An economic analysis of native pasture in the hills and tablelands of south-eastern Australia

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The report

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Related reports

Related reports prepared as part of the project include:

Crosthwaite, J. and Macleod, N.D. In press. Retaining native vegetation on farms: understanding its private value *in* Craig, J.L, Mitchell, N. and Saunders, D.A. (eds), *Nature Conservation 5: Nature Conservation in Production Environments - Managing the Matrix*. Surrey Beatty and Sons, Chipping Norton, New South Wales.

Crosthwaite, J. and B. Malcolm. 1999. *An economic analysis of native grassland on the riverine plains of south-eastern Australia.* Institute of Land and Food Resources, The University of Melbourne, Parkville, Victoria.

Crosthwaite, J., N.Macleod and B. Malcolm 1997 'Case studies: theory and practice in natural resource management' in Vanclay F and Mesiti L (eds) *Sustainability and Social Research*. Wagga Wagga: Centre for Rural Social Research, Charles Sturt University.

Crosthwaite, J. 1998. 'Win, Lose or Draw. The Economics of Native Grasslands on Farms' *Trees and Natural Resources* 40(1): 24-25.

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Summary

The study presents the results of an investigation into the technical and economic aspects of managing native grasslands on farms. Particular attention is given to how changes to the management of predominantly native grass paddocks affect the operation and profitability of the whole farm business.

This report is based on a detailed examination of the human, technical, economic and financial situation of four farms, two in North-East Victoria and two on the Southern Tablelands of New South Wales.[1] Native pastures are integral to the operation of each of the four farms. Three farms run sheep enterprises, one is a dairy farm, and all four have some beef cattle. The farms range in size, carrying between 3,300 and 8,000 dry sheep equivalents. All rely on a single operator or two-generation family partnerships. A case study approach is used to draw out the key processes that are operating on such farms.

On all four farms, the native pasture is found on what was once woodland. The properties are typical of many farms in south-eastern Australia which have native vegetation, e.g. pasture, marsh or bush, which has been significantly modified since European settlement. Like most such farms, none of these have sites which are of high conservation significance. However, the lessons drawn from using the whole farm business approach can be applied to other farms irrespective of the vegetation type or quality. Using the whole farm business approach meant: determining how the current farm system operates and how native pasture contributes to it, identifying and evaluating options to meet farm goals in the future, and evaluating how conservation management options might be integrated into the farm business in the future.

Current farm financial position

While many factors influence how farmers will manage native vegetation, the health of the farm business is critical. Like most Australian farms at present, all farms in the study have expected annual returns to capital of two per cent or below. Expected annual operating profits after tax range for the farms from $2,000 to $28,000. Expected annual net cash flow ranges from -$16,000 to $29,000 (after consumption allowance, interest payments and land lease costs). The effects of the cost-price squeeze mean that, if they stay in farming, the owners of all four farms need to increase annual net income in order to meet consumption requirements, pay for maintenance fertiliser, replace equipment and fences, and keep up interest and principal repayments.

Three main issues are considered:

[1] A related report will present results for case studies undertaken on the riverine plains of Victoria and New South Wales.

(i) are there options available on the farm to increase annual net income sufficiently to meet farm re-investment and consumption requirements?
(ii) what role will the native pasture play in the future of such farms?
(iii) can the required lift in income be achieved without adversely affecting long-term productivity of the land, without increasing off-site effects and while retaining the most diverse native pasture and remnant bush?

The pastures

The farms have relatively small areas of highly productive agricultural land, with most of each property being undulating or steep land of moderate production capacity. The native pastures are the main pasture type on country that is not generally arable. Pasture composition varies, even within paddocks, depending on aspect and topography. Diversity of native species is generally low, with the most native pasture species found at any one site being 14. Naturalised annual grasses make an important contribution to feed supply, particularly in late winter and early spring. At these times of the year, the native species may make up only 20-30 per cent of the ground cover but this increases dramatically as the annual species dry off in summer. Clovers are present throughout the pastures, at low levels if naturalised but in higher proportions if clover seed has been broadcast and then fertilised periodically.

Erosion is a problem on two of the farms. Acidity is constraining pasture management choices on three of the case study farms because many introduced grasses are acid intolerant. Salinity is a minor problem on two of the farms. All farms have some tree-dominated areas which are mostly grazed.

Results

A range of pasture-related development options and conservation management options were tested on one or more farms. The development options examined include: replacing native with introduced pasture, fertilising native pasture, sowing introduced species into native pastures with sub-division or liming, and irrigating or fertilising introduced pasture. The options examined which might assist conservation management include: resting land, retiring land and sub-division.

It was found that each farm has technically feasible options which could substantially lift annual net farm operating profit after tax. The conservation management options are more feasible in the context of such developments.

Farm development options

(a) Annual operating profits can often be increased by sowing higher producing introduced pasture species. However, under current expected conditions, a profitable investment requires a stocking rate increase of six DSE/ha which is maintained for at least eight years. With good management on fertile soils this may not be difficult to achieve, and all four case farms have recently sown or intend to sow introduced pasture. On the poorer land classes achieving and maintaining high stocking rates can be difficult. Spraying out native pasture and replacing it with sown pasture is not found to be justified on the case farms.

(b) The productivity of some native pastures on all case farms can be profitably increased with regular use of low rates of fertiliser. Sub-division, and broadcasting or direct drilling clovers may also be involved. A return to capital of 15 per cent (real) or more can be expected on the case farms, based on a stocking rate increase of four dry sheep equivalent per hectare (DSE/ha) over 10 years. This strategy is very different to other types of investments and is characterised by: a low initial investment; annual fertiliser costs exceeding livestock gross margin for some years; long build-up to the steady state stocking rate; capacity to halt the investment; and a high salvage value.

(c) There are other opportunities on each case farm to improve farm performance which do not require significant capital investment. In most cases these are being pursued by the owners, and can potentially make a substantial difference to their capacity to keep up with the cost-price squeeze. Such opportunities include changing the criteria for selecting rams and improving grazing management.

Conservation management

The effect of managing selected areas of native pasture differently to current management has been tested. The results may be a guide to other situations where different management of native vegetation might help reduce soil erosion and nutrient run-off, or contribute to bush regeneration.

Expected annual net income foregone by retiring marginal areas of farmland is expected to vary between $30/ha and $50/ha, not considering fencing costs. Such losses may lower if done as part of a paddock sub-division which may assist in better utilisation of the rest of the paddock. Resting areas of native vegetation for some weeks or months may have conservation benefits in some cases. The income foregone from resting paddocks will be lower than for retiring land, and may not be significant at all, if it can be used to rejuvenate pastures as well as achieve conservation goals.

If conservation management is placed in the context of managing the whole farm business rather than being treated as an isolated action, its significance changes. If an investment program results in substantially higher farm profit, the significance of expected annual losses associated with conservation management options declines. Results show that, in the absence of extra investments elsewhere on the farm, the expected fall in operating profit associated with conservation management is more than what two of the farmers may now be able to afford. However, if the various development options are undertaken, all four farmers are in a much better position to pursue non-economic goals such as conservation management.

Reconciling public goals and private interests

The importance of non-economic goals varies amongst farmers and so does the extent to which they will voluntarily act in the public interest. Consequently, a basic premise of the following discussion is that it is usually necessary to reward people for doing

things that are in the public interest that they would not otherwise do. Further, bringing about change in the circumstances within which people operate, for instance by encouraging the development of farm business plans, may also lead to farmers taking up management actions in ways which are consistent with public policy goals.

The whole farm business approach requires programs for conservation management on private land to take into account the whole farm situation, and not just the paddock or remnant. It is also important to identify how the parcel of land of public interest might fit into the farm in the medium-term future. If the directions that farmers might take are identified, and the economic efficiency of alternative actions are evaluated taking into account risk and uncertainty, then the role of the native grassland in the farm system is being assessed in the light of the best information available. This provides a sound basis for devising actions to achieve public policy goals, or to convince farmers to change private goals.

