A BASELINE OF ADOPTION OF PASTURE MANAGEMENT PRACTICES - GLENELG REGION

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Abbreviations

ABS	Australian Bureau of Statistics
LMU	Land Management Unit
GPP	Grassland Productivity Program
TPSKP	Temperate Pasture Sustainability Key Program
DSE	Dry Sheep Equivalent
ARU	Agribusiness Research Unit
RIRDC	Rural Industries Research and Development Corporation

SUMMARY

The aim of this report is to document baseline information about the state of adoption of pasture establishment and management practices in the Glenelg Region of Victoria and to evaluate the tools for continued monitoring of the adoption of these practices.

Based upon the available data, the progress towards adoption of pasture management practices in the Glenelg Region can be summarised as follows:

- The ABS farm survey provides a comprehensive measure of the rate of perennial pasture establishment in the Glenelg Catchment. The survey for 1993/94 shows the rate of all perennial pasture resown in the catchment as 1.4 percent per annum, with 1.2 percent to phalaris based pastures and another 0.2 percent to lucerne. The total area resown increased to 2.9 percent in 1996. This measure is comparable to the results of the Grasslands Productivity Survey that found the total pasture area resown to be 2.7 percent in the previous year (1994/95).

- Previous farm censuses did not differentiate annual from perennial pasture. However, it can be deduced from these surveys that the rate of pasture sowing peaked in 1985/86 during a short period of high wool prices, fell in the latter part of the 1980s, and appears to have continued to fall since.

- The low rate of perennial pasture resowing is unlikely to bring about a significant increase in the area of active perennial pasture in the catchment. At this rate it is unlikely to maintain the existing area of perennial pasture, as there is evidence that the lack of maintenance of perennial pastures is likely to reduce the persistence of pastures. ABS and other local studies highlighted the low adoption of improved pasture management systems, such as top dressing and rotational grazing management strategies.

- In 1994/95 approximately 42 percent of pastures were top-dressed. This increased to 60 percent by 1996/97. There is no other data available in the region that can be used to calibrate the ABS fertiliser question. Comparisons, however, between ABS data and data from farm surveys in other regions have shown that the ABS fertiliser question provides a reliable measure of the maintenance of improved perennial pastures.

- There is no ABS data that can be used to monitor the use of grazing rotation practices. Data available from other surveys conducted in the catchment shows set stocking and strategic grazing all year round as predominant methods of grazing management.

- Several studies in the region have identified different groups of graziers according to their commitment to pasture renovation. Only a minority of intensive graziers motivated by increasing productivity and production are adopting the total package of improved pasture management practices. This group is willing to undertake challenges and try out new techniques on their farms.

- The majority of graziers had a conservative approach to pasture management on their small areas of improved pastures. They did not use high rates of fertiliser or stock on their resown pastures and did not intend to do so in future. The cost of pasture establishment was their major concern. These farmers were risk averse and lacked an understanding of the farming system.

- An intermediate group adopting part of the pasture improvement package was also identified.

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August 2001

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1 THE GLENELG REGION

1.1 Sustainability in the Glenelg Region

The Glenelg Region lies south of the Dividing Range and covers about 2.5 million hectares in Western Victoria. The region has a Mediterranean type climate with hot dry summers and cool wet winters. The rainfall in the region varies from 900 mm/year to less than 500 mm/year.

Over 81 percent of the region's land is used for agricultural production, with livestock being the predominant enterprise. Pastures occupy 97 percent of the agricultural land of the region while cereal and other crops occupy the remainder. Wool production was the predominant livestock enterprise and contributed over 50 percent of the gross value of agricultural production in the region during 1989/90, followed by milk production (14 percent) and beef and dairy cattle sales (13 percent). (Glenelg Regional Salinity Strategy 1993; Glenelg Regional Landcare Plan 1993; Glenelg Regional Catchment Strategy 1997).

Major land management units (LMUs) dominating in the Glenelg Region are Volcanic Plains, Dundas Tablelands and Merino Tablelands. The southern two-thirds of the region is characterised by flat volcanic plains (the Basalt Plains). The northern third of the region is dominated by the extensive Grampians Ranges, the Dundas Tablelands and Black Ranges (Figure 1).

The major land degradation forms in the region are dryland salinity, soil and stream erosion, soil acidification and soil structure decline. Land management methods such as excessive grazing, overcultivation, and replacement of woodlands and native perennial grasslands with introduced annual pasture species have largely contributed to these problems. A total of 19970 ha of agricultural land are estimated to be salt affected, predominantly on the tablelands, volcanic plains and northern alluvial plains (Glenelg Regional Salinity Strategy 1993). It was estimated that approximately $2 million of agricultural production was lost to salinity in the region in 1993 (Kearns 1993; Glenelg Regional Salinity Strategy 1993).

Establishment and improved management of perennial pastures, strategic tree planting and fencing and revegetation of affected areas, along with a series of other cropping practices, are promoted in the area as solutions to these problems.

The benefits of sowing perennial pastures to overcome soil degradation lies with their potential to reduce recharge by extracting water from a greater volume of soil than annual pastures due to their deeper root system. Perennial pastures also have the capacity to trap leached nitrates, reducing the rate of soil acidification by 50 kg lime/ha/year compared to annuals (Ridley *et al*. 1990). It is important to note, however, that appropriate pasture management practices such as use of fertilisers, pest and disease control methods, and more importantly, stock management systems such as rotational grazing, largely affect the maximum water use of perennial pastures.

1.2 Indicator practices

The following practices have been selected as indicators of the extent of adoption of sustainable pasture management practices by graziers in the Glenelg Region.

- Perennial pasture sowing rate

The Glenelg Salinity Management Plan recommends sowing perennial pastures on the majority of medium recharge and high recharge areas as a salinity control measure in the region. The plan sets a target for perennial pasture coverage to be achieved on different land management units in the region over a 30 year period, with an annual total of 12655 ha. Given that perennial pastures need to be maintained by a resowing program, a measure of the rate of resowing is used as an acceptable proxy for the area of perennial pasture.

- Top dressing of perennial pastures

Annual top dressing of newly sown pastures is an important factor in maintaining a dense, vigorous growth. This will have a greater impact on the watertable and also improve productivity through increased gross margins. The fertiliser required by pastures in this region depends on the soil type and varies from a minimum of 50-100 kg/superphosphate/ha/year on basalt soils to 250-500 kg/superphosphate/ha/year on black clay soils to achieve marked increases in pasture growth (Schroder 1982). Unfertilised pastures will decline to annual pastures and eventually to an annual and native pasture mix.

- Stock management methods used: rotational grazing systems.

Heavy grazing needs to be introduced through increased stocking rates to utilise newly sown pastures in order to achieve maximum profitability. Heavy grazing is often the best way to deal with any weeds to ensure optimum pasture growth. From the salinity control point of view it is also necessary to introduce rotational grazing systems which enable the pastures to increase leaf area, plant growth and root development in order to maximise the water use of perennial pastures.

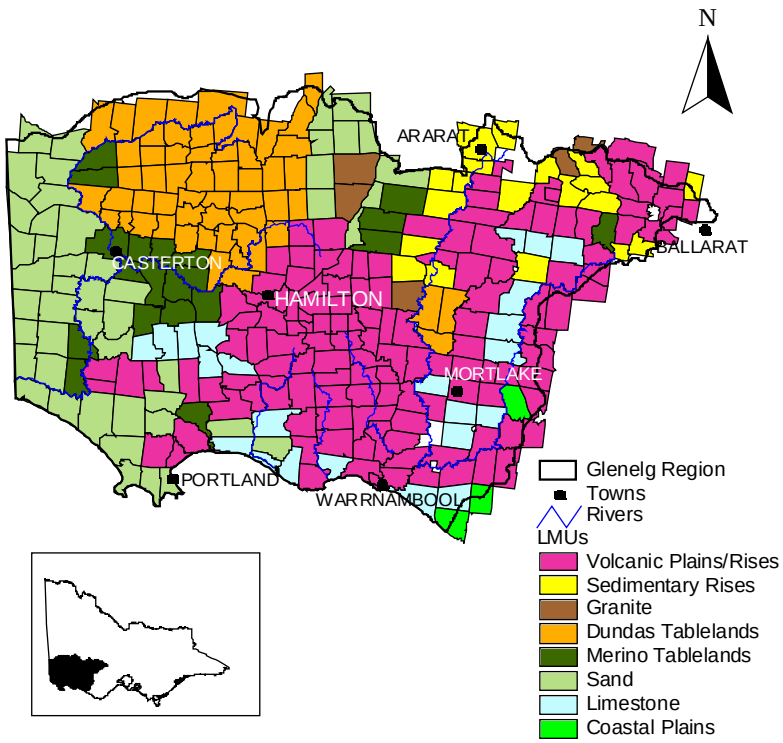


Figure 1 Land management units in the Glenelg Region

2 DATA SOURCES AVAILABLE

2.1 Australian Bureau of Statistics

The Australian Bureau of Statistics (ABS) farm census is distributed annually to all Australian farming businesses that meet a minimum gross income criterion. There is a legislative requirement that all farm business operators complete and return the farm census. In the last decade the ABS farm census has intermittently included questions covering use of fallow, grain legumes, soil ameliorants, fertiliser use and pastures. In recent years, questions have covered the total area and resown area of perennial pastures and lucerne pasture. Data from the ABS farm census is normally available only in aggregated form at state or local government area. As part of this project data was purchased desegregated at parish levels. As parishes are significantly smaller than local government areas, the ABS data was reaggregated according to catchment and soil type boundaries.

