

**A BASELINE OF ADOPTION OF PASTURE
MANAGEMENT PRACTICES
- GIPPSLAND REGION**

August 2001

CENTRE FOR LAND PROTECTION RESEARCH

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Abbreviations

ABS	Australian Bureau of Statistics
SMP	Salinity Management Plan

SUMMARY

The aim of this report is to document baseline information about the state of adoption of pasture establishment and management practices in the Gippsland 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 Gippsland Region can be summarised as follows:

- The ABS farm census is the only available comprehensive measure of the rate of perennial pasture establishment in the Gippsland Region. The ABS farm survey for 1993/94 shows the rate of all perennial pasture sowing in the catchment to be 0.6 percent per annum. Both the area of perennial pasture and lucerne resown increased in 1995/96. The total area resown was 2.4 percent.
- There is no available independent study which can be used to calibrate the ABS pasture sowing data. It would be necessary to obtain more information on pasture resowing and improved pasture management practices in the region through farm surveys.
- 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 from 1984 to 1986 during a short period of high wool prices, fell in the latter part of the 1980s, and appears to have continued to fall since.
- This low rate of perennial pasture sowing 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 area of existing perennial pasture, as there is evidence that the lack of maintenance of perennial pasture is likely to reduce the persistence of pastures. ABS census data showed a low adoption of improved pasture management systems such as top dressing in the region.
- The ABS farm survey in 1994/95 showed the rate of pasture top dressing as 32 percent. This had increased to 49 percent by 1997. The survey in south and west Gippsland highlights the possibility of further improvements in the efficiency of fertiliser use. There is no other data available in the region which can be used to calibrate the ABS fertiliser question. However, comparisons 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 or any other data which can be used to monitor the use of grazing rotation practices. Further information is needed to comment on pasture management practices adopted on resown perennial pastures in the region.

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A BASELINE OF ADOPTION OF PASTURE MANAGEMENT PRACTICES - GIPPSLAND REGION

August 2001

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1 THE GIPPSLAND REGION

1.1 Sustainability in the Gippsland Region

The Gippsland Region extends from the New South Wales border in the east to the eastern edge of the Dandenong Ranges in the west, and from the Great Dividing Range in the north to the southern coast (Figure 1). This region covers about 3.8 million hectares, half of which is crown land covered with forest and woodlands.

The Gippsland Region has a high rainfall variation across the catchment, with an average annual rainfall ranging from about 500 mm in the Snowy Valley to about 2200 mm on the Errinundra Plateau. Livestock grazing is the major agricultural land use in the area, with beef and sheep being the main dryland activities and dairying the major irrigated enterprise (West Gippsland Regional Catchment Strategy 1997; East Gippsland Regional Catchment Strategy 1997).

Soil erosion, soil structure decline, and dryland and irrigation salinity are the major land degradation problems in the Gippsland Region. About 20 000 ha of dryland and another 8000 ha of wetland in the region is currently salt affected. The catchment of Lake Wellington, with high saline areas, has an annual loss of agricultural production of about \$4 Million. This is estimated to rise to \$10 Million if no action against salinity is undertaken (GCRG 1993).

Establishment and improved management of perennial pastures, strategic tree planting, and fencing and revegetation of affected areas, along with a series of other sustainable soil management techniques, are promoted in the area as solutions to these problems. The Target 10 program is a major extension program initiated in the Gippsland Region to increase pasture consumption through improved grazing management practices in order to enhance the viability of the Victorian dairy industry.

The benefits of sowing perennial pastures to overcome soil degradation lies with the potential to reduce recharge by extracting water from a greater volume of soil than annual pastures (using their deep 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). However, appropriate pasture management practices, such as use of fertiliser, pest and disease control methods and more importantly grazing management systems largely affect the maximum water use by perennial pastures.

Additional benefits associated with perennial pasture include the potential to increase carrying capacity and gross margin per hectare, however, the initial capital costs involved in establishing perennial pastures are of a major concern to farmers in the region.

1.2 Indicator practices

The following practices have been selected as indicators of the extent of adoption of sustainable pasture management practices in the grazing industry in the Gippsland Region.

