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Landholder participation in Loddon River health projects

A report to the North Central Catchment Management Authority

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The research team would also like to sincerely thank the many landholders and agency staff who contributed valuable time and effort to completing the survey and participating in interviews. These people are not identified in this report to preserve their anonymity.

Disclaimer

The views expressed in this report are solely the authors, and do not necessarily reflect the views of Charles Sturt University, North Central CMA or any other individual or organisation consulted during the research.

EXECUTIVE SUMMARY

Introduction

The North Central Catchment Management Authority (North Central CMA) contracted Charles Sturt University's Institute for Land, Water and Society (ILWS) to examine landholder participation in two long-term river health protection and enhancement projects covering the entire length of the Loddon River:

1. the Upper Loddon and Campaspe Priority Reaches (ULCPR) project; and
2. the Loddon Stressed River Project (LSRP).

Together, these projects are referred to as the Loddon river health projects and in the rest of this report, as the river health projects.

The Upper Loddon and Campaspe Priority Reaches (ULCPR) project has been implemented along the upper, unregulated section of the Loddon River (70 km) from the headwaters to Cairn Curran Reservoir since 2008-09. As one of the region's most 'ecologically intact' waterways, the project aims to address the key threats of vegetation removal, habitat loss and invasive plants.

The Loddon Stressed River Project (LSRP) is funded by the Victorian Government and is managed by the North Central CMA. The LSRP has the broad aims of working towards a fully-fenced Loddon River; improving fish passage in the Loddon; and engaging the local community in river improvement activities. The LSRP focussed on building partnerships with rural landholders along 360 km of the regulated sections of the Loddon River from Cairn Curran Reservoir to the River Murray. Downstream of Durham-Ox, the project has been delivered by Department of Primary Industries (DPI) staff and upstream of Durham-Ox, by staff from the North Central CMA.

Landholders have been engaged in these two river health projects through a variety of communication and learning tools and processes, supported by strong public contributions to the costs of implementing work to improve river health. The equivalent of one full-time person has worked across the two reaches of the Loddon. The North Central CMA has funding to continue supporting work along the Loddon to improve river health; however, this funding is unlikely to continue beyond 2011/2012.

With approximately 300 km of the total 720 km of Loddon River frontage fenced to improve management of the river, North Central CMA staff believe the river health projects have been effective. At the same time, North Central CMA staff are committed to a collaborative, formative approach to evaluation that identifies lessons that will lead to project improvement and will inform similar projects in the future.

Discussions between North Central CMA staff and the research team established three broad objectives for this evaluation:

1. Assess the effectiveness of the river health projects.
2. Identify the constraints to implementation of recommended practices expected to lead to improved river health outcomes by landholders who have not been engaged in the river health projects.
3. Identify factors influencing the extent of long-term commitment by landholders to river health project outcomes.

Data collection included a survey mailed to all rural landholders with river frontages along the Loddon where the river health projects operated and semi-structured interviews with key informants, including landholders and agency staff. Surveys were mailed to all of the 223 landholders with frontage licences in the river health project areas. The mail out process was closed with 108 useable surveys returned and a 57% response rate.

A total of 30 people were interviewed. Informants were identified through discussion with CMA staff to achieve a mix of participants, non-participants and Natural Resource Management Committee (NRMC) members of the North Central CMA. These informants included 15 landholders who were participants in the river health projects, five landholders who had not participated in the river health projects, and ten key stakeholders (e.g. agency staff, NRMC members).

Evaluation approach

Using a program logic approach, evaluators can identify intermediate objectives expected to lead to improved resource condition. Working with North Central CMA staff, the research team identified key intermediate river health project objectives (see below in Task 1). There was no attempt to assess improvements in resource condition.

A small number of property management practices were identified that were expected to lead to improved river frontage and water quality outcomes. These recommended practices included:

1. fencing frontages to manage stock access to waterways;
2. watering stock off-stream;
3. establishing native vegetation along waterways;
4. managing pest animals and plants; and
5. returning woody debris to streams.

Survey respondents were asked to provide information about their management practices in the last year, the last five years and for the period of their management. The five-year period closely matches the length of time that the river health projects have been operating.

Task 1: Assess the effectiveness of the river health projects

Effectiveness of the river health projects was assessed by answering two questions:

1. Did the project make a substantial contribution to increased: awareness of river health issues; knowledge and understanding of degradation processes and remedial actions; confidence in/acceptability of recommended practices; and implementation of recommended practices?
2. Did the project employ appropriate processes and tools and implement these in ways that were sound?

Without pre and post-intervention data, project impact was assessed by comparing participants with non-participants across the range of intermediate project outcomes. Survey topics also explored the views of respondents who had participated in river frontage programs about the support they received from Department of Primary

Industries (DPI) and North Central CMA staff; and the views of non-participants about why they had not participated in the river health projects. Key informant interviews focussed on the nature and effectiveness of engagement processes, including reasons why non-participants had not joined the river health projects.

Task 2: Identify constraints to implementation by landholders not in river health projects

Survey respondents were asked to rate the importance of a range of possible constraints to implementing recommended practices for river frontage management in their district. Only data from the non-project respondents is relevant to this task. Analyses using pairwise comparisons and regression modelling were also used to explore the factors influencing implementation of recommended practices by non-project participants. The key informant interviews also explored the factors affecting implementation by non-participants.

Task 3: Identify factors influencing long-term commitment by landholders to river health project outcomes

Program managers are beginning to focus on the need to build long-term commitment to project or program outcomes. The key informant interviews were the principal data source to answer questions about the nature of long-term commitment, the extent that the river health projects had engendered long-term commitment to project objectives, and what lessons could be learned about improving commitment.

Key findings

Task 1: Assess the effectiveness of the river health projects

River health projects engage a substantial cross section of riparian landholders

Forty-six per cent of survey respondents (N=105) said they had received support through “All programs”. That is, they said that federal or state government programs, the North Central CMA or DPI had supported work on their frontage in the past five years. Thirty-six per cent of all respondents said they were river health project participants. That is, they were involved in Loddon river health projects implemented by the North Central CMA and DPI since early 2005. Most (69%, n=48) of those who said they had received support from “All programs” in the past five years were also river health project participants.

By engaging 36% of the respondent landholders, the river health projects have engaged a much larger proportion of the target population than is typical of most natural resource management projects/ programs (<10%). River health project participants and non-participants are relatively similar suggesting that project staff have engaged a representative cross-section of the target population. For example, there was no difference between river health project participants and non-participants on property size, absentee ownership, enterprise mix or the proportion identifying as farmers.

River health project participants are more focussed on environmental values and less concerned about loss of autonomy

There are some significant differences between river health project participants and non-participants. Participants managed longer stretches of river frontage and were less likely to have been involved in Landcare, completed a short course or updated a property management plan. Participants and non-participants also differed on five of the 18 items exploring the values landholders attach to their river frontage and the single item exploring landholder stewardship values.

Interestingly, each of the values items where there was a significant difference relates to the value of river frontages for their ecological functions as opposed to more utilitarian values of frontages. In each case, participants gave a higher rating to the value statement. Consistent with these trends, participants gave a higher rating to a number of environmental issues.

Participants and non-participants were also different in terms of their attitudes about the roles and responsibilities of NRM practitioners (different on four of six items). In summary, participants were less concerned about losing some of their autonomy as a result of government taking a stronger role in NRM.

River health project participation linked to desired outcomes

Analysis of survey data suggests that the river health projects had a significant impact on the achievement of key project objectives which can reasonably be expected to lead to improved resource condition outcomes.

- participants gave a significantly higher rating to three of the five items exploring landholder awareness of river health issues.
- participants reported significantly higher knowledge for 10 of the 11 topics.
- participants provided a more positive rating than non-participants for all survey items exploring confidence in recommended practices, with significantly more positive ratings for five of the eight items.
- participants are implementing recommended practices at significantly higher levels than non-participants, that the scale of implementation is beyond what might be described as symbolic, and that at least half of the work implemented has occurred since the river health projects commenced.

Overall, participants were significantly more likely to be engaged in recommended practices for 10 of 14 items (excluding willow-related items because willows are not a problem for most landholders along the Loddon) including in the median amount of work implemented that is related to:

- installation of off-stream watering points, fencing to manage stock access to the waterway, fencing land to encourage natural regeneration of native vegetation, and establishing plants along the frontage during period of management;
- installation of off-stream watering points, fencing to manage stock access to the waterway, establishing plants along the frontage and time spent poisoning or physically removing woody weeds during the past five years;
- time spent poisoning or physically removing woody weeds in 2009.

Despite the apparent evidence of project impact from the pairwise comparisons (participants and non-participants), it is important to explore the extent that other independent variables might be contributing to these intermediate outcomes. This analysis was undertaken using regression modelling that included other independent variables.

River health projects confirmed as having a significant positive impact on outcomes

Awareness of issues

Regression modelling established that participation was linked to a higher rating for one of the three items where pairwise comparisons had identified a significant link between project participation and a higher rating for an environmental issue (a measure of awareness). In this case, the issue was: Declining water quality in rivers/ streams affecting river health.

Knowledge of river health related topics

Regression analyses established a significant positive relationship between participation in river health projects and five knowledge items:

1. How to access information about government support for landholders to better manage Crown Land river frontages
2. The role of river frontages as corridors supporting the movement of animals from one area to another
3. The contribution of floodplain wetlands towards the health of the Loddon River
4. The ability of perennial vegetation and standing stubble to improve the quality of runoff water *(All programs on river frontages)*
5. Predicted impact of climate change on river flows in the Loddon catchment (*All programs on river frontages)*

Respondent's values (mostly those attached to the river frontage), extent of on-property work, participation in Landcare, involvement in short courses, property size, attitudes and concern about issues were also linked to higher self-reported knowledge for the 11 items using regression modelling.

Confidence in recommended practices

Regression modelling established that participation in river health projects was linked to higher confidence for one of the five items where pairwise comparisons had identified a significant link between participation and confidence in recommended practices. In this case, that was for confidence that areas of native vegetation along waterways with limited stock access are able to trap nutrients before they enter waterways.

Respondent's values (mostly those attached to the river frontage), concern about issues and the enterprise mix were also linked to higher self-reported confidence for the eight items using regression modelling.

Implementation of recommended practices

The regression modelling established a significant positive relationship between participation and five implementation items:

1. the number of off-stream watering points established (the management period);
2. the number of off-stream watering points established (past five years);
3. the number of trees/shrubs planted (past five years);
4. the length of fencing erected to manage stock access (past five years) (All river frontage programs); and
5. the time spent poisoning or physically removing woody weeds (past 12 months).

Respondent's values (mostly those attached to the river frontage), participation in Landcare, attitudes and extent of previous family ownership were also linked to more work being implemented in/on river frontages.

Assessment of the quality of engagement through river health projects

Our view is that most river health project staff were highly competent practitioners. That is, these staff were aware of different landholder contexts and the influence of these on their motivations and capacity to engage with the river health projects and implement recommended NRM practices.

Program participants were very satisfied with the support provided by CMA/DPI staff. Almost all survey respondents provided very positive feedback for all 11 items exploring the key aspects of staff engagement, including that they were approachable and responsive, treated landholders with respect, were flexible when negotiating work, treated landholders as equal partners, provided sufficient technical advice and clearly explained future management responsibilities.

Project participants interviewed were largely satisfied with the nature of the interactions they had with project personnel. These landholders were satisfied with the overall program delivery model, their interactions with staff, the information that was provided and the extent they were able to negotiate the location of fence lines. These interviewees appeared to have a clear understanding of their responsibilities under the river health project management plans.

River health project participants also identified areas for improvement, including the need for more follow-up from staff to reinforce the value of work undertaken and to provide advice about future management approaches, particularly as sites responded to project interventions. Some informants also thought the river health projects needed to identify and engage less willing landholders, particularly through one-on-one extension to explain the program and address landholder concerns.

Discussions with the NRMC and river health project staff identified the following strengths of the engagement tools and processes employed:

- engaging landholders through informal approaches to individuals;
- helping landholders gain a better understanding of the connectivity between their riparian areas and those of other landholders through the use of visual materials during site visits, including aerial photos;

- demonstrating the benefits of river health projects by way of examples of success;
- providing information and enabling debate about the nature of the projects through community meetings; and
- including credible, knowledgeable individuals with diverse farming backgrounds on the NRMC and listening to the advice and feedback they provided.

NRMC and river health project staff identified the following issues with landholder engagement:

- landholders being unclear and/or concerned about their responsibilities – particularly in relation to maintenance should floods damage fences erected;
- insufficient follow up with participating landholders;
- insufficient emphasis on building long-term commitment by undertaking community capacity building;
- some staff lacking understanding of the social drivers of practice change;
- instances of over-zealous staff who seemed insensitive to the values and needs of landholders;
- the use of coercion to obtain landholder participation (e.g. the implied threat that if landholders didn't participate in the projects that at some point in the future governments would require them to do so and at their expense);
- inconsistent use of management plans and apparent differences in the nature or content of those plans for different landholders; and
- high project staff turnover which made consistent engagement with farmers more difficult.

Reasons for non-participation in river health projects

Survey respondents identified three key explanations for non-participation:

1. not being approached;
2. not aware of the program; and
3. my frontage is in good condition and no work is needed.

Interview data confirmed that project staff had focussed on landholders who were likely to be sympathetic to project aims and had worked through existing landholder networks to identify potential project participants. So, it is likely that many landholders simply were not contacted and invited to participate. Some of the interviewees also said they didn't engage with the river health projects because they had completed the work they wanted to do on their property.

Survey and interview data suggest there is only a small proportion (<20%) of landholders who would be difficult to engage in conservation projects such as the river health projects. For example, only 10% of all respondents disagreed with the survey item exploring the extent of a stewardship ethic. This small group has a very weak commitment to environmental stewardship, is suspicious of governments and concerned about the potential loss of decision making autonomy in terms of property decision making. Many of these landholders also have strong reservations about the efficacy of some recommended practices promoted by the river health projects, including fencing river frontages to manage stock access to waterways and stream sides.

These findings suggest there is a real opportunity to engage a substantial proportion of the non-participants should the lead agencies want to extend the river health projects or implement similar projects/programs. Findings in this section provide some useful guidance about the concerns that would need to be addressed if the aim was to engage all/almost all landholders and the way to structure engagement.

Task 2: Identify constraints to implementation by landholders not in river health projects

Constraints to implementation by non-participants

The cost of materials and equipment to carry out work; drought conditions affecting the availability of water for wetlands; the impact of flood events on fences and other infrastructure; and the increased risk that fires will have severe impacts because of fuel build up behind fences were the items most frequently rated as important constraints by non-participants. Indeed, these were the only items rated as important constraints by more than half of the non-participants.