Incentives may be justifiable to assist in the transition to farming systems that are viable in the long-run if the changes meet public goals but have insufficient private incentives. Developments that have a long lead-time like fertilising native pasture, or other developments that will indirectly ease the pressure on native pasture areas, may qualify. Such assistance could involve well-defined cross-compliance obligations with recipients negotiating conservation outcomes in advance.

The whole farm business approach makes it possible to give attention to the future of the farm itself as well as to the future of the conservation area to be managed. It is consistent with, and needs to be considered together with, other approaches, now in place or under consideration in Australia. The approach is a different perspective on rewarding to farmers for the provision of conservation services (Binning & Young 1997).

The whole farm business approach will encourage but not guarantee management for conservation values, so a more secure system of covenants or management agreements for areas with high conservation value areas is also required.

Implementing the proposed approach will require:

(a) incorporating native pasture considerations into research, policy and extension programs for both production and conservation; and

(b) integrating knowledge and principles about native pasture management and whole farm management, including the basic principles of farm management economics, into extension programs and advisory services, both public and private.

1. Introduction

In this report the results of an investigation into the economics of managing native grasslands on farms are presented. In particular, the focus is on the way changes to the management of predominantly native grass paddocks affect the operation and profitability of the whole farm business. This question has been investigated for two reasons related to public policy:

(i) native grasslands on farms may require particular management if they are to retain their conservation values, and

(ii) native grasses and forbs may help prevent or reduce land degradation.

There are several terms currently used to describe areas on farms that have native grasses and forbs - native grassland, herblands, native pasture and natural pasture (eg Lodge and Whalley 1987, Mott and Groves 1994). In this report, the term 'native grassland' is generally used as being most appropriate for high conservation value areas. More generally the term 'native pasture' is used to refer to all areas with significant proportions of native perennial grasses that are used for grazing purposes, irrespective of their conservation value.[2]

This report is based on a detailed examination of the human, technical, economic and financial situation of four farms, two in North-East Victoria and two on the Southern Tablelands of New South Wales. In another report, results for four case studies undertaken on the riverine plains of Victoria and New South Wales are presented. While this study is concerned with native pasture, the principles apply to other forms of remnant vegetation.

The objectives of the project, funded by Environment Australia, the Land and Water Resources Research And Development Corporation (LWRRDC) and the Victorian Department of Natural Resources and Environment, were to:

- identify the key economic, environmental and social factors taken into account by land holders when making decisions which affect native grasslands;
- quantify the technical and economic roles of native grassland and native grasses and forbs, in different property management systems under different economic conditions. This includes direct economic uses such as livestock production as well as some consideration of any indirect and off-site effects such as control of waterlogging and salinity;
- produce region-specific economic and financial information about the management of remnant grasslands and native grasses and native forbs within whole farm systems;

[2] A strict definition of native pasture is difficult to give for two reasons. Firstly, the composition of most pastures with a mixture of perennial and annual species varies over the year. In winter and early spring, native grasses are likely to be less significant compared to legumes and annual grasses. By late spring or early summer in most years, the annual grasses and legumes will by drying off. Secondly, the perennial grass component of a pasture is important in terms of production and maintaining the soil condition, and to regard a pasture with 70% annual grasses, 20% native grasses and 10% other species as an annual grass pasture misses the significance of the perennial grass component.

- develop methods for decision-making by land managers about native pasture in situations where there is limited information about pasture characteristics, about response to management and about future benefits;
- identify feasible financial and non-financial incentives for sustainable management and conservation of native grasslands and management and establishment of native pastures, based on the likely private and public benefits already identified.

In this report, first an overview is presented of the results of the study. A detailed account of each of the four case studies follows.

2. The issues - public and private perspectives

Public policy goals for remnant vegetation include maintenance of biodiversity and long-term agricultural productivity, and minimising negative off-site effects of farming activities (Environment Australia & Department of Primary Industries and Energy 1997). These public policy goals are not inconsistent with the hopes and aspirations of farmers seeking to maintain the productivity of their land for the next generation as well as aims of maintaining diversity of the agro-ecological systems on farms. However, values, attitudes and intentions are not the same as behaviour. Farm management practices are conditioned by short and medium term needs for net income which may not be easily reconciled with longer term public policy goals.

As farms are businesses organised around generating income for business survival and profit, understanding how different parts of the farm contribute, or might contribute, to the profitability and cash flow of the farm business is central to resolving the public policy issues. Given the complexities and complementarities of farming systems, and their component parts, and the varying productivity of different land classes, it is not simple to define the contributions of the different land classes to the operation and profitability of a farm business. Two aims of this report are to determine the contribution of native vegetation to the farm business, and to demonstrate appropriate methods for determining and evaluating this contribution.

The public policy issues are different, depending on the environment. On the hills and tablelands, decline of biodiversity is associated with the loss and fragmentation of the original bush vegetation. Naturally occurring grasslands were historically less significant than on the plains, except in particular environments like the Monaro Plains. Nevertheless, outside the Monaro Plains and similar areas, there are pockets of grasslands that are extremely important for conservation. More generally, where clearing of the bush has occurred, most of the ground flora species have disappeared leaving a few native perennial grasses and, in the occasional paddock, additional species such as glycines, orchids and daisies. These areas may contribute to conservation by providing genetic diversity within species, by providing buffers for high conservation value areas, and by providing some habitat for native wildlife.

Native grasses form the perennial component of most pastures on the hills and tablelands of south-eastern Australia (Pearson *et al* 1997, Garden *et al* 1993). In the absence of trees and shrubs, perennial grasses are important in maintaining long-term

productivity of agricultural activities, and in minimising soil erosion. The deep rooted perennial grasses do more to prevent soil erosion than the shallow rooted annual grasses which die off in late spring or early summer. Apart from any off-site effects, measures which prevent the loss of the topsoil and its organic content of farm soils is particularly important given the fragile nature of most Australian soils. Perennial grasses have a role in grazing systems because they provide feed, particularly green matter, at times of the year when annual grasses and legumes have senesced. Consequently, given the variable climate in Australia, perennial grasses provide more stability in the feed supply than would otherwise be the case (Wilson 1996).

Persistence is a problem with introduced grasses on less productive soils (Jones 1996, Garden *et al* 1996, Kemp *et al* 1996). Many reasons have been identified, including drought, lack of phosphorus and poor management (Wilson 1996). In spite of the many success stories in establishment of introduced pastures, and the longevity of selected pastures especially on more productive soils, survey results show that across wide areas where introduced grasses have been sown, they have not persisted (Garden *et al* 1993, Quigley *et al* 1992). The extent to which introduced grasses have declined in and been replaced by native grasses is not widely recognised possibly because the ability to distinguish between grass species is a quite specialised skill (Millar & Curtis 1995), and because some of the prostrate native and introduced grasses have similar characteristics. The dominance of naturalised annual grasses in previously sown pastures may increase the prospects of erosion, once the ground cover has gone, especially after sudden downpours, and of increased water accession possibly contributing to off-site salinity problems.

Considerable rethinking of the role of both native and introduced pasture on the hills and tablelands of south-eastern Australia, is occurring because of problems with introduced grasses in these areas. Identification of low input native and introduced species suitable for these areas and the persistence of these grasses, has become a focus of research in recent times (Garden *et al* 1996). Pasture ecology is receiving renewed attention (Michalk & Kemp 1994) and research on introduced grasses is now swinging back to emphasise persistence whereas research on grasses over the last 50 years has mainly concentrated on productivity (D. Chapman pers comm). The productive value of native grasses on less productive soils depends on appropriate management, and relevant techniques of management are being identified (Simpson & Langford 1996).

3. The case study approach

A systematic analytical approach is outlined in this section for clarifying the role of native pasture on a farm, and for finding feasible investment options which are consistent with managing selected areas for conservation and long-term productivity. The approach is the whole farm approach of farm management economics which has been used to study the operation of four farms in depth. The use of case study theory in selection of the farms and the design of the study is explained in Crosthwaite, MacLeod and Malcolm (1997).

