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The social drivers of natural resource management in the Wimmera region

Report No. 68



Allan Curtis
Emily Mendham

**Research commissioned by:
Wimmera Catchment Management Authority**

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Curtis, Allan and Mendham, Emily (2012).

The social drivers of natural resource management in the Wimmera region, by A. Curtis, E. Mendham. Institute for Land, Water and Society, Charles Sturt University, Albury, NSW, 2640.

1 v., - (Report / ILWS, No. 68).

ISBN: 978-1-86-467244-2

Cover photos

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Final report to the Wimmera Catchment Management Authority

**Allan Curtis and Emily Mendham
with
Royce Sample and Simon McDonald**

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The social drivers of natural resource management in the Wimmera region

Acknowledgements

The authors thank Kieran Lawton, Tony Baker, Kerry Grigg and La Vergne Lehmann for their important contributions to this work as project managers for the Wimmera Catchment Management Authority (WCMA). We also thank other WCMA staff and Board Members who provided valuable comments on the survey instrument and draft report.

Staff from the following local governments also provided valuable support in preparing the property data (properties > 10 hectares) used to develop the survey mailing list: Ararat, Hindmarsh, Horsham, Northern Grampian, Pyrenees, Buloke, West Wimmera and Yarriambiack. Julie Baxendale and Kristy Neilson at the Northern Grampians Council coordinated the mail out process for that shire and we also thank them for their willingness to implement our survey process.

Finally we would like to thank all the landholders who took the time to complete the survey. A summary of this report will be mailed to all respondents.

Disclaimer

The views expressed in this report are solely the authors', and do not necessarily reflect the views of Charles Sturt University, the Wimmera Catchment Management Authority, the NCGRT or people consulted during the research project.

List of acronyms

ABS – Australian Bureau of Statistics
WCMA – Wimmera CMA
CMA – Catchment Management Authority
CRP – Current Recommended Practices
GIS – Geographic Information System
LGA – Local Government Area
RMU – Resource Management Unit
NRM – Natural Resource Management
RCS – Regional Catchment Strategy
VFF – Victorian Farmers' Federation

EXECUTIVE SUMMARY

This research was commissioned by the Wimmera Catchment Management Authority (WCMA) to provide data that would inform preparation of the 2012 Regional Catchment Strategy. The research gathered information that would enable the research team to address four key aims:

1. Assess progress in the achievement of natural resource management (NRM) program objectives at catchment and local government area scales that are consistent with objectives in the WCMA Regional Catchment Strategy.
2. Describe trends in social and farming structure (property size, property turnover, property subdivision/ amalgamation, occupational identity of landholders, extent of absentee ownership) for the region and for each local government area.
3. Provide a coherent explanation of landholder adoption of recommended practices identified in the WCMA Regional Catchment Strategy.
4. Provide advice about how to engage rural landholders in NRM.

The principal data collection instrument was a survey mailed to a random sample of rural landholders in the WCMA region during 2011. Similar surveys were undertaken in 2002 and 2007 by the Charles Sturt University research team led by Professor Allan Curtis. With the three surveys conducted over a decade there is the opportunity to identify longitudinal trends in social and farming variables and to provide insights into the outcomes of NRM investments in the region.

A response rate of 49% (494 completed surveys returned from the sample of 1,003) was achieved. To test for non-respondent bias we compared survey respondents with selected data for all rural property owners in the Wimmera using Australian Farm Census data. Those comparisons established that there were no significant differences between the survey respondents and the Wimmera respondents to the ABS survey.

Subsequent sections of the Executive Summary provide a brief overview of key findings for each survey topic. There is also a summary of the Conclusions section of the Final Report where we address key research objectives. All trends identified in the Executive Summary are statistically significant changes over time.

Long-term plans

Sixty-two percent of respondents intended to live on the property for as long as possible. The majority of respondents intended for ownership of the property to stay within the family (66%). Twenty-nine percent of respondents planned to sell all or most of their property and 28% of respondents intended to buy additional land.

Survey data suggest the Wimmera has had a relatively stable rural landholder population in that the median length of residence in the local district was 45 years, while the median length of property ownership was 28 years. Modelling of future rates of property turnover suggested there will be unprecedented rates of property turnover in the future, with the change in ownership of half of all properties occurring in the next decade. This predicted rate of property turnover involved 44% of the land area.

Assessment of issues

The item for which most respondents expressed concern at the district scale was the loss of important services (61%), followed by the impact of reduced water flows (50%), decline in soil health (45%) and salinity threatening water quality (41%). At the property scale, the issue most respondents expressed concern for was the impact of managing weeds and pests (54%), followed by the impact of changing rainfall patterns on property viability (47%) and uncertain/low returns limiting the capacity to invest on property (44%).

A comparison between 2002 and 2011 could be made for two of the seven property scale items and four of the 15 district level issues. At the property scale, there was increased concern about the impact of weeds and pest animals affecting profitability. At the district scale, there was increased concern for three of the four issues, including dryland salinity threatening productive capacity of land, salinity threatening water quality in rivers and farming practices contributing to erosion. A reduced proportion of landholders expressed concern about the impact of reduced water flows, perhaps a reflection of changed seasonal conditions in 2011.

Values

The most highly ranked value attached to property was for providing the lifestyle that I want. Being part of a rural community and an attractive place to live were rated equal second, along with being able to pass the property on in better condition. The next highest rated value was a sense of accomplishment from improving property infrastructure, followed by rural land representing a sound long-term investment and a great place to raise a family. Most respondents gave a high rating to at least one of the social, environmental and economic value statements in the survey.

Of the 19 statements exploring attached values, data for 2002 and 2011 were available for 12 items. There was a decline in the proportion of respondents who said the property provides most household income, and increases in the proportion of respondents who gave an important rating to the environment of my farm sustains life for different plants and animals, my property is an attractive place to live, being part of a rural community, my property is a great place to raise a family, and work on property is a welcome break from my normal occupation. These trends are consistent with other data indicating changes in the social structure of the region, including a decline in the proportion of respondents self declaring as farmers by occupation. Farmers were more likely to say they depended on property income and were motivated by the sense of accomplishment from maintaining a viable business.

Held values

Between 2007 and 2011 there has been an increase in the median score for the item measuring a landholder commitment to a stewardship ethic. Indeed, in 2011 there is, for the first time in the Wimmera surveys, a small majority of respondents exhibiting a stewardship ethic (52%).

Views on the roles and responsibilities of different NRM actors

The three highest rated statements in this topic were that landholders should manage their properties in expectation of extreme weather events, landholders should be paid for providing environmental services that benefit the wider community and paddock trees are important because they provide a place for native animals to shelter and feed. Widespread agreement with

the second statement is to be expected, but the high level of support (around 75% agreed) for the other two statements suggests that most landholders acknowledge or understand some of the fundamental assumptions of contemporary NRM policy. It also seems that many landholders have attitudes and beliefs that conflict with contemporary NRM policy, particularly where statements are examining views about private property rights. For example, 46% of respondents agreed that landholders should have the right to harvest water that falls on their property, even if that action impacts on others. On a more positive note, the proportion agreeing with this statement had declined and a larger proportion agreed that the public should have the right of access to rivers, streams and wetlands on private property. Several survey items explored aspects of the concept of a landholder duty of care towards the environment. Half of all respondents agreed that it is fair for the wider community to expect landholders to manage land in ways that will not cause foreseeable harm to the environment. However, only 38% agreed that in the future landholders should be legally responsible for managing land in ways that do not cause foreseeable harm to the environment. These results were similar to those in 2007.

Confidence in CRP

Over 80% of respondents expressed confidence in fencing waterways as a practice to improve riparian areas and 73% agreed that fencing to manage stock access to waterways is an essential part of the work required to revegetate those areas. While 42% agreed that the time and expense involved in watering stock off-stream was justified, only 5% disagreed and 53% were either unsure or thought this CRP was not appropriate for them (i.e. it is possible they don't have a stream/ wetland). Despite recent concerns about the efficacy of direct drilling because of residual stubble and pests, most respondents agreed that the benefits of stubble retention on cropping land outweigh problems arising (55%). Only 10% of respondents disagreed with this statement. Survey data suggest that landholder confidence in CRP is improving over time in that there was a positive change for the three items (out of five) where a change had occurred. Those positive changes related to the benefits of stubble retention on cropping land, the time and expense involved in watering stock off-stream and fencing to manage stock access to waterways.

Knowledge

There were only three topics where over 50% of respondents reported they had sound knowledge: how to use chemicals correctly, grazing and cropping strategies to manage paddock ground cover to minimise soil erosion, and the benefits of retaining native vegetation on properties. Of the 20 items included in the knowledge topic of the 2011 survey, there were 11 items where data were available over the past decade, with a change for seven items. Self-reported knowledge increased for four items, including those items relating to perennial pasture (the ability of perennial pasture to prevent water tables from rising and how to establish perennial pasture in the local district), the severity of gully erosion across the region, and the value of woody debris such as snags in rivers and streams. The three items where knowledge had declined were: how to use soil samples, the extent of water savings as a result of the Wimmera-Mallee pipeline, and the area of land affected by salinity in the district. Between 2007 and 2011, knowledge increased for: the use of stock containment areas to manage stock in drier seasons, the benefits of retaining native vegetation on properties, how to identify local plant species, and how to protect and improve the health of native bush areas.

Land use

The most common land use among respondents was dryland pasture (69%), followed by broadacre cropping (67%) and sheep (63% for meat and 57% wool production). Fifty-seven percent of respondents had planted more than a hectare of trees on their property, and 15% reported that some part of their property was under a conservation covenant or management agreement. Ten percent of respondents reported having remnant vegetation on their property.

Uptake of CRP

The CRP implemented by most respondents was planting trees and shrubs (56% during the full period of their management and 32% in the past five years). Over 50% of respondents had implemented practices related to cropping (minimum tillage, adaptive no-till and precision farming).

Our view is that the median amount of on-ground work implemented for each practice represents a substantive, rather than a symbolic contribution to NRM outcomes. For example, the median amount of tree planting undertaken by respondents was four hectares in the last five years. This amount of tree planting is likely to have an impact on catchment condition if that work is strategically located, replicated by others, and properly maintained.

Fencing to manage stock access to rivers/streams/wetlands was the CRP for which most respondents had received funding over the past five years (42% of those implementing the practice) and over the period of management (52% of those implementing). For all other CRP, more respondents indicated they had undertaken work without government assistance than with it.

Analysis of trends over time indicate:

- an increase in those involved in farm forestry as well as the area on which the practice was undertaken (period of management);
- a decrease in those sowing perennial pasture and the area on which it was sowed (period of management);
- a decrease in those undertaking minimum tillage (the median area remained stable) (last five years);
- a decrease in those planting trees/shrubs but an increase in the number of trees planted (last five years); and
- a decrease in those fencing bush/grasslands to manage stock access and a decrease in the median length of fencing erected (last five years).

Information sources

The most widely utilised source of NRM information was newspapers (59%), followed by books, magazines and journals (53%). Thirty-nine percent of respondents reported using the Wimmera CMA for information on NRM topics. Seventy percent of respondents received information in the post. It seems that respondents are drawing upon a more diverse set of information sources, and that there are important differences in those sources for farmers and non-farmers. Non-farmers are less likely to rely on traditional sources such as the CMA, farmer/ commodity organisations and extension staff.

Wetlands and groundwater

The survey included a set of items exploring respondent views about risk in relation to groundwater and wetlands management and trust and trustworthiness in relation to wetlands management. It seems many respondents were unsure regarding the trust items (between 33% and 48% of respondents selecting unsure) and trustworthiness items (48%-49%). For example, 49% were unsure if sound principles seem to guide the WCMA decisions about river frontage management (18% both agreed and disagreed); and 48% were unsure if the WCMA keeps landholders' interest in mind when making decisions about river frontage management (16% agreed and 21% disagreed). These items provide a benchmark for future surveys.

Survey data suggest that most/almost a majority of respondents were concerned about the potential for negative outcomes from cropping and draining wetlands and pumping groundwater in the Wimmera region. For example, 52% of respondents agreed that only a few people in the Wimmera would receive benefits from cropping and draining wetlands, and 47% agreed that only a few would receive benefits from pumping groundwater. A comparison of those who live close to (i.e. within a kilometre of a wetland) and those who live further away (i.e. beyond one kilometre) established that those who own property closer to a wetland are less concerned about negative impacts of cropping and draining wetlands, more optimistic that negative impacts can be managed, and more positive about the extent that the benefits of cropping and draining wetlands will be shared widely.

Social and farming structure

The social benchmarking data suggest there have been important changes in the social and farming structure of the Wimmera region over the last decade. There has been a significant decline in the proportion of respondents identifying as farmers by occupation, from 80% identifying as farmers in 2002 to 56% in 2011. The 2011 survey data also demonstrates that farmers and non-farmers are very different. These differences are likely to have important implications for regional NRM practitioners seeking to achieve resource condition changes and do that by engaging rural landholders.

Non-farmers were more likely to own smaller properties; to have owned their property and lived in the district for shorter periods of time; to be absentee landholders; to plan on selling or subdividing their property; and to have spent more time engaged in off-property work. Non-farmers were also less likely to spend time undertaking on-property work; to be a member of a commodity group; to have undertaken a short course related to property management; and to have family interested in taking over the property or to have started succession planning. Farmers had significantly higher self-rated knowledge on 11 of the 19 knowledge topics included in the survey. Non-farmers exhibited greater concern for the environment in terms of the values they attached to their property; levels of concern for specific environmental issues; the item measuring an environmental stewardship ethic; and their support for a duty of care for biodiversity. Non-farmers were also more likely to agree with statements consistent with contemporary NRM policy, while farmers were more likely to be concerned about maintaining private property rights, including access to resources when that access might have negative impacts for others. There were also important differences in the key sources of information for farmers and non-farmers, with non-farmers less likely to use traditional sources of NRM information such as the WCMA, field days and extension officers. Farming as an occupation was significantly linked to the implementation of five CRP included in the 2011 survey. These were

positive associations with adaptive no-till, minimum-tillage, precision farming and sowing perennial pasture; and a negative relationship with tree-planting. These relationships are consistent with the different value orientations and knowledge of farmers and non-farmers.

Modelling of property turnover suggests the Wimmera region is likely to experience a change in ownership of up to 50% of rural properties in the next 10 years. This expected increase suggests there will be a change from a relatively stable rural landholder population of the Wimmera in the past, given the median length of residence is 45 years and the median length of property ownership is 28 years. This trend largely reflects the approaching retirement of an ageing cohort of baby-boomer farmers. The predicted turnover in the Wimmera based on 2011 data is an increase on that predicted in 2002 (50% change in 15 years or approximately 25% by 2010). Only 10% of the 2011 survey respondents identified as new property owners in the past 10 years, prompting some reflection amongst the research team. We are confident that our approach to predicting property turnover is reliable. Our approach is largely based on assumptions consistent with Australian Bureau of Statistics data about median age of farmers, the median retirement ages of farmers and life expectancy tables for Australians. It has previously been supported by comparisons with property sales data for the Corangamite and Wimmera regions. It is possible that predicted rates of transfer have not occurred because landholders have not wanted to sell during the extended drought. It is also possible that there has been an increase in multiple property ownership as existing owners purchase property from other longer-term (> 10 years) owners wanting to exit agriculture.

Given that the ageing baby boomer cohort of farmers is approaching retirement (or end-of-life); that there could be increased rural property sales post-drought; and that new property owners are different from longer-term owners on important social and farming characteristics, rural property turnover is a trend upon which the WCMA should focus. As with many social trends, there will be challenges and opportunities as a result. WCMA programs will need to accommodate differences between new and longer-term owners in terms of their values, attitudes, level of experience, knowledge of land management and preferred sources of information. In other publications we have advised CMA to monitor changes in property ownership, particularly in areas with key environmental assets. The WCMA needs to identify the scale of turnover, assess the extent that turnover represents an opportunity to accomplish desired changes in management or land use, and gain insights into the attributes of new owners that might shape their capacity to implement CRP. These insights should inform changes in the way the WCMA seeks to engage new owners.

Research findings highlight key differences across the LGA, including the median property size, the proportion of absentee owners, and farming as an occupation. Again, these differences across the LGA should inform efforts to engage rural landholders in NRM.

Factors influencing adoption of current recommended practices (CRP)

There were significant positive links between implementation of CRP included in the 2011 survey and many of the levers at the disposal of the WCMA. The factors most frequently identified in the pairwise comparisons included knowledge of NRM (15 of 16 CRP), property management planning participation (8 CRP), government departments as a source of information (8 CRP), extension officers as a source of information (8 CRP), larger property size (7 CRP), Landcare as a source of information (7 CRP), short course participation (6 CRP), more hours worked on property (6 CRP), CMA as a source of information (6 CRP), environmental organisations as a source of information (6 CRP), received government funding last five years (5 CRP) and farming occupation (5 CRP). Confidence in recommended practices was also linked to implementation,

including landholder belief in benefit of stubble retention (3 CRP), belief in the benefit of fencing stock access to waterways (3 CRP), and belief that stock access should be carefully managed (3 CRP).

These relationships reflect correlations but they assist researchers and practitioners to unravel causality when they are able to draw upon sound theory, other empirical evidence and knowledge of program activities. These relationships (and those explored using regression analysis) confirm findings discussed already about the important implications of different occupational identities, but they also provide strong affirmation that investments by NRM organisations in raising awareness of issues, improving knowledge and skills and building confidence in CRP are sound, particularly where CRP are complex or poorly understood, are not closely aligned with landholder values, when resource condition outcomes are uncertain, or where the public benefits of the work outweigh the benefits to landholders.

Progress in achievement of NRM program objectives

The standard approach to NRM program evaluation is to focus on measures of resource condition change and then the intermediate outcomes expected to lead to desired changes, including in the land use and management of private landholders. These intermediate outcomes typically include rural landholder awareness/concern about NRM issues, landholder knowledge about the processes leading to land and water degradation and of best-practice NRM, and landholder implementation of CRP, or those practices assumed to lead to improvements in the condition of key environmental assets.

With three Wimmera social benchmarking surveys undertaken at approximately five-yearly intervals between 2002 and 2011, there was the opportunity to examine trends over time for intermediate outcomes across the region or specific environmental assets. At the request of the WCMA, these analyses have focused on five “asset” classes at the regional scale: paddock trees; soils (WCMA focus was on stubble retention); pest plants (native vegetation and introduced pasture/cropping land are the relevant assets); waterways; and wetlands. Given changes in priority assets over time there were some important constraints on the scope of survey data relevant to each of these assets. For example, in 2007 groundwater flows systems were a key asset but they were not included in the five key assets in 2011; and paddock trees were a priority asset in 2011 but not in 2002 or 2007. While the surveys provide very good coverage of the intermediate outcomes for waterways and wetlands, most of these items do not distinguish between the two assets.

A key point here is that the WCMA priorities have changed over time and this is to be expected given the widely diverging seasonal conditions experienced in the past decade; changes in society, including increased concern for the environment; and the turnover in key WCMA staff (e.g. three CEOs) and Board members. It is also important to acknowledge that no other CMA has undertaken this challenging task, so there is no “how-to” manual to follow. In the remainder of this Summary, we identify the key findings from our analysis of the time-series data for one of those assets, wetlands, as a way of illustrating the challenges of NRM evaluation; the potential of the social benchmarking process to make a useful contribution to evaluation, both formative (where the focus is on improvement) and summative (where the focus is on making judgements about success); and to suggest some next steps for the WCMA and the social researchers to optimise the value of the social benchmarking data for evaluation of regional NRM.

Between 2002 and 2011 there was increased concern about salinity threatening water quality in rivers/streams/wetlands but less concern about the impact of reduced water flows on the long-

term health of rivers/streams/wetlands. Both trends may be as much a response to recent changes in seasonal weather patterns (i.e. move from very dry to very wet seasons) as to NRM investments. Between 2002 and 2011 there was increased self-reported knowledge about the benefits of woody debris such as snags in rivers/streams. There was also increased confidence in watering stock off-stream and fencing to manage stock access to streams and wetlands. However, there was no change in the proportion of respondents fencing waterways and wetlands to manage stock access or establishing off-stream watering points. From a WCMA perspective it seems that much of the hard work in laying the preconditions for on-ground implementation has been accomplished. It is also possible that much of the work of implementing off-stream water points and fencing waterways and wetlands has been achieved. The WCMA will therefore need to make judgements about the level of on-ground work completed to date in relation to the level of implementation needed to achieve resource condition targets. To the extent that further work is needed, the WCMA will need to investigate the efficacy of the various policy instruments available to them. An additional issue is the challenge of maintaining work undertaken, and future surveys should include items distinguishing work implemented to establish infrastructure and work undertaken to maintain that infrastructure.

1 INTRODUCTION

1.1 Research context

This report presents findings from research commissioned by the Wimmera Catchment Management Authority (WCMA) to gather data that would inform preparation of the 2012 Regional Catchment Strategy (RCS). The principal data collection instrument was a survey mailed to a random sample of rural landholders in the WCMA region during 2011. Similar surveys were undertaken in 2002 (Curtis and Byron 2002) and 2007 (Curtis et al. 2008). With the three surveys conducted at approximately five-yearly intervals, there is the opportunity to identify longitudinal trends in social and farming variables and to provide insights into the outcomes of natural resource management (NRM) investments. A survey response rate of 49% (494 completed surveys returned from the sample of 1,003) was achieved.

This research drew on a widely accepted methodology for catchment-scale social benchmarking (see Curtis et al. 2005) developed and refined through a series of studies across Australia, including in Victoria with the Goulburn Broken Dryland (Curtis et al. 2000), the Ovens Catchment (Curtis et al. 2002), Glenelg Hopkins region (Byron et al. 2004) and the Corangamite region (Curtis et al. 2006).

1.2 Research objectives

The mail survey instrument was to be similar to those employed in 2002 and 2007 and gathered information that would enable the research team to:

1. Assess progress in the achievement of NRM program objectives at catchment and local government area scales that are consistent with objectives in the WCMA Regional Catchment Strategy.
2. Describe trends in social and farming structure (property size, property turnover, property subdivision/ amalgamation, occupational identity of landholders, extent of absentee ownership) for the region and for each local government area.
3. Provide a coherent explanation of landholder adoption of recommended practices identified in the WCMA Regional Catchment Strategy.
4. Provide advice about how to engage rural landholders in NRM.

1.3 Report structure

The next chapter provides some background to the Wimmera region. The methodology chapter briefly outlines the research approach, including the mail out and data analysis processes undertaken, as well as the theory and empirical research underpinning items included in the survey. The remaining chapters present summaries of research findings, including:

- the results for each of the survey topics;
- the relationships between survey items and landholder implementation of recommended practices;
- a comparison of farmers and non-farmers;
- a comparison of absentee and resident landholders;
- a comparison of those who live close to and those who live away from a wetland;
- Wimmera local government profiles;
- a summary of key differences across local government areas;
- trends over time in social and farming structure in the Wimmera region; and

- trends over time for outcomes of NRM investments at the regional scale.

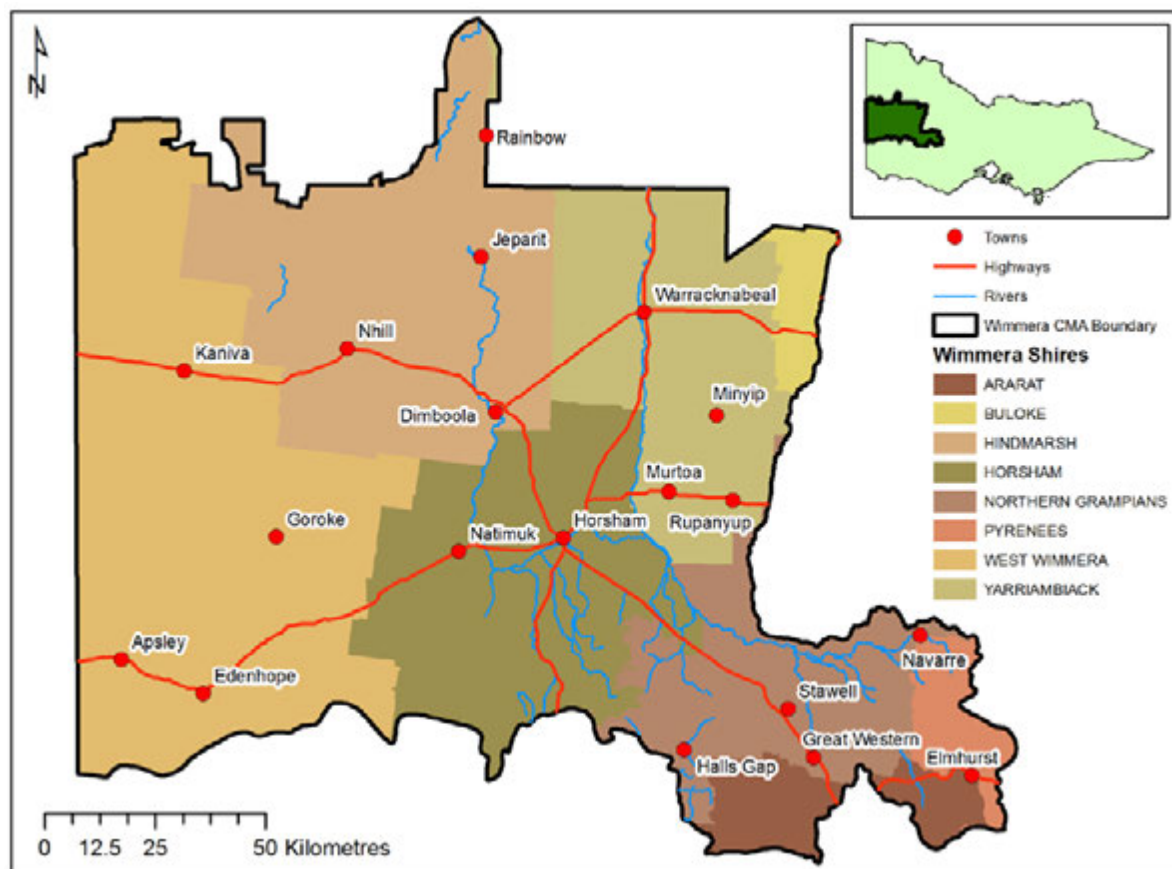


Figure 1 Wimmera region local government areas

2 BACKGROUND

2.1 The Wimmera region

The Wimmera Catchment Management Region (WCMA region) is located in Western Victoria and covers approximately 30,000 square kilometres [Figure 1]. The Wimmera region includes the Wimmera River Catchment and part of the Millicent Coast Basin. The Wimmera River is the largest Victorian river that does not flow to the sea and the region includes a series of terminal lakes, the largest of which are Lake Hindmarsh and Lake Albacutya [Figure 2].

Agriculture is the predominant land use and approximately 85% of the region has been cleared of native vegetation. Much of the remaining native vegetation exists within public reserves including the Grampians and Little Desert National Parks [Figure 2]. Cropping (cereal, oil seed and grain legume) is the principal agricultural activity, followed by meat, wool and dairy. Tourism is also an important industry in the region.

The Wimmera regional population is around 50,000 with almost a third of these people living on farms or in small townships. Horsham is the largest centre, with Edenhope, Nhill, Stawell and Warracknabeal other larger centres.

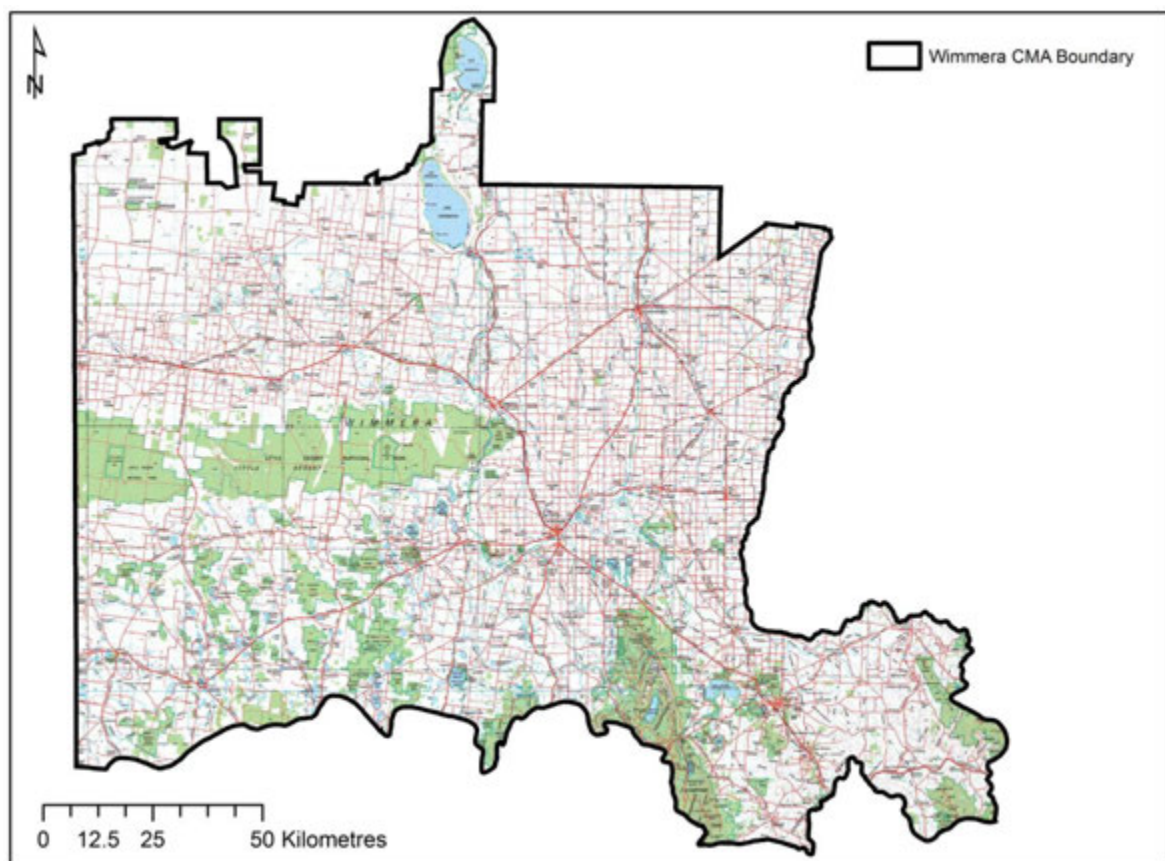


Figure 2 Wimmera region: physical setting, towns and road network

3 METHODOLOGY

3.1 Background to this research

Catchment groups in Australia are required to develop regional plans that set out how the land, water and biodiversity of the region are to be managed (Commonwealth of Australia 2007).