2.2 Attitudes to pasture renovation (Wegman Consulting 1986)

A qualitative study among graziers was conducted to explore attitudes to pasture renovation with respect to perceived problems, current practices and the role of herbicides in pasture renovation. This study used focus groups composed of herbicide users and non-users in key pasture areas in Victoria and New South Wales. Hamilton was one of the three locations selected for this study.

2.3 Farmers' perceptions of upgrading pastures to realise the potential of their grazing land (Coffey 1992)

A study of farmers' attitudes, opinions and knowledge of pasture resowing in the Glenelg Region was conducted in 1992 as a part of a degree program in Agricultural Science at La Trobe University, Bundoora, with a view to identifying the factors limiting the adoption and use of pasture resowing. This study also collected information on the area of pasture resown in the five years between 1988 and 1992. The study included personal interviews with a random sample of 30 farmers in the Chetwynd, Balmoral and Cavendish districts of the region, using a structured questionnaire.

2.4 Project for CSIRO on adoption of pasture research (O'Keeffe 1993)

A qualitative research study was conducted in high rainfall areas to investigate the decision making process of graziers and to explore their motivations, attitudes and perceptions in the adoption of pasture research. The Hamilton area was selected as one of the locations where the graziers, extension officers, suppliers of agricultural inputs, agribusiness consultants and bankers were interviewed for this study.

2.5 Qualitative study of pasture improvement (Condon *et al*. 1994)

Another study of farmer attitudes, perceptions and motivations was carried out in three locations across Victoria in order to determine the barriers to adoption of perennial pastures. The Glenelg Region was selected as one of the locations. The initial stage of this project, funded by the National Landcare Program, was aimed at increasing farmer awareness and understanding of the technology associated with perennial pasture establishment and management. In-depth interviews using a semi-structured questionnaire were conducted with 13 farmers in the Glenelg Region.

2.6 Producer survey of Temperate Pastures Sustainability Key Program (TPSKP) (Reeve *et al*. 1995)

The Meat Research Corporation's TPSKP program was aimed at developing guidelines and techniques for upgrading run-down pastures and for maintaining newly sown perennial pastures to increase pasture quality, productivity and sustainability in high rainfall zones by the year 2000. As part of this program, a survey was carried out to establish baseline data to be used in determining the changes that could occur in pasture management systems and farmer attitudes towards these systems during the period 1994-2000. A 36 percent response rate was achieved in a detailed questionnaire mailed out to 209 livestock producers in the Hamilton district.

2.7 The effect of the Grasslands Productivity Program (GPP) on the adoption of productive pasture technology (Trompf 1995)

The Grassland Productivity Program initiated in 1993 was aimed at lifting the productivity and profitability of grazing industries. This involved groups of farmers comparing productive pasture technology with standard management systems, in paired-paddocks on their farms. The primary aim of this study was to determine the effectiveness of GPP in promoting the adoption of productive pasture technology and to identify the barriers to adoption of these practices. A survey was conducted using structured questionnaires with two distinct farmer groups. One group being farmers involved in GPP and the other, a representative group of farmers from throughout the region, not involved in GPP.

2.8 The model to increase pasture seed sales (Marks & O'Keeffe 1996)

The pasture seed market in the Glenelg Shire was investigated by the Agribusiness Research Unit (ARU) at Monash University to develop a strategy for increasing the pasture seed sales. This was the initial stage of a larger project of Agriculture Victoria and the pasture seed industry, funded by the Rural Industries Research and Development Corporation (RIRDC) to develop a marketing model that will increase pasture seed sales. The investigation comprised four focus group discussions and 14 in-depth interviews with pasture seed users (both in and around the Glenelg Shire) to assess farmer attitudes and barriers to pasture improvement, as well as ways of overcoming these barriers.

2.9 Glenelg Salinity Implementation Survey (Amirtharajah & Kearney 1996)

The Glenelg Region Salinity Strategy (Salt Assault) has identified seven on-farm land management techniques, required to be adopted by land-holders if salinity was to be controlled, including establishment and improved management of perennial pastures. Measuring the progress in adoption of these practices, and farmer attitudes towards them, provides a measure of the success of the salinity strategy in the region. Hence, a farm survey was carried out in the area to measure the current adoption of these management practices, which can be used as baseline data in monitoring the future adoption rates of these practices. A stratified random sample of 237 farms based on shires and farm size classes were selected for the survey. One-sixth of this sample was from the shires of Hampden and Heytesbury in the Corangamite Region, hence the data on adoption rates should be treated with caution when relating it to the Glenelg Region.

2.10 A qualitative market research project: towards a new perspective on adoption and extension (O'Keeffe & Fletcher 1998)

A qualitative study of Victorian wool growers covering a range of regions from Gippsland, Central Victoria, the Wimmera and Western Districts was conducted to explore the relationship between farm families, the farm business and the adoption of new practices. The main aim of this study was to gain insight into the low rate of productivity gains and to understand attitudes to new extension and marketing programs. The study included both focus group discussions and in-depth interviews. The findings of this study were presented as a total and were not disaggregated to regions. However, there was consistency in the results across the different regions.

3 MEASURING PERENNIAL PASTURE ESTABLISHMENT AND MANAGEMENT

3.1 Pasture resown rates

3.1.1 Australian Bureau of Statistics

The questions on the ABS census from 1984 to 1990 asked the farmers for total pasture areas and areas sown or resown with pastures during the survey year (see Appendix 1). While these surveys could be used to compare rates of pasture resowing, these questions do not distinguish between perennial and annual pastures. However, local knowledge suggests that the absolute rate of pasture resowing may be a reasonable indicator of measuring adoption of perennial pastures. Research in NSW and Victoria shows there is tremendous variation in the quality of pastures described as 'perennial' by farmers.

Pasture questions in 1991 to 1993 related only to the total pasture area, and did not measure the pasture resown area, making the information useless for measuring the adoption rates (Appendix 1).

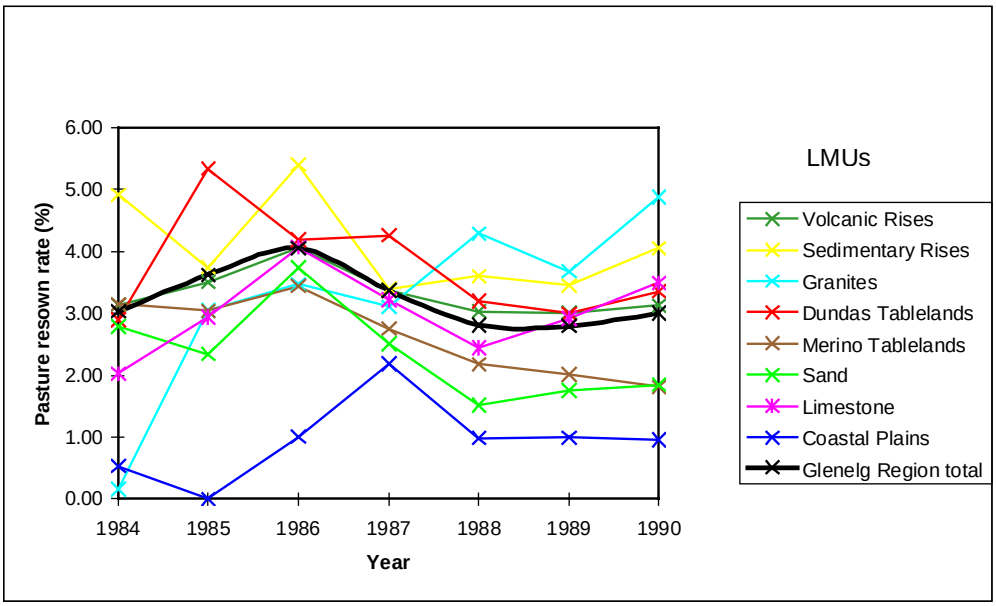
The ABS questions included in the 1993/94 survey provide the most valuable information on perennial pasture resown rates. This survey question distinguishes between the total area of pasture and the total pasture resown during that year. This allows the rate of pasture resown to be calculated. Another major advantage of this set of questions is that it separates lucerne, other perennial pasture and annual pastures in pasture mixtures (Appendix 1).

The question in the 1994/95 census asked only for the amount of pastures sown or resown during that year and did not include the total pasture area. This difference between the two sets of questions during 1993/94 and 1994/95 has led to unreliable responses to the 1994/95 question, with many farmers filling in the total area of pasture rather than sown area. Hence, these results are not included in this report.

This inconsistency in the pasture questions in the ABS census during the last decade limits its role in determining a trend in perennial pasture and lucerne adoption rates.