Criteria for selecting the case farms included presence of native pasture and its characteristics, farm enterprises, proportion of income derived from the native pasture, availability of information, and landholder interest. The presence of native grasslands of high conservation value was not necessary to achieve the objectives of understanding how particular parts of the farm contribute to the whole.

The method is outlined below. It involved some general guidelines for the analysis which were varied according to the specifics of each farm. The method can be adapted to farm situations where investigators are short of time and information is limited. Such an application has been made for a farm in south-western Victoria where the owners face difficult choices about management of native grassland (Crosthwaite & MacLeod 1997).

For each case, the **first stage** of the inquiry was to determine how the farm system currently operates This means:

(i) clarifying the farm family goals, the resources available and farm activities,[3]

(ii) determining the botanical and agronomic characteristics of each pasture type on each case farm in spring 1997.[4] Tables detailing species found by abundance and cover/dry matter estimates by vegetation class have been prepared for each farm,

(iii) identifying stocking pressure on each pasture type. In some cases, this involved quantifying the feed utilised from each pasture based on the length of time livestock were grazing on those pastures,[5]

(iv) determining the current financial situation of the farm business.

For the owners of each case farm, and from an economic viewpoint, the value of native pasture in the farming system is determined by the means and extent it contributes to whole farm profit, relative to what else could be done with that land area. Importantly, the contribution of native pasture to farm profits, and potential for changed management to increase that contribution, has to be seen in the light of the other possibilities which may exist for changing use of the resources under the owners

[3] This was done during the course of at least two visits to each property and many phone conversations.

[4] There was no assessment of invertebrates, reptiles, or other fauna. Pasture assessments were done by Meredith Mitchell and Jo Millar in North-east Victoria and by Nicky Taws on the Southern Tablelands of New South Wales. The method essentially involved the following steps:

- grouping paddocks on the farm according to pasture type based on information provided by the owner,
- selecting paddocks to inspect,
- locating a 'typical' part of the paddock. Sometimes two or more sites were selected in the one paddock,
- identifying species at the site and recording abundance status (rare, localised, common, abundant). Approximately 20-30 minutes was allocated,
- visually estimating percentage composition of the pasture (e.g. introduced annual grasses, native forbs, native perennial grasses) in cover and/or dry matter terms,
- verification of the accuracy of composition estimates by throwing 50 quadrats at one or two sites on each property.

[5] The method is outlined in the report Who's Eating Where? (Crosthwaite 1998). In essence, it involves determining the livestock months (lsms) of feed that are being utilised in the given paddock or pasture type on a total and per hectare basis. It requires input of livestock numbers by type, livestock weights by month of the year, supplementary feed given out by paddock, paddock names, and stock movements from one paddock to another.

control to better achieve goals of the farm family. Thus the **second stage** of the inquiry involved investigating the potential contribution to profit and cash flow of native pasture relative to the potential contribution of other resources of the farm business. This means:

(i) understanding farm family goals and current plans,

(ii) determining possible options for increasing farm operating profit and net cash flow from (a) the native pasture area and (b) from other farm resources,

(iii) investigating farmer plans and options using the following criteria:

- how they contribute to the farm feed supply and livestock carrying capacity,
- the *extra* profit/loss and return on marginal capital resulting from the changes,
- whether they can be financed (peak debt, years before positive cash flow),
- uncertainty and risk (sensitivity to changes in key variables).

The **third stage** of inquiry into each case study farm has been to investigate a range of 'conservation management' options for native pasture. These options may be directed at improving the long-term productivity of the land from which the owner will ultimately benefit, or may aim to maintain conservation values and minimise off-site effects of agricultural activity from which the public or others primarily benefit. The aim is to see how these options would fit into a changed farm business operation. The conservation management options evaluated on the different case farms were:

- temporarily destocking or resting the pasture for up to three months a year,
- retiring land from production and total destocking,
- sub-division to allow better grazing control.

The economic questions revolve around how managing the native pasture in these ways will fit in with the whole farm operation - specifically whether significant loss of income will result.

The **fourth stage** of the inquiry is to assess any off-site effects (e.g. salinity) associated with the current management methods, and with alternative forms of managing the native pasture.

The **fifth stage** of the inquiry is to consider whether incentives are appropriate to achieve public policy goals, and if so, what form of incentive. These issues can be assessed once more is known about:

- the potential contribution of native pastures to the farm business,
- factors influencing management of the native pasture,
- the on-farm and off-farm implications of the conservation management option.

One of the contributions of this report is in theory-building about natural resource management. Case studies such as have been undertaken as part of this project, form a basis from which some generalisations can be made (Crosthwaite, MacLeod & Malcolm 1997). The reports on each case study set out the key processes operating on each farm. The aim of the case studies is to shed light on processes that also operate on other farms in the hills and tablelands of south-eastern Australia, given the different contexts in which all farming activity takes place. The multiple dimensions of farming - pasture and livestock management, business viability, farm-family goals, stages of life

and livelihood needs, land protection, biodiversity conservation - mean that each farm is different. The strength of the case study approach is in its ability to draw out the key processes that are operating on farms.

Sound case studies are designed with the aim of identifying what may be 'generalisable' (Crosthwaite, MacLeod & Malcolm 1997). In this study each farm report was provided to the farm owners for checking and verifying. Conclusions are drawn in the report for each case farm about:

- the contribution of native pasture to the total feed supply
- the current state of the farm business,
- the profitability and financial feasibility of various investment options
- the scope to increase income over the medium-term
- the scope for incorporating conservation management options into both the current and future farm business

Finally some conclusions of a general nature are drawn.

The conservation and investment options which were examined varied from one case study to the next. The conservation management options examined are:

- to rest land for 6-12 weeks annually - case reports one, two, three and four
- to retire land from production - case reports one, two and three
- to sub-divide - case farm four

The investment options analysed for areas of the case study farms that now grow native pasture are:

- to fertilise more frequently - case reports one, two, three and four
- to replace with sown pasture - case report one
- to sub-divide, direct drill clover seed and fertilise frequently - case reports two and three
- to lime and direct drill introduced grasses and clover into native grasses - case report four

The investment options analysed for areas of the farm with introduced or naturalised pastures are:

- to spray out pasture and direct drill introduced grasses and clover - case reports one and two
- to sow and irrigate pasture - case report one
- to fertilise more heavily and frequently- case reports two and four

Some different types of information has been gathered and analysed about the operation of each of the four case study farms. For example, more detailed background information about each pasture type is contained in case reports one, two and three. Livestock movements from one pasture type to another are recorded in case reports one and three.

5. Overview of the current operations of the case study farms

The case study farms are all grazing properties. All four carry beef cattle, three have sheep enterprises while on the fourth farm sheep were replaced by with dairy cattle 10 years ago. Only one farm is cropped, where grain is grown for use on the farm.

The main characteristics of each farm are given in Table 1.

Table 1 Characteristics of the four case farms

	Case farm			
	1	2	3	4
	North-East Victoria		Southern Tablelands NSW	
Size (ha)	1,130	361	907	1,215
Area of farm in native pasture	66%	75%	63%	est 75%
Stock using native pasture	Ewes and lambs Wethers	Beef cattle Dairy heifers Dairy cows	Young ewes and wethers Wethers	Ewes and lambs Wethers Cattle
Stock using introduced pasture	Weaner sheep	Dairy cows	Ewes and lambs	Weaner sheep and cattle
DSEs carried	6,658	est 3,300	5,616	8,003
Farm labour	2 (father age 55 and son age 30)	1 (age ~55)	2 (father age 60 and son age 30)	1 (age ~ 45)
Enterprise size				
Self-replacing merinos (ewes)	1000	-	1250	2,500
Wethers	1000	-	900	1,200
2 yo fine wool	-	-	700	-
First cross lambs (ewes)	500	-	-	-
Studs (ewes)	275	-	-	-
Beef cattle (cows)	100	60	12	60
Dairy cattle (cows)	-	100	-	-

Case farms one and three are organised as two-generation partnerships (parents-son and wife) partnerships. Responsibility is gradually being handed over to the younger generation. It is likely that the fathers in the partnerships will continue to be actively involved in the operation of the farm for many years to come. Costing the labour on these farms is an issue. In both cases, the farms could most likely be run by one full-time manager/operator, with some paid permanent or casual labour. This would be consistent with standard of one labour unit to 5-7,000 dry sheep equivalents. Case farm four which carries the most stock and has the most difficult country to manage has one manager/operator. In these analyses, operator's labour is valued according to established economic theory, by considering both the opportunity cost of the manager/operator's labour and the cost of obtaining equivalent manager/operators services in the market. In the analysis operator's labour and management services are assumed to be provided at a cost of $40,000 per year.