- Perennial pasture sowing rate

The Lake Wellington Salinity Management Plan recommends sowing perennial pastures and lucerne as a salinity control measure in the region. The plan sets a 15 year target of 15 000 ha of perennial pasture and 6385 ha of lucerne, to be achieved in the sub-regions (Lake Wellington Catchment Salinity Management Plan 1993). The 1993/94 annual report for the Lake Wellington SMP area sets a target of 400 ha of perennial pasture and 50 ha of lucerne to be achieved during the year 1994/95. 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 pasture that will have an impact on reducing watertable and also gain higher productivity through increased gross margins. 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 to achieve maximum profitability. Heavy grazing is often the best method to deal with any weeds and to ensure optimum pasture growth. To assist in salinity control, it is also necessary to introduce rotational grazing systems which enable the pastures to increase leaf area, plant growth and root development, thus maximising the water use of perennial pastures.

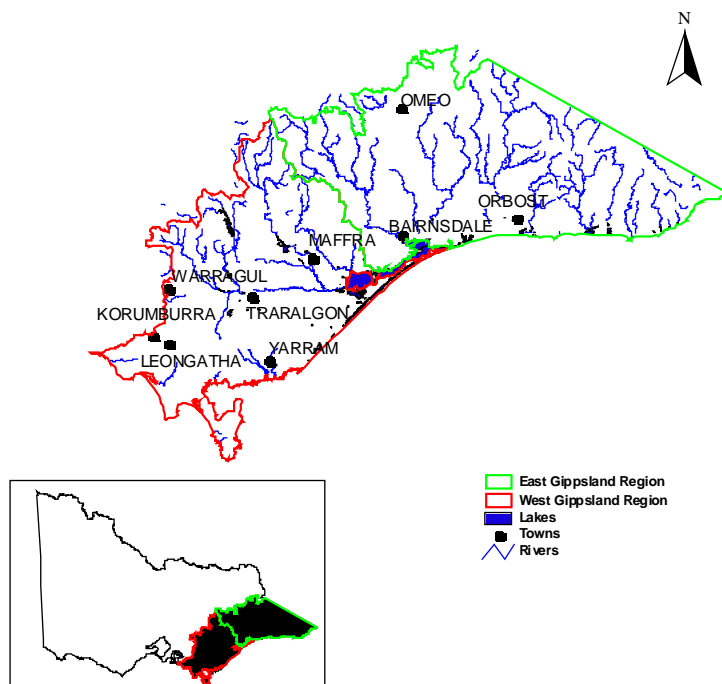


Figure 1 Gippsland Region

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 which 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 in aggregated form at state or local government area. As part of this project, data is purchased disaggregated at parish levels. As parishes are significantly smaller than local government areas, ABS data has been reaggregated according to catchment and soil type boundaries.

2.2 Fertiliser and pasture renovation practices in South and West Gippsland (Meaney 1991)

A survey was undertaken in south and west Gippsland in 1989 to determine farmers' practices and attitudes to fertilisers and pasture renovation. A random sample of 295 farmers (owning over 60 ha of land) was surveyed by telephone interview. This survey received an 81 percent response rate, 51 percent were dairy farmers and 38 percent and 17 percent were beef and sheep farmers respectively.

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 farmers for total pasture area and areas sown or resown with pastures during the survey period. The pasture resown area data could be used to compare the pasture resown rates, however, 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 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 from 1991 to 1993 included only the total pasture area, and did not measure the pasture resown area, making the information useless for measuring adoption rates.