A pasture question similar to the 1993/94 format was repeated in the 1995/96 and 1996/97 census questionnaires and the data therefore can be used as a measure of change in lucerne and perennial pasture adoption rates. The pasture questions utilised in different census years are shown in Appendix 1.

Total pasture resowing rates from 1984 to 1990 on different land management units are shown in Figure 2. The figures for the total region show a relationship between wool prices and pasture resowing rates. An increase in pasture resowing rates in the mid 1980s was associated with high wool prices and a drop in pasture resowing in the latter part of the 1980s was associated with a drop in wool prices. The trend towards increased resowing rates in 1986 is shown on all land management units (LMUs) except on the Dundas Tablelands, which was identified as a high priority area for salinity control. In contrast, this area had the highest resowing rates both during 1985 and 1987. The Sand and Coastal Plains LMUs, identified as low priority areas for salinity control, show the lowest rates of resown pasture during this period. As suggested earlier, this measure does not distinguish between the perennial and annual pastures, although it is still an indicator of changes in the rate of resowing of perennial pasture.



Source: Australian Bureau of Statistics (1984-1990).

Figure 2 Total pasture resown rate on different land management units in the Glenelg Region (1984-1990)

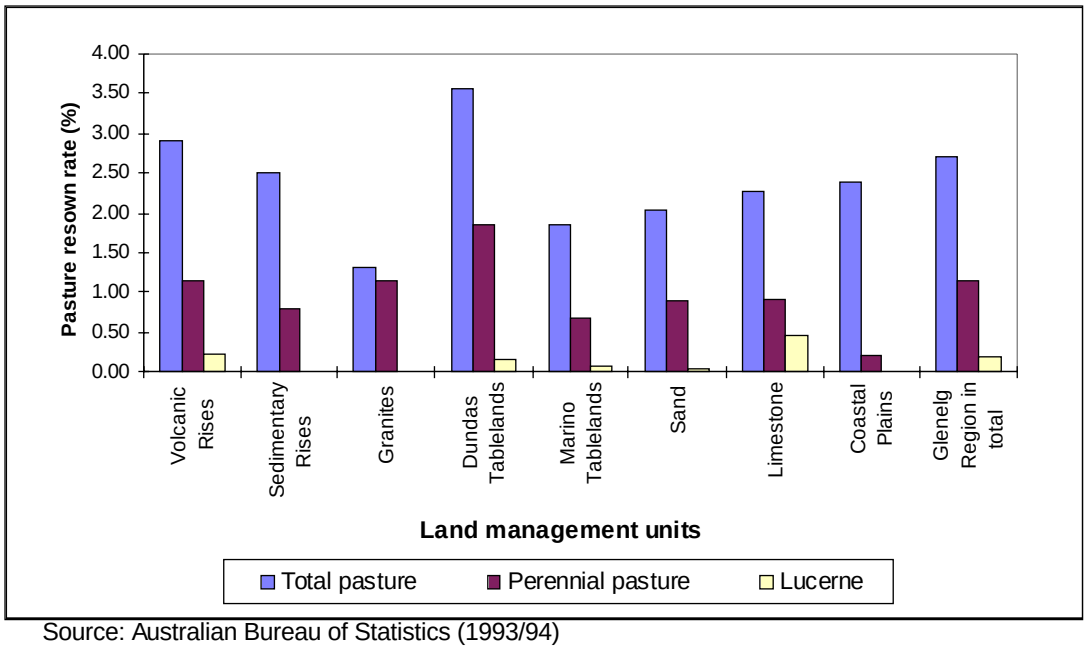
The 1993/94 ABS farm census data shows that 32 percent of the existing pasture was described as perennial pastures while another 4.6 percent were under lucerne pastures. However, field surveys suggest the quality of much of this existing perennial pasture may be low (Quigley & Morgan 1990)

For 1993/94, lucerne resowing rates were calculated considering pure lucerne resown during the season, together with a mixture of lucerne and other pasture species, as a percentage of total pasture area. Similarly the perennial pasture resowing rates included a category for use of a mixture of perennial grasses and legumes, excluding lucerne. During the season 1.16 percent of total pasture area in the region was sown or resown with perennial pastures, while only 0.2 percent was resown to lucerne. The Volcanic Rises LMU had the largest area of resown perennial pasture while the Dundas Tablelands LMU had the highest rate of resown perennial pasture, reaching 1.8 percent of the total pasture area (Table 1 and Figure 3). The rate of resowing of perennial pasture and lucerne pasture in 1993/94 in the Glenelg Region is mapped in Figure 4.

Table 1 Pasture resown area (ha) in Glenelg Region according to LMUs (1993/94.)

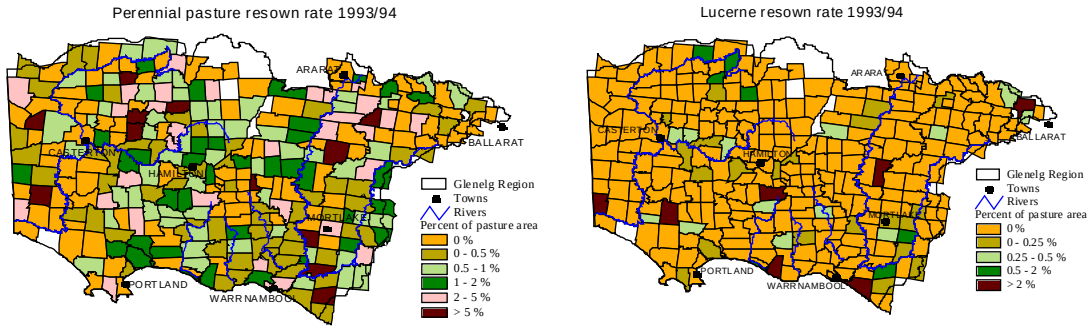
LMU	Lucerne	Perennial pasture	Total pasture area
Volcanic Rises	1706	8293	724010
Sedimentary Rises	4	789	99453
Granites	0	211	18363
Dundas Tablelands	511	5768	310232
Merino Tablelands	92	1003	145651
Sand	95	1679	189392
Limestone	790	1525	167699
Coastal Plains	0	28	13166
Glenelg Region Totals	3198	19296	1667966

Source: Australian Bureau of Statistics (1993/94).



Source: Australian Bureau of Statistics (1993/94)

Figure 3 Pasture resowing rate in the Glenelg Region (1993/94)



Source: Australian Bureau of Statistics (1993/94).

Figure 4 Perennial pasture and lucerne resown rates in the Glenelg Region (1993/94)

There was a large increase in the reported area of perennial pastures in 1996, with almost twice as many farmers sowing or resowing perennial pastures when compared to the 1994 figures (Table 2). This trend was consistent in all LMUs (Table 3). In contrast, regional measures for lucerne have significantly dropped within these two years. The rate of resowing of lucerne for 1996 was half the reported rate for 1994 (Table 2).

There is a further increase in the reported total perennial pasture area during the following year. Fifty-six percent of the existing pasture was described as perennial pastures in 1996/97. However, less area was resown with perennial pastures in 1997 resulting in lower rates of resowing compared to the previous year. No significant difference in the rate of resowing of lucerne was shown between the two years (Table 2).

The Volcanic Rises and Tablelands LMUs are identified as high priority areas for salinity control. They had larger areas of lucerne and perennial pasture resown than other LMUs during the three years from 1994 to 1997 (Table 3). The rates of resowing of perennial pasture and lucerne in 1995/96 and 1996/97 in the Glenelg Region are mapped in Figure 5 and 6 respectively.

Table 2 Pasture resown areas in the Glenelg Region (1993/94-1996/97)

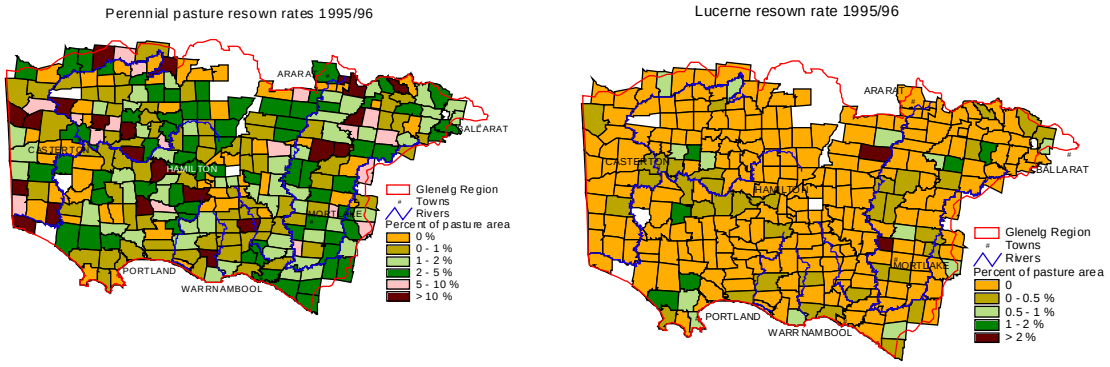
Measure	1993/94	1995/96	1996/97
Total pasture area (ha)	1669463	1204810	1232543
Total pasture resown area (ha)	45368	52432	50169
Total perennial pasture area (ha)	533996	637790	696425
Total lucerne area (ha)	76822	16026	13842
Perennial pasture resown area (ha)	19300	33323	30008
Lucerne resown area (ha)	3199	1436	1314
Percent of perennial pasture (%)	32	52.9	56.5
Percent of lucerne pasture (%)	4.6	1.33	1.12
Perennial pasture resown rate (%)	1.16	2.8	2.4
Lucerne resown rate (%)	0.2	0.12	0.11

Source: Australian Bureau of Statistics (1993/94, 1995/96).

