

Farming Systems in the Pastoral Zone of NSW: An Economic Analysis

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Economic Research Report No. 31



**NSW DEPARTMENT OF
PRIMARY INDUSTRIES**

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ABSTRACT

A 'broad brush' picture of farming in the pastoral zone of NSW is presented in this report. The pastoral zone of NSW is characterised by wide variations in climatic conditions, soil type and vegetation species. Hence representative farming system analysis was conducted for three sub-regions - the Upper Darling, the Murray-Darling and Far West. The regions were defined and described in terms of their resources, climate and the nature of agriculture. The main enterprises that farmers choose between were described and whole farm budgets and statements of assets and liabilities for the representative farms were developed. The representative farm models were used to compare traditional Merino based sheep enterprises with alternative sheep enterprises where meat was an important source of income. We found that the farming systems that have evolved in these areas are well suited to their respective environments and that the economic incentives to switch to more meat focussed sheep enterprises were not strong.

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Acronyms and Abbreviations Used in this Report

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ASC	Australian Standard Classification
BG	Bestprac Group
CFA	Cull For Age
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DLWC	Department of Land and Water Conservation
DSE	Dry Sheep Equivalent
FW	Far West
GM	Gross Margin
LBG	Louth Bestprac Group
LMDCMA	Lower Murray-Darling Catchment Management Authority
LMDCMB	Lower Murray-Darling Catchment Management Board
M-D	Murray-Darling
NIEIR	National Institute of Economic and Industry Research
PZ	Pastoral Zone
RLPB	Rural Land Protection Board
RP	Representative Farm
SAMM	South African Meat Merino
SLA	Statistical Local Area
SOI	Southern Oscillation Index
SR	Self Replacing
SSD	Statistical Sub-Division
TS	Terminal Sire
UD	Upper Darling
WCMA	Western Catchment Management Authority
WCMB	Western Catchment Management Board
WPF	Wheat Pasture Fallow

Executive summary

The objectives of this report were to describe important farming systems in the pastoral zone of NSW in terms of their resources and constraints; and to develop representative farm models consisting of whole farm budgets and statements of assets and liabilities, allowing some indication to be gained of the financial performance of agriculture in the region. The representative farm models were also used to compare the profitability of traditional sheep breeding enterprises such as self-replacing Merino ewes and Merino wethers, with alternative breeds more directed to meat production using either terminal sires, or the Dorper or the Damara sheep breeds.

Representative farm modelling and analysis are useful tools for describing and understanding the nature and financial characteristics of important farming systems in a particular region. The models consist of a description of the physical and financial resources of the representative farm, and estimates of financial performance such as farm business profit, farm cash income and expenses, and business return on equity. The representative farm models can be used to give an indication not only of current performance but also of how farm income might be altered by a change in relative product prices, the introduction of a new technology, or a change in management, towards meat sheep for example. This report presents some examples of their application but importantly it provides a template for the development of additional whole-farm budgets for particular farms or for alternative farming systems in this and other regions.

Because farming systems vary considerably across the pastoral zone we have identified three sub-regional farming systems, the Upper Darling (UD), the Murray-Darling (M-D) and the Far West (FW), and developed whole farm models to represent these three systems.

The UD region includes the shires of Bourke, Brewarrina, Cobar and part of Walgett and is characterised by summer dominant rainfall averaging about 380mm. Agricultural production in the area is based primarily on sheep and cattle with limited dryland, irrigated and opportunistic cropping. The representative farm in the region has a total land area of about 24,000 hectares used for running about 9,000 dry sheep equivalents with total capital investment of about \$1.5 million with an equity ratio of 85%. The representative farm makes about \$85,185 farm business profit in a normal year giving business return on equity of 6.7%.

The M-D region covers the shires of Balranald and Wentworth and the surrounding areas with dominant winter rainfall averaging 225mm per annum. Agricultural production in the area is based on the integration of both livestock and cropping contributing about 62 and 38% to the total farm income, respectively. The representative farm in the region has about 25,000 hectares used for running about 8,800 dry sheep equivalents with some cropping and some land set aside as natural reserve. This region was used as a trial location for a land set aside project conducted in the 1990's by the NSW State Government where landholders were able to "lock up" land that was highly valuable from a nature conservation perspective and develop other land on their farms that was suited for cropping. The total capital assets of the representative farm amount to about \$1.4 million with an equity ratio of 84%. In a normal year the representative farm earns about \$160,605 farm business profit giving a 13.3% business return on equity.

The FW region consists of the shires of Broken Hill, Central Darling and Unincorporated West regions of the pastoral zone of NSW with low and highly variable seasonal rainfall averaging 175mm per annum. In this system, sheep breeding for wool and meat dominates agricultural production contributing over 98% of the total farm income of individual producers. The representative farm in the region has a total land area of about 35,000 hectares running 7,000 dry sheep equivalents. Its total capital asset value is about \$0.883 million with an equity ratio of about 80%. The business return on equity for the representative farm is about 14% from farm business profit of about \$98,312 in a normal year.

The key management issues relevant to producers are the structure of livestock enterprises in the pastoral zones given the volatility of wool price since the demise of the reserve price scheme in 1989, the difficulty of finding labour and shearers and the availability of meat only breeds such as Dorper and Damara.

The representative farm models were used to compare traditional Merino based sheep enterprises with alternative sheep enterprises where the sale of lamb was an important source of income. The alternatives included SR Merinos with a proportion of ewes mated to a terminal sire for prime lamb production, Merino wethers only, SR ewe Merinos only, and SR Dorper and Damara enterprises. We found that the farming systems that have evolved in these areas are well suited to their respective environments and that the economic incentives to switch to more meat focussed sheep enterprises were not strong unless the supply of labour for shearing becomes an intractable issue.

1. Introduction

In this report, a ‘broad brush’ picture of farming in the pastoral zone of NSW is presented. The region is defined and described in terms of its resources, climate and the nature of agriculture. The main enterprises that farmers choose between are described and GM budgets for these enterprises are presented.

The pastoral zone of NSW is characterised as an arid environment and spans various climatic zones from summer dominant rainfall in the north to winter dominant rainfall in the south, with wide variation in soil types and vegetation species. Livestock production from pasture is the main source of farm income although agricultural diversification has permitted limited production of other agricultural commodities. Diversification away from grazing activities has been limited by legislation. Much of the land used for agricultural production is leasehold land for the purpose of grazing and special permits are required for alternative uses. The choice of enterprises is influenced not only by their profitability as independent enterprises but also by their contribution to other enterprises in the farming system. The labour and capital resources of the farm also have an influence on the choice and size of enterprises

These interrelationships mean that any changes within enterprises require examination in a whole-farm context. Hence an important part of this report is the presentation of “model” farms that represent common farming systems in the Pastoral Zone. These representative farms are described in terms of land, labour and machinery resources and enterprises and their rotation within the farms. That information, together with GM and overhead cost information, has been used to develop whole-farm budgets.

This report is organised in four sections. The first section presents an overview of the pastoral zone of NSW in terms of its resources and constraints. The second part describes and presents representative farm models for the UD, the M-D and FW regions farming systems. The third part assesses the profitability of running alternative sheep enterprises and the final section presents a discussion and draws some conclusions. The enterprise and whole-farm budgets are all available as spreadsheet models which can be manipulated by someone with reasonable skills in Microsoft® EXCEL™

2. Uses of representative farm analysis

This report presents a description of farming in the pastoral zone and an indication of its profitability. The whole-farm budget provides a ‘snapshot’ at a particular point in time of a farm with a particular set of resources. However while this report may give a broad indication of what is happening on many farms in the pastoral zone, it may be misleading for farms with markedly different soil type, climate and resources to those of the representative farm.

The representative farm models and associated GM and whole-farm budgets can be used as a template allowing variations from the representative farms to be examined. Individual farmers may wish to adapt them for their own farms. They can also be used to give an **indication** of how farm income might be altered by some new technology, with respect to the type of sheep being run for example. However, it is only an indication as the particular circumstances of individual farms are likely to give them different outcomes.

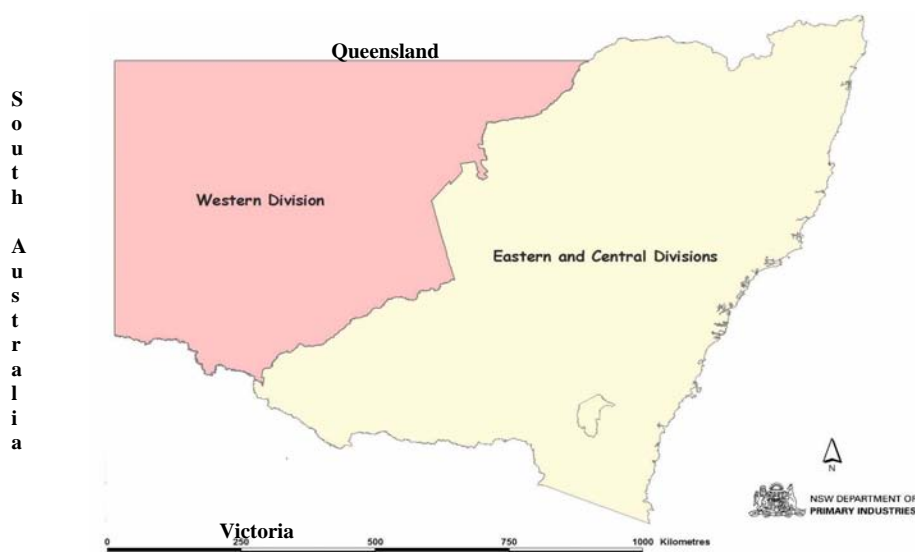
Additionally, while the whole-farm budget can be manipulated to indicate the change in farm income from a new technology or resource management strategy, we only get a view of

“before” and “after” the new technology. If the change in technology has an impact that takes many years to work through the system, soil fertility for example, then a simple “before” and “after” comparison of whole-farm budgets is an inadequate basis for such an important investment decision. More sophisticated budgeting tools are required that allow the impact of such changes over many years to be estimated and aggregated.

3. An Overview of the Pastoral Zone of NSW

The pastoral zone as defined in this report is the area of western NSW bounded by the central west of NSW in the east, Queensland in the north, South Australia in the west and Victoria in the south as shown in Figure 3.1¹

Figure 3. 1 The Pastoral Zone of NSW



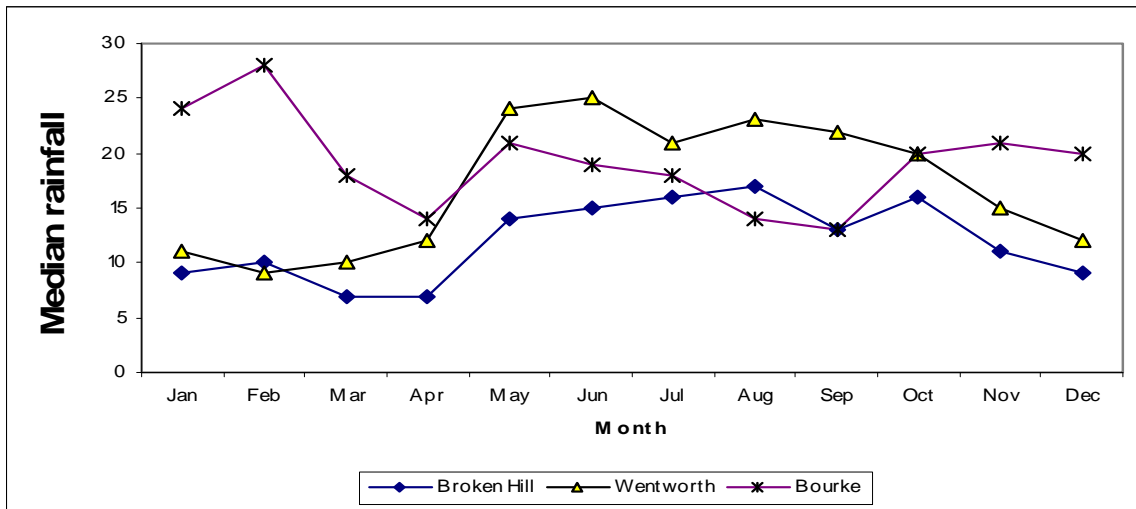
The region covers over 32,000 square kilometres, which is about 42% of the total land area of the state of NSW (DLWC, 2000). Over 90% of the land is held in the form of perpetual leases and is administered by NSW Department of Lands. A grazing lease is intended for grazing sheep and cattle and other domestic stock. Additional uses, such as cultivation for cropping, require an additional permit.

The climate of the pastoral zone is generally described as arid and semi-arid with low and variable rainfall, high temperatures and high evaporation rates (Hacker et al., 2004; Date, 1992). Long term median monthly rainfall of Broken Hill, Bourke and Wentworth districts from 1881 to 2004 shown in Figure 3.2, indicates that rainfall is highly variable and is relatively lower in the FW (eg. Broken Hill) than the UD (eg. Bourke) and the M-D (eg.

¹ The pastoral zone of NSW is also referred to as the Western Division of NSW. According to the Australian Statistical Classification (ASC), much of the pastoral zone is represented by three statistical sub-divisions (SSD): The Upper Darling SSD consists of the shires of Brewarrina, Bourke and Cobar SLAs. The Far West SSD includes the shires of Unincorporated, Broken Hill and Central Darling SLAs and the Murray-Darling SSD consists of the shires of Wentworth and Balranald SLAs.

Wentworth). Rainfall tends to be more summer dominant in the UD but it is winter dominant in the M-D and FW.

Figure 3. 2 The long-term median monthly rainfall for Broken Hill, Bourke and Wentworth in mm



Source: Clewett et al. (2003)

The long term average annual rainfall varies between 450 mm in the north east and 150 mm in the north west. The average number of rainy days expected each year varies from 29 to 49, the temperature often exceeds 40⁰C in summer and the evaporation rate can be as high as 3000 mm per annum.

According to Cunningham (1992) there are eight dominant soils types which are irregularly distributed across the pastoral zone. These include:

- Hard Red (Cobar & Bourke)
- Soft Red (Cobar & Eubalong)
- Solonised Brown (Menindee)
- Heavy Clays (Murray River)
- Brown Gibber (Broken Hill)
- Desert Loam (all over the PZ)
- Texture (Bogan and Darling)
- Skeletal (Barrier Ranges)

All categories of soils are subjected to different forms and degrees of soil degradation as a result of erosive forces of wind and water. One of the main strategies being promoted to reduce the effects of erosive forces is the use of conservative stocking rates to protect adequate ground cover (WCMB, 2003; LMDCMB, 2002 and Hacker et al., 2005).

The vegetation species also reflect the variability in rainfall and soil types (DLWC, 2000 & Hacker et al., 2005). The main vegetation species in the pastoral zone comprise:

- Belah and Blue bush;
- Bimble box-pine;
- Downs country;
- Gidgee and Brigalow;
- Mallee;
- Mitchell grass plains;
- Mulga;
- Northern Flood plains;
- Saltbush plains;
- Southern grass land;
- Southern riverine woodlands;

Pasture for livestock production is derived from a wide range of annual and perennial grasses and forages growing in different environments. Many annual plant species are sources of pasture for livestock production; whereas perennial plant species provide stability to the rangeland system. In the northern regions where red soils and summer rainfall are dominant, a wide range of grasses and forages are the major sources of pasture. In the southern areas where brown soils and winter rainfall dominate, shrubs are an important source of forage for animal production (Brooke and McGarva, 1998).

