Report No. 169

Understanding the social drivers of catchment management in the Wimmera region

Allan Curtis and Ian Byron

September 2002
Albury, NSW

Wimmera Catchment Management Authority
Waterways for Life.

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LIST OF ACRONYMS

ABS	Australian Bureau of Statistics
ABARE	Australian Bureau of Agricultural and Resource Economics
CMA	Catchment Management Authority
CRP	Current Recommended Practice/s
CSU	Charles Sturt University
GIS	Geographic Information System
NRE	Department of Natural Resources and Environment
RMU	Resource Management Unit/s
WCMA	Wimmera Catchment Management Authority

1.0 EXECUTIVE SUMMARY

1.1 Background

This report presents a summary of key findings from a mailed survey to 959 landholders in the Wimmera Catchment Management Region (Wimmera region) in 2002. The survey focussed on gathering base-line information regarding the key social factors affecting landholder decision-making about the adoption of practices expected to improve the management of natural resources in the Wimmera region.

1.2 Research objectives

The Wimmera Catchment Management Authority commissioned Dr Allan Curtis from Charles Sturt University to undertake this study. This project drew heavily on the methodology of similar projects completed in the Goulburn Broken Dryland and Ovens Catchment. The four key research objectives are listed below.

1. To gain a better understanding of the limitations/barriers/constraints to the adoption of:
   a. sustainable land management practices relevant to the Wimmera region; and
   b. alternative enterprises or new technologies to improve the sustainability of the farm system.
2. To gather information on a geographic basis that reflects current management units and would enable easier implementation of policy changes.
3. To evaluate attitudes towards current tools and potential alternative tools for improved land management.
4. To determine key indicators and methodology to repeat this work in the future.

1.3 Data collection and analysis

The principal data collection method employed was a mailed survey during May 2002. Surveys were sent to a random sample of 959 landholders in the Wimmera region with properties greater than 10 hectares in size. Property owners were identified from local government ratepayer rolls. A final response rate of 73 per cent was achieved. Such a high response rate provides considerable confidence for those attempting to extrapolate from the sample to the wider population of landholders in the Wimmera.

Much energy was expended in identifying and operationalising (establishing the format of statements to be asked in the survey) the Current Recommended Practices (CRP) to be included in the survey. CRP are practices that are expected to achieve improvements in land and water management and ultimately environmental conditions. There were 10 CRP included in the survey.

1. Number of trees and shrubs planted.
2. Number of paddocks where machinery or stock traffic had been reduced on seasonally wet soils.
3. Length of fencing erected to protect eroded gullies or manage stock access to waterways.
4. Area of non-wetting soils treated with clay.
5. Area of native bush or waterway fenced to manage stock access.
6. Area sown to introduced perennial pastures.
7. Number of paddocks where there is a record of soil test results.
8. Number of paddocks where stock is usually watered from a trough or tank.
9. Area cropped using conservation tillage practices such as direct drilling and stubble retention.
10. Estimated cost of work to control weeds and rabbits last year (your time at $20 per hour).

An important aspect of the research was the comparison of survey data with existing technical data. A Geographic Information System (GIS) was used to combine different data layers.

The survey sampling method also allowed examination of sub-regional differences using Resource Management Units (RMU).

1.4 Assessment of issues

Whilst this section assessed the importance of issues as opposed to values, it is interesting to note that four of the top five topics were social issues. The three highest rated issues were:

- lack of employment opportunities for young people;
- the impact of government cut backs on employment opportunities; and
- the decline of small villages and towns.

The importance of introduced weeds and pest animals as a priority issue in the Wimmera region was confirmed by survey data. The cost of managing pest plants and animals undermining on-property profitability on both the respondent's property and throughout the district were the highest rated economic issues. The impact of introduced weeds and pest animals on on-property profitability (five) was rated higher than the impact on the decline of native plants and animals in the district (nine), suggesting that landholders placed a higher value on economic impacts.

Dryland salinity was rated as an important issue by only 15 per cent of respondents. At the same time, 23 per cent of respondents reported saline areas on their property. Higher concern about salinity was linked to significantly higher involvement in government programs and adoption of CRP related to salinity management. Attempts to engage landholders in the Wimmera region will need to move beyond a narrow focus on salinity.

Only a minority of respondents thought the removal of vegetation contributing to the decline of native birds and animals in the district was an important issue. While there are large areas of forested land in reserves in the Wimmera, most private land has been extensively cleared. Higher concern about the removal of native vegetation was significantly linked to the adoption of CRP related to the protection of remnant vegetation and revegetation.

These findings indicate a need for further investment in community education about the importance of salinity prevention and the extent of native vegetation decline.

1.5 Values attached to property

Survey data highlighted a diverse range of values attached to respondents' properties. Fourteen of the 16 values included in the survey were rated as important by more than half of all respondents. Values considered most important included:

- a sense of accomplishment from knowing the property will be passed on to others in better condition;
- providing the majority of household income; and
- the freedom of being self-employed.

Various social and recreational values were also highly rated by the majority of respondents.

Attempts to appeal to landholders in the Wimmera region should consider the broad range of values most respondents attach to their property.

1.6 Knowledge

There were only three survey topics where the majority of respondents indicated they had sufficient knowledge to take action if required:

- how to manage ground cover on paddocks used for grazing to minimise soil erosion;
- the extent of water savings as a result of the Wimmera/Mallee pipeline project; and
- how to collect samples for testing soil acidity and fertility.

For all other topics, the majority of respondents reported insufficient knowledge to take action. These topics included:

- processes leading to soil acidification;
- identifying sodic soils;
- the area of salt affected land;
- the ability of perennial vegetation to prevent rising water tables;
- the extent of gully erosion;
- people to contact about government programs to help manage erosion;
- the approximate per hectare returns of farm forestry; and
- the value of woody debris in streams and rivers.

Higher knowledge about natural resource management issues was significantly linked to adoption of conservation related CRP.

Comparisons of landholder identified salinity sites and those predicted by expert maps suggested that landholders in the Wimmera region had excellent knowledge of current salinity sites on their property. Those respondents who reported salinity sites had adopted CRP related to salinity mitigation at significantly higher rates than all other respondents.

Maps of discharge sites prepared by the Department of Natural Resources and Environment (NRE) failed to predict more than half of the salinity sites reported by landholders. It is unlikely that landholders would deliberately overstate the extent of salinity on their property. However, it is possible that some landholders failed to distinguish between water logged areas and salinity sites. It seems there is a need for increased investment in verifying and updating maps of salinity sites in the Wimmera region.

These findings highlight the importance of ongoing community education activities that raise landholder knowledge about the extent and management of key issues. Demonstration sites and field days should be an important component of these activities. Demonstration sites and field days allow landholders to test the efficacy of recommended practices under local conditions and provide a focus for the sharing of ideas within a community. However, as will be explained, attention also needs to be given to follow-up activities that provide ongoing support to, and obtain feedback from landholders trialling CRP.

1.7 Age

The median age of Wimmera survey respondents was 53 years. Most of rural Australia has an ageing population and this trend was expected to be an important constraint affecting landholder willingness and capacity to adopt CRP. Indeed, survey data showed that the outward migration of youth from the region was a major issue for survey respondents.

Over two thirds of respondents (69 per cent) planned to pass their property on to another member of their family. Given the current trends for younger people to abandon farming and leave rural areas, many of these plans for family succession may not be realised. With increasing life expectancy, inter-generational transfer of many properties may not occur for some time. In this study, half of all properties surveyed would not

change hands until after 2015. This information suggests that resource management agencies should further consider older landholders and must understand their values, aspirations, and needs.

The common perception of a relationship between younger age and higher adoption of CRP was not supported in this research.

1.8 On-property and off-property income

Respondents in the Wimmera region had generally high on-property profitability with 86 per cent reporting an on-property profit and nearly half of these reporting a profit exceeding the $50,000 threshold considered necessary to maintain a household and fund investment in a farm's natural and capital resources (Rendell *et al.* 1996). Almost two thirds of respondents reported off-property income. Over half of all respondents reported a total household income in excess of $50,000 in the past year. The combined total household income for all respondents was $34 million. Combined on-property income accounted for approximately 71 per cent of all income, or $24 million.

The capacity of landholders to adopt CRP has been assumed to depend on the profitability of their on and off-property enterprises. In this study there were few links between profitability and adoption of CRP. While the general assumption has been that higher profitability would result in greater adoption, it seems equally plausible that where profitability is high it will be more difficult to convince landowners of the need to alter existing practices. Most respondents had high levels of equity in their property. In this study there were no significant links between the level of equity and adoption of CRP.

1.9 Planning

Just over half of all respondents were not involved in property planning. Given that preparation of a property plan was significantly linked to adoption of CRP, a greater emphasis on property planning in the Wimmera region appears warranted. To the extent that there has been a large investment in promoting property planning, current approaches may need to be re-thought. Recent experience suggests that landholders are more likely to undertake property planning when it is delivered as part of a package that provides assistance with on-ground work.

1.10 Property size and farming as an occupation

The median size of the respondents' properties was 900 hectares and 80 per cent of respondents indicated that farming was their primary occupation.

Individuals with larger properties, and those who identified farming as their primary occupation, managed the majority of land in the Wimmera region. Property size is an important element in determining the financial viability of dryland cropping and grazing enterprises. There was a significant positive relationship between increased property size and likelihood of respondents returning an on-property profit, as well as a higher amount of on-property profit. These findings may in part explain the fact that 43 per cent of respondents planned to increase the land they managed by purchasing, leasing or share farming additional land.

Both property size and occupation appeared to have little impact on the adoption of CRP.

1.11 Involvement in new enterprises

Survey findings highlighted very limited involvement in emerging enterprises such as:

- grapes (less than one per cent of respondents, median area 30 hectares);
- other horticulture (two per cent of respondents, median area 10 hectares); and
- farm forestry (six per cent of respondents, median area 13 hectares).

By contrast, involvement in tree planting for shade and shelter, habitat, erosion control or recharge control was quite widespread (47 per cent of respondents, median area 10 hectares).

Important barriers limiting entry into new enterprises included:

- concerns about low rainfall and limited water storage capacity;
- the existence of long-term markets;
- commitment and support from family; and
- making substantial new investments on-property.

It seems there is a large number of constraints that are likely to limit entry of landholders into new enterprises. Fourteen of the 18 topics listed as potential constraints were each rated as important by more than half of all respondents. While economic issues were considered the major constraints, respondents also identified important social and environmental factors as important constraints. This mix of environmental, social and economic issues represents a formidable challenge for those attempting to implement change in the enterprise mix in the Wimmera region.

1.12 Involvement in government programs

Just over a third of respondents said that they had work undertaken on their property in the past five years that was funded by government programs. Involvement in government-funded programs was significantly linked to higher adoption of CRP related to habitat rehabilitation. There were also some links between adoption and membership of Landcare (47 per cent a member) and Topcrop groups (20 per cent a member).

Respondents were also asked to indicate their level of interest in committing to additional revegetation work in exchange for an incentive package that provided for establishment costs, opportunity costs and a fee for active management. About half the respondents said they would take up the incentive proposal. To give some indication of the potential for this arrangement, respondents who said that the grant would allow them to revegetate on a larger scale than otherwise possible were asked to indicate the area they would like to plant with native species over the next three years if such a grant were available. The total area respondents planned to replant using the grant package was 6,075 hectares (median 12), or less than one per cent of the total area surveyed. While this level of support is encouraging, the fact that about half the respondents were not interested suggests that constraints other than financial capacity limit the adoption of CRP.

1.13 Uptake of Current Recommended Practices

Survey data indicated generally high rates of adoption of CRP relating to maintaining or enhancing productivity and biodiversity conservation. For example, over three quarters of respondents said that they had undertaken work to control pest plants (non-crop), and animals in the past 12 months. Over half of respondents had also watered stock off-stream, used conservation tillage practices, conducted soil tests on some part of their property, and planted trees and shrubs. Just under half of all respondents said they had sown introduced perennial pasture. Less than one third of respondents had fenced eroded gullies, waterways or native bush to manage stock access.

1.14 Confidence in Current Recommended Practices

Survey findings highlighted a high level of concern about the efficacy of many CRP, primarily those relating to habitat conservation. For example, while most respondents (70 per cent) acknowledged that fencing was an important part of the work required to revegetate waterways, survey data highlighted some important concerns about the efficacy of fencing these areas. Over half of all respondents (55 per cent) said that fencing waterways or eroded gullies makes it difficult to minimise the risk of fires and 49 per cent said that adoption of this CRP also makes it difficult to manage pest plants and animals.

Contrary to expectation, higher confidence about the efficacy of CRP was not linked to higher adoption. It seems that those who trial CRP, and those who do not, share concerns about their efficacy. In other words, for many respondents, concerns about the efficacy of CRP are based on their experiences trialling these practices. For example, over half of the respondents who had fenced eroded gullies or waterways, used conservation tillage practices, watered stock off stream or sown perennial pasture had concerns about the efficacy of these CRP. This is an important finding as it is widely assumed that landholders who trial a CRP are likely to continue with that practice and promote the efficacy of that practice to others. Findings from this survey suggest that these assumptions are problematic. This finding requires further investigation.

1.15 Factors affecting the adoption of Current Recommended Practices

Survey data highlighted the complex nature of adoption. Factors affecting respondents' adoption of CRP included a diverse range of farm management, socio-demographic and knowledge factors. The most common variables that were significantly linked to the adoption of CRP were:

- involvement in property planning;
- involvement in government funded programs;
- landholder identified saline affected areas; and
- greater knowledge about the extent and management of land degradation issues.

The common perceptions that older age, lower income and lower levels of equity constrain landowners' capacity to adopt CRP were not widely supported in this research.

1.16 Differences across Resource Management Units

Whatever actions are contemplated, it is important to recognise that there are significant differences across RMU in the Wimmera region. These differences include:

- extent of saline affected areas on properties;
- property size;
- proportion of respondents with farming as their primary occupation;
- on-property profitability;
- perceived importance of social, economic and environmental issues;
- knowledge about the extent and management of land degradation issues;
- involvement in Landcare and TopCrop groups;
- level of adoption of CRP;
- level of confidence in CRP;
- plan to continue living on their property in the long-term; and
- plan to lease or share farm their property in the long-term.

1.17 Future research

This research has provided detailed information explaining landholder adoption of CRP in the Wimmera region. The survey also provides baseline social data that is not provided by other sources such as the Australian Bureau of Statistics Household and Farm surveys. The real potential of this study will only be realised if there is a follow up study in about three-five years to begin the process of identifying trends over time.

There are a number of topics that warrant further investigation, including:

- reasons for low levels of confidence in some CRP and ways of addressing those concerns;
- the needs, aspirations and values of older land managers and ways of supporting them to achieve improved natural resource management outcomes;
- explanation for low levels of involvement in property planning and ways of addressing any issues;
- the relative impact and cost effectiveness of potential policy options, such as stronger cost sharing arrangements on the achievement of catchment targets; and
- the apparent failure of NRE discharge maps to predict up to 60 per cent of landholder identified saline affected sites.

2.0 INTRODUCTION

2.1 Research context

This report presents a summary of key findings from a mailed survey to 959 landholders in the Wimmera region in 2002. The survey focussed on gathering base-line information regarding the key social factors affecting landholder decision making about the adoption of practices expected to improve the management of natural resources in the Wimmera.

This project drew heavily on the methodology of similar projects completed in the Goulburn Broken Dryland in 1999 (Curtis *et al.* 2000) and the Ovens Catchment in 2001 (Curtis *et al.* 2002). The Wimmera Catchment Management Authority (WCMA) commissioned Dr Allan Curtis from Charles Sturt University (CSU) to undertake this study.

The Department of Natural Resources and Environment (NRE) was the other principal stakeholder.

2.2 Research objectives

1. To gain a better understanding of the limitations/barriers/constraints to the adoption of:
    a. sustainable land management practices relevant to the Wimmera region; and
    b. alternative enterprises or new technologies to improve the sustainability of the farm system.
2. To gather information on a geographic basis that reflects current management units and would enable easier implementation of policy changes.
3. To evaluate attitudes towards current tools and potential alternative tools for improved land management.
4. To determine key indicators and methodology to repeat this work in the future.

3.0 REPORT STRUCTURE

The next chapter provides some background to the Wimmera region. The subsequent methodology chapter includes a summary of the literature the research team drew upon to identify the variables included in the survey and brief descriptions of the mail out process and the approach to data analysis.

Research findings are presented in 3 chapters.
1. Findings by survey topic [Section 6.0].
2. Landuse/enterprise mix [Section 7.0].
3. Conclusions: Adoption of CRP and characteristics of RMU [Section 8.0].

There is an executive summary at the start of this report.

4.0 BACKGROUND

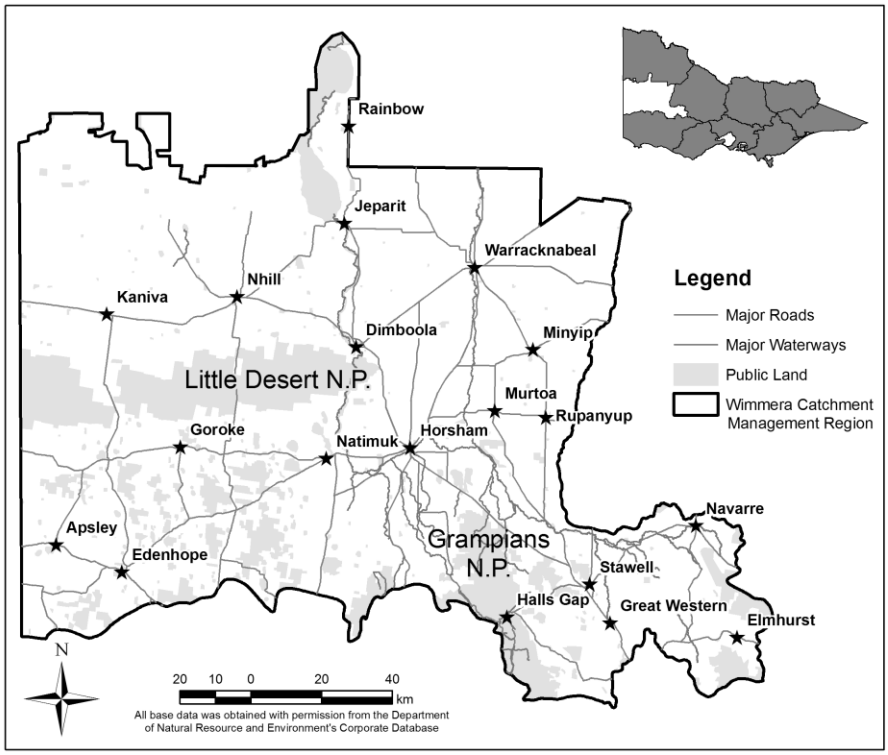
4.1 The location and character of the Wimmera

The Wimmera Catchment Management Region (Wimmera region) is located in Western Victoria and covers an area of approximately 30,000 square kilometres [Map 1]. The Wimmera region includes the Wimmera River catchment and part of the Millicent Coast Basin. The Wimmera River is the largest river in Victoria that does not flow into the sea and the Wimmera region also includes a series of terminal lakes, the largest of which are Lake Hindmarsh and Lake Albacutya. Agriculture is the most predominant landuse and approximately 85 per cent of the region has been cleared of native vegetation. Much of the remnant vegetation exists within public reserves including the Grampians and Little Desert National Parks. Cropping (cereal, oil seed and grain legume) forms the bulk of agricultural production followed by wool, meat and milk. Primary production and associated processing industries are the main contributors to economic wealth. Tourism is also an important industry (WRCLPB 1997).

The population of the Wimmera region is about 50,000 with almost a third of these living on farms or in small townships (WRCLPB 1997). Major townships in the region include Edenhope, Horsham, Nhill, Stawell and Warracknabeal.

The Wimmera Regional Catchment and Land Protection Board Regional Catchment Strategy identified the high priority natural resource management issues as being water erosion, salinity, soil structure decline, soil fertility, soil acidity, pest plants and animals, community education and effective communication of information (WRCLPB 1997).