While there are State and regional differences, these catchment groups are typically asked to:

- articulate their vision and objectives (where do we want to go?);
- describe their catchment condition and identify the key regional assets and the threatening processes likely to affect their condition (where are we now?);
- explain how they will implement their strategy (how do we go forward?); and
- identify targets for the implementation of management actions and for improvements in resource condition that will enable the assessment of progress towards plan objectives (how do we know what we have achieved and learned?).

Private landholders manage large parts of most Victorian catchments. Affecting behavioural change in private landholders is a complex task. In a widely cited synthesis paper, Pannell et al. (2006) concluded that landholders readily adopt conservation practices that are consistent with them achieving their goals/objectives. Drawing on their backgrounds in economics, psychology and sociology and extensive research experience, these authors proposed a framework for exploring adoption that has four broad sets of factors:

- nature of the practice: trialability, observability, complexity, extent of re-skilling required, extent it fits with existing farming systems and lifestyle, cost and time for returns to accrue, and whether it is a substantial improvement on what already exists;
- personal characteristics of the landholder and their immediate family: occupation, education levels, knowledge, skills, length of experience in the area/as a land manager, extent they are risk takers, whether they are introverts/extroverts, level of income, stage of life, if there is to be farm family succession, and extent of their personal network;
- wider social context: prevailing norms, information flows through networks, the existence and activities of local organisations, and the level of trust in extension agents; and
- nature of any intervention/learning process: regulation, market-based instrument, grant program, and group processes.

Topics included in the survey explored landholder values, long-term plans and some factors from each of the four sets of topics in the Pannell et al. (2006) framework explained above [refer to the following section for a more complete listing of survey topics]. In our previous studies we developed a methodology for predicting property turnover (Curtis and Byron 2002, Mendham and Curtis 2010). An important outcome of this research was the finding that a large and substantially increased proportion of rural properties were likely to change hands in the next decade and that many of these new owners were from outside the local district and often absentee owners (Mendham and Curtis 2010). Questions exploring these topics were included in the 2007 and 2011 surveys.

Given their responsibilities, it is essential for catchment groups to have access to information about the social and farming context in which they operate (Curtis et al. 2005). Social benchmarking surveys provide a useful and cost effective way of providing these data. The analysis of data collected through farm and household censuses can provide useful information, but as Curtis et al. (2001) and Shultz and Daenz (1998) demonstrated, these data are unlikely to satisfy catchment managers who need to monitor outcomes from investments they make in

NRM, understand landholder adoption of CRP, and make judgements about the likely efficacy of available policy instruments. In the first instance, national data collection processes are unlikely to address most of the topics for which data are needed (Curtis et al. 2005). Secondly, data are only available to the public in aggregated form, the smallest scale being census collector districts that combine data for about 200 households. In most cases census data analysis is only provided at the local government scale. This level of aggregation reduces the usefulness of data, particularly when sub-regional contexts are so different, as for the Wimmera region (Curtis et al. 2008).

3.2 Topics included in the mail survey

Drawing on the above literature (and other literature identified when addressing specific topics) and given the space constraints of a mail survey and complexity of questions that can be effectively posed, the authors, in collaboration with the WCMA, identified the topics listed below for inclusion in the 2011 survey. The intention was to ensure that the 2011 survey replicated topics in the 2007 and 2002 survey as far as practical while reflecting the current situation. In 2011, the principal survey topics were:

- long-term plans for the property;
- issues of concern at property and district scales;
- beliefs and attitudes about roles and responsibilities of different NRM actors;
- attitudes about the management of wetlands and groundwater;
- trust in the WCMA;
- values attached to the property and held values;
- knowledge of NRM processes and practices;
- confidence in recommended practices for improvement in resource condition;
- sources of information about NRM;
- land use and enterprise mix;
- implementation of CRP for sustainable agriculture and biodiversity conservation;
- involvement in NRM programs; and
- background social and farming topics (e.g. occupation, place of residence, property size, on and off-property work and income, membership of Landcare and commodity groups).

3.3 Current recommended practices

An important research objective was to explore the key factors linked to adoption of current recommended practices identified in the RCS, and those which the WCMA has invested significant resources in encouraging. There were 18 items exploring the adoption of CRP in the survey. Some items were cropping or grazing specific, while others applied to all or most landholders. Some items referred to the total time of property management while others asked about actions in the past five years of property ownership. The items related to 13 CRP measured over the period of management and/or the last five years of management [Table 1].

Table 1 Survey items exploring current recommended practices

Practices undertaken over the full period of your management
Area of trees and shrubs planted (including direct seeding) [ha]
Area of farm forestry established [ha]
Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km]
Area of native bush/grasslands fenced to manage stock access [ha]
Area sown to perennial pasture and lucerne [ha]
Number of off-stream watering points established
Area of gully erosion addressed [ha]
Monitor bore height (<i>please write NA if not applicable</i>)
Monitor bore water quality (<i>if not applicable write NA</i>)
Practices undertaken over the last five years
Maximum area of crop sown in any year using adaptive no-till techniques [ha]
Max area of crop sown in any year using minimum tillage techniques [ha]
Area sown to perennial pasture and lucerne [ha]
Used precision farming techniques for cropping
Area of trees and shrubs planted (including direct seeding) [ha]
Area of farm forestry established [ha]
Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km]
Area of native bush/grasslands fenced to manage stock access [ha]
Have you put an artificial wetland on your property?

3.4 The mail survey process

The survey design and mail out processes employed a modified Dillman (1978) process that has been refined through the experience of successive catchment surveys in Australia. A detailed explanation is provided in Curtis et al. (2005). A draft survey instrument was refined by the project steering committee.

Dillman's *Total Design Method* provides specific advice about survey design and involves a series of survey mail outs and reminder cards over a period of three months to achieve response rates above those often accepted by researchers. In this project the research team had only seven weeks to complete the survey process to meet the end of November deadline for presentation of the Interim Report so that survey data could contribute to the development of the RCS. The first mail out of surveys was followed by a reminder card sent out one week later, with a second and third reminder card mailed out in consecutive weeks. Five weeks after the initial survey mail out, another copy of the survey and a brief cover letter were sent to landholders that had not responded. The second mail out was followed by two reminder cards posted a week apart.

Surveys were addressed to property owners identified from the local government rural property owner lists. WCMA staff had previously approached each of the eight shire councils and negotiated access to ratepayer mailing lists. Seven provided access to their ratepayer lists, while the Northern Grampians Shire conducted the mail out process on the research team's behalf. A random sample of approximately 1400 owners of properties greater than 10 hectares was identified. Subsequent examination of this list identified a number of multiple listings of the same owners and these were removed. Of the 1243 surveys mailed to landholders, 494 were completed and returned. Twenty-eight surveys were "returned- to-sender", 20 were returned

with another survey (i.e. owners received two surveys), 74 surveys were returned blank with an excuse (i.e. sold property, owner died, too old to complete survey, no active land use on property, not interested in completing survey, too busy), and 118 were returned blank (i.e. 512 were not returned). The final N value for the survey was 1003 with an overall response rate of 49% [Table 2]. The geographical spread of survey respondents across the region is shown in Figure 3.

All data collection methods have their strengths and limitations. A survey is a cost-effective way of gathering data from a large number of potential informants or stakeholders and if carefully developed, can provide reliable information and the basis for analyses that produce useful and robust findings. Social scientists are often asked about the impact of non-responses on the reliability of findings from surveys. The research team typically aims for a 60% response rate for surveys mailed to rural landholders in Australia. Our view is that a 60% response rate represents current “best-practice” and that with 60% of a substantial sample non-responses are unlikely to change findings significantly. Non-respondents may be different from respondents, but our experience is that there are many reasons for non-responses, and that non-respondents are unlikely to be a homogenous group. Feedback through our 1800 phone line and by post indicated that some non-respondents owned small properties and thought the survey didn’t apply to them, others were overseas, some didn’t trust the WCMA, some didn’t like filling in surveys, some were elderly and no longer managing their property or able to complete a survey, while others were simply too busy.

Some researchers attempt to address the potential issue of non-respondent bias by comparing respondents with the population their sample was drawn from or by comparing non-respondents and respondents. The former can be accomplished by comparing a limited range of survey data with comparable Census data. The latter can be accomplished by contacting non-respondents, typically by phone, and gathering a limited range of data included in the survey. Both approaches have their limitations in that census data are typically for the entire population and so difficult to compare with data for rural landholders and many non-respondents will not respond to telephone calls.

For this study, we have been able to compare survey respondents with the population of rural property owners using two data sets: the Australian Farm Census and local government ratepayer lists. We used data gathered by the Australian Bureau of Statistics through the Australian Farm Census (2009-2010) (Australian Bureau of Statistics 2011) to compare respondents to the ABS Census with respondents to the CSU survey [Table 3]. The comparison using area of holding, age and membership of Landcare suggests that there are no significant differences between the respondents to the CSU survey and the population of rural landholders included in the ABS survey. The ABS survey had a \$5,000 minimum Estimated Value of Agricultural Output as a pre-requisite for inclusion in that study. There was no similar pre-requisite for inclusion in the CSU survey. It is therefore to be expected, as is indicated by the data in Table 3, that there was a trend for the ABS respondents to have larger properties and for a higher proportion to be in Landcare, although these were not significant differences. Using data from the local government ratepayer database we were also able to establish that there was no significant difference between the median property size of CSU survey respondents and median property size of all survey recipients ($p=0.373$) or between the survey respondents and all property owners of greater than 10 ha in the WCMA region ($p=0.74$). These analyses support the view that the survey respondents are representative of the wider population of rural landholders in the WCMA region.

Table 2 Survey response rates by local government area, 2011

Local government area	Sample	Returned and usable surveys	Unusable surveys (blank, excuses)	Return to sender/ duplicates	Response rate
Ararat	85	38	11	1	52%
Buloke	28	8	4	4	40%
Hindmarsh	198	79	36	8	51%
Horsham	285	116	38	13	50%
Northern Grampians	116	49	10	3	48%
Pyrenees	41	17	6	1	50%
West Wimmera	264	96	44	8	45%
Yarriambiack	226	88	43	10	51%
Unknown	3				
WCMA total	1243	494	192	48	49%

Table 3 Assessment of the representativeness of the survey respondents based on comparisons of CSU and ABS survey data

Topic	ABS survey respondents (87% response rate) 2009-10	CSU survey respondents (49% response rate) 2011
Area of holding (ha)	791 ha	759 ha
Average age	55 years	57.9 years
Member of a Landcare group	32%	34%

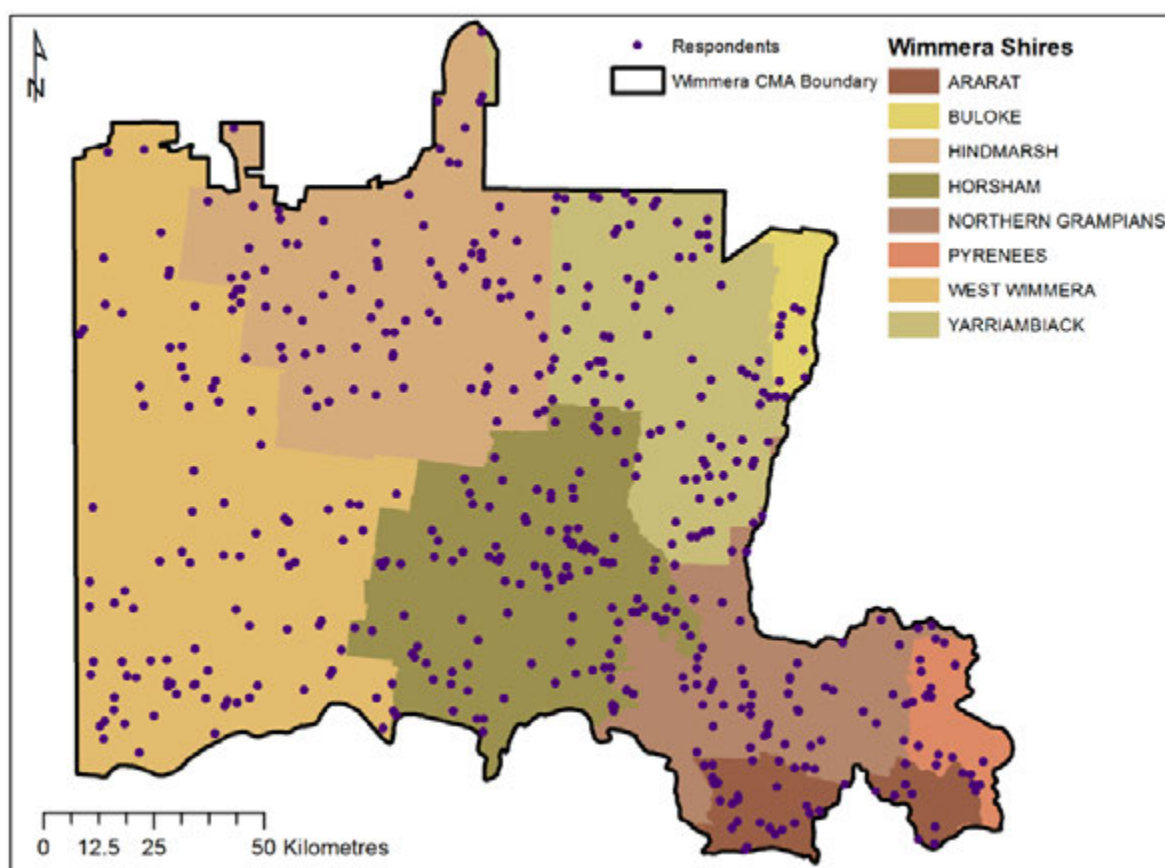


Figure 3 Distribution of Wimmera survey respondents, 2011

3.5 Data analysis

Statistical analyses applied in this report include descriptive statistics (including mean, median, sum and total data) of survey items; and the analysis of trends over time, pairwise comparisons and multiple linear regression to explore landholder adoption of CRP. Descriptive statistics such as frequencies, means and medians were used to summarise responses to all survey questions (“not applicable” and missing responses were removed from the analysis of means). For questions that required respondents to specify an amount (e.g. hectares of trees planted) zeros were excluded in the calculation of means and medians (hence, these were treated as a ‘no’ response). In these situations, the means and medians should be treated as the median of those who had undertaken the practice.

Further analyses included examination of data for statistically significant differences between groups (e.g. those who identified as farmers and those who did not); trends over time (e.g. whether there was a difference between 2002, 2007 and 2011 in the proportion of farmers in the region); and relationships between variables (e.g. understanding the factors influencing adoption of CRP and the influence of a mix of factors on CRP implementation).

Analyses exploring adoption were undertaken for each CRP based on a classification of CRP as either cropping specific, grazing specific or non-specific. That is, only respondents engaged in relevant land-uses were included in the analyses for those CRP (e.g. only those who ran stock were included in analyses related to fencing to exclude stock from riparian zones).

Kruskal Wallis Rank Sum Tests were used to test for differences on a continuous variable or a likert scale based on a grouping variable (e.g. farmer/non-farmer). Chi Squared Tests and Fishers Exact Tests were used to examine dependence between two categorical (or grouping) variables (e.g. between farmer/non-farmer and Landcare member/Landcare non-membership). Proportions Tests were used to test for differences in the proportion of respondents who answered yes to a question. Linear models were used to test for similarity between two continuous variables. These tests were used to explore relationships between independent variables and dependent variables (in this case, CRP implementation). Variables were considered to be possible predictors of the implementation of CRP if there was a significant result.

Multiple linear regression modelling was used to better determine the extent that a number of independent variables identified from the pairwise analysis as having a significant relationship with the dependent variable (in this case, adoption of CRP) contributed to the presence or absence of adoption of CRP. The modelling was used to help identify the set of variables that best explained adoption of each CRP. Only those variables where there was a greater than 80% response rate were included in the analysis. The regression results and coefficients were checked to guard against multicollinearity to prevent two variables acting as surrogates for each other (or two variables essentially explaining the same thing) being included in the analysis. Variables were entered in a stepwise modelling process using Akaikes (AIC) information criterion as the step criteria. The R^2 value indicates the amount of variance explained by the model. CRP were treated as continuous variables where the data were available (several CRP were categorical or yes/no responses). An R^2 value of 30% is considered useful in the social sciences where there is typically a large number of potentially influencing and intervening variables. In this report results from both the pairwise and regression modelling are presented. 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 that it is unlikely (probability of less than five percent) that the observed relationship or difference has occurred purely by chance. All statistical analyses were performed using SPLUS software and Microsoft Excel.

4 FINDINGS BY RESEARCH TOPIC

The following tables and figures present descriptive statistics for each topic included in the 2011 survey. For some survey questions, respondents were asked to rate how strongly they agreed with a topic, how important an issue was for them, or how likely an outcome was for them on a likert scale of 1 (not likely, not important, strongly disagree) to 5 (highly likely, very important, strongly agree). Not applicable/don't know was a separate response option (6). To simplify the presentation of these data in this report, the response options have been collapsed into four categories: "unimportant" (combining not important and of minimal importance), "some importance", "important" (combining important and very important) and "not applicable". For items asking respondents whether they agreed with a statement, response options "strongly disagree", "disagree", "unsure", "agree", "strongly agree" and "NA" have been collapsed into "disagree" (disagree and strongly disagree), "unsure", "agree" (combining agree and strongly agree) and "NA". For questions asking the likelihood of a certain outcome, response options "highly unlikely", "unlikely", "unsure", "likely", "highly likely" and "NA" have been collapsed into "unlikely" (highly unlikely and unlikely), "unsure", "likely" (highly likely and likely) and "NA".

In addition to the percentage of respondents who agreed, were unsure or disagreed with each item, mean values are reported in the tables for all survey items. In each table we also indicate the items which were significantly different across the local government areas in 2011.

4.1 Long-term plans

A quick analysis of the responses to survey questions examining long-term plans seems to suggest a relatively stable population and steady rate of change. The majority of respondents planned to live on their properties for as long as possible [Table 4]. Combining all the survey options for selling (those who intended to sell their property, those intending to sell and buy another rural property and those intending to subdivide and sell a large amount) indicated that 29% of respondents planned to sell all or most of their property. These respondents owned 17% of the land surveyed. A similar proportion (28%) intended to purchase additional land. These individuals owned a much higher proportion of the area surveyed (41%). The median length of residence in the local district was 45 years, and the median length of property ownership was 28 years [Table 28]. That is, half of respondents had lived in the local district for longer than 45 years.

Further analysis highlighted the potential for a much higher and accelerated rate of change in property ownership. While the majority of respondents intended that ownership of the property would stay within their family (66% of respondents who managed 75% of the land area surveyed) and 53% of respondents stated they had family members interested in taking on their property, only 30% of these individuals had a completed or well advanced succession plan. Forty percent had not begun formal planning for succession. Overall, only 20% of all respondents who had begun planning for succession had a completed plan [Figure 4].

Using a now well-established methodology for predicting property turnover (Curtis and Byron 2002, Mendham and Curtis 2010) which considers survey data about respondents' age, national data about retirement and life expectancy, and survey data about plans to sell and the likelihood of family succession occurring, we established there was likely to be a much higher rate of change in the ownership and management of land in the Wimmera than was suggested by the finding that 29% of respondents were likely to sell all or a part of their property.

The calculations involved in predicted future property turnover suggest a median year for transfer of all properties of 2022. That is, 50% of properties were predicted to change hands in 10 years time (much of this can be attributed to the median age of respondents of 57 years). This property turnover in the next decade involved 44% of the land area. The predicted median year of transfer was not significantly different across the local government areas in the Wimmera region.

There was a significant difference across the local government areas on four items exploring respondents' long term plans (these are denoted by an asterisk in the table below) [Table 4]. There were some significant changes over time on several items in this section. When examining trends over time, we primarily report on data where a comparison between 2002 and 2011 was possible. There were seven items in this topic where that comparison could be made. While there were some significant changes, they do not reveal any obvious or important trends. For example, there was no significant change in the proportion of people who said the property would be sold or that ownership of the property would stay within the family. On the other hand, significantly fewer people said the property would be subdivided and either a large or small part sold. At the same time, there was a significant increase in the proportion of people who said they would live on the property for as long as possible.

Table 4 Long-term plans, 2011 (N=494)

Long term plans	n	Likely	Unsure	Unlikely	NA	Mean
Ownership of the property will stay within the family	475	66%	12%	20%	2%	3.83
I will live on the property for as long as possible*	471	62%	8%	16%	14%	3.91
Additional land will be purchased, leased or share farmed	467	28%	13%	53%	6%	2.44
The property will be sold	475	25%	12%	62%	2%	2.31
The enterprise mix will be changed to reduce my farm workload	461	21%	15%	50%	14%	2.39
All or most of the property will be leased	468	21%	17%	57%	5%	2.31
I am planning to undertake work to mitigate flood impacts on my property*	456	19%	10%	51%	20%	2.27
I will seek additional off-property work	462	18%	8%	57%	17%	2.15
I will reduce the extent of my off-property work	458	16%	7%	38%	40%	2.34
All or some part of the property will be placed under a conservation covenant*	458	16%	11%	68%	6%	1.99
All or most of the property will be share farmed*	464	14%	13%	65%	7%	2.05
The enterprise mix will be changed to more intensive enterprises	462	10%	13%	66%	11%	1.99
The property will be sold and another rural property bought	465	5%	6%	84%	6%	1.52
The property will be subdivided and a large part of the property sold	461	5%	6%	81%	9%	1.44
The property will be subdivided and a small part of the property sold	462	5%	5%	81%	9%	1.41

* denotes a significant difference across the local government areas.

Responses were rated on a scale from 1, 'Highly unlikely' to 5, 'Highly likely'. 'Not applicable' was a separate response option.

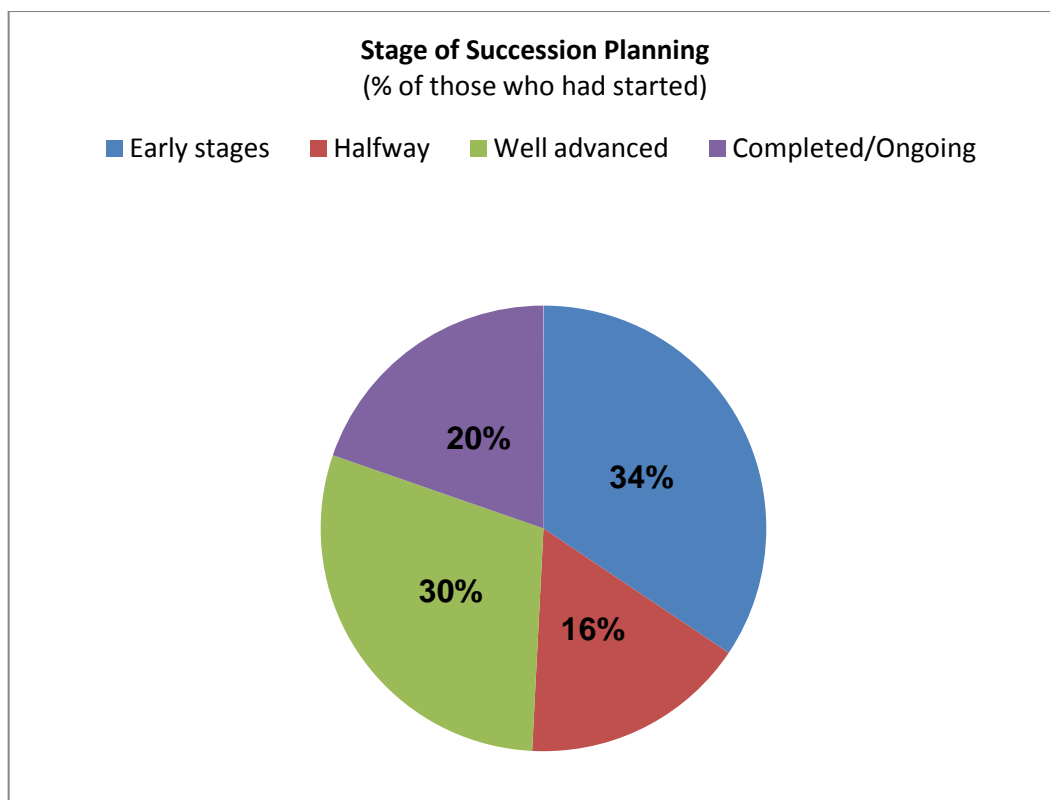


Figure 4 Stage of succession planning, 2011 (N=494)

4.2 Assessment of issues

A comparison between 2002 and 2011 could be made for two of the seven property scale items and five of the 15 district level issues. With regards to the property-level issues, there was no change in the topic *dryland salinity undermining long-term productive capacity*, however there was a significant increase in concern about *the impact of weeds and pest animals affecting profitability*. At the district scale, there had been a significant increase in concern for three of the five issues: *dryland salinity threatening productive capacity of land*, *salinity threatening water quality in rivers*, and *farming practices contributing to erosion*. A reduced proportion of landholders expressed concern about the *loss of wetlands as a result of cropping* and *the impact of reduced water flows*, with this latter finding likely reflecting the fact the region has recently experienced flooding.

4.2.1 District level issues

The district issue that was ranked highest by respondents in the 2011 survey was a social item *the loss of important services*. The impact of reduced water flows on the health of waterways was the second highest ranked district-level issue. Only these two issues were rated as important by over half of all survey respondents. Three of the top five issues were related to water. Thirty-nine percent of respondents rated vegetation in waterways obstructing flows leading to flooding as important, and the impact of floods on the financial viability of the district was ranked 10th [Table 5]. Items examining the loss of wetlands were rated least important by the survey respondents.

There was a significant difference across the local government areas on 17 of the issue items (15 district level issues and two property scale issues). These differences highlight the variation in the relative importance of NRM issues for rural landholders at the subregional scale.

Table 5 Assessment of issues at the district scale, 2011 (N=494)

Importance of issues affecting your district	n	Important	Some	Not important	NA	Mean
Loss of important services (e.g. health, banks, schools)*	460	61%	12%	19%	8%	3.82
Impact of reduced water flows on the long-term health of rivers/ streams/ wetlands*	469	50%	17%	26%	7%	3.41
Decline in soil health (e.g. declining fertility or structure)*	468	45%	20%	30%	6%	3.31
Salinity threatening water quality in rivers/ streams/ wetlands*	468	41%	17%	32%	11%	3.19
Vegetation in waterways obstructing flows leading to flooding*	468	39%	14%	34%	14%	3.11
Farming practices contributing to erosion*	467	36%	15%	41%	9%	2.97
The effect of existing ground water extraction*	466	34%	11%	38%	17%	2.97
Loss of paddock trees*	469	32%	17%	46%	6%	2.85
Dryland salinity threatening the long-term productive capacity of land*	471	29%	16%	43%	13%	2.80
The impact of floods on the financial viability of the district*	469	26%	17%	44%	12%	2.75
Loss of native plants and animals or increased soil erosion caused by cropping wetlands or floodplains*	467	22%	13%	48%	17%	2.60
Stock entering rivers/wetlands causing erosion and reducing water quality*	467	22%	11%	48%	18%	2.57
The effect of increased surface water extraction*	462	21%	15%	46%	18%	2.59
Loss of wetlands as a result of drains being constructed*	466	20%	12%	46%	22%	2.57
Loss of wetlands as a result of cropping*	466	17%	15%	48%	20%	2.46

* denotes a significant difference across the local government areas

Responses were rated on a scale from 1, 'Not important' to 5, 'Very important'. 'Not applicable' was a separate response option.

4.2.2 Property level issues

At the property scale, managing weeds was the most pressing issue for landholders and was rated as important by 54% of respondents, followed by the impact of changing rainfall patterns affecting property viability at 47% [Table 6]. The impact of dryland salinity on the productive capacity of each respondent's property was the least important issue, despite salinity effects on water quality at the district scale being identified as an important issue by 41% of respondents. Again, the impact of floods was not ranked highly by most respondents, with only 14% of respondents rating it as important as an issue at the property scale.

Table 6 Assessment of issues at the property scale, 2011 (N=494)

Importance of issues affecting your property	n	Important	Some	Not important	NA	Mean
The impact of managing weeds and pest animals (including native species) affecting profitability	471	54%	20%	20%	6%	3.60
Impact of changing rainfall patterns on property viability*	469	47%	24%	24%	5%	3.36
Uncertain/low returns limiting capacity to invest in my property*	472	44%	24%	21%	11%	3.42
Impact of poor management of pest plants and animals on public land	469	43%	18%	30%	9%	3.31
Lack of skilled labour to undertake important on-property work	471	33%	16%	37%	14%	2.86
The impact of floods on the financial viability of my property	468	14%	13%	52%	21%	2.29
Dryland salinity undermining long-term productive capacity	470	11%	11%	56%	22%	2.13

* denotes a significant difference across the local government areas

Responses were rated on a scale from 1, 'Not important' to 5, 'Very important'. 'Not applicable' was a separate response option.

4.2.3 Salinity

Seventeen percent of respondents reported observing signs of salinity on their properties, with the median area affected five hectares. This proportion was not significantly different across the local government areas, and there was not a significant difference between results from 2002 (19%, 10 ha), 2007 (22%, 10ha) and 2011.

4.3 Values

Attached values as well as more deeply held values were explored in the 2011 Wimmera survey. Values are specific modes of conduct or guiding principles that influence our choices and actions, are relatively enduring, and are not readily influenced by others, at least in the short-term (Seymour et al. 2010). 'Held values', or more deeply held values towards the environment, have been the focus of most research from a social science perspective. For the Wimmera survey, we drew on established theory and scales developed by researchers to explore held values. In particular, we drew upon Value-Belief-Norm Theory (Stern et al. 1998), Cognitive Hierarchy Theory (Fulton et al. 1996) and the Theory of Planned Behaviour (Ajzen 1985). These frameworks provide a useful way to explore the links between held values, beliefs, norms and behaviour, in combination with other influences on behaviour (such as assigned values, attitudes, demographic factors, goals and the nature of the practice).

'Attached' or 'assigned values' (values which relate to specific places) can influence landholder behaviour and may also provide useful information to guide management agencies seeking to engage and influence rural landholders (Seymour et al. 2010). Survey items exploring attached values drew on the work of Seymour et al. (2010) and the previous work of the authors, including the Wimmera surveys of 2002 and 2007.