Table 3 Pasture resown area (ha) in the Glenelg Region according to LMUs (1995/96, 1996/97).

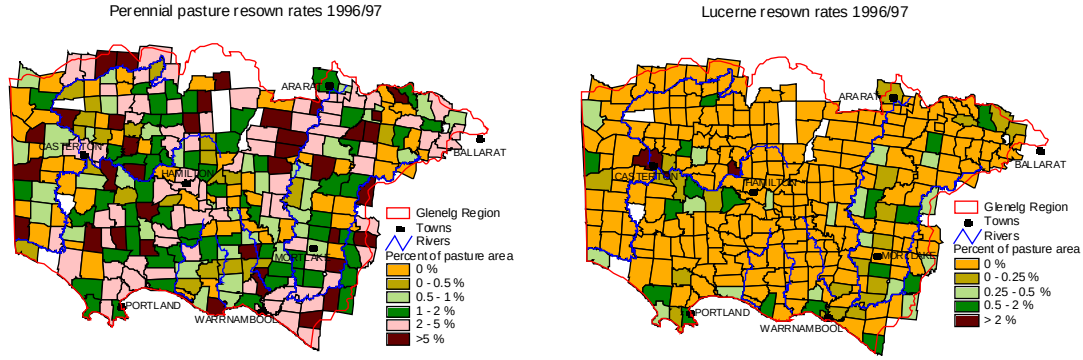
LMU	1995/96			1996/97		
	Lucerne resown	Perennial pasture resown	Total pasture area	Lucerne resown	Perennial pasture resown	Total pasture area
Volcanic Rises	753	12387	523245	364	12052	528458
Sedimentary Rises	54	3262	66116	19	2094	71590
Granites	0	247	13873	0	309	14587
Dundas Tablelands	159	7741	228081	151	7052	240117
Merino Tablelands	109	2952	108468	459	2933	109016
Sand	174	1962	128010	148	2480	139023
Limestone	157	4533	126823	142	2761	119587
Coastal Plains	30	239	10194	31	327	10165
Glenelg Region Totals	1436	33323	1204810	1314	30008	1232543

Source: Australian Bureau of Statistics (1995/96, 1996/97).



Source: Australian Bureau of Statistics (1995/96).

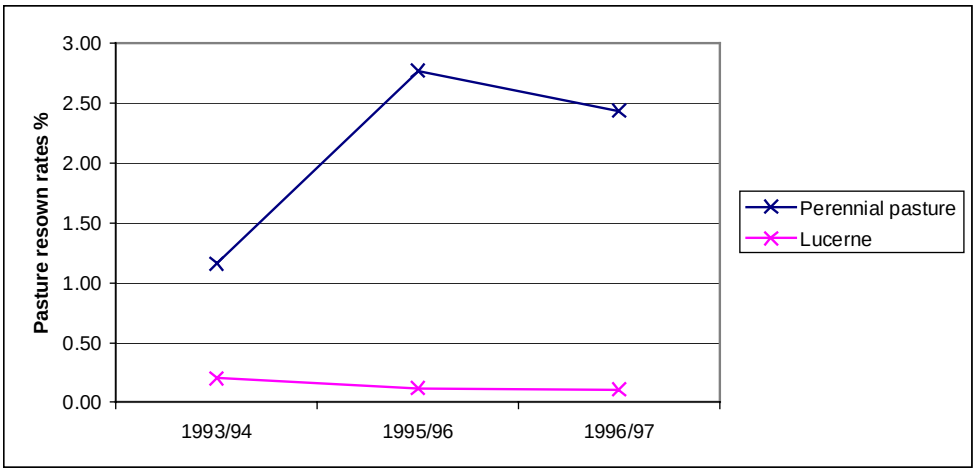
Figure 5 Pasture resown rates in the Glenelg Region (1995/96).



Source: Australian Bureau of Statistics (1996/97).

Figure 6 Pasture resown rates in the Glenelg Region (1996/97).

Figure 7 shows the overall trends in pasture resowing rates in the Glenelg Catchment Management Authority region during the 1993/94 to 1996/97 seasons. The lucerne resowing rate has not shown a significant change over the period of four years. The trend towards increased resowing of perennial pastures in 1995/96 started to decline in the following year.



Source: Australian Bureau of Statistics (1993/94-1996/97).

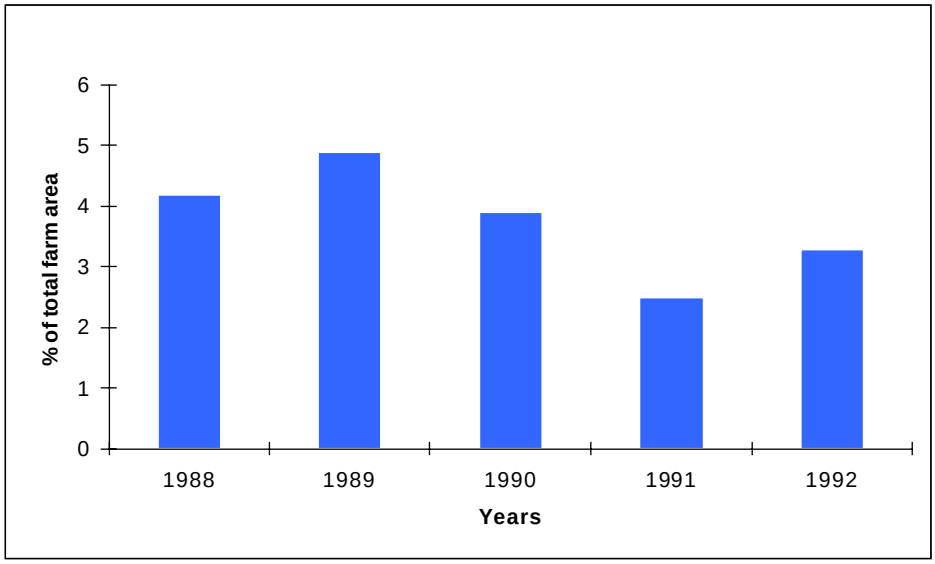
Figure 7 Trends in pasture resown rates in the Glenelg Region (1993/94-1996/97)

3.1.2 Study on farmer perceptions of upgrading pastures (Coffey 1992)

This study measured the rate of pasture resown in the Glenelg Region over a period of five years between 1988 and 1992. This information does not separate perennial pasture and lucerne pastures from annual pastures. The rate of adoption of pasture resowing in the five years was reported to be 97 percent, with 93 percent of the farmers planning to continue resowing an average of 5.4 percent of their farms the following year. In this study the rate of pasture resown was measured as a percentage of the total farm area and not as a percentage of the total pasture area, as in ABS data. Taking this into consideration one would expect the former measure to be lower than the ABS measure. This difference would not greatly influence the comparison of the two sets of data as pasture dominates the agricultural land use of the region and covers over 90 percent of the farm area. However, pasture resowing rates measured in this study were much higher than ABS estimates. An annual average of 3.8 percent per farm was resown to pastures during this period. This could be due to the inclusion of annual pastures resown and also a sampling bias towards farmers who favour resowing pastures. The proportion of farm areas resown to pastures each year are shown in Figure 8. This again indicates the relationship between wool prices and the decision to sow pasture, with increased sowing rates during years with high wool prices.

3.1.3 Qualitative study of pasture improvement (Condon 1994)

This study was of a qualitative nature and did not ask for information on areas of resown pasture. Only 50 percent of farmers interviewed had sown pastures each year during the three years from 1991-93. While these farmers did not complain of any technical problems in resowing pastures successfully, they also reported that they did not intend to increase their sowing area over 8-10 percent of total farm area in the future. None of the interviewed farmers were satisfied with the state of their pastures due to range of reasons. 'Cost' was the main reported reason for the poor condition of ‘improved’ pastures.



Source: Coffey (1992)

Figure 8 Proportion of farms resown to pastures from 1988-1992

3.1.4 Producer survey of TPSK program (Reeve *et al.* 1995)

This study did not collect information on rate of resowing of pastures. Farmers were asked to assess the worth of a set of practices for maintaining pasture quality. The majority of the respondents perceived the resowing of old or run-down pastures as a worthwhile practice

3.1.5 The Grasslands Productivity Program (GPP) survey (Trompf 1995)

This study analysed the rate of pasture resowing as a percentage of total farm area, between 1988 and 1993 for both GPP producers and non-GPP producers separately. The average resown rates per year between 1988-1993 did not differ much between GPP producers and non-GPP producers, being 3.0 percent and 2.9 percent respectively. The survey indicated a 22 percent increase in the amount of pasture resown by GPP producers from 1988-1993 to 1994/95, with an average of 3.9 percent of the total farm per year being resown in 1994/95. In contrast, a 7 percent decrease in the pasture sowing rates was reported for non-GPP producers, with 2.7 percent of pastures resown. The figure for non-GPP producers was similar to the 1993/94 ABS measure of total pasture resown rate.