Non-participants appeared to be less concerned than participants about most of the constraints covered by items in this survey topic. It is possible that non-participants simply are less interested in river health and therefore, less concerned by many of the constraints listed in the survey. Non-participants were also more concerned about the potentially negative impacts or costs imposed by fencing out river frontages and appeared to want greater clarity about who is responsible for managing river frontages. It seems that a lack of confidence in fencing is an important influence on river health project participation.

Factors influencing implementation by non-participants

Regression modelling results demonstrated positive relationships between implementation by non-participants in river health projects and widely established NRM approaches that rely on engaging and building social and human capital, including Landcare participation; property management planning; and government support of onground work on properties.

There is also evidence that values (those attached to river frontages) and attitudes (about the roles of stakeholders, including government) are powerful influences on landholder behaviour. Again, these findings are consistent with findings from the survey and interviews about the constraints to implementation discussed above. It is unrealistic to expect to change these more deeply ingrained personal characteristics, at least not in the short-term. However, NRM practitioners need to consider the values and attitudes of landholders when they develop engagement tools and processes.

One of the interesting findings of this research is the relatively important influence of attitudes on practice implementation by those not participating in the river health projects. Past studies have found little evidence that attitudes are an important influence on NRM practice implementation in Australia.

Plans to sell or subdivide don't appear to be inhibiting the willingness of non-participants to engage in best-practice management of river frontages. This is an encouraging finding given the increased subdivision occurring and predicted in much of Victoria.

Task 3: Identify factors influencing long-term commitment by landholders to river health project outcomes

Most of the survey respondents with a management plan seem to have made a serious attempt to implement the work as agreed. For example,

- two-thirds said they had implemented most/all of the work agreed related to weeds, stock access and fence maintenance; and
- over half had implemented about half/most/all work as agreed for the remaining topics of manage pests animals and revegetation.

What is understood by long-term commitment?

Our key informants indicated that long-term commitment was a difficult concept for them to define. Nevertheless, it was possible to identify a set of attitudes and behaviours they recognise as demonstrating commitment by landholders, either in their conversations with landholders or when visiting a property, including:

- landholders acknowledging they are responsible for maintaining the infrastructure provided by projects;
- landholders undertaking the ongoing maintenance of infrastructure provided through the projects;
- landholders engaging in sound/appropriate land management before and after the installation of infrastructure provided by projects;
- ongoing landholder participation in NRM programs (e.g. Bush Tender); and
- landholders demonstrating that they accept the public-good value of caring for riparian areas.

Our discussions with landholders and key informants provided some additional insights into their construction of the concept of long-term commitment, including:

1. long-term for some interviewees extended beyond 10 years and both landholders and project staff mentioned 20 year time-frames.
2. some landholders emphasised the need for long-term commitment by agencies and governments, including to the cost of maintaining infrastructure, such as fences damaged by floods. Some landholders also wanted a commitment through support for one-on-one extension that would reinforce the value of volunteer contributions (e.g. through on-site visits to see work accomplished) and enable landholders to learn to better manage riparian areas.
3. an implicit understanding that scientific knowledge/understanding and community values/standards change over time and that this temporal dimension to NRM needs to be part of any concept of long-term commitment.

Building long-term commitment

Some of the key informants interviewed also talked about what was needed to help build long-term commitment amongst landholders. Three key findings were identified:

1. long-term commitment was easier to achieve by working with landholders who were already willing to engage in improved natural resource management;
2. long-term commitment was the end result of long-term engagement informed by understanding of the context in which landholders operate and individual's goals/aspirations and capacity; and
3. long-term commitment was built on the demonstration of successful program outcomes on the ground.

Building long-term commitment provides substantial challenges for NRM programs and practitioners. In the first instance, NRM agencies will need to give considerable thought to the level and rates of implementation that is needed to achieve desired outcomes, including the level of implementation over time at property and sub-catchment scales; and the extent that objective(s) can be accomplished with willing participants, with and without extension or cost-sharing support.

Secondly, it is difficult to demonstrate success given that in many instances in NRM we don't have a clear understanding of causality and the final goal is uncertain and most likely to change over the long-term. Under these circumstances, effective/ practical NRM will almost certainly involve some "shifting of the goal posts". If that is the case, then learning becomes critical to success and extension approaches are likely to be needed to engage "willing" and "less-willing" landholders.

Thirdly, to the extent that learning is critical, agencies will need to employ highly competent extension staff, preferably with a commitment to working with landholders over a number of years. This continues to be a major challenge given the short-term nature of programs and the common practice of employing extension staff on entry-level conditions.

Most of the river health project non-participants were more production-focused when considering how they would manage their riparian areas in the future. Their responses were typically framed by stating that they had no plans to change what they were doing. Where they talked about a future vision for their sites, they tended to speak primarily about seeking increased soil and bank stability and a reduced weed burden. However, some non-participants were committed to improving both the productivity and the ecological functioning of their riparian areas.

As demonstrated above, at least 90% of the survey respondents have values that suggest it would be possible to engage them in river health projects. There is also evidence that some non-participants have not been engaged simply because they have not been approached. In other research we have identified the goal of "leaving the land in better condition" as a personal norm that almost all landholders ascribe to. While there are differences in individual interpretation of what "better condition" means, there are common threads that should guide communication and extension efforts. "Better condition" can involve improving the profitability of business enterprises, upgrading or enhancing property infrastructure or improving environmental health. It is also possible for NRM programs to establish new social norms, particularly those approaches that attempt to engage landholders in dialogue and learning, and that these norms about "what good farming" involves can be powerful influences on landholder behaviour and lead to long-term commitment to program goals.

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1.0 INTRODUCTION

1.01 Background

The North Central Catchment Management Authority (North Central CMA) contracted Charles Sturt University's Institute for Land, Water and Society (ILWS) to examine landholder participation in two long-term river health protection and enhancement projects covering the entire length of the Loddon River [Figure 1]:

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With approximately 300 km of the total 720 km of Loddon River frontage fenced to improve management of the river, North Central CMA staff believe the river health projects have been effective. At the same time, North Central CMA staff are committed to a collaborative, formative approach to evaluation that identifies lessons that will lead to project improvement and will inform similar projects in the future.

1.02 Research objectives and data collection

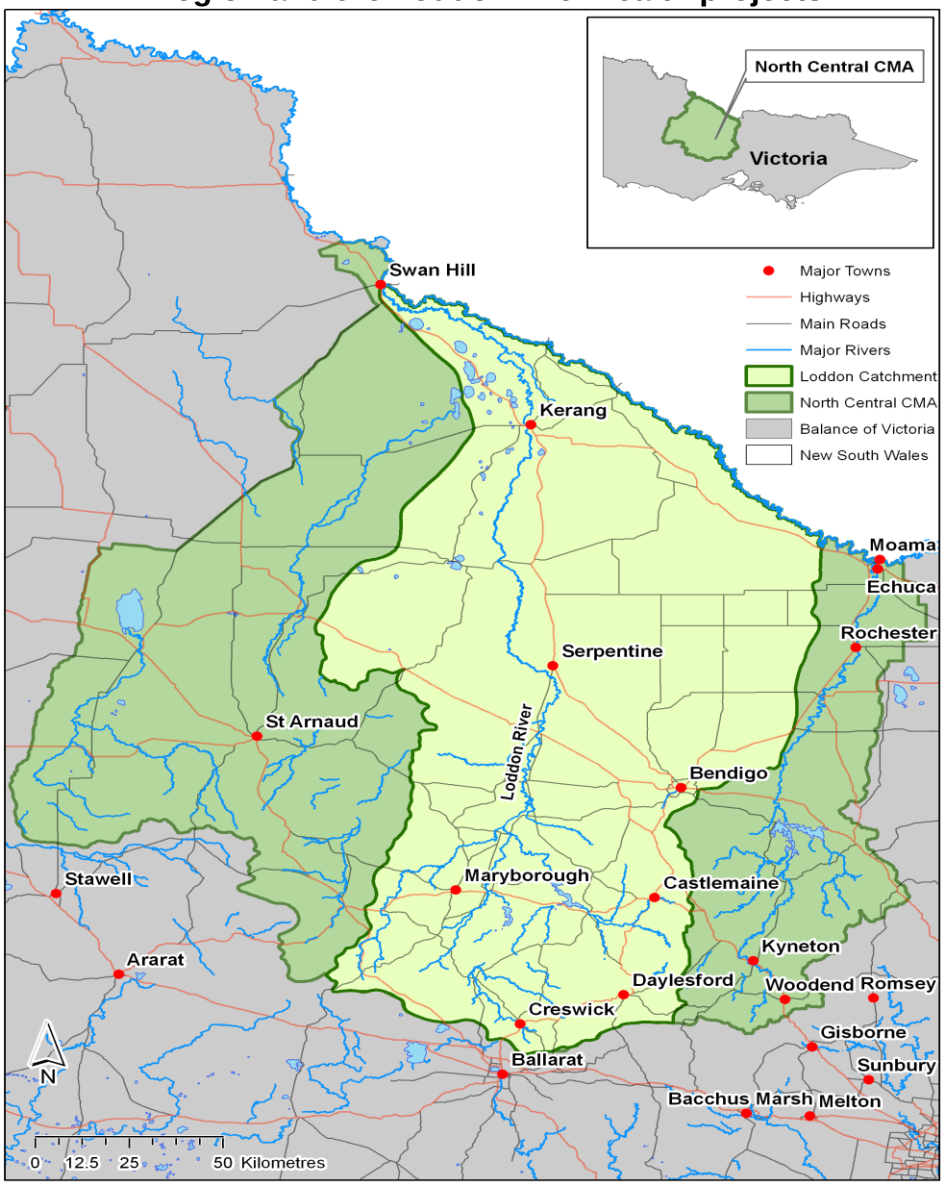
The research team had previously conducted similar studies of river frontage managers in the Goulburn Broken Catchment (Curtis *et al*. 2001; 2008a); the Ovens (Allan *et al*. 2005; Curtis *et al.* 2008b) and in Tasmania (Curtis *et al*. 2009).

Discussions between North Central CMA staff and the research team established three broad objectives for this evaluation:

1. Assess the effectiveness of the river health projects.
2. Identify the constraints to implementation of recommended practices expected to lead to improved river health outcomes by landholders who have not been engaged in the river health projects.
3. Identify factors influencing the extent of long-term commitment by landholders to river health project outcomes.

Data collection included a survey mailed to all rural landholders with river frontages along the Loddon where the river health project operated and semi-structured interviews with key informants, including landholders and agency staff.

Figure 1: Location of the North Central Catchment Management Authority region and the Loddon river health projects



Map supplied by SPAN CSU

2.0 METHODOLOGY

2.01 Introduction

The North Central CMA wanted to assess the effectiveness of engagement through the river health projects; identify constraints to implementation of recommended practices for river frontage management; and explore the factors leading to long-term commitment to river health project goals. In this section we provide a summary of the theory underpinning our approach to these tasks and of the way we approached each task.

The research team has investigated the management of river frontages and waterways in the Goulburn Broken and Ovens catchments in Victoria and more recently, in Tasmania. In each catchment we have used a combination of semi-structured interviews with purposively selected informants and a survey mailed to all/ randomly selected property owners with mostly closed-ended questions. This combination of approaches, that also includes workshops to explore preliminary findings, is time consuming but provides useful insights that managers say contribute to project and program improvements. With North Central CMA encouragement, we again adopted a mixed-methods approach to data collection.

As Pannell *et al*. (2006) explain, engaging landholders in practice change is complex and difficult, not the least because there is a potentially large set of factors influencing decisions. Even the concept of implementation is problematic. For example, when does a trial change in practice represent implementation? The task of evaluating natural resource management project impact is further complicated by the reality that there is often a range of interventions influencing landholder behaviour; different stakeholders may have contradictory views about project objectives; and there can be long lead times between interventions being made and outcomes achieved. Each of these evaluation challenges has been addressed for this project.

The framework proposed by Pannell *et al.* (2006) identifies four broad sets of factors influencing practice change by rural landholders: the nature of the practice or technology; the personal characteristics of the landholder and their immediate family; the wider social, economic and environmental context of the landholder; and the nature of any intervention or learning process. Experience has enabled the research team to identify a more limited set of factors likely to influence landholder management of river frontages. These topics include factors that can be readily influenced and others that are unlikely to be influenced by natural resource management (NRM) practitioners, but which can provide important guidance for those seeking to engage landholders in practice change. For example, landholder values are often linked to behaviour, but are relatively stable. It is difficult to change values, but appeals to values can be the key to effective engagement.

Improved understanding of adoption theory has enabled program managers to move beyond a narrow focus on improved resource condition as the outcome of natural resource management projects (Curtis *et al*. 1998). Using a program logic approach to evaluation (Rossi and Freeman 1985; Prosavac and Carey 1992), managers and independent evaluators have been able to identify intermediate objectives that are

expected to lead to improved resource condition. Over a number of years, the research team has worked with regional NRM practitioners to identify intermediate project objectives, including for the river health projects, that include landholder awareness of issues; knowledge of degradation processes and the management practices expected to address those threats; confidence in recommended practices; and implementation of those practices. For this study there was no attempt to assess improvements in resource condition.

It is now more widely understood that participation is not the same as commitment (Lobley and Potter, 2003) and there is evidence that government incentives may influence behaviour in the short-term, but landholders can often revert to their original behaviour once the project is finished (Dwyer *et al*. 1993). Program managers are therefore beginning to focus on the need to build long-term commitment to project or program outcomes. However, there has been little research examining long-term commitment. Mendham and Curtis (2010) identify ten years as a commonly applied threshold for distinguishing between short and long-term social phenomena. A ten-year threshold may be problematic for NRM in Victoria if half of all rural properties in the state will change hands in the next decade (Curtis and Mendham 2010). We also need to consider the reality that “dis-adoption” may be a sensible strategy for landholders when circumstances change, including as a result of climate change, changes in their land use or new research findings that undermine the validity of a recommended practice.

The research team drew on the expertise of our North Central CMA partners to identify a small number of property management practices expected to lead to improved river frontage and water quality outcomes. These recommended practices include fencing frontages to manage stock access to water ways; watering stock off-stream; establishing native vegetation along water ways; managing pest animals and plants; and returning woody debris to streams [Figure 2]. Respondents were asked to provide information about their management practices in the last year, the last five years and for the period of their management. The Loddon river health projects began in 2003, so the five-year period closely matches the period that these projects have been operating.

Some recommended practices apply to all landholders, others are more relevant to those that have stock or who crop or who have a specific pest plant or animal, such as willows. For this reason, analyses exploring the factors affecting implementation of recommended practices have distinguished between those that apply to all respondents or only to those with stock.