Map 1
Location of the Wimmera region



4.2 Resource Management Units

The Wimmera region has been divided into nine Resource Management Units (RMU). These RMU reflect areas within the region that share similar landform, soils and vegetation [Map 2]. All topics included in the mail survey were analysed to identify differences across RMU. The presence or absence of differences across the various topics has been reported in the text and where possible included in the relevant tables. Differences across RMU for the topics included in survey are detailed in Appendix 1. Table 32 in Appendix 1 summarises the response to key variables included in the survey across the nine RMU.

The following descriptions of the resource management units in the Wimmera region have come from the Wimmera Regional Catchment Strategy (WRCLPB 1997).

Desert Sands

Landform: Chains of windblown white dunes mainly in the north west.
Soils: Soils are mainly uniform fine to medium sands and sandy yellow duplex types.
Native Vegetation: Woodland to open heathland of Brown Stringy-bark and Mallee species. (About 3% of the original vegetation remains).
Landuse: Grazing, cropping and National Parks.
Annual rainfall: 325-375mm.

Flat Grey Plains

Landform: Natural Floodplain of the Wimmera River and Yarriambiack Creek.
Soils: Varies from grey self-mulching and cracking clays to red and yellow duplex.
Native Vegetation: Open forest of Buloke, Yellow Gum, Grey Box, Red Gum and Black Box. (About 5% of the original vegetation remains).
Landuse: Cropping, grazing and irrigation.
Annual rainfall: 325-550mm.

Grampains Group

Landform: Grampians National Park, Black Range State Park and State Forest and Mt Arapiles unit of the Mt Arapiles-Tooan State Park.
Native Vegetation: Brown Stringy-bark, Long Leaved Box and Messmate, woodlands of Red Gum, Yellow Box, Manna Gum as well as heath and woodlands of Apple Box and Brown Stringy-bark on yellow duplex soils.
Landuse: Flora and fauna, recreation and water harvesting.
Annual Rainfall: 400-1000mm.

Mallee Calcarous Plains

Landform: Undulating plains with sand dunes running mostly east west.
Soils: Sand to sandy loam and light clays on the flats.
Native Vegetation: Mallee eucalypts, Black Box, Yellow Gum, Buloke, Callitris and Casuarina (About 1% of the original vegetation remains).
Landuse: Grazing and cropping.
Annual rainfall: 325-450mm.

Northern Footslopes

This RMU contains an amalgam of smaller land management units. (About 5% of the original vegetation remains across the Northern Footslopes).

5a) Tertiary Rises
Landform: Gently undulating plateau.
Soils: Mottled yellow duplex soils with coarse structure.
Native Vegetation: Long Leaved Box, Grey Box, Yellow Gum.
Landuse: Grazing and gravel extraction.
Annual rainfall: 450-650mm.

5b) Granites
Landform: Hills with boulders and undulating plains.
Soils: Mottled duplex soils with ironstone.
Native Vegetation: Long Leaved Box, Yellow Box, Manna Gum and Messmate.
Landuse: Grazing, timber and recreation.
Annual rainfall: 500-750mm.

5c) Volcanic Plain
Landform: Gently undulating plain.
Soils: Medium to heavy clay soils.

Native Vegetation: Open Red Gum woodland.
Landuse: Grazing and cropping.
Annual rainfall: 500-850mm.

5d) Sedimentary Rises
Landform: Low hills and undulating rises.
Soils: Duplex with some thin stony soils.
Native Vegetation: Grey Box, Long Leaved Box and Yellow Box.
Landuse: Grazing and cropping.
Annual rainfall: 450-750mm.

5e) Upland and Grampians Alluvial Plains
Landform: Highland valleys of the Upper Wimmera.
Soils: Predominantly red and yellow duplex.
Native Vegetation: Red and Yellow Gum, Grey and Yellow Box, with Manna Gum towards the Grampians.
Landuse: Grazing and cropping.
Annual rainfall: 500-1000mm.

5f) Steep Hills
Landform: Rolling to steep hills.
Soils: Rocky ridges have generally stony soils, whilst the lower slopes have red duplex soils.
Native vegetation: Yellow Box, Red Box, Red Gum and Yellow Gum.
Landuse: Grazing and forestry.
Annual rainfall: 450-750mm.

South West Wimmera Plains

Landform: Flat to undulating plain with significant wetland system.
Soils: Yellow duplex soils and some uniform grey and brown self mulching clays.
Native vegetation: Shrubby woodland of Brown and Red Stringy-bark, Messmates, Red Gum, Yellow Gum, Grey Box and Buloke. (About 15-20% of the original vegetation remains).
Landuse: Grazing and cropping, with large tracts of vegetated public land.
Annual rainfall: 400-550mm.

Undulating Alluvial Plains

Landform: Flat to undulating plains.
Soils: Sandy rises to red, and red and yellow duplex and uniform grey self-mulching clays.
Native Vegetation: Open forest of Grey Box, Yellow Gum and Red Gum, closed forest of Brown String-bark and Messmates and wetlands of Samphire and Beaded Glasswort. (About 2% of the original vegetation remains).
Landuse: Cropping and Grazing.
Annual rainfall: 400-850mm.

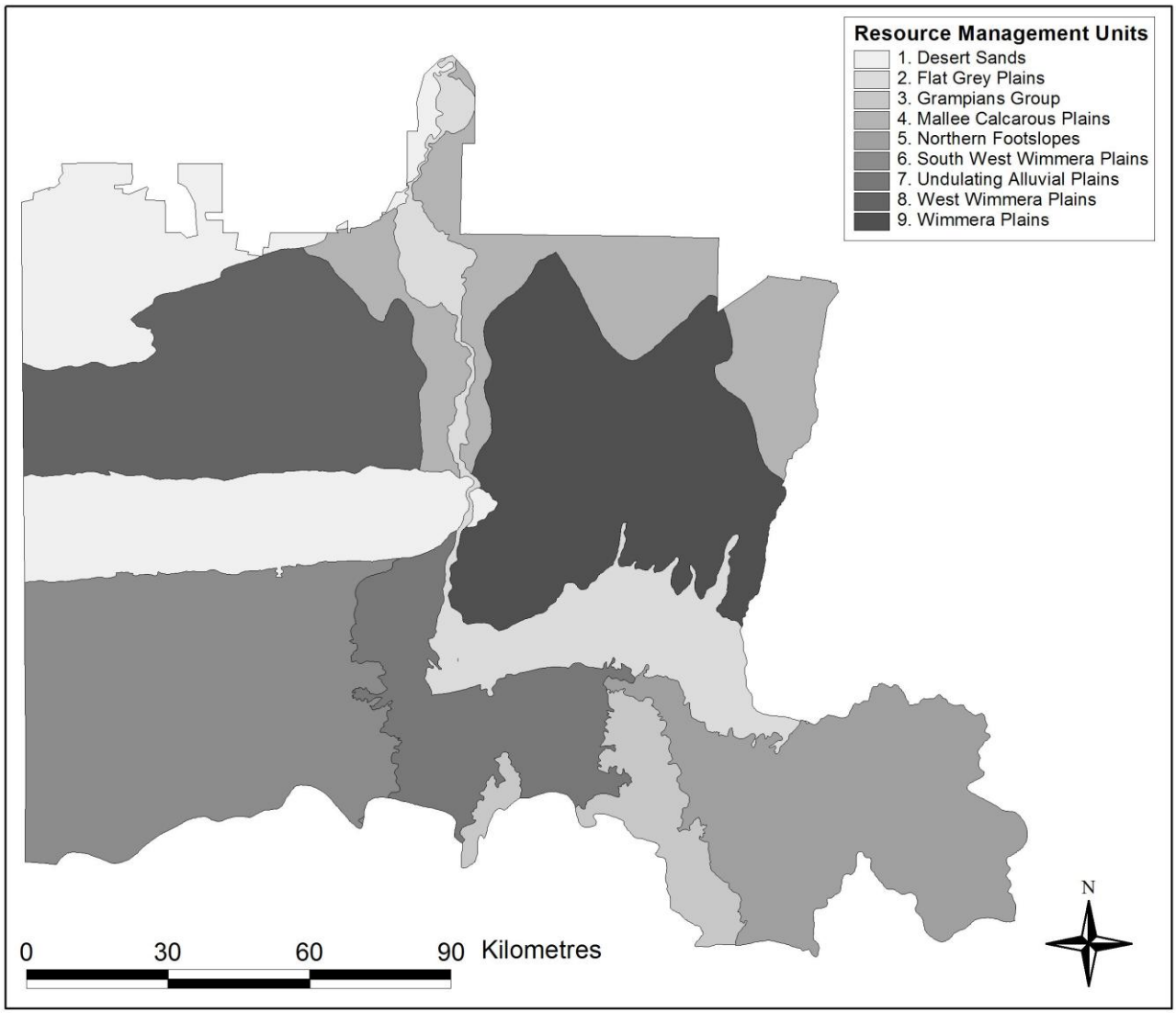
West Wimmera Plains

Landforms: Low irregular undulating plain with pronounced ridges and occasional dunes.
Soils: Wimmera self-mulching grey cracking clay, red duplex and sandy loam duplexes.
Native Vegetation: Open woodland forest of Stringy-bark, Yellow Gum, Buloke and Black Box. (About 2% of the original vegetation remains).
Landuse: Cropping and grazing.
Annual rainfall: 350-450mm.

Wimmera Plains

Landform: Gently undulating to flat plains.
Soils: Uniform grey self mulching and brown cracking clays and some red duplex.
Native Vegetation: Open forest with Black Box, Buloke, Yellow Gum and Grey Box (About 2% of the original vegetation remains).
Landuse: Cropping and grazing.
Annual Rainfall: 375-500mm.

Map 2
Resource Management Units in the Wimmera region



5.0 METHODOLOGY

5.1 Background to this research

Governments have assumed that, at least in part, poor adoption rates for recommended practices arose because landholders were unaware of important land degradation issues; lacked sufficient knowledge and skills; or had attitudes that emphasised short-term economic returns over maintaining the long-term health of the land (MDBC 1990; ASCC 1991). There has been a large investment of resources over the past decade in awareness raising and education programs, including those carried out by Landcare groups. There is credible evidence that these activities do contribute to increased awareness and understanding and that these changes enhance landholder capacity to adopt recommended practice (Vanclay 1992; Curtis and De Lacy 1996; Curtis *et al.* 2001a). However, though most landholders already have a strong stewardship ethic, such attitudes have not been linked to increased adoption of recommended practices (Curtis and De Lacy 1998).

Some landholders have lifestyles and values that limit their response to approaches that focus on increasing agricultural production and profit maximisation (Barr *et al*. 2000; Curtis *et al.* 2001b). Non-farmers and retirees may respond less quickly to economic signals; be more averse to risking off-property income in on-property enterprises; and will probably have less time for property management (Barr *et al*. 2000). On the other hand, non-farmers may bring new ideas, skills and financial resources that contribute to the renewal of local communities and they may be more likely to respond to appeals for biodiversity conservation (Curtis and De Lacy 1996).

There is now abundant evidence that part of the explanation of low adoption is that many of the current recommended practices or enterprises are either unprofitable and/or unsustainable. Amongst other things, some of the recommended plant-based management systems "leak" water and contribute to ground water flows that mobilise salt (Stirzacker *et al.* 2000; Walker *et al.* 1999). Lack of confidence in recommended practices has been identified as an important constraint affecting adoption (Curtis *et al.* 2001b).

Low on-property income will constrain the capacity of landholders to respond to new opportunities. Over the past decade, most broad acre farming enterprises in the Murray-Darling Basin have been unprofitable using the FM 500 project benchmark of financial sustainability (Barr *et al.* 2000). The FM 500 benchmark assumes that a disposable family income exceeding $50,000 per year is required to sustain a household and fund investment in a farm's natural and capital resources (Rendell *et al.* 1996). There is increasing evidence that many rural landholders have limited on-property incomes and that this is a critical constraint to adoption (Barr *et al*. 2000; Curtis *et al.* 2001a). Poor returns from grazing have meant that landholders could not afford the remedial lime and fertiliser regimes required to maintain pastures and prevent the downward spiral in grass production that effects water uptake and eventually, farm income (Millar and Curtis 1997).

It is also unlikely that many dryland landholders will generate substantial income from new enterprises such as olives, wine grapes and farm forestry (Stirzacker *et al.* 2000; Curtis *et al.* 2000). Landholders are very reluctant to take on new enterprises that will involve them entering long-term agreements with powerful industry partners (Curtis and Race 1996). Problems also arise if recommended practices or new enterprises are complex, are perceived as being risky, do not fit with existing enterprises or conflict with existing social norms (Vanclay 1992; Curtis and Race 1996; Barr and Cary 2000).

It seems that understanding of issues and congruent attitudes are necessary but not sufficient to ensure adoption. Landholders are also increasingly aware that they are being asked to implement work that has community benefits in terms of biodiversity conservation, improved public health and protecting export income (agriculture and tourism) and infrastructure. They also understand that many of the problems that they are being asked to address have resulted from previous government policies. Establishment of the

Natural Heritage Trust, with the federal government sharing the costs of large-scale on-ground work on private land, was an acknowledgment of the legitimacy of these arguments (Curtis and Lockwood 2000). Discontinuity between the source and impact of issues, particularly those related to water degradation, adds a further complication. Many landholders in the upper reaches of catchments are either not experiencing these problems, believe they can live with them or are unaware or unconcerned about contributing to downstream impacts (Curtis *et al.* 2001a).

Australia has an ageing rural population with life expectancy increasing and younger people drifting from rural areas to the more prosperous and attractive lifestyles in urban centres (Haberkorn *et al.* 1999). We can no longer assume that a substantial proportion of the inter-generational transfer of properties will occur within families. Where family succession is unlikely, property owners may be less willing to invest in recommended practices or new enterprises. In an era of reduced farm profitability and lower land prices, particularly where demand for rural subdivisions is not high, some landholders may feel they are locked into living on their properties in retirement. With increasing life expectancy, this trend could delay inter-generational property transfer. These elderly property owners may also be less willing to invest in recommended practice or new enterprises. Guerin (1999) and Curtis *et al.* (2001a) found that there was no clear correlation between landholder age and adoption, and suggested this was an important area for future investigation.

Such pressures were expected to lead to the amalgamation of some smaller grazing properties into larger units. While some amalgamation has occurred, there has not been large-scale consolidation of properties, and the trend has not been uniform across the Murray-Darling Basin (Barr *et al.* 2000). Within commuting distance of larger regional centres, there has been considerable conversion and subdivision of existing holdings into lifestyle farming enterprises for retirees and people with off-farm work. Land prices based on rural residential use will militate against the aggregation of smaller and less viable holdings and closer settlement may impose environmental controls on broad acre farming.

It is increasingly obvious that there are limits to the capacity of landholders to voluntarily effect required change at the landscape scale (Curtis 2000). Effecting behavioural change in private landholders is a complex task and experience suggests that no single instrument will address the underlying reasons for non-adoption (Vanclay 1997; Lockwood *et al.* 2001). As Dovers (1995) and Dovers and Mobbs (1997) emphasised, the challenge is to develop integrated packages that may include:

- legislation or regulations to create the institutional framework for management, set aside areas of land, and enforce standards and prohibitions;
- self regulation;
- research to clarify problems, develop solutions, and monitor environmental conditions;
- education to convince people of the need to change behaviour, gain support for policies, and ensure the ability to apply policy instruments; and
- economic measures such as charges, subsidies, penalties, and tradeable permits to assist efficient allocation of resources and equitable distribution of costs and benefits.

This research also recognised that regional catchments are, increasingly, the scale at which natural resource management occurs in Australia. Understanding and monitoring critical social processes and trends is an important part of the management that regional Catchment Management Committees/Authorities (CMA) and agency staff should do. In turn, regional experience should inform the development of national policies. As our recent research in the Goulburn Broken Dryland (Curtis *et al.* 2000) and Ovens Catchment (Curtis *et al.* 2002) illustrated, there are also considerable differences at the sub-regional scale. There are differences in the physical settings of the Wimmera RMU, the types of rural land use, the extent of rural subdivision and the obvious contrasts in terms of proximity and commuting time to the larger regional centres of Horsham and Stawell. To the extent that there are significant differences at the RMU scale, there will also need to be sub-regional differences in the policy mix implemented by the CMA and other organisations (Curtis *et al.* 2001a).

5.2 Need to conduct the survey

Surveying landholders over an area as large as the Wimmera region is a challenging and time-consuming task. If there are other data sources available, they should be examined to avoid duplication of research effort. Other organisations, such as the Australian Bureau of Agriculture and Resource Economics (ABARE) and the Australian Bureau of Statistics (ABS), collect data on households and farms. In recent times there have been attempts to interpret these databases and identify important social trends in rural Australia (Barr *et al*. 2000; Haberkorn *et al.* 1999). However, analyses using these databases have their limitations for those developing plans and policy at the regional scale. Few questions used by ABARE or ABS directly assess factors affecting landholder capacity to change practices or enterprises. Researchers are often forced to infer from the available data and their findings can be misleading in that important variables were not able to be considered. Furthermore, data is only available to the public in aggregated form, the smallest scale being census collector districts that combine data for about 200 households. Aggregation reduces the usefulness of data, particularly when sub-regional or RMU contexts are important, as for the Wimmera region.

5.3 Topics and variables included in the mail survey

Drawing on the above literature and given the constraints of a mailed survey (mainly space and the type of questions that can be effectively posed), the authors, in collaboration with our industry partners, identified the topics listed below for inclusion in the survey. Whilst a copy of the survey is not included in the report, explanations of survey questions, response options and any additional background information are provided in the relevant section of the report.

- Assessment of issues affecting property and district.
- Self-assessment of knowledge for different topics.
- Awareness of on-property salinity.
- Views about roles and responsibilities for natural resource management.
- Views about the importance of factors affecting decision making about new enterprises.
- Response to stronger cost sharing for revegetation and protecting remnant vegetation.
- Involvement in planning related to family succession, property and business.
- Long-term plans for the property.
- Adoption of recommended practices.
- Other property data, including: property size, broad enterprise mix, remnant bush, area under specific enterprises (now and in three years).
- Background socio-economic data, including: age, gender, education, occupation, on and off-property hours worked, on and off-property household income, Landcare membership, Topcrop membership, funding through government programs, time lived in district, level of equity in property.

5.4 Current Recommended Practices (CRP)

It must be remembered that the 2002 Wimmera landholder survey was not intended to contribute to monitoring the achievement of the Wimmera Regional Catchment and Land Protection Board Regional Catchment Strategy targets. The main purpose of collecting survey data was to explore the impact of factors expected to explain variance in the adoption of current recommended practices (CRP). Hence there was no requirement to be comprehensive in the coverage of CRP.

Nevertheless, much energy was expended in identifying and operationalising (establishing the format of statements to be asked in the survey) the CRP to be included in the survey. This process took into account the:

- key NRM issues identified by the Regional Catchment Strategy;
- targets identified;
- views of our industry partners;
- practicalities of a mail survey; and
- the results of pre-testing the survey with peers, agency partners and landholders.

There were 10 CRP included in the survey.

1. Number of trees and shrubs planted over the past 3 years.
2. Number of paddocks where machinery or stock traffic had been reduced on seasonally wet soils over the past 3 years.
3. Length of fencing erected to protect eroded gullies or manage stock access to waterways at May 2002 and over the past 3 years
4. Area of non-wetting soils treated with clay at May 2002 and over the past 3 years.
5. Area of native bush or waterway fenced to manage stock access at May 2002 and over the past 3 years.
6. Area sown to introduced perennial pastures at May 2002 and over the past 3 years.
7. Number of paddocks where there is a record of soil test results at May 2002 and over the past 3 years.
8. Number of paddocks where stock is usually watered from a trough or tank.
9. Area cropped using conservation tillage practices such as direct drilling and stubble retention.
10. Estimated cost of work to control weeds and rabbits last year (your time at $20 per hour).

5.5 The mail survey process

The following points briefly outline the sampling method used in the mail survey to landholders in the Wimmera region.