4. Agricultural Production in the Pastoral Zone

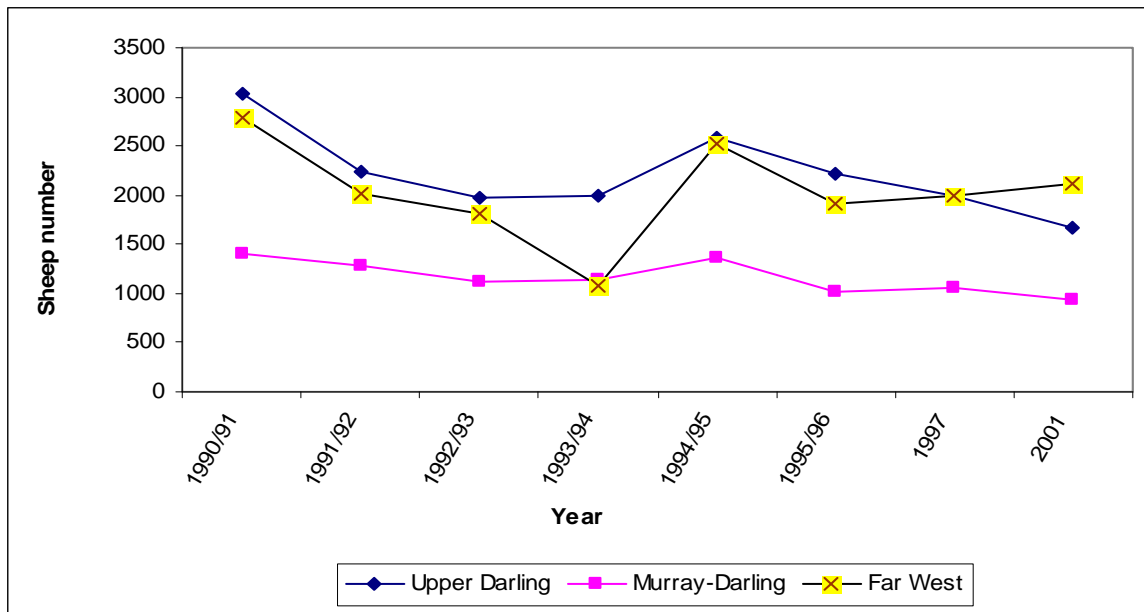
Agriculture in the pastoral zone of NSW began in the 1830s when the first European settlers arrived in the region with a large number of sheep and cattle and established a semi-nomadic pastoral system (Condon, 1999). Sheep enterprises dominated cattle enterprises as financial returns from cattle enterprises fluctuated more widely in response to changes in climate (Cunningham, 1992). In recent years there has been increasing interest in dryland and irrigated cropping on properties along the banks of rivers and on properties with cropping licences (DLWC, 2000). Legal restrictions on leaseholders in the pastoral zone have prevented more widespread crop production.

4.1. Sheep enterprises

The sheep industry is predominantly based on Merino breeding for wool and meat production with a small percentage of cross-breeding enterprises with a greater emphasis on meat production. Merinos are the dominant sheep type in the area because of their ability to produce wool hence income in what is typically a harsh production environment and the marketability of any class of animal at any time in the year. Other sheep breeds, with greater emphasis on meat production such as SAMM, dual purpose types and in some cases the no wool types such as the Dorpers, the Damaras, are being adopted as alternative sources of farm income.

Cunningham (1992) reported that the total number of sheep in the region declined significantly from its peak of 15 million in 1900 to four million in 1920 and has averaged about five million since that time. The rapid decline in the number of sheep has been associated with the major changes in the structure of the rangelands due to drought, the introduction rabbits and exotic weeds and clearing for cultivation. Figure 4.1 shows that the total number of sheep in the UD, the M-D and FW regions declined between 1990/91 and 2001. ABARE (2006) indicated that the number of sheep per farm declined by about 3% between 1996 and 2006.

Figure 4. 1 The average sheep numbers in the UD, the M-D and FW regions ('000)



Source: ABS (1997 and 2001)

Although the number and profile of sheep run on individual properties vary with the resource characteristics of farms, self-replacing Merino ewes and Merino wether enterprises are the most common enterprises in the region. In the SR Merino enterprise, replacement breeding ewes are obtained from ewe hoggets produced in the system. The calendar of operations presented in Table 4.1, shows that ewes are joined with rams for up to eight weeks between December and March and lambing is either in winter or spring. Shearing, marking and mulesing operations are done at different times during the year. Marketing operations are also done throughout the year.

In a self-replacing Merino enterprise, farm revenue is achieved through the sale of wool, ewes culled for age, surplus ewe hoggets, and wether weaners. In Merino wether enterprises, income is achieved through the sale of wool and wethers culled for age. Sheep are sold to local or export markets whereas wool is sold at Sydney and Adelaide wool marketing centres.

Table 4. 1 Calendar of operations for winter and spring lambing

Months	Winter lambing			Spring lambing		
January	Join					
February		Vaccinate	Crutch/Shear			
March			Check flystrike		Join	
April						
May		Sell		Shear	Vaccinate	
June				Sell		
July	Lamb		Mark & Vaccinate			
August				Lamb		
September		Check flystrike	Crutch/Shear	Wean & Vaccinate	Mark, Mules & Vaccinate	Jet
			Sell			Check fly strike
October						
November						
December			Join	Wean	Crutch, Vaccinate & Sell	

4.2. Cattle enterprises

There are many producers who run cattle with sheep and/or cropping enterprises. Cattle production is based on a mixture of pure bred lines such as Herefords and Shorthorns but there are many producers who also undertake crossbreeding programs with *Bos indicus* breeds such as Brahman, Braford or Santa Gertrudis to promote hybrid vigour. Crossbreeding also occurs using different British breeds or with Euros. The cattle enterprise primarily produces vealers and stores and depending on climatic conditions and availability of pasture offspring could be carried through to bullock weights and marketed as prime beef. Cattle production accounts for between 8 and 50% of the total dry sheep equivalent grazing pressure and up to 40% of individual farm income.

4.3. Goat enterprises

Many properties muster and sell feral goats and some have purchased meat goat genetics for improved production. The interest in goat production has increased during the last decade as reliable markets have been established for the feral goats and improved technologies for mustering have been employed. Feral goats have been running wild in the pastoral zone for many decades but as a result of these more reliable markets, more attention has been placed on them as an enterprise because (1) goats complement income through diversification; (2) they control edible woody weeds and (3) they are well adapted to the rangeland environment. According to NIEIR (2000a) the importance of goat harvesting to farm profitability varies depending on locations and it is estimated to have contributed between \$13,000 and \$22,000 revenue per farm in the pastoral zone of NSW in 1999. However, the goat enterprise remains largely an opportunistic enterprise; goats are only mustered when there are sufficient numbers and when the market prices are good (NIEIR, 2000b) Therefore, the contribution to whole

farm profit is highly variable and for this reason we have not included it in our representative farm models.

4.4. Cropping enterprises

Although cropping is regulated in the pastoral zone, more producers are undertaking dryland, lake-bed or flood plain and irrigated cropping. Annual cropping is restricted to the eastern and southern areas of the pastoral zone and is allowed on private properties and under permit only. Further west, cropping is undertaken on an opportunistic basis.

The cropping industry produces a wide range of cereal and non-cereal crops. The cropping activities are dominated by wheat and barley production with small areas of maize, oats, cereal rye, sorghum and triticale (ABS, 2001). The dominant non-cereal crops produced are cotton and canola, though they tend to be grown only on irrigated land. The less common non-cereal crops are chickpeas and safflower.

4.5. Recent changes in enterprise mix

The pastoral industry has experienced significant changes in the structure of sheep enterprises and sources of income since 1996 as indicated in Table 4.2. Between 1996 and 2006 the average number of sheep on individual properties declined by 3% although the average number of ewes per farm increased by about 7%. In the same period the average number of wethers and lambs decreased by about 40 and 16%, respectively. About 68% of the sheep on individual farms are ewes while wethers and lambs account for 9 and 21% respectively in 2006.

An overall reduction in the sheep numbers is the result of continued drought conditions and the increase in the proportion of ewes per farm suggests a change in the structure of the livestock enterprise mix and a shift from wool producing Merino sheep to prime lamb production.

Table 4. 2 Recent changes in enterprise mix in the pastoral zone of NSW

Enterprise type	Average number per farm			Proportion %	
	Mean 1996 -06	2006	Change %	1996-06	2006
Sheep	4650	4500	-3		
Ewes	2860	3060	7	61	68
Wethers	576	412	-40	12	9
Lambs	1154	970	-16	22	21
Cattle	190	175	-8		

Source: (ABARE 2006)

Farm business revenue is derived from the sale of wool, sheep, cattle and crops as shown in Table 4.3. Between 1996 and 2006, the wool receipts per farm declined by about 19% while income from the sale of sheep increased by about 58%. Average receipts from the sale of cattle declined by about 35% while receipts from the sale of crops increased by about 8%.

Table 4. 3 Changes in sources of average income for individual producers

Sources of income	Income in \$ (000)		% Change	Proportion in %	
	Mean 1996 -06	2006		Mean 1996-06	2006
Wool	99	80	-19	43	35
Sheep	40	63	58	17	28
Cattle	40	26	-35	17	12
Crops	51	55	8	22	25

Source: ABARE (2006)

Wool and sheep receipts continue to dominate producers' incomes. Table 4.3 shows the changes in the contribution and sources of income of a sample of individual producers between 1996 and 2006. On average, producers derived about 60% of the total income from the sales of wool and sheep, 22% from the sales of crops and 17% from sales of beef cattle between 1996 and 2006.

The contribution of crops to the average farm income evident in the ABARE survey data is higher than expected. In the UD region, cropping is only undertaken opportunistically except around Walgett whereas in the FW region cropping is rare. According to ABS (2003) survey the contributions of crops to the total farm income in the UD and M-D regions were estimated at about 16 and 22%, respectively while it was as about 3% in the FW region. Perhaps the anomaly arises because the ABARE estimates come from their survey of broadacre agriculture which may not adequately represent the specialist pastoral enterprises predominant in the region.

5. Key Management Issues

The key management issues in the pastoral zone are related to the sustainability of the rangeland resource and the profitability of pastoral enterprises. There is general acknowledgement that the high and sustained total grazing pressures of the past have caused substantial damage to the rangeland environment and the level of pastoral productivity (CSIRO and DLWC, 1999). Total grazing pressure includes the grazing impact of not only the animals used for agricultural production such as sheep and cattle but also the grazing impact of rabbits, feral goats and increased population of kangaroos.

Considerable anecdotal evidence indicates an improvement in the condition of rangelands following the control of rabbits in the 1950's, assisted by generally higher rainfall in the later half of the 20th century (Condon, 1999). Nevertheless, the economic climate of recent decades, and increasing community expectations in relation to the management of land resources, have increased the pressure on graziers to increase production while maintaining or improving the land resource. Major issues for land management in the region have been identified by both the WCMA (2006) and the LMDCMA (2006). Some of the key issues affecting the operation and economic viability of pastoral enterprises are discussed below.

5.1. Land degradation

Soil erosion by both wind and water is the most important form of land degradation affecting pastoral productivity. Erosion of top soil reduces nutrient availability, and often exposes subsoils that are relatively impervious to water and inhospitable for plant growth. Sealed

surfaces produced by sheet erosion on gently sloping areas result in excessive run off and substantially reduce the capacity of the landscape to produce forage. However, the extent of erosion varies across land types and localities from minor to severe. It has been noted that restoration of eroded areas is often difficult and may require mechanical intervention, which is uneconomic, and require changes to grazing management that ensure retention of ground cover.

Loss or reduction of perennial forage species is an almost ubiquitous form of land degradation with significant implications for pastoral production. Animal production is closely linked to the availability of green feed (Freudenberger et al., 1999) and continuity of the green feed supply can only be maximised, in a semi-arid environment, by the presence and relative abundance of perennial forage species. These include both grasses and shrubs, particularly chenopod shrubs. Reduction of the former is probably most severe in the poplar box, pine and mulga woodlands of the Cobar pediplain while the latter have been severely reduced in the 'rosewood-belah' country and over extensive areas of stony downs country in the Far West. While some improvements in rangeland condition have been noted since the 1950's, the productivity of pastoral land is probably still well below its potential in many areas, particularly those where reduction of perennial grasses is associated with encroachment by woody species (see below).

Management changes necessary to facilitate the restoration of perennial species include the adoption of tactical grazing management (e.g. Campbell and Hacker, 2000) that adjusts the level and timing of grazing in relation to the needs of the vegetation and the opportunities or threats imposed by climatic conditions.

5.2. Total grazing pressure

Total grazing pressure is the demand for forage from all herbivores relative to the available supply. Non domestic herbivores, particularly rabbits, feral goats and kangaroos, can account for a substantial portion of the total forage demand. Hacker and McLeod (2003) estimated that the kangaroo population of the pastoral zone has in recent decades varied from about 45% to 60% of the livestock population on a DSE basis, or between 28-40% of the total animal population excluding rabbits and feral goats. When combined, the forage consumed by non-domestic herbivores can represent a significant level of competition for livestock. Under good seasonal conditions the demand by all species can be satisfied but when conditions deteriorate, the level of competition increases and pastoralists suffer increasing economic impact. Under low forage conditions, the effect of one kangaroo on wool growth or sheep live weight gain has been estimated to equal approximately 0.6 sheep of equivalent weight (Wilson, 1991). Competition between sheep and kangaroos is most likely when forage availability falls below about 300 kg/ha (Short, 1987).

Rabbit populations have been substantially reduced since the release of the rabbit calicivirus in the late 1990s. Feral goat numbers have probably also declined since this time with the development of relatively stable markets, the more widespread use of self mustering or trapping facilities and the establishment of domesticated goat enterprises on some properties.

Control of total grazing pressure is a fundamental requirement for management aimed at addressing the land degradation issues discussed above. Kangaroos remain, for graziers, the most serious source of concern in this respect although Hacker and McLeod 2003 suggested

some simple management practices that can help manage their impact especially when sheep are removed from an area to allow regeneration.

5.3. Woody shrubs

Unpalatable native shrubs ('woody weeds' or 'invasive native scrub') have encroached on large areas of formerly open woodland causing serious management difficulties (e.g. restricted mustering) and substantially reduced production. Areas so affected are probably more susceptible to sheet erosion due to reduced ground cover, and may also be more prone to damage by grazing due both to the reduced quantity of forage available and the stress induced by competition with the scrub.

This phenomenon has been a recurring feature of the Pastoral zone and has been recorded from the 1870's onwards (DLWC, 2000). While the ecology of scrub encroachment is complex, the process involves the removal of perennial grasses, and the competition they provide for shrub seedlings, by excessive grazing pressure, and the suppression of fire which is effective in destroying seedlings of all shrub species even though some are resistant to fire as adults (Hodgkinson and Harrington, 1985, Hacker et al., 2005). Under these conditions the mass germination that occurs in periods of high rainfall represents another step in an ongoing process. Not all land types are equally susceptible however, the effect being most obvious on the 'hard red' soils of the Cobar pediplain and the 'soft red' aeolian soils of the north west

The costs of mechanical or chemical rehabilitation of significant areas of woody weed are generally far greater than the financial gains and such treatments are usually restricted to special purpose areas such as laneways. Landholders argue that economic control of invasive native scrub, and restoration of perennial grasslands, is only feasible by use of short term cropping (in suitable areas) to recover the cost of shrub removal. This is now permitted under the Native Vegetation Act (2003) although the best management practices that should be applied to this process are not well defined.