Figure 2: Survey statements employed to explore implementation of recommended practices to achieve improved river health outcomes

Practices undertaken during your management
Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)
Area of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) during your management of the property (number of trees)
Removed willows during your management of the property
Removed willows and replaced them with native vegetation during your management of the property
Placed large woody debris or snags in the water way as fish habitat
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property (number)
Practices undertaken in the last 5 years (since early 2005)
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) (number of trees)
Length of fencing erected near the river to manage stock access to the water way (metres)
Willows removed
Willows removed and replaced with native vegetation
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property (number)
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (yes or no, days per year) **
Practices undertaken this year (2009)
During 2009, did stock graze any part of your river frontage for more than a week at a time? (Circle YES or NO) ***
During 2009, did stock access drinking water from any part of your river frontage for more than a week at a time? ***
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (yes or no, days per year) **

*** Note these items have been split to cover both Yes/No and Number of days.*

****statements in the negative*

Task 1: Assess effectiveness of the river health projects

Effectiveness of the river health projects was assessed by answering two questions:

1. Did the project make a substantial contribution to increased?
- awareness of river health issues (through survey topic exploring concern about issues);
- knowledge and understanding of degradation processes and remedial actions;
- confidence in/acceptability of recommended practices; and
- implementation of recommended practices.

Without pre and post-intervention data, project impact was assessed by comparing participants with non-participants across the range of intermediate project outcomes. It is possible that the two cohorts are different in terms of their social and farming backgrounds and these differences explain variations on those outcomes. To address this issue, we compared the two cohorts across a range of background social and farming variables and employed regression modelling that included participation/non-participation as one of the independent variables expected to influence project outcomes.

2. Did the project employ appropriate engagement processes and tools and implement these in ways that were sound?

The research team was asked to assess which processes and tools had been most effective. Data were collected through key informant interviews and survey topics. The survey topics explored the views of respondents who had participated in river frontage programs about the support they received from Department of Primary Industries (DPI) and North Central CMA staff; and the views of non-project participants about why they had not participated in the river health projects.

Task 2: Identify constraints to implementation by those not in river health projects

All respondents were asked to rate the importance of a range of possible constraints to implementing recommended practices for river frontage management in their district. Only data from the non-participants is relevant to this task. Analyses using pairwise comparisons and regression modelling were used to explore the factors influencing implementation of recommended practices by non-participants. The key informant interviews also explored the factors affecting implementation by non-participants.

Task 3: Explore long-term commitment by landholders to river health project outcomes

The key informant interviews were the principal data source to answer questions about the nature of long-term commitment, the extent that river health projects had engendered long-term commitment to project objectives, and what lessons could be learned about improving commitment. One survey item explored the extent that project participants had implemented work as agreed in their management plan with the North Central CMA. This item was expected to provide some preliminary

indications of the extent that the river health projects had engendered long-term commitment to project outcomes.

2.02 The mail survey

In September 2009, the North Central CMA provided the research team with a list (188) of all Crown frontage licence land holders in the project area drawn from the DSE data base. There were 57 multiple listings and these were removed prior to posting 131 surveys in mid- September. In late October 2009, the North Central CMA provided the research team with another list with 119 additional landholders (with the cooperation of three local governments) with freehold Loddon River frontages in the project areas. This list had 27 multiple listings. A second mail to the remaining 92 additional landholders was made in early November. The 2009 river health projects survey therefore included all of the 223 landholders with either Crown frontage licences (public land) or private freehold frontage in the project areas.

The 2009 survey design and the mail out process employed a modified Dillman (1979) approach. The survey was presented as a distinctive booklet and was mailed with an appealing cover letter. Several reminder and thank you notices were posted to respondents and non-respondents. After three reminder notices, all non-respondents were sent a new mail package which was followed by one reminder notice. Given that the mail-out process spread across the Christmas holiday period, all non-respondents were send another survey package in January 2010.

The mail out process was closed with 108 useable surveys returned and a 57% response rate [Table 1]. Thirty three surveys were either; “returned to sender” (9), respondents said they owned multiple properties and received multiple surveys (4), returned blank (2), the listed owner was incapacitated by illness (1), had died (1), had sold (5), were travelling overseas (1), claimed not to own a river/ creek frontage (3), refused to complete the survey (3), owned by agencies (3), or claimed to have returned the survey but the survey was lost (1). These respondents were all removed prior to calculation of the survey response rate.

Drawing on this experience and input from the North Central CMA staff, the extensive literature on adoption studies in Australia (Vanclay 1992; Barr and Cary 1992; Barr and Cary 2000; Cary *et al.* 2002); and the Pannell *et al.* (2006) framework, the research team identified a number of survey topics and prepared specific items to explore each topic. The topics included in the survey were:

- values attached to the Loddon River;
- short and long-term plans for the property;
- assessment of issues affecting the district and property;
- attitudes about the roles of natural resource management stakeholders;
- knowledge of NRM topics;
- views about the importance of constraints to implementing recommended practices for river frontage management in the district;
- Participation/non-participation in natural resource management programs, including river health projects;
- river frontage program participant views about the support they received from Department of Primary Industries (DPI) and North Central CMA staff;

- management actions implemented in their river frontage over their management period, last five years and 2009;
- land use; and
- background information on the property (e.g. size, length of frontage) and landholder (place of residence, involvement in short courses and Landcare, occupation, income).

The 2009 survey achieved a response rate of 57% (N=108), close to the 60% target which the research team believes is an acceptable response rate for surveys mailed to rural landholders in south eastern Australia. There may be differences between respondents and non-respondents to mail surveys. However, our experience is that with a 60% response rate that the non- respondents would need to be very different to the respondents for findings to be significantly different.

This survey was a census of all rural landholders with Crown frontage licences or private freehold frontage, so the findings represent the population. Those wanting to extrapolate from the respondents to the population of 223 landholders with Crown frontage licences (e.g., for work implemented in Table 33), can do so by multiplying the total for the work implemented by the respondents to that survey item by the population of landholders (N=223), divided by the number of respondents to that survey item (n=).

Table 1: Survey response rate
Loddon river health projects landholder survey, 2009 (N=108)

Group	Initial mail out	Sound reasons for non-inclusion*	Surveys returned useable	Response rate %
All known frontage landholders within the river health project areas N=223	223	33	108	57%

*See explanation in text above

2.03 Data analysis (including treatment of missing data)

Survey data analysis included in this report consists of descriptive statistics, correlations, chi-square tests, Fishers exact tests, Z tests for proportions, Kruskal Wallis tests, linear modelling, stepwise multiple linear modelling and stepwise generalised linear modelling.

Descriptive statistics such as frequencies, means, medians and percentages were used to summarise the responses to particular survey questions. Correlations, linear models, chi-square tests, Fishers exact tests and Kruskal Wallis tests were used in pairwise analysis to see if the relationships or differences observed by the summary statistics were significant.

- Relationship: In the case of correlations, Spearman's Rho was used to identify if there were significant relationships between pairs of continuous variables. For

example property size and amount of work undertaken on the river frontage. In certain cases, the relationship was explored further using a linear model instead of Spearman's Rho, in an effort to quantify the structure of the linear trend.

- Difference: The Kruskal Wallis test was used to see if there were any significant differences on a continuous variable based on a grouping variable. For example, fencing along a water way based on whether or not the property was the survey recipient's principal place of residence.
- Dependence: The Chi-squared tests and Fisher's exact tests were used when comparing two categorical (or grouping) variables depending on the frequencies found in the cross-tabulated counts. These statistics test for dependence in the grouping. For example, farmer/ non-farmer compared to Landcare/ non-Landcare member.

The statistical tools identified above were used to explore relationships between variables (independent) thought to influence the implementation of the intermediate outcomes of the river health projects, including implementation of recommended practices (dependent variables). For example, tests were undertaken to explore the relationships between participation in Landcare and the planting of trees and shrubs; and participation in the river health projects and planting of trees and shrubs. If the values were significant, then those variables were considered as possible predictors of each recommended practice. However, it is possible that some independent variables are influencing each other. For example, it is possible that the project staff approached members of Landcare to participate in projects. If that was the case, then Landcare and project participation would probably be correlated. Analyses using regression modelling address this issue by removing correlated variables other than the variable that has the statistically strongest link to the dependent variable. So, using our example, one of Landcare and river health project participation would be removed.

While the research team employs regression modelling to assist in understanding causality, and in this research, explore the impact of the river health projects on the achievement of intermediate program outcomes, this approach also has its limitations. One of these is the assumption that where there are correlated variables, only the most strongly correlated variable should be retained. It is possible that this assumption eliminates important influences on behaviour that theory or practical experience suggests are important. Using the example above, it is possible that both the river health projects and Landcare might influence behaviour in different ways and therefore, could be expected to make their own contribution to achievement of program outcomes. Examination of the set of variables linked to a dependent variable through pairwise analyses enables researchers to consider a larger range of potential factors that might be influencing an outcome. For this reason, the research team presents the results of both the pairwise comparisons and regression modelling. As a rule, results from regression analysis should carry more weight. There are other statistical tools for exploring causal relationships, but most of these techniques rely on larger sample sizes (around 200 cases) than could be obtained for this study (N=108) and it is our view that this level of exploration was not required for this evaluation of river health impact.

Each of the possible predictors indicated by pairwise analyses was then scrutinised for a response rate above 80% to ensure modelling integrity. The final list of predictors was then used in a stepwise modelling process that used Akaike's information criterion as the step criteria. If the dependent variable was continuous (e.g., length of fencing) then a stepwise linear modelling process was used. If the dependent variable was dichotomous (sound or unsound knowledge), then a stepwise binomial generalised linear modelling process was used. The modelling process was used to identify the set of variables that collectively contributed most to the achievement of each intermediate outcome. The amount of variance explained by the model (R^2 value) provides a test of the extent that key independent variables have been included in the study. A model that explains 30% of variance is considered as useful in the social sciences where there are typically a large number of potentially influential variables.

All data analysis was performed in the package S-Plus and the Z tests on the following website:

http://www.dimensionresearch.com/resources/calculators/ztest.html

In some instances survey respondents do not complete whole topics or individual items. This phenomenon is called “missing data”. These gaps in a data set can occur for a large number of reasons, including that respondents consciously ignored topics or items they felt were less relevant to them, they had difficulty understanding, felt were intrusive or they had difficulty providing accurate information in a short period of time. Respondents can also unconsciously skip an item or even turn a page without noticing that several pages are stuck together. The extent of missing data is readily apparent if researchers provide the n values for each survey item in tables or figures.

Missing data can compromise the ability of researchers to apply some statistical analyses, particularly those exploring causality that rely on model development. Missing data can also lead to errors in the calculations of the proportion of respondents undertaking an activity, in the mean or median scores for those respondents and in any extrapolations from the sample to the larger population. This issue typically arises when respondents ignore items because they think that topic doesn’t apply to them. That is, they don’t respond when really they should record a nil score or zero.

Missing data can be treated in a number of ways. The first approach is to do nothing because it is assumed that the missing data represents non-responses rather than a nil score. We adopted this approach for survey topics seeking respondent’s views (e.g., for attitudinal statements). In this survey, those topics typically employed six-point likert-type response options (e.g., from strongly agree to strongly disagree). A second approach is to assume that the non-response is in reality, a nil score and allocate zero for that item. We adopted this approach for some survey topics and items where we had asked respondents to indicate a specific amount or value. If at least one item in a topic had been completed by the respondent, then we assumed that a nil response (zero) was a more accurate assessment than a non-response. Where there was no response to any item in topic list, we allocated a non-response

to each item. A third approach is to estimate the value of the missing data. Estimation can be accomplished by simply applying the mean for all respondents on that topic or using statistical techniques that predict the value of the missing score based on the scores of "like" respondents. We have not applied this approach to the task of addressing missing data in this research.

2.03.1 Interviews with landholders and program managers

A modified semi-structured open-ended interview schedule (SOEI) (Patton 1990) was used to survey landholders and key stakeholders. This technique involves interviewers asking informants a similar set of questions, worded in the same or similar wording, and asked in the same or similar sequence. Unlike closed questions where informants choose from amongst a predetermined set of responses, qualitative interviewing enables informants to seek clarification on the meaning of questions if needed and to answer in their own words. This form of interviewing also allows the interviewer to explore unexpected or previously unidentified issues should they arise. Using SOEI's tends to minimise the variation in the questions asked by interviewers, which reduces interviewer bias and elicits more standardised and comparable interview data. In addition, as the interview is highly focused, interviewees' time is used efficiently.

The interview schedule covered the following broad topics:

1. how landholders value, use and manage their riparian areas;
2. landholders' long term plans and/or visions for their riparian areas;
3. landholders' awareness of the river health projects;
4. reasons why landholders choose to be involved or to not be involved; in river health projects;
5. river health project strengths and areas needing improvement;
6. factors impeding or enabling good riparian and land management; and
7. The impact of river health projects on improved resource management.

A total of 30 people were interviewed. Informants were identified through discussion with project and CMA staff to achieve a mix of project participants, non-participants and NRMC members. These informants included 15 landholders who were project participants, five landholders who had not participated in the river health projects, and ten key stakeholders (e.g. agency staff, NRMC members).

All interviews were taped and subsequently transcribed. Content analysis techniques were used to analyse the responses. All categories were derived using inductive analysis of the patterns that emerged from the manifest and latent content in the interview data (Berg 1989). Respondents' comments were manually grouped into themes corresponding to the interview questions. Another coding frame was used to sub-divide these data into more specific categories according to the discussions around the topic areas.

3.0 FINDINGS

3.01 Task 1: Assessing the effectiveness of river health projects

3.01.1 Extent of participation in river frontage management programs

The survey included two items exploring landholder participation in natural resource management programs focussed on river health. The first item asked whether federal or state government programs, The North Central CMA or DPI had supported work on the respondent's river frontage in the past five years (from the start of 2005). We refer to this cohort as being involved in "All programs". The second item focussed on Loddon river health projects implemented by the CMA and DPI since early 2005.

Forty-six per cent of respondents (N=105) said they had received support through "All programs". That is, they said that federal or state government programs, the CMA or DPI had supported work on their frontage in the past five years. Thirty-six per cent of all respondents said they were river health project participants. River health participants comprised most (69%, n=48) of those who said they had received support from "All programs" in the past five years.

North Central CMA staff advised that most of the work implemented in riparian areas in the Loddon in the past five years that has been supported by government programs has been implemented through the river health projects. Notwithstanding that advice, the research team has used the landholder responses to identify river health project participants. Given that most of those who said they had received support through "All programs" were river health participants we have also reported links between participation in "All programs" and the achievement of intermediate program outcomes.

3.01.2 Background property and personal data for respondents

The focus of this report is the comparison of river health project participants and non-participants. To set the context for that comparison, it is important to provide a very brief overview of the background property and personal characteristics of all respondents. The data referred to is provided in Table 2 on the following page and is also provided in Section 4, which covers most survey topics.

