Case Farm Three

(Northern Plains, Victoria)

Part of the report

An economic analysis of native pasture on the plains of south-eastern Australia

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Disclaimer

The options for this paper have been developed for the purposes of this study. They do not constitute recommendations for this property and should not be used as such without a more thorough examination of the validity of the assumptions used and of alternative options that might be available.

1. Nature of the case study

This case study is about managing native grassland on a mixed cropping-livestock property that is intensively managed. It investigates options for managing the native grasslands and the effects of these options on conservation values and on farm business income.

Long-term sustainability of production is seen by the owners to depend on maintaining the perennial native grasses, but the way in which this is done may or may not conflict with conservation goals. The study examines the economic costs, if any, of retaining native grassland on part of the farm, and of lighter stocking.

2. The current farming system

2.1 Background to the farm

The farm is one of four case farms located in located in the Riverine plains, the flat or gently sloping flood-plains of the Murray River and its tributaries located to the west and north of foothills and ranges. The farm is one of two in North-Central Victoria.

Much of the plains in North-Central Victoria is now used for irrigation. In dryland areas, the main agricultural activities are sheep and cattle grazing, and cropping. While over-cropping has occurred in the past, causing long-term damage to soils, periodic cropping has strong attractions particularly as techniques improve (Crosthwaite 1997).

The farm is located near Mitiamo, which is north-east of Bendigo and west of Echuca. Farm size is 2,430 hectares with an additional 1,053 hectares leased. Several blocks are connected, and there are three blocks a short distance to the north and west of the main farming area. One area known as James's is held on a long-term lease.

Rainfall averages 370 mm with great variability from year to year - eg. 290 mm in 1990 and 610 mm in 1992 (G. Rankin, 1993).

About 500 hectares is native pasture, all of which was cropped in the 1960s and which has reverted to native pasture. The balance is crop or introduced pasture. Up to 200 hectares of native pasture has recently been cropped - after two crops it is expected to revert to native pasture over time. Approximately 600 hectares has been sown to lucerne, some of this has since been cropped.

The farm is now mainly a cropping operation, though it also carries a large flock of self-replacing fine wool merinos. Wethers are also carried; their numbers varying with seasonal and market conditions.

The dry sheep equivalents (DSE) for the self-replacing merino enterprise are shown in Table 2-1.[1]

Table 2-1 Stocking - total and per hectare

	DSE
Self Replacing Merinos	6,400
Wethers	500
DSE/ha	2.9

2.2 Conservation overview

The property is in the Land for Wildlife scheme, a voluntary scheme for farmers prepared to manage with conservation goals in mind.

All of the farm has been cultivated at least once in the last 30 years. Species diversity is not as great as in grassland sites which are relatively undisturbed. The Plains Wanderer, a threatened quail-like bird, has been identified on the property (Maher & Baker-Gabb 1993). Invertebrate diversity has also been noted (S. Hadden pers comm). While these grasslands may not be as important as others that are less depleted, they still represent an ecological community which is recognised as one of the most threatened ecosystems in Australia (Kirkpatrick *et. al.* 1995) and there are relatively few grassland areas remaining on the northern plains of Victoria (Diez & Foreman 1996). The grasslands in this region are more fragmented and scattered than on the Hay Plains in New South Wales. Considerable effort has been invested in identifying appropriate conservation management approaches for native grasslands on public and, to a lesser extent, private land (Diez & Foreman 1996). As there are few conservation reserves of any size, the recently acquired Terrick Terrick property being an exception, roadsides and remnants on private land are particularly important.

While many native species can return after a first cropping, many will not and consequently species diversity is likely to plateau significantly lower than in the pre-cultivation state (P. Foreman pers comm). Repeated rounds of cultivation will further reduce the number considerably. Provided management is appropriate, more native species are also likely to return as the time since cropping increases.

2.3 Farmer goals

Maintaining net farm income and minimising year to year fluctuations in income are judged to be the predominant goals on this farm.

[1] Dry sheep equivalents are a standard used to compare the feed requirements of different classes of livestock; one DSE is the amount of feed required to maintain a wether sheep weighing 48 kg for a year.

The owners have a long-standing in the management of native pastures, and in the species making up the pastures. They see their property as being marginal country, with difficult soils and erratic rainfall, which needs careful management. The native species, especially the grasses, play an important role in this given that introduced species are not persistent in this country.

While the conservation ethic is important, it is probably secondary to the need to generate income. Vegetation along depressions has been fenced out with some government grants. There is a fenced out wetland which has never been cropped. The owners are very proud of it, as three lignum swamps disappeared in the area the week after the Victorian clearance regulations were announced. The owners say this is the only one fenced. The other remaining one is on crown land, but not fenced and never checked - “a cow paddock”.

The owners see themselves as much graziers as croppers, and say that they would reduce the amount of cropping if wool prices were higher. Cropping has been important on the property for at least a generation. Over the last decade, expansion of cropping on the farm and through share cropping has been the main vehicle for increasing income. Conservation cropping techniques (ie. minimum tillage and chemical weed control) have been used over the past three years to increase returns from cropping. They are now returning to more mechanical fallowing, stating that research is showing higher crop yields.

One member of one of the families works off farm.

The farm has carried a high debt load in recent years, in part related to land purchase and in part to cropping. Acquisition of land has been a strategy for increasing income for twenty years. Purchases of nearby blocks were made in 1973, 1975 and 1984. Very poor crops in the last three years have resulted in a very high overdraft, which has recently been converted to a long-term loan. All activities have been geared to generating sufficient income to reduce the debt and to support three families

Managing risk is a major element of farm management. Cropping in this region is inherently risky because of the rainfall and relatively poor soils. On this farm, this risk is hedged partly through leasing extra land to crop and also share cropping off-farm (650 hectares in 1995) which spreads the overheads over a larger set of activities. Some of the major equipment items eg. cultivator have been purchased second-hand, and other has been manufactured on the farm eg. seed and fertiliser bulk storage.

The farm carries a very large stock of hay. The owners are also prepared to search widely for opportunities to buy cheaply (eg. large second-hand cultivator, weaner sheep from the NSW pastoral zone in the 1994 drought) and sell dearly (eg. grain).