5.1 Land management issues and conservation indicators

There are aspects of the operation of each farm which have implications for long-term productivity, mostly associated with the poorer land classes (see Table 2).

The conservation status on each property was assessed by looking at plant diversity and abundance at 10 or more sites. There was no assessment of invertebrates, reptiles, or other fauna. All case farms are located on former bushland, although case farm two has what may be a natural clearing which includes a range of native pasture species. The number of native species found in the pasture was highest of all farms on parts of case farm three, as shown in Table 2. The 14 species found in the most diverse pasture contrasts with the 50 or more that are sometimes found in relatively intact native grassland.

Table 2 Land management and conservation indicators on the four case farms

	Case farm			
	1	2	3	4
	North-East Victoria		Southern Tablelands NSW	
Size (ha)	1,130	361	907	1,215
Area of farm in native pasture	65%	75%	75%	65%
Land management issue				
Erosion	minor if at all	land slips in past	gully erosion in the past	severe slips and gully erosion in parts
Salinity	minor at present	no	no	Minor
Acidity	yes	no	yes	Yes
Conservation indicators				
At any one site, the greatest number of:				
native species	7	8	14	8
native grasses	4	4	10	5
native forbs	2	4	7	3
native legumes	1	1	2	2
The number of native forbs or legumes either abundant or common:				
	0	0	2 [#]	0
Remnant bush	little	yes	small area	small areas
Bush regenerating?	small areas	yes	one paddock	yes

[#] Common Bog-sedge *Schoenus apogon*
Kidney Weed *Dichondra repens*

5.2 Pasture status by land type

Estimates of the proportion of each farm by land class and pasture type are shown in Figure 1.

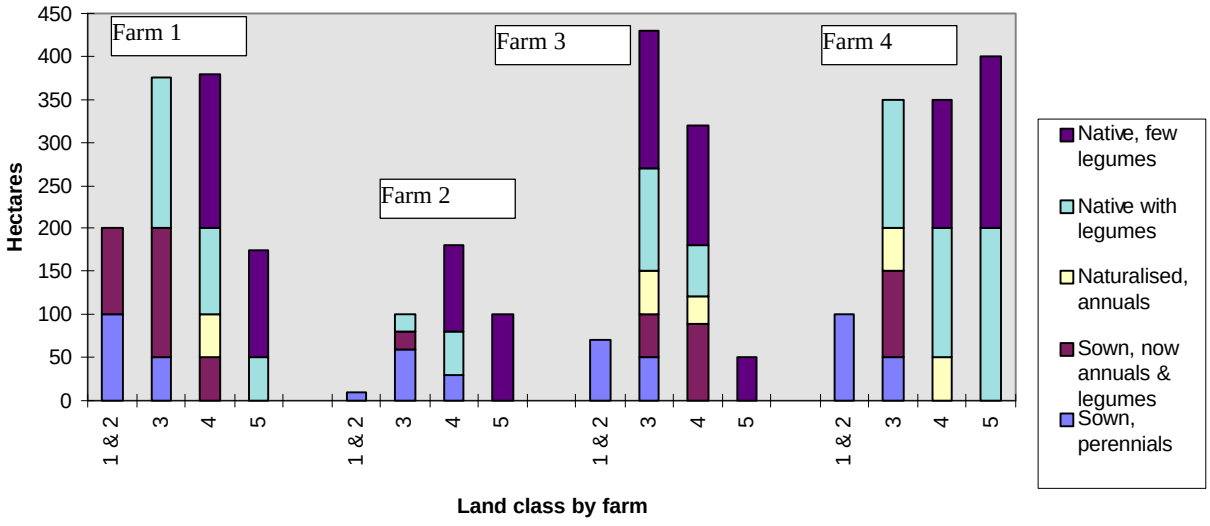
Based on established systems for land classification and following the adaption of these systems by Simpson & Langford (1996), land has been classed as follows:

- Land classes one and two are two classes of land which are arable, have high fertility, minimal erosion risk and are not acidic.
- Land class three is semi arable and is on lower slopes. It is likely to have lower fertilitiy, be moderately acidic (ie ph 4.5-5.0 CaCl), and have moderate erosion risk
- Land class four is non arable land on middle to upper slopes with low fertility, shallow soils, which may be acidic and have a moderate to high erosion risk
- Land class five is similar to land class four, but usually is on highly erodible, steep upper slopes

All farms have less than 100 ha in land classes one and two. This is under 10% of the property in each case. Case farm one has 200 ha in land classes one and two, which is slightly under 20 per cent of the total land area, if leased land is included. In all cases, land of classes one and two has been sown to introduced pasture. Case farm one has had poor results in recent years in establishing pastures, and around half the land classes one and two are dominated by annual grasses.

Land class three comprises the largest land type on each farm and is suitable for direct drilling legumes, and possibly acid tolerant introduced grasses. Land class four is also a significant portion of all farms, and can be fertilised. Land class five is found on all farms. It is probably the main land class on case farm four, and has a major impact on how the farm is run.

Figure 1 Area of pasture - pasture type, land class and farm



5.3 The current economic and financial situation

The health of the farm business as it now operates will be one of the most important factors influencing how native pastures are currently managed and will also influence plans for the future.

Measures of importance in determining the health of a farm business are profitability which relates to efficiency of resource use and cash surplus which relates to financial viability. In Table 3, expected annual operating profit after tax and return to capital are used as indicators of efficiency of resource use. Expected annual cash surplus or net cash flow before and after debt servicing indicates likely financial availability of the business - that is ability to meet all financial demands including family consumption.

Looking at all the farms, case farm one has the highest expected return to capital, and expected annual operating profit after tax is second highest. However, interest and principal payments and costs of leasing land mean that annual cash flow is expected to be negative (if a consumption allowance of $40,000 is made) from the current farm plan.

Case farm two is a much smaller farm than the others, and expected annual net cash flow (with a $30,000 consumption allowance) is negative.

Case farm three has an expected annual return to capital of around two percent and a healthy expected annual cash surplus.

Case farm four has an expected annual operating profit after tax of around 1.5% and expected annual net cash flow is positive.

Table 3 The current economic and financial situation on the case farms

		Case farm			
		1	2	3	4
		North-East Victoria		Southern Tablelands NSW	
Total capital	$'000	1,251	845	1,340	1,680
Economic situation					
Expected operating profit after tax	$'000	18	2	28	10
Return to capital	%	2.3	0.2	1.8	1.4
Financial situation					
Equity	%	95	85	100	100
Expected uses of cash					
Cash in (ie. Income)	$'000	159	98	161	195
Cash out	$'000	168	114	132	173
Net cash flow	$'000	-9	-16	29	22

In these cases, as is usually the case in Australian farming, the more highly geared businesses face the possibility of not being able to service their debts, at least in some years.

6. Alternative scenarios for the case farms

6.1 Owner plans and opportunities

All four farm owners are planning changes to management of some of the native pasture area on the farm, as shown in Table 4. Possible conservation management options are also shown.