- WCMA approached seven municipalities (Ararat Rural City, Hindmarsh Shire, Horsham Rural City, Northern Grampians Shire, Pyrenees Shire, West Wimmera Shire and Yarriambiack Shire) to cooperate and provide landholder details within the survey region using their local government rural property lists.
- Local government property data was provided to WCMA and CSU on the provision that it be used for this survey only and that the lists be destroyed at the conclusion of the survey process.
- Tables containing rural property information were then entered into a Geographic Information System (ArcView GIS).
- All properties less than 10ha were excluded from the potential survey sample.
- A random sample (spread evenly across the region) of 1,000 landholders was obtained from the remaining names and addresses.
- These names and addresses were forwarded on to CSU, where 41 duplicate names were identified and removed from the sample.
- This produced a final sample of 959 landholders.

The survey design and mail out processes were undertaken using Dillman's (1979) *Total Design Method*. The survey was pre-tested by academic peers and a project steering committee comprised of community representatives and staff from the NRE, CMA and Wimmera Mallee Water. A draft version of the survey was pre-tested with a focus group comprised of representatives from a cross section of Wimmera Landholders, covering eight of the nine RMU. Feedback from the workshop session resulted in some important refinements to the survey instrument.

The first mailout of surveys took place on May 1 2002. A reminder card was sent out one week later, with a second and third reminder card mailed out each consecutive week. Four weeks after the initial survey

mailout, another copy of the survey and a brief letter were sent to landholders that had not responded. The second mailout was followed by another reminder card one week later on June 5, 2002.

Surveys were addressed to property owners identified on the local government rural property owner lists. In the majority of cases only a surname and an initial were provided. It was therefore impossible to tell exactly what proportion of the survey sample were women.

An overall response rate of 73 per cent was achieved. Surveys that were returned to sender or sent back due to the landholder no longer residing at the property, were taken off the original sample along with those where the landholder was too old, ill or deceased or the property had been sold (112). This left a final sample of 846, with 619 completed surveys returned. The response rate varied from 65 per cent in the South West Wimmera Plains (RMU 6) to 76 per cent in the Wimmera Plains (RMU 9) [Table 1].

It is important to note that the majority of Grampians Group (RMU 3) consists of public land. As such, there was only a small number of respondents from RMU 3. Readers need to keep this in mind during later discussions about differences across RMU.

Table 1
Survey response rate by RMU
Wimmera region 2002, N=619

RMU	RMU name	Number surveyed	Completed surveys	Return to sender	Response rate (%)
1	Desert sands	55	33	8	70%
2	Flat grey plains	72	43	11	70%
3	Grampians groups	15	10	0	67%
4	Mallee calcareous plains	100	67	11	75%
5	Northern footslopes	101	68	10	75%
6	South West Wimmera plains	184	108	19	65%
7	Undulating alluvial plains	78	50	8	71%
8	West Wimmera plains	147	91	23	73%
9	Wimmera plains	203	139	21	76%
Total*		958	619	112	73%

*Totals calculated by adding RMU data will differ slightly from these figures. There were a small number of respondents who removed the identification number from the survey and could not be allocated to a RMU.

5.6 Data Analysis

Findings in this report have been presented so they can be interpreted without understanding the statistical methods used. However, for those who are interested to know how we approached the task of data analysis, a brief explanation of the statistical methods used is given below.

Statistical analysis included in this report consists of descriptive statistics, Spearman rank order correlations, Gamma correlations, non-parametric chi-square tests, binary logistic regression, alpha estimation, and paired samples T test. All statistical analyses used the SPSS software package.

Spearman rank order correlations were used to identify hypothesised relationships between variables. For example, higher on-property profitability was hypothesised as being linked to larger property size. Spearman rank order correlations place respondents on each variable from highest to lowest and determine the extent that there is a relationship between ranks on the two variables. For cases exploring the relationship between ordinal variables, Gamma correlations were used. A negative correlation coefficient or r_s indicates that a higher score on one variable is linked to a lower score on the other. The value of r_s can range from 1 to –1 with higher values (either negative or positive) indicating a stronger relationship.

Kruskal-Wallis chi-square tests were used to determine the presence of significant differences across continuous variables for two or more independent groups. For example, the Kruskal-Wallis chi-square was used to determine if there were any significant differences in property size between those adopting a CRP and non-adopters. The value of the chi-square statistic or χ^2 indicates the strength of the difference between groups on a given variable with a higher value indicating a larger difference. However, the χ^2 value does not indicate the direction of the relationship. The Pearson chi-square test was used to determine the presence of differences across ordinal or binomial data for two or more independent groups. For example, the Pearson chi-square test was used to determine if there were significant differences between Landcare members and non-Landcare members on the adoption of CRP.

The paired samples t-test was used to identify significant differences in the mean score between related variables. For example this test was used to compare the level of concern about salinity at the property and district level. Higher t values indicate a larger difference.

Binomial logistic regression was used to better determine the extent that a number of independent variables or factors identified by correlation or chi-square tests contributed to the presence or absence of a dependent variable, in this instance adoption of CRP. The Wald statistic provides a measure of the effect of each independent variable on the dependent variable, with higher scores indicating a greater effect. The Exp(B) or odds ratio represents the change in the odds of adoption given a unit increase in the independent variable. Odds ratios above one indicate a positive relationship, while scores below one represent a negative relationship or decreased likelihood of adoption.

In all analyses the p statistic represents the significance level where a value below 0.05 is considered to be statistically significant. A p value below 0.05 means there is more than a 95 per cent chance that an observed relationship or difference has not occurred purely by chance.

5.7 Limitations of this research

No single instrument is able to collect data on all possible variables and therefore, some variables were not addressed in this research. Ultimately, professional judgement was used to determine the variables included in the survey.

Every research instrument has its strengths and weaknesses. A mail survey allows researchers to collect information across a large number of respondents and at a much lower cost than would be possible with face-to-face interviews. However, the mail survey does not allow for researchers to use follow-up questions to explore respondents' motivations.

In this research it was not possible to collect information across time. This is an important limitation given the results of Barr *et al.* (2000) that identified important temporal trends across the Murray-Darling Basin. The 2002 Wimmera survey should be followed by another, say in three to five years time. It would then be possible to identify trends over time

The high response rate (>70 per cent) and relatively large sample size (959) suggests that survey data should be representative of landholders in the Wimmera region.

6.0 FINDINGS BY SURVEY TOPIC

6.1 Assessment of issues

Respondents were asked to assess the importance of a range of issues in their district and on their property. These issues had been identified through discussions with the project steering committee and at the survey pre-testing workshop. The response options were 'very important', 'important', 'some importance', 'minimal importance' and 'not important'. To simplify the tabulation of data, the five response options have been collapsed into three categories – very important/important, some importance, and minimal/not important [Table 2]. It is important to note that the original five-point scale was used in all data analysis.

Analysis of survey data provides some interesting and useful findings.

Six of the eighteen issues were rated as very important/important by a majority of respondents. The highest rated issue was lack of employment opportunities for young people threatens the long-term viability of rural communities. The impact of government cut backs on employment opportunities for younger people was the next highest rated issue [Table 2].

Whilst this section assessed the importance of issues as opposed to values, it is interesting to note that four of the top five issues related to social issues. Indeed, only one of the five social issues listed was rated as very important/important by less than half of all respondents. There is quite clearly a great deal of concern about the viability of rural communities in the Wimmera region.

By comparison, only one issue from either the economic or environmental topics covered in the survey was considered to be very important/important by the majority of respondents.

The importance of introduced weeds and pest animals as a priority issue in the Wimmera was confirmed by survey data. The cost of managing pest plants and animals undermining profitability on both the respondent's property and throughout the district were the two highest rated economic issues. The impact of introduced weeds and pest animals on on-property profitability (five) was ranked higher than the impact on the decline of native plants and animals in the district (nine), suggesting that landholders placed a higher value on economic impacts [Table 2].

The only environmental issue that was rated as important by more than half of all respondents was reduced river/stream flows threaten the long-term health of river/streams/wetlands in the district [Table 2].

Only a minority of respondents (26 per cent) thought the removal of native vegetation has contributed to the decline of native birds and animals in the district was a very important/important issue [Table 2]. While there are large forested areas in reserves in the Wimmera, most private land has been extensively cleared. Higher concern about native vegetation removal was linked to higher adoption of the CRP related to the protection of remnant vegetation and revegetation (see below). These findings appear to justify further investment in community education to raise awareness of the extent and importance of native vegetation removal/decline.

For three topics, soil acidity, salinity and pest plants and animals, there was reference to both the district and the property scale. In each of these cases respondents rated district issues as being significantly more important ($t_{acidity} = 10.594$, $p < 0.001$; $t_{salinity} = 11.240$, $p < 0.001$; $t_{pests} = 6.203$, $p < 0.001$). It is difficult to assess the extent that this perception is correct or represents a case of denial by respondents of the severity of on-property issues. In the case of dryland salinity, later sections of this report [refer to section 6.3.1] show that few respondents had a salinity problem, so it is probably true that for most respondents the impact of salinity will be greater at the district as opposed to the property scale.

In addition to the three items in Table 2 assessing the perceived importance of salinity, an overall index of concern about salinity was calculated by summing respondents' scores across these individual items. Adopting this approach, approximately 15 per cent of respondents indicated salinity was a very important/important issue.

There were some significant differences across RMU in respondents' assessment of particular issues [Appendix 1].

There were significant relationships between respondent's assessment of issues and adoption of CRP.

- Higher concern about the removal of native vegetation contributing to the decline of native plants and animals in the district was significantly linked to adoption of the CRP:
  1. trees and shrubs planted (Wald = 13.064, $p < 0.001$, Exp(B) = 1.268); and
  2. native bush and waterways fenced to manage stock access (Wald = 8.699, $p = 0.003$, Exp(B) = 1.394).
- Higher concern about the threat of dryland salinity to water quality in the district was significantly linked to adoption of the CRP fencing erected to protect eroded gullies or manage stock access to waterways (Wald = 7.164, $p = 0.007$, Exp(B) = 1.344).

The scale comprised of the three variables regarding concern about salinity was also linked to adoption of trees and shrubs planted (Wald = 5.951, $p = 0.015$, Exp(B) = 1.076).

Table 2
Assessment of issues
Wimmera region 2002, N=619

Topic		n	Very Important/ Important	Some	Not Important/ Minimal	Mean score
Social	Lack of employment opportunities for young people threatens to undermine the long-term viability of rural communities in the district.	614	78%	14%	8%	4.21
	Cut backs by government or large businesses have reduced employment opportunities for younger people in this district.	610	63%	21%	16%	3.82
	The decline of villages and small towns in this district is/will make it more difficult to attract investment in agriculture.	612	56%	23%	21%	3.58
	Difficulties accessing important health services is/will make it more difficult to retain or attract people to live in this district.	614	56%	24%	20%	3.55
	Changes to river/stream banks and flows have reduced the quality of recreational experiences for people living in or visiting the district.	603	45%	18%	37%	3.21
Economic	The cost of managing weeds and pest animals is undermining the profitability of on-property enterprises in this district.	612	52%	23%	25%	3.46
	The cost of managing weeds and pest animals is undermining the profitability of my on-property enterprises.	610	43%	23%	34%	3.19
	Dryland salinity threatens the long-term productive capacity of land in this district.	611	22%	24%	54%	2.61
	Soil acidity threatens the long-term productive capacity of land in this district.	599	16%	21%	63%	2.34
	Farming practices contributing to erosion are undermining the long-term productive capacity of land in this district.	611	12%	26%	62%	2.33
	Dryland salinity threatens the long-term productive capacity of my property.	600	11%	11%	78%	1.99
	Soil acidity threatens the long-term productive capacity of my property.	605	10%	13%	77%	1.98
Environmental	Reduced river/stream flows threaten the long-term health of rivers/streams/wetlands in this district.	604	58%	15%	27%	3.58
	Introduced plants and animals have contributed to the decline of native plants and animals in this district.	612	34%	25%	41%	2.92
	Removal of native vegetation since European settlement has contributed to the decline of native birds and animals in this district in my lifetime.	607	26%	25%	49%	2.71
	Leasing out or share farming land will make it more difficult to manage land and water degradation in this district.	612	21%	28%	51%	2.58
	Dryland salinity threatens quality of river/stream/wetland water quality in this district.	597	22%	22%	56%	2.52
	Nutrient runoff from farms and towns threatens river/stream/wetland water quality in this district.	602	17%	19%	64%	2.33

Mean score where 1 = not important through to 5 = very important.

6.2 Values attached to property

The mail survey included a range of statements exploring values respondents attached to their property. Respondents were asked to indicate the importance for a range of potential values using a five-point scale. The response options were 'very important', 'important', 'some importance', 'minimal importance' and 'not important'. As in the previous section, the five response options were collapsed into three categories to simplify interpretation – very important/important, some importance, and minimal/not important [Table 3].

Survey data highlighted a diverse range of values attached to respondents' properties. Fourteen of the 16 values included in the survey were rated as important by more than half of all respondents. Values considered most important included a sense of accomplishment from knowing the property will be passed on to others in better condition, providing the majority of household income, and the freedom of being self-employed. Social and recreational values were also highly rated by the majority of respondents [Table 3].

Work on the property is a welcome break from my normal occupation and I feel closer to earlier generations who have worked this land were the lowest rated topics [Table 3].

Attempts to appeal to landholders in the Wimmera region should consider the broad range of values landholders attach to their property.

There were significant differences across RMU for six of the 16 values explored in this section of the survey [Appendix 1].

There were some links between adoption of CRP and values.

- Respondents who said that their property was important because it provided the majority of their household income were significantly less likely to adopt the CRP fencing erected to protect eroded gullies and manage stock access to waterways (Wald = 13.864, $p < 0.001$, Exp(B) = 0.645).
- Respondents who said that their property was important because it was an attractive place to live were significantly more likely to adopt the CRP stock watered from a trough or tank (Wald = 6.897, $p = 0.011$, Exp(B) = 1.172).

Table 3
Values attached to property
Wimmera region 2002, N=619

Choices	n	Very important/ Important	Some	Not important/ Minimal	Mean score
Sense of accomplishment from knowing that I will be passing the property on to others in better condition than I found it.	607	89%	7%	4%	4.37
Provides most of our household income.	604	81%	11%	8%	4.36
The freedom of working for myself.	603	87%	7%	6%	4.33
Sense of accomplishment from building/maintaining a viable business.	604	86%	8%	6%	4.29
This is a great place to raise a family.	603	81%	8%	11%	4.09
It is an attractive place to live.	606	78%	12%	10%	4.04
Being part of a rural community.	604	77%	15%	8%	4.03
Sense of accomplishment from producing food or fibres for others.	606	68%	19%	13%	3.82
An asset that will fund my retirement.	599	67%	16%	17%	3.80
Work on the property keeps me in good health.	602	61%	22%	17%	3.57
Place for recreation by me, my family and friends.	606	59%	21%	20%	3.57
Native vegetation provides habitat for birds and animals.	607	51%	30%	19%	3.45
Being able to build a business that employs other family members.	601	55%	15%	30%	3.40
Work on the property keeps me in touch with nature.	601	50%	25%	25%	3.35
When I'm here I feel closer to earlier generations who have worked this land.	604	42%	21%	37%	3.06
Work on the property is a welcome break from my normal occupation.	508	30%	12%	58%	2.37

Mean score where 1 = not important through to 5 = very important

6.3 Awareness of salinity

Landholder awareness of salinity was explored in the mail survey. The key question asked respondents to indicate if there were areas on their property where plants showed signs of the effects of saline water. Respondents were then asked to indicate the total area of land affected on their property [Table 4].

Twenty-three per cent of respondents indicated that they had areas where plants showed signs of the effects of saline water [Table 4]. For most respondents, the area affected was relatively small (median 10 hectares) [Table 4]. The total area of affected land was 3,404 hectares or less than one per cent of the area surveyed [Table 4].

There were significant differences in respondents reporting that they had areas where plants showed signs of salinity across RMU, ranging from 50 per cent in the Desert Sands (RMU 1) and Northern Footslopes

(RMU 5), to nine per cent in West Wimmera Plains (RMU 8) ($\chi^2 = 66.574$, $p < 0.001$) [Table X]. However, there was no significant difference in the area on each property where plants showed signs of salinity across RMU ($\chi^2 = 13.004$, $p = 0.112$).

Table 4
Area of property where plants showed effects of salinity
Wimmera region 2002, N=619

RMU	n	% 'yes'	<1 Ha	1-10 Ha	11-20 Ha	21-30 Ha	> 30 Ha	Median	Total Ha
1	15	50%	0%	20%	40%	13%	27%	15 ha	888 ha
2	9	21%	0%	75%	0%	0%	25%	25 ha	217 ha
3	2	25%	0%	90%	10%	0%	0%	3 ha	6 ha
4	22	35%	0%	67%	27%	0%	6%	18 ha	928 ha
5	33	50%	3%	61%	7%	13%	16%	10 ha	573 ha
6	15	14%	5%	36%	13%	14%	32%	4 ha	168 ha
7	11	24%	0%	100%	0%	0%	0%	10 ha	104 ha
8	8	9%	0%	44%	0%	11%	45%	4 ha	138 ha
9	16	13%	0%	50%	14%	7%	29%	20 ha	378 ha
Total*	132	23%	2%	57%	11%	9%	21%	10 ha	3,404 ha

* Totals calculated by adding RMU data will differ slightly from these figures. There were a small number of respondents who removed the identification number from the survey and could not be allocated to a RMU.

Using binary logistic regression, landholders in the Wimmera who reported saline affected areas were estimated as being almost two times more likely to establish perennial pastures (Wald = 7.576, $p = 0.006$, Exp(B) = 1.909).

There was no link established between respondents with saline affected areas (self-assessed) and adoption of the CRP trees and shrubs planted. However, amongst those who had adopted this CRP, respondents who reported larger areas of saline affected land on their property were significantly more likely to have planted a greater number of trees and shrubs ($t = 3.120$, $p = 0.003$). Greater knowledge of the area of saline affected land in the district was also significantly linked to respondents who had planted trees and shrubs (Wald = 4.735, $p = 0.030$, Exp(B) = 1.259).

Respondents who reported areas where vegetation showed signs of salinity were significantly more likely to report:

- work funded by government programs undertaken on their property in the past five years (Wald = 14.963, $p < 0.001$, Exp(B) = 2.703);
- dryland salinity was a threat to the long-term productive capacity of their property (Wald = 12.820, $p < 0.001$, Exp(B) = 1.790);
- greater knowledge about how to establish perennial pasture in the district (Wald = 10.300, $p = 0.001$, Exp(B) = 1.473);
- greater knowledge about the area of land affected by salinity in the district (Wald = 5.659, $p = 0.017$, Exp(B) = 1.425); and
- dryland salinity was a threat to the long-term productive capacity of land in the district (Wald = 4.364, $p = 0.037$, Exp(B) = 1.373).

6.3.1 Comparing respondent and expert assessments of salinity

It has been assumed that part of the explanation for limited adoption of recommended practices was that landholders were unaware of the extent of dryland salinity. As part of data analysis we compared each respondent's perception of the occurrence of salinity on their property with maps of saline discharge sites provided by the NRE. For more information about the salinity discharge maps used please refer to Allan *et*

al. (1997). Mail survey data was entered into an ArcView Geographic Information System (GIS) that contained layers for RMU and salinity discharge sites. A one kilometre buffer was adopted to provide some margin of error when comparing the location of discharge sites mapped on a 1:25,000 sheet with landholder reported salinity affected sites that could only be mapped as a property location. We then checked to see if those landholders that said they did not have any areas where plants showed the effects salinity were near a discharge site (using a spatial intersection).

Most respondents said they did not have areas on their property where plants showed the effects of salinity (77 per cent) [Map 3]. Only 10 per cent (N= 444, n= 43) of those reporting no effects of salinity on vegetation were within one kilometre of a discharge site on NRE maps [Map 4]. In other words, 90 per cent of the respondent landholders that said they had no areas currently affected by salinity were correct according to the expert maps [Map 4]. By comparison, in our other recent studies, five per cent of respondents reporting no effects of salinity in the Goulburn Broken Dryland (N= 456, n= 18) and 10 per cent in the Ovens Catchment (N=488, n=47) were within one kilometre of a discharge site on NRE maps (Curtis *et al*. 2000; Curtis *et al.* 2002).