A range of farm activities have been, and are being trialled, at least in part for their risk reduction potential. These include saltbush plantations and tall wheat grass,

One of the owners has expressed concern about cropping during several interviews. His concerns centre on the exposure to risk and the workload.

3. The state of the pastures and their utilisation

An inspection of the property was carried out on 20 October 1997 by rangeland management and research consultant Allan Wilson. The content of this section draws heavily on information he provided during the visit to the property. He is not responsible for any errors in this analysis.

The aim was to gain an appreciation of the different pasture types on the property, their distribution across the farm and how they might be contributing to production in different seasons.

One of the owners provided background information about paddock types and 'representative' paddocks using a rough farm map. In the selected paddocks, species were recorded against a regional species list. Visual estimates of the abundance of vegetation categories were made at several sites, with these abundance estimates validated by quadrat throws at one site (see Table 8-2 in the appendices).

3.1 State of the soils

Soils are mostly red duplex (2/3^{rds}), grey self-mulching clays (1/3rd) and about 10 per cent corag clay. The corag clay is difficult to work, and the owners say that the last block purchased was bought solely because of the grey clays it contains.

Soil condition was found to vary considerably during the assessment by A. Wilson. Some paddocks with cultivated grey and red soils were identified as having a hard setting surface. On the roadside adjoining one paddock, soils were grey clay but were covered with three millimetres of organic matter. Here the soils were more crumbly and not as tight as in the adjoining paddock. One paddock with native pasture was in better condition with prominent insect holes which would allow infiltration; however, this paddock allowed very poor grazing at least at the time of inspection. Surface soil structure noticeably improves the longer the time since paddocks have been cropped. The longer the period, the more organic matter and a higher number of large pores arising from insect burrowing or old root paths (A. Wilson pers comm). The ram paddock has very friable soils, a red sandy clay loam, with comparatively high organic matter.

3.2 The pasture, feed supply and seasonal management

Abundance estimates by vegetation category are shown in Table 3-1. Estimates of the proportion of dry matter accounted for by each vegetation category were made using the dry weight rank technique (Jones & Hargraves 1979). These estimates were made

primarily to gauge the production value for livestock of the different pasture types. They are also an approximate guide to the proportion of the pasture cover accounted for by each vegetation class - another indicator of conservation value.

The longer the period since cultivation, the more significant the native perennial grasses. However, this association is relatively weak. Some paddocks uncultivated for many years have a low proportion of dry matter accounted for by native perennial grasses. There is a stronger correlation between length of time uncultivated and the percentage of plants like storksbill and capeweed.

Annual grasses produce a significant proportion of the dry matter available in spring and early summer.

Generally, the longer the time since cropping on this farm, the more silver grass and storksbill, both species of low productivity and quality, become dominant. This is particularly the case in paddocks near the shearing shed and house. The dominance of these poor species suggests that the pastures have been grazed intensely, perhaps continuously, and that they have not been fertilised since cropping. The more lightly stocked ram paddock had better composition. (A.Wilson pers comm).

Table 3-1 Estimated species composition (per cent dry weight) by site [2]

Site Paddock	1 Wake East	2 Wake Shed	3 Wake Corner	4 Tiller East	5 North Tier - west	6 North Tier - east	7 North Akes	8 Greig's Cnr	9 Jamieson	10 Mail-box	11 Ram	12 Trudy
Introduced or naturalised annuals												
grasses	49	30	50	70	40	32	80	59	60	50	30	60
forbs-storksbill, capeweed	15	5	10		15	20		20	15	25	25	30
legumes - clover, medics	20	25	25	29	13	25	20	10	15	10		
Introduced perennials												
lucerne		30										
Native annuals												
forbs				1								
Native perennials												
cool season C3 grasses	15	10	15		20	10		10	5	5	25	10
warm season C4 grasses	1				10	10				10	25	
forbs					2	3		1	5			
Total	100	100	100	100	100	100	100	100.2	100	100		
% annual	84	60	85	99	68	77	100	89	90	85	55	90
% introduced or naturalised	84	90	85	100	68	77	100	89	90	85	55	90
% perennial	16	10	15	0	30	20	0	10	5	15	50	10
Years since cultivated	19	8	7	<4	21	21	13	21	~5	~25	>30	35

[2] Survey estimates were validated with quadrat throws at two sites (see Table 8-2 in the appendices).

3.3 Species composition

Table 8-1 in the appendices shows the species found at each site.

In total 53 species were identified on the case farm, 24 of which are introduced or naturalised. Only three paddocks were found to have 15 or more species. There are at most seven native species in any one paddock, and most of these are usually perennial grasses with one or two forbs being also present.

It is highly likely that early flowering native daisies, lilies and orchids, if present on some of the paddocks, had disappeared by the time of the inspections in October 1997. As winter was particularly dry, it is likely they would flower early, if at all. The conditions at the time of survey mean that the botanical diversity is likely to be under-estimated.

Allowing for the dry seasonal conditions at the time of survey, these native pastures have relatively low diversity.

Saltbush was probably the dominant species historically, with other bushes, annual native forbs, some native grasses and small palatable chenopods always present (Foreman 1993). As saltbush has disappeared under grazing pressure, cottonbush has become the main shrub cover. Saltbush is no longer found in the region, and only small blue bushes are occasionally found on farmland.

Perennial grasses are present in only some paddocks. Wallaby grass (danthonia) is the main cool season C3 grass, though spear grass is also found. It was estimated that on 10 of the 12 sites inspected, they comprised between five per cent and 25 per cent of the vegetation - see Table 3-1. These grasses can provide green feed following autumn showers right through until early summer. In this cooler region, by comparison to the Hay plains, they tend to stay green and are responsive to summer showers.

Warm season C4 grasses including rigid panic and windmill grass are found on fewer paddocks than the wallaby grasses. It was estimated that they comprise between 10 per cent and 25 per cent of the vegetation at four inspection sites - see Table 3-1. These grasses are green from early spring (but when the stock prefer the lush annuals) through to summer, and will shoot again if summer rains occur.

Annual species, both naturalised and native, were estimated to account for 30 per cent or more of the vegetation at all inspection sites, and for 50 per cent or more at eight sites - see Table 3-1. Annual species have a relatively short growing season in winter/spring, and they will be a minor part of the vegetation and provide very little feed, if any, after spring, except in wet summers.