Table 4 Changes which could be considered on the four case farms

	Case farm			
	1	2	3	4
	North-East Victoria		Southern Tablelands NSW	
Owner's plans				
Native pasture areas	Fertilise more	Fertilise more Sub-divide and manage grazing	Sub-divide, direct drill and broadcast clover Fertilise	Fertilise Sow introduced species
Other resources	Expand stud Improve genetic quality of sheep Irrigate	Increase fertiliser on dairy areas Direct drill clovers and grasses	Buy rams to increase wool cut per sheep	Use nucleus mob to increase genetic quality of sheep
Additional options				
Native pasture areas	Concentrate fertiliser Replace with sown pasture Direct drill clovers and grasses	Concentrate fertiliser Replace with sown pasture Direct drill clovers and grasses	Concentrate fertiliser Replace with sown pasture	Concentrate fertiliser Replace with sown pasture Direct drill clovers and grasses
Other resources	Remove stud	Sow pastures	Sow pastures Stock more cattle	Sow pastures Produce first cross lambs
Conservation management				
Currently done		Lighter stocking in spring		
Options	Lighter stocking in spring Destock	Destock	Lighter stocking in spring Destock	Lighter stocking in spring Destock

6.2 Options to increase income on each farm

6.2.1 Sowing introduced grasses on land classes one and two

All four farms have pastures sown to introduced grasses within the last five years. Most were sown onto areas dominated by annual grasses and broad-leafed weeds. On case farm one, extra land was leased to run the stock displaced by the pasture development program. The program has only been a partial success.

Every year on case farm two a small area is sown to introduced grasses by direct drilling. A large area on case farm three was sown in the 1960s. Some of these areas have been resown recently.

6.2.2 Replacing native pasture

Native pasture on flatter areas of case farm one have been sprayed out, and introduced grasses and clover sown. However, the introduced grasses have not persisted. The owners are intending to confine future sowings to areas of the farm that are not in native pasture.

Pasture replacement is only being considered for the native pasture areas on the other farms where there are problem pastures. On case farm four, a paddock dominated by Rush has recently been sprayed out and resown. Serrated tussock has established a foothold on parts of this farm; pasture replacement may be one solution if it cannot be brought under control by other means.

6.2.3 Using more fertiliser on native pastures

All case study farmers currently fertilise the native pasture areas on a three or four year rotation, or something even less frequently. All farmers expressed a desire to fertilise more frequently - if it would pay to do so and if they could afford it.

There are a range of options for managing native pasture (Simpson & Langford 1996). The main option considered in this study for increasing production off native pasture is for 100kg or 125kg superphosphate to be applied to native pasture annually for 10 years. Trials have shown that this application has resulted in stocking rate increases of five DSE/ha (Simpson & Langford 1996) over the 10 year period. These results have been obtained on native pasture where there is a sufficient legume base to respond to the fertiliser. A faster response may be obtained if legumes are present (P. Simpson pers comm). If the native pasture did not have an adequate legume base, direct drilling or broadcasting seed possibly after spraying out the pasture would be necessary to achieve the stocking rate increases (Simpson & Langford 1996). Assuming a linear rate of increase in stocking rate over the 10 years is a reasonable approximation of what happens. If shown to be economically worthwhile, the strategy of fertilising native pasture might be adopted on at least some of the farms.

On case farm one there are some flatter paddocks that can be easily traversed that the owners would like to fertilise more frequently.

The owners of case farm two are currently increasing their annual fertiliser application fourfold. This is in dairy paddocks which have areas sown to introduced species but which also have some native grasses, particularly on, but not confined to, the steeper slopes. Annual fertilising of a native pasture paddock that is used by the dairy herd might be of interest. This would be done by air.

The owners of case farm three are prepared to fertilise annually paddocks in which legumes are being introduced into the native pasture to increase winter feed. On other pastures, they are concerned that the level of stocking required with this strategy is like a high input strategy which pushes the system to its limits. For them, as stocking levels increase, feed shortages develop much more rapidly if weather patterns are unfavourable. The recent long run of poor autumns on the Southern Tablelands have made these farmers cautious.

The owners of case farm four feel a strategy of increasing fertiliser use on native grasses would require fertilising another area less often, and pointed out the importance of fertilising the steep hill country where the ewes lamb. As this farm has 100% equity, there is an implicit concern about financing medium term fertiliser applications from medium term borrowings.

All four case farmers expressed some reluctance to borrow extra funds to pay for fertiliser. However, all four are currently re-thinking their fertiliser strategy. The reluctance can be linked to the history of farm development over the last 50 years.

During the 1950s and 1960s, many farmers could afford to apply maintenance levels of fertiliser to the whole property every year because product prices (wool, meat and dairy) were relatively high and fertiliser was cheap. The autumn break was also more reliable during this period. Over the 1970s fertiliser became more expensive, farm area expanded and product prices began to fluctuate much more. Fertilising the whole property, or even half of it, was becoming more difficult. Lacking an alternative strategy, and under pressure to expand the farm area, many fell back to *ad hoc* fertilising of different parts of the farm when and if fertiliser could be paid for out of the previous year's cash flow. Some tried to fertilise the whole farm on a rough three or four year cycle, with fertiliser going on in the years that cash flow was high enough to cover the costs.

These points are illustrated on one of the case study farms. Fertiliser was applied through the 1970s every year or every second year to most of the farm. When new land was bought around 1980, fertiliser applications stopped for 12 years on the main part of the farm, with some areas on the newly purchased area receiving some fertiliser. A concerted fertiliser program was re-started in 1993, and the area being covered is gradually expanding.

In this report, optimal fertiliser strategies for each farm and the appropriate levels of maintenance fertiliser are not investigated. The merit of options to apply *extra* fertiliser as an investment (rather than as maintenance) in particular circumstances are

investigated. If an option to fertilise a particular part of the farm meets the key investment criteria of profitability, affordability and acceptable risk, then borrowing to do so is worthwhile.

6.2.4 Sub-division and introducing clover seed into native pastures

Sub-division of two large native pasture paddocks is a priority for case farm three; one paddock is being sub-divided at present. The intention is to direct drill easily accessed parts of the new paddocks and to broadcast seed across the rest. These paddocks would be fertilised on an annual basis. Case farm three has one paddock which has many native grass species but is dominated by unpalatable wire grass - the owners expect to be able to sow clovers into it.

Case farm two has two areas where sub-division is being considered. One large area of native pasture was previously divided by a fence which has fallen into disrepair. A large hill paddock used by the dairy cows could be managed better if sub-divided - the owner is very concerned at the erosion potential with cows creating tracks along the new fence boundaries.

Sub-division is not a priority on case farms one and three.

6.2.5 Changing grazing method

All four farms have a grazing system which is based on set stocking, but in which there is some movement of animals. On all four farms some paddocks are rested for short times.

Grazing systems based on more frequent stock movements can have several advantages relating to manipulating the pasture composition and shifting feed supply to the seasons of shortest supply. Composition of pastures can be manipulated by increasing stock numbers to eat out undesirable species at the time of year when the favoured species will not be adversely affected. It may be possible to change composition of the pasture to obtain more green feed in summer and autumn if species which respond to summer and autumn rain are favoured.

None of the farms systematically pursue a rotational grazing system. It is likely that all four will move somewhat further in this direction given their current efforts to increase knowledge and experience in observing pastures. The owners of case farm one have been involved in pasture trials, including the Community Grasses program which aimed to increase farmer knowledge of native grasses and their seasonal changes. Case farm two is involved in the Target 10 dairy extension program which closely monitors pasture response to seasonal conditions and fertiliser application. Both farmers on the Southern Tablelands are involved in Prograze courses.

In all cases, there are constraints to moving towards a more flexible grazing system involving the whole farm. Three of the farms are split into several blocks. Increased movement of the main ewe flocks is limited on case farm one because the studs occupy

a relatively large area of the farm. The owners are interested in trialling a system of rotationally moving wethers around the paddocks in one block. On case farm three the two year old ewes and wethers could feasibly be rotated around the block they run on. However, the animals are now moved only four times a year and the lack of labour requirement for those stock is an aspect of the current system that the owners value. The dairy enterprise occupies most of case farm two, and rotational grazing is practiced already - partly utilising native pasture. On the rest of the farm, sub-division would be first required. On case farm four, it takes a full day to muster stock and move them from the steeper paddocks. Rotational grazing might be feasible on the flatter native pasture paddocks near the house.