Held values were measured based on a selection of items from Schwartz's value typology, including biospheric, altruistic and egoistic held values (Schwartz 1992, 1994). The survey uses the 12 item scale developed by de Groot and Steg (2007). Survey respondents were asked to rate the importance of each value as a guiding principle in their life where a rating of '1' meant 'opposed to my values', '2' was not important through to '6' indicating 'very important'. Held values were not explored in the 2002 or 2007 surveys.

4.3.1 Attached values

The most highly ranked value attached to property was *provides the lifestyle that I want. Being part of a rural community* and an *attractive place to live* were rated equal second, along with the value *being able to pass the property on in better condition* (82% rated as important) [Table 7]. The next highest rated value was *a sense of accomplishment from improving property infrastructure*, followed by *rural land representing a sound long-term investment* and *a great place to raise a family* (78% rated important), indicating that at least one social, environmental and economic value was in the top four rated attached values. This finding reinforces previous research by the authors indicating that most rural landholders are influenced by a range of values and that appeals attempting to engage them in NRM should embrace the full range of attached values for specific assets. NRM staff are encouraged to identify ways of linking their work to improve natural resource condition to the wider range of values that landholders attach to their properties.

There were significant differences across the local government areas on five items in this section. Again, this finding highlights the importance of local contexts, particularly in terms of the extent landholders are focused on farming as an occupation. Farmers are more likely than non-farmers to focus on production and the financial viability of the farm business.

Of the 19 statements exploring attached values, there were 12 where 2002 and 2011 data were available. The assumption in the literature is that values are relatively stable. This is particularly the case for held values, but likely to be less so for values attached to parts of a person's property or district. Nevertheless, we would expect attached values to be reasonably stable over a period of ten years (as per this comparison). Comparisons of data for 2002 and 2011 for the 12 statements indicate some significant changes in the attached values of respondents. There were six items where there was a significant change over time, including a decline in the proportion of respondents who said the property *provides most household income*, and increases in the proportion of respondents who rated as important *the environment of my farm sustains life for different plants and animals*, the property is *an attractive place to live*, *being part of a rural community*, the property is *a great place to raise a family*, and *work on property is a welcome break from my normal occupation*. Initially these results seem surprising, but the trends are consistent with other data indicating changes in the social structure of the region. For example, there has been a significant decrease in the proportion of respondents self declaring as farmers. Farmers are likely to be more dependent on on-property income and more likely to be motivated by the sense of accomplishment from maintaining a viable business. On the other hand, non-farmers are less likely to be dependent on on-property income and express stronger pro-environmental values (Mendham and Curtis 2010).

Table 7 Values attached to property, 2011 (N=494)

Why your property is important to you	n	Important	Some	Not important	NA	Mean
<i>Social values</i>						
Provides the lifestyle that I want	473	87%	8%	3%	3%	4.44
An attractive place to live	466	82%	7%	5%	7%	4.34
Being part of a rural community	471	82%	10%	7%	2%	4.19
A great place to raise a family	466	78%	5%	6%	11%	4.33
The freedom of working for myself	469	77%	8%	4%	11%	4.33
Opportunity to learn new things	466	61%	21%	16%	2%	3.64
A place for recreation	467	60%	20%	17%	3%	3.70
To preserve tradition as the property has been in my family for a long time	469	44%	15%	22%	19%	3.45
Work on the property is a welcome break from my normal occupation*	464	28%	10%	19%	43%	3.19
<i>Environmental values</i>						
Being able to pass the property on to others in better condition	470	82%	8%	8%	3%	4.26
Sense of accomplishment from knowing that my property is contributing to improved environmental health in the district	468	72%	15%	12%	2%	3.94
The environment on my farm sustains life for many different plants and animals *	467	63%	23%	13%	2%	3.80
<i>Economic values</i>						
Sense of accomplishment from improving property infrastructure (fencing, sheds, water supply, pasture)	471	81%	10%	6%	3%	4.24
Rural land represents a sound long-term investment	469	78%	12%	8%	2%	4.09
Sense of accomplishment from building/maintaining a viable business*	469	75%	8%	9%	9%	4.20
Sense of accomplishment from producing food or fibre for others	466	67%	13%	13%	8%	3.90
An asset that will fund my retirement	470	62%	15%	17%	6%	3.80
Provides most of the household income*	472	61%	12%	18%	10%	3.96
My groundwater entitlement adds to the market value of my property*	463	22%	7%	24%	47%	2.90

* denotes a significant difference across the local government areas

Responses were rated on a scale from 1, 'Not important' to 5, 'Very important'. 'Not applicable' was a separate response option.

4.3.2 Held values and stewardship ethic

Environmental stewardship was examined using one item (*reduced production in the short-term is justified by long-term benefits to the environment*) from a stewardship ethic scale developed by Frank Vanclay. The original scale has had mixed success in discriminating between our survey respondents in the past. Indeed, the stewardship ethic itself was not associated with higher adoption of recommended practices amongst survey respondents across time and jurisdictions (e.g. Curtis and De Lacy 1998). However, the authors have established significant positive relationships between the item included in the 2011 survey and implementation of conservation-related management practices [see Section 4.8.2].

About half of the respondents to the survey gave an important rating to the stewardship item *reduced production in the short-term is justified where there are long-term benefits to the environment* [Table 8]. Our recent work in other Australian catchments provides some interesting comparisons. For example, in the Namoi catchment only 39% of groundwater licence holders gave an important rating to the stewardship item (Sharp and Curtis 2012). Subsequent analyses of survey data suggest this item is a useful predictor of conservation intent [see Section 4.8.2]. There were significant differences across the local government areas on nine of the items relating to held values and stewardship [Table 8].

Results for the items drawn from de Groot and Steg (2007) measuring held values are provided in Figure 5. The item *a world at peace: free of war and conflict* was rated as important by almost three-quarters of respondents, but no other item exploring guiding principles was rated important by at least 60% of respondents. Indeed, a number of items were rated as important by very small proportions of respondents (indeed half of the items were rated as important by less than half of all respondents) [Table 8]. For example, approximately a quarter of respondents rated the held values *authority* and *influence* as important, perhaps explaining some of the difficulty in attracting leaders for community organisations. At the same time, for these items the majority of respondents gave the item 'some importance'. One implication of this is that almost all respondents in the Wimmera are likely to respond favourably to appeals for NRM that focus on contributions to the welfare of others and protecting natural resources, and will respond positively to programs that are administered in ways that provide equal opportunity for all (as opposed to selecting winners). On the other hand, it seems they will be less likely to be engaged by appeals that focus on profitability as an end in itself.

The held values items were new to the 2011 survey and, hence, change over time could not be assessed. However, the item measuring a landholder stewardship ethic was included in the 2007 and 2011 surveys. There was a significant increase in the median score between 2007 and 2011. In 2011 there is a now majority of respondents exhibiting a stewardship ethic. There could be a number of possible explanations for this trend including that increased environmental awareness in the general population is being reflected in the landholder population; that the increase can be attributed to the change in composition of the rural landholder population in the Wimmera where there are now significantly more non-farmers, and non-farmers exhibit a stronger stewardship ethic; or it could reflect the long-term impact of investments in Landcare, catchment management and other activities of NRM agencies engaging rural landholders in learning, dialogue and action.

Table 8 Values that guide your life and stewardship ethic, 2011 (N=494)

Values that guide your life	n	Important	Some	Not important	Mean
A world at peace: free of war and conflict	455	73%	24%	3%	4.42
Being helpful: working for the welfare of others	461	56%	41%	3%	4.34
Preventing pollution: protecting natural resources*	456	56%	41%	3%	4.28
Equality: equal opportunity for all*	458	55%	41%	5%	4.18
Protecting the environment: preserving nature*	459	54%	44%	2%	4.28
Social justice: correcting injustice, caring for the weak*	456	50%	46%	4%	4.19
Respecting the earth: harmony with other species*	454	45%	50%	6%	4.04
Unity with nature: fitting into nature*	453	37%	57%	6%	3.92
Authority: using knowledge and experience to lead others	456	28%	60%	12%	3.72
Influential: having an impact on people and events*	453	23%	66%	11%	3.67
Wealth: accumulating material possessions, money *	455	21%	63%	16%	3.61
Social power: strongly persuading others in order to achieve certain outcomes	454	16%	62%	22%	3.29
<i>Stewardship ethic</i>					
Reduced production in the short-term is justified where there are long-term benefits to the environment *	459	52%	32%	15%	3.46

* denotes a significant difference across the local government areas

Responses were rated on a scale from 1, 'Not important' to 5, 'Very important'. 'Not applicable' was a separate response option.

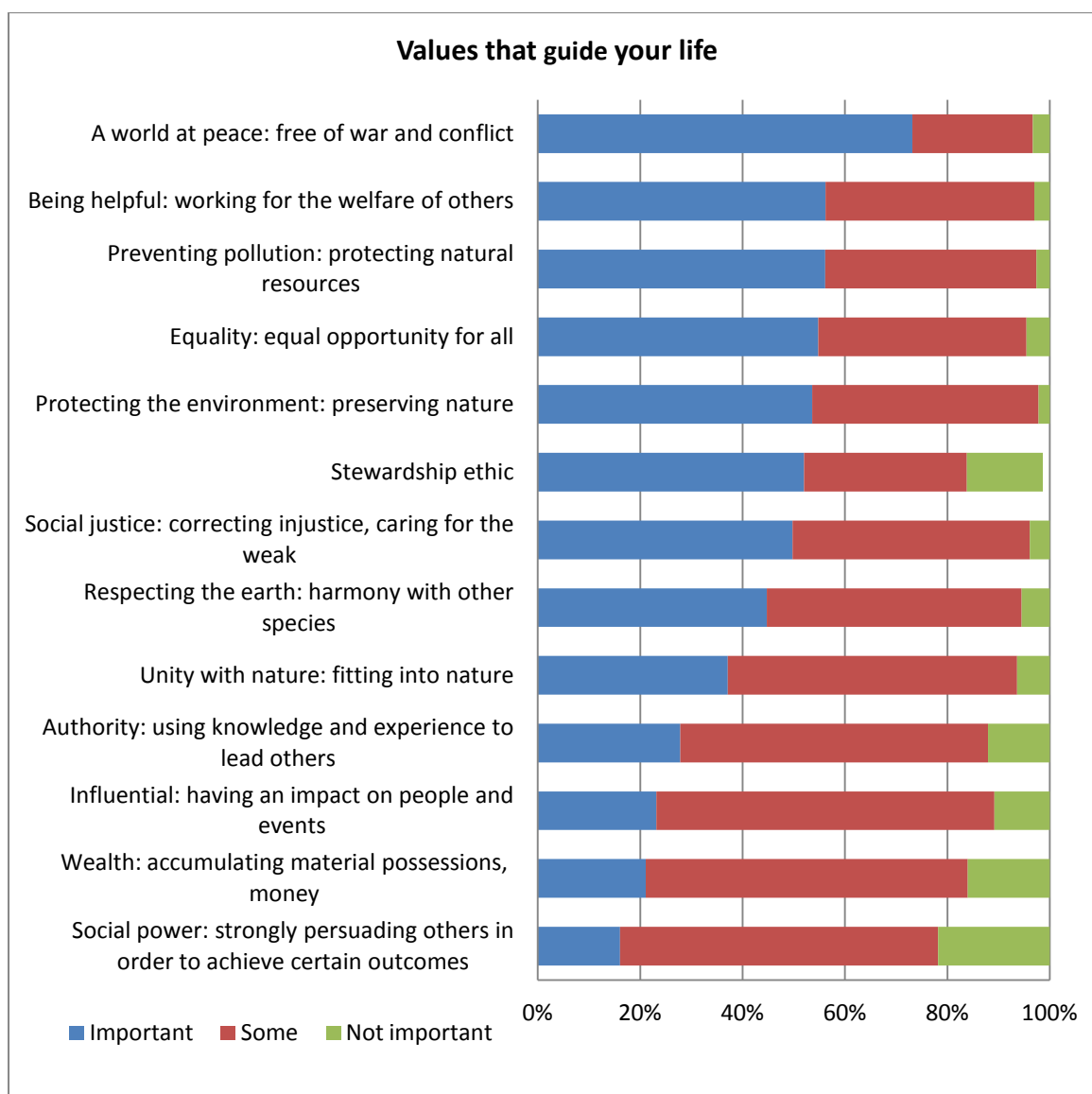


Figure 5 Values that guide your life and stewardship ethic, 2011 (N=494)

4.4 Your views

The survey explored statements about the roles and responsibilities of those involved in NRM, including landholders, management agencies and staff. These items asked respondents if they strongly disagree (1), disagree, agree or strongly agree (5) with each item. In the following table [Table 9] survey items have been broken down into those relating to attitudes (what should happen) and those relating to beliefs (what is true).

The three highest rated statements were that *landholders should manage their properties in expectation of extreme weather events*; *landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native plants and animals)*; and *paddock trees are important because they provide a place for native animals to shelter and feed* [Table 9]. Sixty percent of respondents agreed that the *environment should be given a specific allocation of river water*. Forty-six percent recognised the importance of floodplain land and wetlands.

While agreement with the second statement above is to be expected, the extent of support for the other three suggests that most landholders acknowledge or understand some of the fundamental assumptions of contemporary NRM policy: droughts and other extreme weather events can be expected and should be planned for; allocating water to the environment is critical for river health; and that in highly modified landscapes even single trees on private land provide important habitat for native fauna. At the same time, it is also clear that a substantial minority of respondents express attitudes and beliefs that conflict with contemporary NRM policy, particularly where statements are examining views about private property rights. For example, only 36% of respondents disagreed that *landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals* [Table 9]. Forty-six percent of respondents agreed that *landholders should have the right to harvest water that falls on their property, even if that action impacts on others*. The latter responses emphasise the importance of property rights but this statement is not inconsistent with current policy that provides for on-property water harvesting. What these results suggest is that NRM staff need to understand the extent and intensity of these attitudes as they apply to particular assets.

As explained in the background to this report, most native vegetation in the Wimmera has been cleared, although there are some small pockets of important remnant vegetation. It seems that many respondents remain unaware of the extent of land clearing or are not prepared to acknowledge that it has occurred. In this survey, 21% disagreed and 24% were unsure whether *clearing native vegetation since European settlement has substantially reduced the number and variety of native plants and animals in this district*.

Several survey items explored aspects of the concept of a landholder duty of care towards the environment. In 2011, 50% of respondents agreed that *it is fair for the wider community to expect landholders to manage land in ways that will not cause foreseeable harm to the environment*. However, only 38% agreed that *in the future landholders should be legally responsible for managing land in ways that do not cause foreseeable harm to the environment*. Also relating to a duty of care for the environment, 55% of survey respondents felt *new owners should abide by agreements entered into by previous landholders*, and 44% agreed with *using industry standards to determine if land is managed responsibly*.

There was a significant difference across the local government areas on nine items in this section. Data were available for three of the 17 items in this topic for 2002 and 2011. A significant difference was apparent in one of these items – the attitudinal statement *the public should have the right to access rivers, streams and wetlands*. The proportion of landholders agreeing with this statement has increased. There was no change in the item measuring belief about the impact of clearing native vegetation.

There were some attitudinal and belief statements where significant differences were found between 2007 and 2011 which we highlight as they are relevant to the knowledge base that might underpin effective engagement with rural landholders in the Wimmera. For example, a reduced proportion of respondents exhibited strong attitudes about property rights in relation to *landholders having rights to harvest water that falls on their property even if that action impacts on others*. This change suggests an increased proportion of landholders with attitudes consistent with contemporary NRM principles and practices. This change is also consistent with the finding highlighted in the previous section that there has been an increase in the proportion of respondents exhibiting a stewardship ethic. However, NRM practitioners should note that over 46% of respondents still agreed that landholders have the right to harvest water on their properties regardless of the impact on others which suggests that there are still strong attitudes

about maintaining private property rights. Consistent with a strong property rights attitude, there was a significant decline in the median for *new owners should abide by agreements entered into by previous owners where public funds have paid for land protection or conservation work*. This is an interesting finding and somewhat contrary to other trends summarised above.

The three items exploring the application of a duty of care to biodiversity conservation have not changed significantly between 2007 and 2011. Additionally, there was no change in the proportion of respondents who agreed that *landholders should manage properties in expectation of extreme weather events*.

Table 9 Views, attitudes and beliefs about NRM, 2011 (N=494)

Statements about your views	n	Agree	Not sure	Disagree	NA	Mean
<i>Attitudes</i>						
Landholders should manage their properties in expectation of extreme weather events*	461	79%	13%	7%	1%	3.96
Landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native plants & animals)*	462	74%	15%	9%	2%	4.01
The environment should have a specific allocation of river water	457	60%	22%	14%	4%	3.63
New owners should abide by agreements entered into by previous owners where public funds have paid for land protection or conservation work	459	55%	26%	17%	2%	3.49
The public should have the right to access river/ streams/ wetlands*	461	55%	23%	20%	2%	3.48
Landholders should have the right to harvest water that falls on their property, even if that action impacts on others	456	46%	27%	24%	2%	3.39
In future, landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment*	459	38%	24%	37%	0%	2.99
Landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals*	462	23%	35%	36%	6%	2.81
<i>Beliefs</i>						
Paddock trees are important because they provide a place for native animals to shelter and feed*	468	65%	22%	12%	1%	3.89
Clearing native vegetation since European settlement has substantially reduced the number and variety of native plants and animals in this district	460	55%	24%	21%	0%	3.50
It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment*	458	50%	23%	26%	0%	3.30

Floodplain land and wetlands provide important places for native birds to live*	465	46%	17%	22%	15%	3.47
Using industry standards developed with landholder input would be an acceptable way of determining if land is being managed responsibly*	456	44%	33%	23%	1%	3.21
The use of land for carbon farming/biofuels will lead to food shortages	453	29%	49%	22%	0%	3.12
There will be opportunities for carbon farming on my property in the future	458	23%	51%	19%	7%	3.03
The recent floods have prevented me from farming as I normally do	458	21%	5%	38%	36%	2.68
Floodplain land and wetlands provide additional land for grazing stock	464	11%	15%	37%	37%	2.36

* denotes a significant difference across the local government areas

Responses were rated on a scale from 1, 'Strongly disagree' to 5, 'Strongly agree'. 'Not applicable' was a separate response option.

4.5 Confidence in CRP

A large majority of respondents expressed confidence in fencing waterways as a practice to improve riparian areas and 42% agreed that *the time and expense involved in watering stock off-stream was justified* [Figure 6]. Only five percent disagreed and 53% were either unsure or thought this CRP was not appropriate for them (i.e. it is possible they don't have a stream/wetland). Despite recent concerns about the efficacy of direct drilling because of residual stubble and pests, most respondents agreed that the *benefits of stubble retention on cropping land outweigh problems arising*. Only 10% of respondents disagreed with this statement [see Section 7.2 for further examination of trends over time for this practice].

There was a significant difference across the local government areas on two items in this section: *stock access to rivers/streams/wetlands should be carefully managed*, and *fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands*.

Of the five items exploring landholder confidence in CRP, there were three where there were significant changes over time. In each case, there has been an increase in reported levels of confidence: *the benefits of stubble retention on cropping land outweigh problems arising*, *the time and expense involved in watering stock off-stream is justified*, and *fencing to manage stock access to waterways is an essential part of the work required to revegetate waterways*.

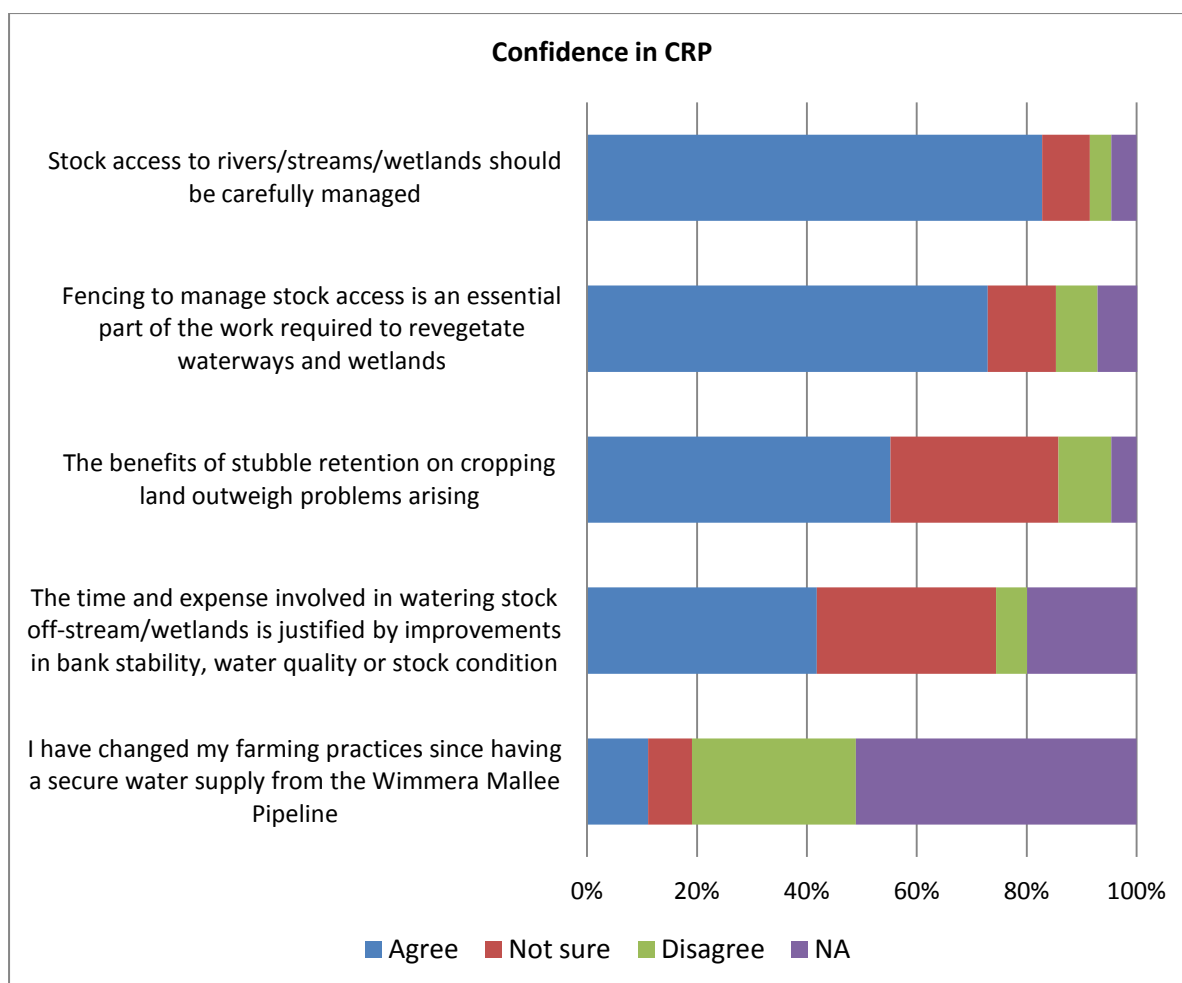


Figure 6 Confidence in CRP, 2011 (N=494)

4.6 Knowledge

Respondents were asked to self-assess their knowledge on a range of different NRM topics. Self-assessment is an accepted approach to gather this information, as opposed to testing respondents on their knowledge which can be unreliable when respondents are able to check references for information and respondents can regard this approach as insulting, leading to non-responses. For this survey, the response options were no knowledge (1), very little knowledge (2), some knowledge (3), sound knowledge (4), and very sound knowledge (could give a detailed explanation, 5). For Table 10, options 1 and 2 have been combined, as have options 4 and 5.

There were only three topics where over 50% of respondents stated they had sound knowledge, including *how to correctly use chemicals*, *grazing and cropping strategies to manage paddock ground cover to minimise soil erosion*, and *the benefits of retaining native vegetation on properties* [Table 10]. This finding is somewhat surprising, given the extent of participation in Landcare (34%), commodity groups (22%), and the scale of the activities of these organisations and other NRM investments in the region over time. Having said that, there has been property turnover in recent years (10% had owned their property for less than 10 years) and an increasing proportion of owners are not farmers (now compared to in the past). Previous research has established that non-farmers report that their knowledge of NRM is lower (Mendham and Curtis 2010). There was a significant difference across the local government areas on 10 of the knowledge items.

Trends over time for knowledge items relating to weeds, stubble retention, paddock trees, waterways and wetlands are explored further in Section 7 of the report. Here we outline differences in the remaining knowledge items. Of the 20 items included in the knowledge topic of the 2011 survey, there were 11 items for which data from 2002 to 2011 were available. There was a significant change for seven items (there was an increase in knowledge on four and a decrease for three of the items). Of the four where an increase was apparent, two were related to perennial pasture (*the ability of perennial pasture to prevent water tables from rising*, and *how to establish perennial pasture in the local district*). There was also an increase in knowledge of *the severity of gully erosion across the region* and *the value of woody debris such as snags in rivers and streams*. Items where a decrease was evident included *how to use soil samples*, *severity of water savings as a result of the Wimmera-Mallee pipeline*, and *the area of land affected by salinity in the district*.

There were four knowledge items where data were available for 2007 and 2011. In each case there was a significant change, and for all items there had been an increase from 2007 to 2011. These items were: *the benefits of retaining native vegetation on properties*, *the use of stock containment areas to manage stock in drier seasons*, *how to identify local plant species*, and *how to protect and improve the health of native bush areas*.

Table 10 Knowledge of NRM topics, 2011 (N=494)

Knowledge topics	n	Sound knowledge	Some	No/little knowledge	NA	Mean
How to correctly use agricultural chemicals *	472	69%	16%	11%	4%	3.88
Grazing and cropping strategies to manage paddock ground cover to minimise soil erosion*	470	64%	22%	10%	4%	3.76
The benefits of retaining native vegetation on properties*	470	51%	38%	10%	2%	3.55
The use of stock containment areas to manage stock in drier seasons	468	47%	30%	16%	7%	3.42
How to prepare a farm or property plan that allocates land use according to different land classes	465	44%	29%	23%	5%	3.27
How to use soil sample results to guide fertiliser applications	468	43%	34%	19%	4%	3.27
How to protect and improve the health of native bush areas on properties	468	42%	38%	19%	2%	3.32
How to establish introduced perennial pastures (e.g. lucerne) in this district	467	41%	32%	24%	3%	3.23
The ability of perennial vegetation to prevent water tables rising*	467	38%	36%	23%	3%	3.22
The existence of accessible groundwater underneath your property that is of sufficient quality to irrigate crops or water stock *	468	36%	21%	28%	15%	3.09

The role of wetlands in filtering water entering rivers*	467	33%	37%	24%	6%	3.13
The extent of water savings as a result of the Wimmera/Mallee pipeline *	469	32%	33%	18%	16%	3.18
How to identify local plant species including weeds in the understorey vegetation	471	30%	48%	21%	1%	3.10
How to protect and improve the health of rivers/streams & wetlands on properties	459	27%	36%	22%	15%	3.07
Organisations or individuals to contact for advice about government programs supporting landholders to manage gully or stream bank erosion*	469	24%	32%	34%	10%	2.82
The value of woody debris such as snags in rivers/streams*	469	21%	40%	31%	8%	2.87
The nature of native vegetation cover in the Wimmera region before European settlement	470	20%	43%	36%	1%	2.79
The severity of gully erosion across the Wimmera region*	469	13%	40%	41%	6%	2.63
The area of land (hectares) with saline affected vegetation in your district	469	11%	35%	47%	7%	2.47
The ability of biochar to improve soil structure	461	10%	31%	57%	2%	2.26

* denotes a significant difference across the local government areas

Responses were rated on a scale from 1, 'No knowledge' to 5, 'Very sound knowledge'. 'Not applicable' was a separate response option.

4.7 Land use

The most common land use among respondents to the Wimmera 2011 survey was dryland pasture (69%), followed by broadacre cropping (67%) and sheep (63% for meat and 57% wool production) [Table 11]. Fifty-seven percent of respondents had planted more than a hectare of trees on their property, and 15% reported that some part of their property was under a conservation covenant or management agreement. Ten percent of respondents reported having remnant vegetation on their property.

There were eight items in this section where there was a significant difference across the local government areas in 2011 [Table 11]. Trends over time are not explored in this section as there are more detailed sources of information on land use change the WCMA could access, including farm census data.

Table 11 Land use, 2011 (N=494)

Land use/enterprises on your property	n	Yes
Dryland pasture*	478	69%
Broadacre cropping*	479	67%
Sheep for meat*	479	63%
Sheep for wool*	479	57%
Areas of more than 1 ha of trees planted to provide shade and shelter, habitat, erosion control, recharge control	479	57%
Beef cattle *	479	15%
Part of the property is under a conservation covenant / management agreement with the Wimmera CMA or another organisation (e.g. Greening Australia)	479	15%
Remnant native bush (trees and/or grasses) covered by a conservation covenant	478	10%
Farm forestry	479	8%
Other livestock (e.g. goats, deer, horse studs)	479	6%
Viticulture/horticulture *	479	6%
Irrigated pasture/cropping *	479	4%
Carbon farming	478	4%
Intensive livestock (e.g. pigs, poultry, feedlot cattle)*	479	4%
Land managed to protect cultural heritage sites	478	4%
Farm-based tourism (e.g. farm stays)	479	2%
Dairying	478	0%

* denotes a significant difference across the local government areas

4.8 Uptake of CRP

It is important to acknowledge that the objective of NRM is unlikely to be 100% uptake of CRP. There will be cases where particular properties are not identified as priority areas for investment. It is also unlikely that CRP will need to be implemented on every property to achieve NRM condition targets for specific environmental assets. In some instances, the cost of action may outweigh the benefits expected. In any case, there are likely to be some examples where remedial action has already been implemented. It is also unlikely that NRM organisations will have sufficient resources to invest in supporting every landholder with a priority asset to implement CRP at any one time, or even over a period of some years. The key is that NRM organisations are able to make these decisions, including identifying the CRP to be implemented and the extent of implementation required over time to accomplish condition targets. The social benchmarking survey provides regional NRM organisations with the capacity to benchmark and then monitor the implementation of specific CRP (and the intermediate objectives expected to lead to implementation). In the next section, we summarise the extent CRP have been implemented in the past five years or over the period of management of the landholder for the Wimmera region. It is possible to use data from previous surveys to track the extent of implementation over time and those data are presented for a limited number of key assets in a subsequent section of the report [Section 7].