Annual grass species include ryegrass, barley grass, wild oats and silver grass. In winter and spring they provide the bulk of feed for stock. The livestock system is organised around this, with available greed feed matching peak demand from lactating ewes and weaner lambs. Barley grass responds quickly to rain in late autumn and early winter. Rye grass complements it by producing most of its bulk in early to mid spring. The feed available from annual grasses, and how long it remains green, varies with the

season. If the season is good, weaner lambs and cull stock will have been sold while the annual grasses are still providing the bulk of feed.

Medics, which are naturalised annual forbs, are a lesser component of the pasture. They provide the most palatable feed at the same time as the naturalised annuals. Burr from medics can be a valuable feed source through the summer. Storksbill (*Erodium spp.*) is probably the main introduced annual forb.

Chenopods and other perennial forbs like fissure weed (*Maireana pentagona*) and Sida (*Sida corrugata*) were only found in a few paddocks and are not thought to be significant. Only a few different species were found. These species are not as digestible as soft grass and legumes. They're good quality in spring but won't be eaten until the December-May period.

With the exception of two daisy species, annual native forbs such as lilies, daisies and orchids were not found. In a wetter spring, more may have been present.

3.3.1 Species composition related to cultivation history

There is some relationship between the number of native species, particularly number of native grasses and years since cultivation - see Table 3-2. However, the relationship is not a strong one. The three paddocks with six or more native species have not been cultivated for 19 or more years. However, three paddocks not cultivated for 25 years were found to have no more than three native species. By comparison to two other case study farms with paddocks uncropped for 20 or more years, the number of native species, particularly forbs, on these paddocks is very low. Management history would appear to be the key explanatory factor here.

The variation between paddocks in number of species is almost entirely accounted for by differences in the number of naturalised species.

Table 3-2 Species count by years since cultivation

	Site											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Years since cultivation	**19**	**8**	**7**	**<4**	**21**	**21**	**13**	**21**	**~5**	**~25**	**>30**	**35**
Species count	**24**	**13**	**14**	**9**	**13**	**20**	**10**	**17**	**11**	**12**	**9**	**7**
No. of native species	**6**	**4**	**3**	**0**	**4**	**6**	**1**	**7**	**3**	**3**	**3**	**2**
comprising												
grasses	**3**	**2**	**1**		**2**	**4**		**2**	**1**	**2**	**2**	**2**
forbs	**2**	**2**	**1**		**2**	**2**	**1**	**4**	**2**	**1**	**1**	
rushes	**1**		**1**					**1**				

4. Economic and financial state of the current farm business

Total property value is estimated at $1,500,000, which includes stock worth an estimated $230,000 and equipment at $200,000.

Equity is estimated at 87 per cent.

Expected profitability and cash flow in future years are now estimated, based on an assumption that the farm will continue to be managed as it is now. The results will not reflect what might occur in any one year, but are based on a 'typical' year or on expected values which take account of seasonal fluctuations.

Expected gross margin for each enterprise is shown in Table 4-1. Break-up of sheep gross margins are shown in Table 8-3 in the appendices. The expected long-term values used to derive income in the sheep enterprise are: 5.2 kg/head wool clip, $4.30/kg greasy wool price, 80 per cent weaning and a $32 average weaner sale price.

Expected gross margin for cropping activities is based on 1,300 hectares total crop area. The crops sown each year varies, but the rotation has typically been: canola, wheat, lupins, wheat, barley. Break-up of the gross margins is shown in Table 8-4. Derivation of the expected values for yield and price on which they are based is shown in Table 8-5 and Table 8-6.

Table 4-1 Expected gross margin by enterprise

	$'000	%
Crop	139	58
Self Replacing Merinos	93	39
Wethers	6	3
Total	238	100

Expected operating profit after tax and return to capital are shown in Table 4-2. Overhead costs include an allowance for what the operator's labour is worth - estimated at $90,000 for the three fully occupied family members.

Annual overhead costs are $173,000 including $33,000 for depreciation and $90,000 for family labour.

Return to capital is estimated to be 5.6 per cent.

Table 4-2 Estimated Profit and Loss and Return to Capital

	$
Income	
Self Replacing Merinos	148,753
Wethers	10,225
Crop	325,353
Total income	$484,331
Variable costs - activities	
Self Replacing Merinos	56,004
Wethers	4,139
Crop	186,680
Total activity costs	$246,823
Variable costs - whole farm	$26,500
Overheads (incl labour & depn)	$128,030
less land lease costs	$10,530
Total costs	$390,823
Operating profit before tax	$93,508
Tax payable	$21,136
Operating profit after tax	$72,372
Return to capital	
Total farm capital	$1,475,861
Return to capital	5.6%

Net cash flow is shown in Table 4-3.[3] This is based on a family consumption allowance of $90,000. Net cash flow does not include equipment replacement or investment out of cash flow for farm development.

[3] Estimated tax payable is high because it is based on total income less deductions which include variable costs, overheads, estimated interest payable, livestock purchase costs and depreciation on equipment aged 10 years and less.

Table 4-3 Estimated Uses of Cash Statement

	$'000
Cash in	
Sales	484
Cash out	
Activity variable costs	247
Whole farm variable costs	27
Cash overheads	18
Land lease costs	11
Income tax	21
Interest on overdraft	13
Interest on loan	15
Principal on loan	13
Consumption	74
Total	438
Net cash flow	47

5. The future - current plans and other opportunities

Based on the results shown earlier, this property is achieving an average return to capital of five per cent or higher. This is what should be expected on a well-managed cropping property. After paying off loans and the overdraft and deducting a very modest sum for consumption, there is a reasonable sum left for re-investment.

However, these expected results mask the year by year fluctuations. In recent years return to capital and net cash flow have been unsatisfactory. Poor seasonal conditions have adversely affected crop yields, and the owners have had difficulty in paying off the overdraft built up from when crops are planted. Debts consequently accumulate. The problem is compounded when wool prices are low as at present.

