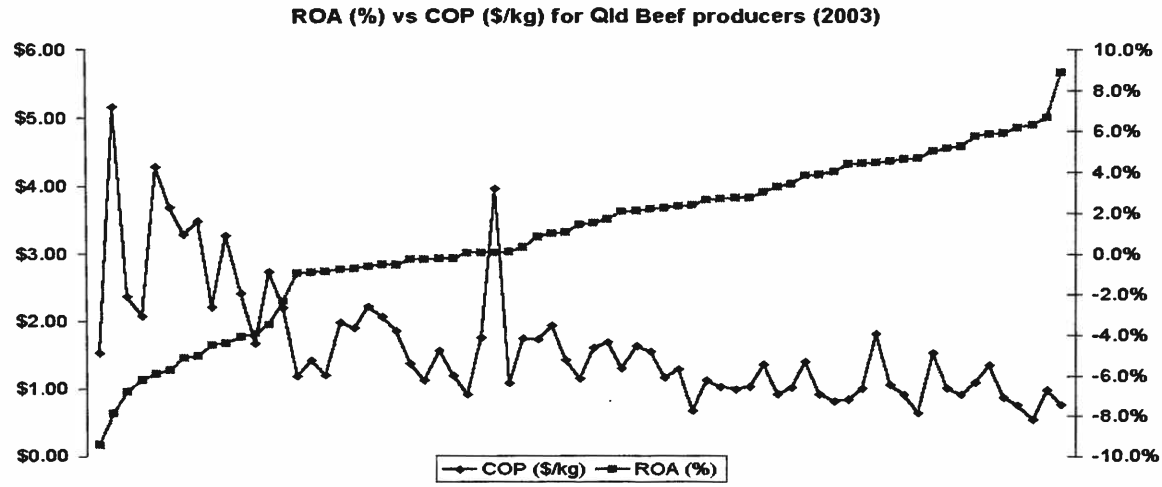

Figure 1. Percent Return on Assets (ROA%) versus Beef Cost of Production (CoP in $/kg LW) for 69 individual beef producers in Queensland in 2002-03.

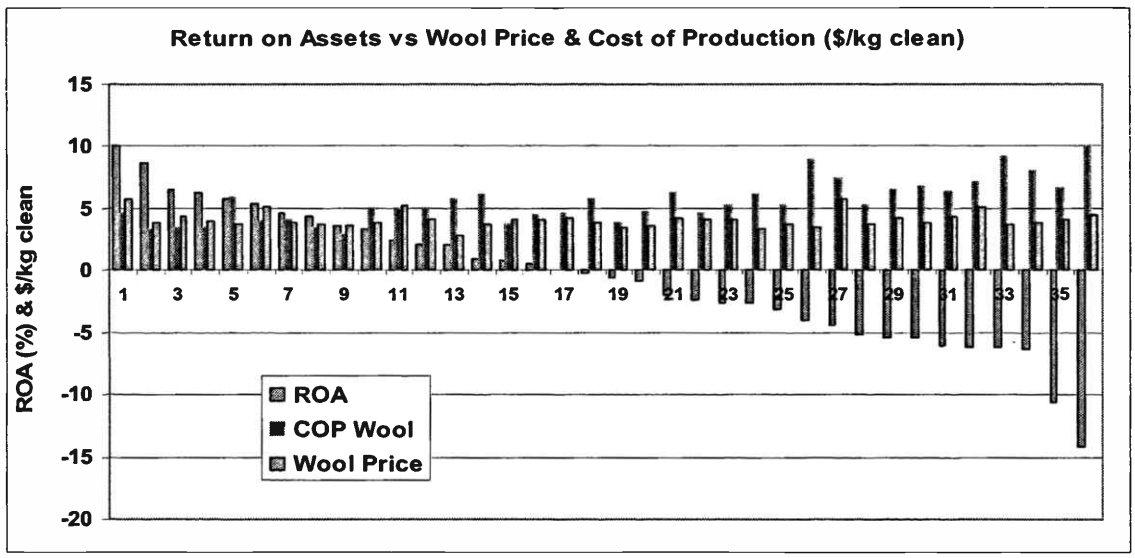

Figure 2. ROA, wool price and CoP in the Gascoyne Murchison region of WA for 36 individual sheep producers in 2001-02.