There was also the opportunity to examine the efficacy of the expert maps by assessing their capacity to predict areas affected by salinity as identified by landholders. Twenty-three per cent (N=575, n=131) said they had areas on their property where plants showed the effects of salinity. The expert maps correctly predicted areas where salinity was affecting vegetation for 36 per cent (n= 47) of the 131 properties where landholders had identified salinity-affected areas [Map 5]. Assuming that landholders had correctly diagnosed saline affected areas, this research suggests that the expert maps had failed to predict 64 per cent of the areas affected by salinity. It is unlikely that landholders would deliberately overstate the extent of salinity on their property. However, there is a possibility that some landholders have failed to distinguish between waterlogged and saline affected areas. The scale of discrepancy between landholder reported saline affected areas and the expert maps suggests further investigation is warranted.

6.3.2 Level of concern about salinity

In another section of the survey, respondents were asked to indicate the importance of dryland salinity as a threat to the quality of river water in their district, the long-term productive capacity of land in their district and the long-term productive capacity of their property. Respondents were asked to select one of five response options from ‘very important’, ‘important’, ‘some importance’, ‘minimal importance’ and ‘not important’. This section also asked about a range of other environmental, social and economic issues, providing the opportunity to assess the relative importance of salinity to respondents [Table 2].

Dryland salinity was not rated highly as an important issue affecting the quality of river water (22 per cent rated very important/important) or the long-term productive capacity of respondent’s properties (11 per cent) or their district (22 per cent) [Table 2].

As mentioned earlier, respondents who reported areas showing signs of salinity were significantly more likely to be concerned about potential impacts of salinity on water quality (42 per cent $\chi^2 = 62.710$, $p < 0.001$), the productive capacity of their property (28 per cent $\chi^2 = 86.179$, $p < 0.001$) and district (40 per cent $\chi^2 = 41.642$, $p < 0.001$).

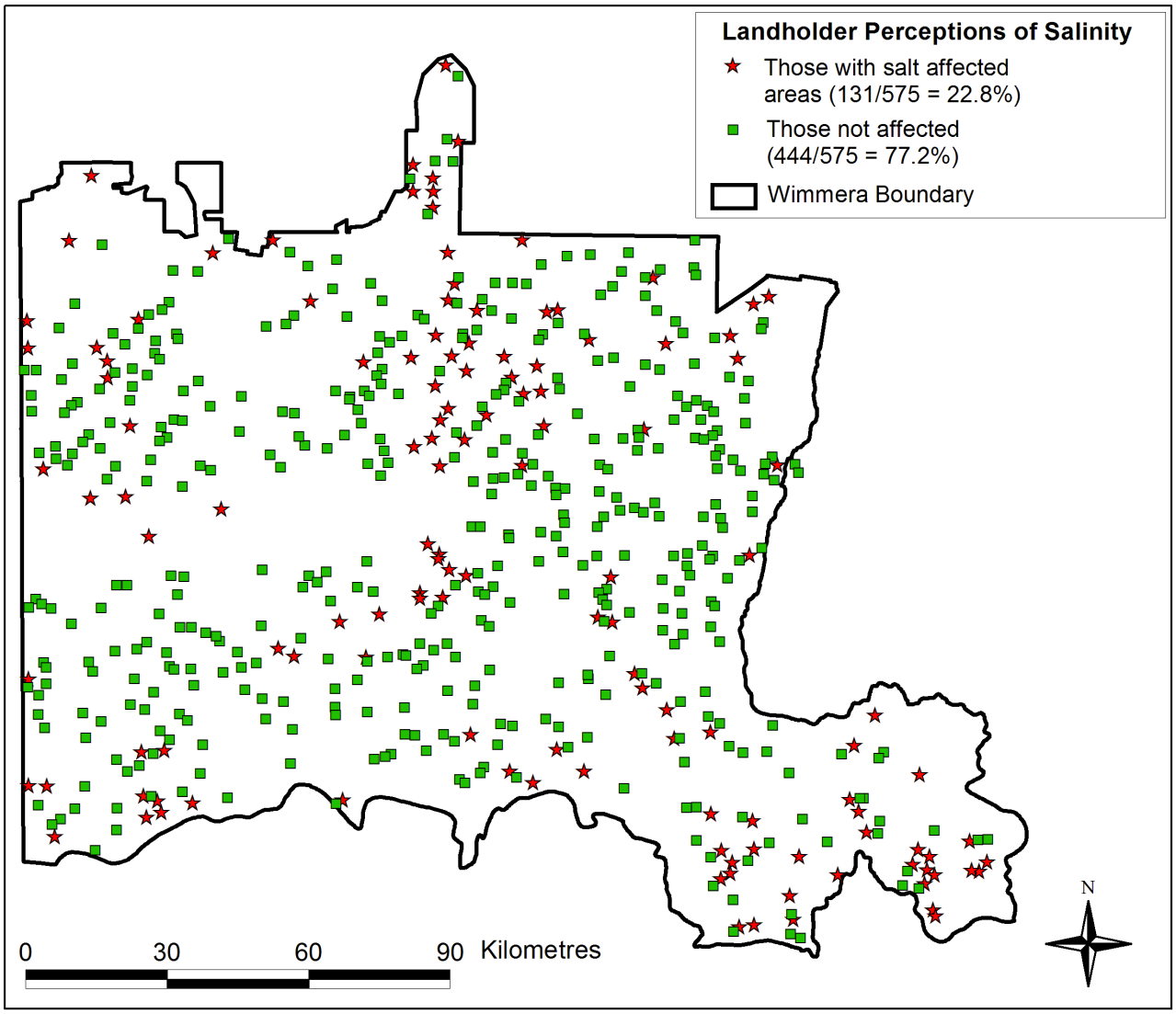
There were significant differences in the level of concern about the impacts of salinity across RMU [Appendix 1], ranging from:

- seven per cent of respondents in the West Wimmera Plains (RMU 8) to 42 per cent in the Northern Footslopes (RMU 5) for concern about the impact of salinity on water quality ($\chi^2 = 76.757$, $p < 0.001$);

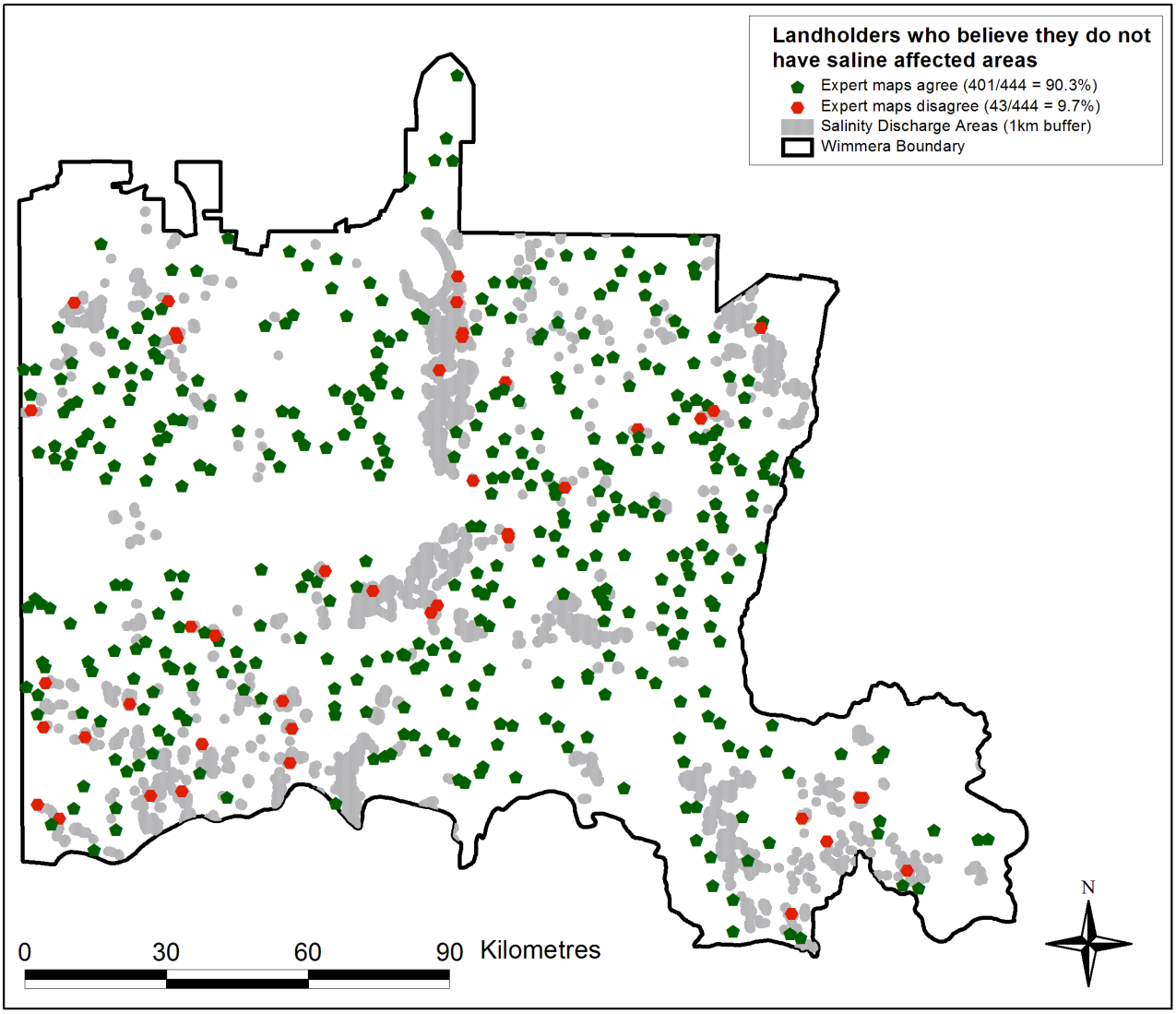
- 13 per cent of respondents in the South West Wimmera Plains (RMU 6) and West Wimmera Plains (RMU 8) to 38 per cent in the Northern Footslopes (RMU 5) for concern about the impact of salinity on the productive capacity of the region ($\chi^2 = 45.294$, $p < 0.001$); and
- zero per cent of respondents in the Grampians Group (RMU 3) to 22 per cent in Northern Footslopes (RMU 5) for concern about the impact of salinity on the long-term productive capacity of respondent's property ($\chi^2 = 45.839$, $p < 0.001$).

In the Wimmera region, higher concern about the impacts of dryland salinity (using the scale described in section 6.1) was also linked to significantly higher adoption of trees and shrubs planted (Wald = 5.951, p = 0.015, Exp(B) = 1.076).

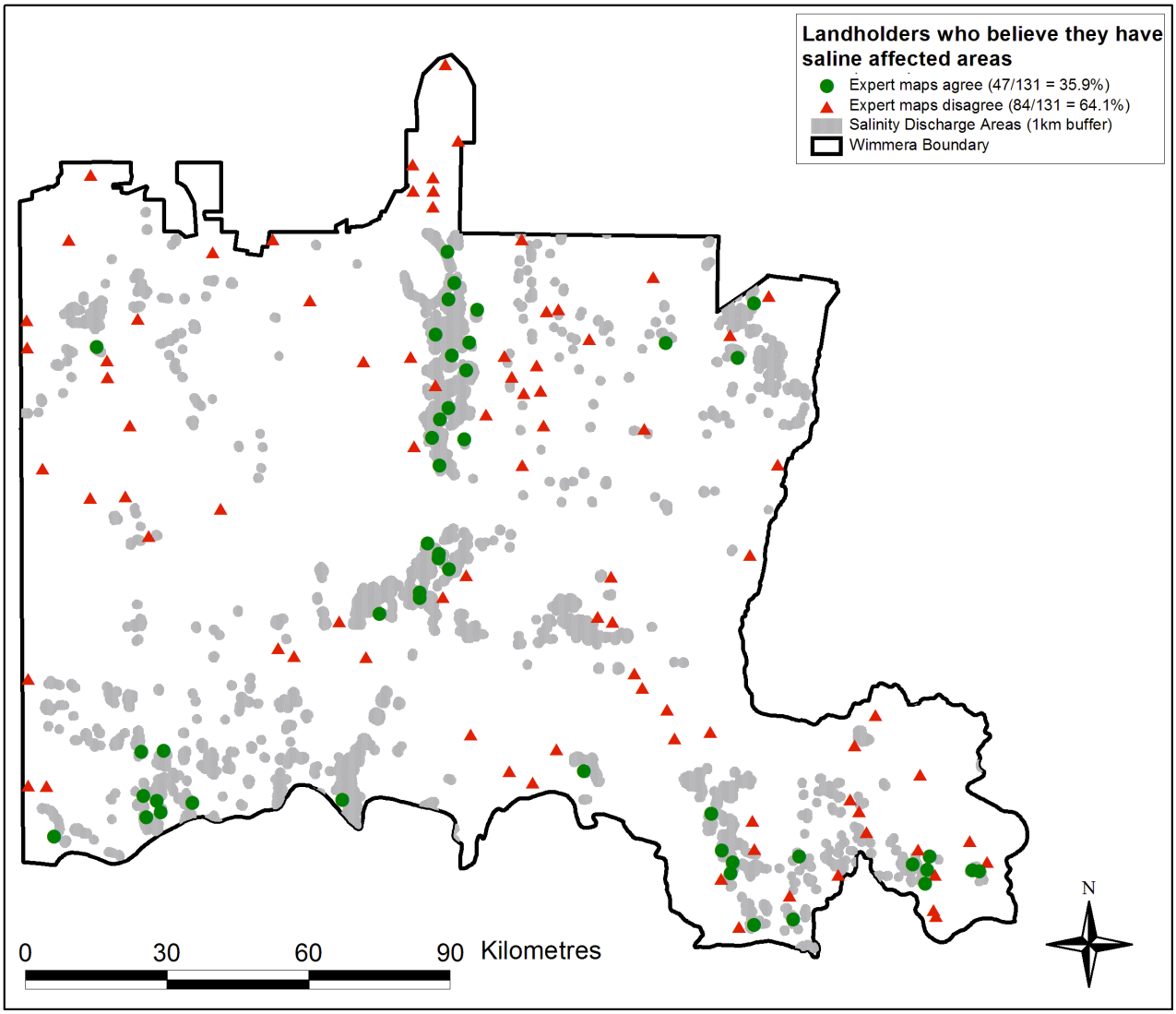
Map 3
Landholder perceptions of salinity
Wimmera region 2002, N=619



Map 4
Comparing landholder awareness of salinity with expert maps
Wimmera region 2002, N=619



Map 5
Comparing salinity problems reported by landholders with expert maps
Wimmera region 2002, N=619



6.4 Knowledge about natural resource management issues

Self-assessment is a widely accepted approach to gathering information about knowledge of natural resource management topics. One approach is to ask each respondent to answer questions that test their knowledge of a particular topic. The researchers then "correct" the respondent's answers (Shindler and Wright 2000). In this study respondents were asked to rate their level of knowledge about 15 topics relating to major natural resource management issues in the Wimmera region. For each statement, respondents were asked to select the best response option from amongst 'no knowledge', 'very little knowledge', 'some knowledge but need more information to act', 'sound knowledge - could take action if required', and 'very sound knowledge - could provide a detailed explanation to others' [Table 5].

There were only three topics where the majority of respondents indicated they had sufficient knowledge to take action if required.

1. How to manage ground cover on paddocks used for grazing to minimise soil erosion (76 per cent).
2. The extent of water savings as a result of the Wimmera/Mallee pipeline project (56 per cent).
3. How to collect samples for testing soil acidity and fertility (55 per cent) [Table 5].

Nearly half of all respondents also indicated they had sufficient knowledge to take action if required about the process leading to herbicide resistance (48 per cent) and how to prepare a farm or property plan (47 per cent) [Table 5].

For all other topics, including identifying sodic soils, the ability of perennial vegetation to prevent rising water tables, and people to contact about government programs to help manage erosion, there were at least a third of respondents who reported no/very little knowledge [Table 5].

The survey data highlighted particularly low levels of knowledge about:

1. the approximate per hectare returns of farm forestry (79 per cent no/little knowledge);
2. the extent of gully erosion (74 per cent no/little knowledge);
3. the area of salt affected land in the district (47 per cent no/little knowledge);
4. processes leading to soil acidification (45 per cent no/little knowledge); and
5. the value of woody debris in streams and rivers (45 per cent no/little knowledge) [Table 5].

There were a number of significant links between knowledge and adoption of CRP.

- Higher knowledge about how to collect samples for testing soil fertility and acidity was significantly linked to adoption of the CRP soil test recorded (Wald = 40.016, $p < 0.001$, Exp(B) = 2.519). While the majority of respondents indicated they had sufficient knowledge to act if required on this topic it is important to note that 45 per cent said they would require further information.
- Higher knowledge about the process leading to herbicide resistance was significantly linked to adoption of the CRP used minimum tillage practices (Wald = 15.139, $p < 0.001$, Exp(B) = 1.733).
- Higher knowledge about how to identify sodic soils was significantly linked to the adoption of the CRP non-wetting soils treated with clay (Wald = 5.134, $p = 0.028$, Exp(B) = 1.443).
- Higher knowledge about the ability of perennial vegetation to prevent water tables rising was significantly linked to adoption of the CRP sown introduced perennial pasture (Wald = 27.542, $p < 0.001$, Exp(B) = 1.710).
- Higher knowledge about organisations or individuals to contact for advice about government programs supporting landholders to better manage gully or stream bank erosion was significantly linked to adoption of the CRP native bush or water ways fenced (Wald = 8.677, $p = 0.003$, Exp(B) = 1.416).
- Higher knowledge about the value of woody debris in rivers and streams was significantly linked to adoption of the CRP fenced to protect eroded gullies or manage stock access to waterways (Wald = 27.313, $p < 0.001$, Exp(B) = 2.014).

- Higher knowledge about the area of land in the district where vegetation had been affected by salinity was significantly linked to adoption of the CRP trees and shrubs planted (Wald = 4.735, p = 0.030, Exp(B) = 1.259).

Survey data highlighted limited knowledge about many aspects of natural resource management in the Wimmera region. Furthermore, lack of knowledge appears to be an important constraint to the adoption of CRP. It is unreasonable to expect widespread adoption of CRP where there is limited knowledge about the extent of issues and the application of management techniques.

There were significant differences in level of knowledge on a number of topics across RMU. Respondents from the Desert Sands (RMU 1), Mallee Calcarous Plains (RMU 4), West Wimmera Plains (RMU 8) and Wimmera Plains (RMU 9) had significantly higher knowledge about the process leading to herbicide resistance in broad acre cropping situations with over 50 per cent indicating sufficient knowledge to take action if required. There was also higher knowledge about how to establish introduced perennial pasture such as phalaris for respondents in the Desert Sands (RMU 1), Northern Footslopes (RMU 5), South West Wimmera Plains (RMU 6) and the Undulating Alluvial Plains (RMU 7) [Appendix 1].

Table 5
Respondent knowledge of different topics
Wimmera region 2002, N=619

Topic	n	Sound knowledge/ Very sound knowledge	Some knowledge but need more	No knowledge/ Very little knowledge	Mean score
How to manage ground cover on paddocks used for grazing to minimise soil erosion.	600	76%	18%	6%	3.84
The extent of water savings as a result of the Wimmera/Mallee pipeline project reducing channel seepage and evaporation.	594	56%	29%	15%	3.50
How to collect samples for testing soil fertility or acidity.	602	55%	28%	17%	3.41
The process leading to herbicide resistance in broad acre cropping situations.	598	48%	28%	24%	3.29
How to prepare a farm or property plan that allocates land use according to different land classes.	593	47%	30%	23%	3.25
How to establish introduced perennial pastures such as phalaris in this district.	596	40%	26%	34%	3.01
Ability to identify sodic soils in this district.	597	33%	34%	33%	2.93
The ability of perennial vegetation to prevent water tables rising.	590	31%	36%	33%	2.93
The amount of native tree cover remaining in the Wimmera region as a percentage of what was there before the arrival of European settlers.	599	24%	42%	34%	2.87
Organisations or individuals to contact for advice about government programs supporting landholders to better manage gully or stream bank erosion.	585	26%	35%	39%	2.82
The value of woody debris such as snags in rivers/streams.	576	23%	32%	45%	2.69
The process leading to soil acidification in this district.	590	20%	35%	45%	2.63
The area of land with saline affected vegetation in your district.	585	16%	37%	47%	2.60
The extent of gully erosion across the Wimmera region.	583	5%	21%	74%	2.04
The approximate per hectare returns for farm forestry in the district.	582	5%	16%	79%	1.85

Mean score where 1= no knowledge through to 5 = very sound knowledge

6.5 Attitudes about the roles and responsibilities of various stakeholders

A set of four statements explored attitudes about the roles and responsibilities of different stakeholders in managing natural resources. For each statement, respondents were asked to choose one of five response options that ranged from 'strongly agree', 'agree', 'not sure', and 'disagree' to 'strongly disagree'. The five response options have been collapsed for presentation of data in Table 6.