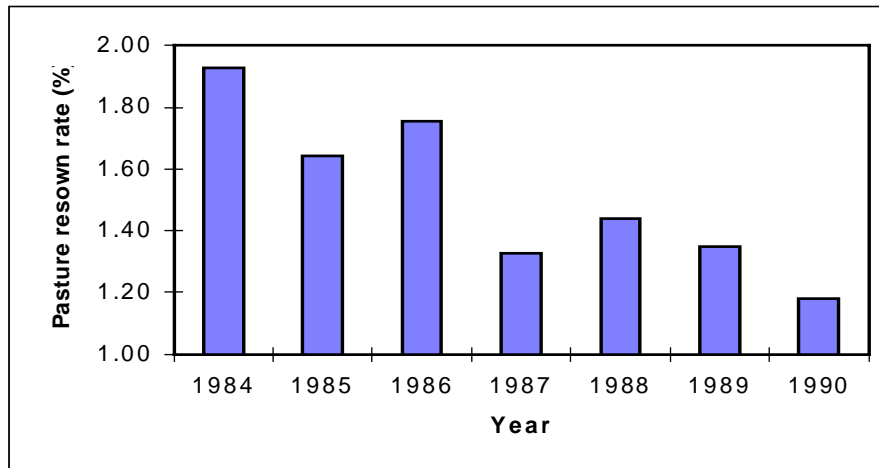
The questions included in the 1993/94 survey provide the most valuable information on perennial pasture resown rates. This survey separates the total area of pasture and the area of pasture resown during that year. Another major advantage of this set of questions is that it separates lucerne, other perennial pasture and annual pastures in pasture mixtures.

The questions in the 1994/95 census only asked for the area of pasture 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.

A pasture question similar to 1993/94 format was repeated in 1995/96 and 1996/97 censuses and the data could be used as a measure of change in lucerne and perennial pasture adoption rates.

The pasture questions in different census years are shown in Appendix 1. The inconsistency of pasture questions in ABS censuses during the last decade limits their role in determining a trend in perennial pasture and lucerne adoption rates.

Total pasture resown rates from 1984 to 1990 in the Gippsland Region are shown in Figure 2. Figures for the total region show a relationship between wool prices and pasture resowing rates. There were high wool prices in the mid 1980s and a parallel increase in resown rates, followed by a drop in the latter part of the 1980s associated with low wool prices. As mentioned earlier, this measure does not distinguish between resown perennial or annual pastures, but is still an adequate indicator of resowing rate changes for perennial pasture.



Source: Australian Bureau of Statistics (1984-1990)

Figure 2 Total pasture resown rate in the Gippsland Region (1984-1990)

The 1993/94 ABS farm census data shows that only 18 percent of the existing pasture in the Gippsland Region was described as perennial pastures, while another 5.2 percent was under lucerne pastures. However, field surveys suggest that the quality of much of this existing perennial pasture may be low (Quigley & Morgan 1990).

For the 1993/94 season, lucerne resowing rates were calculated considering pure lucerne resown, together with mixture of lucerne and other pasture species, as a percentage of total pasture area. Similarly the perennial pasture resown rates included pastures with a mixture of perennial grasses and legumes (excluding lucerne). Of the total pasture area in the region, 0.48 percent was sown or resown with perennial pastures during this season, while only 0.08 percent was resown to lucerne (Table 1). Perennial pasture and lucerne pasture resown rates in 1993/94 in the Gippsland Region are mapped in Figure 3.

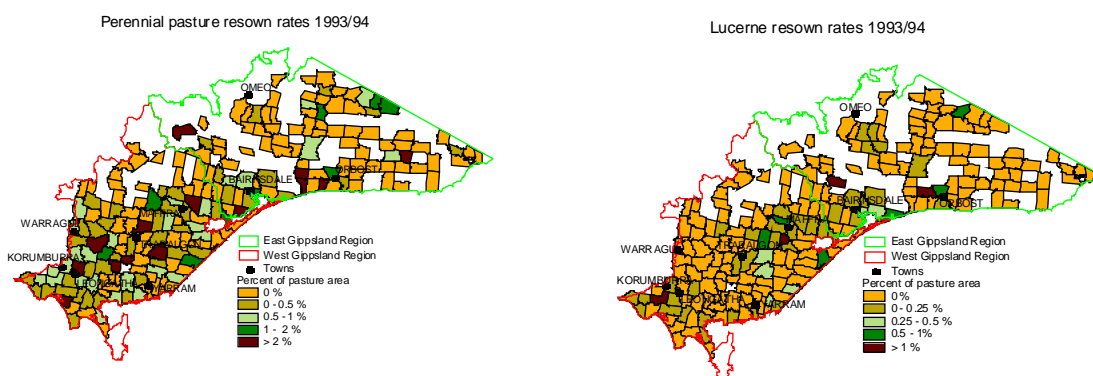
The 1995/96 farm census data shows that the percentage of existing pasture reported as perennial pastures had significantly increased during the two years from 1994 to 1996. This is a result of both an increase in total perennial pasture area and a huge reduction in the total pasture area reported in 1995/96. In contrast, the percentage of existing pasture described as lucerne had declined. However, both the perennial pasture and lucerne resown areas had significantly increased during this period resulting in higher overall resown rates compared to 1994 figures (Table 1). The perennial pasture and lucerne pasture resown rates in 1995/96 in the Gippsland Region are mapped in Figure 4.