3.1.6 Glenelg salinity implementation survey (Amirtharajah & Kearney 1996)

This study measured only the existing pasture areas and not the rates of pasture resowing in the region. The study revealed that 28 percent of the farmers in the survey either used lucerne in their current farming system or have grown lucerne in the past. Only 10 percent of land-holders intended to sow lucerne in 1995/96.

Ninety-two percent of farmers in the study area were either using perennial pasture or had used it in the past, and 71 percent intend to sow it in 1995/96.

3.1.7 Overall summary of rates of pasture resowing

The available information can be summarised as follows:

- Rates of pasture resowing were related to wool prices. Reductions in the rate of resowing of pastures correlate with low wool prices.

- Technical difficulties in establishing pastures do not appear to be a significant factor in low resowing rates in the Tablelands and Volcanic Plains LMUs, but may be a factor in districts with sandy soil.

- The current rate of pasture resowing is higher than the desired rate to meet the objectives of the salinity management plans. Reaching the annual proposed targets for pastures of a total of 12 655 hectares in the region requires a resowing rate of about 0.75 percent (pasture resown as a percent of total pasture area). ABS data for 1993/94 shows the rate of resowing of perennial pasture to be 1.34 percent in the region. This increased to 2.5 percent by 1996/97.

3.2 Fertiliser applications on pasture

The rate and frequency of application of fertiliser plays an important role in maintaining stable perennial pasture growth, free of weeds and inferior grasses. Poorly managed perennial pastures will not have any more impact on the watertable than will annual pastures. Hence, application of fertiliser on pastures is used as a proxy for measuring the level of pasture management undertaken by farmers in the region.

3.2.1 Australian Bureau of Statistics

In the 1987/88 agricultural census farmers were asked the areas of pure lucerne, other pastures and crops fertilised, as well as the type and quantity of fertiliser applied. The 1988/89 and 1989/90 censuses utilised the same questions to collect information for total pasture areas, but did not separate pure lucerne from other pastures. A similar question was asked again in the 1994/95 season regarding the use of selected fertilisers on established pastures. The 1995/96 and 1996/97 census questions asked for the total pasture areas top-dressed or fertilised and did not collect information on types of fertilisers used. These sets of questions are shown in Appendix 2.

Little over half of the total area sown to pasture was fertilised by 73 percent of farmers in 1987/88. Both the percentage of pasture area fertilised and the percentage of farmers using fertiliser increased in 1988/89, followed by a reduction in both measures in 1989/90 (Table 4). However, more farmers applied fertiliser on pastures in 1989/90 than the previous year, the percentage reduction being a result of the higher rate of increase in number of total farms reporting census data in 1990 than the rate of increase in the number of farmers using fertilisers between the two years. There was a huge decrease in fertiliser usage during the five years from 1990 to 1995. Both the area of pasture fertilised and the number of farmers using fertiliser decreased. Less than 50 percent of farmers used fertiliser on 42 percent of the pasture area in this period. In the following season there was a further reduction in both the number of farmers using fertiliser and the area fertilised. The increase in the percentage of pasture area fertilised during this year, however, was mainly a result of a large reduction in the total reported pasture area. While the reduction in use of fertiliser is clearly related to the prolonged period of poor wool prices, there was a slight increase in both the number of farmers using fertiliser and the area of pastures fertilised in the Glenelg Region in 1996/97.

Table 4 Measure of fertiliser application on pastures in the Glenelg Region (1988-1997)

Measure	1987/88	1988/89	1989/90	1994/95	1995/96	1996/97
Pasture area fertilised, as a proportion of total farm area (%)	50.8	52.9	49.6	36.1	35.0	37.8
Proportion of pasture area fertilised (%)	58.9	60.9	57.8	42.3	56.6	60.0
Percentage of farmers using fertiliser on pastures (%)	73.0	76.6	75.6	48.3	43.0	47.4
Percentage of lucerne area fertilised (%)	74.1	*	*	*	*	*
Percentage of farmers using fertiliser on lucerne (%)	58.2	*	*	*	*	*

Source: Australian Bureau of Statistics (1988-1997)
* Information for lucerne was not collected during these seasons

3.2.2 Study of farmer perceptions of upgrading pastures (Coffey 1992)

This study indicated that the majority of farmers in the Glenelg Region were not adopting increased fertiliser management systems and several farmers were applying very little or no superphosphate to their pastures. This study did not measure the total fertilised pasture in the region

Coffey classified farmers into three groups according to their pasture improvement practices.

High Input Producers: Always willing to consider new approaches to management. They resowed larger areas of their pastures and planned to sow more pasture in future. These farmers achieved optimal standards of production from their land through improved pasture treatment practices. All resown pastures were stocked at higher rates than unsown pastures while most resown paddocks were heavily fertilised. This type constitutes only 23 percent of the sample population.

Moderate Input Producers: This group constitutes 37 percent of the sample population. They resowed smaller areas of pasture and partly adopted pasture improvement techniques. These farmers had plans to resow more pastures, increase stocking rates and the application of fertiliser on resown pastures in the future, but were concerned about the risks associated with these practices, and the dependency on high wool prices.

Traditional Low Input Producers: This group constitutes 40 percent of the sample population. They were conservative in pasture management approaches and did not plan to adopt new techniques such as increased stocking rates or increased fertiliser rates. They resowed only a small area of pasture and less than half of this group stocked or fertilised the resown paddocks heavier than the unsown pastures. Financial and labour constraints associated with these practices were their main concerns in adopting the techniques.

3.2.3 Qualitative study of pasture improvement (Condon 1994)

Fifty-four percent of the respondents in the region saw the importance of fertiliser management in long-term persistence of perennial pastures. Nevertheless, many farmers did not have a fixed fertiliser strategy and treated their upgraded pastures with the same fertiliser rates as they did the rest of their paddocks. Twenty-three percent of the farmers wanted to increase the phosphorus levels before resowing.

3.2.4 Producer survey of TPSK program (*Reeve et al*. 1995)

The frequency of application of fertiliser was analysed in this study to understand fertiliser use on pasture paddocks in the Glenelg Region. Only 39 percent of farmers applied fertiliser to most or all of their paddocks every year, while 12 percent had not applied any fertiliser for the three years from 1991-1993 (Table 5). Forty-three percent of respondents considered that utilising higher fertiliser rates than usual for the district was a worthwhile practice, while another 22 percent regarded this as a practice not worth adopting. The majority favoured resowing old or run-down pastures and grazing management for maintaining pasture quality.

Table 5 Frequency of fertiliser application (1991-1993)

Frequency	Percent of respondents
No fertiliser in last three years	11.8
No fertiliser in occasional years	5.9
Less than half the paddocks every year	11.8
About half the paddocks every year	31.4
Most paddocks every year	17.6
All paddocks every year	21.6

Source: Reeve *et al*. (1995)

3.2.5 The Grasslands Productivity Program (GPP) survey (Trompf 1995)

Fertiliser use in this study was calculated as kilograms of phosphorus applied per hectare (kg P/ha) over the entire farm. This study compared the fertiliser use of GPP producers and non-GPP producers and was designed to measure the impact of the GPP program on adoption of fertiliser as a pasture improvement technique. Non-GPP producers showed only a small increase in fertiliser use over the period of the project. In 1993 the average amount of fertiliser applied (kg P/ha) was 5.7 and 5.6 for GPP and non-GPP producers respectively. In 1995, however, there was a reported 93 percent increase (11 kg P/ha) in fertiliser use by GPP producers, but an increase of less than 20 percent (6.7 kg P/ha) by non-GPP producers. The estimates of intended future fertiliser use for 1997 suggested a continuation of low application rates for non-GPP producers (7.2 kg P/ha compared to 12.7 kg P/ha for GPP producers).

3.2.6 Glenelg salinity implementation survey (Amirtharajah & Kearney 1996)

The Glenelg salinity implementation survey collected information on top dressing of pastures (annual, perennial and lucerne based pastures). According to this survey, 88 percent of land-holders top-dressed a proportion of their pastures in 1994/95 and 96 percent intended to top-dress their pastures in 1995/96. Reported future intentions, however, are notoriously optimistic measures of behaviour. Unfortunately, this survey does not give an indication of the proportion of pasture area fertilised, making it difficult to arrive at firm conclusions. Many farmers may be using fertiliser, but on small areas of pasture only.

3.2.7 A qualitative market research project: towards a new perspective on adoption and extension (O'Keeffe & Fletcher 1998)

This study was of qualitative nature and did not measure the pasture areas fertilised by the woolgrowers. However, the high cost of fertiliser and the high level of management skills required to obtain maximum benefits from new technology were the main concerns of the farmers in this survey. The continued low return to wool growing discouraged most farmers from investing in improved management practices.