Survey data highlighted uncertainty about which government agency was responsible for helping landholders manage pest plants and animals. Forty per cent of respondents said it was difficult to know which agency to turn to for advice or assistance in this area. Three-quarters of respondents also said that inaction by neighbours made it very difficult to control pest plants and animals on their property [Table 6].

Sixty per cent of respondents acknowledged that individual landholders must take responsibility for managing salinity on their land. At the same time, the vast majority of respondents also indicated that landholders should be rewarded for providing environmental services that benefit the wider community.

There were no links between these attitudinal variables and adoption of CRP.

There were significant difference between RMU in terms of the proportion of respondents who said it was difficult to know which government agency to turn to for advice in managing pest animals and weeds, ranging from 11 per cent in the Grampians Group (RMU 3) to 50 per cent in the Wimmera Plains (RMU 9).

Table 6
Roles and responsibilities of stakeholders
Wimmera region 2002, N=619

Statements	n	Strongly agree/Agree	Not Sure	Strongly disagree/ Disagree	Mean Score
Landholders should be rewarded for providing environmental services that benefit the wider community.	606	84%	12%	4%	4.12
Inaction by neighbours makes it very difficult to control weeds or pest animals.	603	75%	10%	15%	3.91
Individual landholders must take responsibility for managing salinity on their land.	606	62%	18%	20%	3.50
It is difficult to know which government agency to turn to for advice or assistance with the management of pest animals and weeds.	605	40%	16%	44%	2.98

Mean score where 1= strongly disagree through to 5 = strongly agree

6.6 Confidence in Current Recommended Practices

Respondents were asked to provide information about their level of confidence in fencing waterways and eroded gullies, watering stock off stream, cropping using stubble retention and works to prevent salinity. This information was gathered from nine statements. Respondents were asked to indicate the extent they agreed with each statement from the following options: 'strongly agree', 'agree', 'not sure', 'disagree' and 'strongly disagree'. To simplify presentation of this information responses have been collapsed into three groups 'strongly agree/agree', 'not sure' and 'strongly disagree/disagree'.

The majority of respondents acknowledged that fencing was an important part of the work required in revegetating waterways (70 per cent strongly agreed/agreed). Nevertheless, survey data highlighted some important concerns about the efficacy of fencing these areas. Over half of all respondents (55 per cent) reported that fencing waterways or eroded gullies makes it difficult to minimise the risk of fires and 49 per cent said that adoption of this CRP also makes it difficult to manage pest plants and animals. There was less concern about damage to fences by flood events (27 per cent strongly agreed/agreed) and fencing making it difficult to manage stock (27 per cent strongly agreed/agreed). Written comments on surveys suggested that many landholders were not convinced about the efficacy of fencing waterways and eroded gullies, particularly in terms of creating a harbour for pest plant and animals and increasing the risk of fire [Table 7].

There was also a high degree of uncertainty regarding the efficacy of watering stock off stream with the majority of respondents indicating they were uncertain that the time and effort involved was justified by the improvement in bank stability and water quality. Again there were many written comments highlighting difficulties in watering stock from a trough or tank [Table 7].

A substantial minority of respondents reported that problems with pests and disease and difficulties of seeding through stubble outweighed the benefits of stubble retention (32 per cent strongly agreed/agreed). In addition, a further 29 per cent of respondents were unsure about the efficacy of stubble retention [Table 7].

Survey data also highlighted much uncertainty about efforts to manage salinity in the Wimmera region. Only 17 per cent of respondents indicated that they were confident that scientists knew how to manage salinity in their district (52 per cent unsure) and nearly half of all respondents were unsure that on-ground work would be undertaken to prevent salinity undermining the viability of the district [Table 7].

There were no significant links between these variables and adoption of associated CRP.

The lack of any significant relationship between concerns about the efficacy of CRP and adoption suggests these concerns are not restricted to individuals who have not adopted. That is, it appears that concerns regarding the efficacy of CRP are in many instances based on respondents' experience. For example:

- 54 per cent of respondents who had fenced eroded gullies or waterways said this CRP makes it more difficult to manage pest plants and animals;
- 54 per cent of respondents who had fenced eroded gullies or waterways said this CRP makes it more difficult to manage the risk of fire;
- 54 per cent of respondents who had used conservation tillage practices were unsure or concerned about the efficacy of this practice;
- 53 per cent of respondents who had watered stock off stream were unsure that the time and expense was justified by the improvement in bank stability and water quality; and
- 52 per cent of respondents who had sown perennial pasture were uncertain scientists knew how to manage dryland salinity in their region.

There were significant differences across RMU for five of the topics relating to respondents' confidence in CRP [Appendix 1].

Table 7
Respondent confidence in current recommended practices
Wimmera region 2002, N=619

Statements	n	Strongly agree/Agree	Not Sure	Strongly disagree/ Disagree	Mean Score
Fencing to manage stock access is an essential part of the work required to revegetate river/creek/wetland frontages.	597	70%	18%	12%	3.76
Fencing river/stream/wetland frontages or eroded gullies makes it difficult to minimise the risk of fires.	583	55%	24%	21%	3.44
Fencing river/stream/wetland frontages or eroded gullies makes it difficult to manage weeds and pest animals.	582	49%	28%	23%	3.30
The time and expense involved in watering stock off-stream/wetlands is justified by improvement in bank stability and water quality.	576	35%	52%	13%	3.24
I'm confident that on-ground work will be undertaken to prevent salinity undermining the viability of this district.	595	34%	47%	19%	3.13
Fencing river/stream/wetland frontages or eroded gullies is not practical because of damage to fences by flood events.	574	27%	44%	29%	2.98
Problems with pest and diseases and the difficulties of seeding through stubble outweigh the benefits of stubble retention on cropping land.	599	32%	29%	39%	2.91
Fencing river/stream/wetland frontages or eroded gullies makes it difficult to manage stock.	575	25%	34%	41%	2.78
I'm confident scientists know how to manage dryland salinity in this district.	598	17%	52%	31%	2.78

Mean score where 1= strongly disagree through to 5 = strongly agree

6.7 Property size and farming as an occupation

A number of related topics that focus on occupation and property size will be addressed in this section, including:

1. property size;
2. occupational grouping that best describes the main area of paid/unpaid work; and
3. level of on and off-property work.

6.7.1 Property size

Survey data shows that most properties in the Wimmera region (65 per cent) were in excess of 600 hectares. The median property size for respondents was 900 hectares [Table 8].

There were significant differences in property size across RMU, ranging from a median of 161 hectares in the Grampians Group (RMU 3) to 1,290 hectares in the Desert Sands (RMU 1).

Property size is an important element in determining the financial viability of dryland cropping and grazing enterprises. There was a significant positive relationship between increased property size and likelihood of returning an on-property profit (χ^2 = 66.835, df = 1, p< 0.001); as well as a higher amount of on-property profit (r_s = 0.438, p< 0.001). The threshold considered the minimum to sustain a family and provide sufficient funds to maintain the natural and capital assets of a property is $50,000 (Rendell *et al.* 1996). The smallest property to report an on-property profit of over $50,000 was 175 hectares.

Analysis showed that property size was also an important element in property management issues. There were significant relationships between larger property size and the adoption of CRP:

- non-wetting soils treated with clay (Wald = 14.694, p < 0.001, Exp(B) = 1.001);
- spent time or money to control pest plants and animals (Wald = 6.551, p = 0.010, Exp(B) = 1.001).

Table 8
Proportion of respondents by property size for each RMU
Wimmera region 2002, N=619

RMU	n	% respondents in each property size category						Median (ha)
		10 - 40	41 - 150	151 - 300	301 - 450	451 - 600	> 601	
1	30	0%	3%	3%	7%	10%	77%	1290
2	40	5%	10%	5%	7%	8%	65%	796
3	8	25%	13%	50%	0%	0%	12%	161
4	62	0%	0%	7%	8%	6%	79%	1175
5	57	2%	17%	12%	18%	11%	44%	508
6	102	0%	8%	8%	8%	14%	62%	802
7	47	0%	2%	8%	14%	16%	60%	800
8	83	0%	1%	4%	9%	10%	75%	1011
9	129	2%	2%	5%	11%	11%	69%	995
Total*	573	1%	5%	8%	10%	11%	65%	900

* Totals calculated by adding RMU data will differ slightly from these figures. There were a small number of respondents who removed the identification number from the survey and could not be allocated to a RMU.

6.7.2 Occupation

Respondents were asked to list the occupational grouping that they thought best described their main area of paid/unpaid work in terms of the time and energy they put into that activity. Some examples were provided including farmer, teacher, accountant, investor and retiree.

Responses on the open-ended question were collapsed into five broad occupational groupings: farmer; professional; trades; retired; and other [Table 9]. Farmers were the largest occupational grouping and comprised the majority of all respondents (80 per cent). Only 20 per cent of all respondents were not farmers and these respondents owned only 13 per cent of all land.

There were significant differences across RMU with respect to the proportion of respondents with farming as their major occupation, ranging from 50 per cent in The Grampians Group (RMU 3) to 88 per cent in the Mallee Calcarous Plains (RMU 4) and the West Wimmera Plains (RMU 8) (χ^2 = 23.785, p = 0.002) [Table 9].

Amongst farmers, median on-property income ($45,000) and total on-property income ($21 million) exceeded median off-property income ($15,000) and total off-property income ($5.3 million).

In this study, farming as an occupation was not significantly linked to adoption of any CRP.

As expected, there were significant relationships between farming as an occupation and:

- longer hours worked on-property (Wald = 77.741, $p < 0.001$, Exp(B) = 1.095);
- higher on property profitability (Wald = 8.409, $p = 0.004$, Exp(B) = 1.272);
- larger property size (Wald = 4.429, $p = 0.035$, Exp(B) = 1.001); and
- lower off-property income (Wald = 14.999, $p < 0.001$, Exp(B) = 0.110).

Table 9
Landholder occupations
Wimmera region 2002, N=619

RMU	n	Farmer	Professional	Trades	Retired	Other: clerical, admin, retail, home duties
1	33	70%	3%	0%	18%	9%
2	43	72%	7%	0%	9%	12%
3	10	50%	20%	0%	20%	10%
4	65	88%	6%	1%	5%	0%
5	66	68%	15%	3%	5%	9%
6	106	84%	4%	0%	5%	7%
7	47	87%	5%	2%	2%	4%
8	90	88%	6%	1%	3%	2%
9	136	79%	9%	1%	6%	5%
Total*	605	80%	7%	1%	6%	6%

* Totals calculated by adding RMU data will differ slightly from these figures. There were a small number of respondents who removed the identification number from the survey and could not be allocated to a RMU.

6.7.3 Level of on and off-property work

Almost all respondents (96 per cent) indicated that they had spent time on farming related activities in the past 12 months. The median time respondents reported working per week on-property over the past 12 months was 50 hours. There were significant differences across RMU on this variable with median hours spent on farming related activities ranging from 11 hours per week in The Grampians Group (RMU 3) to 55 hours per week in the Mallee Calcarous Plains (RMU 4) ($\chi^2 = 20.087$, $p = 0.010$).

Thirty-eight per cent of respondents also reported that they had been involved in paid off-property work in the past 12 months. The median number of days spent in off-property work for these respondents was 50 days.

There were significant differences in the level of off-property work across RMU, from zero days per year in the Desert Sands (RMU 1), Flat Grey Plains (RMU 2), Mallee Calcarous Plains (RMU 4), South West Wimmera Plains (RMU 6), Undulating Alluvial Plains (RMU 7) and the Wimmera Plains (RMU 9) to 50 days per year in the Grampians Group (RMU 3) ($\chi^2 = 24.095$, $p = 0.002$).

6.8 Levels of income and property equity

The survey included five questions exploring levels of income and levels of equity in the property. A profit was defined as a situation where the amount of income from the property exceeded all expenses before tax. Respondents who indicated a profit were also asked to indicate the amount of profit from one of eight ranges. For the purpose of data analysis, each respondent was allocated the mid-point of the chosen dollar interval. These questions were completed by the vast majority of respondents with between 559 and 597 responses from the total of 619 surveys returned.

6.8.1 On-property income

Eighty-six per cent of respondents reported that their property returned a pre-tax profit in the 2000/2001 financial year. The median level of on-property profit reported was $45,000 and 46 per cent reported an on-property profit exceeding the $50,000 threshold discussed earlier in this report (Rendell *et al.* 1996) [Table 10].

There were significant differences in both the proportion of respondents reporting an on-property profit (χ^2 = 51.229, $p < 0.001$) and the level of profit (χ^2 = 101.291, $p = 0.002$) across RMU [Table 10].

On-property profit was only linked to the adoption of one CRP. Higher on-property profitability was significantly linked to adoption of the CRP stock watered from a trough or tank (Wald = 6.450, $p = 0.011$, Exp(B) = 1.172).

6.8.2 Off-property income

Approximately two thirds of respondents (66 per cent) reported an off-property profit in the 2000/2001 financial year. The median level of profit for these respondents was $15,000 [Table 10].

There were significant differences across RMU in terms of the proportion of respondents who said they had off-property income (χ^2 = 15.891, $p = 0.044$). There was no significant difference between RMU for the amount of off-property income reported.

Respondents who reported an off-property profit were significantly more likely to adopt the CRP trees and shrubs planted (Wald = 5.186, $p = 0.023$, Exp(B) = 1.607).

6.8.3 Total household income

Combining on and off-property income, 59 per cent of respondents had a total household income above the $50,000 threshold (median $60,000) [Table 10]. The combined total household income for all respondents was $34 million. Combined on-property income accounted for approximately 71 per cent of all income, or $24 million. Combined off-property income was approximately $10 million or 29 per cent of the combined total income.

Table 10
On and off-property income available to households
Wimmera region 2002, N=619

RMU	n	% indicating on-property profit	Median on-property profit	n	% indicating off-property income	Median off-property income	Combined median income	% earning >$50,000
1	32	88%	$45,000	33	70%	$30,000	$75,000	53%
2	42	81%	$45,000	40	78%	$20,000	$65,000	50%
3	10	40%	$5,000	10	100%	$25,000	$30,000	33%
4	64	91%	$55,000	61	54%	$15,000	$70,000	68%
5	66	65%	$25,000	66	74%	$30,000	$55,000	58%
6	105	91%	$35,000	104	67%	$25,000	$60,000	51%
7	46	91%	$35,000	46	59%	$15,000	$50,000	44%
8	88	94%	$55,000	89	61%	$15,000	$70,000	61%
9	135	87%	$55,000	134	65%	$15,000	$70,000	58%
Total*	597	86%	$45,000	592	66%	$15,000	$60,000	59%

* Totals calculated by adding RMU data will differ slightly from these figures. There were a small number of respondents who removed the identification number from the survey and could not be allocated to a RMU.

6.8.4 Level of property equity

Respondents were asked to indicate the level of equity in their property (excluding land they leased or share farmed) using five options, each covering a 20 per cent range [Table 11].

Survey data indicated high levels of equity for most respondents with 64 per cent indicating their equity level was between 81-100 per cent and 85 per cent greater than 60 per cent equity. Only 15 per cent of respondents said the level of equity in their property was below 61 per cent.

There were no significant differences across RMU in the level of equity reported by respondents.

There were no significant links established between reported level of equity and adoption of CRP.

Table 11
Level of equity
Wimmera region 2002, N=619

Equity level	n	% of respondents
Below 20%	580	2%
21% - 40%		4%
41% - 60%		9%
61% - 80%		21%
81% - 100%		64%

6.9 Budgeting and property plans

6.9.1 Property budget

Sixty-four per cent of respondents indicated that they had a property budget that was updated at least annually, and it seems that most properties were being managed using sound business practices [Table 12].

There were no significant differences across RMU in the proportion of respondents who had a property plan that was updated at least annually.

In this study there were few links between property budgeting and adoption of CRP, with the exception being used minimum tillage (Wald = 7.717, p = 0.005, Exp(B) = 2.119).

Table 12
Property budget updated annually
Wimmera region 2002, N=619

Property budget	n	% of respondents
Yes	587	64%
No		32%
Unsure		4%

6.9.2 Property planning

For this topic respondents were asked if they had prepared a written property plan that involved a map and/or other documents that addressed the existing property situation and included future management and development plans. The response options were 'completed', 'well advanced', 'halfway', 'early stages', and 'not started'.

Twenty per cent of respondents said they had completed or were well advanced with the preparation of a property plan. At the same time, most respondents (51 per cent) reported they had not started preparation of a property plan [Table 13].

There were no significant differences across RMU in the proportion of respondents who indicated they had a property plan.

In this study there were a number of links between property planning and adoption of CRP. Respondents who were further advanced in the preparation of a property plan were significantly more likely to adopt the CRP:

- fencing erected to protect eroded gullies or waterways (Wald = 10.810, p < 0.001, Exp(B) = 1.324);
- native bush or waterways fenced to manage stock access (Wald = 7.665, p = 0.006, Exp(B) = 1.238); and
- recorded soil test results (Wald = 20.748, p < 0.001, Exp(B) = 1.451).

It appears that there is a need for an ongoing investment to promote and assist landholders in developing a property plan.

Table 13
Preparation of a property plan
Wimmera region 2002, N=619

Property plan	n	% of respondents
Not started	577	51%
Early stages		14%
Halfway		7%
Well advanced		13%
Completed/ongoing		15%

6.9.3 Succession plan

Respondents were asked if their family had agreed on a succession plan to manage the transfer of their property to the next generation. The possible response options were 'not started', 'early stages', 'half way', 'well advanced' and 'completed/ongoing'.

Forty-five per cent of respondents said that they had not begun to plan the transfer of the property to the next generation. Sixteen per cent had completed these plans and 13 per cent were well advanced [Table 14].

There were no significant differences in the proportion of respondents who had prepared a succession plan across RMU.

There were no significant links between succession planning and adoption of CRP.

Table 14
Preparation of a succession plan
Wimmera region 2002, N=619

Succession plan	n	% of respondents
Not started	572	45%
Early stages		20%
Halfway		6%
Well advanced		13%
Completed/ ongoing		16%

6.10 Landholder stage of life and long term plans

6.10.1 Age

Most of rural Australia has an ageing population and this trend was expected to be an important constraint affecting landholder willingness and capacity to change CRP and enterprises.

The median age of Wimmera survey respondents was 53 years. Twelve per cent of respondents were under forty years, while 18 per cent were over 65 years. The over 65 years group managed 14 per cent of all land surveyed.

There was no significant difference in the median age of respondents across the RMU.

The common perception of younger age being linked with higher adoption of CRP was not largely supported by survey findings. There was only one CRP where younger age was significantly linked to higher adoption, reduced traffic on seasonally wet soils (Wald = 7.908, p = 0.005, Exp(B) = 0.968). This finding suggests that the ageing of rural landholders was not a major constraint to the adoption of CRP.

6.10.2 Long-term plans

Eleven statements explored the likelihood that each respondent's long-term plans would involve the following choices.