These data might surprise some readers, but are generally consistent with the findings from the research team's studies of river frontage landholders in Victoria and Tasmania. Most properties are relatively small (median 125 ha), almost all have river frontages (median of 1,000 m with over half (63%) managing both sides of the river, over two-thirds (74%) have a licensed Crown river frontage, just over a third irrigated last year (39%), with a variety of on-property enterprises, including livestock, some cropping, dairy, viticulture and horticulture.

Almost all respondents were men (90%) with a median age of 55 years (and 63% aged between 46 and 65 years with similar proportions older and younger). A small majority (53%) of respondents identified themselves as having a non-farmer occupation. Only 37% said the property had been previously owned operated by a family member and a substantial minority (45%) indicated that their principal place of residence was off-the property. Most of those that lived in the district where their property was located had done so for many years (median of 30 years). Most respondents (58%) don't have a family member interested in taking on the property in the future. Thirty-six per cent of respondents said they were Landcare members, and 34% said they had completed short course related to property management in the past five years. Most (64%) respondents said their property did not return a net profit (income from your property exceeded all paid expenses before tax) last financial year (2008/2009). The median profit for those that were profitable was $15,000. At the same time, most respondents said they or their partner received a net off-property income over the same period, with the median income $35,000.

Table 2: Property and social information for all respondents Loddon river health projects 2009 landholder survey (N=108)

Property data	**n**	**% or median**
Property size	105	125 ha
Distance the Loddon River runs along/through the property (one side)	99	1,000 m
Total length of Loddon River frontage, including both sides	46	2,500 m
Have a riparian right for some part of the river frontage	86	56%
Have a Loddon River Crown Water Frontage	99	74%
Time property owned or managed by respondent	105	15 yr
Property owned or operated by others in their family	105	37%
Time property has been in their family	57	60 yr
Property is the principal place of residence	106	55%
Time respondent has lived in the local district	93	30yr
Social data	**n**	**% or median**
Age	100	55 yr
Respondents who are males	104	90%
Farmer occupation	103	47%
Grazing as the main farming enterprise	97	33%
Irrigated some part of the property last year (2009)	104	39%
Hours per week worked on farming/property related activities over the past 12 months	99	25 hr
Days that landholders worked (paid) off-property in the past 12 months	95	0 days
Member of a local Landcare group	103	36%
Prepared a property management or whole farm plan that addressed the existing situation and included future management and development plans	73	56%
Completed or updated the whole farm plan in the last five years	77	34%
Completed a short course relevant to property management past 5 years	103	34%
Respondent or their partner received a net off-property income (after expenses and before tax) last financial year (2008/2009)	96	68%
Total off-property income (before tax) for respondent or partner last financial year (2008/2009)	59	$35,000
A net on-property profit (income exceeded all paid expenses before tax) last financial year (2008/2009)	99	36%
Total on-property profit (before tax) last financial year (2008/2009)	33	$15,000
Family members interested in taking on the property in the future	96	42%
Agreed succession plan for the transfer of the property to the next generation	43	69%

3.01.3 Participants and non-participants in river health projects

Without pre and post-intervention data, river health project impact was assessed by comparing participants with non-participants across the range of intermediate project outcomes. It is possible that the two cohorts are different in terms of their social and farming backgrounds and these differences explain variations on project outcomes. To address this issue, we compared the two cohorts and employed multi-variate statistical analyses that include participation/non-participation as one of the independent variables expected to influencing project outcomes.

Comparisons of participants and non-participants also has the potential to provide useful information for those seeking to engage the cohort of landholders not involved in river frontage or river health programs. In this section the comparison of participants and non-participants focuses on some key social and farming variables, including background property, land use and personal data; views about the importance of a range of on and off-property issues; landholder values; attitudes about NRM roles and responsibilities; and the landholder's long-term plans. This section excludes those items exploring the achievement of intermediate river health project outcomes, including awareness of river health issues; knowledge and understanding of degradation processes and remedial actions; confidence in recommended practices; and implementation of recommended practices.

Information presented in Tables 3 and 4 suggests that the river health project participants and non-participants are relatively similar. For example, there was not a significant difference on property size or the proportions that were resident owners as opposed to absentee owners [Table 3]. The enterprise mix of participants and non-participants were similar as were the proportions of participants and non-participants who identified themselves as farmers by occupation, or reported an on-property net profit [Table 4]. This is a somewhat surprising finding given that a recent similar study in Tasmania found that participants and non-participants were very different (Curtis *et al*. 2009).

One question that arises relates to the selection of participants. The operational area of the river health projects contains a diverse group of landholders and it would have been possible for the program to focus on some landholder cohorts. For example, almost half the respondents were farmers yet the river health projects embraced farmers and non-farmers. Information from Section 3.01.8 presented in Table 13 suggests that many non-participants were simply not contacted and/or unaware of the projects. This finding suggests project staff purposefully selected a cross section of landholders. Interviews with agency staff indicated that participants were not intentionally stratified. However, project staff generally preferred to work with those who were more likely to be receptive to the values, principles and practices underpinning the river health projects [as indicated by this quote].

Our approach has always been to work with people who come to us ... when they are ready ... the long term management is up to them, and if you don't have their full support when they get involved, our investment is worthless.

It is also clear that project staff had a strategy of engaging potential project "champions" who were respected by their peers and could provide advice about ways of approaching other, less committed landholders. Landholders interviewed were evenly split between those who had approached the CMA to inquire about the river health projects and those that had been approached by project staff.

Participants and non-participants also provided similar assessments of Loddon River health in their district [Table 8]. The river health projects aimed to improve landholder understanding of river health issues and knowledge topics have been included in the later section exploring achievement of intermediate program outcomes.

Despite the overall degree of similarity, information in Tables 3 & 4 indicates there are some significant differences between participants and non-participants. For example, participants managed longer stretches of river frontage [Table 3] and were less likely to have been involved in Landcare, completed a short course or updated a property management plan [Table 4]. Participants and non-participants also differed on five of the 18 items exploring the values landholders attach to their river frontage and the single item exploring landholder stewardship values [Table 5]. Interestingly, each of the items where there was a significant difference relates to the value of river frontages for their ecological functions as opposed to more utilitarian values of frontages. In each case, participants gave a higher rating to the value statement. The most striking difference between participants and non-participants was for respondent attitudes about the roles and responsibilities of NRM actors (different on four of six items) [Table 8]. For each item where there was a difference, participants were significantly more likely to agree with the attitudinal statements. If there is a common thread across these statements it is that each explores the extent respondents are concerned about limits being placed on their autonomy or government taking a stronger role in NRM. That is, participants were less concerned about losing some of their autonomy as a result of government taking a stronger role in NRM. Participants also gave a higher rating for each of the five property/district issues where there was a significant difference between the two cohorts [Table 7]. With the exception of the item exploring the impacts on property viability of changing rainfall patterns, these issues focussed on the environmental issues or outcomes. Consistent with the trends identified so far, participants gave a higher rating to these environmental issues.

There were significant differences between the participants and non-participants for two of the 13 items exploring long-term intentions for the property: subdividing and selling part of the property; and selling all or part of the irrigation entitlement [Table 6]. These differences held for both the five year and 20 year time frames.

3.01.4 River health project participants and non-participants: background property and social data

Table 3: Comparison between participants and non-participants: property data
Loddon river health projects 2009 landholder survey (N=108)

Survey items	n*	overall median***	participant median	non-participant median	p value
The area of the property	97	130 ha	181 ha	126.5 ha	0.3195
Estimated distance that the Loddon River runs along/through the property (one side)	91	1,000 m	2,300 m	800 m	0.0263
Estimated total length of Loddon River frontage, including both sides (if applicable).	42	400 m	400 m	400 m	0.7471
The % that have a riparian right for some part of the river frontage	79	44%	70%	47%	0.0623
The % that have a Loddon River Crown Water Frontage	91	69%	76%	76%	1.0000
The number of years the property has been owned or managed (at least some part)	97	15 yr	16 yr	14.5 yr	0.7807
The % of properties that have been owned or operated by others in their family	97	37%	43%	35%	0.5182
The number of years the property has been in their family	53	60 yr	61 yr	55 yr	0.4461
The % of properties that are the principal place of residence	98	53%	66%	48%	0.0953
The number of years the landholder has lived in the local district	85	29 yr	42 yr	26.5 yr	0.3682

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)
n is smaller than all respondents' data because some respondents did not answer the river health project participation question*
*overall median*** only includes the responses from participants and non-participants answers to the River health project participation question.*

Table 4: Comparison between participants and non-participants: social data
Loddon river health projects 2009 landholder survey (N=108)

Survey items	n	overall % or median	participant % or median	non-participant % or median	p value
The % of landholders that are a member of a local Landcare group	97	34%	62%	21%	0.0001
The % of landholders that completed or updated the whole farm plan in the last five years	73	24%	60%	19%	0.0006
The % of landholders that completed a short course relevant to property management in the past 5 years	98	33%	50%	25%	0.0238
The % of landholders that have prepared a property management or whole farm plan that involved a map and/or other documents that addressed the existing property situation and included future management and development plans	68	57%	64%	52.5%	0.0671
The % of landholders or their partners that received a net off-property income (after expenses and before tax) last financial year (2008/2009)?	91	61%	79%	60%	0.0665
If received a net income, the approximate figure for the total off-property income (before tax) for the of landholders or their partners last financial year (2008/2009*).*	56	$35,000	$40,000	$35,000	0.7023
The % of properties that returned a net profit (income from the property exceeded all paid expenses before tax) last financial year (2008/2009)	94	34%	41%	33%	0.5061
If returned a net profit, the approximate figure for the profit (before tax) from the property last financial year (2008/2009)	32	$15,000	$15,000	$25,000	0.3733
The % of landholders that have family members interested in taking on the property in the future	90	37%	31%	47%	0.1844
If family members are interested taking over management, the % of landholders that agreed to a succession plan for managing the transfer of the property to the next generation	40	57.5%	55%	59%	0.5266
The average number of hours per week that landholders worked on farming/property related activities over the past 12 months (aver hr/wk)	94	25 hr	37.5 hr	23.5 hr	0.3729
The % of landholders that were farmers grazing livestock on their property	92	74%	81%	70%	0.4017
The landholders age	94	55 yr	55 yr	56 yr	0.6116
The % of landholders that irrigated some part of the property last year (2009)	98	40%	44%	39%	0.6698
Landholders gender	98	91%	91%	91%	1.0000
The % of landholders that were farmers	97	47.5%	47%	48%	1.0000

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)

Table 5: Comparison between participants and non-participants: values
Loddon river health projects 2009 landholder survey (N=108)

Survey items	n	overall mean	participant mean	non-participant mean	p value
Reduced production in the short-term is justified where there are long-term benefits to the environment	92	3.73	4.09	3.51	0.0015
Vegetation on the frontage holds the banks and stops erosion	94	3.82	4.19	3.59	0.0097
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	79	3.19	3.64	2.87	0.0120
Provides a source of nutrients for in-stream plants and animals	88	3.64	3.91	3.45	0.0368
Place where native animals live on land	93	3.95	4.17	3.81	0.0404
In-stream vegetation traps and stabilises sand/gravel	85	3.32	3.64	3.12	0.0433
Is a habitat corridor (allowing wildlife to move between areas) ***	93	3.83	4.03	3.71	0.0564
Provides a place for recreation for me, my family and friends	92	3.67	3.92	3.52	0.0669
Is an attractive area of the property	93	4.44	4.58	4.35	0.0677
Is a peaceful place to be	94	4.29	4.44	4.19	0.0704
Provides habitat for native birds	93	4.38	4.44	4.33	0.1882
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	91	3.60	3.74	3.52	0.2588
Provides important shade and shelter for stock	69	3.29	3.46	3.20	0.3939
Provides additional land for grazing stock, particularly in summer	59	2.76	2.63	2.82	0.5489
Provides access to water for stock	69	3.35	3.17	3.43	0.5514
A place for me, my family and friends to fish	79	2.95	2.86	3.00	0.5538
I rely on the river for irrigation water	48	3.63	3.79	3.56	0.7216
Provides timber for fence posts and fire wood	51	2.14	2.14	2.14	0.8804
Adds to the market value of the property	91	4.01	4.03	4.00	0.9966

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)
**** note: this item is so close to .05 that it is probably significant*

Table 6: Comparison between participants and non-participants: long term plans
Loddon river health projects 2009 landholder survey (N=108)

Survey items	n	overall mean	participant mean	non-participant mean	p value
The property will be subdivided and part of the property sold	55	1.76	2.25	1.49	0.0151
I will sell all or part of my irrigation water entitlement	55	2.20	2.83	1.89	0.0169
The enterprise mix will be changed to reduce my farm workload	54	2.56	2.28	2.69	0.1636
The property will be sold	61	2.26	2.57	2.10	0.1794
I plan to introduce/ expand irrigation on my property	63	2.25	2.00	2.37	0.2588
Additional land will be purchased, leased or share farmed	64	2.39	2.18	2.50	0.3960
Ownership of the property will stay within the family	72	3.71	3.62	3.75	0.4205
All or most of the property will be leased or share farmed	55	1.85	1.67	1.95	0.4625
I will reduce the extent of my off-property work	39	2.72	2.87	2.62	0.5114
I will live on the property for as long as possible	56	3.89	4.05	3.81	0.6639
The enterprise mix will be changed to more intensive enterprises	55	2.33	2.28	2.35	0.7948
All or some part of the property will be placed under a conservation covenant	61	2.26	2.25	2.27	0.8289
I will seek additional off-property work	54	2.61	2.55	2.65	0.9113

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)

Table 7: Comparison between participants and non-participants: issues
Loddon river health projects 2009 landholder survey (N=108)

Survey items	n	overall mean	participant mean	non-participant mean	p value
Getting the balance between water for the environment, agriculture, town water supply and recreation	93	4.37	4.74	4.15	0.0003
Impact of changing rainfall patterns on property viability	91	3.93	4.25	3.76	0.0111
Growth of in-stream vegetation affecting the Loddon River	92	3.74	4.12	3.52	0.0138
The effects of increased ground and surface water extraction	89	3.91	4.26	3.69	0.0319
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	90	3.90	4.18	3.74	0.0404
Rising cost of farming inputs undermining financial viability	80	4.06	4.21	3.98	0.0739
Having the right to use surface or ground water for irrigation	82	4.05	4.19	3.98	0.1390
State/ local government planning rules limiting your ability to subdivide	74	2.74	3.04	2.58	0.2304
Increasing land prices constraining opportunities for farmers to expand their properties	88	3.13	3.27	3.04	0.2866
Declining soil health (e.g. declining fertility or structure)	86	2.98	3.20	2.86	0.2932
The impact of recent and future clearing of native bush and grasslands	89	3.53	3.71	3.42	0.3209
Salinity undermining long-term productive capacity	76	3.08	2.96	3.14	0.5594
The cost of managing weeds and pest animals affecting profitability	89	3.37	3.50	3.30	0.5827
The right to increase on-property water storage	84	3.13	3.06	3.17	0.7883
Availability of labour for important on-property work	77	2.91	2.94	2.89	0.8817
Uncertain/low returns limiting capacity to invest in property	78	3.74	3.71	3.76	0.9565

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)
Note all shaded survey items are district/catchment level issues, non-shaded items are property level issues

Table 8: Comparison between participants and non-participants: attitudes
Loddon river health projects 2009 landholder survey (N=108)

Survey items	n	overall mean	participant mean	non-participant mean	p value
Governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	94	3.40	3.91	3.10	0.0003
Reduced production in the short-term is justified where there are long-term benefits to the environment	92	3.73	4.09	3.51	0.0015
Landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	97	4.07	4.28	3.95	0.0194
Landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	94	3.31	3.61	3.12	0.0210
New owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work	92	3.91	4.09	3.81	0.1012
In most cases, the public should have the right to access publicly owned river frontages that are managed by private landholders	96	2.79	2.97	2.68	0.2377
The condition of the Loddon River in this district has improved in the last 10 years ***	94	2.34	2.35	2.33	0.6890
The Loddon River is in good condition in this district ***	97	2.40	2.42	2.39	0.8739

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)
**** These statements were included in a topic exploring views about the management of waterways and adjoining land*

3.01.5 Does participation explain differences in river health project outcomes?

An introduction

Drawing on our understanding of the river health projects and of similar programs, the research team (with advice from the North Central CMA staff) identified a range of intermediate program outcomes expected to lead to improved river health. These include awareness of issues; knowledge of degradation processes and management practices; confidence in recommended practices; and implementation of recommended practices. The survey included items assessing each of these intermediate outcomes.