This raises a further question – "What drives Cost of Production?". Simply stated it is driven up by rising overheads and/or lower productivity, and is principally driven down through cost containment and productivity increases. A good leading indicator of CoP is Gross Product (GP) per Full Time Equivalent Employee (FTE) and this is illustrated below in Table 2. A positive number indicates the T20 group has a higher Gross Product (a measure of economic output) per FTE. It is clear that the gap starts to get bigger in 1994-95 and 1995-96. These are the years during which we realized the driving nature of this indicator on profitability and developed strategies to lower CoP and increase GP/FTE.

Gross Product per FTE is driven by price, productivity (meat and wool production per ha and per head) and the ability of management to achieve productivity gains while containing overheads.

CASE STUDIES

We have selected several clients of RCS in the western Queensland rangelands, who have made changes and whose data we have over an extended period, to look at what happens when property development and management change with a focus on balancing ecological renewal, production and profitability. The property development included water development and fencing which facilitated pasture resting, better utilization, more accurate attempts at matching stocking rate (SR) to carrying capacity (CC) and more planning and monitoring of grazing.

Table 2. The difference in GP/FTE ($000) between the Top 20% and Average producers in the Qld, NSW and WA rangelands.

	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03
GP/FTE	30	30	26	49	63	99	65	56	89	155	91	124
						Gascoyne Murchison >			52	55	31	

"Somerville", North of Richmond in North Queensland

"Somerville" is a 29,000 ha cattle property owned by Tony and Mandy Mott with approximately one third each of sandy open forest, Gidyea country and black-soil downs. AAR is 458mm. It had been run on traditional lines until 1993, after which the waterpoint density were improved to no more than a two km grazing radius and the property was fenced to facilitate both cell grazing and rotational grazing systems. This was largely completed by 1997. The numbers shown in Table 3 are frequency of occurrence, totaled for the plant grouping and averaged across ten sites. Sites were chosen originally on healthy rangeland, some distance from original and new water points.

Table 3. Summary of ten GrassCheck sites on "Somerville".

	95	**96**	**97**	**98**	**99**	**00**	**01**	**03**
Ground cover > 50%	29	11	27	31	27	17	23	12
Desirable perennial grasses	60	50	54	34	54	51	49	46
Undesirable perennial grasses	23	24	25	31	22	22	23	14
Annual grasses	119	69	115	91	77	68	59	97
Forbs	0	12	13	4	14	22	61	121
Rainfall (mm for wet season)	410	306	625	432	573	771	913	287

Rainfall in 2002 was 367 mm but the Grasscheck sites were not monitored.

The only trend evident from these data is the increase in forbs since 1999, despite an increase in carrying capacity and stocking rate. This occurred in both frequency and number of species recorded. Despite a considerable amount of effort expended by the Mott family and staff on monitoring, the Grasscheck process did not provide them with any useful feedback on their management practices. We have found that it is too subjective, influenced by recent grazing pressure and difficult to interpret.

"Wolston" and "Lilford", South of Richmond in North Queensland

"Wolston" and "Lilford" is a 36,000 ha aggregation owned by John and Claudia Power in open Mitchell grass downs, running sheep and cattle. Annual average rainfall is 450 mm. It had been run traditionally until 1999, after which the waters were improved to a maximum 1.5 km grazing radius and fencing was started on the 16,000 ha at "Lilford" to facilitate rotational grazing. Paddock numbers were increased from 6 to 14. Property development is continuing on "Wolston".

The data (Table 4) for these two stations are instructive as they show:

- ROA in the good years following property development (1999 to 2001) was much higher than that of the earlier good year (1994-95).
- That the variability in production and profitability over an extended period is large.
- An effective trend in reducing both wool and beef cost of production and how beef CoP rose sharply in a low production year (eg. 2001-02).