- The property will be sold.
- The property will be subdivided and a large part of the property sold.
- The property will be subdivided and a small part of the property sold.
- All or most of the property will be leased/share farmed.
- Someone else in the family will make the management decisions.
- Ownership of the property will stay within the family.
- The respondent will increase land they manage by purchasing, leasing or share-farming additional land.
- The respondent will retain ownership but no longer undertake much physical property work.
- The respondent will live on the property.
- The respondent will live off the property in a neighbouring town or rural setting.
- The respondent will live outside the region where the property is located.

The response options were 'highly likely', 'likely', 'not sure', 'unlikely', and 'highly unlikely' These choices were not mutually exclusive (person could respond positively to a number of choices). Where respondents indicated highly likely/likely for the property will be sold or will be subdivided and a large part sold, they were asked to indicate the year they thought this might happen. These response options have been collapsed to simplify the data presented in Table 15.

Survey data was expected to contribute to a better understanding of the potential for change in the management and ownership of land in the Wimmera, including:

- the extent of family succession and of hypothesised links between family succession and adoption of CRP and new enterprises;
- the extent there will be changes in property ownership in the next 10 years as older landholders pass the normal retirement age. A large turnover of ownership could have implications for extension; and
- predicting the extent and time of property transfer would help those evaluating the potential for policy initiatives such as purchases of land to accomplish catchment targets for salinity or biodiversity. The opportunity for intervention is likely to be strongest where properties are put up for sale as opposed to those that are transferred in the family.

Table 15
Likelihood that long-term plans will involve a range of choices
Wimmera region 2002, N=619

Choices	n	Highly likely/ Likely	Not sure	Highly unlikely/ Unlikely	Mean score
Ownership of the property will stay within the family.	597	71%	14%	15%	3.89
I will live on the property.	597	55%	15%	30%	3.32
I will retain ownership but no longer undertake much physical property work.	597	45%	24%	31%	3.12
Someone else in the family will make management decisions.	596	45%	14%	41%	2.98
I will increase the land I manage by purchasing, leasing or share-farming additional land.	596	43%	16%	41%	2.93
I will live off the property in a neighbouring town or rural setting.	601	31%	15%	54%	2.58
All or most of the property will be leased/share farmed.	594	23%	17%	60%	2.31
The property will be sold.	604	18%	19%	63%	2.25
I will live outside the region where the property is located.	595	14%	13%	73%	1.91
The property will be subdivided and a large part of the property sold.	597	4%	9%	87%	1.55
The property will be subdivided and a small part of the property sold.	594	3%	10%	87%	1.51

Mean score where 1 = highly unlikely through to 5 = highly likely

6.10.3 Continue to live on the property

Information in Table 15 shows that the majority of respondents (55 per cent) believed it was highly likely/likely that they would continue to live on their property in the long-term. This set of respondents managed 56 per cent of land surveyed. Some of these people indicated they were highly likely/likely to pass some or all of the management decisions to others. This could happen if they passed decision making to others in their family; to those who will lease all or most of the property; or to those who will purchase land when they subdivide and sell part of the property. For the purpose of this research it has been assumed that most respondents who continue to live on their property will make most of the management decisions.

There were significant differences in the proportion of respondents who said they were likely to continue to live on the property across RMU ranging from 30 per cent in the Desert Sands (RMU 1) to 67 per cent in the West Wimmera Plains (RMU 8) ($\chi^2 = 31.298$, $p = 0.012$).

There was a significant positive relationship between planning to continue living on the property in the long-term and the adoption of the CRP planted trees and shrubs in the past three years (Wald = 13.064, $p < 0.001$, Exp(B) = 1.268).

6.10.4 Property will stay within family

Seventy-one per cent of respondents said that ownership of their property was highly likely/likely to stay within the family [Table 15]. This set of respondents managed 75 per cent of land surveyed.

There were no significant differences across RMU on this variable.

There were no significant positive relationships between planning to retain property ownership in the family and the adoption of CRP.

6.10.5 Property will be sold or large part subdivided and sold

Only 18 per cent of respondents thought it was highly likely/likely that their property would be sold [Table 15]. A small proportion of respondents (four per cent) indicated that they would subdivide and then sell a large part of their property. Combining the two groups, 22 per cent thought it highly likely/likely that they would be selling all or a large part of their property.

There were no significant differences in the proportion of respondents who reported they were likely to sell all or a large part of their property across RMU.

There were no significant links between the intention to sell all or a large part of their property and adoption of the CRP.

6.10.6 Extent of property subdivision

Only seven per cent of respondents said that in the long-term they were highly likely/likely to subdivide and sell some part of their property [Table 15]. Those intending to subdivide owned six per cent of the land covered by the survey.

There were no significant differences on this variable across RMU.

There was no link between plans for subdivision and adoption of CRP.

6.10.7 Plan to lease or share farm majority of property

Twenty-three per cent of respondents said that they were highly likely/likely to lease or share farm the majority of their property in the long term. These respondents owned 17 per cent of land covered by the Wimmera survey [Table 15].

There were significant differences across RMU in the proportion of respondents who said their plans were highly likely/likely to involve leasing or share farming most of their property ranging from 11 per cent in the Northern Footslopes (RMU 5) to 38 per cent in the Wimmera Plains (RMU 9) ($\chi^2 = 44.989$, $p < 0.001$).

Respondents who said they were likely to lease or share farm most of their property were significantly less likely to adopt the CRP sown introduced perennial pasture (Wald = 10.604, $p < 0.001$, Exp(B) = 0.794).

6.10.8 Plan to purchase, lease or share farm additional land

Forty-three per cent of respondents said their long-term plans were highly likely/likely to involve increasing the area of land they manage by either purchasing, leasing or share farming additional land. These respondents already owned 52 per cent of the land cover by the survey [Table 15].

There were no significant differences across RMU for this variable.

Respondents who reported that their long term plans were likely to involve increasing the land they managed were significantly more likely to adopt the CRP recorded soil tests results (Wald = 5.334, p = 0.021, Exp(B) = 1.195).

6.10.9 Long-term commitment to living in the local region

If property owners expect to live in their local region on retirement, they might be more committed to taking action to address natural resource problems. Respondents were asked to indicate if their long-term plans involved them moving away from the region where their property is located. Most respondents were committed to living in their region in the long-term. Only 14 per cent of all respondents indicated they were highly likely/likely to live outside their region [Table 15].

There were significant differences in the proportion of respondents who reported they were highly likely/likely to live outside the region across RMU, from nine per cent in the West Wimmera Plains (RMU 8) to 31 per cent in the Desert Sands (RMU 1) ($\chi^2 = 27.787$, p = 0.034).

There were no significant positive relationships between planning to live outside the region in the long-term and the adoption of CRP.

6.10.10 When the transfer of property ownership is likely to occur

Respondents were allocated to one of three long-term options if they selected highly likely/likely for any of the options in Table 15. Those who did not place highly likely/likely on any option (n=24) were removed from the sample for this analysis.

1. Sell all or a large part of the property.
2. Retain property in the family.
3. Other plans, including continue to live on the property.

Those indicating highly likely/likely for only one long-term option were allocated to that option. Other respondents were allocated to one of the three options on the following basis and in the order shown:

- if they had a succession plan, then they were allocated to retain property in the family;
- if they nominated a date when they expected to sell the property, they were assumed to be likely to sell;
- if they planned to transfer the property in the family but did not have a succession plan they were still allocated to retain in the family as long as they had not indicated they were likely to sell; and
- those indicating highly likely/likely for both selling the property and retaining it in the family, had no succession plan and did not nominate a date to sell were assumed to be likely to sell.

The date of property transfer was assumed to occur in the year nominated on the survey. Where respondents had not nominated a date, it was assumed that transfer would occur on retirement at age 65 years for those under 65 years, and at death for those over 65 years. For the latter set, the ABS Life Tables (ABS 2001) were used to calculate the remaining life expectancy and provide the expected date of property transfer.

All other respondents were assumed to be planning to continue living on and retaining ownership until death required the transfer of their property. Obviously, transfer could then be within the family or to others. Again the ABS Life Tables (ABS 2001) were used to calculate remaining life expectancy and provide the expected date of property transfer.

The mean age (53 years) was assigned to those respondents (n = 12) who hadn't provided their age.

Adopting the approach outlined above:

- 20 per cent of respondents (n = 119) appear likely to sell their property;
- 69 per cent of respondents (n = 409) appear likely to pass the property to someone else in the family; and
- 11 per cent of respondents (n = 67) had other plans, mostly to stay on the property in the long-term.

The median year of transfer was 2015, with 17 per cent of properties expected to change hands by the end of 2006 (within five years from 2002) and 36 per cent by the end of 2011 (within 10 years from 2002).

The median year for property transfer by sale was 2010. The median year for property transfer through family succession was 2017. The median year for property transfer for other plans was 2018.

6.11 Involvement in government funded programs

The survey asked respondents to indicate their involvement in government funded programs, that amongst other things aim to assist landholders to implement improved land management practices. Respondents were asked three questions:

1. had work undertaken on their property been funded by government programs in the past five years;
2. were they currently a member of a Landcare group; and
3. were they currently a member of a Topcrop group.

6.11.1 Work funded by government on their property

Thirty-six per cent of respondents said that in the past five years there had been work on their property that had been partially funded by federal or state government programs [Table 16].

There were significant differences across RMU in the proportion of respondents who reported government funded work on their property, ranging from 24 per cent in the Mallee Calcarous Plains (RMU 4) to 60 per cent in the Northern Footslopes (RMU 5) ($\chi^2 = 36.010$, $p < 0.001$).

Respondents who said government contributions for work on their property were significantly:

- more likely to know which government agency to turn to for advice or assistance in managing pest plants and animals (Wald = 14.725, $p < 0.001$, Exp(B) = 0.673);
- more likely to report higher knowledge about the ability of perennial vegetation to prevent water tables rising (Wald = 10.076, $p = 0.002$, Exp(B) = 1.500);
- more concerned about the threat of dryland salinity to water quality in the district (Wald = 6.828, $p = 0.009$, Exp(B) = 1.352);
- more concerned about introduced plants and animals contributing to the decline of native plants and animals in the district (Wald = 6.747, $p = 0.009$, Exp(B) = 1.294);
- more likely to be a farmer by occupation (Wald = 6.520, $p = 0.0011$, Exp(B) = 2.334);
- more likely to own larger properties (Wald = 6.356, $p = 0.012$, Exp(B) = 1.001);
- more likely to report areas where plants show signs of salinity (Wald = 6.299, $p = 0.012$, Exp(B) = 1.500); and
- more likely to be concerned about reduced river/stream flow threatening the long-term health of rivers/streams/wetlands in the district (Wald = 4.781, $p = 0.029$, Exp(B) = 1.235).

There were significant positive relationships between respondents who reported government contributions and the adoption of CRP relating to:

- native bush and waterways fenced to manage stock access (Wald = 12.457, $p < 0.001$, Exp(B) = 2.296);

- trees and shrubs planted (Wald = 9.300, p = 0.002, Exp(B) = 1.893); and
- fencing to protect eroded gullies or manage stock access to waterways (Wald = 4.081, p = 0.043, Exp(B) = 1.755).

6.11.2 Landcare membership

Almost half of all respondents in the Wimmera region (47 per cent) said that they were a member of a Landcare group [Table 16].

There were significant differences in Landcare membership across RMU, from a low of 10 per cent in Grampians Group (RMU 3) to a high of 66 per cent in the Northern Footslopes (RMU 5) (χ^2 = 38.157, p < 0.001).

Landcare membership was significantly linked with:
- respondents who had completed a short course relevant to property management in the past five years (Wald = 18.376, p < 0.001, Exp(B) = 4.033);
- higher concern about the threat of dryland salinity to water quality in the district (Wald = 11.991, p = 0.001, Exp(B) = 1.566);
- higher knowledge about how to prepare a property plan (Wald = 10.502, p = 0.001, Exp(B) = 1.614);
- respondents who reported areas where plants showed the signs of salinity (Wald = 6.322, p = 0.012, Exp(B) = 2.388); and
- larger property size (Wald = 4.978, p = 0.026, Exp(B) = 1.001).

Membership of a Landcare group was significantly linked to adoption of the CRP expenditure on controlling pest plants and animals (Wald = 14.408, p < 0.001, Exp(B) = 3.179). The lack of any relationship between Landcare membership and other CRP may be explained by the finding that membership of a Landcare group was very strongly linked to respondents who had reported work funded by government programs undertaken on their property. Work funded by government programs was strongly linked with adoption of CRP relating to fencing and tree planting. Under the multi-variate analyses employed in the study, the high correlation between Landcare membership and involvement in government programs meant that Landcare membership often "dropped out" of the final model. That is, these two variables performed almost identical roles in the model and only one could be included.

6.11.3 Membership of a Topcrop group

Twenty per cent of survey respondents were a member of a Topcrop group [Table 16].

There were significant differences in the proportion of respondents who were a member of a Topcrop group across RMU, ranging from five per cent in the Northern Footslopes (RMU 5) to 37 per cent in the Mallee Calcarous Plains (RMU 4) (χ^2 = 31.844, p < 0.001).

Membership of a Topcrop group was significantly linked to:
- higher knowledge about identifying sodic soils in the district (Wald = 18.339, p < 0.001, Exp(B) = 1.995);
- respondents who had completed a short course relevant to property management in the past five years (Wald = 15.903, p < 0.001, Exp(B) = 5.125);
- respondents who had made greater progress towards a plan for the transfer of their property to the next generation (Wald = 12.936, p < 0.001, Exp(B) = 1.378); and
- respondents who spent fewer days in off-property work (Wald = 4.060, p = 0.044, Exp(B) = 0.995).

Membership of a Topcrop group was significantly linked to adoption of cropping related CRP.

- Topcrop members were significantly more likely to adopt the CRP soil tests recorded (Wald = 19.555, p < 0.001, Exp(B) = 4.681).
- Topcrop members were significantly more likely to adopt the CRP used minimum tillage practices (wald = 10.210, p =0.001, Exp(B) = 4.889).

Table 16
Involvement in government programs
Wimmera region 2002, N=619

RMU	n	Member of Landcare group	n	Member of Topcrop group	n	Work undertaken on property funded by government programs
1	33	49%	33	9%	33	46%
2	42	62%	42	26%	43	44%
3	10	10%	10	10%	10	30%
4	65	52%	65	37%	66	49%
5	67	66%	66	5%	65	60%
6	108	31%	108	14%	108	31%
7	46	50%	45	20%	46	24%
8	88	41%	88	28%	88	31%
9	136	35%	137	21%	136	25%
Total	605	47%	604	20%	605	36%

* Totals calculated by adding RMU data will differ slightly from these figures. There were a small number of respondents who removed the identification number from the survey and could not be allocated to a RMU.

6.12 Intention to take up stronger cost sharing

Most incentive programs reimburse landholders for all or part of the establishment costs associated with revegetation work. These costs can include the price of materials and labour for fencing, weed and pest animal control, ripping and seed/seedlings. However, there are other important costs, including those related to ongoing management to maintain fences, control weeds and pest animals and manage wildfires. There is also the issue of opportunity cost where a landholder forgoes potential income from other enterprises in the area revegetated. At the same time, revegetation can enhance farm productivity by providing wind breaks for crops and pasture, shelter for stock, materials for fencing and habitat for birds and insects that predate on pest species. In most instances, government programs have only funded part of the cost of establishment work and there has been no attempt to reimburse landholders for opportunity costs or pay a fee for ongoing management. To the extent that the full cost of revegetation work has not been funded, landholders have effectively subsidised conservation work.

In this research we wanted to assess the extent stronger incentives would motivate landholders to adopt revegetation.

The scenario we posed to respondents required them to enter a written agreement with the Wimmera Catchment Management Authority that would set out the nature of the work to be completed and payments to be made. This agreement was to run for 10 years and would be binding on anyone who purchased their property. The proposal offered a grant of $1,000 per hectare to fund establishment costs plus a payment at least equal to the gross returns per hectare from grazing for a period up to 10 years.

Almost all respondents (N = 619, n = 600) completed the question asking if they would apply for funding under this type of arrangement to carry out replanting with native species or better manage existing remnant bush over the next three years. Just under half said they were likely to apply (20 per cent said 'yes', 28 per cent 'more likely than not'). Twenty-nine per cent said 'unlikely' and 23 per cent said 'no'.

Respondents who said 'yes' or 'more likely than not' were significantly associated with:

- higher concern about the removal of native vegetation contributing to the decline of native birds and animals in the district (Wald = 19.071, $p < 0.001$, Exp(B) = 1.657);
- respondents who had work on their property funded by government in the past five years (Wald = 12.131, $p < 0.001$, Exp(B) = 2.242);
- the perception that landholders should be rewarded for providing environmental services that benefit the wider community (Wald = 7.488, $p = 0.006$, Exp(B) = 1.509);
- higher concern about the threat of salinity to the long-term productive capacity of their property (Wald = 6.971, $p = 0.008$, Exp(B) = 1.365);
- respondents who were less likely to report their long-term plans involved living off the property (Wald = 6.403, $p = 0.011$, Exp(B) = 0.822);
- younger age (Wald = 5.921, $p = 0.015$, Exp(B) = 0.978); and
- the perception that clearing for grazing or cropping had substantially altered the existence and diversity of native vegetation in the district (Wald = 5.821, $p = 0.016$, Exp(B) = 1.304).

Amongst those who said 'yes' and 'more likely than not', only three per cent of respondents did not think that the grant would enable them to do more replanting or better manage existing remnants than previously planned (54 per cent said 'yes', 43 per cent said 'possibly').

To give some indication of the potential of this arrangement, respondents who said the grant would allow them to revegetate on a larger scale than otherwise possible were asked to indicate the area they would like to plant with native species over the next three years. The total area these respondents indicated they would like to replant in the next three years using this funding arrangement was 6,075 hectares (median 12 hectares) or less than one per cent of the total area surveyed.

Intention to apply for funding to replant native species or better manage existing remnant vegetation was significantly linked with adoption of the CRP used minimum tillage practices (Wald = 5.701, $p = 0.017$, Exp(B) = 1.360) and native bush and waterways fenced to manage stock access (Wald = 4.657, $p = 0.031$, Exp(B) = 1.272).

Some of those who said they would not be involved may have done so because the package did not offer the full-cost of revegetation work, they lacked confidence in the WCMA or they did not fully understand the proposal or felt it lacked detail. Notwithstanding these points, it seems a large proportion of respondents simply were not interested in undertaking revegetation work on their property. This finding demonstrates the need for a variety of appeals and policy options.

Table 17
Cost Sharing
Wimmera region 2002, N=619

Grant program	n	Yes	More likely than not	Unlikely	No
Apply for funding to replant with native trees.	600	20%	28%	29%	23%
If yes or more likely	**n**	**Yes**	**Possibly**	**No**	
Would the funding allow you to plant more trees than you had previously planned.	290	54%	43%	3%	
If yes or possibly	**n**	**Median (ha)**			
How many hectares would you plant with native species over the next three years using these funds.	271	12 ha			

6.13 Other topics

6.13.1 Gender

Women play an important role in decision-making in farming families but their voice is often not heard (Curtis *et al.* 1997). About 32 per cent of Australia's farm work force is female and slightly less than 20 per cent of agricultural decision-makers are women (Elix and Lambert 2000). The mailing list for this survey was compiled from lists of rural property owners provided by local councils [see the earlier section on Methodology]. No attempt was made to target women property owners or managers.

Of the 605 respondents who gave an indication of their gender, 11 per cent were women.

There were no significant differences in the gender of respondents across RMU.

There were no significant links between gender and the adoption of CRP included in this project.

6.13.2 Time lived in the local district

This data was expected to give some insights into the extent respondents have had time to learn from experience about managing a property in their area and to locate themselves within their community.

Ninety-four per cent of respondents had been living in their local district for at least 10 years (median 46 years). This information suggests that the Wimmera region has had a fairly stable rural population.

There were significant differences in the time respondents had lived in the district across RMU, ranging from a median of 30 years in the Grampians Group (RMU 3) to 50 years in the Mallee Calcarous Plains (RMU 4) ($\chi^2 = 18.359$, $p = 0.019$) [Appendix 1].

There were no significant relationships between the length of time respondents had lived in their local area and the adoption of CRP.