In this section, we examine landholder implementation of CRP in several ways. Firstly, we report on the proportion of landholders involved in each practice [Table 12 and 13], the median area of land on which that practice was conducted, and the proportion of landholders who had received government support for that practice. Respondents were not asked to report if they had

received government support for three items: adaptive no-till techniques, minimum tillage and area sown to perennial pasture in the last five years [Table 14]. We also provide a comparison of the extent of implementation of each CRP where those data were gathered in the 2002, 2007 and 2011 surveys. Secondly, we provide a summary of results from the pairwise analysis conducted between each dependent variable (CRP) and independent variables included in the survey [Tables 15 and 16, Appendix 1]. Finally, we report on results of multiple linear regression analysis conducted to explore the 'best' combination of factors (drawn from the pairwise analysis) that influence adoption of each practice [see the Methodology section of the report for further information]. There were often two survey items exploring implementation of the same recommended practice (one examining adoption of that practice over the full period of management, and one asking about adoption of that practice over the past five years). In these instances and in the interest of brevity, we have presented results of analysis using data over the full period of management. We chose the full period of management as this included the last five years and government programs have been operating for a substantial period of time in most regions. We present the results of nine models in this section. There were four CRP where we were unable to create a model: monitoring bore height, monitoring bore quality, precision farming and installing an artificial wetland.

4.8.1 CRP implementation

The CRP implemented by most respondents was planting trees and shrubs (56% had implemented the practice during the full period of their management, and 32% had planted trees or shrubs in the past five years) [Table 12, Table 13]. Over 50% of respondents had implemented practices related to cropping (minimum tillage, adaptive no-till and precision farming) [Table 13].

Fencing to manage stock access to rivers/streams/wetlands was the CRP for which most respondents had received funding over the past five years (42% of those implementing the practice) and over the period of management (52% of those implementing). For all other CRP, more respondents indicated they had undertaken work without government assistance than with it.

The median amount of work undertaken by respondents for each practice listed in Tables 12 and 13 represents substantive, as opposed to symbolic work. For example, the median amount of tree planting undertaken by respondents was four hectares over the last five years. This amount of tree planting is likely to have an impact on catchment condition if that work is strategically located, replicated by others, and properly maintained.

We examine trends over time for the three CRP included in the survey which are not covered in the later section addressing trends over time in NRM outcomes [Section 7]. These CRP are the area sown to perennial pasture and lucerne (over the period of management and last five years), area of gully erosion addressed (over the management period), and the area of farm forestry established (over the period of management and last five years). Analysis of data for 2002 and 2011 on the proportion of landholders implementing the practice revealed a significant difference for farm forestry (period of management), sowing perennial pasture (period of management), and minimum tillage (last five years). Results indicate:

- an increase in the proportion of respondents involved in farm forestry as well as the area on which the practice was undertaken;
- a decrease in the proportion of respondents sowing perennial pasture and the area on which it was sowed; and
- a decrease in those undertaking minimum tillage (the median area remained stable).

Table 12 Uptake of current recommended practices over the full period of management, 2011 (N=494)

Practices undertaken over the full period of your management	Year	n	% respondents implemented the practice	Median
Area of trees and shrubs planted (including direct seeding) [ha]	2011	466	56%	4 ha
	2007	487	54%	5 ha
	2002	NA	-	-
Area of native bush/grasslands fenced to manage stock access [ha]	2011	386	33%	11 ha
	2007	416	36%	10 ha
	2002	478	32%	20 ha
Area sown to perennial pasture and lucerne [ha]*	2011	465	31%	85 ha
	2007	490	36%	75 ha
	2002	590	47%	120 ha
Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km]*	2011	386	28%	3 km
	2007	415	26%	4 km
	2002	NA	-	-
Number of off-stream watering points established	2011	386	25%	6
	2007	416	23%	5.5
	2002	NA	-	-
Area of farm forestry established [ha]	2011	465	13%	5 ha
	2007	489	9%	5 ha
	2002	587	6%	11 ha
Monitor bore water quality *	2011	441	12%	-
	2007	NA	-	-
	2002	NA	-	-
Area of gully erosion addressed [ha]*	2011	466	10%	3 ha
	2007	487	11%	5 ha
	2002	NA	-	-
Monitor bore height *	2011	442	10%	-
	2007	NA	-	-
	2002	NA	-	-

* denotes a significant difference across the local government areas

Table 13 Uptake of current recommended practices over past five years, 2011 (N=494)

Practices undertaken over the last five years	Year	n	% respondents implemented the practice	Median
Maximum area of crop sown in any year using minimum tillage techniques [ha]*	2011	312	67%	400 ha
	2007	362	65%	355 ha
	2002	473	77%	400 ha
Maximum area of crop sown in any year using adaptive no-till techniques [ha]*	2011	312	54%	500 ha
	2007	361	53%	380 ha
	2002	NA	-	-
Used precision farming techniques for cropping*	2011	271	52%	-
	2007	NA	-	-
	2002	NA	-	-
Area of trees and shrubs planted (including direct seeding)	2011	466	32%	4 ha
	2007	491	37%	4 ha
	2002	NA	-	-
Number of trees planted per year over the last five years (2007/2011) or three years (2002)	2011	494	30%	200 trees
	2007	491	37%	200 trees
	2002	581	60%	83 trees
Area sown to perennial pasture and lucerne [ha]*	2011	463	29%	55 ha
	2007	489	30%	60 ha
	2002	NA	-	-
Area of native bush/grasslands fenced to manage stock access [ha]	2011	386	19%	10 ha
	2007	418	23%	10 ha
	2002	480	27%	16 ha
Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km]*	2011	386	17%	2.5 km
	2007	418	19%	3 km
	2002	NA	-	-
Area of farm forestry established [ha]	2011	466	6%	5 ha
	2007	491	4%	5 ha
	2002	NA	-	-
Have you put an artificial wetland on your property?	2011	430	5%	-
	2007	NA	-	-
	2002	NA	-	-

* denotes a significant difference across the local government areas

Table 14 Government support received for implementation of current recommended practices, 2011 (N=494)

Government support of current recommended practice	n	Government support (% said yes)
Practices undertaken over the full period of your management		
Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km]	386	52%
Area of trees and shrubs planted (including direct seeding) [ha]*	466	46%
Area of native bush/grasslands fenced to manage stock access [ha]	386	35%
Area of gully erosion addressed [ha]*	466	33%
Area of farm forestry established [ha]	465	31%
Area sown to perennial pasture and lucerne [ha]	465	12%
Number of off-stream watering points established	386	10%
Monitor bore height	442	6%
Monitor bore water quality	441	5%
Practices undertaken over the last five years		
Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km]*	386	42%
Area of trees and shrubs planted (including direct seeding)	466	39%
Area of native bush/grasslands fenced to manage stock access [ha]	386	34%
Area of farm forestry established [ha]	466	19%
Have you put an artificial wetland on your property?	430	10%
Used precision farming techniques for cropping*	271	8%

* denotes a significant difference across the local government areas

4.8.2 Relationships between CRP and influencing factors

There were a large number of independent variables linked to landholder behaviour (the uptake of CRP). In this section, we provide a list of items where there was a significant relationship to each CRP. As explained above, where there were two items examining the same practice we have provided results for the item which examined uptake over the period of management. Results for monitoring bore height and monitoring bore quality are not included (over 60% of respondents said the question was not applicable to them).

We have separated the variables linked to CRP implementation into two tables:

- those factors management agencies can seek to influence; and
- those factors that management agencies are unlikely to influence (or unlikely to influence in the short term) but which they should be aware of, such as landholder values.

Analysis was undertaken with CRP treated as a continuous variable (i.e. the amount of work undertaken) when possible. For precision farming and installing an artificial wetland, only categorical (yes/no) data were available.

Knowledge items were positively related to all conservation CRP practices, including creating an artificial wetland, tree planting, fencing waterways and native bush to manage stock access, and establishing off-stream watering points. Knowledge was also positively related to several

production-oriented CRP. Awareness of salinity on property was significantly linked to a range of production and conservation-oriented CRP. Landcare membership was linked to a mix of conservation and production related CRP: tree planting, fencing bush to manage stock access, addressing gully erosion, sowing perennial pasture and no-till cropping techniques. Commodity group membership was also positively related to a mix of production and conservation practices [Table 15]. Having received government support was positively related to tree planting, fencing waterways and bush to manage stock access, addressing gully erosion and establishing perennial pasture.

The importance of property management planning was highlighted by the analysis. Property management planning was positively related to all practices except the cropping-related-CRP of minimum tillage, no-till and precision farming. These practices are strongly associated with cropping and their uptake is less likely to be influenced by property management planning compared to other practices that may require a change in farm layout, such as fencing bush to manage stock access. Attending a short-course was positively related to tree planting, fencing waterways and bushland to manage stock access, perennial pasture and farm forestry [Table 15].

An initially surprising result is the negative relationship between the number of off-stream watering points established and belief that *stock access to rivers/streams/wetlands should be carefully managed*. This is likely explained by larger property owners who are more likely to be farmers and production focused establishing more off-stream watering points where they have implemented the practice. These larger property owners may have installed off-stream watering points at a relatively lower rate than non-farmers who own smaller properties. Analysis of the establishment of off-stream watering points as a categorical (yes/no) variable returned a non-significant result for *stock access to rivers/streams/wetlands should be carefully managed* and a significant positive association with *the time and expense involved in watering stock off-stream is justified*.

Table 15 Significant relationships between capacity building approaches and implementation of CRP (continuous) (N=494)

Capacity building approaches	Area of trees and shrubs planted	Created artificial wetland (y/n)	Length of fencing to manage stock access to waterways	Area of native bush/grasslands fenced to manage stock access	Number of off-stream watering points established	Area of gully erosion addressed	Area of perennial pasture sown	Area of farm forestry established	Max area of crop sown using no-till techniques	Max area of crop sown using min-till techniques	Precision farming (y/n)
Self assessed knowledge	+	+	+	+	+	+	+	ns	+	+	+
19/20 items all positively related except knowledge of water savings from the Wimmera-Mallee pipeline negatively related to off-stream watering point & perennial pasture	+	+	+	+	+	+	+	ns	-	ns	ns
Awareness of salinity on property	+	ns	+	+	ns	+	+	ns	+	ns	ns
Confidence in CRP (only relevant CRP for each practice are included, otherwise na)	na	na	ns	+	_*	ns	na	na	+	ns	na
Landcare participation	+	ns	ns	+	ns	+	+	ns	+	ns	ns
Commodity group participation	+	ns	ns	+	ns	ns	ns	ns	+	ns	+
Property management plan	+	+	+	+	+	+	+	+	ns	ns	ns
Government/WCMA support last five years	+	ns	+	+	ns	+	+	ns	ns	ns	ns
Short course	+	ns	+	+	ns	ns	+	+	ns	ns	ns

+ denotes a significant positive relationship. – denotes a significant negative relationship. ns denotes a non-significant relationship. na denotes not applicable to that CRP
 * Analysis undertaken with CRP as a yes/no returned a positive relationship

Table 16 show items that NRM agencies should be aware of, but are unlikely to be able to influence easily, such as deeply held values and values attached to property. However, it is important for NRM agencies seeking to engage with landholders to be aware of these factors. Understanding the values of landholders can provide ways for NRM staff to more readily engage landholders. For example, appeals to pro-conservation values or stressing the economic benefits of a practice. Farming as an occupation was negatively related to conservation oriented practices such as tree planting, and positively related to production-oriented practices requiring specialised knowledge, skills and equipment, including minimum tillage, no-till and precision farming.

As expected, owning more than one property in the Wimmera region was positively related to production-oriented CRP likely to be enhanced by larger property sizes, including those related to cropping. Property size showed similar trends, as did hours spent on on-property work. Indeed, there was a negative relationship between more hours spent on property and creating an artificial wetland, suggesting that those respondents who spend less time on their property and, hence, are less likely to depend upon on-property income (i.e. non-farmers by occupation) are more likely to implement practices unrelated to production and profitability. Making an off-property income was positively related to tree planting and fencing bush and waterways. The stewardship ethic item (*reduced production in the short-term is justified where there are long-term benefits to the environment*) was positively associated with the conservation-related CRP creating a wetland and tree planting. There were significant relationships between most CRP and values (both held and attached values). In most cases, significant relationships were found with a mix of economic, social and environmental values, reinforcing that most rural landholders are influenced by a range of values and that appeals attempting to engage them in NRM should embrace the full range of attached values.

Table 16 Significant relationships between topics NRM practitioners have limited capacity to influence but should consider and the implementation of CRP (continuous) (N=494)

Items exploring topics that NRM agencies are unlikely to influence but should know about	Area of trees and shrubs planted	Created artificial wetland (y/n)	Length of fencing to manage stock access to waterways	Area of native bush/grasslands fenced to manage stock access	Number of off-stream watering points established	Area of gully erosion addressed	Area of perennial pasture sown	Area of farm forestry established	Max area of crop sown using no-till techniques	Max area of crop sown using min-till techniques	Precision farming (y/n)
Occupation (farmer/non-farmer) (+ means farmers completed more)	-	ns	ns	ns	ns	ns	+	ns	+	+	+
Property size	+	ns	ns	+	+	ns	+	+	+	+	+
Values attached to property	Social (y)	Env (+)	Env (+)	Env (+) Env scale(+)	ns	ns	Env (+) Social (y)	Social (y)	Env (+) Eco (+) Social (y)	Env (+) Eco (+) Social (y)	Env (+) Eco (+) Social (y)
Held values	ns	Social justice (+) Wealth (-)	+	ns	ns	ns	-	Altruistic (+) Biospheric (+) Egoistic (+)	+	ns	+
11/12 items											
Hours worked on property	ns	-	ns	ns	+	ns	+	ns	+	+	+
Made off-property income	+	ns	+	+	ns	ns	ns	ns	ns	-	ns
Made on-property income	-	ns	ns	ns	ns	ns	+	ns	ns	+	ns
On-property profitability	ns	ns	ns	ns	ns	ns	ns	ns	+	+	+
Days worked off-property	ns	ns	ns	ns	ns	ns	ns	ns	-	-	ns
Own more than one property	ns	ns	ns	ns	ns	ns	+	ns	+	+	ns
Stewardship ethic	+	+	ns	ns	ns	ns	ns	ns	ns	ns	ns

*social mix of positive and negative relationships depending on the item

+ denotes a significant positive relationship. - denotes a significant negative relationship. ns denotes a non-significant relationship. na denotes not applicable to that CRP

4.8.3 Modelling CRP implementation

In this section we outline results from multiple linear regression modelling for several CRP included in the survey, including:

- area of trees and shrubs planted (period of management);
- area of farm forestry established (period of management);
- fencing to manage stock access to waterways (period of management);
- area of native bush/grasslands fenced to manage stock access (period of management);
- area sown to perennial pasture (period of management);
- number of off-stream watering points established (period of management);
- area of gully erosion addressed (period of management);
- maximum area of crop sown in any year using adaptive no-till techniques (last five years); and
- maximum area of crop sown in any year using minimum tillage techniques (last five years).

The results presented below represent the ‘best combination of factors’ that explain implementation of each practice. Analysis was undertaken using implementation of each CRP as a continuous variable. Regression results are not presented for monitoring bore water height or quality, creating an artificial wetland, or precision farming. Models were unable to be determined or only poor model results were obtained for these CRP. Readers are advised to refer to Appendix 1 for pairwise results which indicate the direction of each relationship found.

Table 17 Multiple linear regression modelling for planting trees and shrubs (n=206), R² 28%, p-value <0.001

Independent variables
Information source: environmental organisations
Value attached to property: provides the lifestyle I want
Property management plan/whole farm plan
Views: the use of land for carbon farming/biofuels will lead to food shortages
Long-term plan: all or most of the property will be share-farmed
Land use: conservation covenant
Member of a commodity group
Utilised an agricultural consultant
Participation in property decision making
Land use: dryland pasture
Information source: extension officers

Table 18 Multiple linear regression modelling for establishing farm forestry (n=207), R² 28%, p-value <0.001

Independent variables
Property size (land owned by you)
Issue: dryland salinity threatening the long-term productive capacity of land
Information source: extension officers
Confidence in CRP: benefits of stubble retention outweigh the problems
Altruistic held value scale
Information source: environmental organisations
Egoistic held value scale

Table 19 Multiple linear regression modelling for fencing rivers, streams and wetlands to manage stock access, (n=222), R² 23%, p-value <0.001

Independent variables
Government/WCMA funding last five years
Awareness of signs of salinity on property
Information medium: desktop computer
Long term plan: enterprise mix changed to more intensive industries
Property management plan/whole farm plan
Information source: internet
View: landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals

Table 20 Multiple linear regression modelling for fencing bush and grassland to manage stock access (n=240), R² 12%, p-value <0.001

Independent variables
Land use: conservation covenant
Information source: environmental organisations
Confidence in CRP: stock access to rivers/streams/wetlands should be carefully managed
Property issue: lack of skilled labour

Table 21 Multiple linear regression modelling for sowing perennial pasture (n=147), R² 65%, p-value <0.001

Independent variables
Property size (land owned by you)
Land use: beef
Knowledge: benefits of retaining native vegetation on properties
View: any negative impacts of pumping groundwater can be fixed
District issue: farming practices contributing to erosion
Government/WCMA funding last five years
Information source: WCMA
Own more than one property in Wimmera region
Long term plans: all or most of the property will be leased
Time spent volunteering
Time spent on property related activities
Short course
Land use: wool
View: landholders have the right to harvest water that falls on their property, even if it impacts on others
View: it is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment
Information source: books, magazines, journals

Table 22 Multiple linear regression modelling for establishing off-stream watering points (n=202), R² 57%, p-value <0.001

Independent variables
Property size (land owned by you)
Land use: farm forestry
Time spent on property work
Land use: beef
Information source: environmental organisations
View: any negative impacts of cropping or draining wetlands can be fixed
View: pumping groundwater will create long lasting environmental problems
Land use: conservation covenant
View: only a few people in the Wimmera region will receive benefits from cropping or draining wetlands
Long-term plans: the enterprise mix will be changed to reduce my farm workload

Table 23 Multiple linear regression modelling for erosion control (n=244), R² 13%, p-value <0.001

Independent variables
Awareness of signs of salinity on property
Information source: extension officers
View: landholders should manage their properties in expectation of drought events
Knowledge: the role of wetlands in filtering water entering rivers

Table 24 Multiple linear regression modelling for adaptive no-till (n=134), R² 71%, p-value <0.001

Independent variables
Land owned by you or your immediate family
Confidence in CRP: benefits of stubble retention outweigh the problems
Commodity group membership
Value: property provides the lifestyle that I want
Knowledge: how to establish introduced perennial pastures
Own more than one property in the Wimmera
Land leased from others
Long term plans: all or most of the property will be leased
Would do more 'Landcare type work' if CMA provided cash/materials
Issue: dryland salinity threatening the long-term productive capacity of land
View: cropping or draining wetlands creates economic opportunities that will benefit our district
View: the public should have the right to access river/streams/wetlands
View: landholders should manage their properties in expectation of drought events
Value: property an attractive place to live
Held value: authority, using knowledge and experience to lead others

Table 25 Multiple linear regression modelling for minimum tillage (n=177), R² 35%, p-value <0.001

Independent variables
Land owned by you or your immediate family
Land use: broadacre cropping
District issue: salinity threatening water quality in rivers, streams, wetlands
Information source: environmental organisations
Off-property income
View: only a few people in the Wimmera region will receive benefits from cropping or draining wetlands
Land use: beef

4.9 Information source and medium

The 2011 survey explored respondents' preferred sources of information for NRM. This topic was only included in the 2007 and 2011 surveys. Items in the 2011 survey topic represented a condensed list of the items included in the 2007 survey. A list of common NRM information sources and mediums (e.g. the post) were provided and respondents were asked to indicate which sources they used.

As might be expected, the most widely utilised source of NRM information was newspapers (59%), followed by books, magazines and journals (53%) [Figure 7]. Thirty-nine percent of respondents reported using the Wimmera CMA for information on NRM topics. Seventy percent of respondents received information in the post [Table 26].

The overall trend over the two survey periods was for a significant decline from 2007 to 2011 in the proportion of respondents who listed each of the sources of information, with the exception of the internet. The extent of this change is somewhat surprising. It may represent a real change explained by the splintering of information sources with the advent of the internet and social media, as well as the increased proportion of respondents who are non-farmers and more likely to use non-traditional sources of information. It is also possible that the trends observed result from the change in the format of the survey topic. That is, by collapsing the number of items into 19 broad headings it is possible that respondents were not as readily stimulated to remember all of the information sources they had used. There was a significant difference across the region on the use of VFF, newspapers, Landcare, radio, agricultural consultants and environmental organisations.

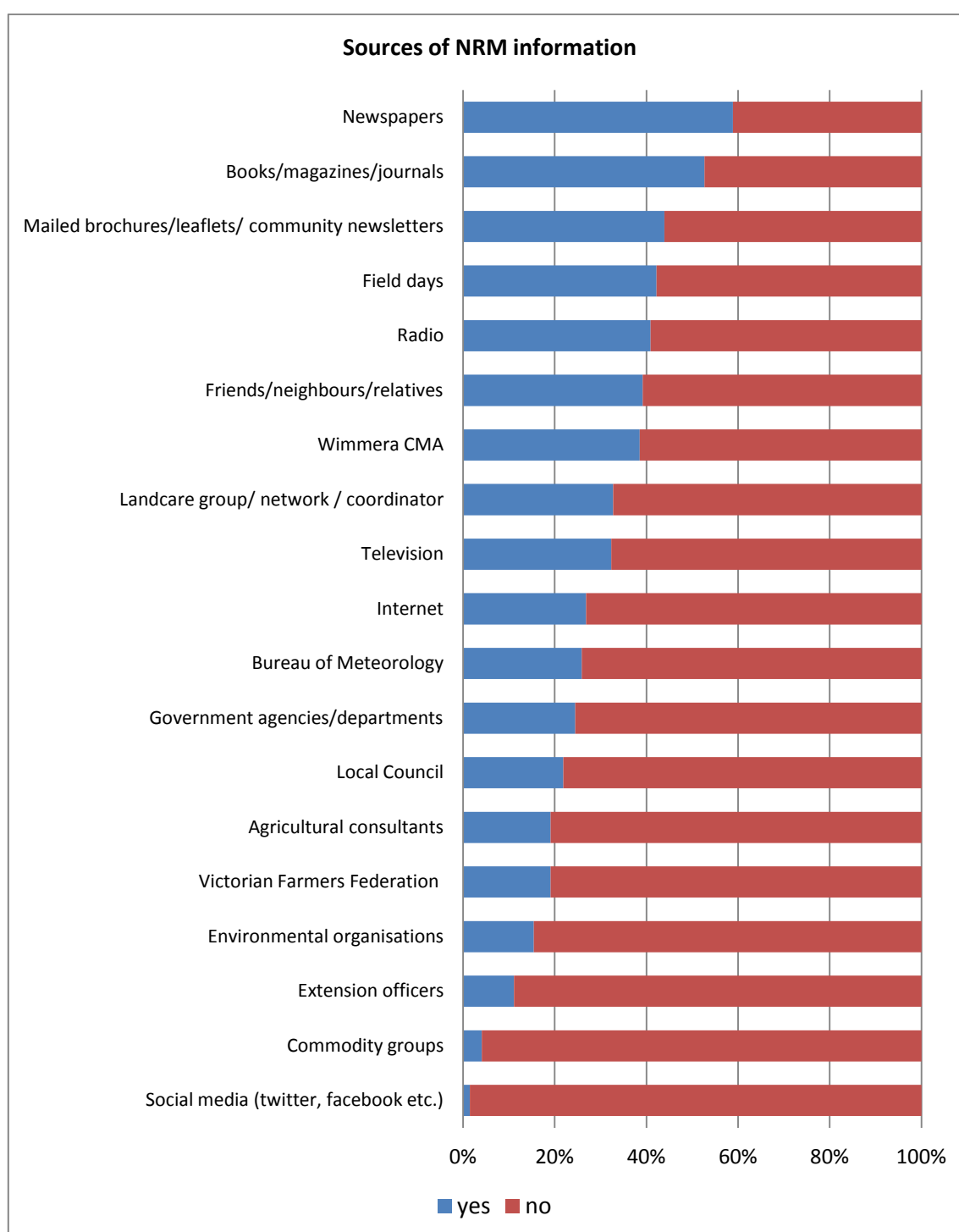


Figure 7 Sources of NRM information, 2011 (N=494)

Table 26 NRM information medium, 2011 (N=494)

Information medium	n	Yes
Through the post	466	70%
Desktop computer	465	36%
Local commodity/environmental group*	465	31%
Smart phone technology	464	4%

* denotes a significant difference across the local government areas

4.10 Wetlands and groundwater: trust and risk

This topic was included for the first time in the 2011 survey. The topic explored landholder attitudes towards risk regarding wetland and groundwater management as well as trust and trustworthiness in the WCMA with regards to wetland management.

Multiple benefits of building trust between communities and NRM agencies have been identified in the literature and there have been some attempts to distinguish between trust and trustworthiness (Sharp 2010). Mayer et al. (1995) suggest that trustworthiness, or expectations about another's intentions or behaviour, is comprised of three characteristics: ability (i.e. trustor perceptions of the trustee's knowledge, skills and competencies); benevolence (i.e. the extent to which a trustor believes that a trustee will act in the best interest of the trustor); and integrity (i.e. the extent to which the trustor perceives the trustee as acting in accord with a set of values and norms shared with or acceptable to the trustor). In this survey we aimed to measure *agency* trustworthiness (ability, benevolence and integrity). Intention to trust was measured using items which captured respondents' willingness to rely on the WCMA (Sharp 2010).

A substantial proportion of respondents indicated they were unsure on the trust and trustworthiness measures [Table 27]. Thirty-three percent of respondents agreed with the intention to trust measure *I can rely on the Wimmera CMA to provide useful advice about river frontage management*, while 17% agreed with the second intention to trust measure *I can rely on the Wimmera CMA to provide appropriate financial assistance for river frontage management*. Respondents were generally unsure about the trustworthiness of the WCMA:

- 50% were unsure if *the WCMA was very knowledgeable about river frontage management* (20% agreed and 17% disagreed);
- 49% were unsure if *sound principles seem to guide the WCMA decisions about river frontage management* (18% both agreed and disagreed); and
- 48% were unsure if *the WCMA keeps landholders' interest in mind when making decisions about river frontage management* (more disagreed than agreed with this item, 16% agreed and 21% disagreed).

We suggest that while these results are not overwhelmingly positive, the WCMA has the opportunity to engage and build relationships with the high proportion of respondents who were unsure. These respondents may have little previous experience with the WCMA, or their experience to date has not been either extremely positive or negative.

To explore landholders' risk perceptions towards groundwater use and wetland management, we adapted items utilised by Stedman et al. (2011) to explore risk perceptions to natural gas developments in the United States. We think these items provide a useful way to explore risk in the groundwater and wetland management contexts, including exploring perceptions of whether negative impacts can be prevented or addressed; whether benefits outweigh the costs; whether only a few people will benefit; and whether the practice will create long-lasting environmental problems.

Survey data suggest that most respondents are concerned about the risks of cropping and draining wetlands and pumping groundwater in the Wimmera region. For example, 52% of respondents agreed that only a few people in the Wimmera would receive benefits from cropping and draining wetlands, and 47% agreed that only a few would receive benefits from pumping groundwater [Table 27]. There were also substantial proportions of respondents indicating they were unsure on most of the items in this topic. Only a minority of respondents agreed that the benefits of cropping or draining wetlands and pumping groundwater

outweighed problems arising. There was a significant difference across the local government areas on eight of the items in this topic [Table 27].

To further explore risk perception in relation to wetlands, we compared respondents who lived close to (i.e. within a kilometre) of a wetland and those who lived further away (i.e. beyond one kilometre). Our intention was to test the hypothesis that those living/ working (i.e. own property) in close proximity to a wetland would be more concerned about risks associated with resource exploitation. Our analysis established that those who own property closer to a wetland are less concerned about negative impacts, more optimistic that negative impacts can be managed and more positive about the extent that the benefits of resource use will be shared widely. These results may reflect reality based on practical experience with or observation of local wetlands; ignorance of the extent of negative impacts of resource use on local wetlands; or an attempt to rationalise exploitation of local wetlands. For example, those who owned property closer to a wetland were significantly:

- less likely to agree that cropping or draining of wetlands will create long lasting environmental problems (wetland n=145, mean=3.31; non-wetland n=310, mean=3.54; p=0.017);
- more likely to agree that any negative impacts of cropping or draining wetlands can be fixed (wetland n=142, mean=3.01; non-wetland n=308, mean=2.79; p=0.012); and
- were less likely to agree that only a few people in the Wimmera region will receive benefits from cropping or draining wetlands (wetland n=144, mean=3.44; non-wetland n=315, mean=3.64; p=0.015).

Table 27 Views about wetlands and groundwater, 2011 (N=494)

Your views about wetlands and groundwater	n	Agree	Not sure	Disagree	NA	Mean
Wetlands						
Only a few people in the Wimmera region will receive benefits from cropping or draining wetlands	459	52%	34%	8%	7%	3.58
Cropping or draining of wetlands will create long lasting environmental problems	455	46%	30%	15%	10%	3.46
Negative impacts of cropping or draining wetlands can be prevented if we proceed carefully	456	35%	35%	20%	9%	3.13
Any negative impacts of cropping or draining wetlands can be fixed*	450	20%	43%	28%	9%	2.86
Cropping or draining wetlands creates economic opportunities that will benefit our district*	456	18%	42%	32%	8%	2.78
All in all, the benefits of cropping or draining wetlands outweigh the costs*	453	14%	36%	35%	14%	2.67
Groundwater						
Only a few people in the Wimmera region will receive benefits from pumping groundwater*	455	47%	30%	15%	8%	3.44
Any negative impacts of pumping groundwater can be prevented if we proceed carefully*	453	33%	44%	14%	10%	3.21
Pumping groundwater will create long lasting	455	29%	46%	16%	9%	3.16

environmental problems*						
Pumping groundwater creates economic opportunities that will benefit our district*	454	31%	42%	17%	10%	3.15
All in all, the benefits of pumping groundwater outweigh the costs*	453	22%	45%	21%	12%	3.02
Any negative impacts of pumping groundwater can be fixed	454	10%	50%	30%	10%	2.72
Agency trustworthiness and intention to trust						
I can rely on the Wimmera CMA to provide useful advice about river frontage management (<i>trust</i>)	459	33%	33%	16%	18%	3.19
The Wimmera CMA is very knowledgeable about river frontage management (<i>ability</i>)	454	20%	50%	17%	12%	2.99
Sound principles seem to guide the Wimmera CMA decisions about river frontage management (<i>integrity</i>)	456	18%	49%	18%	15%	2.95
I can rely on the Wimmera CMA to provide appropriate financial assistance for river frontage management (<i>trust</i>)	458	17%	47%	17%	20%	2.99
The Wimmera CMA keeps landholders' interests in mind when making decisions about river frontage management (<i>benevolence</i>)	456	16%	48%	21%	16%	2.92

* denotes a significant difference across the local government areas

Responses were rated on a scale from 1, 'Strongly disagree' to 5, 'Strongly agree'. 'Not applicable' was a separate response option.