5.4. Loss of biodiversity

The changes associated with European settlement, including the introduction of livestock and the associated development of artificial watering points, together with the impact of feral cats, rabbits, foxes and feral goats, have had a major impact on the biodiversity of the Pastoral zone. A significant number of extinctions has occurred among the vertebrate fauna, particularly among the medium-sized mammals, and a number of other species or ecological communities are threatened or are of conservation concern (CSIRO and DLWC, 1999). The effect of these changes on pastoral production is uncertain although many believe that conserving biodiversity is essential if the biological systems, landscape character and potential productivity are to be retained.

5.5. Rainfall variability

Rainfall in the Pastoral zone is highly variable and for the most part lacks distinct seasonality although there is a tendency to winter or summer dominance in the south and north respectively. This is a difficult environment for decision making since there is no clear signal that marks the beginning or the end of the feed production period. Seasonal risk assessments based on the SOI Phase system provide useful information over much of the region in the late winter-spring period but at other times graziers have recourse only to historical climate data

or to ‘trigger points’ for decision making based on historical pasture growth simulations (Hacker et al., 2006).

If they expect rainfall to be low, graziers may adopt a number of alternative management strategies for minimising production risk. These strategies include production feeding, maintenance feeding¹ and agistment. Production feeding is not common but maintenance feeding, not traditionally considered an option for Pastoral zone graziers, has been more widely practised in recent years (Mackay, 2002).

5.6. Labour utilisation

The labour utilisation index measures hours worked by the residential labour force compared to available working hours. It is calculated as the total hours worked divided by the labour force and multiplied by 37.5 to provide the labour utilisation rate. The labour utilisation rate for the pastoral zone and Australia are 60 and 80%, respectively (NIEIR, 2000b). Walgett and Brewarrina particularly have a lower labour utilisation index of about 54% which is very low relative to other parts of the pastoral zone. A low rate means that there are many workers in part time and casual jobs representing underutilisation of labour and lower spending in the local economy. Consequently, there has been constant migration of labour from regional centres to cities creating labour shortages during peak seasons of pastoral operations and affecting their timeliness.

5.7. Government policy

Recent and current policy initiatives in the region are concerned with both the viability of rangeland enterprises and natural resource management. The WEST 2000 and WEST 2000 Plus Regional Partnership Programs in the late 1990s and early 2000’s sought to address both of these issues through the provision of a wide range of assistance measures for property amalgamation, debt reconstruction, exit from the industry, infrastructure development, natural resource management and education and training. Some of these measures, particularly in relation to natural resource management, have effectively continued through the Catchment Action Plans of the Western and Lower Murray-Darling CMAs.

Some of the strategies involve partnerships between community, industry and government organisations to communicate knowledge and new industry initiatives to reduce resource degradation and maintain viable income.

Hacker (2004) argued that the current policy settings in relation to land administration, drought, taxation and other financial measures (eg Farm Management Deposits) did not provide an adequate framework for the management of environmental risk in the rangelands. In particular, policies are lacking that discourage short term profit taking and promote longer term environmental outcomes, which directly relate assistance to those outcomes, and actively encourage learning and adaptation by land managers. Incentive-based policies were argued to have the potential to redress these deficiencies. The Enterprise Based Conservation pilot project initiated by the WEST 2000 Plus program and currently administered by the Western Catchment Management Authority is an example of one such policy initiative (Shepherd, 2006).

² Production or maintenance feeding involves providing supplementary feed to satisfy either the production or maintenance requirements of livestock until conditions improve.

6. Farming systems in the pastoral zone of NSW

A farming system is defined as a complex agricultural production process in which various combinations of inputs are managed by farmers and influenced by environmental, economic, institutional and social factors to produce income (Swift, 1994). In particular, the interaction of the various elements of climate and natural resources affect the quality and quantity of pasture available for livestock which pastoral producers manage within an economic environment to earn income and reduce risk.

The production system in the pastoral zone can be thought of as a series of linked subsystems as shown in Figure 6.1. The various combinations of climatic variables and natural resource conditions affect the types of farming systems adopted and the production risk associated with them. Because of variation in climate and natural resource endowments across the pastoral zone, we have identified three main farming systems: the Upper Darling, the Murray-Darling and the Far West regions farming systems.

6.1. The Upper Darling region farming system

The Upper Darling region farming system is characterised by a mixed farming system of sheep and cattle enterprises but with limited cropping. The system covers much of the Upper Darling area including the shires of Bourke, Brewarrina, Cobar and south west of Walgett with dominant summer rainfall averaging about 380 mm per annum and with 36 rain events per year (Clewett et al., 2003).

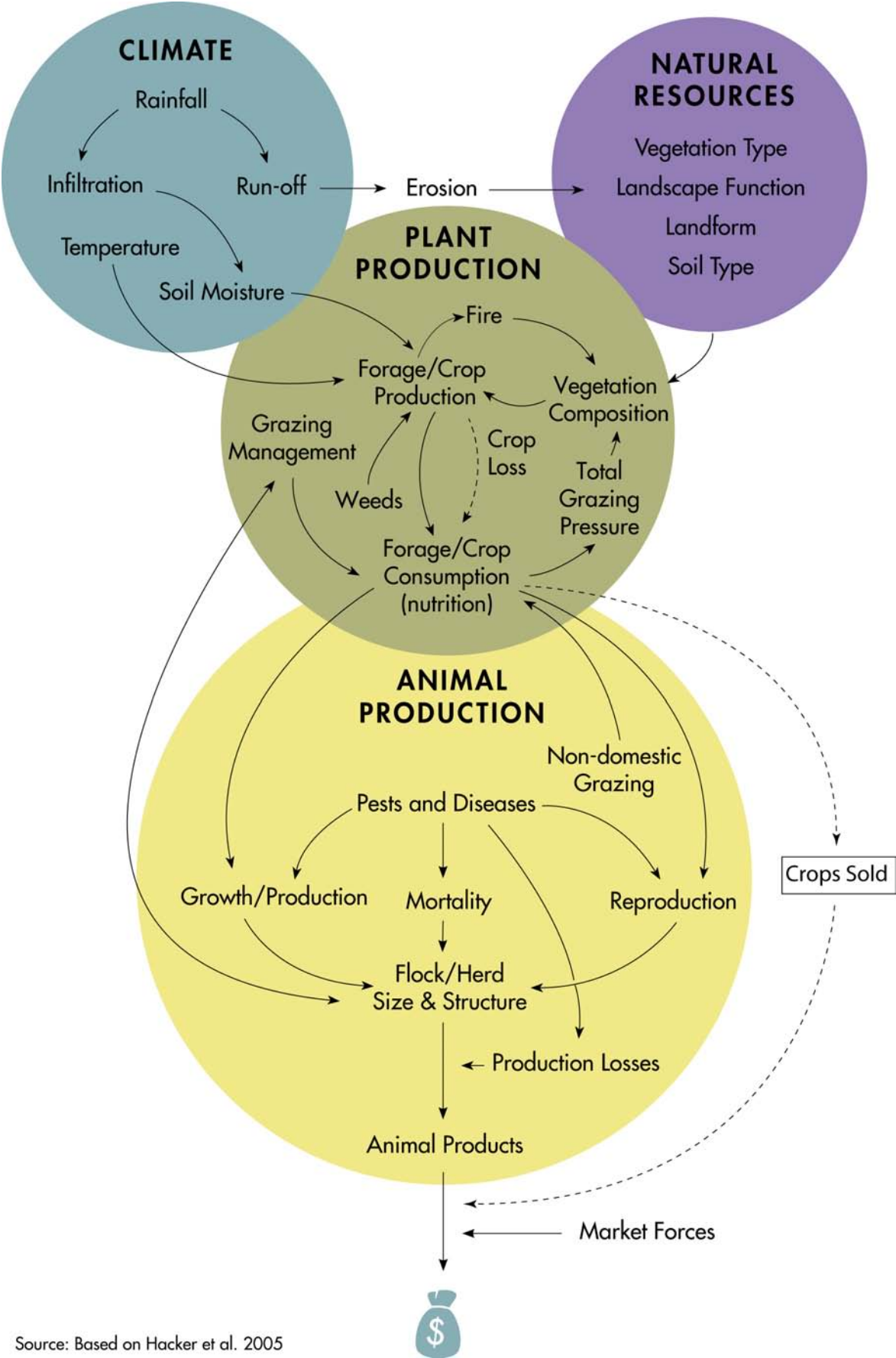
Ewes are generally kept on the better part of the property whereas wethers are kept on the rest (Weilmoringle BG, 2001 & Louth BG, 2001). Although the cattle enterprise contributes up to 40 per cent to the total farm income, it receives less management attention because its financial returns fluctuate widely with changes in climate. Pasture is managed using continuous, rotational and deferred grazing systems and stocking rates vary depending on the quality and quantity of pastures. Dryland, irrigated and opportunistic cropping are undertaken on private properties and on leasehold properties with cropping licences. There are some producers who harvest feral goats out of hills and scrubby areas.

6.2. The Murray-Darling region farming system

The Murray-Darling region farming system is characterised by the integration and management of livestock and cropping enterprises. This system dominates the shires of Balranald and Wentworth where winter-dominant rainfall averaging about 225mm per annum. The sheep enterprise, which contributes over 80% of the total income from livestock, is the major component of the M-D region farming system.

The typical land use system in the area consists of a combination of native pasture, cropping and natural reserve. The natural reserve is the land that has been set aside as part of a regional planning strategy for clearing and cultivation in which landholders were encouraged to “lock up” land that was valuable from a nature conservation perspective and develop other land on their farms that was suited for cropping. The cropping system is characterised by low input and low yielding but good quality wheat in long fallow or continuous crop rotations.

Figure 6. 1 The agricultural production system in the extensive grazing land



Source: Based on Hacker et al. 2005

The important crop rotations are either three year rotations of wheat, volunteer pasture and fallow or intensive rotations such as wheat/fallow/wheat (WFW); or wheat, barley triticale, fallow (WBTF) (McIntosh, 2004a). The main outputs of this system include wool, sheep, cattle, wheat, and sometimes small amounts of barley, sunflower, and sorghum. In average seasons the yield of wheat ranges from 1.3 t/ha to 1.8 t/ha. In drier than average seasons, the yield of wheat falls to 1 t/ha but in wet seasons it can be as high as 2.4 t/ha..

6.3. The Far West region farming system

The Far West region farming system is dominated by specialist sheep breeding enterprises for wool and meat. This farming system is predominately found in the shires of Broken Hill, and Central Darling and in the Unincorporated area of the Western Division. Rainfall is low and highly variable averaging 175mm per annum. Cropping occurs on a few properties with fertile soil and where run off from surface water accumulates (Wilcannia BG, 2000/1). According to ABARE (2003), wool and sheep revenue account for more than 90 per cent of the total farm income. There are a few producers who harvest feral goats but the extent of its economic contribution to individual farm income varies depending on location (NIEIR, 2000a).

7. Statistical Information

The Australian Bureau of Agricultural and Resource Economics (ABARE) collects information on the physical and financial characteristics of agricultural production activities in the pastoral zone of NSW. Each year ABARE surveys a large number of individual producers to obtain both physical and financial information on individual farm businesses which it uses to estimate and report on average financial performance indicators such as the capital value of the average farm, farm cash income, farm business profit and rates of return at a particular point in time.

The summaries of the average physical and financial characteristics of producers in the pastoral zone of NSW between 1996 and 2006 are presented in Table 7.1 and Table 7.2. The average size of pastoral properties in the region is 27,000 hectares with approximately 4,450 sheep and 190 cattle with minor crop production. The total value of assets of an average property was estimated at \$1.9 million with an equity ratio of 87%. Farm revenues obtained from the sale of sheep and wool contribute about 60% to the total farm receipts whereas cattle and cropping enterprise contribute about 17 and 22%, respectively. It is estimated that the average farm earned about 2.9 per cent business return on equity (see Table 7.3).

Table 7. 1 The average physical characteristics of producers in the pastoral zone of NSW (1996 -2006).

Physical Characteristics	Unit	Estimate	RSE*
Estimated population	no	830	
Sample contribution	%	4	
Physical			
Area of land operated	ha	27000	(21)
Total area cropped	ha	260	(28)
Beef cattle at 30 June	no	190	(31)
Sheep at 30 June	no	4450	(17)
Sheep and lamb purchases	no	240	(61)
Sheep sold	no	1250	(26)
Wool production	kg	24380	(18)
Wool sold	kg	24318	(17)
Wool cut per sheep shorn	kg/hd	5	(9)
Sheep and lambs shorn	no	4691	(18)
Proportion of Merino wool	%	99	(1)
Micron - main fleece line	m	22	(2)
Stocking rate	DSE/ha	0.2	

*Figures in brackets are relative standard errors (rse) and provide a guide to the reliability of the survey estimate. It is obtained by dividing the standard error of the estimate (SE(r)) by the estimate itself (r). It is calculated as follows: $RSE=100 \times (SE(r)/r)$. Estimates with large RSEs are considered unreliable.

Table 7. 2 The average financial characteristics of producers in the pastoral zone of NSW (1996 -2006).

Financial Characteristics			
Receipts			
Wheat	\$	44000	(36)
Sheep sales	\$	39600	(26)
Wool sales	\$	99157	(19)
Beef cattle sales	\$	40000	(56)
Off-farm share farming	\$	1675	(122)
Off-farm contracts	\$	2680	(90)
Other farm income	\$	21600	(32)
Other receipts	\$	11275	
Total cash receipts	\$	260000	(22)
Costs			
Seed purchase	\$	570	
Sheep purchases	\$	32600	60
Accounting services	\$	2500	(42)
Repairs and maintenance	\$	21500	(47)
Fuel, oil and lubricants	\$	16800	(26)
Livestock materials	\$	4800	(45)
Shearing and crunching expenses	\$	22000	(25)
Administration expenses	\$	4000	(29)
Freight costs	\$	10000	(34)
Rents and rates	\$	14684	(40)
Interest payments	\$	20600	(50)
Payments to share farmers	\$	10500	(59)
Agistment costs	\$	3260	(80)
Advisory services	\$	500	(83)
Contracts - livestock	\$	3200	(35)
Contracts - crop and other	\$	3280	(62)
Insurance	\$	8100	(23)
Other costs)	\$	79416	(28)
Total cash costs	\$	227000	(28)
Capital and debt			
Total capital value	\$	1.912000	(18)
Farm debt at 30 June	\$	244000	(36)
Equity ratio at 30 June	%	87	(4)

Table 7. 3 The average financial performance indicators of producers in the pastoral zone of NSW (1996 -2006).