7.0 LANDUSE/ENTERPRISE MIX

7.1 Introduction

Respondents were asked to provide information about their landuse/enterprise mix in two questions.

1. Select the best description from 12 options provided of the landuse/enterprises on their property.
2. Indicate the area allocated to 12 landuses/enterprises at the time of the survey and the area they expected to allocate to each in five years time.

We were interested in exploring the extent respondents were prepared to enter new enterprises, including farm forestry, grapes and other horticulture (flowers, olives, nuts) to assess the extent landholders were prepared to try new options that would diversify income sources away from cropping and grazing.

7.2 Best description of landuse/enterprise mix

Dryland cropping (84 per cent of properties) was the dominant landuse with dryland pasture (72 per cent), sheep for wool (sixty-four per cent) and sheep for meat (57 per cent) also reported by the majority of respondents. Forty-seven per cent of respondents also reported trees for shade and shelter, habitat, erosion control or recharge control. Only small minorities were involved in other enterprises including irrigated cropping or pasture, cattle for milk or beef, grapes, farm forestry and other horticulture [Table 18].

Table 18
Landuse/enterprise by property
Situation at the end of 2002
Wimmera region 2002, N=619

RMU	n	Dryland pasture	Irrigated pasture	Dryland cropping	Irrigated cropping	Sheep for wool	Sheep for meat	Beef cattle	Dairying	Grapes	Other hort.	Farm forestry	Other tree plantings
1	33	87%	7%	90%	3%	87%	74%	19%	0%	0%	0%	10%	45%
2	43	74%	10%	86%	5%	57%	62%	14%	0%	0%	2%	12%	62%
3	10	67%	0%	22%	0%	67%	44%	33%	11%	0%	33%	22%	44%
4	67	63%	0%	95%	2%	45%	48%	9%	2%	0%	2%	2%	46%
5	65	83%	3%	55%	0%	89%	49%	25%	0%	2%	5%	11%	54%
6	107	83%	4%	70%	7%	78%	74%	30%	0%	1%	2%	11%	52%
7	49	84%	8%	84%	2%	80%	71%	22%	2%	0%	4%	0%	41%
8	89	77%	1%	98%	0%	70%	58%	13%	0%	1%	1%	5%	40%
9	137	51%	3%	96%	2%	39%	43%	2%	0%	0%	0%	2%	45%
Total	586	72%	4%	84%	3%	64%	57%	17%	0.5%	0.5%	2%	6%	47%

Table 19
Future landuse/enterprise by property
Situation at the end of 2005
Wimmera region 2002, N=619

RMU	n	Dryland pasture	Irrigated pasture	Dryland cropping	Irrigated cropping	Sheep for wool	Sheep for meat	Beef cattle	Dairying	Grapes	Other hort.	Farm forestry	Other tree plantings
1	33	77%	7%	84%	7%	71%	65%	16%	0%	0%	0%	7%	44%
2	43	74%	12%	86%	5%	55%	60%	14%	0%	0%	5%	12%	61%
3	10	56%	0%	22%	0%	56%	44%	22%	11%	0%	22%	11%	40%
4	67	62%	0%	94%	2%	42%	48%	9%	2%	0%	2%	3%	48%
5	65	75%	2%	52%	0%	80%	42%	23%	0%	3%	5%	14%	55%
6	107	70%	6%	63%	7%	65%	63%	25%	0%	2%	1%	13%	52%
7	49	86%	8%	84%	2%	74%	69%	20%	0%	0%	4%	2%	43%
8	89	66%	2%	89%	0%	63%	47%	10%	0%	1%	0%	8%	43%
9	137	47%	3%	87%	2%	35%	41%	2%	0%	0%	1%	5%	43%
Total	586	66%	4%	78%	3%	57%	52%	14%	0.3%	0.9%	2%	8%	48%

7.3 Entry into new enterprises

Respondents were asked to provide an estimate of the area allocated to 12 landuses/enterprises on their property at the time of the survey and the area they expected to allocate to each by the year 2005.

The list of landuses/enterprises included four alternative or new enterprises:

- grapes;
- other horticulture (eg. flowers, vegetables, herbs, nuts etc.);
- farm forestry; and
- other tree planting for shade and shelter, habitat, erosion control or recharge control.

Survey findings highlighted very limited interest in emerging enterprises such as, grapes, other horticulture and farm forestry. By contrast involvement in tree planting for shade and shelter, habitat, erosion control or recharge control was quite widespread.

7.3.1 Grapes

Only three respondents (0.5 per cent) indicated that their enterprise mix included grapes, with a median area of 30 hectares. Survey data indicated very little intention to enter into grapes in the next three years with only an additional two respondents indicating that their enterprise mix was likely to include grapes. Both respondents who planned to include grapes as part of their enterprise mix in the future only intended to devote two hectares to this enterprise.

Due to the small proportion of individuals adopting grapes as an enterprise it was not possible to conduct analyses to identify variables linked to adoption.

7.3.2 Other horticulture

Of those surveyed, 13 respondents (2 per cent) said they had included other horticulture as part of their enterprise mix. The median area of land under this enterprise was 10 hectares. When asked to indicate their expected enterprise mix in 2005 there was no indication of additional entry into other horticulture. In fact, survey data indicated a very marginal exit with one of the 13 respondents currently involved in other horticulture indicating they would not be involved by 2005.

Again, given the small number of respondents, analyses of factors linked to the adoption of other horticulture is problematic. However, findings from chi-square tests may help provide some indication. Using chi-square tests the adoption of other horticulture as an enterprise was significantly linked to:

- respondents who were less likely to report making an on-property profit (54 per cent of those who adopted horticulture said they did not make an on-property profit compared to 12 per cent of all other respondents) ($\chi^2 = 18.623$, df = 1, p = 0.001); and
- respondents who were more likely to apply for government funding to replant native species in the next three years (92 per cent of those who adopted other horticulture said ‘yes’ or ‘more likely than not’ compared to 48 per cent for all other respondents) ($\chi^2 = 13.487$, df = 3, p = 0.004).

7.3.3 Farm forestry

Thirty-six respondents (six per cent) indicated that they were currently involved in farm forestry, with a median of 12 hectares under this enterprise. Survey data revealed a slight trend towards future entry into farm forestry with 46 respondents (eight per cent) planning to include this enterprise by the year 2005 (median area of 13 hectares).

Using chi-square tests the adoption of farm forestry was significantly linked to:

- higher value attributed to their property as native vegetation providing habitat for native birds and animals (67 per cent of those who adopted farm forestry said this was important/very important compared to 50 per cent of all other respondents) (χ^2 = 16.750, df = 4, p = 0.002);
- higher concern about introduced plants and animals contributing to the decline of native plants and animals in the district (45 per cent of those who adopted farm forestry said this was an important/very important issue compared to 33 per cent of all other respondents) (χ^2 = 14.677, df = 4, p = 0.005);
- respondents who were less likely to indicate that reluctance to change things at their stage of life was an important factor limiting their capacity to alter their enterprise mix (33 per cent of those who adopted farm forestry said this was an important/very important constraint compared to 50 per cent of all other respondents) (χ^2 = 13.588, df = 4, p = 0.009); and
- respondents who had work funded by a government program on their property in the past 5 years (53 per cent of those who adopted farm forestry said 'yes' compared to 35 per cent of all other respondents) (χ^2 = 4.349, df = 1, p = 0.037).

7.3.4 Tree planting for shade and shelter, habitat, erosion control or recharge control

Involvement in other tree planning was quite widespread. Nearly half of all respondents (47 per cent) reported involvement in this landuse. The median area of land under this use was 10 hectares. While the proportion of landholders with other tree planting appears likely to remain the same over the next three years (48 per cent), survey data indicates a trend towards larger areas planted with an expected median of 20 hectares by 2005.

Using binary logistic regression, adoption of the enterprise tree planting for shade and shelter, habitat, erosion control or recharge control was significantly linked to:

- respondents who had work funded by a government program on their property in the past 5 years (Wald = 16.897, p < 0.001, Exp(B) = 4.392);
- higher knowledge about who to contact for advice on government programs supporting landholders to better manage gully or stream bank erosion (Wald = 8.808, p = 0.003, Exp(B) = 1.607);
- respondents who were more likely to indicate the new enterprise fitted with work requirements of existing enterprises (Wald = 6.111, p = 0.013, Exp(B) = 1.555);
- higher concern about the removal of native vegetation contributing to the decline of native plants and animals in the district (Wald = 6.081, p = 0.014, Exp(B) = 1.520); and
- respondents who indicated there were areas on their property where plants showed signs of salinity (Wald = 3.916, p = 0.048, Exp(B) = 2.316).

7.4 Capacity to change enterprise mix

There were two parts to this section. In the first, the survey explored the importance of 18 factors that our previous research and industry partners thought were likely to affect landholder decision making about taking on a new enterprise. Enterprises suggested in the preamble included farm forestry, wine grapes, vegetables, cut flowers, nut trees or aquaculture. The response options were 'very important', 'important', 'some importance', 'minimal importance' and 'not important'. These response options have been collapsed into three categories – 'very important/important', 'some importance', and 'minimal/not important'.

In the second part of this section, we posed a scenario where respondents were asked to include/add farm forestry to their existing enterprise mix and then select from the list of 18 factors the three most important constraints affecting their decision. The far right column in Table 20 provides a summary of the proportion of "votes" for each topic as the most important constraint.

It seems there is a large number of constraints that are likely to limit entry of landholders into new enterprises. Eleven of the 18 topics listed in Table 20 had mean scores above 3.5 out of a possible five and from 65 per cent to 81 per cent of respondents rated the 11 constraints as very important/important influences on decision making.

It seems respondents are particularly concerned about low rainfall and limited water storage capacity, the existence of long-term markets, and commitment and support from their family [Table 20].

While economic (three) issues dominate the top five constraints in Table 20, respondents also identified a range of important social and environmental factors. This mix of environmental, social and economic issues represents a formidable challenge for those attempting to implement change in the enterprise mix in the Wimmera region.

When asked to indicate the most important constraint to the adoption of farm forestry, low rainfall and/or limited water storage capacity received the highest proportion of "votes" with 16 per cent. Needing a large investment of additional funds, time taken for income to come on-stream, and the extent the new enterprise fits with current enterprises or unsuitable soils were also rated as the number one constraint by 10 per cent or more of respondents. No respondents indicated that uncertainty about farm forestry in helping control rising water tables or lack of people in their district with that enterprise was the most important constraint [Table 20].

Table 20
Capacity to change enterprise
Wimmera region 2002, N=619

Topic	n	Very important/ Important	Not sure	Very unimportant/ Unimportant	% said most important	Mean score
Low rainfall and/or limited water storage capacity on your property.	568	80%	9%	11%	16%	4.03
Uncertainty about the existence of long-term market.	572	75%	15%	10%	9%	3.95
Extent there is commitment or support from family or partner(s).	579	77%	10%	13%	3%	3.92
Markets seem to be dominated by industry and producers are price takers.	561	69%	19%	12%	4%	3.85
Needs a large investment of additional funds.	573	70%	16%	14%	15%	3.79
Extent new enterprise fits with work requirements of existing enterprises.	573	69%	12%	19%	11%	3.76
Availability of labour.	576	71%	14%	15%	2%	3.74
Your soils are unsuitable.	567	62%	25%	13%	10%	3.74
Extent new enterprise fits with your existing lifestyle.	577	70%	11%	19%	4%	3.70
Need to invest considerable time/effort to acquire new knowledge/skills.	578	70%	12%	18%	3%	3.69
Better returns available from off-farm investments.	570	65%	21%	14%	3%	3.68
You will need to reorganise the physical layout of your property.	573	58%	21%	21%	1%	3.48
Income from enterprise does not come on-stream for at least five years.	573	55%	19%	26%	13%	3.47
It is difficult to access professional advice in this district.	569	51%	29%	20%	1%	3.38
Reluctance to change things at your stage of life.	580	48%	20%	32%	4%	3.27
The particular industry will lead to a smaller population in your district.	571	43%	33%	24%	1%	3.22
Uncertain that enterprise would help control rising water tables.	567	37%	42%	21%	0%	3.14
There are not many other people with this enterprise in your district.	567	35%	23%	42%	0%	2.93

Mean score where 1= very unimportant through to 5 = very important

8.0 CONCLUSIONS: FACTORS AFFECTING LANDHOLDER ADOPTION OF CURRENT RECOMMENDED PRACTICES

8.1 Adoption of Current Recommended Practices by respondent and Resource Management Unit

CRP information was obtained for use in analyses that attempted to explain differences in adoption by landholders. Respondents were asked to provide information for CRP across a range of issues [refer to section 5.4]. Some questions asked for details of the current situation on the property, others referred to activity over the past three years [Table 21].

There were significant differences across RMU for both the proportion of respondents who had adopted and the area adopted for most CRP explored in this research [Tables 22 and 23].

The results of multi-variate analyses exploring hypothesised links between independent variables and the adoption of CRP have been presented in earlier sections of the report. A summary of significant relationships is presented in Table 24. It is also important to identify those variables for which the hypothesised relationship(s) were not identified.

The ensuing discussion will examine the range of natural resource management issues, including dryland salinity, pest plants/animals and habitat decline and will attempt to highlight lessons for natural resource managers.

Four of the top five issues canvassed in the survey were social issues. Only one issue from either the economic or environmental aspects covered in the survey was considered to be very important/important by the majority of respondents. These findings suggest that appeals that focus primarily on environmental or production benefits of remedial or preventative action will have limited success. Higher concern about environmental impacts of native vegetation clearing and environmental and economic impacts of salinity were significantly linked to adoption of related CRP. However, these issues were not rated highly by the majority of respondents.

There was a diverse range of values attached to respondents' properties. Values considered most important included a sense of accomplishment from knowing the property will be passed on to others in better condition, providing the majority of household income and the freedom of being self-employed. Attempts to appeal to landholders in the Wimmera region should consider the broad range of values respondents attached to their property. There were links between the values attached to the property and adoption of CRP. Higher value in terms of the property providing the majority of household income was linked to lower adoption of the CRP fenced to protect eroded gullies and manage stock access to waterways. This finding appears to suggest that this CRP is considered problematic for respondents who depend on their property as a major source of income. The earlier finding of concern about the efficacy of fencing eroded gullies and waterways is likely to provide some explanation of this finding [refer to section 6.6].

It had been assumed that landholders were either unaware of the extent and impact of less obvious forms of land degradation, such as dryland salinity, or were in a state of denial. Those who reported saline affected areas on their property or were aware of the extent of salinisation in the district were significantly more likely to adopt CRP for salinity mitigation. These findings suggest that awareness is linked to adoption and that investment in salinity education in this region has/would contribute to raising salinity awareness and adoption of CRP linked to salinity mitigation. At the same time, our analyses suggested that respondents have excellent awareness of saline affected areas on their property.

Survey data highlighted strong links between adoption of CRP and knowledge of natural resource management issues. Of the 15 natural resource management issues explored in this research, there were only three (how to manage ground cover to minimise erosion, water savings from the Wimmera/Mallee pipeline, how to collect sample for testing soil acidity/fertility) where the majority of respondents reported sufficient knowledge to take action if required. More than half the respondents indicated they didn't have sufficient knowledge to act for the topics relating to the processes leading to soil acidity, dryland salinity and herbicide resistance, gully and stream bank erosion, preparing a farm/property plan and the approximate returns per hectare from farm forestry. It appears that investment in community education about these issues would promote greater adoption of CRP.

Survey findings highlighted a high level of concern about the efficacy of many CRP, primarily those relating to habitat conservation. Contrary to expectation, higher concern about the efficacy of CRP was not linked to lower adoption. It seems that both those who trial CRP, and those who do not, share concern about their efficacy. In other words, for many respondents, concerns about the efficacy of CRP are based on their experiences trialling these practices. For example, over half of the respondents who had fenced eroded gullies or waterways, used conservation tillage practices, watered stock off stream or sown perennial pasture had concerns about the efficacy of these practices. This is an important finding as it is widely assumed that landholders who trial a CRP are likely to continue with that practice and promote the efficacy of that practice to others. Findings from this survey suggest that these assumptions are problematic. This finding requires further investigation.

On-property profitability was only linked to the adoption of one CRP. This finding is in contrast to the authors' previous research in the Goulburn Broken and Ovens catchments, and appears to be explained by the comparatively high level of on-property profitability in the Wimmera region. Eighty-six per cent of all respondents reported an on-property profit and 46 per cent reported an on-property income above the $50,000 threshold required to sustain a household and fund investment in a farm's natural and capital resources (Rendell *et al.* 1996). These findings imply that improved economic conditions for example, a sustained rise in commodity prices, would have little impact on the adoption of CRP in the Wimmera region.

Respondents with properties larger than 600 hectares and those who were farmers by occupation owned most land, suggesting that an effective strategy to improve the adoption of CRP would include a strong focus on farmers. However, there is ongoing subdivision of properties in some parts of the Wimmera. Again, it needs to be emphasised that non-farmers, including retirees, are less likely to be motivated by appeals to improving agricultural production and profits. The finding that higher levels of off-property work was associated with significantly higher involvement in tree planting suggests that non-farmers can be motivated to adopt CRP, particularly those related to habitat rehabilitation.

Access to government funded programs was linked to higher adoption of CRP related to habitat rehabilitation. There were also some links between adoption and membership of Landcare and Topcrop groups. Respondents were also asked to indicate their level of interest in committing to additional revegetation work in exchange for an incentive package that provided for establishment costs, opportunity costs and a fee for active management. About half the respondents said they would take up the incentive proposal and that the proposal would substantially increase the area they revegetated. While this level of support is encouraging, it seems a large proportion of respondents simply were not interested in undertaking revegetation work on their property. This finding demonstrates the need for a variety of appeals and policy options.

Almost half of all respondents had completed or were in the process of developing a property plan and almost two thirds had a property budget that was updated at least annually. There were some links between involvement in these planning activities and higher adoption of CRP. While these findings are encouraging, 51 per cent were not involved in property planning and 32 per cent did not have a property budget. It seems a case could be made for the inclusion of these activities in community education programs. These findings suggest a need for continued investment in promoting and assisting landholders to undertake these planning processes.

The median age of Wimmera survey respondents was 53 years. The common perception of younger age being linked with higher adoption of CRP was not widely supported by survey findings, suggesting that the ageing of rural landholders was not a major constraint to the adoption of CRP. Indeed, there was only one CRP (reduced traffic on seasonally wet soils) where younger age was linked to adoption.