5 TRENDS IN SOCIAL STRUCTURE

Understanding the social structure of the region provides useful information for NRM organisations attempting to engage rural landholders, especially as the social characteristics of a region change over time. Additionally, those changes often differ spatially and NRM agencies need to be aware of who they are engaging and tailor their approaches accordingly. For example, occupational identity is linked to behaviour, with farmers more likely to rely on their property to make a living and support a family and hence be more focused on production and profitability. As we have already illustrated with the results of analyses using the 2011 survey data, property size, membership of Landcare and commodity groups, involvement in property management planning and short courses are all important influences on the implementation on both conservation and production CRP [see Section 4.8.2]. There are other variables that have not been linked to adoption of CRP in the earlier section, including age, length of residence and absentee ownership that are included in this section. For most items included in this section there are data for the three survey periods.

The median property size of respondents was 450 ha and the total amount of land owned or managed in the local district was 600 ha [Table 28], indicating a considerable production emphasis in the Wimmera region. There has been a significant decrease over time in these two items. The total amount of land owned/managed in the local district by survey respondents has decreased from 900 ha in 2002 to 600 ha in 2011, while the median property size has decreased from 630 ha in 2007 to 450 ha in 2011 (data were only available for these two years for this item). This trend could reflect broader changes occurring across south-eastern Australia in terms of a dichotomy appearing between those landholders expanding their enterprises in production landscapes, through to those subdividing and the in-migration of newcomers in amenity landscapes. For example, the median amount of land owned has decreased in Ararat, while it has remained stable in the West Wimmera Shire [see Section 5.2 for further discussion on trends over time for property size and other important social characteristics]. In other landscapes, a transition is occurring from production to amenity or other uses.

In 2011, thirty-four percent of respondents owned more than one property in the Wimmera region, and a further 10% owned an additional property outside the Wimmera region. That is, 44% of survey respondents owned multiple properties. This was the first time this item was included in the Wimmera survey, so we are unable to determine the nature of any trends in multiple property ownership or explore what this might mean in terms of changes in the median property size (e.g. trending down overall across successive surveys in the Wimmera). However, other research conducted by the authors (Mendham et al. forthcoming) suggests this phenomenon may be increasing, associated with higher rates of rural property turnover and the amalgamation of properties in production-focused regions as some farmers attempt to increase the scale of their enterprises and manage risk by having properties in different locations. This phenomenon is also likely to have social and economic implications for the wider regional community. Unless owners are replaced by live-in managers, there are likely to be less people living in areas where 44% of properties are part of multiple ownerships. Fewer people living in a district is likely to have flow-on effects to stores, schools, volunteer organisations and sporting clubs.

Twenty-eight percent of respondents said that their principal place of residence was not on the property they were identified as the property owner. These absentee owners would include 'weekenders' living outside the Wimmera region and perhaps in Horsham (e.g. with properties around the Grampians and Pyrenees where there are attractive landscapes and a high proportion of non-farmers). With 34% of respondents indicating they owned multiple properties

in the Wimmera, it seems that the level of absentee ownership has been significantly under-reported. Such a conclusion would be consistent with recent findings from doctoral research by Gina Lennox in the Lachlan catchment of NSW where around 50% of properties are owned by people who live off the property (and not on an adjacent property). This level of absenteeism can present challenges for NRM agencies (Mendham and Curtis 2010).

In the 2011 survey, 27% of respondents had completed a short course (this proportion was significantly lower than previous survey results). Previous research has consistently established significant positive relationships between short course attendance and implementation of recommended practices by landholders. Short courses appeal as a cost effective investment option for NRM agencies. Thirty-five percent of respondents had prepared a property management plan. Property management planning is consistently linked to the adoption of recommended practices. The proportion of landholders involved in property management planning as decreased over time.

Just over half (56%) of all respondents identified themselves as farmers by occupation. The proportion of farmers has decreased significantly over time [Table 31]. The trend to a larger proportion of non-farming landholders has potentially very important implications for NRM (and other aspects of rural life), as non-farmers typically spend less time on-farm, have stronger conservation values, but less knowledge and experience of NRM, different personal networks and use different sources of information about NRM (Mendham and Curtis 2010). Examination of data across the three surveys indicates that there has been a significant increase over time in time spent off farm and a decrease in hours spent on farm. The implications of these trends are discussed further in the next section comparing farming and non-farming respondents.

Sixty-nine percent of respondents reported making an on-property profit (2010/11) (median \$40-50,000) and 74% reported receiving a net off-property income (median \$30-40,000). The median combined income from on and off-property sources was \$60,000. These on-property and total household incomes are significantly higher than those in 2007 and reflect the ending of a decade-long drought. The median on-property profit was similar to that of 2002. Previous research has established significant positive links between on-property profitability and implementation of recommended practices. In 2011 there was a link between higher profitability and minimum tillage, no-till and precision farming. Reporting an on-property profit was positively linked to the establishment of farm forestry, minimum tillage and perennial pasture, and negatively linked to tree planting.

Forty-five percent of respondents had received government funding for at least one of the CRP included in the survey (either over the full period of management or the past five years), and survey data indicate that over 50% of those implementing most practices were doing so without government support. The proportion who reported receiving government funding in the last five years has decreased significantly over time (36% in 2002 to 26% in 2011). At the same time, 41% of respondents reported undertaking 'Landcare-type' work without government assistance. Sixty-nine percent of respondents said they would do more if supported.

The proportion of respondents involved in Landcare has significantly decreased between 2002 and 2011, from 44% in 2002, to 39% in 2007 and 34% in 2011. The pairwise analyses suggest that Landcare participation is positively linked to a range of practices. The trends to smaller proportions of landholders involved in Landcare and receiving government funds for NRM may be linked (feedback both ways).

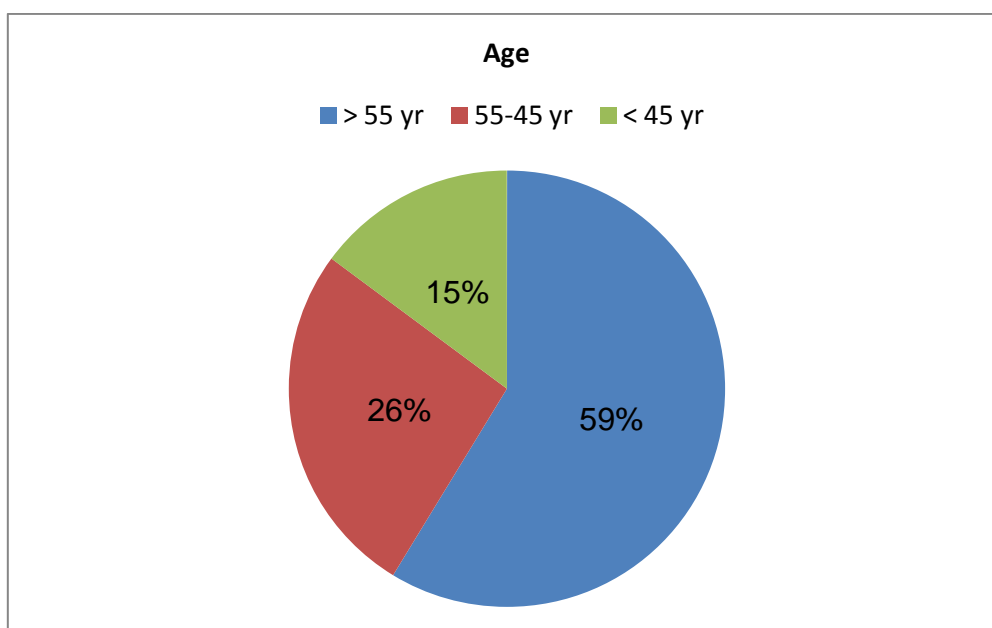


Figure 8 Age of survey respondents, 2011 (N=494)

Table 28 Social and farming variables of all survey respondents, 2011 (N=494)

Social and farming variables	n	%, median/ mean score
Total amount of land owned/managed by you or your immediate family in your local district*	452	600 ha
Size of property*	450	450 ha
Lease, share farm or agist land from others*	450	29%
Area leased, share farmed or agisted from others*	130	300 ha
Lease, share farm or agist land to others	457	24%
Area of property leased, share farmed or agisted to others*	105	241 ha
Length of property ownership*	449	28 yr
Own more than one property in the Wimmera region *	462	34%
Own another rural property outside the Wimmera region*	460	10%
Property is principal place of residence	457	72%
Percent male *	464	83%
Age	458	57 yr
Attended short course relevant to property management (last five years)	463	27%
Occupation *	494	Farmer: 56% Professional: 23% Retiree: 14% Trade: 6%
Hours per week spent on farming/property related activities past year*	416	40 hr
Involved in off property work	416	41%
Days involved in paid off-property work (past year)*	459	150 days
Hours per week spent attending activities for any	461	2 hr

voluntary groups in (past year)		
Years lived in local district*	449	45 yr
Member of Landcare group*	463	34%
Member of commodity group*	466	22%
Federal/ state government programs or the Wimmera CMA supported on property work (past five years)*	463	26%
Received government support for CRP*	383	45%
Prepared a property management plan	440	35%
Utilised contractor for property management (past year)	465	40%
Family succession aspiration	473	53%
"Landcare operations" undertaken on property without government assistance*	466	41%
Would do more "Landcare operations" if CMA provided assistance	449	69%
Made on farm profit (last year)*	288	69%
Median on farm profit (last year)*	288	\$40,000-\$50,000
Received net off property income (last year)*	461	74%
Median net off property income (last year)	318	\$30-\$40,000
Total on and off property income (last year)	407	\$60,000
Participation in property decision making*	451	Me & partner: 41% Me: 31% Multi-generations of family: 23% Property manager: 5% Property manager & me: 1%
Equity in property	494	<40%: 7% 41-60%: 12% 61-80%: 22% 81-100%: 59%
Stage of succession planning of those with family interested in taking on the property	240	Early stages: 21% Halfway: 10% Well advanced: 18% Completed: 12%

* denotes a significant difference across the local government areas

Table 29 On property profit, 2011 (N=494)*

Received a net on-property profit	% yes
Less than \$10,000	18%
\$10,000 to \$20,000	14%
\$20,000 to \$30,000	7%
\$30,000 to \$40,000	8%
\$40,000 to \$50,000	9%
\$50,000 to \$60,000	8%
\$60,000 to \$100,000	13%
Above \$100,000	23%

* denotes a significant difference across the local government areas

To further explore these findings regarding the social and farming characteristics of the Wimmera region, we compared farmers and non-farmers. Our previous research suggests they are different and that these differences influence management. As more landholders are non-farmers, the differences are becoming more important to NRM agencies seeking to engage landholders in land use and practice change.

5.1 Comparing farmers and non-farmers

The results of analyses presented in Table 30 demonstrate that farming and non-farming landholders are significantly different on a number of key variables. Non-farmers were more likely: to own smaller properties; to have owned their property and lived in the district for shorter periods of time; to be absentee landholders; to plan on selling or subdividing their property; and to have spent more time engaged in off-property work. Non-farmers were less likely to spend time undertaking on-property work; to own multiple properties in the Wimmera region; to be members of a commodity group; to have undertaken a short course related to property management; to have family interested in taking over the property; or to have started succession planning [Table 30].

While there is not the space to explore all significant differences between the two groups in detail here, farmers reported significantly higher self-rated knowledge on 11 of the 19 knowledge topics; non-farmers expressed greater concern for nine of 16 environment items (concern about issues); while farmers were more concerned about items relating to productivity and social issues. Non-farmers expressed a stronger stewardship ethic and support for a duty of care for the environment, and expressed less support for attitudinal items reflecting stronger views about private property rights (such as the right to harvest water without regard for the impact on others). Non-farmers were also more likely to agree with statements reflecting belief that clearing native vegetation has affected biodiversity. As would be expected, non-farmers were less likely to be involved in land uses that require specialist skills and equipment (cropping) and were more likely to be involved in dryland farming and other forms of livestock husbandry. Farmers and non-farmers are also likely to give different ratings to possible sources of NRM information, with non-farmers more likely to give higher ratings to magazines and lower ratings to more traditional sources of NRM information such as the CMA, field days, newspapers, radio and extension officers. Additionally, non-farmers were more likely to value the environmental and recreational aspects of their property, while farmers expressed greater value for the production and economic aspects of owning a rural property. Non-farmers also gave a higher rating to the value *being part of a rural community*. These are important indicators of potentially successful ways for NRM agencies to engage with non-farming rural landholders.

Table 30 Comparing social and farming characteristics of farmers and non-farmers, 2011
(N=494)

Topic	Farmer		Non-farmer		p value
	n	%, median/ mean score	n	%, median/ mean score	
The property will be sold	242	2.0	194	2.7	<0.001
The property will be sold and another rural property bought	240	1.4	187	1.6	0.202
The property will be subdivided and a large part of the property sold	239	1.3	185	1.6	0.032
The property will be subdivided and a small part of the property sold	240	1.3	186	1.5	0.066
Ownership of the property will stay in the family	248	4.2	190	3.4	<0.001
Will live on the property for as long as possible	244	4.0	190	3.7	0.026
Additional land will be purchased, leased or share-farmed	242	2.8	188	1.9	<0.001
All or some part of the property will be placed under a conservation covenant	236	1.8	187	2.2	0.011
Family members are interested in taking on the property	247	65%	192	38%	<0.001
Stage in succession planning	154	Early stages	71	Not started	0.004
Area of land owned by you or your immediate family	246	1100 ha	196	118.5 ha	<0.001
Area of property owned	245	940 ha	195	111 ha	<0.001
Years owned/managed the property	243	31 yrs	194	20 yrs	<0.001
Own more than one property in the Wimmera region	251	45%	199	21%	<0.001
Own another property outside the Wimmera region	251	11%	198	9%	0.543
Property is the principal place of residence	250	84%	197	57%	<0.001
Male	251	92%	199	73%	<0.001
Age	249	57 yrs	196	58 yrs	0.372
Undertaken short course in last five years	251	39%	200	13%	<0.001
Hours per week spent on-property	252	50 hrs	196	10 hrs	<0.001
Days per year in off-property paid employment	247	0 days	195	100 days	<0.001
Years lived in local district	246	50 yrs	185	35 yrs	<0.001
Member of Landcare	246	44%	198	22%	<0.001
Member of commodity group	247	35%	200	7%	<0.001
Received government funding in last five years	246	34%	199	17%	<0.001
Used a contractor in past 12 months	246	49%	200	28%	<0.001
Made a net on-property profit	242	84%	192	53%	<0.001
On-property profit range	188	\$50-60,000	96	\$10-20,000	<0.001
Made a net off-property income	245	61%	194	89%	<0.001
Off-property income range	139	\$20-30,000	165	\$40-50,000	<0.001

Prepared a property management plan	230	44%	191	25%	<0.001
Information source: CMA	249	45%	195	31%	<0.001
Information source: environmental groups	249	15%	195	18%	0.387
Information source: government departments	249	25%	194	24%	0.784
Information source: commodity group	247	35%	200	7%	<0.001

* denotes a significant difference across the local government areas

5.2 Trends in social and farm structure by local government area

Research findings highlight key differences across the LGA, including median property size, the proportion of absentee owners, and farming as an occupation. For example, in the Pyrenees Shire 31% of respondents were farmers; the median property size was 55 ha; 40% of new residents had owned their properties for less than 10 years; and 29% of respondents were absentee landholders. The median off-property income in the area was \$60-100,000 (with a median 175 days per year of off-property work) and the median on-property income was \$40-50,000 (with a median of 35 hours per week on property work). Twelve percent of respondents from the Pyrenees were a member of a commodity group and 53% were involved in Landcare. The top land use was tree-planting (82% had planted more than one hectare of trees on their property), followed by dryland pasture and sheep. Twenty-four percent of respondents had a conservation covenant on their property and 77% agreed with the item measuring commitment to a stewardship ethic [see Table 32a and 32b as well as the relevant council profiles).

In contrast, in the Yarriambiack shire 67% of respondents were farmers and the median property size was 718 ha. As with the Pyrenees, 29% of respondents were absentee landholders; however, in stark contrast only 3% were new property owners (<10 years). Off-property income for the region was \$30-40,000 (median 140 days/year), while the median on-property income was \$50-60,000 (median 50 hours/week). Fewer respondents were involved in Landcare (36%) and more were members of a commodity group (47%). Compared to the Pyrenees where the top land use was tree-planting, in Yarriambiack 98% of respondents were involved in broadacre cropping. Compared to respondents in the Pyrenees Shire, almost half the number agreed with the stewardship ethic item (40% in Yarriambiack, 77% in the Pyrenees). These findings are important in terms of engagement and point to the values NRM agencies might appeal to. For example, in the Pyrenees one of the top three rated property values was *a sense of accomplishment from contributing to the environmental health of the district*. These findings also indicate possible areas where NRM agencies might seek to increase involvement. For example, 53% were involved in property management planning in the Pyrenees and only 35% were involved in the practice in Yarriambiack.

Throughout this report we have listed significant changes over time for each survey topic. In this section we report on a limited number of changes over time for the region as a whole as well as the local government areas in the Wimmera region. This analysis highlights important sub-regional differences in change in social structure. For example, the proportion of farmers in Ararat has decreased from 66% to 24% while in West Wimmera the proportion has decreased 15%, from 85% to 70%.

Table 31 Trends in social structure over time: Wimmera region, 2011 (N=494)

Topic	Year	n	% median/ mean
Will subdivide a small or large part of property Not significant	2011	463	7%
	2007	477	8%
	2002	597	6%
Will buy additional land Significant difference all years, p-value <0.001	2011	467	28%
	2007	474	32%
	2002	596	43%
Median property size (property owned) Significant difference, p-value=0.0106	2011	450	450 ha
	2007	493	630 ha
	2002	NA	-
Median property size (owned and managed by immediate family) Significant difference 2007:2002; 2011:2002, p-value<0.001	2011	452	600 ha
	2007	493	630 ha
	2002	573	900 ha
Principal place of residence (% absentee landholder) Not significant	2011	457	28%
	2007	498	22%
	2002	NA	-
Occupation (% farmer) Significant difference, p-value<0.001	2011	494	56%
	2007	503	69%
	2002	619	80%
New residents (<=10 years) Significant difference, p-value=0.03	2011	449	10%
	2007	479	11%
	2002	607	7%
Median year of transfer	2011	494	2022
	2007	503	2019
	2002	619	2017

Table 32a Trends in social structure over time by local government area, 2011 (N=494)

Topic	Year	Ararat		Buloke		Hindmarsh		Horsham	
		n	%, mean or median	n	%, mean or median	n	%, mean or median	n	%, mean or median
Will subdivide a small or large part of property	2011	37	14%	7	0%	75	7%	110	9%
	2007	40	13%	NA	-	107	7%	34	9%
	2002	34	9%	NA	-	116	5%	121	7%
Will buy additional land	2011	37	16%	7	29%	76	22%	111	23%
	2007	40	23%	NA	-	106	34%	33	21%
	2002	34	29%	NA	-	114	43%	121	39%
Median property size (owned)	2011	36	69 ha	8	875 ha	75	750 ha	107	250 ha
	2007	41	128 ha	NA	-	107	760 ha	34	318.5 ha
	2002	NA	-	NA	-	NA	-	NA	-
Median property size (owned/ managed by family)	2011	36	69 ha	8	950 ha	75	845 ha	108	311.5 ha
	2007	41	128 ha	NA	-	107	760 ha	34	318.5 ha
	2002	30	362 ha	NA	-	114	1000 ha	114	755 ha
Principal place of residence (% absentee)	2011	37	35%	8	25%	75	28%	107	28%
	2007	42	38%	NA	-	108	3%	34	50%
	2002	NA	-	NA	-	NA	-	NA	-
Occupation (% farmer)	2011	38	24%	8	88%	80	65%	117	44%
	2007	42	33%	NA	-	108	86%	35	52%
	2002	34	66%	NA	-	122	82%	126	75%
New residents (<=10 years)	2011	37	14%	8	0%	78	8%	103	13%
	2007	40	26%	NA	-	104	5%	32	9%
	2002	34	3%	NA	-	117	1%	122	11%
Median year of transfer	2011	37	2020.5	8	2022	80	2021	117	2021
	2007	40	2017.5	-	-	108	2023	35	2016
	2002	34	2020	-	-	122	2020	126	2015

Table 32b Trends in social structure over time: by local government area, 2011 (N=494)

Topic	Year	Northern Grampians		Pyrenees		West Wimmera		Yarriambiack	
		n	%, mean or median	n	%, mean or median	n	%, mean or median	n	%, mean or median
Will subdivide small or large part of property	2011	47	9%	15	0%	90	7%	82	4%
	2007	67	12%	16	13%	112	5%	98	6%
	2002	34	9%	7	0%	159	6%	119	4%
Will buy additional land	2011	48	27%	15	20%	90	38%	83	37%
	2007	67	15%	16	31%	111	35%	98	45%
	2002	34	38%	7	43%	159	42%	119	52%
Median property size (owned)	2011	42	206 ha	16	55 ha	83	700 ha	83	718 ha
	2007	72	190 ha	20	53 ha	115	804 ha	101	931 ha
	2002	NA	-	NA	-	NA	-	NA	-
Median property size (owned/ managed by family)	2011	43	200 ha	16	59 ha	83	800 ha	83	960 ha
	2007	72	190 ha	20	53 ha	115	804 ha	101	931 ha
	2002	29	760 ha	7	364 ha	156	996.5 ha	115	1027 ha
Principal place of residence (% absentee)	2011	43	35%	17	29%	87	18%	83	29%
	2007	72	26%	20	45%	119	25%	100	17%
	2002	NA	-	NA	-	NA	-	NA	-
Occupation (% farmer)	2011	50	47%	17	31%	96	70%	88	67%
	2007	74	38%	20	40%	119	76%	102	89%
	2002	35	63%	7	71%	165	85%	122	87%
New residents (<=10 years)	2011	44	11%	15	40%	86	12%	80	3%
	2007	70	23%	18	22%	112	9%	101	6%
	2002	35	9%	7	14%	164	10%	121	6%
Median year of transfer	2011	50	2024	17	2022	96	2022	88	2024
	2007	74	2018	20	2019.5	119	2020	102	2020
	2002	35	2014	7	2012	165	2018	122	2017

6 COUNCIL PROFILES

In this section, we present specific data about the social structure and key issues in each local government area, highlighting key differences at the subregional level. In each council profile we report on:

- Median property size
- Median length of residence
- Median age
- Proportion who are farmers by occupation
- Proportion who are absentee
- Proportion who own more than one rural property
- Percent involved in Landcare
- Percent who are members of a commodity group
- Percent who have completed a short course (last five years)
- Percent involved in property management planning
- Proportion who have received government funding
- Top three sources of information
- NRM topics respondents reported least and most knowledge
- Three most likely long-term plans
- Top three values attached to property
- Top three district issues
- Top five most common land uses
- Confidence in CRP
- Top three most commonly adopted conservation practices
- Top three most commonly adopted sustainable agricultural practices
- Landholder agreement with: *landholders should manage their properties in expectation of extreme weather events; expression of a stewardship ethic (reduced production in the short-term is justified where there are long-term benefits to the environment); and support for a landholder duty of care (it is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment)*

6.1 Ararat

Median property size	69 ha	Property not principal place of residence	35%
Median length of residence	37 yrs	Own more than one property in the Wimmera	29%
Median age	63 yrs	Landcare membership	45%
Farmer by occupation	24%	Completed a short course in the past five years	35%
On-property income (median)	\$10,000 to \$20,000	Off-property income (median)	\$40,000 to \$50,000
On-property work (hrs/week)	20 hrs	Off-property work (days/year)	200 days
Commodity group membership	16%	Involved in property management planning	35%
Proportion with government funded work on property (past 5 years)	34%	Top 3 preferred sources of information	<ul style="list-style-type: none"> Mailed brochures/leaflets/community newsletters - 49% Landcare group/network/coordinator – 49% Wimmera CMA – 41% Friends/neighbours/relatives - 41%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> The ability of biochar to improve soil structure - 73% The nature of native vegetation cover in the Wimmera region before European settlement - 41% The existence of accessible groundwater underneath your property that is of sufficient 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> The benefits of retaining native vegetation on properties - 55% How to correctly use agricultural chemicals - 53% Grazing/cropping strategies to manage paddock ground cover to minimise soil erosion - 49%

quality to irrigate crops or water stock - 40%	
3 most likely long term plans	<ul style="list-style-type: none"> Ownership of the property will stay within the family - 66% Will live on the property for as long as possible - 60% Undertake work to mitigate flood impacts on the property - 39%
Top 3 values attached to property	<ul style="list-style-type: none"> Provides the lifestyle I want - 95% Sense of accomplishment from improving property infrastructure - 90% Being able to pass the property on to others in better condition - 87%
Your views on	<p>Top 3 district issues</p> <ul style="list-style-type: none"> Impact of reduced water flows on the long-term health of rivers/streams/wetlands - 62% Decline in soil health (e.g. declining fertility or structure) - 58% Salinity threatening water quality in rivers/streams/wetlands - 55% <p>5 most common land uses</p> <ul style="list-style-type: none"> Dryland pasture - 66% Areas >1ha of trees planted – 61% Sheep for meat - 58% Sheep for wool - 55% Broadacre cropping - 21% <p>Confidence in CRP</p> <ul style="list-style-type: none"> Stock access to rivers/streams/wetlands should be carefully managed - 94% Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 86% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 57% The benefits of stubble retention on cropping land outweigh problems arising - 56%
3 most commonly adopted sustainable agricultural practices	<p>3 most commonly adopted conservation practices</p> <ul style="list-style-type: none"> Length of fencing erected to manage stock access to rivers/streams/wetlands - 60% Area of trees and shrubs planted (including direct seeding) - 53% Number of off-stream watering points established - 43%

6.2 Buloke

Median property size	450 ha	Property not principal place of residence	25%
Median length of residence	48 yrs	Own more than one property in the Wimmera	50%
Median age	61 yrs	Landcare membership	0%
Farmer by occupation	88%	Completed a short course in the past five years	13%
On-property income (median)	\$60,000 to \$100,000	Off-property income (median)	\$20,000 to \$30,000
On-property work (hrs/week)	50 hrs	Off-property work (days/year)	195 days
Commodity group membership	25%	Involved in property management planning	50%
Proportion with government funded work on property (past 5 years)	13%	Top 3 preferred sources of information	<ul style="list-style-type: none"> Books/ magazines/ journals - 71% Newspapers - 71% Field days - 57%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> The nature of native vegetation cover in the Wimmera region before European settlement - 75% Organisations or individuals to contact for advice about government programs supporting landholders to manage gully or stream bank erosion - 75% The ability of biochar to improve soil structure - 63% 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> How to correctly use agricultural chemicals - 88% Grazing/ cropping strategies to manage paddock ground cover to minimise soil erosion - 75% The use of stock containment areas to manage stock in drier seasons - 75%

3 most likely long term plans	<ul style="list-style-type: none"> Will live on the property for as long as possible - 57% All or most of the property will be leased - 43% The enterprise mix will be changed to more intensive enterprises - 43% Undertake work to mitigate flood impacts on the property - 43% 	Top 3 district issues	<ul style="list-style-type: none"> Loss of important services - 88% Salinity threatening water quality in rivers/streams/wetland - 50% Farming practices contributing to erosion - 50%
Top 3 values attached to property	<ul style="list-style-type: none"> Provides the lifestyle I want - 95% Sense of accomplishment from improving property infrastructure (fencing sheds, water supply, pasture) - 90% Being able to pass the property on to others in better condition - 87% 	5 most common land uses	<ul style="list-style-type: none"> Broadacre cropping - 88% Sheep for meat - 75% Intensive livestock – 75% Dryland pasture - 75% Areas >1ha of trees planted - 63% Sheep for wool - 63%
Your views on	<ul style="list-style-type: none"> Landholders should manage their properties in expectation of extreme weather events - 88% It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment - 50% Reduced production in the short-term is justified where there are long-term benefits to the environment - 50% 	Confidence in CRP	<ul style="list-style-type: none"> Stock access to rivers/streams/wetlands should be carefully managed - 88% The benefits of stubble retention on cropping land outweigh problems arising - 63% Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 63% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 14%
3 most commonly adopted sustainable agricultural practices	<ul style="list-style-type: none"> Maximum area of crop sown in any year using min-till techniques - 100% Maximum area of crop sown in any year using adaptive no-till techniques – 71% Area sown to perennial pasture and lucerne - 63% 	3 most commonly adopted conservation practices	<ul style="list-style-type: none"> Area of trees and shrubs planted (including direct seeding) - 63% Area of native bush/grasslands fenced to manage stock access - 29% Number of off-stream watering points established - 29%

6.3 Hindmarsh

Median property size	750 ha	Property not principal place of residence	28%
Median length of residence	48 yrs	Own more than one property in the Wimmera	34%
Median age	56 yrs	Landcare membership	43%
Farmer by occupation	65%	Completed a short course in the past five years	28%
On-property income (median)	\$40,000 to \$50,000	Off-property income (median)	\$30,000 to \$40,000
On-property work (hrs/week)	50 hrs	Off-property work (days/year)	153 days
Commodity group membership	28%	Involved in property management planning	35%
Proportion with government funded work on property (past 5 years)	23%	Top 3 preferred sources of information	<ul style="list-style-type: none"> Books/ magazines/ journals - 48% Friends/ neighbours/ relatives - 45% Landcare group/network/coordinator - 43%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> The ability of biochar to improve soil structure - 54% The area of land (ha) with saline affected vegetation in your district - 47% The severity of gully erosion across the Wimmera region - 45% 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> Grazing/ cropping strategies to manage paddock ground cover to minimise soil erosion - 78% How to correctly use agricultural chemicals - 74% The use of stock containment areas to manage stock in drier seasons - 53%
3 most likely long term plans	<ul style="list-style-type: none"> Ownership of the property will stay within the family - 70% Will live on the property for as long as possible - 47% All or most of the property will be leased - 29% 	Top 3 district issues	<ul style="list-style-type: none"> Loss of important services - 69% Impact of reduced water flows on the long-term health of rivers/streams/wetlands - 55% Decline in soil health - 52%