Without pre and post-intervention data, project impact was assessed using a three-step process:

1. comparing participants and non-participants to test for significant differences on each intermediate project outcome;
2. using additional pair-wise comparisons to test for significant relationships between independent variables, including project participation, and river health project intermediate outcomes; and
3. for those intermediate outcomes where there was a significant link with project participation, using regression modelling to take into account the extent variables identified in step two are correlated (only retain the variable most strongly linked to the outcome); and then employing an iterative process to develop a model that identifies a set of variables that provides the best explanation of variation in the dependent variable.

3.01.6 A comparison between participants and non-participants

1. Assessment of river health issues

The survey included 23 items exploring respondent's opinions about the importance of a range of issues at the property and district scale. Seven of those items have been used as indirect measures of landholder awareness of NRM issues, one of the sets of intermediate project outcomes [Table 9]. The remaining 16 items have been used to explore differences in the backgrounds of participants and non-participants and the influence of concern about NRM issues on project outcomes [Table 7].

Respondents were asked to rate the importance of each issue and their level of agreement with each statement exploring their views using a six-point scale. These response options have been collapsed into four categories – "unimportant" (combining not important and minimal importance), "some" (of some importance), "important" (combining very important and important), plus "not applicable" (NA). Table 7 & 9 presents the mean scores which exclude the NA responses so that the maximum score is five. Table 9 also includes information for the proportion of respondents rating the issue as being important/very important. Additional tables on property and district issues have been included in Section 4 for respondents' summary data [Tables 17 & 21].

2. Knowledge of topics related to river health

Self-assessment is a widely accepted approach to gathering information about people's knowledge of NRM (Shindler and Wright 2000; Curtis *et al*. 2001). In this study, respondents were asked to rate their knowledge for 11 items relating to river health [Table 10]. Respondents were offered a six-point scale, ranging from "not applicable", "no knowledge", "very little knowledge", "some knowledge", "sound knowledge" (sufficient to act) and "very sound knowledge" (could give a detailed explanation). In this Table [10], we have only included the mean scores which excluded the NA responses so that the maximum score is five. An additional table/figure has been included in Section 4 for respondents' summary data. [Table 28].

3. Confidence in recommended practices

Eight survey items explored confidence in recommended practices [Table 11], including the fencing of river frontages to manage stock access to the water way and remnant vegetation, willow removal, intensive grazing of frontages for short periods, retaining dead/down timber as habitat in frontages and watering stock off-stream. Respondents were offered a six-point scale, ranging from "not applicable", "strongly disagree", "disagree", "not sure", "agree and "strongly agree". In this report, we have only included the mean scores which excluded the NA responses so that the maximum score is five. An additional table has been included in Section 4 for respondents' summary data [Table 31].

4. Implementation of recommended practices

This survey topic included 16 items (expanded to 18 as explained below) exploring the implementation of recommended practices. Seven survey items explored implementation during the period of management, six during the last five years and three during 2009 [Table 12]. For some survey items, respondents were asked to provide an estimate of the amount of work undertaken. Where that was the case, comparisons have been made between the median amount of work undertaken by participants and non-participants. For other items, respondents were simply asked to say whether they had undertaken this activity or whether the activity was not appropriate for their situation. For the two items exploring work undertaken to poison or physically remove woody weeds, respondents were also asked to indicate the number of days they had worked on the activity. Table 12 therefore includes two additional items created by comparing the median number of days worked on this activity by participants and non-participants.

Those interpreting Table 12 need to note that some practices were only relevant to those with stock enterprises and that two items (exploring grazing of frontages and stock accessing water directly from the river frontage past year) were expressed in the negative. That is, a 'No' response indicates that the recommended practice is being implemented. Even after removing those who were identified as croppers, the number of respondents to this question was less than for other items. It is possible that this reflected the position of the items at the bottom of the page, or that some landholders don't agree that these are desirable practices. A 'Not applicable'

response option was not offered for these items. Data for all respondents for the 18 items is presented in Section 4 for respondents' summary data [Table 32].

Key findings

Compared to non-participants, river health project participants gave a significantly higher rating to three of the five items exploring landholder awareness of river health issues [Table 9]. Given the earlier finding that participants had stronger environmental values, this finding may simply reflect the inter-relationship between values and concern about issues. Nevertheless, there is some evidence of program impact on awareness.

Data presented in Table 10 appears to provide strong affirmation of the positive impact of the river health projects on landholder knowledge in that participants reported significantly higher knowledge than non-participants for 10 of the 11 topics. Given that that participants are significantly less likely to be involved in Landcare, short courses or updating property plans [Table 10], and therefore less likely than non-participants to be exposed to these important influences on landholder knowledge (Curtis and Mendham 2010), it seems the river health projects have played a critical role in influencing the knowledge of participants.

Participants provided a more positive rating than non-participants for all survey items exploring confidence in recommended practices, with significantly more positive ratings for five of the eight items [Table 11]. Given that participants and non-participants are very similar, particularly in terms of their occupational identify (proportions identifying as farmers), the survey data suggests the river health projects have had a positive impact on participants confidence in CRP related to watering stock off-stream, limiting stock access to native vegetation along waterways, retaining dead/down timber, and fencing river frontages to manage stock access. Participants were not more confident in willow removal as a way of improving the condition of native vegetation or in the relative merit of intensive grazing frontages for short periods compared to set stocking those areas.

The median amount of work implemented by participants was significantly higher than non-participants for four CRP undertaken during the period the property had been under the respondent's management (i.e. for four of seven items) [Table 12]. These items included the installation of off-stream watering points, fencing to manage stock access to the waterway, fencing land to encourage natural regeneration of native vegetation, and establishing plants along the frontage.

It is possible that some of the work undertaken on properties pre-dated the river health projects. The survey included three items that asked for quantitative measures of work undertaken for both the period of management and the last five years: length of fencing erected to manage stock access to the water way; number of trees/shrubs planted along the river frontage; and number of off-river /wetland stock watering points established. By selecting only those respondents who had owned their property for five years or more, the research team was able to compare work

undertaken in the past five years with work undertaken during the period of management. Of the 41 respondents who had off-stream watering points, 59% had implemented 100% of that work in the past five years. Of the 51 respondents who had erected fencing to manage stock access to the water way, 47% had implemented 100% of that work in the past five years. Of the 23 respondents who had planted trees/shrubs along the river frontage, 39% had implemented 100% and 48% had implemented more than 50% of that work in the past five years. These data suggest that for these practices that at least half of all work has been implemented in the period since the river health projects commenced.

It is also important to acknowledge that in an era of low on-property profitability [Table 3] that many landholders do not have sufficient funds to implement work with relatively small private benefit without substantial support from government or the private sector. However, two of these practices (those related to fencing) can be relatively inexpensive for landholders but they require substantial effort and usually, their long-term commitment to the underlying river health project goals. Information presented earlier suggests that participants are likely to be more committed to those goals.

There was no significant difference between the proportions of participants and non-participants who said they had been involved in willow removal (two items) or placing snags in waterways as fish habit during their period of property management or the past five years (4 of the 18 items) [Table 12]. As indicated in Table 12, only 13% of respondents had removed willows and even fewer (3%) had removed willows and replaced them with native vegetation. More than half of all respondents to these items said that willow removal was not applicable to their situation. It is possible that willows did not exist on many of these properties, including as a result of work by landholders and government to remove them in the past. It is also possible that some landholders don't think willow removal or removal and replacement with native vegetation is desirable. While willow removal can be contentious in some areas, this doesn't appear to be the situation in the Loddon where most participants and non-participants agree (62% of all respondents, Table 31) that willow removal is an important part of work to improve the condition of native vegetation on river frontage. The interviews with landholders and project staff confirmed that willows are not an issue for most landholders and the evidence from agency staff was that willow infestations were only an issue in some areas.

The median amount of work implemented by participants was significantly higher than non-participants for four CRP undertaken during the past five years (i.e for four of seven items) [Table 12]. These items included the installation of off-stream watering points, fencing to manage stock access to the waterway, establishing plants along the frontage and time spent poisoning or physically removing woody weeds. Information in Table 12 suggests that with river health project support, that participants have undertaken substantial rather than symbolic amounts of work related to the four CRP. Again, there was no significant difference between the proportions of participants and non-participants who said they had been involved in willow removal (two items) or poisoning or physically removing woody weeds [Table 12].

There was a significant difference between participants and non-participants in both the proportion who said they had spent time and the amount of time spent poisoning or physically removing woody weeds in 2009 (i.e. two of four items) [Table 12]. There was not a significant difference in the proportion of respondents who said they had limited stock grazing or stock access to drinking water from any part of the frontage to no more than a week at a time in 2009 [Table 12].

In summary, there is substantial evidence that river health project participants are implementing recommended practices at significantly higher levels than non-participants, that the scale of implementation is beyond what might be described as symbolic, and that at least half of the work implemented has occurred since the projects commenced. Indeed, participants were more likely to implement and/or accomplished more work for 10 of the 18 items in Table 12.

These data suggest that the river health projects have had a significant impact on the achievement of intermediate outcomes that are key project objectives and which can reasonably be expected to lead to improved resource condition outcomes. The impact of the projects on practice change is more impressive if the four items that relate to willow removal are discounted because willows are not a problem for most landholders in the Loddon.

Despite the apparent evidence of project impact from the pairwise comparisons (participants and non-participants), it is important to explore the extent that other independent variables might be contributing to these intermediate outcomes. This analysis was undertaken using pairwise comparisons and regression modelling that included a range of other independent variables. The findings of these analyses are reported in the next section.

Photo: R. Sample

Table 9: Comparison of participants and non-participants: assessment of issues (awareness of issues)
Loddon river health projects landholder survey 2009, N=108

Statement	n	% rating the statement important/ very important			means			p value
		overall	participant	non-participant	overall	participant	non-participant	
Declining water quality in rivers/ streams affecting river health	89	47%	70%	43%	4.17	4.45	4.00	0.0246
Soil erosion from farmland affecting water quality and sediment loads entering the Loddon River	91	24%	41%	18%	3.62	3.94	3.42	0.0349
Suitable conditions (adequate flows and refuge pools) to support native animals such as platypus, Murray Cod, Yellow Belly, frogs	91	48%	65%	46%	4.31	4.56	4.16	0.0405
Nutrient and chemical run-off affecting water quality in rivers/ streams/ wetlands	90	35%	47%	34%	3.92	4.15	3.79	0.1332
Loss of native vegetation along water courses	89	31%	41%	31%	3.73	3.88	3.64	0.3066
Non native plants such as willows growing along the river	86	29%	38%	31%	3.50	3.63	3.43	0.5430
Salinity threatening water quality in rivers/ streams/ wetlands	88	41%	53%	43%	3.95	3.94	3.96	0.7466

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)

Table 10: Comparison of participants and non-participants: knowledge and understanding of degradation processes and remedial actions Loddon river health projects 2009 landholder survey, N=108

Knowledge topics	n	overall mean	participant mean	non-participant mean	p value
How to access information about government support for landholders to better manage Crown Land river frontages	90	2.54	3.24	2.13	0.0000
The role of river frontages as corridors supporting the movement of animals from one area to another	89	3.30	3.83	2.94	0.0000
The contribution of floodplain wetlands towards the health of the Loddon River	92	3.11	3.66	2.77	0.0004
The role of large logs and river side vegetation in supporting native fish species	92	3.35	3.78	3.07	0.0008
he ability of perennial vegetation and standing stubble to improve the quality of runoff water	91	3.40	3.81	3.13	0.0020
The role of environmental flows in the Loddon River to maintain a healthy river system	91	3.40	3.77	3.16	0.0052
How to prepare a farm or property plan that allocates land use according to different land classes	86	3.02	3.53	2.72	0.0073
The effects of unrestricted stock access to water ways	84	3.57	3.89	3.35	0.0077
The production benefits of retaining native vegetation on farms	88	3.50	3.86	3.26	0.0083
Predicted impact of climate change on river flows in the Loddon catchment	90	2.82	3.14	2.62	0.0106
How to manage ground cover on paddocks used for grazing to minimise soil erosion and resulting sedimentation of water ways	81	3.49	3.74	3.32	0.0614

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)

Table 11: Comparison of participants and non-participants: confidence in/acceptability of recommended practices
Loddon river health projects 2009 landholder survey, N=108

Your views about aspects of management of waterways and adjoining land in your district	n	overall mean	participant mean	non-participant mean	p value
The time and expense involved in watering stock off-stream is justified by improvement in river water quality	92	3.72	4.20	3.42	0.0001
Areas of native vegetation along waterways with limited stock access are able to trap nutrients before they enter waterways	93	3.89	4.31	3.64	0.0002
Dead trees or timber on the ground in river frontages are important habitat for native birds and animals	97	3.99	4.31	3.80	0.0009
Domestic stock have had substantial impact on the stability of the river bank	94	3.40	3.83	3.15	0.0052
Fencing river frontages is not practical because floods will damage fences ***	94	2.69	2.28	2.95	0.0111
Grazing of domestic stock has had little impact on the existence and diversity of native vegetation on river frontages ***	92	2.65	2.47	2.77	0.1659
Removing willows is an important part of work to improve the condition of native vegetation on river frontages	84	3.74	3.94	3.62	0.1755
Intensive grazing for short periods is usually better than set stocking for retaining native vegetation in paddocks with river frontages	94	3.53	3.63	3.47	0.3144