The proportion of perennial pastures and lucerne pastures continued to show trends similar to the 1995/96 season, with an increase in perennial pastures and a decrease in lucerne. Both the area resown to perennial pasture and lucerne pasture declined during 1996/97 (Table 1). The perennial pasture and lucerne pasture resown rates in 1996/97 in the Gippsland Region are mapped in Figure 5.

Table 1 Pasture resown areas in the Gippsland Region (1993/94-1996/97).

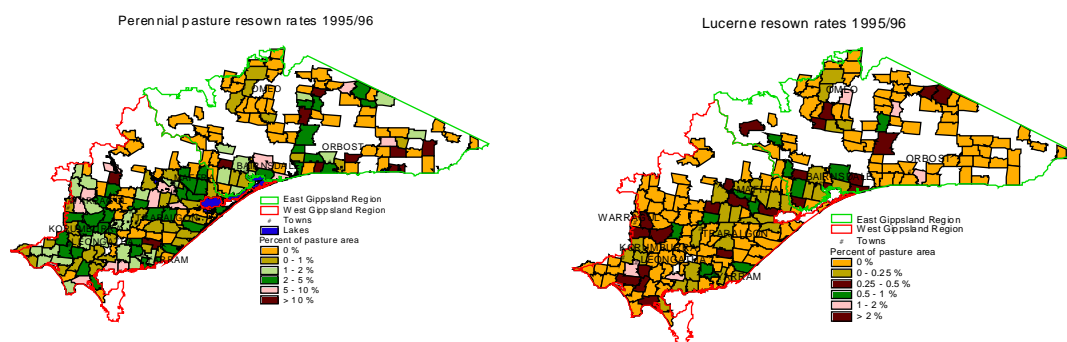
Measure	1993/94	1995/96	1996/97
Total pasture area (ha)	1001831	636038	658387
Total pasture resown area (ha)	16938	30414	23996
Total perennial pasture area (ha)	179992	247161	272571
Total lucerne area (ha)	52155	13017	10182
Perennial pasture resown area (ha)	4774	15395	12391
Lucerne resown area (ha)	819	2388	1003
Percent of perennial pastures (%)	18.0	38.9	41.4
Percent of lucerne (%)	5.2	2.04	1.6
Total pasture resown rate (%)	1.7	4.8	3.6
Lucerne resown rate (%)	0.08	0.38	0.15
Perennial pasture resown rate (%)	0.48	2.42	1.9

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



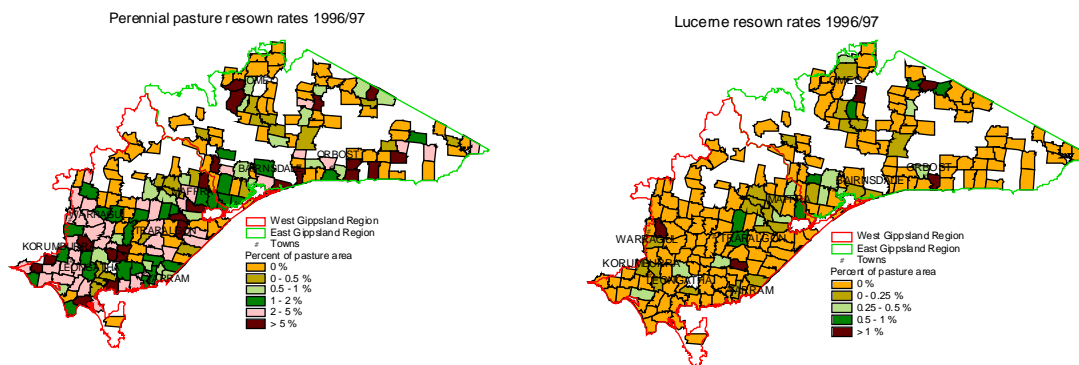
Source: Australian Bureau of Statistics (1993/94)