Top 3 values attached to property	<ul style="list-style-type: none"> Rural land represents a sound long-term investment - 87% Being able to pass the property on to others in better condition - 85% Sense of accomplishment from improving property infrastructure (fencing sheds, water supply, pasture) - 85% 	5 most common land uses	<ul style="list-style-type: none"> Broadacre cropping - 87% Dryland pasture - 71% Sheep for meat - 67% Sheep for wool - 63% Areas >1ha of trees planted - 59%
Your views on	<ul style="list-style-type: none"> Landholders should manage their properties in expectation of extreme weather events - 82% It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment - 46% Reduced production in the short-term is justified where there are long-term benefits to the environment - 57% 	Confidence in CRP	<ul style="list-style-type: none"> Stock access to rivers/streams/wetlands should be carefully managed - 78% Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 72% The benefits of stubble retention on cropping land outweigh problems arising - 57% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 37%
3 most commonly adopted sustainable agricultural practices	<ul style="list-style-type: none"> Maximum area of crop sown in any year using min-till techniques - 75% Used precision farming techniques for cropping - 51% Maximum area of crop sown in any year using adaptive no-till techniques - 49% 	3 most commonly adopted conservation practices	<ul style="list-style-type: none"> Area of trees and shrubs planted (including direct seeding) - 54% Area of native bush/grasslands fenced to manage stock access - 29% Number of off-stream watering points established - 23%

6.4 Horsham

Median property size	250 ha	Property not principal place of residence	28%
Median length of residence	36 yrs	Own more than one property in the Wimmera	36%
Median age	60 yrs	Landcare membership	26%
Farmer by occupation	44%	Completed a short course in the past five years	18%
On-property income (median)	\$30,000 to \$40,000	Off-property income (median)	\$30,000 to \$40,000
On-property work (hrs/week)	30 hrs	Off-property work (days/year)	150 days
Commodity group membership	11%	Involved in property management planning	30%
Proportion with government funded work on property (past 5 years)	14%	Top 3 preferred sources of information	<ul style="list-style-type: none"> ▪ Newspapers - 71% ▪ Books/magazines/journals – 57% ▪ Radio - 50%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> ▪ The ability of biochar to improve soil structure - 54% ▪ The area of land (ha) with saline affected vegetation in your district - 47% ▪ The severity of gully erosion across the Wimmera region - 38% 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> ▪ How to correctly use agricultural chemicals - 62% ▪ Grazing/ cropping strategies to manage paddock ground cover to minimise soil erosion - 54% ▪ The benefits of retaining native vegetation on properties - 50%
3 most likely long term plans	<ul style="list-style-type: none"> ▪ Will live on the property for as long as possible - 63% ▪ Ownership of the property will stay within the family - 57% ▪ The property will be sold - 32% 	Top 3 district issues	<ul style="list-style-type: none"> ▪ Impact of reduced water flows on the long-term health of rivers/streams/wetlands - 51% ▪ Salinity threatening water quality in rivers/streams/wetlands - 44% ▪ Vegetation in waterways obstructing flows leading to

flooded - 43%	
Top 3 values attached to property	<ul style="list-style-type: none"> Provides the lifestyle I want - 89% An attractive place to live - 83% Being able to pass the property on to others in better condition - 79%
Your views on	<p>5 most common land uses</p> <ul style="list-style-type: none"> Broadacre cropping - 64% Irrigated pasture/cropping - 64% Dryland pasture - 55% Beef cattle - 52% Sheep for meat - 44% <p>Confidence in CRP</p> <ul style="list-style-type: none"> Stock access to rivers/streams/wetlands should be carefully managed - 88% Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 76% The benefits of stubble retention on cropping land outweigh problems arising - 57% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 44%
3 most commonly adopted sustainable agricultural practices	<p>3 most commonly adopted conservation practices</p> <ul style="list-style-type: none"> Maximum area of crop sown in any year using min-till techniques - 66% Maximum area of crop sown in any year using adaptive no-till techniques - 54% Used precision farming techniques for cropping - 41% <ul style="list-style-type: none"> Area of trees and shrubs planted (including direct seeding) - 55% Length of fencing erected to manage stock access to rivers/streams/wetlands - 35% Area of native bush/grasslands fenced to manage stock access - 32%

6.5 Northern Grampians

Median property size	206 ha	Property not principal place of residence	35%
Median length of residence	43.5 yrs	Own more than one property in the Wimmera	16%
Median age	57.5 yrs	Landcare membership	43%
Farmer by occupation	47%	Completed a short course in the past five years	22%
On-property income (median)	\$40,000 to \$50,000	Off-property income (median)	\$30,000 to \$40,000
On-property work (hrs/week)	36 hrs	Off-property work (days/year)	200 days
Commodity group membership	17%	Involved in property management planning	38%
Proportion with government funded work on property (past 5 years)	43%	Top 3 preferred sources of information	<ul style="list-style-type: none"> Books/magazines/journals - 48% Wimmera CMA - 46% Newspapers - 46%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> The ability of biochar to improve soil structure - 58% The area of land (ha) with saline affected vegetation in your district - 46% The existence of accessible groundwater underneath your property that is of sufficient quality to irrigate crops or water stock - 44% 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> Grazing/ cropping strategies to manage paddock ground cover to minimise soil erosion - 57% The benefits of retaining native vegetation on properties - 52% The ability of perennial vegetation to prevent water tables rising - 52%
3 most likely long term plans	<ul style="list-style-type: none"> Will live on the property for as long as possible - 69% Ownership of the property will stay within the family - 59% 	Top 3 district issues	<ul style="list-style-type: none"> Decline in soil health - 59% Vegetation in waterways obstructing flows leading to flooding - 57% Loss of important services - 55%

Top 3 values attached to property	<ul style="list-style-type: none"> The property will be sold - 29% Provides the lifestyle I want - 83% An attractive place to live - 83% Being able to pass the property on to others in better condition - 78% Sense of accomplishment from improving property infrastructure (fencing sheds, water supply, pasture) - 78% Sense of accomplishment from knowing that my property is contributing to improved environmental health in the district - 78% Being part of a rural community - 78% 	5 most common land uses	<ul style="list-style-type: none"> Dryland pasture - 72% Areas of >1ha of trees planted - 70% Sheep for wool - 57% Sheep for meat - 55% Broadacre cropping – 38%
Your views on	<ul style="list-style-type: none"> Landholders should manage their properties in expectation of extreme weather events - 82% It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment - 56% Reduced production in the short-term is justified where there are long-term benefits to the environment - 61% 	Confidence in CRP	<ul style="list-style-type: none"> Stock access to rivers/streams/wetlands should be carefully managed - 86% Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 77% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 52% The benefits of stubble retention on cropping land outweigh problems arising - 46%
3 most commonly adopted sustainable agricultural practices	<ul style="list-style-type: none"> Maximum area of crop sown in any year using adaptive no-till techniques - 56% Maximum area of crop sown in any year using min-till techniques - 50% Area sown to perennial pasture and lucerne - 46% 	3 most commonly adopted conservation practices	<ul style="list-style-type: none"> Area of trees and shrubs planted (including direct seeding) - 67% Length of fencing erected to manage stock access to rivers/streams/wetlands - 41% Area of gully erosion addressed - 35%

6.6 Pyrenees

Median property size	55 ha	Property not principal place of residence	29%
Median length of residence	31 yrs	Own more than one property in the Wimmera	12%
Median age	56.5 yrs	Landcare membership	53%
Farmer by occupation	31%	Completed a short course in the past five years	53%
On-property income (median)	\$40,000 to \$50,000	Off-property income (median)	\$60,000 to \$100,000
On-property work (hrs/week)	35 hrs	Off-property work (days/year)	175 days
Commodity group membership	12%	Involved in property management planning	53%
Proportion with government funded work on property (past 5 years)	38%	Top 3 preferred sources of information	<ul style="list-style-type: none"> Books/magazines/journals - 50% Wimmera CMA - 50% Newspapers - 44% Landcare group/network/coordinator - 44% Internet - 44%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> The ability of biochar to improve soil structure - 71% The existence of accessible groundwater underneath your property that is of sufficient quality to irrigate crops or water stock - 47% The extent of water savings as a result of the Wimmera/Mallee pipeline - 44% 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> The benefits of retaining native vegetation on properties - 77% How to protect and improve the health of native bush on properties - 65% How to use soil samples results to guide fertiliser applications - 59% How to correctly use agricultural chemicals - 59% The ability of perennial vegetation to prevent water tables rising - 59%

3 most likely long term plans	<ul style="list-style-type: none"> Ownership of the property will stay within the family - 81% Will live on the property for as long as possible - 53% I am planning to undertake work to mitigate flood impacts on my property - 50% 	Top 3 district issues	<ul style="list-style-type: none"> Decline in soil health - 81% Vegetation in waterways obstructing flows leading to flooding - 69% Dryland salinity threatening the long-term productive capacity of land - 69% Loss of paddock trees - 69% Farming practices contributing to erosion - 69% Loss of important services - 69%
Top 3 values attached to property	<ul style="list-style-type: none"> Provides the lifestyle I want - 94% An attractive place to live - 88% Being able to pass the property on to others in better condition - 88% Sense of accomplishment from knowing that my property is contributing to improved environmental health in the district - 88% 	5 most common land uses	<ul style="list-style-type: none"> Areas of >1ha of trees planted - 82% Dryland pasture - 59% Sheep for wool - 47% Sheep for meat - 29% Broadacre cropping - 24% Part of property is under a conservation covenant/management agreement - 24%
Your views on	<ul style="list-style-type: none"> It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment - 82% Landholders should manage their properties in expectation of extreme weather events - 77% Reduced production in the short-term is justified where there are long-term benefits to the environment - 77% 	Confidence in CRP	<ul style="list-style-type: none"> Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 94% Stock access to rivers/streams/wetlands should be carefully managed - 88% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 71% The benefits of stubble retention on cropping land outweigh problems arising - 59%
3 most commonly adopted sustainable agricultural practices	<ul style="list-style-type: none"> Maximum area of crop sown in any year using min-till techniques - 100% Maximum area of crop sown in any year using adaptive no-till techniques - 50% Area sown to perennial pasture and lucerne - 31% 	3 most commonly adopted conservation practices	<ul style="list-style-type: none"> Area of trees and shrubs planted (including direct seeding) - 63% Area of native bush/grasslands fenced to manage stock access - 55% Length of fencing erected to manage stock access to rivers/streams/wetlands - 36%

6.7 West Wimmera

Median property size	700 ha	Property not principal place of residence	18%
Median length of residence	45 yrs	Own more than one property in the Wimmera	41%
Median age	56 yrs	Landcare membership	26%
Farmer by occupation	70%	Completed a short course in the past five years	32%
On-property income (median)	\$40,000 to \$50,000	Off-property income (median)	\$30,000 to \$40,000
On-property work (hrs/week)	45 hrs	Off-property work (days/year)	100 days
Commodity group membership	13%	Involved in property management planning	34%
Proportion with government funded work on property (past 5 years)	26%	Top 3 preferred sources of information	<ul style="list-style-type: none"> ▪ Newspapers - 57% ▪ Books/magazines/journals - 55% ▪ Mailed brochures/leaflets/community newsletters - 52%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> ▪ The ability of biochar to improve soil structure - 61% ▪ The area of land (ha) with saline affected vegetation in your district - 52% ▪ The severity of gully erosion across the Wimmera region - 47% 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> ▪ How to correctly use agricultural chemicals - 76% ▪ Grazing & cropping strategies to manage paddock ground cover to minimise soil erosion - 69% ▪ The existence of accessible groundwater underneath your property that is of sufficient quality to irrigate crops or water stock - 60%
3 most likely long term plans	<ul style="list-style-type: none"> ▪ Will live on the property for as long as possible - 75% ▪ Ownership of the property will stay within the family - 69% 	Top 3 district issues	<ul style="list-style-type: none"> ▪ Loss of important services - 75% ▪ The effect of existing groundwater extraction - 53% ▪ Impact of reduced water flows on the long term health of rivers/streams/wetlands - 38%

<ul style="list-style-type: none"> Additional land will be purchased, leased or shared farmed - 38% 		
Top 3 values attached to property	<ul style="list-style-type: none"> Provides the lifestyle I want - 88% An attractive place to live - 84% Being part of a rural community - 83% A great place to raise a family - 83% 	5 most common land uses <ul style="list-style-type: none"> Dryland pasture - 85% Sheep for meat - 77% Sheep for wool - 75% Broadacre cropping – 63% Areas of >1ha of trees planted - 52%
Your views on	<ul style="list-style-type: none"> It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment - 48% Landholders should manage their properties in expectation of extreme weather events - 69% Reduced production in the short-term is justified where there are long-term benefits to the environment - 49% 	Confidence in CRP <ul style="list-style-type: none"> Stock access to rivers/streams/wetlands should be carefully managed - 76% Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 62% The benefits of stubble retention on cropping land outweigh problems arising - 44% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 37%
3 most commonly adopted sustainable agricultural practices	<ul style="list-style-type: none"> Maximum area of crop sown in any year using min-till techniques - 57% Used precision farming techniques for cropping - 51% Area sown to perennial pasture and lucerne - 51% 	3 most commonly adopted conservation practices <ul style="list-style-type: none"> Area of trees and shrubs planted (including direct seeding) - 53% Area of native bush/grasslands fenced to manage stock access - 26% Length of fencing erected to manage stock access to rivers/streams/wetlands - 24%

6.8 Yarriambiack

Median property size	718 ha	Property not principal place of residence	29%
Median length of residence	50 yrs	Own more than one property in the Wimmera	39%
Median age	56 yrs	Landcare membership	36%
Farmer by occupation	67%	Completed a short course in the past five years	30%
On-property income (median)	\$50,000 to \$60,000	Off-property income (median)	\$30,000 to \$40,000
On-property work (hrs/week)	50 hrs	Off-property work (days/year)	140 days
Commodity group membership	47%	Involved in property management planning	35%
Proportion with government funded work on property (past 5 years)	30%	Top 3 preferred sources of information	<ul style="list-style-type: none"> Books/magazines/journals - 60% Wimmera CMA - 54% Victorian Farmers' Federation - 52%
NRM topics respondents reported least knowledge	<ul style="list-style-type: none"> The severity of gully erosion across the Wimmera region - 54% The area of land (ha) with saline affected vegetation in your district - 51% The ability of biochar to improve soil structure - 49% 	NRM topics respondents reported most knowledge	<ul style="list-style-type: none"> How to correctly use agricultural chemicals - 85% Grazing & cropping strategies to manage paddock ground cover to minimise soil erosion - 76% How to use soil sample results to guide fertiliser applications - 58%
3 most likely long term plans	<ul style="list-style-type: none"> Ownership of the property will stay within the family - 73% Will live on the property for as long as possible - 59% Additional land will be purchased, leased or 	Top 3 district issues	<ul style="list-style-type: none"> Loss of important services - 72% Impact of reduced water flows on the long term health of rivers/streams/wetlands - 52% Vegetation in waterways obstructing flows leading to flooding - 41%

shared farmed - 37%		
Top 3 values attached to property	<ul style="list-style-type: none"> Provides the lifestyle I want - 88% Being able to pass the property on to others in better condition - 88% Being part of a rural community - 88% 	5 most common land uses <ul style="list-style-type: none"> Broadacre cropping - 98% Irrigated pasture/cropping - 65% Dryland pasture - 60% Beef cattle - 53% Sheep for meat - 50%
Your views on	<ul style="list-style-type: none"> It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment - 40% Landholders should manage their properties in expectation of extreme weather events - 78% Reduced production in the short-term is justified where there are long-term benefits to the environment - 40% 	Confidence in CRP <ul style="list-style-type: none"> Stock access to rivers/streams/wetlands should be carefully managed - 80% Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands - 70% The benefits of stubble retention on cropping land outweigh problems arising - 68% The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition - 34%
3 most commonly adopted sustainable agricultural practices	<ul style="list-style-type: none"> Maximum area of crop sown in any year using min-till techniques - 66% Used precision farming techniques for cropping - 65% Maximum area of crop sown in any year using adaptive no-till techniques - 65% 	3 most commonly adopted conservation practices <ul style="list-style-type: none"> Area of trees and shrubs planted (including direct seeding) - 56% Area of native bush/grasslands fenced to manage stock access - 27% Number of off-stream watering points established - 13%

7 NRM INTERMEDIATE OUTCOMES: TRENDS OVER TIME

This section reports on trends over time in intermediate NRM objectives relevant to five key assets identified by the WCMA, including:

- paddock trees (native vegetation);
- stubble retention (soil);
- weeds (threat to native vegetation/introduced pasture/cropping land);
- waterways; and
- wetlands.

While NRM evaluation can be undertaken through the examination of changes in resource condition, there are some limitations to this approach, including that it can take time (i.e. up to 20 years) for changes to be realised, there can be intervening factors affecting resource condition (e.g. drought), and there may be limits to the science underpinning the assumed links between practice change and change in resource condition (e.g. that riparian buffers trap dissolved nutrients). Given these issues, a typical approach is to focus on intermediate NRM objectives. That is, those objectives that theory and/or empirical evidence suggest lead to improved resource condition and have been the focus of considerable investment by NRM agencies over time. In Australia, the focus has typically been on awareness (explored in this study by examining concern about issues), knowledge and beliefs about processes leading to land and water degradation or best-practice NRM and the implementation of CRP.

There have been some efforts to capture these data at the national and regional scales, but the ability to interrogate those data to evaluate regional NRM outcomes has been limited because the items are not regionally-specific; there are insufficient data points and those data are not spatially-referenced for robust analyses at the sub-catchment or asset class scale; and longitudinal data have not been available to assess or predict trends over time. The CSU Wimmera surveys of 2002/2007/2011 therefore represent the first time in Australia that those criteria for assessing intermediate NRM outcomes have been met.

With the move to asset-based NRM, the focus of NRM evaluation is increasingly on the achievement of objectives in relation to specific asset classes. These assets could be distributed across a region (e.g. wetlands in the Wimmera) but would more typically be confined to particular parts of the landscape (e.g. terminal lakes in the Wimmera). In the 2007 report we examined trends over time between 2002 and 2007 for specific asset classes. In some instances, these were for specific assets (e.g. three groundwater flow systems), in other instances for specific local government areas or the region as whole. At the request of the WCMA, our analysis for the 2011 report is focused on five asset classes at the regional scale, drawing upon data from relevant survey items.

In this section we identify significant changes in survey items measuring changes in NRM intermediate outcomes: concern about issues (as a surrogate for awareness); knowledge/ beliefs about degradation processes; confidence in CRP; and implementation of CRP. We have focused on comparisons between items in the 2002 and 2011 surveys, or if items had not been included in the 2002 surveys, comparisons between items in the 2007 and 2011 surveys. Data presented in the accompanying tables includes all survey items relevant to each asset class. It is important to highlight that items examining each of the possible intermediate outcomes for the five assets were not included in each survey and as a result there are gaps in coverage of outcomes. For example, the surveys did not include an item measuring landholder implementation of weed control. Readers are also referred to the earlier sections of the report for a discussion of trends

over time for those items examining intermediate outcomes for other asset classes. This issue highlights the importance of CMA staff and Boards identifying priority assets and establishing indicators of outcome measures that are sound and can be employed over a number of years.

In the following tables “NA” indicates that data were not collected in the survey that year; “NS” indicates where there was not a significant difference over time; “Increase” indicates there was a significant increase in the median score or the proportion of landholders for that survey item; and “Decrease” indicates a significant decrease in the median score or the proportion of landholders for that survey item. We tested for significant differences over time in CRP implementation using both the median amount implemented (e.g. length of fencing) as well as the proportion of landholders implementing the practice.

7.1 Paddock trees

Our capacity to evaluate trends in intermediate NRM outcomes relevant to paddock trees was constrained by the general rather than specific nature of most of the survey items. The exception was for the item exploring concern about this issue (i.e. *loss of paddock trees*). The topic exploring values attached to properties also included a specific item focused on paddock trees. Values are relatively stable and we don’t think they are appropriate as a measure of NRM outcomes. Nevertheless, we have included this item in Table 33 because it provides additional insight into what appear to be contradictory results.

Landholder concern about the *loss of paddock trees* could only be assessed by comparing data for the 2007 and 2011 surveys. The results for this item are somewhat surprising given the results for items measuring self-reported knowledge relevant to this topic, the value of paddock trees, and beliefs about the impact of land clearing.

There was a significant decrease between 2007 and 2011 in concern about the loss of paddock trees. At the same time, there was a significant increase between 2002 and 2011 in the four self-reported knowledge items relevant to the management of native vegetation on private land; no change between 2007 and 2011 in the value item *paddock trees are important because they provide a place for native animals to shelter and feed*; and no change in the belief item *clearing native vegetation since European settlement has substantially reduced the number and variety of native plants and animals in this district* [Table 33].

Two CRP items relevant to paddock trees were included in the surveys:

- planting trees and shrubs (area over period of management for 2007 and 2011; and trees planted per year over the last five years in 2007/2011 and three years for 2002); and
- area of native bush/grassland fenced to manage stock access (period of management; and last five years for 2002, 2007 and 2011 surveys).

There was no significant trend for either CRP for the period of management of the respondents. However, for both CRP there were significant trends in the last five years the respondent managed their property. For planting trees and shrubs, the trend reveals significantly fewer respondents implemented this CRP. For those that did, they had established a significantly larger median number of trees and shrubs in 2011 compared to 2007. For fencing native bush and grasslands, the trend was for a significant decline in both the proportion of respondents implementing this CRP and the median area fenced in 2011 compared to 2007 [Table 33].

It is difficult to interpret these findings given that many of the survey items were not directly focused on paddock trees and that in the five years up to 2010 the Wimmera had experienced severe drought. Given the positive trends in self-reported knowledge, it would seem that initiatives to improve the management of paddock trees on private property are now more likely to succeed. At this stage, it would be prudent for the WCMA to draw on other sources of information to identify the extent of paddock tree decline and the implementation of work to enhance the condition of that key asset. If this asset class remains a priority asset, the WCMA and the CSU research team will need to develop a more targeted set of survey items to assist evaluation of NRM outcomes.

Table 33 Change over time (2002-2011) in NRM intermediate outcomes relating to paddock trees

Issue	2002 and 2007	2007 and 2011	2002 and 2011
District issue: Loss of paddock trees	NA	Decrease	NA
Value: Paddocks trees are important because they provide a place for native animals to shelter and feed*	NS	NS	NS
Belief: Clearing native vegetation since European settlement has substantially reduced the number and variety of native plants and animals in this district	NA	NS	NA
Knowledge: The nature of native vegetation cover in the Wimmera region before European settlement	Decrease	Increase	NS
Knowledge: How to identify local plant species including weeds in the understorey vegetation	NA	Increase	NA
Knowledge: The benefits of retaining native vegetation on properties	NA	Increase	NA
Knowledge: How to protect and improve the health of native bush areas on properties	NA	Increase	NA
Practices: Area of trees and shrubs planted (including direct seeding) [ha] (full period of management)	NA	NS	NA
Practices: Area of native bush/grasslands fenced to manage stock access [ha] (full period of management)	NS	NS	NS
Practices: Number of trees and shrubs planted (including direct seeding) per year (last three years 2002 and last five years 2007/2011)	Decrease in % yes; Increase number	Decrease in % yes; Stable number	Decrease in % yes; Increase number
Practices: Area of native bush/grasslands fenced to manage stock access [ha] (last five years)	NS	NS	Decrease in % yes; Decrease area

*please note value statements are not intermediate NRM outcomes

7.2 Stubble retention

The 2002, 2007 and 2011 surveys included a number of items measuring concerns about issues, confidence in CRP and the implementation of CRP explicitly relevant to stubble retention [Table 34]. The three knowledge items included in Table 34 are less directly relevant to stubble retention.

Between 2002 and 2011 there was a significant increase in reported concern about *farming practices contributing to erosion*. There was no change in concern about *decline in soil health* between 2007 and 2011. There was a significant increase in respondent confidence in stubble retention as a CRP between 2002 and 2011 (*the benefits of stubble retention on cropping land outweigh problems arising*). However, despite these apparent preconditions for implementation there was no significant increase in adoption of no-till or minimum tillage technologies between 2002 and 2011. Indeed, there was a decrease in the proportion of landholders using minimum tillage techniques (although the median land area on which this practice was implemented remained unchanged) [Table 34].

From a WCMA perspective it should be comforting to know that there is evidence of increased concern about farming practices contributing to erosion and although there was no change in concern about the decline of soil health between the two most recent surveys, the level of concern was already relatively high in 2007. Although increased concern does not appear to have translated into significant increases in adoption of no-till or minimum tillage technologies, the level of adoption was already high and in recent years there have been some legitimate concerns about the efficacy of these technologies that may have limited implementation.

Table 34 Change over time (2002-2011) in NRM intermediate outcomes relating to stubble retention

Issue	2002 and 2007	2007 and 2011	2002 and 2011
District issue: Decline in soil health (e.g. declining fertility or structure)	NA	NS	NA
District issue: Farming practices contributing to erosion	Increase	NS	Increase
Knowledge: How to use soil sample results to guide fertiliser applications	Decrease	NS	Decrease
Knowledge: Grazing and cropping strategies to manage paddock ground cover to minimise soil erosion	Decrease	Increase	NS
Knowledge: How to establish introduced perennial pastures (e.g. lucerne) in this district	NS	Increase	Increase
Confidence in CRP: The benefits of stubble retention on cropping land outweigh problems arising	Increase	NS	Increase
Practices: Maximum area of crop sown in any year using adaptive no-till techniques [ha] (last five years)	NA	NS	NA
Practices: Max area of crop sown in any year using minimum tillage techniques [ha] (last five years)	Decrease in % yes; Decrease area	NS	Decrease in % yes; Stable area

7.3 Waterways

The 2002, 2007 and 2011 surveys included a number of items measuring concerns about issues, knowledge, confidence in CRP and the implementation of CRP explicitly relevant to water ways [Table 35]. Two items exploring attitudes relevant to the management of waterways have also been included in Table 35, but these are not measures of intermediate NRM outcomes.

Between 2002 and 2011 there was a significant increase in concern about *salinity threatening water quality in rivers/streams/wetlands*. Over the same period there was a significant decrease in concern for *the impact of reduced water flows on the long-term health of rivers/streams/wetlands*. Both trends may be as much a response to recent changes in weather patterns (i.e. move from dry to wet seasons) as to NRM investments.

Between 2002 and 2011 there was a significant increase in self-reported knowledge about the benefits of *woody debris such as snags in rivers/streams*. There was also a significant increase for the two items measuring confidence in CRP: *watering stock off-stream* and *fencing to manage stock access to streams*. However, there was no significant change between 2007 and 2011 in the proportion of respondents fencing waterways to manage stock access (full management period and last five years) or establishing off-stream watering points (full management period) [Table 35].

From a WCMA perspective it seems that much of the hard work in laying the preconditions for CRP implementation has been accomplished, including that the attitudes of respondents are now more consistent with those of contemporary NRM policy and management [Table 35]. The WCMA will also need to make judgements about the level of CRP implementation accomplished to 2011 in relation to the level of implementation needed to achieve resource condition targets, and to the extent that further work is needed, the WCMA will need to investigate the efficacy of the various policy instruments available to them.

Table 35 Change over time (2002-2011) in NRM intermediate outcomes relating to waterways

Issue	2002 and 2007	2007 and 2011	2002 and 2011
District issue: Impact of reduced water flows on the long-term health of rivers/ streams/ wetlands	Increase	Decrease	Decrease
District issue: Salinity threatening water quality in rivers/ streams/ wetlands	Increase	Decrease	Increase
Attitude: Landholders should have the right to harvest water that falls on their property, even if that action impacts on others	NA	Decrease	NA
Attitude: The public should have the right to access river/ streams/ wetlands	Increase	Increase	Increase
Knowledge: The value of woody debris such as snags in rivers/streams	NS	NS	Increase
Confidence in CRP: The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition	Increase	NS	Increase
Confidence in CRP: Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands	Increase	NS	Increase
CRP: Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km] (full period of management)	NA	NS	NA
CRP: Number of off-stream watering points established (full period of management)	NA	NS	NA
CRP: Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km] (last five years)	NA	NS	NA

7.4 Weeds

Only three items exploring aspects of pest plant and animals have been included in more than one survey [Table 36]. Two of these items focused on issues of concern and there has been one knowledge item.

Between 2002 and 2011 there was an increase in concern about *the impact of managing weeds and pest animals affecting profitability* but no change in concern about the *impact of poor management of pest plants and animals on public land*. Between 2007 and 2011 there was a significant increase in self-assessed knowledge about *how to identify local plant species including weeds in the understorey* [Table 36].

It is possible that increased concern about weeds, particularly given that trend was for private land rather than public land, can be attributed to recent wet seasons, especially wet summers when weeds can dominate pastures and cropping land. Nevertheless, findings of increased concern and knowledge suggest that some of the key preconditions for landholder action to address weeds and pest animals have been established. If this asset class remains a priority, the WCMA and the CSU research team will need to develop a more targeted set of survey items to assist evaluation of NRM outcomes.

Table 36 Change over time (2002-2011) in NRM intermediate outcomes relating to weeds

Issue	2002 and 2007	2007 and 2011	2002 and 2011
Property issue: The impact of managing weeds and pest animals (including native species) affecting profitability	NS	Increase	Increase
Property issue: Impact of poor management of pest plants and animals on public land	NA	NS	NA
Knowledge: How to identify local plant species including weeds in the understorey vegetation	NA	Increase	NA

7.5 Wetlands

The 2002, 2007 and 2011 surveys included a number of items measuring concern about issues, confidence in CRP and the implementation of CRP explicitly relevant to wetlands [Table 37]. Each of these items was also relevant to the management of waterways and has been discussed in section 7.3 above. Two items exploring attitudes relevant to the management of wetlands were also reported in Section 7.3 above and have also been included in Table 37, but these are not measures of intermediate NRM outcomes.