3.2.8 Overall summary on fertiliser applications

Most farmers understand the need to increase fertiliser applications on resown pastures to obtain the optimum benefits from their pastures. Nevertheless, the rate and frequency of fertiliser application is far below the required amount to maintain soil fertility. Only a minority of farmers in the region treat a proportion of their resown pastures with higher fertiliser rates than their old pastures. These farmers are involved in different pasture productivity projects in the region aimed at increasing farmer awareness and adoption rates of improved pasture technology. Financial and labour constraints, and the risks associated with these practices, as well as a lack of appreciation of the factors driving pasture profitability were the main factors influencing farmers' lack of adoption of improved pasture management practices.

3.3 Grazing management on pasture

3.3.1 Study of farmer perceptions of upgrading pastures (Coffey 1992)

This study of farmer perceptions of upgrading pastures indicated that the majority of farmers did not adopt increased stocking rates on their pastures. Only 30 percent of farmers believed their farms to be heavily stocked, while another 60 percent thought their land was moderately stocked. Ten percent of farmers thought their farms were lightly stocked.

Market segmentation undertaken in this study suggests that only farmers in the *High Input Producer* category (23%) had increased their stocking rates on improved pastures over the five years from 1988-1992, and intended to continue to increase stocking rates in future. All the members in this group had stocked their resown paddocks at higher rates to the unsown paddocks. The *Moderate* and *Traditional Input Producers* had not increased stocking rates during these years. However, all of the *Moderate Input Producers* reported that they had plans to increase their stocking rates 'to a certain extent' in future, while the *Traditional Input Producers* reported that they did not intent to do so. In all, only 62 percent of farmers ran more stock on their resown pastures.

3.3.2 Qualitative study of pasture improvement (Condon 1994)

This study revealed that only 60 percent of farmers in the Glenelg Region adopted some form of grazing management process to help pasture persistence.

3.3.3 Producer survey of TPSK program (Reeve *et al*. 1995)

Set stocking all year and strategic grazing all year round were the most popular grazing management practices (27.5 percent) used by farmers in the region. Rotational grazing all year round was used by 10 percent of respondents. A minority of farmers in the region used other rotational grazing systems, including 8 percent utilising rotational grazing mainly in spring and occasionally in summer and winter, combined with set stocking at other times. Another 8 percent used a combination of set stocking and strategic grazing in combination throughout the year.

Only 43 percent of respondents considered grazing management as a very important factor in achieving a successful grazing enterprise. This was the second lowest factor ranked out of 16 items.

3.3.4 The Grasslands Productivity Program (GPP) survey (Trompf 1995)

In this study GPP producer and non-GPP producer stocking rates were compared to determine the impact of the GPP program on increasing productivity of grazing industries. The average stocking rate for GPP producers and non producers in 1993 (before the program was implemented) were 9.5 and 9.4 DSE/ha respectively. Sixty-five percent of GPP producers reported that they were aiming to increase carrying capacity between 10-30 percent. Twenty percent of non-GPP producers reported that they were aiming at an 8-18 percent increase in stocking rate.

The GPP producers had a significant increase in their stocking rates from 1993 to 1995 and reported plans for further increases in future. In contrast, non-GPP farmers had a slight increase in 1995, and did not plan to change their stocking rates after 1997 (Table 6).

Table 6 Average Stocking rate of GPP producers and non-GPP producers

	Stocking rate (DSE/ha[#])	
Year	GPP producers	Non-GPP producers
1993	9.5	9.4
1995	10.9	9.8
1997*	12.3	10.0
2000*	13.9	10.0

* As a response to a question on future stocking rate plans.
[#] DSE/ha = Dry Sheep Equivalent per hectare.
Source: Trompf (1995)

3.3.5 Glenelg salinity implementation survey (Amirtharajah & Kearney 1996)

This study revealed that following the establishment of perennial pastures 85 percent of land-holders in the Glenelg Region had increased their stocking rates, ranging from 5 to 500 percent (an average of 55 percent). Ninety-three percent of respondents thought that a major advantage of perennial pastures was their ability to cope with increased stocking rates.

3.3.6 A qualitative market research project: towards a new perspective on adoption and extension (O'Keeffe & Fletcher 1998)

This study considers two broad views of woolgrowing: as an occupation or as a business. For the group of graziers 'woolgrowing as a small business', increasing productivity through pasture growth and proper grazing management was the key to increasing profit. Hence, this group was willing to consider changes to the actual grazing system and increase the stocking rates. Some farmers had personal targets for stocking rates up to 20 DSE/ha. But the question of how to implement the new systems was one of the main problems faced by these farmers. Financial and personal risks of adopting higher input strategies and meeting management challenges were also of concern.

In contrast, the group of graziers wool growing as an occupation did not consider increasing profitability through adopting new practices and have not made any significant grazing management changes over the past decade.

3.3.7 Overall summary on grazing management

Set stocking and strategic grazing all year round were the most popular grazing systems adopted in the region. Only a minority of graziers used seasonal and all year round rotational grazing. There was a reluctance to increase stocking rates on resown pasture.

4 UNDERSTANDING LOW RATES OF ADOPTION

In promoting the adoption of perennial pastures and improved pasture management practices, it is important to understand the factors influencing and/or limiting the use of these practices. Several studies have identified these factors. The following section summarises these studies in the Glenelg Region.

4.1 Attitudes to pasture renovation (Habel 1986)

Farmers' perceptions, ignorance and anxiety were said to be real barriers to further pasture renovation. Overall, most farmers involved in this study recognised the need for high producing pastures. These farmers, however, had different opinions and perceptions on pasture renovation. They had no objective method of assessing their pasture (they used visual assessment). The variation in this measure had an impact on the use of pasture renovation activities. Most farmers were anxious about changes in technology and often automatically rejected those assumed to be not suitable for their farms. This reflects the lack of understanding about the technology. Most of these farmers depended on visual evidence of success of a new technology before making a decision about adoption.

4.2 Study of farmer perceptions of upgrading pastures (Coffey 1992)

This study has revealed that low sowing rates, incorrect sowing depths, inappropriate seed mixes, and weed competition are no longer a problem in achieving high pasture establishment rates in at least part of the catchment. Ninety-seven percent of the respondents in the region believed their pasture establishment methods were successful.

The majority of farmers considered expenditure on pasture resowing as a worthwhile long-term investment. However, the immediate financial situation was the main factor determining the area resown each year.

The adoption of improved pasture management systems (increased stocking rates, fertiliser applications) were not popular among farmers in the region. The high cost of fertiliser was the main reason for reduction in fertiliser use. The *Traditional Input Producers* (40 percent) had a conservative approach in pasture management and were not willing to adopt new approaches to pasture improvement in the future. They had not increased their stocking rates over a period of five years and did not intend to do so in future. This group was reluctant to spend more on fertiliser and other improved management practices, mainly due to financial constraints and the risk involved in increasing stocking rates.

The Moderate Input Producers (37 percent) had plans to increase their stocking rates but were conscious of the risks associated with it.

The *High Input Producers* (23 percent of the respondents) were more flexible in their management approaches and willing to try new techniques and have overcome the constraints to the adoption of new technology.

4.3 Project for CSIRO on adoption of pasture research (O'Keeffe 1993)

This study highlighted farmers' concerns about the high cost of pasture establishment and fertiliser, and the cost involved when the paddock was out of production during pasture establishment (resowing).

The difficulty in assessing the benefits of new technology at a reasonably early stage, compared to the high costs involved in adopting the operation, discouraged farmers from adoption.

The study highlighted the importance of the farming system on the decisions made by producers. Graziers differ from croppers and mixed farmers in their decision making process, use of information, and adoption of new technology.

Lack of a detailed understanding of their production system, and the key drivers of profitability in the system, were seen as main reasons for low rates of adoption of pasture management practices among the majority of graziers. These graziers adopt a decision making process based on an awareness-behaviour-attitude model. Less attention is paid to information, which is used mainly to stimulate awareness. The awareness is put into trial, and based on the trialability the new practice is either rejected or adopted in future. The impact of these practices on the grazing system is long-term and hard to visualise within a short period. Hence, there is a high tendency to build up a negative attitude and reject new practices.

Only a minority of the graziers possess a good understanding of their production system. This group seeks and places a high value on information on new technology and builds up a positive attitude to information, this subsequently leads to a change in behaviour and the idea is put into practice. This group had higher adoption rates for improved pasture management practices.

4.4 Qualitative study of pasture improvement (Condon *et al.* 1994)

This study confirms the observations of Coffey's study regarding pasture establishment. No farmers mentioned technical problems or constraints to pasture establishment and all expected successful establishment. The cost of seeds and fertiliser, loss of production while pastures were sown and established, and lack of time were major concerns when deciding the sowing area.

The study identified similar groups of graziers (to the Coffey study) with regard to their commitment to pasture establishment and management. Thirty percent of farmers had a positive attitude and a motivation towards pasture resowing and management and were grouped as *Committed Adopters*. These farmers were involved in a yearly pasture resowing plan with regular top dressing and rotational grazing or strategic grazing. Loss of production from the new pasture paddocks during the establishment phase was their main concern. This group was similar to the group of graziers with the awareness-attitude-behaviour form of decision making process identified by O'Keeffe in his survey.