The owners are very keen to reduce risk of cropping failure. Canola and lupins have been very disappointing for the last three years, and the owners are not prepared to take a chance that the seasons over the next few years may improve. Consequently, they are shifting to a rotation (wheat, wheat and barley) that has a similar expected gross margin to the present rotation (typically canola, wheat, lupins, wheat, barley), but involves a lower gross income and less cash outlay each year. This means that if there is a run of good seasons, they will miss out on the potential gain with canola and lupins.

5.1 Possible options

There are limited options which might increase net income without risk and with more certainty.

The owners are planning to put their own lambs, and some purchased lambs, through a feedlot prime lamb operation. However, feedlots are risky when carried out on a large scale. Many things, or a combination of them, can go wrong. Lamb sale prices can fall, grain prices and lamb purchase costs increase, crucial alliances with lamb sellers and buyers as well as grain merchants can sour, health costs can sky-rocket, and other farming operations can be affected. Nevertheless, it is possible to do very well if the operation is soundly planned, management is skilled and the right relationships are established, and if there is the flexibility of leaving the activity for a few years while market conditions are poor.

The fat lamb production cannot be treated with any certainty as part of the future farm plan. Consequently, the option is not analysed further.

Cropping native pasture is under consideration because the owners believe that the stocking rate is half what it should be because of soil structure decline. A native pasture paddock was cropped this year for the first time in many years. The owners intend to crop all the pastures some time in the next 15 years. This includes eight native pasture paddocks, totalling approximately 500 hectares. Some of these have recognised conservation values, even thought they have all previously been cropped at some time in the past.

The owners intend to crop for two years after a mechanical fallow, and to undersow legumes and grasses in the second year of crop. Pasture productivity is expected to increase because of new plant vigour, availability of nutrients added as fertiliser during cropping, and because the cropping restores soil structure which has become compacted. After the cropping, a long pasture phase is planned, and it is expected that the native grasses will regenerate over time.

The effect on conservation values is likely to include loss of those native plant species that are less able to withstand the effects of cropping than Wallaby Grass. Native invertebrates may also be affected. Loss of habitat for Plains Wanderer will also occur, though the open sparse structure of vegetation it prefers may be available again in a few years. These effects cannot be known with certainty, though an ecologist who surveyed the paddocks may be able to make a reasonable judgement.

An alternative to cropping these areas might be to decrease stocking levels, particularly in spring to allow the native pastures to regenerate naturally. This would be a positive step towards maintaining the conservation values. While the owners feel that a long-term stocking rate of about 2.7 DSE/hectare is appropriate, they believe that the pastures are overstocked because of three poor springs in which plants have not been able to set seed. They are considering reducing stock numbers across the farm in order to allow stock to be removed from the native pasture paddocks for two or three months in spring. The effect of removing stock in spring on the speed of pasture regeneration is expected to depend partly on improvements in soil condition.

The options are now analysed and compared to the 'do nothing different' situation. In summary, the options are :

1. No change from current management

2. Reduce stocking levels in spring on 500 hectares of native pasture - the conservation management option

3. Crop 500 hectares of native pasture twice and undersow in the second crop year - the production option

The effect of implementing these options on smaller areas e.g. 100 or 250 hectares can easily be determined, provided an allowance is made for how farm overhead costs and unallocated variable costs e.g. fuel might be affected.

5.2 General approach to analysis of the options

Partial budgets, both steady state and discounted cash flow, are used to identify the profitability and pre-tax cash flow effects of additional investments.[4] These budgets allow a comparison of the farm situation - before and after - to be made.

The steady state partial budget involves a snapshot into the future to the point of peak production after all development expenditures have occurred. This budget requires all gains and losses associated with the new situation to be identified. The result indicates the net gain or loss relative to the situation before the investment. It is used to ask 'is it worth getting there?'.

The discounted cash flow budget helps compare options in which revenue and cost streams occur over a different time sequence. All cash flows are discounted to the same point in time irrespective of when they occur to give a net present value (NPV). This budget is useful for answering the question 'is it profitable after taking account of the cost of getting there?' By using salvage values, this budget can handle expected productivity of the initial investment beyond the period of the budget. Falls in revenue can also be incorporated, e.g. declining revenue associated with a drop in pasture productivity after a certain period.

Expected values rather than actual prices or costs are used in these budgets. This is appropriate as the future is unknown. Where an event will occur, but it is uncertain in which year, an expected value is used in each possible year. For instance, if a drought is expected every five years and in such circumstances drought rations will cost $20,000, the expected value each year is $4,000. This approximates the drought

[4] An alternative is to use whole farm budgets. This would be appropriate where a new farm buyer was evaluating the potential of the property - it can be used to show the return to capital of the current farm system as well as the return if additional investments were made.

preparedness strategy of ‘putting a little away each year’. The alternative when using relatively simple spreadsheet models is to guess which year the drought will occur in.

The analysis is run over 15 years in the discounted cash flow budgets. In terms of farm planning, it is a relatively long period—half a farming generation. Real discount rates of five per cent, 10 per cent and 15 per cent are used. Most farmers would require a 10 - 15 per cent return on marginal capital, compared to an expected return of two to three per cent on whole farm capital. The discount rate represents the cost of the capital involved, i.e. the opportunity cost of the funds involved, the actual cost of funds borrowed, or a weighted average of both (Makeham & Malcolm 1993). A high rate is realistic given the choices, often risky, facing farmers about what to do with their borrowings or marginal investment funds. So that options with costs occurring over a different time sequence can be compared, all cash flows (of costs and returns) are discounted to the same point in time irrespective of when they occur to give a net present value (NPV).

In the financial analysis associated with the discounted cash flow budgets, each investment is assumed to be funded with an overdraft at 12 per cent interest per annum. Once debt is paid off, cumulative cash surpluses are invested at five per cent interest per annum.

5.3 ***Option 1 - Do nothing different on the 500 hectares***

The aim is to determine a whole farm result before and after a management change. Consequently, it is not necessary to specify the contribution of the 500 hectares to expected annual profit and net cash flow under current management of the farm. The effect of alternative management compared to current management of the 500 hectares will be clear when the before and after situations are compared.

It is estimated by the owners that stocking rate on the 500 hectares of native pasture is only half that of the other pastures because of soil compaction. This will be accounted for in the analysis of the alternative management options.