6.2.6 Improving animal output

The three case farms with sheep flocks are actively trying to produce either heavier fleeces, finer wool or heavier weaners.

Case farm one has recently established two studs - one Merino and one Border Leicester - as the basis for improving wool quality and better quality weaners.
Through genetic selection, case farm three is using fertiliser on introduced pastures to increase dairy output per cow.

Case farm three has reduced the micron of their fine wool from 19.3 to 17.9 over the past 12 years. Fleece weight has fallen slightly over this time to just under 4.2 kg per sheep. Now the owners are intent on buying rams to increase fleece weight while retaining the same degree of fineness.

The owners of case farm four are pursuing higher wool quality by keeping the better ewes in a nucleus flock separate from the main flock.

6.2.7 Change the enterprise mix

There are no easy answers to increasing income by changing the enterprise mix on any of the case farms - the rule ‘It is not what you do but how you do it’ usually applies.

Case farm one has only recently established the two studs, and intends to trial them for five years. It is difficult to operate small studs so that they are the most profitable use of land, labour and capital. The alternative would be to expand the other livestock enterprises.

Case farm three previously had more cattle. They could increase the number of cattle to the point where the complementarities between sheep and cattle no longer apply. The owners are unwilling to run more cattle. Introducing some meat breed rams and producing first cross lambs is another option. Case farm four could also produce first cross lambs, but the requirements for land on which to fatten them could conflict with the needs of the beef enterprise.

6.2.8 Other changes

The owners of case farm one have proposed irrigating a small area of pasture. The purpose is to complement other pastures by turning stock off those pastures faster in autumn and hopefully obtain higher market prices.

Agroforestry is a potential option. It may be more realistic for the farms in North-East Victoria which are near large timber mills than on the Southern Tablelands. The owner of case farm four on the Southern Tablelands has indicated an interest in how carbon credits will affect the economics of agroforestry on the farm.

6.3 Background to economic and financial analysis

Several selected opportunities to increase income on each case farm have been evaluated. Some involve native pasture. Options relating to increasing genetic quality and stock rotation have not been examined.

The full evaluation is contained in the report on each case farm.

The option for investing to improve productivity on the case farms are analysed using the standard budgets of farm management economic analysis (Makeham & Malcolm 1993). The current situation is shown using whole farm profit and net cash flow budgets. The investment options are analysed using discounted cash flow budgets to determine the likely profitability in terms of net present value at required rates of return, and the expected internal rate of return. Then cumulative net cash flow budgets using nominal dollars and interest rates are utilised to assess the financial viability of the option.

These forms of analysis allows consideration of each option against three criteria, namely:

- expected profitability (as measured by net present value, internal rate of return, return on marginal capital in steady state)
- expected cash flow (indicated by years of debt and peak debt)
- risk and uncertainty (indicated by testing the sensitivity of results to changes in key input variables)

Any analysis of pasture management which does not take all these steps into consideration is inadequate as a guide to decision-making.

The options analysed for case farm one are shown in Table 5.

Table 5 Summary results for case farm one

	Native pasture		Rest of farm	
	Sow grass and clover	**Fertilise**	**Sow grass and clover**	**Irrigation**
Economic analysis				
Initial investment (yr 1 only)	$10,964	$557	$10,964	$11,800
NPV 10% real	$1,005	0%	$10,373	$3,322
Expected steady state year	3	11	3	4
Extra operating profit in steady state	$4,663	$4,145	$6,818	$3,118
Financial analysis				
Years of debt	9	8	6	7
Maximum debt	$27,194	$6,009	$26,341	$13,762
Year of peak debt	2	5	2	2
Cum net cash flow yr 7	-$13,327	-$3,829	$3,004	-$665
Cum net cash flow yr 15	$30,519	$50,282	$82,307	$38,879
Salvage value yr 15	$16,111	$40,567	$17,126	$3,540

The size of each investment varies in terms of the initial capital and the area to which it is applied. The physical result of each investment is measured in terms of extra dry sheep equivalents (DSE) carried ie. the expected stocking rate less the current stocking rate. This is the basis for calculating the change in income and costs in the years following the investment.

The investment in irrigation on case farm one is also measured in terms of extra stock carried, although the aim is not to increase stock numbers but to sell autumn sale stock off faster and at higher weights than otherwise possible. This also increases the feed available for other stock, which is an important factor if seasonal conditions are poor. Increasing stock numbers is a proxy for these changes.

Profitability

Expected steady state year is the year that the expected stocking rate is expected to be achieved. Extra operating profit after tax is based on the extra activity gross margin for the extra stock less unallocated variable costs such as fertiliser, and any changed overhead costs. The activity gross margin takes into account wool price, wool cut, health and other costs as well as livestock sales and purchases.

Net present value measures the return to extra capital invested over the life of the investment. Results in each budget are calculated using three discount rates - five, 10 and 15 per cent. All are in real terms. Discounting of future cash flows is required because farmers have alternative uses for their capital and the earnings foregone from alternative uses of funds and the value of their earnings in the future has to be considered in decision analysis. If net present value is greater than zero at the required rate of return (discount rate), it means the investment is more profitable than the alternatives to which it is being compared.

Each budget also shows the internal rate of return. This is a measure of the return to capital invested over the life of the investment, but it is less satisfactory than the net present value (Makeham & Malcolm 1993).

Cash flow

Cumulative nominal net cash flow indicates the cumulative net cash contribution to the business over time after tax and interest have been taken into account.

The years of debt and maximum debt are two measures of the financial feasibility of the investment. Even if an investment is profitable, it may not be within the owner's financial resources to carry it out.

While the economic analysis is in real values, the financial analysis uses nominal values. The economic outcomes of investments can be analysed in either real or nominal values. Real values have the effect of inflation removed while nominal values include the effects of inflation. Financial outcomes have to be analysed in the expected future nominal values which may apply. This is because servicing of debt and other commitments have to be met using the nominal dollars of the time in question. It is assumed that the current real relationships between income and costs are maintained. This implies that if there is inflation affecting costs then returns will also rise similarly. This could happen in either of two ways: either prices received could increase at the same rate of inflation as costs (this does not usually happen, prices received depend on supply and demand in any year), or farm productivity could increase sufficiently to offset the rise in costs (this is what happens in Australian agriculture), thereby maintaining real net returns.

Salvage value

Salvage value at the end of the investment period reflects what remains of the initial capital invested. Taking account of salvage values ensures that a true return to capital is estimated because changes in the initial stock of capital over time are accounted for. Depreciation of capital invested, over time, may or may not occur, depending on the annual capital maintenance expenditures. In the case of pasture improvement based on introduced grass species it is common to allow for decline in pasture species, quantity and quality over time despite annual maintenance, fertiliser and pasture expenditures. This is done by salvaging a proportion of the initial investment in a 'bank' of superphosphate and introduced pasture seed.

In other situations, the initial capital invested may appreciate over time, and salvage value of initial capital will reflect these capital gains.[6] In the case of fertilising native pastures and steadily increasing productivity through encouraging changes in pasture composition then if there is an increase in the productive potential of the pasture into the future, at the end of the life of the project, it has also to be counted as a benefit of the investment. That is, the salvage value of the capital investment over the life of the project ought to reflect an appreciation in the productive value of the area of native grassland in question.[7]

[6] For example if an investment increased the long term value of the land, then the initial capital invested would be salvaged at a value reflecting the real gain over the life of the investment.

[7] This appreciation of native grassland productive potential can be salvaged or valued (if it is sustainable into the future) in terms of either:

Risk

There are at least five elements to risk that farmers will take into account when evaluating pasture investment decisions. These are:

- the potential loss of initial capital. This will be lower with a small capital outlay.
- how quickly the benefits are received. The longer the period before break-even, the more likely that costs, prices and other factors will change.
- the stocking rate increase needed to reach break-even. The greater the lift required, the more chance there is of the increase not being achieved.
- the potential productivity of the land where the investment might be made. The more productive the land, the more likely the investment is to succeed.
- expected gross margin for the enterprise being run.