All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)
**** These items are expressed in the negative. That is, those that agreed with the statement were expressing that they disagreed with the recommended practice.*

Photo: R. Sample

Table 12: Comparison of participants and non-participants: implementation of recommended practices
Loddon river health projects 2009 landholder survey, N=108

Practices undertaken during your management					
Survey items	**n*** **	**overall mean**	**participant mean**	**non-participant mean**	**p value**
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property ***	67	3 points	6 points	2 points	0.0018
Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)	96	1562 m	2,481 m	1,058 m	0.0039
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) during your management of the property (number of trees)	96	1433 plants	3,601 plants	244 plants	0.0057
Area of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)	96	197 ha	292 ha	144 ha	0.0444
Removed willows and replaced them with native vegetation during your management of the property	38	5% yes	14% yes	0% yes	0.1294
Removed willows during your management of the property	40	30% yes	43% yes	23% yes	0.2808
Placed large woody debris or snags in the water way as fish habitat	70	10% yes	15% yes	7% yes	0.1855
Practices undertaken in the last 5 years (since early 2005)					
Survey items	**n**	**overall mean**	**participant mean**	**non-participant mean**	**p value**
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) (number of trees)	96	414 plants	1,163 plants	4 plants	0.0001
Length of fencing erected near the river to manage stock access to the water way (metres) ***	67	1469 m	3,090 m	728 m	0.0002
Did poison or physically remove woody weeds such as gorse, blackberries or willow regrowth	64	66% yes	81% yes	55% yes	0.0595
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (days per year)	40	7 days	10 days	5 days	0.0041

Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property ***	67	2 points	4 points	1 point	0.0084
Willows removed and replaced with native vegetation	39	5% yes	14% yes	0% yes	0.1228
Willows removed	36	22% yes	33% yes	17% yes	0.3974
Practices undertaken this year (2009)					
Survey items	**n**	**overall mean**	**participant mean**	**non-participant mean**	**p value**
Did poison or physically remove woody weeds such as gorse, blackberries or willow regrowth	66	53% yes	78% yes	36% yes	0.0011
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (days per year)	35	7 days	9 days	4 days	0.0514
During 2009, did stock graze any part of your river frontage for more than a week at a time? ***	66	53% yes	50% yes	54% yes	0.7931
During 2009, did stock access drinking water from any part of your river frontage for more than a week at a time? ***	66	58% yes	60% yes	57% yes	1.0000

The grey shaded survey item is so close as to be considered significant, All survey items used the Kruskal Wallis test for significant differences to 0.05 level (p value significant difference is shaded)

*** *is the number who were identified as a river health project participant and supplied responses for the CRPs*

*** *Statements where only responses from those landholders that were identified as having a livestock enterprise were used.*

3.01.7 Does river health project participation make a difference?

An introduction

This section presents a summary of the results of additional statistical analyses exploring the relationships between participation in the river health projects and other independent variables and achievement of intermediate project outcomes, including: awareness of issues, knowledge, confidence in recommended practices and implementation of recommended practices. As explained in the methodology section, these analyses involved both pairwise comparisons and then multiple regression modelling. These analyses focussed on those practices where the evidence suggested that participants were significantly more likely to be implementing each practice.

A synthesis of the key findings is provided in the Summary section below, including in Figures 3, 4 and 5. Details of the pairwise analysis and regression modelling are provided in Appendix 1. In the Appendix, results are presented for each intermediate outcome with the results of pairwise comparisons followed by a summary of the results from regression modelling. For the pairwise comparisons, all statements have been expressed in the positive. That is, where there was a significant negative relationship between an independent variable and the intermediate outcome, the expression of that variable has been altered to assist readers interpret the findings.

Regression modelling attempts to address the potential for pairwise relationships to be influenced by the relationships between several independent variables. However, regression modelling can eliminate important variables from the final model if they are correlated with other significant variables. There are other statistical tools for exploring causal relationships, but most of these techniques rely on larger sample sizes than could be obtained for this study. Given the limitations of regression modelling, this section includes a summary of the findings from both the pairwise comparisons and regression modelling [Figures 3, 4 and 5].

For the pairwise analyses, variables are listed in Appendix 1 in rank order according to their P value which provides a crude measure of relative strength of the relationships between the variables and the intermediate outcome. As explained in the Methodology section of the report, the R^2 value in provides a measure of the amount of variance in the intermediate program outcomes that can be explained by the regression model. Given the complexity of human behaviour, it is very difficult to include sufficient variables in a study to achieve high R^2 values and most social researchers identify 30% as an acceptable $R^{2.}$ In the analyses reported in the section of the report, the maximum R^2 is 77% and the minimum 7.3%, with 20 out of 27 > 30%. In fact, the R^2 for all awareness, knowledge and almost all confidence in recommended practice models was >30%.

The survey included two items exploring landholder participation in natural resource management programs focussed on river health. The first item asked whether federal or state government programs, The North Central CMA or DPI had supported work on the respondent's river frontage in the past five years (from the start of 2005). We refer to this cohort as being involved in "All programs". The second item focussed on Loddon river health projects implemented by the North Central CMA

and DPI since early 2005. Respondents who said they were involved in the Loddon river health programs are assumed to be project participants. CMA staff advised that most of the work implemented in riparian areas in the Loddon in the past five years that has been supported by government programs has been implemented through the river health projects. Notwithstanding that advice, the research team has used the landholder responses to identify river health project participants. Given that most of those who said they had received support through "All programs" were river health participant, we have reported links between participation in "All programs" and the achievement of intermediate program outcomes.

A summary of results

Awareness of issues

Compared to non-participants, participants gave a significantly higher rating to three of the five items exploring landholder awareness of river health issues [Table 9 and Figure 3].

The regression modelling established that participation was linked to a higher rating for one of the three items where pairwise comparisons had identified a significant link between participation and a higher rating to issues (a measure of awareness). In this case, the issue was: Declining water quality in rivers/ streams affecting river health.

Respondent's ratings of other issues, their values (those attached to the river frontage), on-property profitability and length of residence were also linked to more concern (awareness) of the three issues using regression modelling.

Knowledge of river health related topics

Compared to non-participants, participants rated their knowledge higher on 10 of the 11 items in the survey exploring landholder knowledge of river health related topics [Table 10 and Figure 3].

The regression modelling established that project participation was linked to a higher self-reported knowledge rating for three items while there was a positive relationship with work on the river frontage supported by federal or state government programs, the North Central CMA or DPI (All programs) for a further two items. We have assumed that 'All programs' is really a surrogate for river health project participation. Regression analyses therefore established a significant positive relationship between participation and five knowledge items:

- how to access information about government support for landholders to better manage Crown Land river frontages;
- the role of river frontages as corridors supporting the movement of animals from one area to another;
- the contribution of floodplain wetlands towards the health of the Loddon River;
- the ability of perennial vegetation and standing stubble to improve the quality of runoff water *(All programs on river frontages);* and
- the predicted impact of climate change on river flows in the Loddon catchment (*All programs on river frontages).*

Respondent's values (mostly those attached to the river frontage), extent of on-property work, participation in Landcare, involvement in short courses, property size, attitudes and concern about issues were also linked to higher self-reported knowledge for the 11 items using regression modelling.

Confidence in recommended practices

Compared to non-participants, participants were more confident in the efficacy of five of eight items exploring landholder confidence in recommended practices [Table 11 and Figure 4].

The regression modelling established that participation was linked to higher confidence for one of the five items where pairwise comparisons had identified a significant link between involvement in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years and confidence in recommended practices. In this case, that was for confidence that Areas of native vegetation along waterways with limited stock access are able to trap nutrients before they enter waterways.

Respondent's values (mostly those attached to the river frontage), concern about issues and the enterprise mix were also linked to higher self-reported confidence for the eight items using regression modelling.

Implementation of recommended practices

River health project participants were significantly more likely to be implementing 10 of the 18 items exploring landholder implementation of recommended practices [Table 12 and Figure 5].

The impact of the river health projects on the implementation of recommended practices is all the more impressive when it is considered that four of the eight items where there was not a significant positive relationship related to willow removal [Figure 5]. Advice from CMA staff is that willows are not an important issue in the frontages of a substantial portion of the Loddon where the projects operated. Another item related to the placement of large woody debris or snags in the water way as fish habitat and advice from CMA staff is that this was not a focus of project activity and it would be very difficult for landholders to accomplish this work without substantial equipment.

The regression modelling established that participation was linked to more work implemented for four survey items while there was a positive relationship with work on the river frontage supported by federal or state government programs, the North Central CMA or DPI (All programs) for another item. Again, we have assumed that "All programs" is really a surrogate for river health project participation. Regression analyses therefore established a significant positive relationship between project participation and five implementation items:

1. the number of off-stream watering points established (the management period);
2. the number of off-stream watering points established (past five years);
3. the number of trees/shrubs planted (past five years);

4. the length of fencing erected to manage stock access (past five years) (All river frontage programs); and
5. the time spent poisoning or physically removing woody weeds (past 12 months),

Respondent's values (mostly those attached to the river frontage), participation in Landcare, attitudes and extent of previous family ownership were also linked to more work being implemented in/on river frontages.

Figure 3: Significant positive relationships between project participation and intermediate outcomes: issues and knowledge

River health projects intermediate outcomes		
Assessment of importance of issues	**Pairwise**	**Regression**
Declining water quality in rivers/ streams affecting river health	YES	YES
Soil erosion from farmland affecting water quality and sediment loads entering the Loddon River	YES	NO
Suitable conditions (adequate flows and refuge pools) to support native animals such as platypus, Murray Cod, Yellow Belly, frogs	YES	NO
Nutrient and chemical run-off affecting water quality in rivers/ streams/ wetlands	NO	NO
Loss of native vegetation along water courses	NO	NO
Non native plants such as willows growing along the river	NO	NO
Salinity threatening water quality in rivers/ streams/ wetlands	NO	NO
Knowledge		
How to access information about government support for landholders to better manage Crown Land river frontages	YES	YES
The role of river frontages as corridors supporting the movement of animals from one area to another	YES	YES
The contribution of floodplain wetlands towards the health of the Loddon River	YES	YES
Role of large logs and river side vegetation in supporting native fish	YES	NO
Ability of perennial vegetation and standing stubble to improve the quality of runoff water	YES	YES *
The role of environmental flows in the Loddon River to maintain a healthy river system	YES	NO
How to prepare a farm or property plan that allocates land use according to different land classes	YES	NO
The effects of unrestricted stock access to water ways	YES	NO
The production benefits of retaining native vegetation on farms	YES	NO
Predicted impact of climate change on river flows in the Loddon catchment	YES	YES *
How to manage ground cover on paddocks used for grazing to minimise soil erosion and resulting sedimentation of water ways	NO	NO

** Significant positive relationship under regression modeling observed for all river frontage programs.*

Figure 4: Significant positive relationships between project participation and intermediate outcomes: confidence in recommended practices

River health projects intermediate outcomes		
Confidence in recommended practices	**Pairwise**	**Regression**
The time and expense involved in watering stock off-stream is justified by improvement in river water quality	YES	NO
Areas of native vegetation along waterways with limited stock access are able to trap nutrients before they enter waterways	YES	YES
Dead trees or timber on the ground in river frontages are important habitat for native birds and animals	YES	NO
Domestic stock have had substantial impact on the stability of the river bank	YES	NO
Fencing river frontages is not practical because floods will damage fences **	YES	NO
Grazing of domestic stock has had little impact on the existence and diversity of native vegetation on river frontages **	NO	NO
Removing willows is an important part of work to improve the condition of native vegetation on river frontages	NO	NO
Intensive grazing for short periods is usually better than set stocking for retaining native vegetation in paddocks with river frontages	NO	NO

*** These items are expressed in the negative. That is, those that agreed with the statement were expressing that they disagreed with the recommended practice. Relationship identified is positive, that is, river health projects participants have more positive scores.*

Photo: R. Sample

Figure 5: Significant positive relationships between project participation and intermediate outcomes: implementation of recommended practices

River health projects intermediate outcomes		
Implementation of recommended practices during management period	**Pairwise**	**Regression**
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property ***	YES	YES
Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)	YES	NO
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) during your management of the property (number of trees)	YES	NO
Area of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)	YES	NO
Removed willows and replaced them with native vegetation during your management of the property	NO	NO
Removed willows during your management of the property	NO	NO
Placed large woody debris or snags in the water way as fish habitat	NO	NO
Implementation of recommended practices during past five years		
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) (number of trees)	YES	YES
Length of fencing erected near the river to manage stock access to the water way (metres)	YES	YES
Poison or physically remove woody weeds such as gorse, blackberries or willow regrowth (Yes/No)	NO	NO
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (days per year)	YES	NO
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property	YES	YES
Willows removed and replaced with native vegetation	NO	NO
Willows removed	NO	NO
Implementation of recommended practices this year (2009)		
Poison or physically remove woody weeds such as gorse, blackberries or willow regrowth	YES	YES
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (days per year) ****	YES	NA ***
During 2009, did stock graze any part of your river frontage for more than a week at a time? **	NO	NO
During 2009, did stock access drinking water from any part of your river frontage for more than a week at a time? **	NO	NO

*** These items are expressed in the negative. *** Insufficient cases to undertake regression modelling. **** Assessed as a significant positive relationship even though P value just above 0.05.*

3.01.8 Did the river health projects employ appropriate processes and tools effectively?

An introduction

The interviews with landholders and other river health project stakeholders provided key insights to address this evaluation question. The survey included two topics that provide useful insights to this question.

In the first instance, non-participants were asked to indicate the importance of nine potential reasons why they were not involved in CMA Loddon river health projects in the past five years. Respondents were asked to select from six response options ranging from “don’t know/ not applicable”, “not important”, “minimal”, “some”, “important” and “very important”. The six categories have been collapsed into four by combining “not important”, and “minimal”; and “important” and “very important” [Table 13].

Participants were asked to provide feedback about the extent that CMA/DPI staff working on river frontage projects provided helpful support to respondents. Eleven items were included and again, respondents were asked to select from six response options [Table 14]. For this topic, the response options ranged from “not applicable”, “strongly disagree”, “disagree”, “not sure”, “agree” and “strongly agree”. These categories were collapsed into four by combining “strongly disagree” and “disagree”; and “agree” and “strongly agree”.

Reasons for non-participation in CMA river health projects

An overview

At least a third of respondents gave an important rating to three possible explanations for non-participation: not being approached; not aware of the program; and my frontage is in good condition and no work is needed. Interview data confirmed that project staff had focussed on landholders who were likely to be sympathetic to project aims and had worked through existing landholder networks to identify potential project participants. So, it is likely that many landholders simply were not contacted and invited to participate. Some of the interviewees also said they didn’t engage with the projects because they had completed the work they wanted to do on their property.