5.4 Option 2 - Reduced stocking

The second option is for a reduction in sheep numbers on 500 hectares of native pasture, specifically by removing all stock for three months in spring. If the soils in the native pasture were less compacted, the pastures might carry as many sheep as other pastures. For this reason, the analysis initially assumes that the stocking rate on the native pasture paddocks is no different to the rest of the farm. This will allow the maximum possible effect of a reduction in stocking to be estimated.

The new stocking rate for sheep is expected to be 2.3 DSE/hectare compared to the current rate of 3.1 DSE/hectare. The effect of the reduction is shown in Table 5-1.

Table 5-1 Effect of reduced stocking at the current gross margin/DSE

	Current	New
Stocking rate - DSE/ha	3.1	2.3
DSEs carried	1,560	1,170
Difference		390
Gross margin/DSE	$14.87	$14.87
Gross margin	$23,210	$17,407
Reduction in gross margin		$5,802

Such a reduction can be achieved by reducing the overall number of animals carried or by selling off stock in dry years and buying again in better years. The option of reducing overall numbers is evaluated here.

The compensating effects of reduced stocking are now considered.

Lighter stocking is likely to improve animal performance, reduce drought feeding costs, and may reduce overhead costs and free up labour for on or off-farm work. This may or may not be compensate for the income effects of carrying fewer stock.

The effect of lighter stocking on livestock performance will vary with the seasonal conditions in each year. One of the property owners was asked to indicate the expected

seasonal conditions over the next 20 years using categories of best, good, most likely, poor, worst. Table 5-2 is based on his responses.

Table 5-2 Expected seasons over next 20 years

Season	Best	Good	Most Likely	Poor	Worst
Years in 20 (expected)	1	2	10	5	2

Animal performance measures that are likely to be affected include weaning percentage, wool cut, animal health and sheep sale weights. Lighter stocking may also give more flexibility in the timing of sheep sales. Estimating effect on weaning percentage and wool cut is relatively straight forward. Animal health is more difficult as health problems can arise in both very good and very bad years. Sheep sale weight and timing of sheep sales can both affect the price received.

The variation in animal performance between current and light stocking across seasons is shown in Table 5-3. The differences only show up in poor or bad seasons as there is plenty of feed available in better years at both stocking rates. Averages are based on the expected number of seasons of each type. The difference between the average for the two stocking rates is shown in the last column; this figure will be the basis of the economic evaluation of the two options.

The owners expect a better wool cut to be the main change, and that this will apply in the most likely as well as poorer seasons. They believe that lighter stocking will result in more residual dry feed being available in autumn which will benefit wool production. Increased weaning percentage will be relatively small because lighter stocking is not expected to greatly affect the amount of green feed that is on offer - green feed is important for a ewe's nutrition during pregnancy and later lactation.

Table 5-3 Seasonal conditions, livestock performance and stocking rate

	Season	Best	Good	Most likely	Poor	Worst	Expected value	Difference
Weaning rate	Heavy stocking	107%	98%	90%	85%	80%	89%	
	Light stocking	107%	98%	90%	90%	85%	91%	1.7%
Wool cut - kg/hd	Heavy stocking	7.3	6.4	5.5	4.5	3.6	5.2	
	Light stocking	7.3	6.4	6.4	4.8	3.6	5.7	0.51

The increases in expected values for wool cut and weaning percentage under reduced stocking (Table 5-3) are used in Table 5-4 to derive the extra gross margin per DSE that might be expected as a result of decreased stocking.

Table 5-4 Effect of reduced stocking on sheep gross margin

	Extra wool	Extra lamb sales
New stock numbers	963 DSE	345 ewes
Extra gain	0.51 extra kg/head	2% extra weaning %
Quantity	492 kg	6 extra lambs
Unit value	4.30 $/kg	32 $/lamb
Extra gm/DSE	2.20 $/DSE	0.20 $/DSE
Extra gross margin	$2,118	$193

The owners use a range of strategies for drought management, including selling off and agisting stock, and feeding hay and grain grown on the farm. Each strategy has its costs and benefits. For the purposes of this analysis, it is assumed that there is no difference in the net benefits, and that the cost of purchased drought rations is a reasonable measure of direct and indirect costs. It is expected that reducing stock numbers will reduce the per head drought costs by fifty per cent. Estimated drought feeding costs at old and new stocking rates are shown in Table 5-5. A drought is expected every seven years. An annual cost - the expected value - is obtained by averaging the cost over seven years.

A drought is expected every seven years. The cost is annualised by expected value is the total cost averaged over the drought and non-drought years ie. seven years in all.

Table 5-5 Drought feeding costs and stock numbers

	Current	New
Cost/week/head	$0.50	$0.50
Weeks fed	26	13
Cost/head	$13.00	$6.50
Numbers fed	1560	1170
Cost	$20,285	$7,607
Difference		$12,678
Drought frequency		
…. 1 year in		7
Expected value		$1,811

This option, if implemented could potentially have several effects on operation of the whole farm. The direct effects of the reduction in gross margin on operating profit may be partly compensated for because the option will release capital otherwise tied up in livestock - this effect is shown in the next section. The reduction may also marginally reduce farm overhead and unallocated variable costs. However, the effects on this farm are not likely to be great. The farm is run with family labour - if an employee worked on the farm, reducing sheep numbers might allow that person's hours to be reduced. Savings in fuel, administration and other farm costs are likely to be small.[5]

[5] Changes in sheep enterprise costs have already been accounted for in the gross margin estimates.

5.4.1 Results

The partial budget in Table 5-6 shows that there is expected to be no significant change in net farm income as a result of reduced stocking on the 500 hectares. The critical factors offsetting the lower stock numbers are the increase in the wool cut that is expected in most seasons (Table 5-3) and the savings in drought costs. If these benefits are smaller, the effects can be readily observed from the table.

These results provide an estimate of the maximum loss to the owners that might be expected. The owners state that the stocking rate on the native pasture is lower than elsewhere on the farm - hence a smaller reduction in stock could be assumed. As the gains are proportional to the losses in both cases, the final result would also be a loss, but even smaller.