Figure 3 Pasture resown rates in the Gippsland Region (1993/94)



Source: Australian Bureau of Statistics (1995/96)

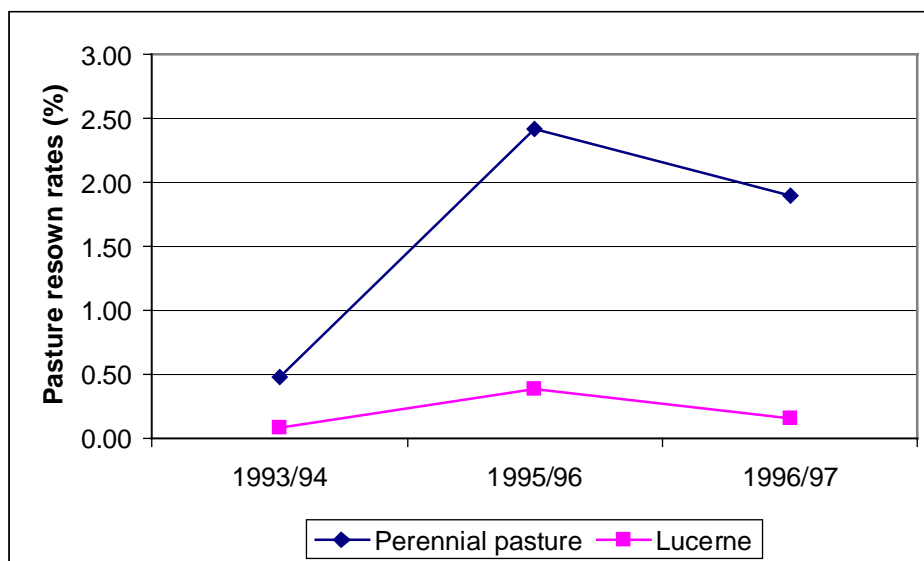
Figure 4 Pasture resown rates in the Gippsland Region (1995/96)



Source: Australian Bureau of Statistics (1996/97)

Figure 5 Pasture resown rates in the Gippsland Region (1996/97)

Figure 6 shows the overall trends in pasture resowing rates in the Gippsland Region from 1993/94 to 1996/97. There was an increase in the rate of perennial pasture resowing during 1995/96, but this dropped to just 2 percent in 1996/97. Lucerne pasture resown rates dropped during 1996/97 after a slight increase in the 1995/96 season.



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

Figure 6 Trends in pasture resown rates in the Gippsland Region (1993/94-1996/97)

3.1.2 Fertiliser and pasture renovation practices in south and west Gippsland (Meaney 1991)

This survey collected information on areas of, and methods used for, pasture renovation in the five years between 1985 to 1989. Fifty percent of the surveyed farmers had undertaken some pasture renovation during those five years. These farmers had resown, on average, 9 percent of their farm ranging from 1 percent to 32 percent. Significantly more dairy farmers were involved in pasture resowing than beef or sheep farmers.

3.2 Fertiliser applications on pasture

Fertiliser rates and frequencies of applications play an important role in maintaining stable perennial pasture growth free of weeds and inferior grasses. Poorly managed perennial pastures will have no greater impact on watertable control than will annual pastures. Hence, application of fertiliser on pastures is used as a proxy for measuring 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, and the type and quantity of fertiliser applied. The 1988/89 and 1989/90 censuses collected the same information for total pasture areas but did not separate pure lucerne from other pastures. A similar set of questions was asked again in the 1994/95 season. The 1995/96 census asked for the total pasture area top-dressed or fertilised and did not collect information on types of fertilisers used. These sets of questions are shown in Appendix 2.