Partial Adopters used parts of the pasture package. These farmers had resown a smaller proportion of their pastures than the former group. Resowing was not included in a yearly program and was dependent on the cost of inputs. This group understood the benefits of perennial pasture as high quality feed and the possibility of increasing stocking rates. They payed greater attention to improved grazing management practices, such as spring lambing, increasing stocking rates and top dressing resown pastures to achieve higher productivity.

Belt Tighteners are risk averse. Any pasture technology with a possible element of risk is likely to be unattractive to the members of this group. They believe it is not economic to resow or fertilise pasture while wool prices are low. Hence, most had not sown improved pastures or applied superphosphate during the previous few years. The cost of establishment was the major concern of these graziers, while risk of establishment was a problem for few farmers. Pasture was managed by set stocking, and rotational grazing was not used. This set of farmers had a lack of understanding of their production system and the key influences on profitability. This group is similar to the group of graziers with the awareness-behaviour-attitude form of decision making process identified by O'Keeffe in his study.

Comfortable includes a group of older farmers looking towards retirement with no intention of investing in significant projects. They were longing to live an easier life on the land, without going into extra risk or work, and were happy with the income from farm and other sources for the foreseeable future. They claim a significant area of perennial pastures on their farm, but were not interested in resowing, top dressing or changing from set stocking to rotational grazing even if the risk of these practices are minimised.

Sceptics had a negative attitude to phalaris and considered it as a weed, a fire risk or as toxic to stock. They are unlikely to sow any exotic perennial pasture in future.

4.5 The Grasslands Productivity Program (GPP) survey (Trompf 1995)

This survey used an open-ended questionnaire on GPP producers and non-GPP producers to identify the key barriers to the diffusion of productive pasture technology into the wider grazing community. About 60 percent of farmers interviewed were concerned about the high costs involved in using the technology and were uncertain about returns on these high input costs. Another primary concern was animal health under the higher stocking rates (80%) and the level of supplementary feeding (55%).

Before the GPP program, disposable income played an important role in deciding the application of fertiliser rates, while the decisions for stocking rates were dependant on farm history and farmer experience, along with visual estimates of feed availability. After the GPP program, fertiliser rates were mainly based on soil testing, while thorough assessment of pasture availability and the condition of livestock were the basis for deciding stocking rates.

One of the main findings of the survey was that on-farm trials are the most effective way to overcome farmer concerns and develop a positive attitude towards adoption of the practice. Next to the guidance provided by the facilitator, the supportive, encouraging, stimulating and challenging group interaction was regarded as important in developing a positive attitude to the system.

The group of farmers who volunteered to be involved in the GPP program may have been predisposed to trialing new technology. Of the non-GPP group, 20 percent believed the GPP system was applicable on their farm but less than five percent were prepared to undertake the practices in the future. The rest of this group felt the system was too risky to be adopted on their farms. One-quarter of the farmers in this group believed that improved pasture systems were not applicable to their farms for reasons such as insufficient labour and difficulties in increasing stocking rates. Another 25 percent of the group were not aware of the benefits of productive pasture systems and had no understanding of the improved management practices involved in the GPP program.

4.6 The model to increase pasture seed sales (Marks & O'Keeffe 1996)

This study identified two groups of graziers, based on their management strategies. *Intensive Graziers* interested in maximising productivity and increasing production are more likely to be involved in trial work with the Dept. of Agriculture. They seem to be active members of local groups and seek new information. Only a minority of this group understands the system they are managing and follows a decision style (awareness-attitude-behaviour) similar to the group of committed farmers identified in previous studies. This group is estimated to be only 10 percent of the graziers.

The other group of graziers identified are the risk averse *Extensive Graziers* who prefer to minimise cost and avoid making changes in their system. They do not have active involvement in local groups and pay less attention to new information. This group, together with the majority of intensive graziers, lack a deep understanding of their production system and follow a trial-and-error decision making process

4.7 Glenelg salinity implementation survey (Amirtharajah & Kearney 1996)

This study looked at farmer attitudes towards various salinity management practices. The majority of land-holders (71 percent) considered lucerne as a high quality feed, while only less than 20 percent recognised the importance of lucerne in lowering the watertable. Eighteen percent did not see any advantages with growing lucerne while almost one-fifth of land-holders did not perceive any disadvantages. Establishment difficulties and cost were the two most common barriers identified to growing lucerne. The need to increase stocking rate to obtain maximum productivity out of lucerne was seen as a barrier by a minority of land-holders.

More farmers saw perennial grass pasture as a method to increase production than as a measure to reduce watertable and salinity. The ability to increase stocking rate and long-term profit were seen as advantages by 93 and 89 percent respectively. Few farmers (3 percent) saw no advantages with perennial pastures. Difficulty in establishment and sowing were the main barriers mentioned by the farmers. Weeds were also a major problem, while cost was not seen as a major disadvantage associated with including a perennial pasture in the farming system.

Achieving high pasture productivity, increasing profits and improving feed quality were the main reasons for top dressing pastures for almost all farmers in the survey. Forty-four percent of farmers were concerned about the high cost involved in top dressing pastures; the need to increase stocking rate was also a concern for some farmers.

4.8 A qualitative market research project: towards a new perspective on adoption and extension (O'Keeffe & Fletcher 1998)

In this study one of the main reasons identified for the lack of adoption of new technology in the wool industry was a poor understanding of management systems. The complexity of the grazing system and the high risk nature of changing it discouraged farmers from trying any changes to their systems. The study also indicates that the adoption of new woolgrowing practices is largely a function of the farm business strategies pursued by the owners and is linked with changing family structures and attitudes. Farm business strategy influences the choice of type and source of information, investment decisions and the interest in the productivity of the enterprise. Hence, this study divides woolgrowers into strategic groups rather than market segments.

Woolgrowing as a small business: This is the most innovative group of woolgrowers with respect to the adoption of new farm practices. They are most likely to understand the grazing systems and believe pasture growth and grazing management drive their profitability. Members in this group play an active role in the system. Their farm management strategies and willingness to go into debt are driven by the aspirations of the family.

Woolgrowing as an occupation: This group of conservative graziers play a passive role in their gazing system. They are not interested in being compared with other farmers in benchmarking type activities. For these farmers, farm income, (which is dependent on the commodity prices) determined the family expenditure and farm investment decisions. These were beyond their control, and cost minimising was believed to be the main reason for success in wool industry. The replacement of ageing machinery was a major cost to these farmers that ultimately led them to non-viability. Most of these farmers rely on off-farm income. The continued low return to woolgrowing encouraged them to invest more in off-farm activities. The majority in this group did not perceive any need for significant management changes on their farm and did not demand new information.

4.9 Overall summary on understanding low rates of adoption

Most farmers in the region have overcome the technical problems and constraints to pasture establishment. A lack of understanding of the new technologies and the driving forces for profit in farming systems prevented many farmers from utilising improved pasture management practices. Financial and labour constraints, concerns about loss of production, pasture availability for stock when land is out of production, and risk aversion contribute to this decision. Difficulty in seeing the benefits of new technology in the grazing industry at early stages is also a contributing factor to low adoption rates.

The above studies have identified different groups of graziers according to their relative commitment to pasture renovation. These groups have some similar characteristics across the different studies.

Only a minority of intensive graziers, motivated by increasing productivity and production, are adopting the total package of improved pasture management practices. These farmers have a good understanding of their production system and the driving forces for system profitability. This group is willing to undertake challenges and try out new techniques on their farms.

The majority of graziers had a conservative approach to pasture management on their small areas of improved pastures. They believe it is not economic to resow or fertilise pasture while wool prices are low. Hence, they did not use high rates of fertiliser or stock on their resown pastures and did not intend to do so in future. The cost of pasture establishment was their major concern. These farmers were risk averse and generally lacked an understanding of their farming system and key influences on profitability.

An intermediate group adopting part of the pasture improvement package was also identified. Farmers in this group were conscious of the risks associated with changes in management practices.

Another group with significant areas of perennial pastures were largely older farmers who were generally not interested in resowing or improved pasture management practices, even if the risk of these practices were minimised. These farmers were also risk averse.

5 RECOMMENDATIONS

The aim of this report is to provide baseline information and establishment trends in the adoption of pasture management practices in the Glenelg Region. The information in this report is based on available research studies and provides reasonable trends in adoption of these practices across the region. One of the limitations to using ABS data in determining adoption trends is the changing format of the question each year. Consistency in the format of questions is important in obtaining reliable information to measure trends in adoption rates. The adoption rates estimated from 1993/94 ABS data provides reliable information and can be used as a baseline to monitor future adoption of these practices. A question similar to the 1993/94 format was repeated in 1995/96 and in 1996/97 and provides suitable continuity in data. The same format should be used in future to estimate the adoption of perennial pastures.