Financial performance			
Total cash receipts	\$	260000	(22)
Total cash costs	\$	227000	(28)
Farm cash income	\$	34133	(145)
plus building in trading stocks*	\$	11500	(430)
less depreciation	\$	31600	(16)
less owner/manager and family labour	\$	44603	(11)
Farm business profit	\$	-30560	(110)
Profit at full equity	\$	63706	(41)
Rate of return including capital appreciation	%	2.9	(108)

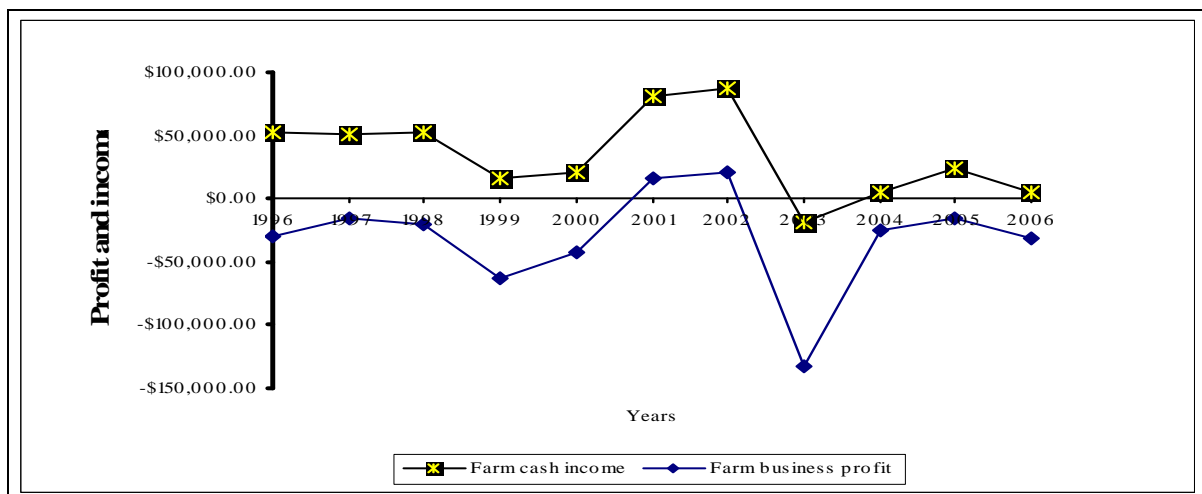
Source: ABARE (2006)

*The imputed value of all changes in the inventories of trading stocks during the financial year. It includes the value of any change in herd or flock size or in the stocks of wool, fruit and grains held on farm. It is negative if stocks are run down.

7.1. Trends in farm income, profit and debt

The most alarming message from the average financial performance indicators presented in Figure 7.1 was that the farm business profits of individual producers not only fluctuated widely between 1996 and 2006 but were only positive twice in the 10 years. The average farm business profit over the last 10 years was negative \$30,560 and in 2003 was negative \$133,000 primarily due to the impact of drought.

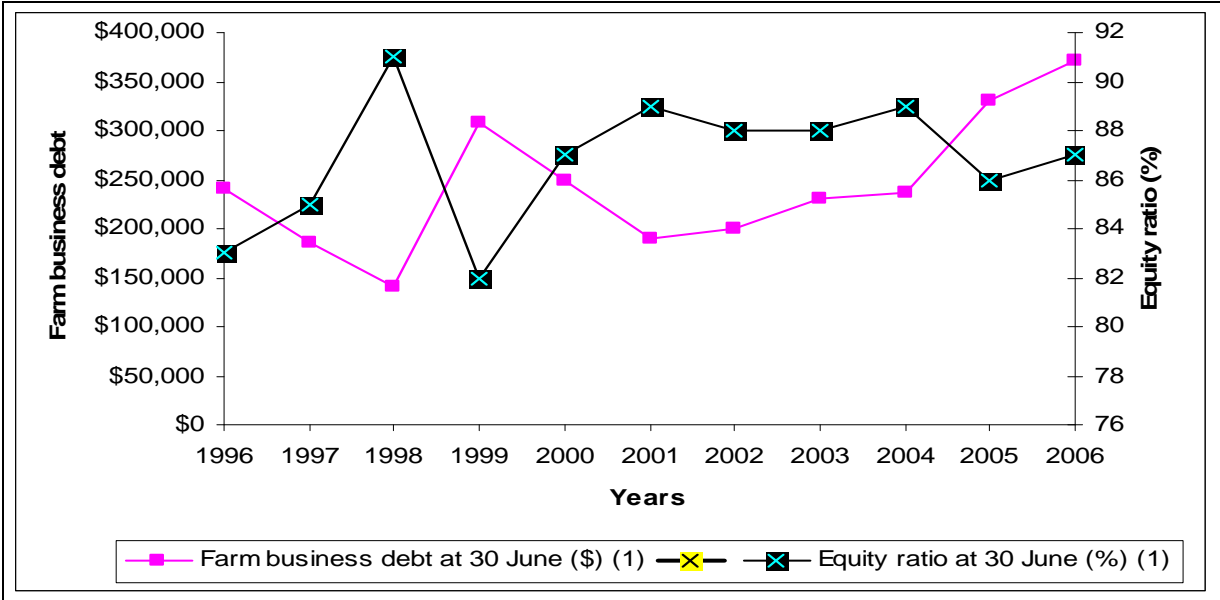
Figure 7. 1 Farm cash income and business profit (1996-2006)



Source: ABARE (2006)

Not surprisingly farm business debt has been steadily increasing from \$141,000 in 1998 to the peak of \$372,000 in 2006. The farm equity ratio declined from 91% in 1998 to 87 per cent in 2006 (Figure 7.2).

Figure 7. 2 Business debt and equity ratio (1996-2006)



Source: (ABARE, 2006)

8. Whole farm budgets for representative farms

The aim of this work has been to develop models representative of important farming systems in the pastoral zone of NSW. Whole farm budgets have been constructed for each of the three subregions identified in Section 6.

While we have used the ABARE data described in the section above to ‘calibrate’ our models, these data give an inadequate description of particular farming systems in terms of crop rotations used and other farm features because they do not relate to particular farming systems but rather, are averages across regions or subregions. Useful details for developing a model to measure the impacts of change is often lacking from such statistics, especially at the local level. In addition, there are often substantial differences between neighbouring farms in terms of resources used, farming methods employed and the skills and outlook of the owner/manager.

We obtained additional information for the representative farm models from discussions with research and advisory staff and producers. One method of obtaining such data is the Local Consensus Data technique (Jayasuriya et al., 1999; Murphy & Date, 1989). This technique is a way of obtaining an accurate picture of the structure of farming for a group of farms in a particular locality. A small group of interested farmers meet with officers from NSW DPI to discuss the practices which have a bearing on the costs and returns of a typical farm in the area being studied. As discussion proceeds, a consensus is reached on the size and nature of the ‘typical farm’ and on aspects of production such as cultural operations, machinery used and time involved. Consensus is also sought on product prices, input costs, yields and expected returns.

The aim is to develop comprehensive sets of data to adequately define the ‘model’ farms in the Upper Darling, the Murray-Darling and Far West regions to ensure that farm management analyses are relevant to existing conditions, and to provide suitable examples for extension advice.

For each region, a representative farm is described in terms of typical size, and enterprise combinations and in terms of key financial parameters. In each case there are two tables presented – an assets and liabilities statement and an annual operating budget statement. The assets and liabilities statement shows land, livestock, plant and equipment and liabilities. The annual budget statement shows enterprise and total farm GM, overhead costs, farm cash income, operating costs and farm business profit and farm business return on owner’s equity. The commodity price assumptions used in preparing the whole farm budgets are given in Appendix 1.

Overhead costs were estimated after some discussions with producers, rural financial counsellors and NSW DPI staff in the respective regions. Land values were estimated from published Valuer General Information for the relevant regions. It is expected that costs will vary considerably between farms since labour requirements, insurance, repairs and maintenance, fuel, and administration costs vary with family requirements, business structure and extra machinery and assets on hand. Similarly, income tax varies considerably with business structure and off-farm investments, so income tax estimates have not been included.

The whole farm budget can be used to examine changes in enterprise combinations and changes in technology, that are likely to be of interest to farmers with similar farming systems in financial terms. The budgets show financial measures such as farm cash income and rate of return on equity and operator labour for a defined enterprise mix; but are not optimising models in that they do not choose the most profitable enterprise mix rather they are simulation models which can be used for evaluating ‘what-if’ questions. One of the drawbacks of this type of model is that it does not account for cash flows in the transition period from one rotation system to another.

The estimates of financial performance below are substantially different from the financial estimates based on ABARE farm survey data presented above. There are several reasons for this. The financial estimates for the representative whole farm models do not include the imputed cost of family labour which would significantly reduce farm business profit and the return to equity. Moreover, they were estimated on the assumption that normal climatic and marketing conditions prevail rather than current drought conditions. The models are not based on statistical averages for broadacre agriculture in the region but more on the judgements of those who assisted in assembling the models.

8.1. The Upper Darling region representative farm model

The statement of assets and liabilities and the whole farm budget for the Upper Darling region representative farm are presented in Table 8.1 and Table 8.2. The total land area of the representative farm is 24,000 hectares. The total carrying capacity of the land is about 9000 DSE at about 0.4 DSE per ha., of which about 75% is sheep (4030 sheep) and the remaining 25 per cent is cattle (144 head).

About 70% of the total value of farm assets (\$1.5 million) is held in the form of land and the remaining 30% as other agricultural assets. Owner's equity is about 85 percent. The annual operating budget presented in Table 8.2 shows that the representative farm earns about \$85,185 farm business profit and a 6.7% business return on equity. The key parameters driving this result, apart from the stocking rate noted above, are an average wool cut of 5 kg/head from ewes and 4.5 kg/head of wethers with 23 micron wool, a lambing rate of 85% and calving rate of 86%.

Table 8. 1 Statement of assets and liabilities for the UD region representative farm

Assets and Liabilities		June 2006		
Assets				
Land	24,000	hectares	\$41/ha	\$984,000
Total value of land				\$984,000
Livestock				
	Number	class		
Sheep	3,072	ewes	\$65/ewe	\$199,680
	890	wethers	\$63/wether	\$55,180
	71	Rams	\$200/ram	\$14,200
Total value of sheep				\$269,060
Cattle				
	98	Cows	\$587/cow	\$57,526
	18	Heifers	\$357/heifer	\$6,426
	24	Steers	\$862/steer	\$20,688
	4	Bulls	\$1,800/bull	\$7,200
Total value of cattle				\$91,840
Total value of sheep and cattle				\$360,900
Plant and Equipment				
	Machinery	(Average)		
		Tractor		\$35,000
		Implements		\$25,000
	Vehicles			\$50,000
	Others)			\$40,000
Total value of plant and equipment				\$150,000
Cash				\$0.00
Total Assets				\$1,494,900
Liabilities				
Total Liabilities				231507
Equity (Assets - Liabilities)				\$1,248,263
Owner equity (%)				85%

Table 8. 2 Annual operating budget for the UD region representative farm

Annual Operating Budget				
	24000	ha farm		
Farm Cash Income	Number	Class	GM	
	3,072	ewes	\$45/ewe	\$138,240
	890	wethers	\$12/wether	\$10,680
	98	Cows	\$378/cow	\$37,044
Total Farm GM:				\$185,964
Overhead Costs				
Casual wages			\$8,659	
Rates			\$2,034	
Registration			\$2,500	
Insurance (vehicle, building)			\$6,126	
Other R&M (fencing, tools, pumps, etc)			\$9,956	
Fuel costs			\$15,039	
Other (elect., phone)			\$5,953	
Total Overhead Costs:				\$50,267
Farm Operating Surplus				\$135,697
Operating Costs				
Depreciation @ 10% of value of plant and equipment			\$28,153	
Interest @ 10% of liabilities			\$22,360	
Operator and family labour			\$0	
Total Operating Costs				\$50,513
Farm Business Profit				\$85,185
Business Return on Equity (%)				6.7%

8.2. The Murray-Darling region representative farm model

The whole farm budget for the Murray-Darling region representative farm is presented in Table 8.3 and 8.4. The representative farm has a total land area of 25,000 hectares of which about 64% (16,000ha) is native pasture; 20% (5,000ha) natural reserve and the remaining 16% (4,000ha) cropping. The total value of assets for the representative farm is about \$1.44 million and owner's equity is 84%.

The total carrying capacity of the pastoral land is about 8,800 DSE at a stocking rate of 0.6 DSE/ha with 74% of total DSE accounted for by sheep and 26% by cattle. Cropping is undertaken on 4,000 hectares used mainly for the production of wheat and annual pastures in a long fallow system. A conventional three-year rotation is long fallow starting in August - wheat - volunteer pasture.

The annual operating budget presented in Table 8.4 shows that the representative farm earns a farm business profit of \$160,605 giving a 13.3% business return on equity. The key parameters driving this result apart from stocking rate are an average wool cut of 5 kg/head from ewes and 4.5 kg/head from wethers with 23 micron wool, a lambing rate of 87 percent and wheat yield of 1.5 t/ha. Wheat yields are highly variable in this environment.

Table 8. 3 Statement of assets and liabilities for the M-D region representative farm

Assets and Liabilities		June 2006		
Assets				
Land	25000	hectares	\$24/ha	\$600,000
Reserve	5000	hectares	20% of the farm	
Cropping	4000	hectares	16% of the farm	
Native pasture	16000	hectares	64% of the farm	
Total value of land				\$600,000
Livestock				
	number	class		
Sheep	3174	ewes	\$65/ewe	\$206,310
	920	wethers	\$62/wether	\$57,040
	74	Rams	\$200/ram	\$14,800
Total value of sheep				\$278,150
Cattle				
	102	Cows	\$587/cow	\$59,874
	19	Heifers	\$357/heifer	\$6,783
	25	Steers	\$862/steer	\$21,550
	4	Bulls	\$1,800/bull	\$7,200
Total value of cattle				\$95,407
Total value of sheep and cattle				\$373,557
Plant and Equipment				
	Machinery	(Average)		
		Tractor		\$200,000
		Implements		\$150,000
	Vehicles			\$80,000
	Others			\$40,000
Total value of plant and equipment				\$470,000
Cash				\$0.00
Total Assets				\$1,443,557
Liabilities				
Total liabilities				\$231,507.31
Equity (Assets - Liabilities)				\$1,212,050
Owner equity (%)				84%

Table 8. 4 Annual operating budget for the M-D region representative farm

Annual Operating Budget				
	25000	Ha farm		
Enterprises GM			GM	
	1333	Ha (WPF)*	\$92/ha	\$122,636
	3174	ewes	\$45/ewe	\$143,005
	920	wethers	\$12/wether	\$11,040
	102	cows	\$378/cow	\$38,556
Total Farm GM:				\$315,237
Overhead Costs				
Casual wages			\$8,659	
Permanent labour			\$40,000	
Rates			\$2,034	
Registration			\$2,500	
Insurance (vehicle, building)			\$6,126	
Other R&M (fencing, tools, pumps)			\$10,000	
Other fuel costs			\$10,000	
Other (elect., phone)			\$5,953	
Total Overhead Costs:				\$85,272
Farm Operating Surplus				\$229,965
Operating Costs				
Depreciation @ 10% of value of plant and equipment			\$47,000	
Interest @ 10% of liabilities			\$22,360	
Operator and family labour			\$0	
Total Operating Costs				\$69,360
Farm Business Profit				\$160,605
Business Return on Equity (%)				13.3%

* The 4000 ha cropping land is sub-divided into annual crop (wheat), volunteer pasture and fallow in a particular year and thus income from the sale of crop is obtained annually from 1333 ha (4000/3).