Table 4. Data on "Wolston" and "Lilford".

	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02
Stocking Rate (SDH/100mm)[1]	9.7	14.4	7.4	11.6	9.4	8.4	12.9	18.2
Carrying Capacity (SDH/100mm)	8	8	8	8	8	10	12	12
Rainfall (mm)	496	303	482	397	522	713	515	276
Seasonal Description	good	poor	good	average	good	good	good	average
ROA (%)	3.1	0.4	0.8	4.7	5.2	7.2	8.1	4.3
Beef CoP ($/kg LW)	0.70	1.07	0.97	0.67	0.46	0.41	0.40	0.95
Beef Prod'n (kg/ha)	12.6	8.5	8.5	11.3	19.6	18.3	28.7	14.4
Beef Prod'n (kg/LSU)	109	94	81	87	115	131	138	96
Wool CoP ($/kg greasy)	5.57	5.60	5.84	3.44	3.85	3.84	4.98	4.67
Wool Prod'n (kg/DSE clean)	2.4	2.4	2.2	2.4	2.6	2.9	2.7	3.2

[1] SDH/100mm is Standard Animal Unit days grazing per hectare per 100mm rainfall.

"Wybenia", North West of Winton in North Queensland

"Wybenia" is an 8,700 ha property acquired in 1997 by Doug and Fiona Nicholson in open Mitchell grass downs, running principally sheep with cattle as a sideline. AAR is 400 mm. It had been run traditionally until Jan 2001, after which the waters were improved to a maximum 1.5 km grazing radius and fencing was completed in mid 2002 to facilitate rotational grazing.

Table 5. Data on "Wybenia".

	97-98	98-99	99-00	00-01	01-02	02-03
Stocking Rate (SDH/100mm)	19.4	5.1	6.3	21.5	19.2	9.1
Estimated Carrying Capacity (SDH/100mm)	6.0	6.0	6.0	6.0	8.0	10.0
Rainfall (mm) AAR = 400mm	635	427	782	279	229	337
Seasonal Description	good	good	good	average	poor	average
ROA (%)	2.3	-1.7	0.0	12.3	3.6	3.7
Beef Cost of Prod'n ($/kg LW)	0.67	0.78	0.49	1.99	1.33	1.59
Beef Production (kg/ha)	36	11	21	31	20	8
Beef Production (kg/LSU)	108	143	196	41	95	92
Wool COP ($/kg greasy)	na	6.20	4.32	3.62	4.49	9.07
Wool Prod'n (Kg/DSE clean)	na	3.60	2.87	4.16	2.60	2.00

The ROA was poor from 1997 to 2000, despite good years. An average year, 2000-01, had the highest ROA due principally to an excellent trade with cattle, which also explains the very low production per LSU. It also had a good sheep trade which produced the anomalous wool production figure (kg/DSE).

Stocking rate (SR) exceeded carrying capacity (CC) in three of the six years with the effect of overstocking in 2000-01 and 2001-02, carrying over to 2002-03 in terms of animal performance, despite getting the stocking rate right in 2002-03. SR exceeded CC in 2001 due to inexperience in feed budgeting. The effect of this one bad decision was still affecting the property in 2004. Animal performance (kg beef/LSU and kg wool/DSE) was highest when SR matched CC.

Basal area of Mitchell grass plants from five fixed transects is averaged in Table 6. Rainfall is for the 12 month period to the end of May (mm) averaged over the same five sites. Flinders grass, herbage and feather top were also recorded, although there were limited amounts of each.

Table 6. Basal area of Mitchell grass on "Wybenia".