These criteria can be used to help clarify farmer decisions about whether to sow a new pasture, fertilise a native pasture, or sub-divide and add clover seed to a native pasture.

Sowing a new pasture carries the risk of a high potential loss because of the substantial initial capital outlay. The prospect of a rapid increase in stocking rate in the early years helps offset the effects of this risk. However, stocking rate usually needs to increase by five or six DSE/ha for the investment to be worthwhile. This is harder to achieve the lower the potential of the area being sown.

Fertilising a native pasture involves small capital outlays over many years, so there is little risk of a large loss of capital. Benefits may not be realised for several years until the stocking rate rises sufficiently to recover the investment in the extra fertiliser. If it becomes clear that the pasture will not respond in the way expected, or other factors like fertiliser prices or livestock product prices change and expected profitability declines, then the development expenditures can be halted.

Sub-dividing native pasture and adding clover seed has a smaller initial capital outlay than sowing a new pasture, and so the potential loss is lower. However, the stocking rate is likely to increase slowly and wool prices and other factors may be less favourable by the time the investment would have reached break-even point.

Sensitivity of results

Sensitivity of results to changes in key variables is explored in the case study reports.

(i) the present value of the capital which a buyer of unfertilised native grassland would have to invest in order to bring productivity up to the level attained, or

(ii) the capitalised value of the extra net returns to the native grassland from the extra productivity from the end of the project into the future. This is the extra amount a buyer of such developed grassland would be prepared to pay above what they would be prepared to pay for grassland in the initial undeveloped state.

6.4 The new farm plan and expected annual profit after investment

The results of undertaking the investments in each farm are shown in Table 6.

Table 6 Expected annual operating profit after tax - ten years from now (current dollars)

	Case farm			
	1	2	3	4
	North-East Victoria		Southern Tablelands NSW	
	$'000	$'000	$'000	$'000
Whole farm - without investments	21.0	1.8	24.1	21.8
Investments - rest of farm				
1. Direct drill - grass & clover	6.4	2.8		5.7
2. Fertilising pasture		8.1		4.9
3. Irrigation	3.1			
Investments - native pasture areas				
1. Fertilise only	3.6		4.5	8.7
2. Direct drill - clover & fertilise			8.3	
3. Sub-divide & fertilise		4.8		
Whole farm - with investments	34.2	17.5	36.9	41.0

Options which have been rejected because they are unprofitable, financially not feasible, or too risky, are not included.

Annual operating profit after tax (at current prices) is expected to be higher in ten years time on all four farms. The investments on native pasture contribute to the net income on all four farms, but particularly on the two New South Wales farms.

The results from the case studies illustrate three points that are likely to apply across the hills and tablelands, namely:

1. The strategy of fertilising native pasture is very different to other investments. It has a very low initial investment and a long period building up to the steady state. Because of interest payments it also has a peak debt several years after the initial investment and a long pay-back period. It also has a high cumulative net cash flow by year 15 and a high salvage value in comparison to the initial investment.

2. Replacing native pasture is risky if pasture production does not remain at peak levels for at least eight years. With good management on fertile soils this may not be difficult to achieve. On land classes three, four and five it is difficult. The higher the number of extra stock carried, and the higher livestock gross margins, the greater the decline in pasture productivity that can occur and overall profitability remain attractive.

3. There is often scope for increasing net income by investing in pastures elsewhere on the farm and by making other management changes.

6.5 Conservation management options

It is assumed initially that the conservation management options do not have any production benefits. Whether or not the conservation management options are compatible with current and alternative farm arrangements, projected five years into the future, can be drawn from the data in Table 7.

In terms of adopting the conservation management options into the current farm system, annual after tax profit is not high on any of the four case farms. Case farms one and two would feel the effects on profitability more than the other two farms, particularly considering their difficult cash flow situation. Unless there were counter-balancing production benefits, the first two farms are most unlikely to consider the conservation management options even if they had a strong interest in conservation management. Case farms three and four might be in a position to do so.

If other investments are made on the farm, meeting both income and conservation management goals becomes more feasible. The expected situation as it could exist five years after the pasture investments were implemented on the case study farms is shown in Table 7. The foregone net profit after tax associated with the conservation management options is relatively small compared to the extra net profit after tax from the pasture investments for all farms. All farms may now be in a position to adopt the measures voluntarily - if of course they are so inclined.

Table 7 Expected operating profit after tax - five years from now - with/without pasture investments and with/without conservation management options

	Case farm			
	1	2	3	4
	North-East Victoria		Southern Tablelands NSW	
	$'000	$'000	$'000	$'000
Whole farm - without investments				
Without conservation management options	21.0	1.8	24.1	21.8
Retire land	-2.3	-0.5	-1.3	
Rest land for 6-12 weeks a year	-1.7	-0.4	-0.5	-1.6
Sub-divide and rest				2.0
With conservation management options	17.0	0.9	22.3	21.4
Whole farm - with investments				
Without conservation management options	36.3	17.5	36.9	41.0
Retire land	-2.3	-0.5	-1.3	
Rest land for 6-12 weeks a year	-1.7	-0.4	-0.5	-1.6
Sub-divide and rest				2.0
With conservation management options	32.3	16.6	35.1	40.6

7. Public goals and private interests

7.1 Is there a problem reconciling public and private interest?

Native vegetation on private land is of public interest for several reasons. It may have high conservation value, or have a role as a buffer or corridor to other remnants. It may be important in land and water management, for instance in salinity control and in minimising nutrient run-off. The latter reasons apply on the case study farms.

The results of the case studies can be used to guide policy considerations irrespective of the vegetation type or its public value.

The conservation of native vegetation in its current state may or may not be consistent with farmer's goals. However, all four case study farmers viewed native pasture as integral to their farming system. The use of introduced species is likely, in the near

future, to be confined to the better land classes on which there is little native grass. This may change depending on the future development of pasture technologies

All four case farm families are likely to work towards achieving a species composition in which productive native grasses and introduced legumes are the main elements. All four case farmers stand to benefit by fertilising native pasture more frequently than they do at present, and by increasing the legume component of pastures. Over time this may lead to the loss of native forbs in the few pastures where such forbs are significant, ie. on case farms two and three.

Increased fertiliser use may lead to indirect effects that may be undesirable from a public policy viewpoint. These effects include higher levels of nutrient run-off into drainage lines and streams and increased acidification.

Erosion has been a problem on case farms two and four. The problem has been linked to pressures to maintain income in the face of falling wool prices combined with poor seasonal conditions causing, and caused by, over-stocking. There is a trade-off between short-term pressures to maintain income and maintaining the long-term productivity of the land. Case study farmers two and four are keenly aware of the importance of the latter, and emphasised it in discussion. The skills of both farmers in understanding and responding to pasture condition are increasing.

The main factors taken into account by these farmers in managing native pasture can be summarised as:

Goals, income needs and family circumstances. These are important parameters in determining how the farm, and consequently each pasture type, is managed. Degree of conservation – mindedness and risk aversion influence the management decisions.

Current financial situation. Recent past and expected future annual net cash flow and livestock product prices, will influence strongly how heavily each pasture is stocked, and the management options that are under consideration. Soil type, topography and rainfall are biophysical factors which constrain management. The degree to which farmers will work within 'safe environmental limits' will depend greatly on past experience, risk aversion, debt to equity situation and needs for extra net income.

Pasture types. Characteristics of pastures will influence the stock that are run on each pasture type or paddock, the seasonal grazing pattern and the management options that are under consideration.

Such characteristics of pasture include:

- Proportion of legumes, introduced perennial grasses, naturalised annual grasses and useful native grasses (and whether cool or warm season growing)
- Carrying capacity of each vegetation type in each season
- Availability of feed in dry times
- Diversity of feed source
- Area of each pasture type

- Complementarities in seasonal production between pasture types

Livestock needs. Farmers utilise native pastures according to animal requirements which vary according to animal types, production systems and seasonal patterns of lambing. Depending on their composition and on seasonal conditions, native pastures alone may or may not be able to be relied on to meet the requirements of breeding animals and for growing out young stock.