8.3. The Far West region representative farm model

The whole farm budget for the Far West region representative farm is presented in Table 8.5 and 8.6. The statement of assets and liabilities for the representative farm shows that it has a total land area of 35,000 hectares with approximately 4,400 sheep (7,000 DSE) used primarily for wool and meat production. The stocking rate is 0.2 DSE per ha. The total value of assets is estimated at about \$0. 883 million and owner's equity is 80%.

The annual operating budget indicates that the representative farm has farm business profit of \$98,312 giving a 14% business return on equity. The key parameters driving this result are an average wool cut of 5 kg/head from ewes and 4.5 kg/head from wethers with 23 micron wool, and a lambing rate of 82%.

Table 8. 5 Statement of assets and liabilities for the FW region representative farm

Assets and Liabilities		June 2006			
Assets					
Land	35000	hectares	\$13/ha		\$455,000
Total value of land					
Livestock					
	Number	Class			
Sheep	3380	ewes	\$65/ewe		\$219,700
	980	wethers	\$62/wether		\$60,760
	76	rams	\$200/ram		\$15,200
Total value of sheep					
Plant and Equipment					
	Machinery	(Average)			
	Grader				\$20,000.00
	Loader				\$35,000.00
	Vehicles				\$50,000.00
	Other				\$27,000.00
Total value of plant and equipment					
					\$132,000.00
Total Assets					\$882,660
Liabilities					
	Other loans				\$25,755
	Business loan				\$150,052
Total Liabilities					\$175,807
Equity (Assets - Liabilities)					\$706,853
Owner equity (%)					80%

Table 8. 6 Annual operating budget for the FW region representative farm

Annual Operating Budget				
	35000	ha farm		
Farm Cash Income				
			GM	
	3380	ewes	\$45/ewe	\$152,286
	980	wethers	\$12/wether	\$11,760
Total Farm GM:				
\$164,046				
Overhead Costs				
Hired labour			\$8,000	
Administrative expenses and services			\$3,000	
Insurance (vehicle, building)			\$3,000	
R&M (fencing, tools, pumps, etc)			\$9,000	
Fuel, oil and lubricants			\$6,000	
Services (elect., phone)			\$5,953	
Total Overhead Costs:				
\$34,953				
Farm Operating Surplus				
\$129,093				
Operating Costs				
Depreciation @ 10% of value of plant and equipment			\$13,200	
Interest @ 10% of liabilities			\$17,581	
Operator and family labour			\$0	
Total Operating Costs				
\$30,781				
Farm Business Profit				
\$98,312				
Business Return on Equity (%)				
14.0%				

9. The profitability of alternative sheep enterprises

9.1. The SR Dorper and Damara

As noted in section 4, the primary focus of the livestock enterprises in the pastoral zone of NSW is the production of medium to broad micron Merino wool and sale of surplus sheep. Other agricultural crops are an additional source of farm cash income. As a result the production of prime lambs has not been important in the region until recently.

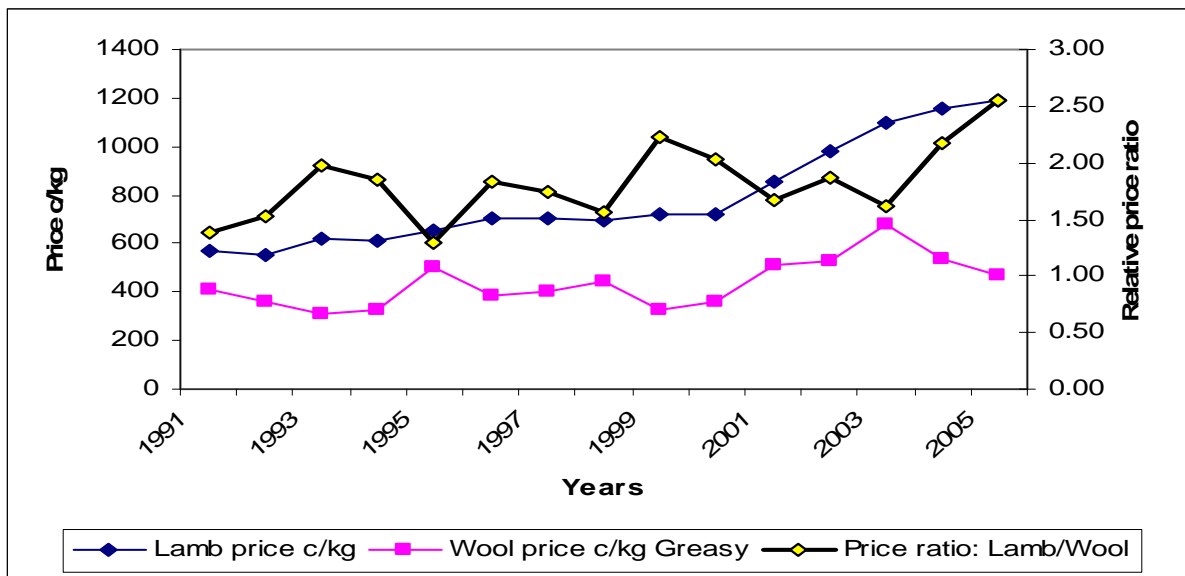
Following depressed wool prices, particularly in the 1970s and 1990s, a prolonged drought, increasing demand for lamb and sheep meat and significant labour constraints, producers have been considering meat producing sheep as an important part of their enterprise mix. The main sheep breeds that have attracted attention have been Dorpers and Damaras. Initially, Dorper or Damara sires are joined to the existing Merino ewes and the progeny backcrossed for a minimum of 4 generations to achieve a pure meat breed flock. This is the most typical approach as there are insufficient numbers of purebred flocks available for purchase.

Producers in the pastoral zone view the Dorper and Damara as an opportunity because they can easily adapt to the rangeland environment and require relatively low maintenance. It is reported that purebred Dorpers and Damaras do not require mulesing, crutching or shearing, are not susceptible to flystrike and in the case of Damaras, do not require the tail to be removed. All these characteristics reduce production costs (Young and Kilminster, 2004) and make these breeds more suited to the pastoral zone than other meat breeds, such as the Poll Dorset and the Suffolk, that have historically been used in Australia.

It has been suggested that Dorpers and Damaras achieve lamb marking rates of up to 130% regularly in the pastoral zone because ewes produce three lambs in two years. In addition, because of their ability to browse during conditions that might cause lambing percentages in Merinos to drop, the lambing percentages of Dorpers and Damaras are expected to be more stable in the face of climatic variations. There is also the view that the lambing percentages of Merino ewes joined to either Dorper or Damara rams in a terminal sire enterprise could reach up to 138 and 131% respectively (Young and Kilminster, 2004).

In addition to the superior production performance and suitability of Dorpers and Damaras in the rangeland environment, producers have also been attracted to them because the relative price of lamb and wool has been increasing as shown in Figure 9.1.

Figure 9. 1 Average prices of lamb and wool between 1991 and 2005



Source: ABARE (2006)

Between 1991 and 2005 there was only or slightly upward trend in the price of wool (0.3% per annum) whereas the price of lamb increased by 2.1% per annum. This trend in relative prices provided some incentive for producers to adjust their mix of sheep enterprises towards a greater focus on meat production

Since Dorpers and Damaras shed their wool, they can remain economically competitive, only if weaning percentages are higher, the cost of production is lower and/or the value of progeny is higher than for Merinos. Moreover, producers should consider the fact that Merino ewes that come into contact with the shedding breeds, such as at joining or with cross bred lambs at foot will receive a discounted wool price because shedding breeds contain not only wool but hair which cannot absorb dye.

9.2. The SR Merino ewe enterprise with terminal sire enterprise

Alternatively, there are a number of crossbreeding systems for meat production available to producers in the pastoral zone. One of these is the terminal crossbreeding system where a portion of ewes is joined to a traditional meat sire such as Dorset or Suffolk and all progeny are slaughtered and none are retained for breeding. It is an organised sequential system of crossing a proportion of Merino ewes or older ewes to a traditional meat sire which must provide the genes for high growth rate and good carcass attributes to suit the particular market goals of the producer. This system can be distinguished from alternative cross breeding enterprises that are set up to produce crossbred ewes, such as the Merino/Border Leicester cross.

The advantage with any crossbreeding enterprise is that the progeny have better carcass characteristics than straight Merinos, and there are no issues with the contamination of Merino wool by the crossbred wool. Lambing percentages are generally higher than from straight Merinos and lambs do not require mulesing. However, producers need to decide the

appropriate numbers of ewes to allocate to a self-replacing Merino enterprise if the aim is to maintain a sustainable SR Merino flock.

In our analysis the proportions of Merino ewes that should be joined to the Terminal Sire were obtained using the Merino versus Terminal Sire Flock Model (CSIRO Livestock Industries and Australian Sheep Industry CRC, 2004). The Terminal Sire Flock Model is a spread sheet model that estimates the proportion of Merino ewes that should be joined to terminal sires with the objective of maintaining the SR Merino enterprise provided that some of the key parameters such as the number of Merino sheep, stocking rate, lambing percentages, mortality rate, age at first joining and lambing percentage are given.

This model assumes that the percentage of the flock joined to a terminal sire is allocated equally across age groups rather than mating cast for age ewes or scanned dry ewes to a terminal sire, although this is a common practice. Ewes joined to the terminal sire are highly saleable either as breeding ewes with lambs at foot or lambs sold as suckers for later breeding. We assumed that about 47% of the Merino ewes were joined to terminal sires in the three representative farms. Details of other assumptions used are given in Appendix 3, 4 and 5.

9.3. Comparing the various enterprises

One of the key management issues for pastoralists in the region has been to assess the financial merit of each alternative breed relative to traditional system from the whole farm perspective. Here we estimate the economic impact on the representative farm in each sub-region of introducing one of five alternative enterprises:

1. Mating a proportion of Merino ewes to terminal sires and maintaining a SR Merino flock and a wether flock;
2. A wether flock only
3. A SR Merino flock only
4. Replacing the Merino SR flock with SR Dorpers
5. Replacing the Merino SR flock with SR Damaras

The potential economic benefits from these enterprises have been compared by adjusting the sheep enterprise mix in the representative farm models. Neither the area cropped nor the numbers of cattle have been changed. Nor have overhead costs been altered. Of course, an important qualification to this partial analysis is that the costs of the transition to the new mix of sheep enterprises have not been assessed. What is presented is simply a 'snapshot' of farm income after the change in sheep enterprises. More over, it should be noted that both the Dorper and the Damara have a higher DSE rating than Merinos. Hence, the number of these breeds that can be run is proportionately lower than the number of Merino sheep and so these variations have been accounted for in the analysis. The results of these analyses for the three regions are presented in Table 9.1 to Table 9.3.

The annual operating budgets for the alternative enterprises in the UD region farming system are presented in Table 9.1. The business return on equity was highest (7.2%) for SR Merino (3) while that of the terminal sire enterprise (1) was 6 percent. The business returns on equity for the Dorper (4) and Damara (5) enterprises were 6.3 and 3%, respectively. The key parameter driving the financial performance of the SR Merino enterprise (3) was the extra income obtained from the sale of additional wool, weaners and hoggets and the lower prices associated with CFA for other breeds relative to the price of Merino CFA.

Table 9. 1 Profitability of alternative enterprises for the UD region representative farm

		The Upper Darling (\$)					
Number	Class	RF	Terminal sire (1)	Wethers (2)	Ewes (3)	Dorper (4)	Damara (5)
24000	ha Total farm						
Representative Farm							
3,072	ewes (SR)	138,240					
890	wethers	10,680					
98	cows	37,044					
Terminal sires							
2179	ewes (SR)		98,175				
890	ewes (TS)		31,819				
890	wethers		10,680				
98	cows		37,044				
Merino wethers only							
5734	wethers			68,808			
98	cows			37,044			
Merino ewes only							
3,373	ewes				151,980		
98	cows				37,044		
SR Dorper							
2,385	ewes					137,601	
98	cows					37,044	
SR Damara							
2,743	ewes						82,623
98	cows						37,044
Total Farm GM:		185,964	177,718	105,852	189,024	174,645	136,867
Total Overhead Costs:		50,267	50,267	50,267	50,267	50,267	50,267
Farm Operating Surplus		120,337	127,451	55,585	138,757	106,397	73,650
Total Operating Costs		50,513	50,513	50,513	50,513	50,513	50,513
Farm Business Profit		85,185	76,938	5,073	88,245	55,885	23,138
Business Return on Equity (%)		6.7	6.0	0.4	7.2	6.3	3.0

The annual operating budgets for the alternative sheep enterprises in the M-D region farming system are presented in Table 9.2. The business return on equity for alternative production systems varied between 6 and 15%. The financial return for the SR Merino enterprise (3) was highest (15.0%) whereas it was about 13.3 and 12.6% for the representative farm and terminal sire enterprises (1) respectively.

Table 9. 2 Profitability of alternative enterprises for the M-D region representative farm

		The Murray-Darling (\$)					
Number	Class	RF	Terminal sire (1)	Wethers (2)	Ewes (3)	Dorper (4)	Damara (5)
25000	ha Total farm area						
Representative Farm							
1333	ha (WPF)	122,636					
3174	ewes (SR)	143,005					
920	wethers	11,040					
102	cows	38,556					
Terminal sires							
1333	ha (WPF)		122,636				
2144	ewes to SR		96,598				
1056	ewes to TS		37,753				
920	wethers		11,040				
102	cows		38,556				
Merino wethers only							
1333	ha (WPF)			122,636			
5926	wethers			71,114			
102	cows			38,556			
Merino ewes only							
1333	ha (WPF)				122,636		
3835	ewes to SR				172,768		
102	cows				38,556		
SR Dorper							
1333	ha (WPF)					122,636	
2465	ewes					142,190	
102	Cows					38,556	
SR Damara							
1333	ha (WPF)						122,636
2786	ewes						101,404
102	cows						38,556
Total Farm GM:		315,237	306,583	232,306	333,960	303382	262,596
Total Overhead Costs:		85,272	85,272	85,272	85,272	85,272	85,272
Farm Operating Surplus		229,965	221,311	147,034	248,688	200,304	166,589
Total Operating Costs		69,360	69,360	69,360	69,360	69,360	69,360
Farm Business Profit		160,605	151,951	77,674	179,328	130,944	97,229
Business Return on Equity (%)		13.3	12.6	6.0	15.0	13.2	9.6

The annual operating budgets for the alternative enterprises in the Far West region farming system presented in Table 9.3 show that the business return on equity for the alternative enterprises varied between 3.4 and 17%. The rate of return for the SR Merino enterprise (3) was highest (17%) followed by the representative farm result which had 14% farm business return on equity.