Survey and interview data suggest there is only a small proportion (<20%) of landholders who would be very difficult to engage in conservation projects such as the river health projects. For example, only 10% of all respondents disagreed/strongly disagreed with the survey item exploring the extent of a stewardship ethic [Table 28]. This small group has a very weak commitment to environmental stewardship, is suspicious of governments and concerned about the potential loss of decision making autonomy in terms of property decision making. Many of these landholders also have strong reservations about the efficacy of some recommended practices promoted by the projects, including fencing river frontages to manage stock access to waterways and stream sides.

These findings suggest there is a real opportunity to engage a substantial proportion of the non-participants should the lead agencies want to extend the river health projects or a similar project/program. Findings in this section provide some useful guidance about the concerns that would need to be addressed if the aim was to engage all/almost all landholders. However it should not be difficult to extend the reach of the river health projects to most landholders in the river health projects' target area.

Survey findings

- At least a third of respondents gave an important rating to three possible explanations for non-participation: not being approached; not aware of the program; and my frontage is in good condition and no work is needed [Table 13].
- There appears to be low levels of concern about a number of potentially important constraints to engagement in river frontage programs, including; that the work will lead to management problems (16% rated this as important); and that there was no funding for ongoing maintenance of work (17%) [Table 13].
- For each of the nine items there was a substantial proportion (21% to 59%) of non- participants who said the item was not applicable/ don't know [Table 13]. It is possible that these respondents are simply not interested in participating in any government programs. Another possible explanation is that these respondents have not given a lot of thought to involvement in river frontage programs and don't really have an opinion to offer.

Table 13: Reasons for non-participation in river health projects during the past 5 years
Loddon river health projects 2009 landholder survey, N=108

Possible explanations for not being involved in CMA Loddon river health projects	n	% not Important	% some	% important	% NA	mean
No-one approached me directly about being involved in the program	63	11%	14%	41%	33%	3.74
I was not aware of the program	63	22%	11%	33%	33%	3.33
My river frontage is in good condition and no work was needed	63	24%	22%	33%	21%	3.08
I was concerned that the program did not include funding for ongoing maintenance of the work to be undertaken	63	21%	6%	17%	56%	2.89
I'm was not convinced that the work proposed would improve the condition of my frontage/ water quality	63	14%	13%	14%	59%	2.77
I didn't want to commit to work that I was unsure I would be able to maintain in the future	63	17%	10%	14%	59%	2.77
I thought that the work proposed would lead to management problems	63	21%	5%	16%	59%	2.73
I can do the work myself and claim it as a tax deduction	63	22%	17%	11%	49%	2.50
I'd prefer to do the work myself without government assistance	63	30%	24%	11%	35%	2.37

Note: the means are ranked on the importance of the explanation to the non-participant

Interview findings

Why not involved

All landholder interviewees were asked about the reasons why they or others might choose not to be involved in the river health projects. Agency/NRMC interviewees were also asked to consider why some landholders would not want to participate.

Non-participant landholders talked about why they chose not to 'sign up' for the river health projects. There were two groups of these interviewees – those who were not involved because they had already fenced off all or a substantial proportion of their riparian areas and those who had not done any fencing. The reasons given by those without fencing along their river/creek frontage included:

- concerns about flooding and damage to infrastructure such as fences;
- mistrust of/resentment towards government; and
- not seeing the proposed work as necessary.

The following quote embodies some of these sentiments:
Well basically I'm a person who [doesn't] like to see money wasted and I thought yeah, like you said if down the track they make you do it, well I suppose I'll have to wear it myself if the program wasn't still going ... but if [fences are] not needed why put it there? Like if it's not broken why fix it?

The non-participant interviewees who had fenced off part/all of their riparian areas said that they had not been approached to be involved in the river health projects. One of them said that he/she had made inquiries about the projects but had not heard back from the CMA or DPI. These interviewees were also asked why they thought other landholders would choose not to participate and suggested others were concerned about the same issues.

Interviewees who were project participants offered a number of reasons why other landholders were not participating in the projects, including that they:

- had not been approached one-on-one by project staff or those with knowledge of the projects;
- did not value and/or understand the benefits of what was being offered;
- assumed they needed capital to co- invest and did not have it;
- were concerned about losing their watering and grazing rights; and
- were simply biding their time to see what the outcomes would be on participating properties.

The following quotes illustrate participants' views of other landholders' reasons for resisting appeals to join the river health projects:
Yeah, look I think purely just generational and people thought they were being denied something they'd always had and they didn't probably look into it.

[My neighbour] ... he's well and truly interested in doing it, but he was just waiting to see what we would do on the other side of the creek ... and there's just a few people around here who I know of and they're good farmers and good people but they would never have fenced it in unless they were pushed to.

Agency staff and NRMC members felt that landholders' resistance stemmed from mistrust of government and a 'green agenda', a strong attachment to farming according to family tradition and a lack of interest in learning about new ways to farm, and/or a lack of understanding about what the program entailed. These interviewees thought that resistant landholders believed that participating in the projects would: result in loss of independence and/or control because the fencing would restrict access to their riparian areas – thereby limiting their ability to manage it as they see fit. In turn, these landholders were thought to be concerned about a number of management problems that would be created, including the cost of managing increased pest plants and animals, the loss of stock access to shelter and/or watering points, and the costs of maintaining fences after floods.

Table 14: Assessments of support provided by river health project staff Loddon river health projects 2009 Landholder survey, N=108

Support provided by CMA/DPI staff	n	% disagree	% not sure	% agree	% NA	mean
Staff provided sufficient technical advice for me to understand what the project involved	35	3%	3%	91%	3%	4.15
Staff showed me respect	35	3%	0%	94%	3%	4.41
Staff were approachable and responsive	35	3%	6%	89%	3%	4.21
Staff were flexible when negotiating work to be undertaken	35	6%	3%	86%	6%	4.18
I was treated as an equal partner	35	6%	6%	86%	3%	4.18
I had sufficient input into decisions about the work undertaken	35	3%	11%	83%	3%	4.15
Staff carefully negotiated the management agreement with me	35	0%	14%	77%	9%	4.16
Staff carefully explained my responsibilities for ongoing management	35	3%	9%	86%	3%	4.12
I have received sufficient technical information to carry out the work that I'm responsible for	35	11%	6%	77%	6%	4.00
Staff ensured that my ongoing management responsibilities are not going to be too onerous in terms of time or expense	35	6%	11%	77%	6%	3.97
The agreement clearly spells out my responsibilities for future work	36	3%	17%	69%	11%	3.91

Note: the means are ranked on the agreement with the statement by the non-participant

Assessments of the quality of support provided to project participants

Survey findings: quality of river health project engagement

- Overall, project participants were very satisfied with the support provided by CMA/DPI staff. Almost all respondents provided very positive feedback for all 11 items exploring all aspects of staff engagement, including that they were approachable and responsive, treated landholders with respect, were flexible when negotiating work, treated landholders as equal partners, provided sufficient technical advice and clearly explained future management responsibilities. Indeed, very small proportions of respondents provided negative comments (only >10% for 1 item) [Table 14].

Interview findings: quality of river health project engagement

River health project participants interviewed were largely satisfied with the nature of the interactions they had with project personnel. These landholders were satisfied with the overall program delivery model, their interactions with staff, the information that was provided and the extent they were able to negotiate the location of fence lines. These interviewees appeared to have a clear understanding of their responsibilities under their management plans. Many said there were no/minimum management plans. The following quote typifies the level of interviewee satisfaction with these elements of the river health projects.

Oh yes, ... it was good ... we worked through the different lines we were going to take for the fencing ... and we sort of modified a few areas where they were going to take probably slightly more area than I was keen on. It was easy negotiation ... we told them that if we were to fence the river off that there was going to be X amount of paddocks there that weren't going to have the access to water for stock etc. They were happy with that and they said, well basically what do you want? And I said well we need, you know, three or four stock troughs, 500 litre stock troughs or whatever they happened to be and then we, I went down and measured how much poly pipe I'd need to run it through to those paddocks, I told them and that was how it went ... it's better that they go and get [the materials], because they would buy a lot more fencing material per year than I ever would, so, you know, surely they must have a better buy price, there's no point in me buying smaller amounts.

River health project participants also identified areas for improvement, including the need for more follow-up from staff to reinforce the value of work undertaken and to provide advice about future management approaches, particularly as sites responded to project interventions. Some informants also thought the projects needed to identify and engage less willing landholders, particularly through one-on-one extension to explain the program and address landholder concerns. The following quotes illustrate these concerns:

Yeah, the staff, there's no issues with the staff but it's always, all right we're doing this grant, bang it's done, move onto the next one, there's no follow-up in how things are going. Come out and have a look, like, maybe you should have done this, maybe you should have, you know, especially with re-veg and that sort of thing or, you know, what species are coming or, you know.

... if you weren't that knowledgeable, [it would be a problem that] there was really no follow up for a management plan or criteria ... [it was] this is the fence, there you are, the work is done.

There are (fencing) gaps in part of Loddon River, and there is also crown land that is not managed by anyone ... it's not a good example to set for those you are trying to get to be involved ... farmers needs to see active things going on ... and the one-on-one discussion is quite important ... (their action/involvement) may not happen straight away, but it will happen at some point ... I do know one landholder who wouldn't get involved, because financially he cannot, but he probably also has not had (the Program details) properly explained to him ... and the one-on-one – some people need personalised delivery of info more than others ... i know it is more expensive, but [eventually] you'll get the benefits of [investing in] it.

Discussions with the NRMC and project staff identified the following strengths of the engagement tools and processes employed:

- engaging landholders through informal approaches to individuals;
- helping landholders gain a better understanding of the connectivity between their riparian areas and those of other landholders through the use of visual materials during site visits, including aerial photos;
- demonstrating the benefits of the projects by way of examples of success;
- providing information and enabling debate about the nature of the project through community meetings; and
- including credible, knowledgeable individuals with diverse farming backgrounds on the NRMC and listening to the advice and feedback they provided.

The following quote illustrates one interviewee's support for the way in which the river health projects identified and approached landholders:

[The strategy is] completely ad-hoc ... every project officer had their own way of finding people ... it was up to the Project Officer ... there were no cold-call sells, nor any sort of tender process unofficial or otherwise ... we relied on word-of-mouth, Landcare meetings, seeing who would approach you afterwards, talking to community leaders and seeing who they suggested we should speak to next. It was [largely] a process of thoughtful ad-hocery, which is a perfect system. [The river health project] is really a 20 year project ... and you start with the best that you can do and you work with people who are willing to work with you and you will keep finding people that way ... unless you want to go down the pathway of a some tender project, where then you need a more transparent (and formalised and organised) process.

NRMC and project staff identified the following issues with landholder engagement through the projects:

- landholders being unclear and/or concerned about their responsibilities – particularly in relation to maintenance should floods damage fences erected;
- insufficient follow up with participating landholders (see landholder comments above);
- insufficient emphasis on building long-term commitment by focussing on community capacity building;
- some staff lacking understanding of the social drivers of practice change;

- instances of over-zealous staff who seemed insensitive to the values and needs of landholders;
- the use of coercion to obtain landholder participation (e.g. the implied threat that if landholders didn't participate in the projects that at some point in the future governments would require them to do so and at their expense);
- inconsistent use of management plans and apparent differences in the nature or content of those plans for different landholders; and
- high project staff turnover which made consistent engagement with farmers more difficult.

The following quotes illustrate some of the issues related to management plans.
You might have to tighten up the rules around ... the operations of a fence ... around grazing management ... you need a more binding agreement to do things ... It needs to be more enforced. I don't know how they go round enforcing it but ... [at the moment] they don't really have to, they really don't have to abide by any agreement if there is an agreement and they get watering points too.

It would be nice to have in their [river health project individual management plans] a yearly check that they (participating landholders) are adhering to their guidelines.

The project staff interviewed were very confident in their ability to engage landholders. Our view is that the staff were highly competent practitioners in that they were aware of different landholder contexts and the influence of these on landholder motivation and capacity to engage with staff and implement recommended NRM practices. The following quote illustrates the depth of these capacities.

It's all about social change leading to environmental change. You have to work with the social stuff as well. I have always thought that I would go on a single property or local area and work on a project that is probably 3rd, 4th or even 10th priority of the farmer/landowner ... it's about (them putting their) toe in the water ... we need to reward that ... They (the biophysical and social change) are both extremely important ... and [while] we are totally here for the biophysical change, we are also here for the social change. The biophysical change is nothing without that (the social change), it won't go anywhere further and won't be sustained ... one drives the other.

... I drop in and have a chat with them and see how they feel about things. You have to gauge their feeling before you give them idea of what you are planning ... you test the water ... you can work out pretty quickly what side of the fence they sit on. ... they think they are losing that land. That is something I always try and say to them, ... you are not actually losing the land .. it's just going to be managed differently.' ... even if they graze it less it's still an improvement ... if it's a farmer I know they are not motivated by the environment, doing it for management – I try and stress to them that the riparian area is more fragile than the rest of the property ... you can graze it intensively for a short period, keep the grass longer, etc ... sometimes project officers can be too narrow minded or environmentally focused – I try and keep in mind [when I go to a farmer's property] that this is a farming operation first ... let's try and work with them so that they get some benefit too. If you are too hard-line you can lose them. I try and think from their perspective...

3.02 Task 2: Constraints to implementation by those not in river health projects

3.02.1 An introduction

The survey included a specific topic (15 items) exploring respondent's views about the importance of possible constraints to the management of water ways and adjoining in their district [Table 15]. The intention was to gather respondent's perceptions of importance of constraints for landholders generally, rather than just for them as individuals. Respondents were asked to select from a six-point response set that ranged from "don't know/ not applicable", "not important", "minimal", "some", "important" and "very important". The six categories have been collapsed into four by combining "not important", and "minimal"; and "important" and "very important". Information in Table 15 provides a comparison of participant and non-participant views, but the focus in this section is on the views of the non-participants.

As explained in the methodology section, pairwise comparisons and regression modelling were employed to explore links between all variables included in the survey and the implementation of recommended practices expected to lead to improved river health. These findings will be presented as summaries for each practice.

The key informant interviews also explored the constraints to implementation by non-participants. Interview data has been discussed in earlier sections.

3.02.2 Constraints identified by the survey respondents

- The items most frequently rated as important constraints by non-participants were the cost of materials and equipment to carry out work; drought conditions affecting the availability of water for wetlands; the impact of flood events on fences and other infrastructure; and the increased risk that fires will have severe impacts because of fuel build up behind fences. These were the only items rated as important constraints by more than half of the non-participants [Table 15].
- Non-participants appear to be less concerned than participants about most of the constraints covered by items in this topic. The exceptions are for items exploring confidence in fencing out river frontages (5 items) and clarity around who is responsible for managing river frontages [Table 15].
- Non-participants were less likely to rate Poor condition of the surrounding catchment as an important constraint to managing river frontages [Table 15].
- Slightly more than a quarter of participants and non-participants rated Public access to the frontage as an important constraint [Table 15].