The 1994/95 fertiliser question provides valid data to measure the use of selected fertilisers on established pastures. This does not provide information on other maintenance practices important in pasture management. The 1995/96 ABS census included a question on maintenance and management of established pastures and can be used in future to monitor the adoption of pasture management practices.

The format of this question is as follows:

ABS Pasture maintenance question in 1995/96

Maintenance and management of established pastures between 1 April 1995 and 31 March 1996

Area of established pasture over which the following maintenance or management operations were carried out:

	Hectares
Top dressing of fertiliser ……..	
Weed control or spraying ……..	
Pest and disease control or spraying ……..	
Slashing or burning (other than prior to sowing the paddock)……..	

To determine the adoption of improved grazing management techniques, it will be necessary to collect more data on grazing management practices by conducting surveys of graziers in the region.

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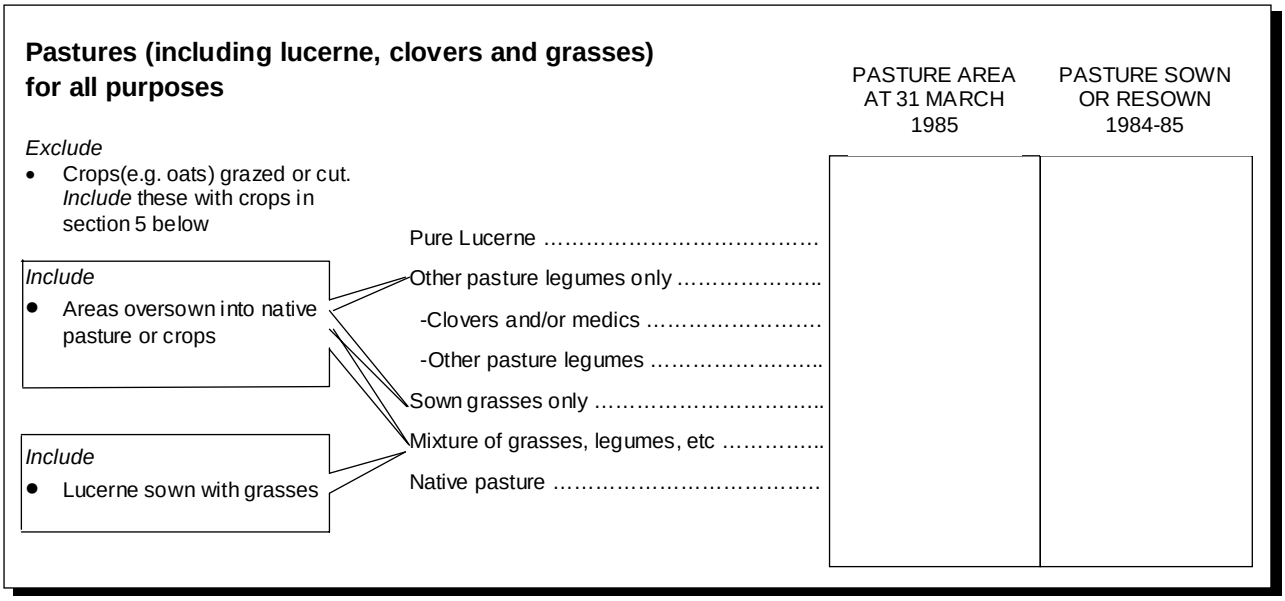
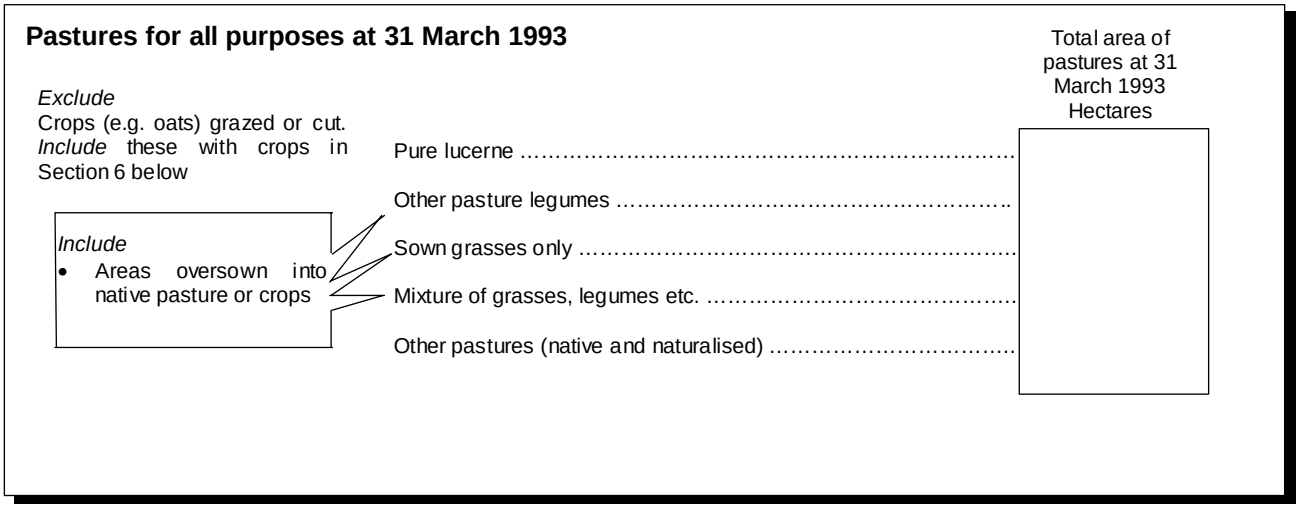
7 APPENDICES AUSTRALIAN BUREAU OF STATISTICS FARM CENSUS QUESTIONS

Appendix 1 ABS pasture questions

ABS pasture question 1984-1990



ABS pasture question from 1991-1993



ABS pasture question 1993/94

Pastures for all purposes at 31 March 1994

Exclude

- Crops (e.g. oats) grazed or cut. Include these with crops in Part 1c below

Include

- Areas oversown into native pasture or crops

Perennial grasses include phalaris, cocksfoot and perennial ryegrass

	Total area of pasture at 31 March 1994 Hectares	Pasture sown or resown during year ended 31 March 1994 Hectares
Pure lucerne		
Other pasture legumes		
Sown grasses only		
Mixture of lucerne and other pasture species.....		
Mixture of perennial grasses and legumes excluding lucerne		
Mixture of annual grasses and legumes excluding lucerne		
Other pastures (native and naturalised)		

ABS pasture question 1994/95-1996/97

Pastures sown or resown for all purposes during year ended 31 March 1997

Include

- Areas oversown into native pasture or crops

Perennial grasses include phalaris, cocksfoot and perennial ryegrass.

Legumes include clovers, medics and vetch.

Annual grasses include Wimmera rye grass.

	Total area of pasture at 31 March 1997 Hectares	Pasture sown or resown during year ended 31 March 1997 Hectares
• **Sowings including lucerne:**		
Pure lucerne		
Mixture of lucerne and other pasture species		
• **Sowings excluding lucerne:**		
Pasture legumes only		
Mixture of perennial grasses and legumes		
Mixture of annual grasses and legumes		
Sown grasses only		

Appendix 2 ABS fertiliser questions

ABS fertiliser question in 1987/88

Artificial fertiliser used (whether applied by you, by contractors, or others)
Season 1987-88

Exclude lime, gypsum and dolomite

Enter double and triple strength superphosphate as single strength equivalent,

Pastures and Crops Fertilised	Area Fertilised	**Quantity and Type of Fertiliser Used**				
		Super-phosphate (including super with trace elements)	Straight nitrogenous types (e.g. urea, sulphate of ammonia)	Straight Potash	Mixtures of super, and potash	Other artificial fertilisers including complex mixtures and mixtures containing nitrogen
	Hectares	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Pure lucerne						
Other pastures (sown or native)						
Wheat						
Oats						
Barley						
Field peas						
Other cereals						
Oilseeds						
Vegetables for human consumption						
Fruit (including nuts)						
Grape vines						
Other (please specify)						

ABS fertiliser question in 1988/89 and 1989/90

Artificial fertiliser used (whether applied by you, by contractors, or others) Season 1988-89

Exclude lime, gypsum and dolomite

Enter double and triple strength superphosphate as single strength equivalent,

Pastures and Crops Fertilised	Area Fertilised	Quantity and Type of Fertiliser Used				
		Super-phosphate (including super with trace elements)	Straight nitrogenous types (eg. urea, sulphate of ammonia)	Straight Potash	Mixtures of super, and potash	Other artificial fertilisers including complex mixtures and mixtures containing nitrogen
	Hectares	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
Pastures sown or native						
Wheat						
All other crops						

ABS fertiliser question in 1994/95

Use of selected fertilisers on established pastures (whether applied by you, by contractors or by others) - Season 1994-95

Exclude

- Pastures sown during the 1994-95 season

Note

- Use total fertiliser weight not weight of active constituents.

Include

- Double and triple super-phosphate, MAP or DAP

	Hectares	Tonnes
Area of existing pasture top-dressed with fertilisers specified below		
Single superphosphate used for top dressing existing pastures		
High analysis fertilisers used for top dressing existing pastures		
Super-potash blends used for top dressing existing pastures		