	June 24th, 2001	May 8th, 2002	April 29th, 2003	April 22nd, 2004
% basal area of Mitchell plants	8.6	13.9	8.1	4.5
12 months rainfall (mm) to May	337	229	304	237

In each season, the bulk of the remainder was bare ground but there was 9% feather top at one site for the first two years but this had gone in the last two years. Both herbage and Flinders grass were only occasionally present and only in very small amounts. In the first two years, the SR exceeded the CC by a factor of two, but the Mitchell remained in good condition largely due to a good wet season in 2001. However in the subsequent two years of very low rainfall, the Mitchell grass regressed severely, despite the SR being matched to CC. Very light grazes were made in association with long rest periods in the latter two years, indicating the Mitchell grass was more severely affected by the rainfall distribution, than by grazing management.

"Yuruga", South West of Longreach in North Queensland

"Yuruga" is a 12,000 ha property owned by Cam and Jenny Lindsay in open Mitchell grass downs, running cattle. AAR is 390 mm. It had been continuously grazed until mid 1999, after which the waters were improved to a maximum 1.5 km grazing radius and fencing was started to facilitate rotational grazing and cell grazing systems. This development was largely completed by the end of 2002.

Table 7. Data on "Yuruga".

	98-99	99-00	00-01	01-02	02-03
Stocking Rate (SDH/100mm)	7.3	15	19.6	14.8	18.9
Carrying Capacity (SDH/100mm)	12	12	24	18	18
Rainfall (mm)	813	473	303	352	228
Seasonal Description	v. good	good	average	average	poor
ROA (%)	9.0	Na	17.7	9.7	1.1
Beef Cost of Production ($/kg LW)	$0.46	Na	$0.31	$0.58	$1.43
Beef Production (kg/ha)	19.5	Na	22.7	22.1	9.3
Beef Production (kg/LSU)	119	Na	139	155	79

The data in Table 7 indicate that:

- In the first very good year (1998-99), prior to any property development and management changes, cost of production was similar and production per head and ROA were lower than in an average year following property development (2001-02).
- In 2000-01 and 2001-02, SR was below CC and animal performance was high.

- In 2002-03, SR slightly exceeded CC and production per head was low. A very short season and destocking would also have influenced these results.
- The carrying capacity benchmark was lowered in 2001-02 as more time elapsed following the good seasons.

The trends in basal area of Mitchell grass plants from 2002 to 2004 are identical to those on "Wybenia" (Table 8). Most of the grazing yield in the last two years came from herbage rather than Mitchell grass. This decline in Mitchell grass basal area also occurred despite very light grazing and long rest for the pasture, confirming that the decline is associated with the environment rather than the management.

Table 8. Basal area of Mitchell grass on "Yuruga".

	Feb, 2002	**April, 2003**	**April 22nd, 2004**
Basal Area of Mitchell Plants	14%	na	5%
12 months Rainfall (mm)	208	125	185
Days Grazed in a year	216	22	30
Number of grazes	2	3	2
Yield (Stock days per ha)	65	51	16

"Kariegasfontein", Aberdeen, South Africa

"Kariegasfontein" is a 12,000 ha property owned by Norman and Jenni Kroon in the Karoo region of South Africa. It receives 195 mm AAR and supports sheep, goats and cattle and is managed by Phillip McNaughton, who has supplied the data. It had been run in a cell grazing system since 1973, with a maximum 2 km grazing radius. Property development has facilitated more appropriate utilization of pastures, allowed pastures to be rested, and facilitated better control of livestock in a rangeland situation.

The purpose of including "Kariegasfontein" is because of the unique data on the relationship between feed available and wool production and reproduction rate, on a commercial scale. The methodology used was to compare the average wool cut per head and the lambing rate to the ratio of the budgeted feed available (in large stock unit (LSU) days) between 1997 and 2001 (the Carrying Capacity) and the actual feed removed (the Stocking Rate in LSU days as recorded on a grazing chart). The seasons run from wool clip to wool clip. A negative number means the stock were eating into the feed reserves being kept for ecosystem health, and the SR thus exceeded what was considered to be an ecologically healthy CC.