Seventy-five percent of the pasture growers had fertilised half of their pasture area during both the 1988 and 1989 seasons. Both these measures dropped during 1990 (Table 2). The area fertilised in 1990 dropped significantly, while the number of farmers using fertiliser remained almost the same, indicating lower average areas fertilised per farm. There was a huge drop in fertiliser usage during the five years from 1990 to 1995. Both the area fertilised, and the number of farmers using fertiliser decreased, with only 45 percent of farmers using fertiliser on one-third of their pasture area. A further reduction in both the area fertilised and the number of farmers using fertiliser was reported during the following year. The increase in the percentage of pasture area fertilised is likely a result of the drop in the total pasture area reported in 1996. The reduction in the use of fertiliser is clearly related to the prolonged period of poor wool prices. There was no significant change in the percentage of pasture area fertilised during 1996/97, while the number of farmers using fertiliser increased slightly.

Table 2 Measure of fertiliser application on pastures in the Gippsland Region (1988-1996).

Measure	1987/88	1988/89	1989/90	1994/95	1995/96	1996/97
Pasture area fertilised, as a proportion of total farm area (%)	32.6	33.4	30.5	23.3	22.4	23.0
Proportion of pasture area fertilised (%)	50.8	50.1	45.8	32.5	49.2	48.8
Percentage of farmers using fertiliser on pastures (%)	74.9	75.2	70.9	45.7	43.5	47.2
Percentage of lucerne area fertilised (%)	59.9	*	*	*	*	*
Percentage of farmers using fertiliser on lucerne (%)	62.0	*	*	*	*	*

Source: Australian Bureau of Statistics (1988-1997)

* Information for lucerne was not collected during these seasons

The rate of application of superphosphate as kilograms per hectare over the pasture area fertilised, and the entire pasture area, is shown in Table 3. An increase in fertiliser rates was evident during 1989 followed by a slight drop in 1990 and 1995.

Table 3 Rate of application of superphosphate (kg/ha)

Measure	1988	1989	1990	1995
Rate per area fertilised	88.8	93.8	86.5	77.7
Rate per entire pasture area	45.1	47.0	39.6	25.2
Rate on lucerne pastures	160.1	*	*	*

Source: Australian Bureau of Statistics (1988-1995)

* Information for lucerne was not collected during these seasons

3.2.2 Fertiliser and pasture renovation practices in south and west Gippsland (Meaney 1991)

This study collected information on types and rates of fertilisers used on pastures by graziers and revealed that they had been applying fertilisers on a regular basis. Between 1985 and 1989, 99 percent of the survey farmers have used phosphorus fertilisers on an annual basis, fertilising 77 percent of their farms, on average.

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. These factors have not been researched in detail in the Gippsland Region. However, Meaney's survey of farmers' attitudes to pasture renovation and fertiliser application identified some constraints to the adoption of these practices in the region.

4.1 Fertiliser and pasture renovation practices in south and west Gippsland (Meaney 1991)

This survey determined farmer attitudes to pasture renovation and fertiliser application and revealed that the main reasons cited for adopting pasture renovation included improvement of pasture production, leveling of rough ground and removing weed problems. However, the level of knowledge of pasture cultivars was low amongst these farmers. Twenty-nine percent failed to identify the species in their pasture mix.

Lack of finances, time and machinery were the main reasons reported for not renovating pastures. Poorer returns from sheep compared to the dairy industry, and the difficulties in renovating pastures on hilly land also contributed to low levels of pasture renovation on sheep farms.

One fifth of the farmers who had not resown new pastures were satisfied with their existing pastures. Another 24 percent were intending to renovate in future, while 11 percent were uncertain about future renovations.

5 RECOMMENDATIONS

The aim of this report is to provide baseline information and establish trends in the adoption of pasture management practices in the Gippsland Region. The information in this report is based on ABS census data and provides reasonable trends in adoption of these practices in the region. Accurate long-term measures of the area of phalaris pastures sown in the region will need to be obtained by continued use of the ABS farm census. One of the limitations of using ABS data in determining the 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 the 1993/94 ABS data provide a reasonably reliable baseline and can be used 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 can be used in future to estimate the adoption of perennial pastures.