Table 37 Change over time (2002-2011) in NRM intermediate outcomes relating to wetlands

Issue	2002 and 2007	2007 and 2011	2002 and 2011
District issue: Impact of reduced water flows on the long-term health of rivers/ streams/ wetlands	Increase	Decrease	Decrease
District issue: Salinity threatening water quality in rivers/ streams/ wetlands	Increase	Decrease	Increase
Issue: Loss of wetlands as a result of drains being constructed	NA	NA	Decrease
Attitude: Landholders should have the right to harvest water that falls on their property, even if that action impacts on others	NA	Decrease	NA
Attitude: The public should have the right to access river/ streams/ wetlands	Increase	Increase	Increase
Confidence in CRP: Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands	Increase	NS	Increase
Confidence in CRP: The time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition	Increase	NS	Increase
CRP: Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km] (full period of management)	NA	NS	NA
CRP: Number of off-stream watering points established (full period of management)	NA	NS	NA
CRP: Length of fencing erected to manage stock access to rivers/ streams/ wetlands [km] (last five years)	NA	NS	NA

8 CONCLUSION

In this section of the report we address the key aims of this research:

1. Assess progress in the achievement of NRM program objectives at catchment and local government area scales that are consistent with objectives in the WCMA Regional Catchment Strategy.
2. Describe trends in social and farming structure (property size, property turnover, property subdivision/amalgamation, occupational identity of landholders, extent of absentee ownership) for the region and for each local government area.
3. Provide a coherent explanation of landholder adoption of recommended practices identified in the WCMA Regional Catchment Strategy.
4. Provide advice about how to engage rural landholders in NRM.

Our response to the fourth objective is contained within our discussion of the implications of key findings relevant to objectives two and three.

8.1 Progress in the achievement of NRM program objectives

The standard approach to NRM program evaluation is to focus on measures of resource condition change and then the intermediate outcomes expected to lead to desired changes, including in the land use and management of private landholders. These intermediate outcomes typically include rural landholder awareness/concern about NRM issues, landholder knowledge about the processes leading to land and water degradation and of best-practice NRM, and landholder implementation of current recommended practices (CRP), or those practices assumed to lead to improvements in the condition of key environmental assets. CSU social researchers have worked with WCMA staff and Board members over a ten-year period to identify intermediate NRM outcomes relevant to key environmental assets and develop survey items addressing each outcome.

With three Wimmera social benchmarking surveys undertaken at approximately five-yearly intervals between 2002 and 2011, there was the opportunity, for the first time in Australia, to examine trends over time for intermediate outcomes across the region or specific environmental assets. At the request of the WCMA, these analyses have focused on five “asset” classes at the regional scale: paddock trees; soils (WCMA focus was on stubble retention); pest plants (native vegetation and introduced pasture/cropping land are the relevant assets); waterways; and wetlands. Given changes in priority assets over time, there were some important constraints on the scope of survey data relevant to each of these assets. For example, in 2007 groundwater flows systems were a key asset but they were not included in the five key assets in 2011; and paddock trees were a priority asset in 2011 but not in 2002 or 2007. While the surveys provide very good coverage of the intermediate outcomes for waterways and wetlands, most of these items do not distinguish between the two assets. In part this situation reflects changes in WCMA priorities. A key point here is that the WCMA priorities have changed over time and this is to be expected given the widely diverging seasonal conditions experienced in the past decade; changes in society, including increased concern for the environment; and turnover in key WCMA staff (e.g. three CEOs) and Board members. It is also important to acknowledge that no other CMA has undertaken this challenging task, so there is no “how-to” manual to follow. In the remaining paragraphs of this section we summarise the key findings from our analysis of the time-series data for three assets – soils, wetlands and paddock trees, as a way of illustrating the challenges of NRM evaluation; the potential of the social benchmarking process to make a useful contribution to evaluation, both formative (where the focus is on improvement) and summative (where the focus is on making judgements about success); and to suggest some next steps for

the WCMA and the social researchers to optimise the value of the social benchmarking data for evaluation of regional NRM.

Between 2002 and 2011 there was a significant increase in reported concern about farming practices contributing to soil erosion and a significant increase in confidence in stubble retention. Despite these changes in the apparent preconditions for on-ground work, the proportion of landholders using minimum tillage techniques declined (although the median land area remained unchanged). From a WCMA perspective it should be comforting to know that there is evidence of increased concern about farming practices contributing to soil erosion and increased confidence in stubble retention. Although those trends have not translated into increased adoption of no-till or minimum tillage technologies, the level of adoption was already relatively high; in recent years there have been legitimate concerns about the efficacy of these technologies that may have limited their use; and there is an increased proportion of non-farmer landholders, who typically report lower knowledge of cropping-related technologies.

Our capacity to evaluate trends in outcomes relevant to paddock trees was constrained by the general nature of most survey items. The exception was an item exploring concern about the issue. Between 2007 and 2011 there was a decline in concern about the loss of paddock trees. There were other survey items exploring knowledge and practices (i.e. fencing, planting trees/shrubs) relevant to the management of native vegetation on private land. There was an increase in the four self-reported knowledge items. Although there was no trend in implementation of either practice over the period of management, in the last five years fewer respondents had planted trees and shrubs (although the median increased). For fencing native bush and grasslands, there was a decline in both the proportion of respondents fencing and the median area fenced. It is difficult to interpret these findings given that many of the survey items were not directly focused on paddock trees and that in the five years up to 2010 the Wimmera had experienced severe drought. Given the positive trends in self-reported knowledge, it would seem that initiatives to improve the management of paddock trees on private property are now more likely to succeed. If this asset class remains a high priority for the WCMA, the WCMA and the CSU research team will need to develop a more targeted set of survey items to assist evaluation of intermediate NRM outcomes. Given that the social benchmarking data are spatially-referenced, the WCMA is also encouraged to identify priority areas (perhaps based on specific vegetation classes) for the retention/enhancement of paddock trees.

Between 2002 and 2011 there was increased concern about *salinity threatening water quality in rivers/streams/wetlands*, but less concern about *the impact of reduced water flows on the long-term health of rivers/streams/wetlands*. Both trends may be as much a response to recent changes in seasonal weather patterns (i.e. move from very dry to very wet seasons) as to NRM investments. Between 2002 and 2011 there was increased self-reported knowledge about the benefits of *woody debris such as snags in rivers/streams*. There was also increased confidence in watering stock off-stream and fencing to manage stock access to streams. However, there was no change between 2007 and 2011 in the proportion of respondents fencing waterways to manage stock access or establishing off-stream watering points. From a WCMA perspective it seems that much of the hard work in laying the preconditions for on-ground implementation has been accomplished. It is also possible that much of the work implementing off-stream water points and fencing waterways has been achieved. The WCMA will therefore need to make judgements about the level of on-ground work completed to date in relation to the level of implementation needed to achieve resource condition targets. To the extent that further work is needed, the WCMA will need to investigate the efficacy of the various policy instruments available to them. An additional issue is the challenge of maintaining work undertaken, and

future surveys should include items distinguishing work implemented to establish infrastructure and work undertaken to maintain that infrastructure.

8.2 Trends in social and farming structure

The social benchmarking data suggest there have been important changes in the social and farming structure of the Wimmera region over the last decade. There has been a significant decline in the proportion of respondents identifying as farmers by occupation, from 80% identifying as farmers in 2002 to 56% in 2011. While this trend has occurred across all local government areas, there are also important differences between the areas in the proportion of rural landholders identifying as farmers. Our view is that this trend reflects wider societal trends, compounded by the impact of a decade-long drought. In combination, those trends have led to what appears to be a paradox: the increased suburbanisation of some rural landscapes, particularly in areas of high amenity; and the amalgamation of holdings in areas that are further from large population centres, away from the coast or other amenity landscapes and that can be described as production landscapes. There is considerable evidence in the survey data supporting this assessment in that there are significant differences in the proportion of respondents who are farmers, in the time spent on-property, in the median property size, in on-property profitability, in the proportions of new owners, and in land use (e.g. grazing compared to cropping) across the local government areas, suggesting that there are amenity and production landscapes in the WCMA region. While the median property size across the WCMA region has declined over the decade, the 2011 survey data indicate that 34% of all respondents (45% of farmers and 21% of non-farmers) own multiple properties within the Wimmera region. It is possible that both cohorts own residential properties, but it seems that a substantial proportion of farmers operate multiple farming properties, consistent with the need for farmers to operate at increased scales to effectively respond to the cost-price squeeze they face. Survey data also indicate that there has been an increase in the median property size in some production-focused shires.

The 2011 survey data also demonstrate that farmers and non-farmers are very different. These differences are likely to have important implications for regional NRM practitioners seeking to achieve resource condition changes and do that by engaging rural landholders. Non-farmers were more likely to own smaller properties; to have owned their property and lived in the district for shorter periods of time; to have been more likely to be absentee landholders; to have planned on selling or subdividing their property; and to have spent more time engaged in off-property work. Non-farmers were also less likely to have spent time undertaking on-property work; to have been a member of a commodity group; to have undertaken a short course related to property management; and to have had family interested in taking over the property or started succession planning. Farmers had significantly higher self-rated knowledge on 11 of the 19 knowledge topics included in the survey. On the other hand, non-farmers exhibited greater concern for the environment in terms of the values they attached to their property; levels of concern for specific environmental issues; the item measuring an environmental stewardship ethic; and their support for a duty of care for biodiversity. Non-farmers were also more likely to agree with statements consistent with contemporary NRM policy, while farmers were more likely to be concerned about maintaining private property rights, including access to resources when that access might have negative impacts for others. There are also important differences in the key sources of information for farmers and non-farmers, with non-farmers less likely to use traditional sources of NRM information such as the WCMA, field days and extension officers. Farming as an occupation was significantly linked to the implementation of five CRP included in the 2011 survey, including positive associations with adaptive no-till, minimum-tillage, precision farming and sowing perennial pasture; and a negative relationship with tree-planting. These are

relationships consistent with the different value orientations and knowledge of farmers and non-farmers.

Modelling of property turnover suggests the Wimmera region is likely to experience a change in ownership of up to 50% of rural properties in the next 10 years. This expected increase suggests there will be a change from a relatively stable rural landholder population of the Wimmera in the past, given the median length of residence is 45 years and the median length of property ownership is 28 years. This trend is consistent with findings from the Corangamite social benchmarking study in 2006 and largely reflects the approaching retirement of an ageing cohort of baby-boomer farmers. The predicted turnover in the Wimmera based on 2011 data is an increase on that predicted in 2002 (50% change in 15 years or approximately 25% by 2010). Only 10% of the 2011 survey respondents identified as new property owners in the past 10 years, prompting some reflection amongst the research team. We are confident that our approach to predicting property turnover is reliable. Our approach is largely based on assumptions consistent with Australian Bureau of Statistics data about the median age of farmers, the median retirement ages of farmers and life expectancy tables for Australians. Our approach has previously been supported by comparisons with property sales data for the Corangamite and Wimmera regions and has been extensively peer-reviewed. It is possible that predicted rates of transfer have not occurred because landholders have not wanted to sell during the extended drought. It is also possible that there has been an increase in multiple property ownership as existing owners purchase property from other longer-term (> 10 years) owners wanting to exit agriculture. We are unable to determine the nature of any trends in multiple property ownership because that item was included in the 2011 survey but not the earlier surveys. District-scale studies drawing upon local knowledge and Victorian property sales data would appear to be the best way to verify the 2002 prediction of property turnover.

Given that the ageing baby boomer cohort of farmers is approaching retirement (or end-of-life); that there could be increased rural property sales post-drought; and that new property owners are different to longer-term owners on important social and farming characteristics, rural property turnover is a trend upon which the WCMA should focus. As with many social trends, there will be challenges and opportunities. WCMA programs will need to accommodate differences between new and longer-term owners in terms of their values, attitudes, level of experience, knowledge of land management and preferred sources of information. Clearly, to the extent that new owners are farmers moving in to the Wimmera or existing landholders purchasing additional farming land, those differences will not be as marked. However, amalgamation of rural properties often leads to increased absentee ownership and rural depopulation. When new people take over a property there is the potential for considerable change in management. In other publications we have advised CMA to monitor changes in property ownership, particularly in areas with key environmental assets. The WCMA needs to identify the scale of turnover, assess the extent that turnover represents an opportunity to accomplish desired changes in management or land use, and gain insights into the attributes of new owners that might shape their capacity to implement CRP. These insights should inform changes in the way the WCMA seeks to engage new owners. For example, in high amenity areas the majority of new owners may have strong conservation values, limited experience of land management, few pre-existing social connections in the region and substantial off-property income. In other areas, many of the new owners may be farmers taking over from a retiring parent, expanding their enterprise by purchasing another property, or simply moving to a more desirable farming region.

Research findings highlight key differences across the LGA, including the median property size, the proportion of absentee owners and farming as an occupation. For example, in the Pyrenees

Shire, 31% of respondents were farmers; the median property size was 55 ha; 40% of respondents had owned their properties for less than 10 years; and 29% of respondents were absentee landholders. The median off-property income in the Pyrenees Shire was \$80,000 and the median on-property income was \$45,000. Twelve percent of Pyrenees respondents were a member of a commodity group and 53% were involved in Landcare. In this Shire, 77% of respondents exhibited a commitment to a stewardship ethic, 24% had a conservation covenant over their property, and tree/shrub planting was the most commonly implemented CRP. By contrast, in the Yarriambiack Shire, 67% of respondents were farmers and the median property size was 718 ha. As with the Pyrenees, 29% of respondents were absentee owners. However, in stark contrast, only 3% of Yarriambiack Shire respondents were new property owners (<10 yrs). Median off-property income for the Shire was \$35,000 while the median on-property income was \$55,000. Respondents in Yarriambiack were more likely to be involved in a commodity group (47%) than in Landcare (36%). Almost all (98%) Yarriambiack respondents were involved in broadacre cropping. Yarriambiack respondents were less likely to exhibit a stewardship ethic (40%). Again, these differences across the Shires should inform efforts to engage rural landholders in NRM.

8.3 Factors influencing adoption of current recommended practices (CRP)

There were significant positive links between implementation of CRP included in the 2011 survey and many of the levers at the disposal of the WCMA. The factors most frequently identified in the pairwise comparisons included knowledge of NRM (12 of 13 CRP), property management planning participation (8 CRP), government departments as a source of information (8 CRP), extension officers as a source of information (8 CRP), larger property size (7 CRP), Landcare as a source of information (7 CRP), short course participation (6 CRP), more hours worked on property (6 CRP), CMA as a source of information (6 CRP), environmental organisations as a source of information (6 CRP), received government funding last five years (5 CRP), and farming occupation (5 CRP). Confidence in recommended practices was also linked to implementation, including belief in the benefit of stubble retention (3 CRP), belief in the benefit of fencing stock access to waterways (3 CRP), and belief that stock access should be carefully managed (3 CRP). For example, there were significant relationships between greater implementation of fencing waterways to manage stock access and government funding, completing a short course, involvement in property management planning, knowledge (including who to contact for advice about government programs for gully/stream bank erosion and how to protect rivers and streams on private property); and a negative relationship with the attitude that landholders have the right to crop floodplain/wetlands.

These relationships reflect correlations but they assist researchers and practitioners to unravel causality when they are able to draw upon sound theory, other empirical evidence and knowledge of program activities. These relationships (and those explored using regression analysis) confirm findings discussed already about the important implications of different occupational identities, but they also provide strong affirmation that investments by NRM organisations in raising awareness of issues, improving knowledge and skills and building confidence in CRP are sound, particularly where CRP are complex or poorly understood, where resource condition outcomes are uncertain, where CRP are not closely aligned with landholder values, or where the public benefits of the work outweigh the benefits to landholders.

Platforms and activities that contribute to dialogue, learning and action, including membership or involvement in Landcare, involvement in property management planning and participation in short courses were all positively linked to implementation of CRP. Again, the survey data provides affirmation of existing policy instruments. It seems logical to then ask if the WCMA

wants to use these “levers” as ways to increase implementation of CRP and achieve desired resource condition targets. Given that the focus might be on key environmental assets, an additional question might be related to where that effort should occur. For the current study, the WCMA identified five assets across the region, therefore regional-scale data is drawn upon for this discussion. Consistent with state-wide trends (Curtis and Cooke 2006), participation in Landcare declined from 44% of respondents in 2002 to 34% in 2011. Completion of a relevant short course declined even more dramatically, from 60% of respondents in 2002 to 27% in 2011. Involvement in property management planning declined from 49% of respondents in 2002 to 35% in 2011. The WCMA staff and Board might reflect on the reasons for these trends, and consider the extent they want to re-invest or employ different approaches to the engagement of landholders in Landcare, short courses and property management planning. It is possible that the trend away from farming occupations is part of the explanation for the decline in participation in what appear to be very cost-effective approaches to NRM.

In 2011, 26% of respondents had received government funding in the last five years and 46% said they had received government support over the period of their management/last five years when asked about specific CRP (50% in 2007). Respondents were more likely to say they had received support from government in the past five years to support fencing river frontages (42%) than for implementing precision farming (8%), reflecting a stronger emphasis on conservation rather than production focused CRP. Government funding was positively linked to the implementation of five CRP, both conservation and production focused: erosion control, fencing to manage stock access to waterways, fencing to manage stock access to bush/grassland, perennial pastures and tree/shrub planting.

Substantial proportions of 2011 survey respondents implemented CRP over the past five years without government funding, including 92% of those using precision farming, 61% of those planting trees and 48% of those fencing river frontages. These apparently non-government funded activities, much of it with more substantial public benefit, occurred through an extended period of drought and low on-property incomes. This level of landholder involvement in CRP implementation without government support suggests these practices are consistent with the values and goals of many landholders and that there has been a dividend from previous investment through the activities of Landcare, property management planning and short courses. In the previous report we expressed the view that government funding for on-ground work should be increased during periods of drought and low on-property profitability. The corollary is that during periods of higher on-property incomes (the median on-property profit in 2007 was \$15,000 compared to \$45,000 in 2011) there is scope to scale back the level of direct government investment in on-ground work.

This research showed that the values landholders attach to their property are a reliable predictor of behaviour. While values are generally stable over time and unable to be influenced easily, they can underpin effective landholder engagement. Appeals that focus on the environmental benefits of CRP are likely to be more effective in engaging those with pro-conservation values, but are less successful with those with a stronger production focus. The 2011 survey results also indicate that some landholders hold attitudes that are inconsistent with contemporary NRM principles and practices. For example, over 46% of respondents still agreed that landholders should be able to harvest water that falls on their property even if that action impacts on others. Nevertheless, there is also cause for optimism in that the proportion of respondents who disagreed with this statement had increased as had the proportion exhibiting a stewardship ethic (now 52%). There could be a number of possible explanations for this trend including that increased environmental awareness in the general population is being reflected in the landholder population; change in the composition of the rural landholder population means

that there is now a higher proportion of non-farmer landholders, and non-farmers exhibit a stronger stewardship ethic; or it could reflect the long-term impact of investments in Landcare and catchment management and the activities of other government and non-government organisations engaging rural landholders in learning, dialogue and action.

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APPENDIX 1

Significant relationships established through pairwise comparisons: CRP and independent variables.

Area of trees and shrubs planted (continuous)

- Farmer/non-farmer (non-farmer)
- Member of a commodity group (positive)
- Utilised a contractor for property management in last 12 months (positive)
- In the past five years received government support for on-property work (positive)
- Government support for specific CRP (tree planting, fencing to manage stock access to waterways, fencing to manage stock access to bush, perennial pasture) (positive)
- Any government support for CRP (positive)
- Total amount of land owned/managed by immediate family (positive)
- Member of Landcare (positive)
- Lease land to others (negative)
- Gender (male)
- Completed a short course relevant to property management in last five years (positive)
- Received an off-property profit (positive)
- Received an on-property profit (negative)
- Total on and off property income (yes)
- Prepared a property management/whole farm plan (positive)
- Conducted 'Landcare type work' without direct financial support from government (positive)
- Would do more 'Landcare type work' if supported by government (positive)
- View: cropping or draining wetlands will create long lasting environmental problems (positive)
- View: negative impacts of cropping or draining wetlands can be prevented if we proceed carefully (negative)
- View: the use of land for carbon farming/biofuels will lead to food shortages (negative)
- View: there will be opportunities for carbon farming on my property in the future (positive)
- View: floodplain land and wetlands provide important places for native birds to live (positive)
- Long-term plan: all or some part of the property will be placed under a conservation covenant (positive)
- Long-term plan: all or most of the property will be share-farmed (negative)
- Property issue: the impact of managing weeds and pest animals affecting profitability (positive)
- Value: provides the lifestyle that I want (negative)
- Confidence in CRP: the time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition (positive)
- Stewardship item: reduced production in the short-term is justified where there are long-term benefits to the environment (positive)
- Knowledge: organisations/individuals to contact for advice about government programs supporting landholders to manage gully/stream bank erosion (positive)
- Knowledge: the benefits of retaining native vegetation on properties (positive)
- Knowledge: how to protect and improve the health of native bush areas on properties (positive)

- Knowledge: how to protect and improve the health of rivers/streams and wetlands on properties (positive)
- Knowledge: the severity of gully erosion across the Wimmera region (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: areas of property showing signs of salinity (positive)
- Knowledge: the ability of perennial vegetation to prevent water tables rising (positive)
- Knowledge: the role of wetlands in filtering water entering rivers (positive)
- Knowledge: the value of woody debris such as snags in rivers/streams (positive)
- Land use: land managed to protect cultural heritage sites (positive)
- Land use: remnant native bush covered by a conservation covenant (positive)
- Land use: part of property under a conservation covenant/management agreement (positive)
- Land use: farm forestry (positive)
- Land use: dryland pasture (negative)
- Land use: sheep for meat (positive)
- Information source: Wimmera CMA (positive)
- Information source: extension officers (positive)
- Information source: friends/neighbours/relatives (positive)
- Information source: government agencies/departments (positive)
- Information source: internet (positive)
- Information source: Landcare group/network/coordinator (positive)
- Information source: books/magazines/journals (positive)
- Information source: environmental organisations (positive)
- Information medium: post (positive)
- Information medium: desktop computer (positive)
- Information medium: local commodity/environmental group (positive)

Area of farm forestry established (continuous)

- Total amount of land owned/managed by immediate family (positive)
- Area of property owned (positive)
- Completed a short course relevant to property management in last five years (positive)
- Prepared a property management/whole farm plan (positive)
- Undertaken 'Landcare-type' work without government financial support (positive)
- Would do more 'Landcare-type' work if CMA provided cash/materials (positive)
- View: there will be opportunities for carbon farming on my property in the future (positive)
- View: landholders should be paid for providing environmental services that benefit the wider community (positive)
- Long-term plan: all or some part of the property will be placed under a conservation covenant (positive)
- Long-term plan: planning to undertake work to mitigate flood impacts (positive)
- District issue: dryland salinity threatening the long-term productive capacity of land (positive)
- District issue: loss of important services (positive)
- District issue: decline in soil health (positive)
- Property issue: dryland salinity undermining long-term productive capacity (positive)
- Value: a great place to raise a family (positive)
- Altruistic held values (positive)
- Biospheric held values (positive)

- Egoistic held values (positive)
- Held value: authority (positive)
- Held value: helpful (positive)
- Held value: social justice (positive)
- Held value: a world at peace (positive)
- Held value: preventing pollution (positive)
- Held value: protecting the environment (positive)
- Held value: social power (positive)
- Held value: unity with nature (positive)
- Confidence in CRP: the benefits of stubble retention outweigh problems arising (negative)
- Land use: land managed to protect cultural heritage sites (positive)
- Land use: remnant native bush covered by a conservation covenant (positive)
- Land use: area >1ha trees planted (positive)
- Information source: Wimmera CMA (positive)
- Information source: commodity group (positive)
- Information source: extension officers (positive)
- Information source: government agencies/departments (positive)
- Information medium: local commodity/environmental group (positive)
- Information source: Landcare group/network/coordinator (positive)
- Information source: local council (positive)
- Information source: environmental organisations (positive)
- Information medium: smart phone technology (positive)

Length of fencing to manage stock access to waterways (continuous)

- Utilised a contractor for property management in last 12 months (positive)
- In the past five years received government support for on-property works (positive)
- Government support for specific CRP (tree planting, fencing to manage stock access to streams, off-stream watering points) (positive)
- Any government support (positive)
- Completed a short course relevant to property management in last five years (positive)
- Received an off-property profit (positive)
- Prepared a property management/whole farm plan (positive)
- Undertaken 'Landcare-type' work without government financial support (positive)
- Would do more 'Landcare-type' work if CMA provided cash/materials (positive)
- Proximity to a wetland (1km) (positive)
- Intention to trust: I can rely on the Wimmera CMA to provide appropriate financial assistance for river frontage management (positive)
- View: pumping groundwater creates economic opportunities that will benefit our district (negative)
- View: all in all, the benefits of pumping groundwater outweigh the costs (negative)
- View: floodplain land and wetlands provide important places for native birds to live (positive)
- Long term plan: the enterprise mix will be changed to more intensive enterprises (positive)
- View: landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals (negative)
- Long-term plan: planning to undertake work to mitigate flood impacts (positive)
- Value: sense of accomplishment from knowing that my property is contributing to improved environmental health in the district (positive)

- Value: the environment on my farm sustains life for many different plants and animals (positive)
- Biospheric held values (positive)
- Held value: social justice (positive)
- Held value: preventing pollution (positive)
- Held value: protecting the environment (positive)
- Held value: social power (positive)
- Knowledge: organisations/individuals to contact for advice about government programs supporting landholders to manage gully/stream bank erosion (positive)
- Knowledge: the benefits of retaining native vegetation on properties (positive)
- Knowledge: the ability of biochar to improve soil structure (positive)
- Knowledge: how to protect and improve the health of native bush areas on properties (positive)
- Knowledge: the use of stock containment areas to manage stock in drier seasons (positive)
- Knowledge: the severity of gully erosion across the Wimmera region (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: areas of property showing signs of salinity (positive)
- Knowledge: how to use soil sample results to guide fertiliser applications (positive)
- Knowledge: the ability of perennial vegetation to prevent water tables rising (positive)
- Knowledge: the role of wetlands in filtering water entering rivers (positive)
- Knowledge: the value of woody debris such as snags in rivers/streams (positive)
- Knowledge: how to protect and improve the health of rivers/streams and wetlands on properties (positive)
- Land use: land managed to protect cultural heritage sites (positive)
- Land use: remnant native bush covered by a conservation covenant (positive)
- Land use: part of property under a conservation covenant/management agreement (positive)
- Land use: broadacre cropping (relationship)
- Land use: farm forestry (positive)
- Land use: area >1ha trees planted (positive)
- Information source: BOM (positive)
- Information source: Wimmera CMA (positive)
- Information source: commodity group (positive)
- Information source: extension officers (positive)
- Information source: government agencies/departments (positive)
- Information source: internet (positive)
- Information source: Landcare group/network/coordinator (positive)
- Information source: books/magazines/journals (positive)
- Information source: environmental organisations (positive)
- Information medium: post (positive)
- Information medium: desktop computer (positive)
- Information medium: local commodity/environmental group (positive)

Length of fencing to manage stock access to native bush/grassland (continuous)

- Member of a commodity group (positive)
- Utilised a contractor for property management in last 12 months (positive)
- In the past five years received government support for on-property works (positive)
- Any government support (positive)

- Total amount of land owned/managed by immediate family (positive)
- Area of property owned (positive)
- Member of Landcare (positive)
- Completed a short course relevant to property management in last five years (positive)
- Received an off-property profit (positive)
- Prepared a property management/whole farm plan (positive)
- Undertaken 'Landcare-type' work without government financial support (positive)
- Would do more 'Landcare-type' work if CMA provided cash/materials (positive)
- View: landholders should be paid for providing environmental services that benefit the wider community (positive)
- View: stock access to waterways should be carefully managed (positive)
- Long-term plan: all or some part of the property will be placed under a conservation covenant (positive)
- Property issue: lack of skilled labour to undertake important on-property work (positive)
- District issue: loss of native plants and animals or increased soil erosion caused by cropping or draining wetlands (positive)
- District issue: loss of wetlands as a result of drains being constructed (positive)
- District issue: the effect of increased surface water extraction (positive)
- District issue: stock entering rivers/wetland causing erosion and reducing water quality (positive)
- District issue: loss of wetlands as a result of cropping (positive)
- Value: sense of accomplishment from knowing that my property is contributing to improved environmental health in the district (positive)
- Value: the environment on my farm sustains life for many different plants and animals (positive)
- Environmental value scale (positive)
- Confidence in CRP: fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands (positive)
- Confidence in CRP: the time and expense involved in watering stock off-stream/wetlands is justified by improvements in bank stability, water quality or stock condition (positive)
- Knowledge: organisations/individuals to contact for advice about government programs supporting landholders to manage gully/stream bank erosion (positive)
- Knowledge: the benefits of retaining native vegetation on properties (positive)
- Knowledge: how to protect and improve the health of native bush areas on properties (positive)
- Knowledge: how to identify local plant species including weeds in the understorey vegetation (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: areas of property showing signs of salinity (positive)
- Knowledge: the ability of perennial vegetation to prevent water tables rising (positive)
- Knowledge: the role of wetlands in filtering water entering rivers (positive)
- Knowledge: how to protect and improve the health of rivers/streams and wetlands on properties (positive)
- Land use: land managed to protect cultural heritage sites (positive)
- Land use: part of property under a conservation covenant/management agreement (positive)
- Land use: remnant bush covered by a management agreement (positive)
- Land use: farm forestry (positive)
- Land use: area >1ha trees planted (positive)
- Information source: BOM (positive)

- Information source: mailed brochures/leaflets/newsletters (positive)
- Information source: Wimmera CMA (positive)
- Information source: extension officers (positive)
- Information source: friends/neighbours/relatives (positive)
- Information source: government agencies/departments (positive)
- Information source: internet (positive)
- Information source: Landcare group/network/coordinator (positive)
- Information source: environmental organisations (positive)
- Information medium: post (positive)
- Information medium: desktop computer (positive)

Area of perennial pasture sown (continuous)