Many other factors to do with the particular farm are taken into account. For example, paddock size relative to size of sheep flocks, and paddock location on the farm relative to other paddocks, shearing shed and yards.

7.4 Feasible financial and non-financial incentives

What will lead or induce farmers to incorporate native pasture into their farming systems in a way that is consistent with public policy goals? This report has shown that managing native pasture in certain ways is consistent with maximising farm income. However, this may not be consistent with public policy goals.

A basic premise of the following discussion is that it is usually necessary to reward people for doing things that are in the public interest that they would not otherwise do. As well, pursuing change can involve facilitating changes in the circumstances within which people operate, so that public policy goals and private interest may come to more closely align. The approach based on identifying necessary compensation payments will be discussed before returning to these points.

Payments for managing native pasture for public purposes

An initial assumption made is that some form of payment is needed to induce farmers to manage native pasture for public policy purposes. Factors governing the sum that would be acceptable as payment or compensation include:

- the obligations involved
- the goals of the farmers
- short-term net income needs
- alternatives available for achieving owner goals
- the extent to which farmers wish to keep options open for the future
- possible uses of native pasture and how each use contributes to achieving goals
- the tactical role of the pasture in the current or proposed farming system
- how strategic the area is to farming operations

If farm owners are solely profit maximisers over the short term, theoretically the amount required by farmers to act in particular ways would be the maximum sum the owners would have to be paid after considering risk to be able to consider themselves financially as well off as if they acted in alternative ways.

For example, what would a farmer accept to retire a pasture from production in comparison to maintaining current production? A profit maximising farmer would accept no less than the equivalent of the expected net income foregone by retiring the land. The expected annual net income foregone by retiring land for the four case farms are shown in Table 8. If the owner has development plans for the area, the expected net income foregone can be higher than in the status quo situation.

If, as is more likely, a farmer wants to maximise profits over a longer term, subject to the constraint of some non-economic goals, then the payment required to compensate for the amount of expected longer term profit foregone, which was also subject to other non-economic goals, will likely be less than the short-term, solely profit maximising case.

Table 8 Expected annual net income foregone from retiring selected land on the case farms

Case farm	Land class	Area involved (ha)	Annual losses $/ha
1	4	50	$46
2	4	100	$31
3	3	27	$48
4	5	50	$33

If the farmer has multiple goals as is usually the case, rather than solely profit maximisation, the value of opportunities foregone depends on how maintaining the status quo, or adopting the conservation management options, affect the whole farm operation, and specifically whole farm income and what it might have been.

As shown in each of the case studies, the losses incurred from retiring a small area of low producing native grassland from production can be small relative to the potential gains from investment alternatives across for the whole farm. Where resting pasture is desirable, the loss incurred is even smaller if the resting assists in rejuvenating the pasture for later use.

Public policy and the whole farm context

How the whole farm context influences management of specific parts of the farm is demonstrated in this report. In particular, the economic contribution of the part can only be understood in the context of the whole.

The implication is that incentive programs are likely to have a greater chance of success for less cost if they seek to change behaviour at the whole farm level while treating changes in the management of the individual parcel of land that is of public interest as a performance indicator, rather than as the target for action. This is not to say that specific incentives directed at the particular target area eg. provision of fencing materials are not appropriate. The point is that the program within which such an incentive is delivered should first be designed taking how the target farms operate into account.

How to do this when, as is emphasised in this report, all farms are different? While farms are complex organisations, varying greatly in their specifics, the key processes at work in the management of native vegetation across farms can be identified. This project has sought to draw these out.

Public policy and the future of the farm

The major decisions farmers make - about enterprise types, fencing, pasture development - are essentially about how the farm will be organised in the future. Decisions are based on choosing, explicitly or implicitly, between options.

The actions that government will need to take to achieve public policy goals, or to convince farmers to change private goals, will be very different if the focus of attention is on how the parcel of land of public interest fits, or might, fit into the farm in 10 or 20 years time rather than now. If the paths that a farm might take, and the economic efficiency of each path, are identified then the place of the native grassland can be anticipated as far as available information allows.

However, the future outcome cannot be determined in advance. The design of incentives must take uncertainty into account (Young 1992, Bowers 1996).

Incentives may be justifiable to assist in the transition to a farming system that is viable in the long-run. Assistance could be justifiable for changes that have a long lead-time such as the fertilising native pasture (if this meets public policy goals), or with embarking on other developments that will indirectly ease the pressure on native pasture areas. Such assistance could involve well-defined cross-compliance obligations with recipients negotiating conservation outcomes in advance.

The incentive arrangement would require a mechanism which ensures that farmers who intend to develop their native pasture area notify this intention. This requires a point of re-entry for farmers into receiving advice or assistance to help in structural adjustment. Self-reporting is only likely if farmers perceive some advantage to themselves.

The approach proposed above may be difficult to reconcile with a standardised payment system, as used in Europe and North America, in which payments are based on average net loss associated with managing native pasture. There are many problems with such systems (Colman *et al.* 1992). An approach which takes account of how the opportunities and constraints vary between farms is preferred.

The approach proposed here is consistent with other programs that are in place or under consideration in Australia. These include:

(a) identifying and resolving, to the extent that is possible when there are multiple public objectives, conflict between public programs which may lead to disincentives to management in accordance with conservation and land management goals. For example, incentive payments for establishing introduced pasture can be directed to areas where native pasture is not present (North East Salinity Working Group 1997)

(b) assistance for farmers to acquire relevant knowledge and develop appropriate skills relevant to managing native grasslands and farm businesses. Relevant knowledge includes an understanding of conservation and production values of native pasture. Skills may cover business management, grazing management, and species identification.
(c) promotion of a duty of care which incorporates pasture and vegetation management standards which are generally accepted within local communities as being fair and reasonable. Where a shift to a new standard is proposed, some form of payment is necessary (Binning & Young 1997, Industry Commission 1997).
(d) reward to farmers for the provision of conservation services over and above the duty of care. If the new farming system will meet income needs, and farmers are assisted in making the transition, farmers may well be satisfied with part-payment of costs (such as fencing) and recognition of their contribution (Young *et al* 1996). Rate rebates and tax deductions or rebates are likely to be effective forms of recognition - they would be received every year, they can be attached to existing administrative systems, and they could be conditional on self-reporting pasture status and any plans for changed management.
(e) use of management agreements to protect sites of particular conservation significance. The above steps will encourage but not guarantee management for conservation values, so a more secure system for areas with high conservation value areas is required. Key elements of such agreements should be use of management criteria which empower the farmer, a review process, monitoring and reporting, and scope to re-negotiate (Binning & Young 1997).

How can this emphasis on the whole farm context and the future of the farm be integrated into public programs? Three actions seem essential.

- Work across commonwealth and state agencies to incorporate knowledge and principles about native pasture considerations into research, policy and extension programs for both production and conservation. It needs to be recognised that misallocation of public resources is likely if these programs are encouraging land use that is not the most profitable and sustainable.
- Integrate native pasture management and whole farm management, including the basic principles of farm management economics, into programs like PROGRAZE, FARM$MART and Sustainable Grazing Systems, and other public and private advisory services (see the accompanying report by Edgar 1998).
- Ensure that the information and expertise that is incorporated into these programs is of high quality, and that the programs are periodically audited for the quality of this information.

Central to the development of this program is the reality that native pasture is only one of the technical inputs that make up a farm business, and that policy directed at one aspect of a farm business without taking account of the whole farm context is unlikely to succeed. Consequently, the proposed program would need to be integrated with other programs relating to agriculture and land management. Initiatives across government rather than by conservation agencies working alone are required. Victoria's Biodiversity Strategy (Department of Natural Resources and Environment) is an example of one such approach.

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