Table 9. 3 Profitability of alternative enterprises for the FW region representative farm

		Far West\$)					
Number	Class	RF	Terminal sire (1)	Wethers (2)	Ewes (3)	Dorpers (4)	Damara (5)
35000	ha total farm						
Representative Farm							
3380	ewes	152,286					
980	wethers	11,760					
Terminal Sires							
2265	ewes to SR		102,032				
1115	ewes to TS		39,877				
980	wethers		11,760				
Merino Wethers only							
6307	wethers			75,684			
Merino Ewes only							
4081	ewes				183,870		
SR Dorper							
2624	ewes					151,425	
SR Damara							
2967	ewes						107,991
Total Farm GM:		164,046	153,669	75,684	183,870	151,425	96,538
Total Overhead Costs:		34,953	34,953	34,953	34,953	34,953	34,953
Farm Operating Surplus		129,093	118,716	40,731	148,917	97,520	61,585
Total Operating Costs		30,781	30,781	30,781	30,781	30,781	30,781
Farm Business Profit		98,312	87,935	27,032	118,136	66,739	30,804
Business Return on Equity (%)		14.0	12.0	3.4	17.0	13.9	6.9

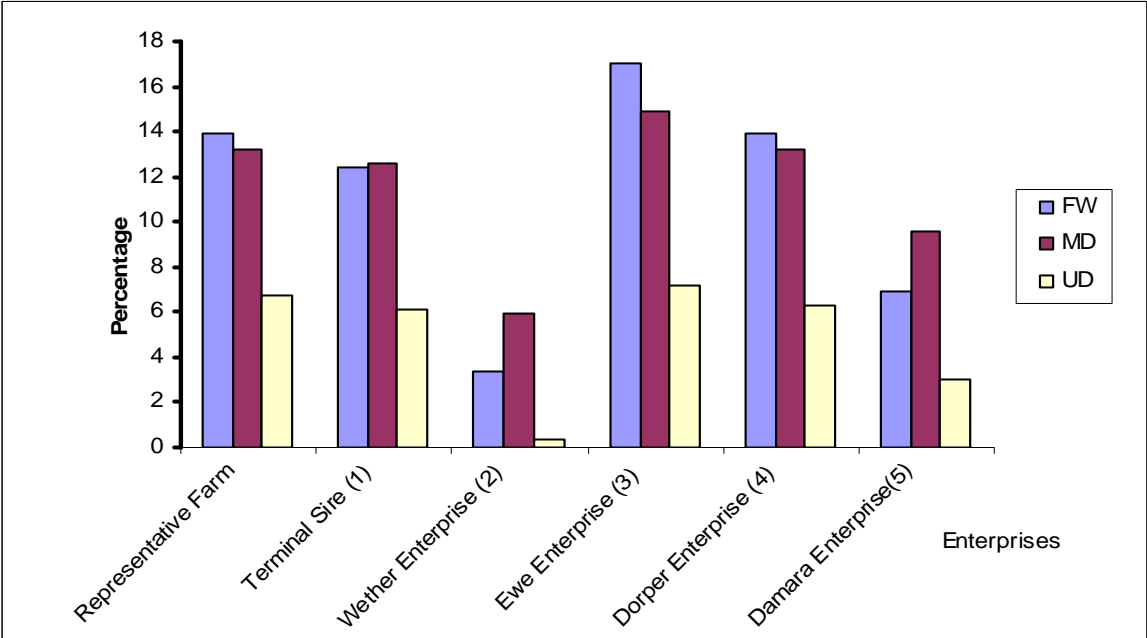
A summary of business returns on equity for alternative sheep enterprise in the UD, M-D and FW regions is presented in Figure 9.1. The business return on equity for the SR Merino only enterprise (3) was the highest in each region.

We are loathe to make definitive recommendations about the profitability of the alternative sheep enterprises on the basis of the simple partial budgeting approach which we have applied to the three representative farm models. There are some important qualifications to our findings. Despite the apparent profitability of the SR Merino flock, very few properties would have the capacity to wholly replace the current SR Merino and Merino wether combinations with a SR Merino ewes only enterprise. Wethers also play a risk management role. They are always saleable. Ewes on the other hand really have only two opportunities to be sold, 6 weeks after weaning and 4 weeks after joining. They can be sold at other times but the buyers are limited or the ewes are ‘occupied’ with another purpose which is usually reproduction. Wethers, although they may be less profitable, are a good enterprise to have because they allow the grazier to manipulate numbers quickly as the season dictates although their performance may not be as high as the Merino ewe enterprise.

The other qualification we have already made is that individual farms are likely to have different economic and physical resources to the representative farms which may alter the relative profitability of the sheep enterprises.

Bearing these qualifications in mind, our results suggest that while it may be profitable for farmers to mate a proportion of their ewes to terminal sires, at the relative prices of wool and lambs used here, there seems to be little attraction in switching to Dorpers or Damaras.

Figure 9: 1 Rates of return on equity for alternative enterprises



10. Discussion and Conclusion

The objectives of this economic research report were to provide an overview of important farming systems in the pastoral zone and assess the profitability of alternative sheep enterprises using representative farming systems analysis. The process of modelling and analysing a farming system requires the description of a ‘representative farm’ which is more or less typical of a group of farms (e.g. in a particular geographical area) which operate with similar resources and constraints. The representative farm reflects both the normal management practices in the area and the financial performance of businesses at a particular point in time.

Representative farm models have been developed for the UD, the M-D and the FW sub-regions of the pastoral zone of NSW. In the UD region the representative farm includes sheep and cattle enterprises. In the M-D region the representative farm includes sheep and cattle with some opportunistic cropping enterprises while a sheep breeding enterprise is often the sole enterprise in the Far West region.

The UD region consists of much of the north east of the pastoral zone of NSW. The representative farm has about 24,000 hectares of agricultural land with about 9000 dry sheep equivalents at about 0.4 DSE per ha. The region has slightly summer dominant rainfall averaging about 380 mm per annum. The total value of its farm assets is estimated at \$1.5 million with 85% owner’s equity and 6.7% business return on equity.

The M-D region covers the south east part of the pastoral zone where the farming system is characterised by mixed farming system consisting of livestock and cropping enterprises and

dominant winter annual rainfall averaging about 225mm. The representative farm in this region has a total land area of 25,000 hectares divided between native pasture (64%), with a carrying capacity of 8,800 dry sheep equivalent at a stocking rate of 0.6 DSE per ha, natural reserve (20%) and cropping (16%). The total value of assets for the representative farm is about \$1.4 million with 84% owner's equity and 13.3% farm business return on equity.

The FW region includes the western part the pastoral zone of NSW characterised by relatively lower and anseasonal rainfall averaging 175 mm per annum. The system is dominated by specialist wool and sheep producers obtaining over 98% of farm income from the sale of wool and sheep. The representative farm in this region has a total land area of 35,000 hectares with 4,400 Merino sheep accounting for 7,000 dry sheep equivalent at the stocking rate of 0.2 DSE per ha. The total value of assets for the representative farm is estimated at about \$0.883 million, with 80% owner's equity and about 14% farm business return on equity.

Because of a sustained period of low wool prices, high sheep and lamb meat prices and increased difficulty sourcing shearers there has been growing interest in changing the nature of the sheep enterprises in the pastoral zone away from a heavy reliance on wool towards a higher share of income from meat. A range of alternative sheep enterprises has been considered and compared with the representative farm in each sub-region. These enterprises include SR Merinos with a proportion of Merino ewes mated to a terminal sire for prime lamb production, wethers only, SR Merino ewes only, and SR Dorper and Damara enterprises

The business return on equity for the Merino ewes only enterprise was the highest in all sub regions with values of 7.2% in the UD, 15% in the M-D and 17% in the FW regions. The business return on equity for all other enterprises was lower than for the representative farm in all regions.

These results indicate that the farming systems that have evolved in these areas are well suited to their respective environments and the economic incentives to replace the traditional mix of a SR Merino flock and a wether flock do not appear strong, at least for the representative farms under the relative price conditions for wool and sheep assumed here. In addition, our analysis did not account for the cost of changing from one enterprise to another. Other assumptions in the analysis, for example that rangeland resources can be used equally well by the different enterprises and that commodity prices are constant across enterprises, also raise questions about the economic incentives to switch enterprises.

References

- ABARE (2006), *Australian Commodity Statistics 2006*, Australian Government Printing Services, Canberra.
- ABARE (2003), *Australian Farm Survey Report 2003*, Australian Government Printing Services, Canberra.
- ABARE (2006), *Australian Farm Survey Report 1996-2006*, Australian Government Printing Services, Canberra.
- ABS (2001), *Agricultural Census Data 2000/01*, Australian Government Printing Services, Canberra.
- ABS (1997), *Agricultural Census Data 1991-1997*, Australian Government Printing Services, Canberra.
- Brooke, G. and McGarva, L. (comp.) (1998), *The Glove Box Guide to Plants of New South Wales Rangelands Grazing Management and Economics Activities*, NSW Agriculture, Orange, ISBN 0731314875.
- Campbell, T. and Hacker, R. (2000), *The Glove Box Guide to Tactical Grazing Management for the Semi-Arid Woodlands*, NSW Agriculture, Orange, ISBN 0 7347 1195 6.
- Clewett, J.F., Clarkson, N.M., George, D.A., Ooi, S.H., Owens, D.T., Patridge I.J. and Simpson G.B. (2003), *Rainman StreamFlow Version 4.3*, Department of Primary Industries, Queensland.
- CSIRO Livestock Industries and Australian Sheep Industry CRC (2004), *The Merino versus Terminal Sire Flock Model*, CSIRO Livestock Industries, Armidale. [On line]. Available. <http://www.sheepcrc.org.au/flock_structure.php>.
- CSIRO and DLWC (1999), *Study D: Biological status and trends of the land and water systems of the Western Division*, NSW Department of Land and Water Conservation, Sydney.
- Cunningham, G.M., Milham, W.E., Milthorpe, P.L., and Leigh, J.H. (1992), *Plants of New South Wales*, Inkata Press, Melbourne.
- Condon, R. (1999), *Out of the West: Historical Perspectives on the Western Division of New South Wales*, Lower Murray-Darling and Western Catchment Management Committees.
- Date, W. (1992), 'Climate', In: *Rangelands Management in Western New South Wales*, Simpson I. (ed.), NSW Agriculture, Orange.
- DLWC (2000), *Western Lands Review*, Final Report, Department of Land and Water Conservation, Sydney.
- Freudenberger, D., Wilson, A. and Palmer, R. (1999), 'The importance of perennial grasses for sheep production in the semi-arid woodlands of eastern Australia', *The Rangeland Journal* 21:199-219.
- Hacker R. B., Alemseged, Y., Carberry, P.M., Browne, R.H. and Smith, W.J. (2006), *Betting on Rain: Managing Seasonal Risk in Western NSW*, NSW Department of Primary Industries, ISBN 0 7347 1727 X..
- Hacker, R., Beange, L., Casburn, G., Curran, G., Gray, P. & Warner, J. (2005), *Best Management Practices for Extensive Grazing Enterprises*, NSW Department of Primary Industries, Orange.

- Hacker, R.B., Alemseged, Y. & Carberry, P.M. (2004), *Improved Seasonal Forecasts for Wool Producers in Western NSW*, Final Report - DAN 16 (Milestone 4), NSW Department of Primary Industries, Orange.
- Hacker, R.B. (2004), Policy contributions to environmental risk management – matching policy to the rangeland environment, In: *Living in the Outback, Australian Rangeland Society 13th Biennial Conference* Alice Springs 5th – 8th July 2004, Conference Papers (eds Bastin, G., Walsh, D. and Nicholson, S.), ISSN 1323-6660. pp 53-58.
- Hacker R.B. and McLeod, S.R. (2003), *Living with Kangaroos: A guide to kangaroos and their management in the Murray-Darling Basin*, NSW Agriculture, ISBN 0 7347 1505 6. 44pp.
- Hoadley J., Milham N. and Davenport S. (1994), *Looking Forward: The Medium-Term Outlook For Farm Financial Performance in The Western Division of New South Wales*, Miscellaneous Report, Economic Services Unit, NSW Agriculture, Orange.
- Hodgkinson, K.C. and Harrington, G.N. (1985), ‘The case for prescribed burning to control shrubs in eastern semi-arid woodlands’, *The Australian Rangeland Journal* 7(2): 64-74.
- Jayasuriya, R., Catt, C. and Young, R. (1999), *Local Consensus Data Technique*, Mimeo, NSW Agriculture, Orange.
- LMDCMB (2002), *Lower Murray-Darling Catchment Blueprint, Integrated Catchment Management Plan for the Lower Murray-Darling Catchment*, Department of land and Water Conservation, Sydney.
- LMDCMA (2006), *Lower Murray-Darling CMA Catchment Action Plan*, Department of land and Water Conservation, Sydney.
- Louth BG, (comp.), (2000/1), *Property management for the members of the Louth Bestprac Group*, NSW Agriculture, Dubbo.
- NIEIR (2000a), *Necessary conditions and options for socio-economic advancement-A prospective and perspective analysis of the Western Catchment Management Area of New South Wales*, A report for the Western Catchment Management Committee, Victoria.
- NIEIR (2000b), *Prospects for socio-economic advancement In the Western Catchment Management area of New South Wales*, A report for the Western Catchment Management Board, Victoria.
- McIntosh, G. (Comp.) (2004a), *Kerribee Core Site Tour – GRDC Low Rainfall Meeting*, Mallee Sustainable Farming Inc. and NSW Agriculture, Dareton.
- McIntosh, G. (2004b), *Outcomes achieved since 1999 in the Lower Murray-Darling Catchment Authority in NSW*, NSW Agriculture, Dareton.
- Mackay, B.I. (2002), *Managing Drought*, NSW Agriculture, Orange.
- Murphy, John and Date, Warwick (1989), *A Consensus Report of Current Costs, Returns and Management Practices for a Typical Western Cobar Grazing Property*, Farm Business Notes No 49, NSW AGRICULTURE & FISHERIES, Agdex 400/820.
- Murphy, J. (1992), ‘Enterprises’ In: *Rangelands Management in Western New South Wales*, ed. Ian Simpson, Chapter 1, NSW Agriculture.

- Shepherd, R. (Comp) (2006), *WEST 2000 Plus: Enterprise Based Conservation Program, Program Management and Recommendations*, West 2000 plus, NSW Department of Natural Resources, ISBN: 0 7347 5667 4.
- Short, J. (1987), 'Factors affecting food intake of rangelands herbivores', in *Kangaroos: their ecology and management in the sheep rangelands of Australia* (Eds. Caughley G., Shepherd, N. and Short, J.), Cambridge University Press, pp 84-99.
- Swift, M.J. and Anderson, J.M. (1994), 'Agricultural Systems' In: *Biodiversity and Ecosystem Functions*, Schulze E.-D. and Mooney, H.A. (1994), eds, Springer-Verlag, Berlin Heidelberg, Germany.
- WCMB (2003), *Western Catchment Action Plan*, Department of Land and Water Conservation, Sydney.
- Weilmoringle BG, (comp.), (2000/1), *Property management for the members of the Weilmoringle Bestprac Group*, NSW Agriculture, Dubbo.
- Wilcannia BG, (comp.), (2000/1), *Property management for the members of the Weilmoringle Bestprac Group*, NSW Agriculture, Dubbo.
- WCMA (2006), *Draft Western Catchment Plan 2006-2016*, Version II. 112 pp.
<http://www.western.cma.nsw.gov.au/>
- Wilson, AD (1991), 'The influence of kangaroos and forage supply on sheep productivity in the semi-arid woodlands', *The Rangeland Journal* 13: 69-80.
- Young, M. and Kilminster, T. (2004), 'Alternative meat sheep in the farming system', *Ovine Observer*, Number 29, Western Australian Department of Agriculture.