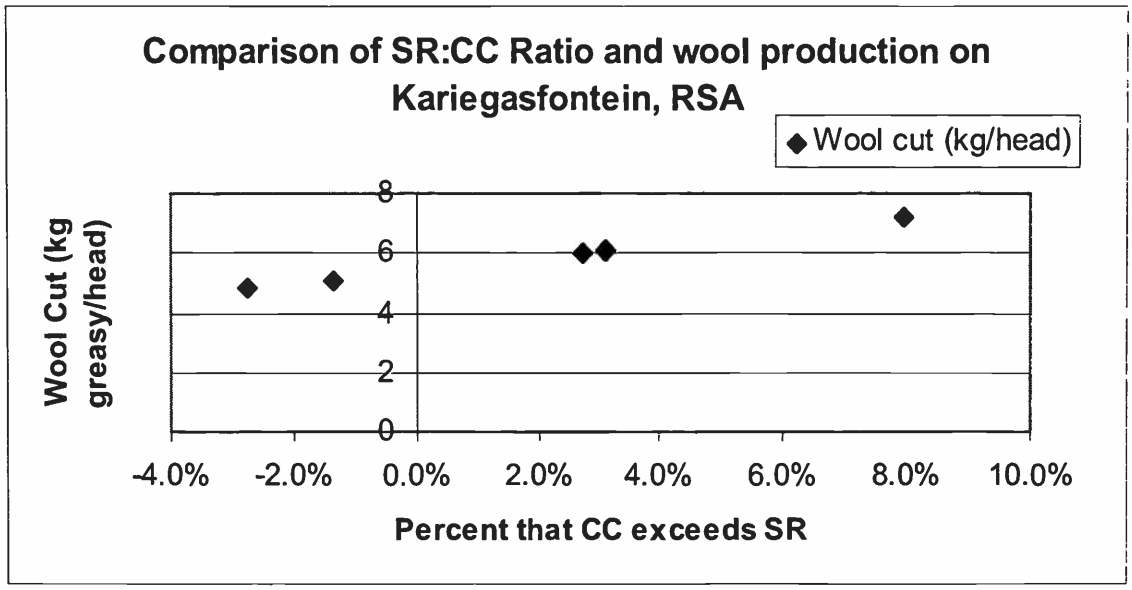

Figure 3. The relationship between wool production per head and the percent by which estimated carrying capacity (CC) exceeds actual stocking rate (SR).

The data in Figure 3 show that even very small variations between SR and CC have significantly affected the wool cut per head. The relationship between wool cut and the CC:SR ratio has an R^2 of 0.99 for the data range tested.

Similar data are available for lambing rate in Figure 4 for the years 1999 to 2003 from lambing to lambing. The relationship between lambing percentage and the CC:SR ratio had an R^2 of 0.90 for the data range tested. It should be pointed out that this property has been run with a focus on ecological renewal, for 30 years and has a very high standard of management.

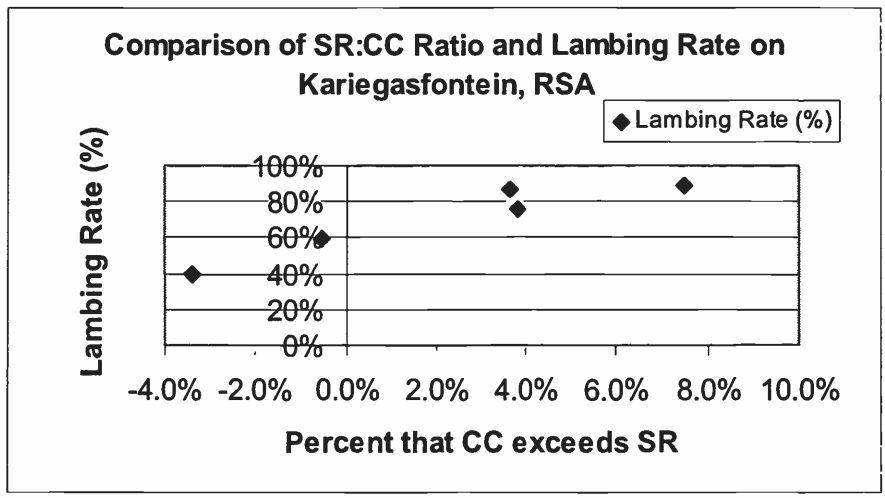

Figure 4. The relationship lambing rate and the percent by which estimated carrying capacity (CC) exceeds actual stocking rate (SR).