Table 21
Adoption of Current Recommended Practices
Wimmera region 2002, N=619

Management practices	Situation at 2002		Activity in past 3 years	
	% responding activity done	Median of those who responded	% responding activity done	Median of those who responded
Number of trees and shrubs planted			60%	250 plants
Number of paddocks where machinery or stock traffic has been reduced on seasonally wet soils.			16%	5 paddocks
Length of fencing erected to protect gullies or manage stock access [metres].	16%	2000 m	15%	2000 m
Area of native bush fenced to manage stock access [hectares].	32%	20 ha	28%	15 ha
Area of non-wetting soils treated with clay [hectares].	11%	63 ha	11%	63 ha
Number of paddocks for which you have a record of soil test results.	55%	6 paddocks	54%	7 paddocks
Area sown to introduced perennial pastures, including lucerne [hectares].	47%	120 ha		
Number of paddocks where stock is usually watered from a trough.	72%	8 paddocks		
Area cropped using minimum tillage practices [hectares sown].	67%	400 ha		
Estimated cost of work (materials & labour) to control rabbits, foxes and non-crop weeds in the last 12 months (your time @ $20 per hr).	86%	$1200		

Table 22
Adoption of Current Recommended Practices across RMU
Wimmera region 2002, N=619

Topic	RMU / % responding activity done									
	1	2	3	4	5	6	7	8	9	Test
Number of paddocks where machinery or stock traffic has been reduced on seasonally wet soils.	10%	12%	50%	6%	17%	18%	21%	16%	14%	χ^2=16.712 p=0.033
Length of fencing erected to protect gullies or manage stock access (total) [metres].	0%	32%	50%	8%	41%	13%	25%	6%	14%	χ^2=59.917 p<0.001
Length of fencing erected to protect gullies or manage stock access (past 3 yrs) [metres].	0%	27%	50%	8%	34%	13%	21%	6%	12%	χ^2=49.975 p<0.001
Area of non-wetting soils treated with clay (total) [hectares].	61%	2%	10%	6%	0%	19%	13%	23%	3%	χ^2=119.871 p<0.001
Area of non-wetting soils treated with clay (past 3 yrs) [hectares].	48%	0%	10%	6%	0%	19%	13%	20%	3%	χ^2=78.059 p<0.001
Number of paddocks for which you have a record of soil test results (total).	48%	51%	20%	65%	44%	58%	60%	58%	62%	χ^2=19.783 p=0.011
Number of paddocks for which you have a record of soil test results (past 3 yrs).	48%	51%	20%	61%	36%	56%	58%	58%	59%	χ^2=17.035 p=0.030
Area sown to introduced perennial pastures, including lucerne [hectares].	77%	48%	60%	36%	67%	71%	58%	37%	20%	χ^2=97.123 p<0.001
Number of paddocks where stock is usually watered from a trough.	90%	61%	40%	83%	30%	85%	71%	92%	67%	χ^2=101.366 p<0.001
Area cropped using minimum tillage practices [hectares sown].	58%	81%	20%	77%	33%	51%	77%	77%	84%	χ^2=87.225 p<0.001

Table 23
Level of adoption of Current Recommended Practices across RMU
Wimmera region 2002, N=619

Topic	RMU / median level of those reporting adoption of CRP									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Test**
Number of trees and shrubs planted.	200	500	1000	500	500	450	200	100	200	χ^2=22.153 p=0.005
Number of paddocks where machinery or stock traffic has been reduced on seasonally wet soils.	2	3	1	5	9	3	6	7	10	χ^2=16.426 p=0.037
Area of native bush fenced to manage stock access [hectares].	70	25	30	15	10	35	5	15	18	χ^2=16.828 p=0.032
Area of non-wetting soils treated with clay (past 3 yrs) [hectares].	150	N/A	150	60	N/A	50	40	54	5	χ^2=16.816 p=0.010
Area sown to introduced perennial pastures, including lucerne [hectares].	210	40	65	78	210	200	80	134	60	χ^2=34.800 p<0.001
Number of paddocks where stock is usually watered from a trough.	24	3	3	5	4	11	50	12	5	χ^2=98.509 p<0.001
Area cropped using minimum tillage practices [hectares sown].	265	400	265	400	100	170	250	400	500	χ^2=46.038 p<0.001

Table 24
Independent variables linked to the adoption of Current Recommended Practices
Wimmera region, 2002 N=619

CRP	● denotes a positive relationship ❍ denotes a negative relationship																												
Trees and shrubs planted							●						●					●				●					●		
Traffic reduced on seasonally wet soils						●								❍															
Fenced to protect gullies/waterways			●						❍									●			●								
Native bush or waterways fenced			●															●	●			●						●	
Non-wetting soils treated with clay	●														❍														●
Sown introduced perennial pastures		●		❍																			●						
Recorded soil test results			●		●											●													
Stock watered from a trough or tank										●	●	●																	
Used minimum tillage practices						●		●								●			●	●					●				
Expenditure to control pests plants/animals	●																●												
Independent variables	Property size	Areas where plants show signs of salinity	Written property plan	Plan to lease/share farm majority of property	Likely to increase land managed	Lease/share farm land owned by others	Plan to live on property in the long-term	Property budget	Property provides majority of household income	Property important as an attractive place to live	Level of on-property profit	Hours worked on-property	Off-property income	Age	Farm work a break from normal occupation	Member of a Top Crop group	Member of a Landcare group	Work on property funded by government	Likely to apply for revegetation grant	Lived longer in the local district	Threat of salinity to water quality in district	Removal of native vegetation and decline of birds and animals	Value of woody debris in rivers or streams	Collecting samples for testing soil fertility or acidity	Perennial pastures ability to prevent water tables rising	Processes leading to herbicide resistance	Area of saline affected land in the district	People to contact for advice about government help to manage gully/stream bank erosion	Identifying sodic soils in the district
	FARM MANAGEMENT								**SOCIO-DEMOGRAPHIC**												**CONCERN**		**KNOWLEDGE**						

9.0 REFERENCES

Allan, M., Reynard, K. and Williams, S. (1997). Dryland salinity discharge sites (linear and point). Department of Natural Resources and Environment, Melbourne.

Australian Bureau of Statistics. (2001). *Deaths.* Cat. No. 3302.0. ABS Government Publishing Service, Canberra.

Australian Soil Conservation Council. (1991). *Decade of Landcare plan.* ASCC, Canberra.

Barr, N. and Cary, J. (2000) Influencing improved natural resource management on farms. Bureau of Rural Sciences, Canberra.

Barr, N., Ridges, S., Anderson, N., Gray, I., Crockett, J., Watson, B., and Hall, N. (2000) Adjustment for catchment management. Murray-Darling Basin Commission, Canberra.

Curtis, A., Graham, M., Byron, I. and Lockwood, M. (2002). Providing the knowledge base for landscape change in the Ovens Catchment. The Johnstone Centre, Charles Sturt University, Albury.

Curtis, A., Lockwood, M., and MacKay, J. (2001a) Exploring landholder willingness and capacity to manage dryland salinity in the Goulburn Broken Catchment. *Australian Journal of Environmental Management* 8, 20-31.

Curtis, A., Robertson, A., and Tennant, W. (2001b) Understanding landholder willingness and capacity to improve the management of river frontages in the Goulburn Broken Catchment. The Johnstone Centre, Charles Sturt University, Albury.

Curtis, A. (2000). Landcare: approaching the limits of volunteer action. *Australian Journal of Environmental Management*, 7(1): 19-27.

Curtis, A. and Lockwood, M. (2000). Landcare and catchment management in Australia: lessons for state-sponsored community participation. *Society and Natural Resources*, 13: 61-73.

Curtis, A. MacKay, J. Van Nouhuys, M. Lockwood, M., Byron, I. and Graham, M. (2000). Exploring landholder willingness and capacity to manage dryland salinity in the Goulburn Broken Catchment. The Johnstone Centre, Charles Sturt University, Albury.

Curtis, A. and De Lacy, T. (1998). Landcare, stewardship and sustainable agriculture in Australia. *Environmental Values* 7: 59-78.

Curtis, A. and De Lacy, T. (1996). Landcare in Australia: does it make a difference. *Journal of Environmental Management*, 46: 119-137.

Curtis, A. and Race, D. (1996). *Review of socio-economic factors affecting regional farm forestry development in Australia.* The Johnstone Centre, Albury.

Curtis, A., Davidson, P. and De Lacy, T. (1997). The participation and experience of women in landcare. *Journal of Sustainable Agriculture*, 10(2/3): 37-55.

Dillman, D.A. (1979). *Mail and telephone surveys: the total design method*. Wiley. New York, USA.

Dovers, S.R. (1995). Information, sustainability and policy. *Australian Journal of Environmental Management* 2:142-156.

Dovers, S.R. and Mobbs, C.D. (1997). An alluring prospect? Ecology, and the requirements of adaptive management. In N. Klomp and I. Lunt (eds) *Frontiers in ecology: building the links*. Elsevier, Oxford.

Elix, J. and Lambert, J. (2000). Missed opportunities: harnessing the potential of women in agriculture. In Proceedings of the International Landcare Conference, March 2-5, 2000. Department of Conservation and Natural Resources, Melbourne.

Guerin, T. (1999). An Australian perspective on the constraints to the transfer and adoption of innovations in land management. *Environmental Conservation*, 26:4,289-304.

Haberkorn, G., Hugo, G., Fisher, M. and Aylward, R. (1999). *Country matters: a social atlas of rural and regional Australia*. Bureau of Rural Sciences, Canberra.

Lockwood, M., Hawke, M., Curtis, A. (2001) *Viability of revegetation incentives for meeting biodiversity and salinity objectives in the Goulburn-Broken Dryland. Johnstone Centre Report* No. 153. Johnstone Centre, Albury.

Millar, J. and Curtis, A. (1997). Perennial Grasses: finding the balance. *Australian Journal of Soil and Water Conservation*, 10:1,21-28.

Murray-Darling Basin Commission. (1990). *Natural Resources Management Strategy*. MDBC, Canberra.

Rendell, R., O'Callagan, P. and Clark, N. (1996). *Families, Farming & the Future.* Agriculture Victoria, Bendigo.

Shindler, B., and Wright, A. (2000). *Watershed management in the central cascades: a study of citizen knowledge and the value of information sources.* USDA Forest Service Research Report, Pacific Northwest Research Station, Corvallis, Oregon, USA.

Stirzacker, R., Lefroy, T., Keating, B. and Williams, J. (2000) A revolution in land use: emerging land use systems for managing dryland salinity. CSIRO Division of Land and Water, Canberra.

Vanclay, F. (1997). The social basis of environmental management in agriculture: a background for understanding Landcare. In S. Lockie and F. Vanclay (eds) *Critical Landcare*, Key Papers Series, No 5.: Centre for Rural Social Research, Charles Sturt University, Wagga Wagga.

Vanclay, F. (1992). The social context of farmers' adoption of environmentally-sound farming practices. In G.Lawrence, F. Vanclay and B. Furze (eds) *Agriculture, environment and society*. Macmillan, Melbourne.

Walker, G., Gilfedder, M., and Williams, J. (1999). *Effectiveness of current farming systems in the control of dryland salinity*. CSIRO Division of Land and Water, Canberra, ACT.

Wimmera Regional Catchment and Land Protection Board (WCLPB). (1997). *Wimmera Regional Catchment Management Strategy*. WCLPB, Horsham.

10.0 APPENDIX 1

Table 25
Assessment of issues across RMU
Wimmera region 2002, N=619

Topic	RMU / % said Very important or Important									
	1	2	3	4	5	6	7	8	9	Test
The decline of villages and small towns in this district is/will make it more difficult to attract investment in agriculture.	50%	50%	60%	73%	40%	57%	46%	59%	57%	χ^2=27.578 p=0.035
Difficulties accessing important health services is/will make it more difficult to retain or attract people to live in this district.	53%	57%	40%	61%	37%	51%	46%	64%	67%	χ^2=40.136 p=0.001
Changes to river/stream banks and flows have reduced the quality of recreational experiences in the district.	31%	48%	50%	79%	43%	30%	33%	32%	57%	χ^2=68.416 p<.001
Dryland salinity threatens the long-term productive capacity of land in this district.	28%	20%	30%	36%	38%	13%	28%	13%	18%	χ^2=23.451 p=0.002
Soil acidity threatens the long-term productive capacity of land in this district.	19%	15%	33%	5%	30%	29%	25%	9%	6%	χ^2=75.405 p<0.001
Farming practices contributing to erosion are undermining the long-term productive capacity of land in this district.	6%	15%	40%	15%	17%	8%	10%	17%	10%	χ^2=29.340 p=0.022
Dryland salinity threatens the long-term productive capacity of my property.	21%	10%	0%	15%	22%	7%	14%	3%	10%	χ^2=45.839 p<0.001
Soil acidity threatens the long-term productive capacity of my property.	13%	7%	0%	0%	22%	18%	12%	2%	8%	χ^2=51.171 p<0.001
Reduced river/stream flows threaten the long-term health of rivers/streams/wetlands in this district.	48%	74%	60%	83%	65%	41%	52%	38%	70%	χ^2=82.721 p<0.001
Dryland salinity threatens quality of river/stream/wetland water quality in this district.	28%	39%	40%	30%	42%	10%	30%	7%	17%	χ^2=76.757 p<0.001
Nutrient runoff from farms and towns threatens river/stream/wetland water quality in this district.	19%	23%	30%	23%	19%	15%	25%	9%	13%	χ^2=31.406 p=0.012

Table 26
Values attached to property across RMU
Wimmera region 2002, N=619

Topic	RMU / % said Very important or Important									
	1	2	3	4	5	6	7	8	9	Test
Provides most of our household income.	70%	77%	10%	87%	67%	77%	89%	93%	88%	χ^2=77.306 p<0.001
Sense of accomplishment from building/maintaining a viable business.	90%	91%	50%	90%	75%	81%	96%	92%	87%	χ^2=34.111 p=0.005
An asset that will fund my retirement.	57%	67%	50%	84%	54%	62%	57%	71%	73%	χ^2=35.953 p=0.003
A place for recreation for me, my family or friends.	48%	58%	90%	64%	59%	65%	58%	56%	53%	χ^2=29.621 p=0.020
Work on the property keeps me in touch with nature.	29%	50%	80%	52%	41%	51%	51%	50%	55%	χ^2=31.206 p=0.013
Work on the property is a welcome break from my normal occupation.	8%	25%	60%	23%	39%	34%	37%	28%	27%	χ^2=40.833 p=0.017

Table 27
Respondent knowledge of different topics across RMU
Wimmera region 2002, N=619

Topic	RMU / % said sufficient knowledge to take action if required									
	1	2	3	4	5	6	7	8	9	Test
How to manage ground cover on paddocks used for grazing to minimise soil erosion.	79%	64%	33%	75%	74%	74%	81%	90%	74%	χ^2=32.047 p=0.010
The extent of water savings as a result of the Wimmera/Mallee pipeline project reducing channel seepage and evaporation.	40%	52%	44%	80%	36%	41%	58%	51%	74%	χ^2=82.442 p<0.001
The process leading to herbicide resistance in broad acre cropping situations.	55%	38%	44%	64%	24%	42%	42%	61%	56%	χ^2=60.990 p<.001
How to establish introduced perennial pastures such as phalaris in this district.	64%	31%	22%	16%	59%	74%	52%	23%	18%	χ^2=155.303 p<0.001
Ability to identify sodic soils in this district.	34%	36%	11%	42%	17%	26%	34%	48%	32%	χ^2=29.807 p=0.019
The ability of perennial vegetation to prevent water tables rising.	41%	29%	33%	35%	48%	35%	25%	25%	23%	χ^2=42.285 p<0.001
Organisations or individuals to contact for advice about government programs supporting landholders to better manage gully or stream bank erosion.	13%	29%	44%	20%	50%	33%	31%	17%	26%	χ^2=53.176 p<0.001
The value of woody debris such as snags in rivers/streams.	14%	24%	33%	16%	38%	23%	29%	16%	23%	χ^2=34.345 p=0.005
The process leading to soil acidification in this district.	21%	15%	11%	13%	23%	32%	23%	22%	15%	χ^2=62.443 p<0.001
The approximate per hectare returns for farm forestry in the district.	0%	2%	0%	3%	11%	9%	2%	2%	3%	χ^2=31.445 p=0.012

Table 28
Roles and responsibilities across RMU
Wimmera region 2002, N=619

Topic	RMU / % said Strongly agree or Agree									
	1	2	3	4	5	6	7	8	9	Test
It is difficult to know which government agency to turn to for advice or assistance with the management of pest animals and weeds.	21%	35%	11%	38%	26%	47%	33%	40%	50%	χ^2=43.183 p<0.001

Table 29
Respondent confidence in current recommended practices across RMU
Wimmera region 2002, N=619

Topic	RMU / % said Strongly agree or Agree									
	1	2	3	4	5	6	7	8	9	Test
Fencing river/stream/wetland frontages or eroded gullies makes it difficult to manage weeds and pest animals.	39%	45%	22%	48%	56%	58%	55%	45%	43%	χ^2=27.631 p=0.035
The time and expense involved in watering stock off-stream / wetlands is justified by improvement in bank stability and water quality.	31%	50%	78%	32%	44%	27%	27%	31%	35%	χ^2=31.767 p=0.011
Fencing river/stream/wetland frontages or eroded gullies is not practical because of damage to fences by flood events.	20%	45%	22%	32%	28%	20%	29%	21%	29%	χ^2=39.220 p<0.001
Problems with pest and diseases and the difficulties of seeding through stubble outweigh the benefits of stubble retention on cropping land.	31%	26%	22%	28%	37%	37%	41%	36%	26%	χ^2=44.500 p<0.001
I'm confident scientists know how to manage dryland salinity in this district.	15%	34%	44%	18%	16%	14%	25%	11%	14%	χ^2=39.441 p=0.012

Table 30
Respondent long-term plans for property across RMU
Wimmera region 2002, N=619

Topic	RMU / % said Highly likely or Likely									
	1	2	3	4	5	6	7	8	9	Test
I will live on the property.	30%	45%	60%	50%	53%	60%	62%	69%	48%	χ^2=31.298 p=0.012
All or most of the property will be leased/share farmed.	13%	26%	30%	27%	11%	13%	13%	24%	38%	χ^2=44.989 p<0.001
I will live outside the region where the property is located.	31%	19%	20%	10%	14%	10%	11%	9%	16%	χ^2=27.787 p=0.034

Table 31
Time lived in the local region across RMU
Wimmera region 2002, N=619

RMU	Median yrs lived in local area
1	42
2	47
3	30
4	50
5	40
6	44
7	45
8	47
9	45

Table 32
Characteristics of Resource Management Units
Wimmera region 2002 (N=619)

Variables	Resource Management Units									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Median age	57 years	55 years	53 years	51 years	54 years	52 years	56 years	51 years	53 years	53 years
Farmer as primary occupation*	70%	72%	50%	88%	68%	84%	87%	88%	79%	80%
Median property size*	1,290 ha	796 ha	161 ha	1,175 ha	508 ha	802 ha	800 ha	1,011 ha	995 ha	900 ha
Median hours worked on property per week*	50 hours	50 hours	11 hours	55 hours	40 hours	50 hours	50 hours	50 hours	50 hours	50 hours
Median total household income (annual)*	$75,000	$65,000	$30,000	$70,000	$55,000	$60,000	$50,000	$70,000	$70,000	$60,000
% said property provided majority of household income*	70%	77%	10%	87%	67%	77%	89%	93%	88%	81%
Median time lived in local area*	42 years	47 years	30 years	50 years	40 years	44 years	45 years	47 years	45 years	46 years
% said they planned to continue to live on-property*	30%	45%	60%	50%	53%	60%	62%	69%	48%	55%
Landcare membership*	49%	62%	10%	52%	66%	31%	50%	41%	35%	47%
TopCrop membership*	9%	26%	10%	37%	5%	14%	20%	28%	21%	20%
% said rural decline was an important issue*	50%	50%	60%	73%	40%	57%	46%	59%	57%	56%
% reported saline affected areas on their property*	50%	21%	25%	35%	50%	14%	24%	9%	13%	23%
% said salinity was a threat to water quality*	28%	39%	40%	30%	42%	10%	30%	7%	17%	22%
% said salinity threatened on-property productivity*	21%	10%	0%	15%	22%	7%	14%	3%	10%	11%
% knew how perennial pastures could control salinity*	41%	29%	33%	35%	48%	35%	25%	25%	23%	31%
% knew how to establish perennial pastures*	64%	31%	22%	16%	59%	74%	52%	23%	18%	40%
% knew the processes leading to soil acidification*	21%	15%	11%	13%	23%	32%	23%	22%	15%	20%
% knew how to identify sodic soils*	34%	36%	11%	42%	17%	26%	34%	48%	32%	33%
% knew the approximate returns from farm forestry*	0%	2%	0%	3%	11%	9%	2%	2%	3%	5%
% said fenced waterways needed more pest management*	39%	45%	22%	48%	56%	58%	55%	45%	43%	49%
% adopted planting trees and shrubs*	48%	66%	80%	62%	56%	60%	67%	55%	64%	60%
% adopted fencing eroded gullies and waterways*	0%	32%	50%	8%	41%	13%	25%	6%	14%	16%
% adopted fencing native bush*	26%	49%	30%	35%	36%	33%	27%	26%	28%	32%
% adopted soil testing*	48%	51%	20%	65%	44%	58%	60%	58%	62%	55%
% adopted watering stock off-stream*	90%	61%	40%	83%	30%	85%	71%	92%	67%	72%
% adopted minimum tillage*	58%	81%	20%	77%	33%	51%	77%	77%	84%	67%

*Denotes variables where there was a significant difference across RMU using the Pearson or Kruskal-Wallace chi square tests.