Table 5-6 Partial budget - reduced sheep numbers

Gains	
Revenue gained if changes made	
Better wool cut	2,573
More lamb sales	223
Costs avoided if changes made	
Drought feed costs	1,811
Total gains	4,608
Losses	
Revenue foregone if changes made	
Sheep gross margin due to lower stock numbers	5,802
Costs incurred if changes made	0
Total losses	5,802
Total gain/loss	-$1,195
Marginal tax rate	20%
Tax on extra gain/loss	-$239
Total gain/loss after tax	-$956
Released capital (sheep)	$7,337
Return (after tax) on released capital	6.5%
Interest on released capital	$477
Net gain/loss after tax and interest	**-$479**

The net present value (over 15 years) of the expected net loss from reducing stocking is shown in Table 5-7. It gives an indication of what the owner might hypothetically want as compensation for reducing stocking; this sum will vary with the owner's expected rate of return (discount rate).

Table 5-7 Expected present value of the gains/losses from removing stock in spring

Discount rate	$	per ha
5% real	-$5,599	-$11
10% real	-$3,928	-$8
15% real	-$2,935	-$6

5.5 Option 3 - A crop and pasture option

This section assesses the net gain from cropping 500 hectares of native grassland that is of conservation interest. The area will be cropped for two years and then returned to pasture. The aim is to increase pasture productivity, but this will cause the loss of conservation values even if native species return as the owners expect based on past experience.

The immediate effects of cropping will include the loss of species which cannot tolerate major disturbance. Others such as wallaby grass are expected to return. Cropping even if only for two years will also affect the soil leading to a change in invertebrate populations and to a loss of the soil pores and root holes which allow ready infiltration of water.

5.5.1 Cropping assumptions

Assumptions have to be made about both the cropping phase and the pasture phase.

For the purposes of this study, it can be assumed that the whole 500 hectares will be cropped immediately for two years and then grazed. The reality is that the owners intend to crop only part of the area each year. The aim is to keep as much of the property in native pasture at any one time so that there are multiple sources of native grass seed. The seed is thought to be transported by sheep or wind.

There will be some grazing in the first year before the paddocks are ploughed in August. After further cultivation, they will be sown down after the autumn rains. As the owners are keen to see the wallaby grass return after cropping, the rotation will be a short one with the grassland being cropped twice after a mechanical fallow. Lucerne will be undersown in the second year of the crop.[6]

Derivation of expected crop yields and prices, taking account of variation across years is shown in Table 8-5 and Table 8-6 in the appendices.

[6] See case study four for an analysis of replacing native grassland with a repeated crop-pasture rotation.

Crop gross margins based on expected values are shown in Table 5-8. Gypsum is not usually used. Fallowing costs in the first year are estimated at an additional $30/hectare. Lucerne seed is costed at $30/hectare.

Table 5-8 Expected gross margins for the crop phase of the rotation

Average area (ha)	500
Yield	2.16
Price	136
Income/ha	293
Variable costs/ha	117
Total cost	117
Gross margin/ha	176
Income	48,872
Costs	19,500
Activity gross margin	29,372

The owners say that the stocking rate on the native pasture paddocks is half the average 3.2 DSE/hectare for grazing areas of the farm - and that they would hope the cultivation phase would lift the stocking rate to the average.

Stocking of the paddocks is expected to be as follows. In the first year, grazing will be available for up to six months before the fallow. Stocking rate will thus be 50 per cent of the present stocking rate or 1.6 DSE/hectare. In the second and third years, there will be no grazing - the small amount of grazing off stubble being ignored. In the fourth year, the undersown pasture will have to be stocked lightly and expected stocking rate is 50 per cent of the present rate. By the fifth year, the pasture is being grazed at 100 per cent of the present stocking rate and in the sixth year, it has reached peak production at double the present stocking rate

Three years after planting it will have reached peak productivity and then some time over the following 10 years, pasture productivity will start to decline. It is assumed that this decline will start in year 10 (seven years after sowing) and be at 20 per cent a year. By year 15, the pasture almost requires renovation again. The pasture has a salvage value because stocking rate is still above the initial level.

The difference in stock numbers that will be carried each year by comparison to the present, based on the above assumptions, is shown in Table 8-9 (the row headed Extra stock after decline adjustment) in the appendices. The increase or decrease in stock numbers is the basis for calculating the gain or loss in sheep activity gross margin.

5.5.2 Results

A discounted cash flow budget incorporating the fallow, the two years of crop and the pasture at different stocking rates outlined above is shown in Table 8-9. The budget shows the expected extra gross margin (revenue less costs) derived from the sheep and cropping enterprises, as well as salvage values for pasture and livestock. Total cash inflow is expected to be over $40,000 during the cropping phase, and over $10,000 when the pasture is fully established. By year 14, total cash inflow has fallen to under $5,000.

Fallowing costs, cost of seed are shown as establishment costs. Extra livestock purchased as pasture productivity increases, and stock sales before the crop is established and when the pasture begins to decline are also included. After taking these costs into account, expected net cash flow after tax varies from -$12,000 in establishment years, to over $40,000 in the first cropping year, and to approximately $75,000 once the pasture has reached peak production.

Some results are shown in Table 5-9. The result depends on the rate of return the owners expect when investing extra capital.

What might convince the owners not to go ahead? If the owners felt the crop/pasture sequence was very risky and wanted a rate of return of 15 per cent from the crop/pasture sequence, they might be satisfied if they could earn a smaller sum by other means - the equivalent lump sum would be $81,853 or $164 per hectare. If the owners felt that the crop/pasture sequence involved little risk, and they would go ahead if a return of as low as say 10 per cent was expected, they would need a larger sum to be convinced not to go ahead - possibly $98,497 or $197/hectare.

Table 5-9 Net present value of short crop - long pasture rotation

		$	per ha
Net Present Value @	5% real	123,339	247
	10% real	98,497	197
	15% real	81,853	164

5.6 Sensitivity

In the cropping case, sensitivity of results to changes in variables has been partially accounted for by showing results at different discount rates and by using expected values which take account of variation in crop yields and prices.

Two critical variables are the expected stocking rate on the new pasture and the crop gross margin (ie. revenue less costs). One of the owners has given expected values for crop yield and price which are possibly low because the last three years have been very disappointing. If their expectations change markedly, the estimates made above could be wrong. In Table 5-10 the effect on net present value of changing the expected stocking rates achieved and the expected value of the cropping rotation are shown.