Appendix 1 Commodity price assumptions used in the whole-farm budgets

Commodity	On farm prices \$
Wheat (APH)	150/tonne
Ewe	65/hd
Wether	62/hd
Ram	200/hd
Cow	587/hd
Steer	862/hd
Heifer	357/hd
Bull	1800/hd
Wool	889cents/kg clean

Source: Livestock Reporting Services 2007 and NSW DPI Enterprise GM Budgets 2007.

Appendix 2 GM budget for Wheat crop in the M-D region representative farm (McIntosh, 2004b)

1. GM BUDGET:	Standard Budget \$/Ha	Your Budget \$/Ha
INCOME:		
1.55 tonnes/ha @ \$150.00 /tonne (on farm) (AH)	\$232.50	
A. TOTAL INCOME \$/ha:	\$232.50	
VARIABLE COSTS:		
Cultivation.....	\$39.94	
Sowing.....	\$12.33	
Fertiliser.....	\$24.40	
Herbicide.....	\$11.70	
Insecticide.....	\$0.44	
Contract-harvesting.....	\$29.63	
Levies.....	\$0.00	
Crop Insurance.....	\$0.00	
Cartage, grading & bagging...	\$21.33	
B. TOTAL VARIABLE COSTS \$/ha:	\$139.76	
C. GM (A-B) \$/ha:	\$92.74	

Appendix 3 Merino – Terminal Sire Flock Model Result (UD)

Merino - Terminal Sire Flock Model			
SR ewes		SR ewes	Number
Size of breeding flock	3070	Weaners	773
Age at first lambing	1	Hoggets	742
Number of lambings	5	Hoggets after cull	668
Weaning percentage	95%	<i>Breeding ewes</i>	
Mortality to 1 year	4%	1 yr	353
Hogget ewe culling %	10%	2 yr	338
Annual mortality 1 yr to cfa	4%	3 yr	325
		4 yr	312
		5 yr	299
Terminal sire matings		Total	1627.1
Percentage of flock	47%		
		Sale/purchase ewes	
		Cull hogget ewes	74
		Surplus hogget ewes	3
		Deficit hogget ewes	0
		CFA ewes	565
		Terminal sire matings	
		<i>Breeding ewes</i>	
		1 yr	313
		2 yr	300
		3 yr	288
		4 yr	277
		5 yr	266
		Total	1442.9

Appendix 4 Merino – Terminal Sire Flock Model Result (M-D)

Merino - Terminal Sire Flock Model			
SR ewes		SR ewes	Number
Size of breeding flock	3174	Weaners	799
Age at first lambing	1	Hoggets	767
Number of lambings	5	Hoggets after cull	690
Weaning percentage	95%	<i>Breeding ewes</i>	
Mortality to 1 year	4%	1 yr	364
Hogget ewe culling %	10%	2 yr	350
Annual mortality 1 yr to cfa	4%	3 yr	336
		4 yr	322
		5 yr	310
Terminal sire matings		Total	1682.22
Percentage of flock	47%		
		Sale/purchase ewes	
		Cull hogget ewes	77
		Surplus hogget ewes	3
		Deficit hogget ewes	0
		CFA ewes	584
		Terminal sire matings	
		<i>Breeding ewes</i>	
		1 yr	323
		2 yr	310
		3 yr	298
		4 yr	286
		5 yr	275
		Total	1491.78


Appendix 5 Merino – Terminal Sire Flock Model (FW)

SR ewes		SR ewes	Number
Size of breeding flock	3380	Weaners	851
Age at first lambing	1	Hoggets	817
Number of lambings	5	Hoggets after cull	735
Weaning percentage	95%	<i>Breeding ewes</i>	
Mortality to 1 year	4%	1 yr	388
Hogget ewe culling %	10%	2 yr	373
Annual mortality 1 yr to cfa	4%	3 yr	358
		4 yr	343
		5 yr	330
Terminal sire matings		Total	1791.4
Percentage of flock	47%		
		Sale/purchase ewes	
		Cull hogget ewes	82
		Surplus hogget ewes	3
		Deficit hogget ewes	0
		CFA ewes	622
		Terminal sire matings	
		<i>Breeding ewes</i>	
		1 yr	344
		2 yr	330
		3 yr	317
		4 yr	305
		5 yr	292
		Total	1588.6


Appendix 6 GM for Merino ewes enterprise (UD)

					Standard Budget	Your Budget
					(\$)	(\$)
MERINO EWES - 23 Micron						
Enterprise size:		1000 Ewes				
INCOME:						
Wool						
	number	class	kg /hd	\$/kg		
Shear	960	ewes	5.00	\$5.37	\$25,776.00	
	20	rams	5.00	\$5.37	\$537.00	
	432	ewe hoggets	4.20	\$2.59	\$4,699.30	
Crutch	1412	adults	0.30	\$2.62	\$1,110.68	
Sheep Sales						
	number	class	\$/hd			
	177	CFA ewes	\$65.00		\$11,505.00	
	4	CFA rams	\$59.00		\$236.00	
	450	weth weaners	\$30.00		\$13,500.00	
	215	ewe hoggets	\$50.00		\$10,750.00	
	846					
A. Total Income:					\$68,113.98	
VARIABLE COSTS:						
	number	class	cost (\$)	reps		
Wool Harvesting & Selling Costs						
Shearing	1392	ewes/hoggets	\$5.21	1	\$7,252.32	
	20	rams	\$7.82	1	\$156.40	
Crutching	1392	ewes/hoggets	\$0.76	1	\$1,057.92	
	20	rams	\$1.50	1	\$30.00	
Wool selling costs						
Wool tax			2.00%		\$642.46	
Commission, warehouse, testing charges			6%		\$1,766.76	
Wool - cartage	40	bales	\$10.97		\$438.80	
- packs	40	packs	\$8.59		\$343.60	
Sheep Health						
Drenching	1412	adults/hoggets	\$0.17	2	\$480.08	
	950	lambs	\$0.18	2	\$342.00	
Narrowspectrum	1426	adults/hoggets	\$0.36	1	\$513.36	
	900	lambs	\$0.18	1	\$162.00	
Dipping	1412	adults/hoggets	\$0.58	1	\$818.96	
Jetting	1412	adults/hoggets	\$0.19	1	\$268.28	
	450	ewe weaners	\$1.42	1	\$639.00	
Vaccination- 6 in 1	1412	adults/hoggets	\$0.18	1	\$254.16	
	950	lambs	\$0.18	2	\$342.00	
Mules +Mark	950	lambs	\$1.45	1	\$1,377.50	
Scanning	960	ewes	\$0.75	1	\$720.00	
Supplementary feed - no allowance made						
Livestock selling costs						
Livestock cartage	817	sale sheep	\$1.50		\$1,225.50	
Commission on sheep sales				5.00%	\$1,799.55	
B. Total Variable Costs:					\$20,630.65	
REPLACEMENTS:						
	number	class	\$/hd			
	4	rams	\$750.00		\$3,000.00	
C. Total Replacements:					\$3,000.00	
GROSS MARGIN (A-B-C)					\$44,483.32	
GROSS MARGIN /EWE					\$44.48	
GROSS MARGIN /DSE					\$26.17	
GROSS MARGIN /HA					\$52.33	


Appendix 7 GM for Terminal Sire enterprise (UD)

 NSW DEPARTMENT OF PRIMARY INDUSTRIES							
Enterprise:		1 ST X EWES - Terminal Rams					
Enterprise size:		1000 Ewes					
INCOME:						Standard Budget (\$)	Your Budget (\$)
Wool	number	class	kg /hd	\$/kg			
Shear	960	ewes	5.00	\$4.15	\$19,920.00		
	20	rams	3.50	\$2.17	\$151.90		
	0	ewe hoggets	2.50	\$1.63	\$0.00		
Crutch	980	adults	0.30	\$2.62	\$770.87		
Sheep Sales	number	class	\$/hd				
	177	CFA ewes	\$65.00		\$11,505.00		
	4	CFA rams	\$59.00		\$236.00		
	588	weth lambs	\$34.00		\$19,992.00		
	588	ewe hoggets	\$50.00		\$29,400.00		
		A. Total Income:			\$81,975.77		
VARIABLE COSTS:							
Wool harvesting and Resplacement costs							
	number	class	cost (\$)	reps			
Shearing	960	ewes	\$5.21	1	\$5,001.60		
	20	rams	\$7.82	1	\$156.40		
	0	ewe hoggets	\$5.21	1	\$0.00		
Dipping	980	adults	\$0.58	1	\$568.40		
	0	ewe hoggets	\$0.58	1	\$0.00		
Crutching	980	ewes	\$0.76	1	\$744.80		
	20	rams	\$1.50	1	\$30.00		
	1176	ewe weaners	\$0.76	1	\$893.76		
Drenching	980	adults	\$0.17	2	\$333.20		
	1230	lambs	\$0.18	3	\$664.20		
Jetting	980	adults	\$1.19	1	\$1,166.20		
	1176	ewe weaners	\$0.18	1	\$211.68		
Vaccination- 6 in 1	980	adults	\$0.18	1	\$176.40		
	1230	lambs	\$0.18	2	\$442.80		
Marking	1230	lambs	\$1.05	1	\$1,291.50		
	960	ewes	\$0.75	1	\$720.00		
Fodder							
Supplementary feed - 3.5 kgs of oats/hd/week over 3 weeks @ \$120/tonne							
	960	ewes	\$0.42	6 weeks	\$2,419.20		
Pature mainenance	8000	ha	\$0.00		\$0.00		
Wool selling costs							
Wool tax			2.00%		\$416.86		
Commission, warehouse, testing charges			5.50%		\$1.54		
Wool - cartage	28	bales	\$10.97		\$307.16		
- packs	28	packs	\$8.59		\$240.52		
Livestock selling costs							
Livestock cartage	1,357	sale sheep	\$1.50		\$2,035.50		
Commission on sheep sales			5.00%		\$3,056.65		
		B. Total Variable Costs:			\$20,878.37		
REPLACEMENTS:							
	number	class	\$/hd				
	4	rams	\$200.00		\$800.00		
	217	ewes (1.5 years)	\$110.00		\$23,870.00		
		C. Total Replacements:			\$24,670.00		
		GROSS MARGIN (A-B-C)			\$36,427.40		
		GROSS MARGIN /EWE			\$36.43		
		GROSS MARGIN /DSE			\$21.43		
		GROSS MARGIN /HA			\$4.29		


Appendix 8 GM for Merino wether enterprise (UD)

 NSW DEPARTMENT OF PRIMARY INDUSTRIES						
MERINO EWES - 23 Micron						
Enterprise size:		1000 Ewes				
INCOME:						
					Standard Budget (\$)	Your Budget (\$)
Wool						
	number	class	kg /hd	\$/kg		
Shear	960	ewes	5.00	\$5.37	\$25,776.00	
	20	rams	5.00	\$5.37	\$537.00	
	432	ewe hoggets	4.20	\$2.59	\$4,699.30	
Crutch	1412	adults	0.30	\$2.62	\$1,110.68	
Sheep Sales						
	number	class	\$/hd			
	177	CFA ewes	\$65.00		\$11,505.00	
	4	CFA rams	\$59.00		\$236.00	
	450	weth weaners	\$30.00		\$13,500.00	
	215	ewe hoggets	\$50.00		\$10,750.00	
	846					
A. Total Income:					\$68,113.98	
VARIABLE COSTS:						
	number	class	cost (\$)	reps		
Wool Harvesting & Selling Costs						
Shearing	1392	ewes/hoggets	\$5.21	1	\$7,252.32	
	20	rams	\$7.82	1	\$156.40	
Crutching	1392	ewes/hoggets	\$0.76	1	\$1,057.92	
	20	rams	\$1.50	1	\$30.00	
Wool selling costs						
Wool tax			2.00%		\$642.46	
Commission, warehouse, testing charges			6%		\$1,766.76	
Wool - cartage	40	bales	\$10.97		\$438.80	
- packs	40	packs	\$8.59		\$343.60	
Sheep Health						
Drenching	1412	adults/hoggets	\$0.17	2	\$480.08	
	950	lambs	\$0.18	2	\$342.00	
Narrowspectrum	1426	adults/hoggets	\$0.36	1	\$513.36	
	900	lambs	\$0.18	1	\$162.00	
Dipping	1412	adults/hoggets	\$0.58	1	\$818.96	
Jetting	1412	adults/hoggets	\$0.19	1	\$268.28	
	450	ewe weaners	\$1.42	1	\$639.00	
Vaccination- 6 in 1	1412	adults/hoggets	\$0.18	1	\$254.16	
	950	lambs	\$0.18	2	\$342.00	
Mules +Mark	950	lambs	\$1.45	1	\$1,377.50	
Scanning	960	ewes	\$0.75	1	\$720.00	
Supplementary feed - no allowance made						
Livestock selling costs						
Livestock cartage	817	sale sheep	\$1.50		\$1,225.50	
Commission on sheep sales				5.00%	\$1,799.55	
B. Total Variable Costs:					\$20,630.65	
REPLACEMENTS:						
	number	class	\$/hd			
	4	rams	\$750.00		\$3,000.00	
C. Total Replacements:					\$3,000.00	
GROSS MARGIN (A-B-C)					\$44,483.32	
GROSS MARGIN /EWE					\$44.48	
GROSS MARGIN /DSE					\$26.17	
GROSS MARGIN /HA					\$52.33	

Appendix 9 GM for the Dorper enterprise (UD)