The 1994/95 fertiliser question provides data to measure the use of selected fertilisers on established pastures. This question appears to be an acceptably accurate measure of pasture maintenance by top dressing. This data, however, does not provide information on other maintenance practices important in pasture management, particularly rotational grazing. The 1995/96 ABS census included a question on maintenance and management of established pastures. This question can be used in future to monitor the adoption of pasture management practices, although it does not include information on rotational grazing. 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.

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
<i>Top-dressing of fertiliser</i>	<div style="border: 1px solid black; width: 80px; height: 100px; margin: 0 auto;"></div>
<i>Weed control or spraying</i>	
<i>Pest and disease control or spraying</i>	
<i>Slashing or burning (other than prior to sowing the paddock).....</i>	

6 REFERENCES AND DATA SOURCES

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7 APPENDICES AUSTRALIAN BUREAU OF STATISTICS FARM CENSUS QUESTIONS

Appendix 1 ABS pasture questions

ABS pasture question 1984-1990

Pastures (including lucerne, clovers and grasses) for all purposes		PASTURE AREA AT 31 MARCH 1985	PASTURE SOWN OR RESOWN 1984-85
<p><i>Exclude</i></p> <ul style="list-style-type: none"> Crops (e.g. oats) grazed or cut. <i>Include</i> these with crops in section 5 below 			
<p><i>Include</i></p> <ul style="list-style-type: none"> Areas oversown into native pasture or crops 	Pure Lucerne		
	Other pasture legumes only		
	-Clovers and/or medics		
<p><i>Include</i></p> <ul style="list-style-type: none"> Lucerne sown with grasses 	-Other pasture legumes		
	Sown grasses only		
	Mixture of grasses, legumes, etc		
	Native pasture		

ABS pasture question from 1991-1993

Pastures for all purposes at 31 March 1993		Total area of pastures at 31 March 1993 Hectares
<p><i>Exclude</i></p> <p>Crops (e.g. oats) grazed or cut. <i>Include</i> these with crops in Section 6 below</p>		
<p><i>Include</i></p> <ul style="list-style-type: none"> Areas oversown into native pasture or crops 	Pure lucerne	
	Other pasture legumes	
	Sown grasses only	
	Mixture of grasses, legumes etc.	
	Other pastures (native and naturalised)	

ABS pasture question 1993/94

Pastures for all purposes at 31 March 1994		Total area of pasture at 31 March 1994 Hectares	Pasture sown or resown during year ended 31 March 1994 Hectares
<p><i>Exclude</i></p> <ul style="list-style-type: none"> Crops (e.g. oats) grazed or cut. Include these with crops in Part 1c below 			
	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)		
<p><i>Include</i></p> <ul style="list-style-type: none"> Areas oversown into native pasture or crops 			
<p>Perennial grasses include phalaris, cocksfoot and perennial ryegrass</p>			

ABS pasture question 1994/95-1996/97

Pastures sown or resown for all purposes during year ended 31 March 1997		Total area of pasture at 31 March 1997 Hectares	Pasture sown or resown during year ended 31 March 1997 Hectares
<p><i>Include</i></p> <ul style="list-style-type: none"> Areas oversown into native pasture or crops 			
	<ul style="list-style-type: none"> Sowings including lucerne: Pure lucerne Mixture of lucerne and other pasture species 		
	<ul style="list-style-type: none"> Sowings excluding lucerne: Pasture legumes only Mixture of perennial grasses and legumes Mixture of annual grasses and legumes Sown grasses only 		
<p>Perennial grasses include phalaris, cocksfoot and perennial ryegrass.</p>			
<p>Legumes include clovers, medics and vetch.</p>			
<p>Annual grasses include Wimmera rye grass.</p>			

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

Area of existing pasture top-dressed with fertilisers specified below

Hectares

Note

- Use total fertiliser weight not weight of active constituents.

Single superphosphate used for top dressing existing pastures

Tonnes

High analysis fertilisers used for top dressing existing pastures

Super-potash blends used for top dressing existing pastures

Include

- Double and triple super-phosphate, MAP or DAP