- Farmer/non-farmer (farmer)
- Hours spent per week attending voluntary group activities (positive)
- Utilised a contractor for property management in last 12 months (positive)
- Those involved in decision making for property (yes, multi generations of family highest score)
- In the past five years received government support for on-property works (positive)
- Any government support (positive)
- Government support for specific CRP (fencing waterways to manage stock access, erosion control) (positive)
- Hours per week spent on on-property work (positive)
- Total amount of land owned/managed by immediate family (positive)
- Area of property owned (positive)
- Member of Landcare (positive)
- Gender (male)
- Own more than one property in Wimmera region (positive)
- Part of property leased/sharefarmed/agisted by others (negative)
- Area of land leased to others (positive)
- Completed a short course relevant to property management in last five years (positive)
- Received an on-property profit (positive)
- Prepared a property management/whole farm plan (positive)
- Proximity to wetland (positive)
- Undertaken 'Landcare-type' work without government financial support (positive)
- Would do more 'Landcare-type' work if CMA provided cash/materials (positive)
- View: any negative impacts of pumping groundwater can be fixed (positive)
- View: any negative impacts of pumping groundwater can be prevented if we proceed carefully (positive)
- View: cropping or draining wetlands will create long lasting environmental problems (negative)
- View: only a few people in the Wimmera region will receive benefits from cropping or draining wetlands (negative)
- View: any negative impacts of cropping or draining wetlands can be fixed (positive)
- View: all in all, the benefits of pumping groundwater outweigh the costs (positive)
- View: cropping or draining wetlands creates economic opportunities that will benefit our district (positive)
- View: pumping groundwater will create long lasting environmental problems (negative)
- View: only a few people in the Wimmera region will receive benefits from pumping groundwater (negative)
- View: it is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment (negative)

- View: landholders have the right to harvest water that falls on their property even if that action impacts on others (positive)
- Long term plan: all or most of the property will be leased (negative)
- District issue: dryland salinity threatening the long-term productive capacity of land (negative)
- District issue: farming practices contributing to erosion (negative)
- District issue: impact of reduced water flows on the long-term health of waterways (negative)
- District issue: loss of paddock trees (negative)
- District issue: salinity threatening water quality in waterways (negative)
- District issue: loss of native plants and animals or increased soil erosion caused by cropping or draining wetlands (negative)
- District issue: stock entering rivers/wetland causing erosion and reducing water quality (negative)
- District issue: loss of wetlands as a result of cropping (negative)
- Property issue: impact of changing rainfall patterns on property viability (negative)
- Value: sense of accomplishment from knowing that my property is contributing to improved environmental health in the district (positive)
- Value: freedom of working for myself (positive)
- Value: work on property is a welcome break from normal occupation (negative)
- Held value: equality (negative)
- Knowledge: the benefits of retaining native vegetation on properties (positive)
- Knowledge: how to protect and improve the health of native bush areas on properties (positive)
- Knowledge: how to correctly use agricultural chemicals (positive)
- Knowledge: the existence of accessible groundwater underneath your property of sufficient quality to irrigate crops or water stock (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: areas of property showing signs of salinity (positive)
- Knowledge: grazing and cropping strategies to manage paddock ground cover to minimise soil erosion (positive)
- Knowledge: the ability of perennial vegetation to prevent water tables rising (positive)
- Knowledge: extent of water savings from the Wimmera-Mallee pipeline (negative)
- Knowledge: how to protect and improve rivers/streams and wetlands on properties (positive)
- Land use: beef (positive)
- Land use: irrigated pasture/cropping (positive)
- Land use: dryland pasture (positive)
- Land use: sheep for meat (positive)
- Land use: sheep for wool (positive)
- Information source: mailed brochures/leaflets/newsletters (positive)
- Information source: Wimmera CMA (positive)
- Information source: agricultural consultant (positive)
- Information source: extension officers (positive)
- Information source: field days (positive)
- Information source: government agencies/departments (positive)
- Information source: Landcare group/network/coordinator (positive)
- Information source: books/magazines/journals (positive)
- Information source: VFF (positive)

- Information medium: local commodity/environmental group (positive)

Number of off-stream watering points established (continuous)

- Utilised a contractor for property management in last 12 months (positive)
- Hours per week spent on on-property work (positive)
- Total amount of land owned/managed by immediate family (positive)
- Area of property owned (positive)
- Prepared a property management/whole farm plan (positive)
- Undertaken 'Landcare-type' work without government financial support (positive)
- View: all in all, the benefits of cropping or draining wetlands outweigh the costs (positive)
- View: cropping or draining wetlands will create long lasting environmental problems (negative)
- View: pumping groundwater creates economic opportunities that will benefit our district (positive)
- View: only a few people in the Wimmera region will receive benefits from cropping or draining wetlands (negative)
- View: any negative impacts of cropping or draining wetlands can be fixed (positive)
- View: cropping or draining wetlands creates economic opportunities that will benefit our district (positive)
- View: pumping groundwater will create long lasting environmental problems (negative)
- View: only a few people in the Wimmera region will receive benefits from pumping groundwater (negative)
- View: stock access to waterways should be carefully managed (negative)
- Intention to trust: I can rely on the Wimmera CMA to provide appropriate financial assistance for river frontage management (negative)
- Long-term plan: additional land will be purchased, leased or share-farmed (positive)
- Long-term plan: all or some part of the property will be placed under a conservation covenant (positive)
- Long term plan: the enterprise mix will be changed to more intensive enterprises (positive)
- Long term plan: the enterprise mix will be changed to reduce my farm workload (positive)
- Long-term plan: to conduct flood mitigation works on property (positive)
- Property issue: lack of skilled labour to undertake important on-property work (positive)
- Knowledge: the benefits of retaining native vegetation on properties (positive)
- Knowledge: the existence of accessible groundwater underneath your property of sufficient quality to irrigate crops or water stock (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: extent of water savings from the Wimmera-Mallee pipeline (negative)
- Land use: beef (positive)
- Land use: part of property under a conservation covenant/management agreement (positive)
- Land use: farm forestry (positive)
- Land use: dairy (positive)
- Land use: farm tourism (positive)
- Land use: area >1ha trees planted (positive)
- Information source: extension officers (positive)
- Information source: government agencies/departments (positive)
- Information source: environmental organisations (positive)

Area of gully erosion addressed (continuous)

- Utilised a contractor for property management in last 12 months (positive)
- In the past five years received government support for on-property works (positive)
- Government support for specific CRP (tree planting, fencing waterways to manage stock access, off-stream watering points, erosion control, fencing bush to manage stock access) (positive)
- Any government support (positive)
- Member of Landcare (positive)
- Prepared a property management/whole farm plan (positive)
- Total on and off property income (yes)
- Undertaken 'Landcare-type' work without government financial support (positive)
- Would do more 'Landcare-type' work if CMA provided cash/materials (positive)
- Intention to trust: I can rely on the Wimmera CMA to provide appropriate financial assistance for river frontage management (negative)
- Long-term plan: planning to undertake work to mitigate flood impacts (positive)
- Property issue: lack of skilled labour to undertake important on-property work (positive)
- Property issue: dryland salinity undermining long-term productive capacity (positive)
- View: landholders should manage their properties in expectation of extreme weather events (positive)
- Knowledge: organisations /individuals to contact for advice about government programs supporting landholders to manage gully/stream bank erosion (positive)
- Knowledge: how to protect and improve the health of native bush areas on properties (positive)
- Knowledge: how to protect and improve rivers/streams and wetlands on properties (positive)
- Knowledge: the severity of gully erosion across the Wimmera region (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: areas of property showing signs of salinity (positive)
- Knowledge: the ability of perennial vegetation to prevent water tables rising (positive)
- Knowledge: the role of wetlands in filtering water entering rivers (positive)
- Land use: viticulture/horticulture (negative)
- Land use: sheep for meat (positive)
- Land use: area >1ha trees planted (positive)
- Information source: Wimmera CMA (positive)
- Information source: agricultural consultant (positive)
- Information source: extension officers (positive)
- Information source: government agencies/departments (positive)
- Information source: internet (positive)
- Information source: Landcare group/network/coordinator (positive)

Monitored bore height (yes/no)

*please note, as this is a yes/no variable, direction of the relationship is unable to be determined for categorical independent variables. 'Yes' indicates a relationship exists. For continuous independent variables, positive indicates a positive relationship and negative indicates a negative relationship

- Prepared a property management/whole farm plan (yes)
- Equity in property (positive)
- View: any negative impacts of pumping groundwater can be prevented if we proceed carefully (positive)
- View: all in all, the benefits of pumping groundwater outweigh the costs (positive)

- Long term plan: all or most of the property will be leased (negative)
- District issue: loss of native plants and animals or increased soil erosion caused by cropping or draining wetlands (negative)
- District issue: stock entering rivers/wetland causing erosion and reducing water quality (positive)
- Knowledge: the use of stock containment areas to manage stock in drier seasons (positive)
- Knowledge: the existence of accessible groundwater underneath your property of sufficient quality to irrigate crops or water stock (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: area of saline affected vegetation in district (positive)
- Knowledge: grazing and cropping strategies to manage paddock ground cover to minimise soil erosion (positive)
- Knowledge: the role of wetlands in filtering water entering rivers (positive)
- Land use: sheep for wool (yes)
- Information source: agricultural consultant (yes)

Monitored bore quality (yes/no)

*please note, as this is a yes/no variable, direction of the relationship is unable to be determined for categorical independent variables. 'Yes' indicates a relationship exists. For continuous independent variables, positive indicates a positive relationship and negative indicates a negative relationship

- Principle place of residence (yes)
- Gender (yes)
- Area of property owned (positive)
- Completed a short course relevant to property management in last five years (positive)
- Equity in property (positive)
- Prepared a property management/whole farm plan (yes)
- Government support for specific CRP(tree planting)
- View: any negative impacts of pumping groundwater can be prevented if we proceed carefully (positive)
- View: pumping groundwater creates economic opportunities that will benefit our district (positive)
- View: all in all, the benefits of pumping groundwater outweigh the costs (positive)
- View: all in all, the benefits of cropping or draining wetlands outweigh the costs (positive)
- View: cropping or draining wetlands creates economic opportunities that will benefit our district (positive)
- View: pumping groundwater will create long lasting environmental problems (negative)
- View: I have changed my farming practices since having a secure water supply from the Wimmera-Mallee pipeline (negative)
- View: in future, landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment (negative)
- Long-term plan: additional land will be purchased, leased or share-farmed (positive)
- Long term plan: all or most of the property will be leased (negative)
- District issue: impact of floods on the financial viability of the district (negative)
- District issue: loss of native plants and animals or increased soil erosion caused by cropping wetlands or floodplains (negative)
- District issue: stock entering rivers/wetlands causing erosion and reducing water quality (negative)
- District issue: vegetation in waterways obstructing flows leading to flooding (negative)
- Value: my groundwater entitlement adds to the market value of my property (positive)

- Knowledge: the benefits of retaining native vegetation on properties (positive)
- Knowledge: how to protect and improve the health of native bush areas on properties (positive)
- Knowledge: how to correctly use agricultural chemicals (positive)
- Knowledge: the use of stock containment areas to manage stock in drier seasons (positive)
- Knowledge: the existence of accessible groundwater underneath your property of sufficient quality to irrigate crops or water stock (positive)
- Knowledge: the nature of native vegetation cover in the Wimmera region before European settlement (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: area of saline affected vegetation in district (positive)
- Knowledge: how to use soil sample results to guide fertiliser applications (positive)
- Knowledge: grazing and cropping strategies to manage paddock ground cover to minimise soil erosion (positive)
- Knowledge: the ability of perennial vegetation to prevent water tables rising (positive)
- Knowledge: the role of wetlands in filtering water entering rivers (positive)
- Knowledge: the value of woody debris such as snags in rivers/streams (positive)
- Information source: agricultural consultant (yes)
- Information source: government agencies/departments (yes)
- Information source: Landcare group/network/coordinator (yes)
- Information medium: local commodity/environmental group (yes)

Area used adaptive no-till techniques (continuous)

- Farmer/non-farmer (farmer)
- Member of a commodity group (positive)
- Government funding for specific CRP (erosion control) (negative)
- Days spent in paid off-property work (negative)
- Those involved in decision making for property (yes, multi-generations of family highest score)
- Hours per week spent on on-property work (positive)
- Total amount of land owned/managed by immediate family (positive)
- Area of property owned (positive)
- Member of Landcare (positive)
- Lease/sharefarm/agist land from others (positive)
- Years owned/managed property (positive)
- Gender (male)
- Own more than one property in Wimmera region (positive)
- Part of property leased/sharefarmed/agisted by others (negative)
- Land leased to others (positive)
- Combined off and on-property income (yes)
- Family members interested in taking over property in the future (positive)
- Would do more 'Landcare-type' work if CMA provided cash/materials (positive)
- View: paddock trees are important because they provide a place for native animals to shelter and feed (negative)
- View: cropping or draining wetlands will create long lasting environmental problems (negative)
- View: cropping or draining wetlands creates economic opportunities that will benefit our district (positive)

- View: landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals (positive)
- View: landholders should manage their properties in expectation of extreme weather events (negative)
- View: landholders should be paid for providing environmental services that benefit the wider community (positive)
- View: the public should have the right to access rivers/streams/wetlands (negative)
- Long-term plan: additional land will be purchased, leased or share-farmed (positive)
- Long term plan: the enterprise mix will be changed to more intensive enterprises (positive)
- Long term plan: all or most of the property will be leased (negative)
- Long term plan: all or most of the property will be share-farmed (negative)
- Long-term plan: property will be sold (negative)
- Long-term plan: ownership of the property will stay within the family (positive)
- District issue: loss of wetlands as a result of cropping (negative)
- District issue: dryland salinity threatening the long-term productive capacity of land (negative)
- District issue: effect of existing surface water extraction (negative)
- District issue: loss of paddock trees (negative)
- District issue: loss of wetlands as a result of drains being constructed (negative)
- Property issue: lack of skilled labour to undertake important on-property work (positive)
- Property issue: the impact of managing weeds and pest animals affecting profitability (negative)
- Value: an attractive place to live (positive)
- Value: sense of accomplishment from building/maintaining a viable business (positive)
- Value: a great place to raise a family (positive)
- Value: provides most of the household income (positive)
- Value: sense of accomplishment from improving property infrastructure (positive)
- Value: provides the lifestyle that I want (negative)
- Value: work on property provides a welcome break from normal occupation (negative)
- Value: being able to pass property on to others in better condition (positive)
- Egoistic held values (positive)
- Held value: authority (positive)
- Held value: influential (positive)
- Confidence in CRP: the benefits of stubble retention outweigh problems arising (positive)
- Knowledge: the ability of biochar to improve soil structure (positive)
- Knowledge: how to correctly use agricultural chemicals (positive)
- Knowledge: the use of stock containment areas to manage stock in drier seasons (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: areas of property showing signs of salinity (negative)
- Knowledge: how to use soil sample results to guide fertiliser applications (positive)
- Knowledge: grazing and cropping strategies to manage paddock ground cover to minimise soil erosion (positive)
- Land use: area >1ha trees planted (positive)
- Information source: agricultural consultant (positive)
- Information source: books/magazines/journals (positive)
- Information source: VFF (positive)

Area used minimum tillage techniques (continuous)

- Farmer/non-farmer (farmer)
- Days spent in paid off-property work (negative)
- Those involved in decision making for property (yes, multi-generations of family highest score)
- Hours per week spent on on-property work (positive)
- Total amount of land owned/managed by immediate family (positive)
- Area of property owned (positive)
- Lease/sharefarm/agist land from others (positive)
- Lease land to others (negative)
- Years lived in district (positive)
- Years owned/managed property (positive)
- Own more than one property in Wimmera region (positive)
- Part of property leased/sharefarmed/agisted by others (negative)
- Property principal place of residence (positive)
- Received an off-property profit (negative)
- Received an on-property profit (positive)
- Family members interested in taking over property in the future (positive)
- Have a succession plan (positive)
- Government support for specific CRP (erosion control) (negative)
- View: all in all, the benefits of cropping or draining wetlands outweigh the costs (positive)
- View: cropping or draining wetlands will create long lasting environmental problems (negative)
- View: only a few people in the Wimmera region will receive benefits from cropping or draining wetlands (negative)
- View: any negative impacts of cropping or draining wetlands can be fixed (positive)
- View: cropping or draining wetlands creates economic opportunities that will benefit our district (positive)
- View: only a few people in the Wimmera region will receive benefits from pumping groundwater (negative)
- View: paddock trees are important because they provide a place for native animals to shelter and feed (negative)
- View: landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals (positive)
- View: the environment should have a specific allocation of river water (negative)
- View: landholders should manage their properties in expectation of extreme weather events (negative)
- View: stock access to waterways should be carefully managed (negative)
- Long-term plan: additional land will be purchased, leased or share-farmed (positive)
- Long-term plan: planning to undertake work to mitigate flood impacts (positive)
- Long term plan: the enterprise mix will be changed to more intensive enterprises (positive)
- Long term plan: all or most of the property will be leased (negative)
- Long term plan: all or most of the property will be share-farmed (negative)
- Long-term plan: property will be sold (negative)
- Long-term plan: ownership of the property will stay within the family (positive)
- District issue: loss of wetlands as a result of cropping (negative)
- District issue: loss of native plants and animals or increased soil erosion caused by cropping wetlands or floodplains (negative)

- District issue: stock entering rivers/wetlands causing erosion and reducing water quality (negative)
- District issue: the effect on increased surface water extraction (negative)
- District issue: loss of paddock trees (negative)
- District issue: loss of wetlands as a result of drains being constructed (negative)
- District issue: salinity threatening water quality in waterways (negative)
- Value: sense of accomplishment from building/maintaining a viable business (positive)
- Value: provides most of the household income (positive)
- Value: sense of accomplishment from improving property infrastructure (positive)
- Value: rural land represents a sound long term investment (positive)
- Value: work on property is a welcome break from normal occupation (negative)
- Value: being able to pass the property on in better condition (positive)
- Confidence in CRP: fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands (negative)
- Knowledge: how to correctly use agricultural chemicals (positive)
- Knowledge: the use of stock containment areas to manage stock in drier seasons (positive)
- Knowledge: how to establish introduced perennial pastures in this district (positive)
- Knowledge: how to use soil sample results to guide fertiliser applications (positive)
- Knowledge: grazing and cropping strategies to manage paddock ground cover to minimise soil erosion (positive)
- Land use: beef (negative)
- Land use: broadacre cropping (positive)
- Land use: sheep for meat (positive)
- Land use: sheep for wool (positive)
- Information source: commodity group (positive)
- Information source: extension officers (positive)
- Information source: friends/neighbours/relative (positive)
- Information source: environmental organisations (positive)
- Information source: VFF (positive)

Utilised precision farming techniques (yes/no)

*please note, as this is a yes/no variable, direction of the relationship is unable to be determined for categorical independent variables. 'Yes' indicates a relationship exists. For continuous independent variables, positive indicates a positive relationship and negative indicates a negative relationship

- Farmer/non-farmer (farmer)
- Age (younger)
- Member of a commodity group (yes)
- Short course on property management (yes)
- Hours per week spent on on-property work (positive)
- Total amount of land owned/managed by immediate family (positive)
- Area of property owned (positive)
- Lease/sharefarm/agist land from others (positive)
- On property profitability (positive)
- Government support (erosion control, yes)
- Family members interested in taking over property in the future (yes)
- Proximity to wetland (yes)
- View: only a few people in the Wimmera region will receive benefits from pumping groundwater (positive)
- Long-term plan: additional land will be purchased, leased or share-farmed (positive)

- Long-term plan: planning to undertake work to mitigate flood impacts (positive)
- Property issue: lack of skilled labour to undertake important on-property work (positive)
- Property issue: the impact of managing weeds and pest animals affecting profitability (positive)
- Property issue: impact of changing rainfall patterns on property viability (positive)
- Value: sense of accomplishment from building/maintaining a viable business (positive)
- Value: provides most of the household income (positive)
- Value: sense of accomplishment from improving property infrastructure (positive)
- Value: being able to pass the property on in better condition (positive)
- Value: being part of a rural community (positive)
- Economic value index (positive)
- Held value: authority (positive)
- Held value: helpful (positive)
- Confidence in CRP: the benefits of stubble retention outweigh problems arising (positive)
- View: the environment should have a specific allocation of river water (negative)
- View: using industry standards developed with landholder input would be an acceptable way of determining if land is being managed responsibly (positive)
- Knowledge: the ability of biochar to improve soil structure (positive)
- Knowledge: how to correctly use agricultural chemicals (positive)
- Knowledge: the use of stock containment areas to manage stock in drier seasons (positive)
- Knowledge: extent of water savings as a result of the Wimmera-Mallee pipeline (positive)
- Knowledge: how to prepare a farm or property plan that allocates land use according to different land classes (positive)
- Knowledge: how to use soil sample results to guide fertiliser applications (positive)
- Knowledge: grazing and cropping strategies to manage paddock ground cover to minimise soil erosion (positive)
- Land use: dryland pasture (yes)
- Land use: sheep for wool (yes)
- Information source: agricultural consultant (yes)
- Information source: VFF (yes)
- Information medium: smart phone technology (yes)

Created a wetland (yes/no)

*please note, as this is a yes/no variable, direction of the relationship is unable to be determined for categorical independent variables. 'Yes' indicated a relationship exists. For continuous independent variables, positive indicates a positive relationship and negative indicates a negative relationship

- Age (older)
- Hours per week spent on on-property work (negative)
- Prepared a property management/whole farm plan (yes)
- Government support for specific CRP(tree planting) (yes)
- View: all in all, the benefits of cropping or draining wetlands outweigh the costs (negative)
- View: cropping or draining wetlands will create long lasting environmental problems(positive)
- View: landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals (negative)
- View: new owners should abide by agreements entered into by previous owners where public funds have paid for land protection or conservation work (positive)

- View: landholders should be paid for providing environmental services that benefit the wider community (positive)
- District issue: impact of floods on the financial viability of the district (negative)
- Property issue: impact of changing rainfall patterns on property viability (negative)
- Property issue: dryland salinity undermining long-term productive capacity (negative)
- Value: sense of accomplishment from knowing that my property is contributing to improved environmental health in the district (positive)
- Value: the environment on my farm sustains life for many different plants and animals (positive)
- Held value: social justice (positive)
- Held value: wealth (negative)
- Stewardship ethic: reduced production in the short-term is justified where there are long-term benefits to the environment (positive)
- Knowledge: the benefits of retaining native vegetation on properties (positive)
- Knowledge: how to protect and improve the health of native bush areas on properties (positive)
- Knowledge: the existence of accessible groundwater underneath your property of sufficient quality to irrigate crops or water stock (positive)
- Knowledge: how to identify local plant species including weeds in the understorey vegetation (positive)
- Knowledge: how to protect and improve the health of rivers/streams and wetlands on properties (positive)
- Knowledge: the nature of native vegetation cover in the Wimmera region before European settlement (positive)
- Knowledge: the ability of perennial vegetation to prevent water tables rising (positive)
- Knowledge: the role of wetlands in filtering water entering rivers (positive)
- Knowledge: the value of woody debris such as snags in rivers/streams (positive)
- Land use: remnant native bush covered by a conservation covenant (yes)
- Land use: part of property under a conservation covenant/management agreement (yes)
- Land use: farm forestry (positive)
- Land use: area >1ha trees planted (yes)
- Information source: books/magazines/journals (yes)

APPENDIX 2

Significant differences across the region

Table 38 Significant differences across the Wimmera region by council area, 2011 (N=494)

Topic	p-value	Topic	p-value
Occupation (% farmer)	<0.001	Protecting the environment - preserving nature (values that guide your life)	0.0003
Who participates in decision making on the property	0.0018	Stock entering rivers/wetlands causing erosion and reducing water quality (assessment of issues: district)	0.0003
Gender	0.0431	The effect of increased surface water extraction (assessment of issues: district)	0.0005
Broadacre cropping	<0.001	Salinity threatening water quality (assessment of issues: district)	0.0005
Beef production	<0.001	I am planning to undertake work to mitigate flood impacts on my property (long term plans)	0.0006
Monitor bore height (over management)	<0.001	Cropping or draining wetlands creates economic opportunities that will benefit our district (view)	0.0006
Monitor bore quality (over management)	<0.001	The environment on my farm sustains life for many different plants and animals (attached values)	0.0006
Member of a commodity group	<0.001	Dryland salinity threatening the long-term productive capacity of land (assessment of issues: district)	0.0007
Returned a net profit	<0.001	Decline in soil health (assessment of issues: district)	0.0008
Area sown to perennial pasture and lucerne (over management)	<0.001	Loss of paddock trees (assessment of issues: district)	0.0008
Area sown to perennial pasture and lucerne (last five years)	<0.001	Area of land leased to others	0.0012
Length of fencing erected to manage stock access to streams (last five years)	<0.001	Values that guide your life: biospheric	0.0012
Area of gully erosion addressed (over management)	<0.001	Farming practices contributing to erosion (assessment of issues: district)	0.0015
Length of fencing erected to manage stock access to streams (over management)	<0.001	Preventing pollution: protecting natural resources (values that guide your life)	0.0022
VFF as an information source	<0.001	In future, landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment (views, duty of care)	0.0032
Government support for planting trees and shrubs (over management)	0.0003	The role of wetlands in filtering water entering rivers (knowledge)	0.0033
Percent new owners (<10yrs)	0.0024	Loss of important services (assessment of issues district)	0.0038
Sheep for meat production	0.0026	Loss of wetlands as a result of drains being constructed (assessment of issues: district)	0.0044

Sheep for wool production	0.003	Paddock trees are important because they provide a place for native animals to shelter and feed (views)	0.0045
Viticulture/horticulture	0.0035	Vegetation in waterways obstructing flows leading to flooding (assessment of issues: district)	0.005
Own another property outside the Wimmera region	0.0036	Unity with nature: fitting into nature (values that guide your life)	0.0051
Received any government support	0.0036	The benefits of retaining native vegetation on properties (knowledge)	0.0055
Undertaken Landcare work in last 10 years on property without government support	0.0045	All or some part of the property will be placed under a conservation covenant (long term plans)	0.0056
Landcare as an information source	0.0076	Stock access to rivers/streams/wetlands should be carefully managed (views)	0.0072
Information medium - commodity/environmental group	0.0082	Fencing to manage stock access is an essential part of the work required to revegetate waterways and wetlands (views, confidence in CRP)	0.0074
Irrigated pasture/cropping	0.0087	The impact of floods on the financial viability of the district (assessment of issues: district)	0.0076
Government support in last five years	0.0088	My groundwater entitlement adds to the market value of my property (attached values)	0.0081
Member of Landcare	0.0106	Years in local district	0.0083
Newspapers as an information source	0.0137	On property profit range	0.0084
Agricultural consultant as an information source	0.0154	All or most of the property will be share farmed (long term plans)	0.0094
Dryland pasture	0.0187	Social justice: correcting injustice, caring for the weak (values that guide your life)	0.0099
Radio as an information source	0.0191	Grazing and cropping strategies to manage paddock ground cover to minimise soil erosion (knowledge)	0.0117,
Government support for erosion control	0.0212	Impact of reduced water flows on the long-term health of rivers/streams/wetlands (knowledge)	0.0121
Lease area of land from others	0.0258	Influential: having an impact on people and events (values that guide your life)	0.0148
Days spent working off property	0.0391	Economic index: attached values	0.0168
Earned an off property income	0.0404	Any negative impacts of pumping groundwater can be prevented if we proceed carefully (views)	0.0168
Information medium - smart phone technology	0.0419	Values that guide your life: altruistic	0.017
Precision farming techniques for cropping (last five years)	0.0442	Only a few people in the Wimmera region will benefit from pumping groundwater (views)	0.0172
Intensive livestock (land use)	0.0445	I will live on the property for as long as possible (long term plans)	0.019
Own more than one property in the Wimmera region	0.0487	Wealth: accumulating material possessions, money (values that guide your life)	0.0211
Area of crop sown using minimum tillage (last five years)	0.0488	Respecting the earth: harmony with other species (values that guide your life)	0.0216

Effect of existing groundwater extraction (assessment of issues: district)	<0.001	The public should have the right to access rivers/streams/wetlands (views)	0.0217
Floodplain land provides important places for native birds to live (views)	<0.001	Landholders should be paid for providing environmental services that benefit the wider community (views)	0.024
The severity of gully erosion across the Wimmera (knowledge)	<0.001	Uncertain/low returns limiting capacity to invest in my property (assessment of issues: property)	0.0284
Impact of changing rainfall patterns on property viability (assessment of issues: property)	<0.001	Pumping groundwater will create long lasting environmental problems (views)	0.0287
Existence of accessible groundwater underneath your property that is of sufficient quality to irrigate crops or water stock (knowledge)	<0.001	Landholders should manage their properties in expectation of extreme weather events (views)	0.0324
Extent of water savings as a result of the Wimmera/Mallee pipeline (knowledge)	<0.001	Landholders should have the right to crop floodplains or wetlands on their property regardless of the impacts on native plants and animals (views)	0.0333
Pumping groundwater creates economic opportunities that will benefit our district (view)	<0.001	All in all, the benefits of cropping or draining wetlands outweigh the costs (views)	0.0342
Property size	<0.001	Work on my property is a welcome break from my normal occupation (attached values)	0.0346
Organisations or individuals to contact for advice about government programs supporting landholders to manage gully/stream erosion (knowledge)	<0.001	The ability of perennial vegetation to prevent water tables rising (knowledge)	0.0352
Environmental index: attached values	<0.001	The value of woody debris such as snags in rivers/streams (knowledge)	0.0359
Property size (immediate family)	<0.001	Equality: equal opportunity for all (values that guide your life)	0.0365
Loss of native plants and animals or increased soil erosion caused by cropping wetlands or floodplains (assessment of issues: district)	0.0001	Any negative impacts of cropping or draining wetlands can be preventing if we proceed carefully (views)	0.0385
Loss of wetlands as a result of cropping (assessment of issues: district)	0.0001	It is fair that the wider community asks landholders to manage their land in ways that will not cause foreseeable harm to the environment (views, duty of care)	0.0388
All in all, the benefits of pumping groundwater outweigh the costs (views)	0.0001	Using industry standards developed with landholder input would be an acceptable way of determining if land is being managed responsibly (views, duty of care)	0.0406
Correct use of agricultural chemicals (knowledge)	0.0001	Sense of accomplishment from building/maintaining a viable business (attached values)	0.0452
Provides most of the household income (attached values)	0.0002	Reduced production in the short-term is justified where there are long-term benefits to the environment (stewardship)	0.0453
Length of property ownership	0.0003		



research for a sustainable future

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