The figures in brackets are per hectare results. The results are very sensitive to both factors.

Table 5-10 Effect on NPV (at 15% real) of changes in sheep GM and crop rotation expected value

	Crop rotation expected value			
Peak stocking rate compared to current stocking rate	150	176	200	225
100%	48,858	63,902	77,788	92,254
	(98)	(128)	(156)	(185)
200%	66,798	**81,853**	95,728	110,194
	(134)	(164)	(191)	(220)
300%	84,214	99,258	113,145	127,610
	(168)	(199)	(226)	(255)

per hectare results are in brackets

6. General conclusions

This property has native grasslands which are of regional significance. All of the grasslands have a high proportion of naturalised annual grasses and weeds. During the pasture survey, only a few pastures were found to have many native species other than grasses. If the survey was repeated in better seasonal conditions, the number might be higher. However, given the cropping history of these paddocks and the set stocking, it is likely that the estimates are reasonably close.

The profitability and cash flow situation provide the context for the management of and plans for the native pasture paddocks In some years, the farm is generating adequate cash flow. But in other years, it is not. The owners struggle in the good years to get far enough ahead to keep the debt in poor years at a manageable level.

If cropping yields were more even and wool prices higher, the owners might be in a position to manage the grasslands in a way which was compatible with conservation goals. Management of the native grasslands is driven partly by short-term income needs. Though the owners also see cultivation as leading to an increase in productivity of the pastures that will hold for 10 years or more.

Even if the owners were convinced that the conservation goal was worthwhile and could be achieved, their income requirements make it difficult to implement a reduction in stocking which might result in increased species diversity in the pasture.

Reducing stocking by one-third is not very costly to the owners if the gains - especially extra wool cut and lower drought costs - from reducing stocking are realised. The contrast for this option is the cropping/pasture option rather than ‘do nothing different’. Cropping native grasslands for two years and then establishing pasture has

the promise of significantly higher returns, and would be the owner's choice purely on economic criteria.

There are no obvious actions that the owners could take elsewhere on the farm that might allow them to maintain income while implementing a reduction in stocking rather than cropping the grassland areas. This study has found that the farm business is being run relatively efficiently. A competent farm management consultant might identify opportunities to reduce costs or improve management if they worked closely with the owners. However, it may take several visits by a consultant over a couple of years before the consultant and owners could identify such opportunities and act on plans to take advantage of them.

7. References

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8. Appendices

8.1 The pastures

8.1.1 Species composition

Table 8-1 Species list by abundance - 20 October 1997

Exotic	Species	Common Name	Site 1	2	3	4	5	6	7	8	9	10	11	12	13
1	Arctotheca calendula	Cape Weed	o										o	o	c
1	Avena fatua	Wild Oats		c			A	c	o	o	c		c	c	c
1	Circium vulgare	Spear Thistle													y
1	Echium plantagineum								c				o		
1	Erodium cicutarium	Common Heron's-billl							c				A		
1	Hedypnois rhagadioloides	Cretan Weed									y				
1	Hordeum leporinum	Barley Grass							A				A		
1	Hypochaeris radicata	Flatweed									y				
1	Lolium rigidum	Wimmera Rye-grass	A	A	c	A	A	A		A	A	A		A	A
1	Marrubium vulgare	Horehound													
1	Medicago polymorpha		c	c	c	c	o	c		c	c	A	c		
1	Medicago praecox													A	c
1	Medicago truncatula	Barrel Medic							o						
1	Phalaris paradoxa	Paradoxa Grass								y					
1	Podospermum resedifolium	Scorzonera					y								
1	Sisymbrium erysimoides	Smooth Mustard							o						
1	Sonchus asper subsp. glaucescens	Rough Sow-thistle	o	o											
1	Sonchus oleraceus	Sow-thistle					o								
1	Vulpia spp.	Fescue	c						c		c	o	c	c	
	Acacia pendulaVic		o		o	o									
	Asperula conferta	Common Woodruff						y				y			
	Atriplex leptocarpa	Slender-fruited Saltbush											o		
	Calocephalus sonderi	Pale Beauty-heads										o			
	Calotis scabiosifolia var. scabiosifolia	Rough Burr-daisy					y	y		y	y	y			
	Chamaesyce drummondi	Caustic Weed												y	
	Chenopodium dsertorum subsp. virosum	Foetid Goosefoot	y												
	Chrysocephalum semipapposum	Clustered Everlasting				y						y			
	Chrysocephalum semipapposum	Clustered Everlasting												y	y
	Danthonia caespitosa	Wallaby Grass	c		A	A				o	c	c		A	A
	Daucus glochidiatus form G	Austral Carrot									o				
	Enteropogon ramosus		o			c						A	c	o	o
	Eriochlamys behrii	Woolly Mantle										y			
	Erodium crinitum	Blue Heron's-bill								r				o	c
	Goodenia pinnafida	Scrambled Eggs												y	y
	Homopholis proluta	Rigid Panic	c	A	o	o	A	A		c	A				o
	Ixiolaena leptolepis	Stalked Plover-daisy	y					y							
	Leptorhynchos panaetoioides	Woolly Buttons					y			y					
	Leucochrysum molle	Hoary Sunray									y				
	Leucochrysum molle	Hoary Sunray	y			y									
	Maireana aphyllaVic		c	c	c	c	c	r		A	c	A			o
	Maireana excavataVic	Bottle Blue-bush	c		A	A						o	o		
	Maireana pentagona	Slender Blue-bush	o		o	c					c	o			c
	Oxalis perennans	Grassland Wood-sorrel	o	o	o	o	o			o	c	o		o	o
	Paspalidium constrictum	Box Grass							o						
	Plantago turrifera	Small Sago-weed									y				
	Rhagodia spinescens					r			o						
									Site						

Exotic	Species	Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13
	Rodanthe coymbiflora	Grey Sunray												y	y
	Salsola kali	Prickly Saltbush						o					o		
	Sclerolaena muricata var	Roly-poly				y									
	Sclerolaena muricata var. semiglabra	Five-spined Bassia		r		c						r			
	Sida corrugata	Variable Sida	o		o							o	c	o	
	Solanum esuriale	Quena						o							
	Stipa aristiglumis	Plump Spear-grass												o	
	Stipa nodosa	Knotty Spear-grass	c		c	c				o	o	c	c	o	
	Teucrium racemosum	Grey Germander								y					
	Vittadinia cueata group	Fuzzweed				y	y								

Notes to table 3.