DISCUSSION

A number of common issues stand out when looking at the case studies collectively. These include:

- Rainfall amount, distribution and timing have an overriding influence on the ecology and businesses, even when stocking rate is matched to carrying capacity and plants are rested.
- Discussions with each manager reveal that each is now much more focused on the amount of pasture they leave behind in the full spectrum of seasons, than on how much they take.
- In most cases, the previous year's seasonal conditions had an effect on the subsequent year's production and profit. In other words, parameters are not only affected by what happens in the current year, but both good and poor seasonal and management effects are cumulative. Matching SR to CC is similar to a bank account. If it is overdrawn one year, then you have to have more in credit the following year to pay back the deficit as well as operate in the current year. This implies that a surplus, or ecological investment, needs to be cumulatively deposited and maintained over a number of seasons. How much do we need to leave behind for eco-maintenance, and how much for eco-expansion? Perhaps we should develop a ROEI or "return on ecological investment" indicator (McNaughton *pers. comm.*).
- Cost of production skyrockets in years when productivity (both animal unit and per ha) is low. High CoP reduces ROA.
- Hard data on ecological renewal are hard to find in commercial settings, however anecdotal evidence abounds. One of the problems with getting long term hard evidence has been the failure of GrassCheck to provide any useful data. While several properties have kept GrassCheck data for many years, it is virtually un-interpretable. RCS now recommends a basal area technique to graziers, but this has been only recent so no long term data are available. Evidence has however been previously published by McCosker (2000), Joyce (2000) and Sparke (2000).

The challenges for rangelands producers are therefore to:

- Structure their business to cope with the seasonal variability in rainfall. The difference between the T20 and AV illustrates that it is possible to have profits in bad years, albeit lower, but the correct strategies are necessary.
- Increase productivity (per head and per ha) faster than the ever upward creep in overheads. Our data (RCS, unpublished) indicate that extensively managed rangelands properties generally have high and increasing costs of production. This is because overheads have steadily climbed for the last 20 years, but productivity increases have stalled with diseconomies of scale.
- Manage the rangelands for ecological renewal while concurrently increasing productivity per head and per ha. To merely sustain the current level of health and productivity in the rangelands is both an economic and ecological folly. Obviously a healthier rangeland will sustain higher productivity. The constraint to this is not scientific knowledge but rather necessity, training and capital.
- Populate the rangelands. Increased productivity can only come about through more intensive management. However there is no evidence that intensification can occur extensively. Therefore the huge poorly utilized properties that characterize the extensively operated rangelands in Australia will need to be handled as smaller, well managed units. A direct comparison between 400,000 ha in the VRD and 400,000 ha in the Hughenden/Richmond region in Queensland shows the smaller properties have three times the stocking rate, higher per animal productivity and lower CoP than the VRD, under current management practices. Improved management practices have been shown to increase productivity in this Queensland region by a further 50%.

For too long, sustainability has been a catch-cry. Sustainability infers the maintenance of what we already have. More important than sustainability, is renewal. Renewal is about changing the way in which land and business is managed, to allow continuous improvement in the current ecological,

human and economic condition of our resources.

Popular belief has been that it is not possible to achieve ecological renewal while at the same time improving livestock, lifestyle and profitability. This paper shows that through changes in management (introducing strategic and tactical rest to pastures, matching stocking rate to carrying capacity, and planning, monitoring and controlling management), graziers have been able to improve livestock productivity with the end result of a more profitable business. Anecdotal evidence of improved ecological condition of land has been easy to find, however hard evidence is still lacking.

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