 NSW DEPARTMENT OF PRIMARY INDUSTRIES							
DORPER EWES - Dorper Rams							
Farm Enterprise Budget Series - January 2006							
Flock size:	1000 ewes						
Ewe body weight:	63 kgs						
DSE rating:	2.6 dse's / ewe						
INCOME						Standard Budget (\$)	Your Budget (\$)
Wool	number	class	kg /hd	\$/kg			
Shear	0	ewes	0.00	\$0.00	\$0.00		
	0	rams	0.00	\$0.00	\$0.00		
	0	ewe lambs	0.00	\$0.00	\$0.00		
Crutch	0	mixed ages	0.00	\$0.00	\$0.00		
Sheep Sales	number	class	\$/hd				
	177	CFA ewes	\$47.49	(25.8 kg cwt)	\$8,406.44		
	4	CFA rams	\$60.92		\$243.68		
	284	weth lambs	\$67.00	(20.0 kg cwt)	\$19,028.00		
	284	weth lambs	\$67.00	(20.0 kg cwt)	\$19,028.00		
	340	ewe lambs	\$75.00	(12 months)	\$25,500.00		
Fodder	tonnes	type	value per tonne				
Hay	0 t	lucerne hay @	\$200.00		\$0.00		
Fodder crop grain	0 t	oats @	\$150.00		\$0.00		
A. Total Income:					\$72,206.12		
VARIABLE COSTS							
	number	class	\$/hd				
	4	rams	\$1,500.00		\$6,000.00		
Wool Harvesting & Selling Costs							
Shearing	0	ewes/hoggets	\$5.29		\$0.00		
	0	rams	\$7.94		\$0.00		
Crutching	0	ewes/hoggets	\$0.79		\$0.00		
	0	rams	\$1.58		\$0.00		
Wool tax			2.00%		\$0.00		
Commission, warehouse, testing charges			\$39.14/ bale		\$0.00		
Wool - cartage	0	bales	\$13.11		\$0.00		
- packs	0	packs	\$11.10		\$0.00		
Sheep Health	number	class	cost (\$)	reps			
Drenching following DrenchPlan							
Broadspectrum	1537	adults/hoggets	\$0.27	1	\$414.94		
	1190	lambs	\$0.15	1	\$178.50		
Dipping	0	adults/hoggets	\$0.58	0	\$0.00		
Jetting	0	adults/hoggets	\$1.19	0	\$0.00		
	0	ewe weaners	\$1.42	0	\$0.00		
Vaccination- 6 in 1	1537	adults/hoggets	\$0.18	1	\$276.62		
	1190	lambs	\$0.18	2	\$428.40		
Mark	1190	lambs	\$1.05	1	\$1,249.50		
Scanning	960	ewes	\$0.75	1	\$720.00		
Livestock Selling Costs							
Livestock cartage	1,089	sale sheep	\$1.50		\$1,633.50		
Commission on sheep sales			5.00%		\$3,610.31		
Fodder							
Supplementary feed - 3.5 kgs grain/hd/week @ \$150 /t							
	960	ewes	\$0.53 /week	6 weeks	\$3,024.00		
Grazing crops	0 ha	@	\$255 /ha		\$0.00		
Supplementary fodder	0 t	@	\$0 /t		\$0.00		
Pasture maintenance	0 ha	@	\$17 /ha		\$0.00		
B. Total Variable Costs:					\$17,535.77		
					incl. fodder costs	excl. fodder costs	
GROSS MARGIN (A-B)					\$54,670	\$57,694	
GROSS MARGIN /EWE					\$54.67	\$57.69	
GROSS MARGIN /DSE					\$21.03	\$22.19	
GROSS MARGIN /HA					\$4.21	\$4.44	

Appendix 10 GM for the Damara enterprise (UD)

 NSW DEPARTMENT OF PRIMARY INDUSTRIES						
DAMARA EWES - Damara Rams						
Farm Enterprise Budget Series - January 2006						
Flock size:	1000 ewes					
Ewe body weight:	52 kgs					
DSE rating:	2.3 dse's / ewe					
					Standard Budget (\$)	Your Budget (\$)
INCOME						
Wool	number	class	kg /hd	\$/kg		
Shear	0	ewes	0.00	\$0.00	\$0.00	
	0	rams	0.00	\$0.00	\$0.00	
	0	ewe lambs	0.00	\$0.00	\$0.00	
Crutch	0	mixed ages	0.00	\$0.00	\$0.00	
Sheep Sales	number	class	\$/hd			
	177	CFA ewes	\$35.11	(21.3 kg cwt)	\$6,214.82	
	4	CFA rams	\$60.92		\$243.68	
	235	weth lambs	\$57.00	(20.0 kg cwt)	\$13,395.00	
	235	weth lambs	\$57.00	(20.0 kg cwt)	\$13,395.00	
	244	ewe lambs	\$65.00	(12 months)	\$15,860.00	
Fodder	tonnes	type	value per tonne			
Hay	0 t	lucerne hay @	\$200.00		\$0.00	
Fodder crop grain	0 t	oats @	\$150.00		\$0.00	
A. Total Income:					\$49,108.50	
VARIABLE COSTS						
	number	class	\$/hd			
	4	rams	\$1,500.00		\$6,000.00	
Wool Harvesting & Selling Costs						
Shearing	0	ewes/hoggets	\$5.29		\$0.00	
	0	rams	\$7.94		\$0.00	
Crutching	0	ewes/hoggets	\$0.79		\$0.00	
	0	rams	\$1.58		\$0.00	
Wool tax			2.00%		\$0.00	
Commission, warehouse, testing charges			\$39.14/ bale		\$0.00	
Wool - cartage	0	bales	\$13.11		\$0.00	
- packs	0	packs	\$11.10		\$0.00	
Sheep Health	number	class	cost (\$)	reps		
Drenching following DrenchPlan						
Broadspectrum	1441	adults/hoggets	\$0.27	1	\$389.02	
	990	lambs	\$0.15	1	\$148.50	
Dipping	0	adults/hoggets	\$0.58	0	\$0.00	
Jetting	0	adults/hoggets	\$1.19	0	\$0.00	
	0	ewe weaners	\$1.42	0	\$0.00	
Vaccination- 6 in 1	1441	adults/hoggets	\$0.18	1	\$259.34	
	990	lambs	\$0.18	2	\$356.40	
Mark	990	lambs	\$1.05	1	\$1,039.50	
Scanning	960	ewes	\$0.75	1	\$720.00	
Livestock Selling Costs						
Livestock cartage	895	sale sheep	\$1.50		\$1,342.50	
Commission on sheep sales			5.00%		\$2,455.43	
Fodder						
Supplementary feed - 3.5 kgs grain/hd/week @ \$150 /t						
	960	ewes	\$0.53 /week	6 weeks	\$3,024.00	
Grazing crops	0 ha	@	\$255 /ha		\$0.00	
Supplementary fodder	0 t	@	\$0 /t		\$0.00	
Pasture maintenance	0 ha	@	\$17 /ha		\$0.00	
B. Total Variable Costs:					\$15,734.69	
					incl. fodder costs	excl. fodder costs
GROSS MARGIN (A-B)					\$33,374	\$36,398
GROSS MARGIN /EWE					\$33.37	\$36.40
GROSS MARGIN /DSE					\$14.51	\$15.83
GROSS MARGIN /HA					\$2.90	\$3.17

Appendix 11 Assumption used in calculating GM for alternative sheep enterprises

The Upper Darling region							
Enterprise	DSE Rating	Stocking Rate	Ewe BWt	Weaning %	Average Price	Total Sheep Income	GM per Ewe/Wether
MERINO EWES - Merino Rams	1.7	0.2	50.0	0.9	65	69280	45
MERINO EWES - Terminal Rams	1.7	0.2	50.0	0.9	66	72675	36
MERINO WHETHERS	1.1	0.15	55.0	1.2	46	34994	12
DORPER EWES - Dorper Rams	2.6	0.2	63.0	1.2	75	72206	58
DAMARA EWES - Damara Rams	2.3	0.2	52.0	1.0	65	49109	36
The Murray-Darling region							
MERINO EWES - Merino Rams	1.7	0.3	50.0	0.9	65	69280	45
MERINO EWES - Terminal Rams	1.7	0.3	50.0	0.9	66	72675	36
MERINO WHETHRS	1.1	0.15	55.0	1.2	46	34994	12
DORPER EWES - Dorper Rams	2.6	0.3	63.0	1.2	75	72206	58
DAMARA EWES - Damara Rams	2.3	0.3	52.0	1.0	65	49109	36
The Far West region							
MERINO EWES - Merino Rams	1.7	0.2	50.0	0.8	65	66591	43
MERINO EWES - Terminal Rams	1.7	0.2	50.0	0.8	66	68440	32
MERINO WHETHES	1.1	0.15	55.0	1.2	46	34994	12
DORPER EWES - Dorper Rams	2.6	0.2	63.0	1.1	75	64680	51
DAMARA EWES - Damara Rams	2.3	0.2	52.0	0.9	65	42643	31

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Number

- 1 Brennan, J.P. and Bantilan, M.C.S. 1999, *Impact of ICRISAT Research on Australian Agriculture*, Report prepared for Australian Centre for International Agricultural Research, Economic Research Report No. 1, NSW Agriculture, Wagga Wagga.
- 2 Davies, B.L., Alford, A. and Hollis, G. 1999, *Analysis of ABARE Dairy Data for Six Regions in NSW 1991-92 to 1996-97*, Economic Research Report No 2, NSW Agriculture, C.B. Alexander College, Paterson.
- 3 Brennan, J.P. and Singh, R.P. 2000, *Economic Assessment of Improving Nutritional Characteristics of Feed Grains*, Report prepared for Grains Research and Development Corporation, Economic Research Report No. 3, Wagga Wagga.
- 4 Zhao. X., Mullen, J.D., Griffith, G.R., Griffiths, W.E. and Piggott, R.R. 2000, *An Equilibrium Displacement Model of the Australian Beef Industry*, Economic Research Report No 4, NSW Agriculture, Armidale.
- 5 Griffith, G., I'Anson, K., Hill, D., Lubett, R. and Vere, D. 2001. *Previous Demand Elasticity Estimates for Australian Meat Products*, Economic Research Report No 5, NSW Agriculture, Armidale.
- 6 Griffith, G., I'Anson, K., Hill, D. and Vere, D. 2001. *Previous Supply Elasticity Estimates for Australian Broadacre Agriculture*, Economic Research Report No 6, NSW Agriculture, Armidale.
- 7 Patton, D.A. and Mullen, J.D. 2001, *Farming Systems in the Central West of NSW: An Economic Analysis*, Economic Research Report No. 7, NSW Agriculture, Trangie.
- 8 Brennan, J.P. and Bialowas, A. 2001, *Changes in Characteristics of NSW Wheat Varieties, 1965-1997*, Economic Research Report No. 8, NSW Agriculture, Wagga Wagga.
- 9 Mullen, J.D. 2001, *An Economic Perspective on Land Degradation Issues*, Economic Research Report No. 9, NSW Agriculture, Orange.
- 10 Singh, R.P., Mullen, J.D., and Jayasuriya, R. 2005, *Farming Systems in the Murrumbidgee Irrigation Area in NSW: An Economic Analysis*, Economic Research Report No. 10, NSW Department of Primary Industries, Yanco.
- 11 Brennan, J.P., Aw-Hassan, A., Quade, K.J. and Nordblom, T.L. 2002, *Impact of ICARDA Research on Australian Agriculture*, Economic Research Report No. 11, NSW Agriculture, Wagga Wagga.

- 12 Alford, A., Griffith, G. and Davies, L. 2003, *Livestock Farming Systems in the Northern Tablelands of NSW: An Economic Analysis*, Economic Research Report No. 12, NSW Agriculture, Armidale.
- 13 Alford, A., Griffith, G. and Cacho, O. 2003, *A Northern Tablelands Whole-Farm Linear Program for Economic Evaluation of New Technologies at the Farm Level*, Economic Research Report No. 13, NSW Agriculture, Armidale.
- 14 Mullen, J.D. and Vere, D.T. 2003, *Research and Extension Capabilities - Program Economists in New South Wales Agriculture*, Economic Research Report No. 14, NSW Agriculture, Orange.
- 15 Farquharson, R.J., Griffith, G.R., Barwick, S.A., Banks, R.G. and Holmes, W.E. 2003, *Estimating the Returns from Past Investment into Beef Cattle Genetic Technologies in Australia*, Economic Research Report No. 15, NSW Agriculture, Armidale.
- 16 O'Donnell, C.J., Griffith, G.R., Nightingale, J.J. and Piggott, R.R. 2004, *Testing for Market Power in Multiple-Input, Multiple-Output Industries: The Australian Grains and Oilseeds Industries*, Technical Report for the Rural Industries Research and Development Corporation, Economic Research Report No. 16, NSW Agriculture, Armidale.
- 17 Brennan, J.P., Martin, P.J. and Mullen, J.D. 2004, *An Assessment of the Economic, Environmental and Social Impacts of NSW Agriculture's Wheat Breeding Program*, Economic Research Report No. 17, NSW Agriculture, Wagga Wagga.
- 18 Griffith, G.R., Davies, B.L., Alford, A.R., Herd, R.M., Parnell, P.F. and Hegarty, R.S. 2004, *An Assessment of the Economic, Environmental and Social Impacts of NSW Agriculture's Investment in the Net Feed Efficiency R,D&E Cluster*, Economic Research Report No. 18, NSW Department of Primary Industries, Armidale.
- 19 Scott, J.F. and Farquharson, R.J. 2004, *An Assessment of the Economic Impacts of NSW Agriculture's Research and Extension: Conservation Farming and Reduced Tillage in Northern NSW*, Economic Research Report No. 19, NSW Department of Primary Industries, Tamworth.
- 20 Scott, J.F., Farquharson, R.J. and Mullen, J.D. 2004, *Farming Systems in the Northern Cropping Region of NSW: An Economic Analysis*, Economic Research Report No. 20, NSW Department of Primary Industries, Tamworth.
- 21 Crean, J., Shaw, A., Singh, R. and Mullen, J.D. 2004, *An Assessment of the Economic, Environmental and Social Impacts of NSW Agriculture's Advisory Programs in Water Use Efficiency*, Economic Research Report No. 21, NSW Department of Primary Industries, Orange.
- 22 Mullen, J.D. 2004, *Evaluations in 2003 of Five Areas of Investment by NSW Agriculture: Summary*, Economic Research Report No. 22, NSW Department of Primary Industries, Orange.

- 23 Vere, D.T., Jones, R.E. and Dowling, P.M. 2004, *An Economic Evaluation of Research into the Improved Management of the Annual Grass Weed Vulpia in Temperate Pastures in South-Eastern Australia*, Economic Research Report No. 23, NSW Department of Primary Industries, Orange.
- 24 Jones, R.E. and Dowling, P.M. 2004, *Sustainability, Externalities and Economics: The Case of Temperate Perennial Grazing Systems in NSW*, Economic Research Report No. 24, NSW Department of Primary Industries, Orange.
- 25 Brennan, J.P. and Quade, K.J. 2004, *Analysis of the Impact of CIMMYT Research on the Australian Wheat Industry*, Economic Research Report No. 25, NSW Department of Primary Industries, Wagga Wagga.
- 26 Brennan, J.P., Sykes, J.D. and Scott, J.F. 2005, *Trends in Pulse and Oilseed Crops in Winter Cereal Rotations in NSW*, Economic Research Report No. 26, NSW Department of Primary Industries, Wagga Wagga.
- 27 Vere, D.T., Griffith, G.R. and Silvester, L. 2005, *Australian Sheep Industry CRC: Economic Evaluations of Scientific Research Programs*, Economic Research Report No. 27, NSW Department of Primary Industries, Orange.
- 28 Singh, R.P., Brennan, J.P. Lacy, J. and Steel, F. 2005, *An Assessment of the Economic, Environmental and Social Impacts of the Ricecheck Program*, Economic Research Report No. 28, NSW Department of Primary Industries, Yanco.
- 29 Jones, R., Saunders, G. and Balogh, S. 2005, *An Economic Evaluation of a Pest Management Control Program: "Outfox the Fox"*, Economic Research Report No. 29, NSW Department of Primary Industries, Orange.
- 30 Griffith, G.R., Parnell, P.F. and McKiernan, W. 2005, *An Evaluation of the Economic Benefits to NSW from Investment in the CRC for Beef Genetics Technologies*, Economic Research Report No. 30, NSW Department of Primary Industries, Orange.
- 31 Khairo, S.A., Mullen, J.D., Hacker, R.B. and Patton, D.P 2008, *Farming Systems in the Pastoral Zone of NSW: An economic Analysis*, Economic Research Report No. 31, NSW Department of Primary Industries, Trangie.
- 32 Griffith, G., Vere, D., and Jones, R. 2006, *Sheep CRC Renewal Proposal: Economic Evaluation of the Proposed Scientific Themes*, Economic Research Report No. 32, NSW Department of Primary Industries, Armidale.