Exotic = introduced/naturalised.
A = abundant; **c** = common; **o** = occasional; **l** = localised; **r** = rare

Native pasture sites - 1 = East Wake; **5** = North Tier - west; **6** = North Tier - east; **8** = Greig's Cnr; **10** = Mailbox; **11** = Ram; **12** = Trudy

Recently cropped/introduced pasture 2 = Wake Corner; **3** = Tiller East; **4** = Newths; **7** = North Akes; **9** = Jamieson;

8.1.2 Validation of the abundance estimates

Abundance was estimated by visual inspection and assessed by the dry weight rank technique (Jones & Hargraves 1979). In order to verify the accuracy of their estimates, quadrats were thrown at two sites. The visual estimates accurately determined the relative importance of the major categories. Annual grasses were correctly estimated to comprise the bulk of the vegetation.

Table 8-2 Comparison of abundance measures - visual estimates and quadrat throws at two sites

	North Tier - east				Ram			
	% composition				% composition			
	Estimate	Actual	Error	Error propn	Estimate	Actual	Error	Error propn
Naturalised annuals								
grasses	32	50	18	0.36	30	39	9	0.23
forbs-storksbill, capeweed	20	28	8	0.29	20	28	8	0.29
legumes - clover, medics	25	7	18	2.57				
Introduced perennials								
lucerne	0	0			0	0		
Native annuals								
forbs	0	0			0	0		
Native perennials								
cool season C3 grasses	10	5	5	1.00	25	30	5	0.17
warm season C4 grasses	10	10	0	0.00	25	2.6	22	8.46
forbs	3	0.3	2.7	9.00		0.1	0.1	1.00
Total	100	100.3			100			
% annual	77	85			55	67		
% perennial	23	15			45	33		
% introduced/ naturalised	77	85			55	67		

*based on 50 quadrats

8.2 Gross margins - livestock and crop enterprises

Table 8-3 Gross margins - livestock enterprises

	Self Replacing Merinos	Wethers
INCOME :		
Wool (gross)	$15.59	$23.65
Livestock trading profit/loss	$7.65	-$3.20
Total Income	$23.24	$20.45
COSTS :		
Shearing & crutching	$3.48	$3.60
Mulesing	$0.14	$0.00
Animal health	$1.03	$1.15
Supplementary feed	$2.05	$1.00
Freight	$0.34	$0.47
Wool tax	$0.62	$0.95
Wool selling expenses	$0.62	$0.95
Stock selling expenses	$0.47	$0.17
Total Costs	$8.75	$8.28
GM PER DSE	$14.49	$12.17
CAPITAL VALUE	$18.77	$26.00

Table 8-4 Gross margin - crop

Phase of rotation	1	2	3	4	5	Total/average
	canola	wheat	lupins	wheat	barley	
Average area (ha)	260	260	260	260	260	1,300
Yield	0.88	2.16	1.09	2.16	2.15	1.69
Price	350	136	111	136	111	169
Income/ha	307	293	121	293	237	250
Variable costs/ha	235	117	136	117	113	144
Gypsym cost/ha	-	-	-	-	-	-
Total cost	235	117	136	117	113	144
Gross margin/ha	72	176		176	124	107
			(15)			
Income	79,793	76,240	31,342	76,240	61,738	325,353
Costs	61,100	30,420	35,360	30,420	29,380	186,680
Activity gross margin	18,693	45,820		45,820	32,358	138,673
			(4,018)			

Table 8-5 Expected yields by crop and expected frequency of seasons

Season	Best	Good	Most Likely	Poor	Worst	
Frequency .. out of 20	1	4	10	4	1	
Yield - kg/ha						EV
Canola	2.47	1.24	0.82	0.49	0.00	0.88
Wheat	4.94	3.09	2.06	1.24	0.31	2.16
Lupins	2.47	1.65	1.03	0.62	0.00	1.09
Barley	4.45	2.47	2.14	1.65	0.66	2.15

estimated by one of the owners

Table 8-6 Expected price crop and expected frequency of price

Price	Best	Good	Most Likely	Poor	Worst	EV	Mkting Cost	EV-less mkting
Frequency .. out of 20	2	5	9	2	2			
Price/tonne								
Canola	370	370	370	370	370	370	20	350
Wheat	220	200	180	150	130	181	45	136
Lupins	210	180	160	140	110	163	20	143
Barley	180	170	160	140	90	156	45	111

estimated by one of the owners

8.3 Livestock trading schedules

Table 8-7 Livestock trading schedule - self-replacing flock

	$/hd	No.	Value $		$/hd	No.	Value $
Opening stock				**Sales**			
Breeding ewes	25	2,700	67,500	cfa ewes	18	594	10,692
1 yo maiden ewes	32	1,112	35,599	1 yo ewes	32	405	12,962
				Wether weaners	32	1,113	35,618
Rams	210	81	17,010	Rams	20	25	491
Births		2,295		**Deaths**		186	
Purchases				**Closing stock**			
Rams	400	27	10,800	Ewes	25	2,700	67,500
				1 yo maiden ewes	32	1,112	35,599
				Rams	210	81	17,010
Profit/Loss			48,952				
		6,215	179,861			6,215	179,861

The self-replacing and wether enterprises are linked. Here it is assumed replacement wethers are 'purchased' from the self-replacing flock.

Table 8-8 Livestock trading schedule - wethers

WETHER FLOCK							
	$/hd	No.	Value $		$/hd	No.	Value $
Opening stock				**Sales**			
Wethers	26	1,700	44,200	Wethers	15	374	5,610
				Deaths		51	
Purchases				**Closing stock**			
Wethers	26	425	11,050	Wethers	26	1,700	44,200
Profit/loss			-5,440				
		2,125	49,810			2,125	49,810

8.4 Crop-pasture discounted cash flow analysis

I. Table 8-9 Discounted cash flow - short crop, long pasture rotation