It is possible that non-participants simply are less interested in river health and therefore, less concerned by many of the constraints listed in the survey. It is also possible that those involved in the projects have a heightened appreciation of their need for support to undertake work in their river frontages. It seems that a lack of confidence in fencing is an important influence on participation. However, participation could be expected to lead to increased confidence in fencing as a recommended practice, either as a result of gaining first-hand experience with

fencing, or acquiring knowledge of the potential positive impact on river health by fencing to manage stock access to water ways.

Table15: Comparison of participants and non-participants: constraints to managing river frontages in your district;
Loddon river health projects 2009 landholder survey, N=108

Constraints		n	% not important	% some	% important	% NA	mean
The cost of materials and equipment to carry out work	non-participants	63	5%	16%	73%	6%^	4.00
	participants	34	6%	9%	85%	0%	4.21
Drought conditions affecting availability of water for wetlands	non-participants	62	13%	26%	55%	6%	3.67
	participants	34	3%	9%	88%	0%	4.24
Impacts of flood events on fences and other infrastructure	non-participants	62	16%	21%	52%	11%	3.64
	participants	34	24%	18%	56%	3%	3.48
Fencing out river frontages will increase the likelihood or severity of fires because of fuel building up	non-participants	62	15%	24%	53%	8%	3.58
	participants	34	38%	18%	41%	3%	3.12
Drought conditions affecting the survival of existing or planted native vegetation	non-participants	63	17%	275	49%	6%	3.49
	participants	34	6%	24%	71%	0%	3.94
Access to on-site technical advice about managing problem areas	non-participants	62	13%	35%	44%	8%	3.40
	participants	34	12%	21%	65%	3%	3.67
Lack of time or access to labour to carry out work	non-participants	63	14%	35%	40%	11%	3.38
	participants	34	12%	32%	53%	3%	3.67
Lack of work undertaken on neighbouring properties	non-participants	62	21%	26%	39%	15%	3.32
	participants	34	6%	26%	62%	6%	3.91
It is unclear who is responsible for managing river frontages	non-participants	61	21%	26%	41%	11%	3.31
	participants	34	29%	24%	38%	9%	3.06
Poor condition of the surrounding catchment	non-participants	58	16%	31%	36%	17%	3.27
	participants	33	21%	27%	48%	3%	3.50
Fencing out river frontages will create harbour for pest animals	non-participants	63	24%	27%	41%	8%	3.26
	participants	34	32%	26%	35%	6%	3.19
Fencing out river frontages will increase management time	non-participants	62	26%	23%	29%	23%	3.06
	participants	34	50%	24%	18%	9%	2.65
Fencing out river frontages will make it difficult to water stock	non-participants	63	30%	13%	38%	19%	3.00
	participants	33	36%	245	24%	15%	2.68
Fencing out river frontages will reduce the area for grazing or cropping	non-participants	63	30%	27%	29%	14%	2.93
	participants	34	44%	415	9%	6%	2.47
Public access to the frontage	non-participants	63	38%	29%	24%	10%	2.74
	participants	34	35%	29%	26%	9%	2.90

Note: the means are ranked on the importance of the constraint to the non-participant

3.02.3 Factors affecting implementation by non-participants: findings from the survey data

An introduction

The analysis of factors linked to implementation by non-participants considered all potential independent variables in the survey, including the other intermediate river health project outcomes, such as awareness of issues, knowledge and confidence in recommended practices.

Regression modelling attempts to address the potential for pairwise relationships to be influenced by the relationships between several independent variables. This can happen when one independent variable is in turn influenced by another. For example, Landcare participation might relate to undertaking property planning courses and both might be related to implementation of off-stream watering points. However, regression modelling can eliminate important variables from the final model if they are correlated with other significant variables. For example, it is possible that project participation and Landcare participation are both correlated with implementing off-stream watering points and are in turn, both correlated. Regression modelling is likely to eliminate the variable least strongly correlated with the intermediate outcome. However, both river health projects and Landcare might influence behaviour in different ways and therefore, could be expected to make their own contribution to the implementation of recommended practices. There are other statistical tools for exploring causal relationships, but most of these techniques rely on larger sample sizes and it is our view that this level of exploration was not required for this evaluation of project impact. Given this limitation of regression modelling, this section includes a summary of the findings from both the pairwise comparisons and regression modelling.

There were no significant relationships between the independent variables included in the survey and nine practice items. In addition, there were insufficient numbers of respondents to reliably interpret results from the pairwise comparisons for one practice item: Days spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth during the last 5 years. This left eight items where pairwise analyses have been reported in Appendix 2 [and Figure 6]. In addition, there were two items where the results from the modelling have not been included because the resulting model only included one variable and that variable explained a very small amount of the variance in the recommended practice. There were therefore six practice change items where regression modelling results are reported in Appendix 2 [and Figure 6].

For the pairwise analyses, variables are listed in Appendix 2 in rank order according to their P value which provides a crude measure of relative strength of the relationships between the variables and the intermediate outcome. As explained in the Methodology section of the report, the R^2 value in provides a measure of the amount of variance in the intermediate program outcomes that can be explained by the regression model. Given the complexity of human behaviour, it is very difficult to include sufficient variables in a study to achieve high R^2 values and most social researchers identify 30% as an acceptable $R^{2.}$ In the analyses for this section of the report, the maximum R^2 is 75% and the minimum 19%.

Figure 6: Relationships between project participation and project outcomes: implementation of recommended practices

River health projects intermediate outcomes		
Implementation of recommended practices during management period	**Pairwise**	**Regression**
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property	YES	YES
Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)	YES	YES
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) during your management of the property (number of trees)	YES	YES
Area of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)	YES	YES
Removed willows and replaced them with native vegetation during your management of the property	NO	NO
Removed willows during your management of the property	NO	NO
Placed large woody debris or snags in the water way as fish habitat	NO	NO
Implementation of recommended practices during past five years		
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) (number of trees)	YES	NO
Length of fencing erected near the river to manage stock access to the water way (metres)	YES	YES
Poison or physically remove woody weeds such as gorse, blackberries or willow regrowth (Yes/No)	NO	NO
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (days per year)	NO	NO
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property	YES	NO
Willows removed and replaced with native vegetation	NO	NO
Willows removed	NO	NO
Implementation of recommended practices this year (2009)		
Poison or physically remove woody weeds such as gorse, blackberries or willow regrowth (Yes/No)	NO	NO
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (days per year)	YES	YES
During 2009, did stock graze any part of your river frontage for more than a week at a time? **	NO	NO
During 2009, did stock access drinking water from any part of your river frontage for more than a week at a time? **	NO	NO

*** These items are expressed in the negative.*

A summary of results

Examination of the results from the pairwise comparisons and regression modelling [Appendix 2] reinforces the impact of widely established NRM approaches that rely on engaging and building social and human capital: Landcare participation; property management planning; and government support/implementation of onground work on properties. At the same time, there is also evidence that values (about aspects of river frontages) and attitudes (about the roles of stakeholders, including government) are powerful influences on landholder behaviour. One of the interesting findings of this research is the relatively important influence of attitudes on practice implementation by non-participants. Past studies have found little evidence that attitudes are an important influence on NRM practice implementation in Australia (Curtis and De Lacy 1998; Pannell *et al*. 2006). It is unrealistic to expect to change these more deeply ingrained personal characteristics - at least not in the short-term. However, NRM practitioners need to consider the values and attitudes of landholders when they develop communication tools and processes.

There is also evidence that different landholder cohorts, such as farmers and non-farmers, may have different values, attitudes and concerns and that these influence their willingness to implement recommended practices (Curtis and Mendham 2010). At the same time, there is evidence that participation in local organisations enhances the flow of information, provides access to critical resources and can establish positive social norms that lead farmers to implement work with a conservation focus (Curtis and Mendham 2010). There is some evidence in this study that that is happening in the Loddon in that there are links between implementation and past family ownership and larger property size. Interestingly, plans to sell or subdivide don't appear to be inhibiting willingness to engage in the best-practice management by non-participants. There is also no evidence from these analyses that knowledge or confidence in recommended practices as assessed in the survey are important influences on the management practices of non-participants.

Variables included in the survey contributed to a model that explained 75% of the variance in the Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) during the respondent's management period. The results of pairwise analyses emphasised the importance of government support for onground work; involvement in Landcare, having undertaken a property management plan or short course related to natural resource management; and the influence of positive attitudes in relation to the responsibilities and rights of landholders. The regression modelling emphasised the role of Landcare; positive attitudes, including in relation to a landholder's duty of care for the environment; and larger property size [Appendix 2].

3.03 Task 3: Long-term commitment by landholders to river health project outcomes

3.03.1 An introduction

The key informant interviews were the principal source of data to respond to this evaluation question. Landholders were asked about their long-term vision and plans for the property while project staff and NRMC members were asked more directly about long-term commitment. The survey included one topic exploring the extent that participants had implemented work as agreed in their management plan with the CMA. Responses to this topic were expected to provide preliminary indications of the extent that the river health projects had engendered long-term commitment to project outcomes.

Self-assessment is a reliable method of gathering information from survey respondents. The Loddon survey asked respondents if they had agreed to implement a management plan for the works area on their property and if they had, the extent they had undertaken work as agreed [Table 16]. Four response options were provided and each is included in Table 16.

3.03.2 Findings from the survey data

- Seventy-four per cent of those responding to this item (n=38) said they had agreed to implement a management plan for the works area on their property.
- It seems that most respondents with a management plan have made a serious attempt to implement the work as agreed. For example, most (66%) said they had implemented most/all of the work agreed that related to weeds, stock access and fence maintenance; and three quarters of respondents had implemented about half/most/all of the work agreed that related to weeds (89%) and stock access (75%). Over half of all respondents had implemented about half/most/all work as agreed for the remaining topics of manage pests animals (66%) and revegetation (57%) [Table 16].
- Very few respondents said they had implemented work to a limited extent, suggesting a high level of commitment to the agreed management plans [Table 16].

Table 16: Extent participants implemented work as agreed in their management plan
Loddon river health projects 2009 landholder survey, N=108

Type of work agreed to	n	% who answered NA	% who answered limited extent	% who answered about half	% who answered most/all
Manage pest animals	35	20%	14%	20%	46%
Manage weeds	35	3%	9%	23%	66%
Manage stock access	35	26%	0%	9%	66%
Maintain fences	35	20%	6%	9%	66%
Revegetate	35	17%	26%	14%	43%

3.03.3 Findings from the key informant interviews

What is understood by long-term commitment

While the success of a program like the river health project can be determined in part by its short term outcomes (e.g. amount of riparian fencing erected), many resource managers hope to see longer term goals achieved – such as landholders' on-going commitment to better natural resource management. What needs further consideration, however, is an understanding of how we should define long-term commitment – so that we know what we are attempting to achieve and assess; and what we might do to help engender long-term commitment.

Our discussions with key informants indicted that long-term commitment was a difficult concept for them to define. However, our discussions suggest that long-term commitment involves a set of attitudes and behaviours that they can recognise, either in conversation or when visiting a property, including:

- landholders acknowledging they are responsible for maintaining the infrastructure provided;
- landholders undertaking the ongoing maintenance of infrastructure provided;
- landholders engaging in sound/appropriate land management before and after the installation of infrastructure;
- ongoing landholder participation in NRM programs (e.g. Bush Tender); and
- landholders demonstrating that they accept the public-good value of caring for riparian areas.

Our discussions with key informants and landholders provided some additional insights into their construction of the concept of long-term commitment, including:

- long-term for some interviewees extended beyond 10 years and both landholders and project staff mentioned 20 year time-frames.
- some landholders emphasised the need for long-term commitment by agencies and governments, including to the cost of maintaining infrastructure, such as fences damaged by floods. Some landholders also wanted commitment to ongoing engagement through one-on-one extension to reinforce the value of volunteer contributions and enable landholders to learn to better manage riparian areas.
- an implicit understanding that scientific knowledge/understanding and community values/standards change over time and that this temporal dimension to NRM needs to be part of any concept of long-term commitment.

The following quote illustrate some of the ideas identified above:

Its hard to define in simple words ... when you are in a conversation with someone you get a sense of where they are coming from ... the more conversation you have the more you get that sense ... certainly I would meet people who seemed open to learning, which I always thought was a good sign ... or [they had] a significant amount of knowledge [about NRM] already – they already had learned a lot ... there were people who had a willingness to try out something that was a bit out on a limb. I thought that if they were willing to go out on a limb, there is something there for them ... they are going to follow it up ... [it is also about] ... what the land looks like - before the fence goes up ... which may or may not putting plants in the ground. It may

involve a different way of stocking. It probably involves less stocking ... better quality land management. [It is] also in what they show you. Some people choose to show you their problems. Some people choose to show you what they are proud of ... the people who show you the little patch of bushland ... it shows that they are switched on to something.

Yeah there was quite a few that got bush tender. Well it's been good for the good operators ... it's helped them understand [better land management] and then people have been able to see the improvements of the frontage and the regeneration of black box, your native grasses coming back, just the health of that and that's a good probably selling point for the project.

Building long-term commitment

Some of the key informants also talked about what was needed to help build long-term commitment amongst landholders. Their responses, either explicitly or implicitly, reflected a belief that long-term commitment was easier to achieve by working with landholders who were already willing to engage in improved natural resource management; was the result of long-term engagement informed by understanding of the context in which landholders operate and individual's goals/aspirations and capacity; and was built on the demonstration of successful program outcomes on the ground.

Each of these preconditions will represent substantial challenges for NRM programs and practitioners. In the first instance, NRM agencies will need to give considerable thought to the level and rates of implementation that is needed to achieve desired outcomes, including the level of implementation over time at property and sub-catchment scales; and the extent that objective(s) can be accomplished with willing participants, with and without extension or cost-sharing support. Secondly, it is difficult to demonstrate success given that in many instances in NRM we don't have a clear understanding of causality and the final goal is uncertain and most likely to change over the long-term. Under these circumstances, effective/practical NRM will almost certainly involve some "shifting of the goal posts". If that is the case, then learning becomes critical to success and extension approaches are likely to be needed to engage "willing" and "less-willing" landholders. To the extent that learning is critical, agencies will need to employ highly competent extension staff, preferably with a commitment to working with landholders over a number of years. This continues to be a major challenge given the short-term nature of programs and the common practice of employing extension staff on entry-level conditions.

The following quotes illustrate some of the key points about the need to focus on learning, the capacity to adapt over time; and the role of onground demonstrations of project effectiveness.

With our experience we sort of know who the good landholders are, who the issues are going to be with ... it's [about] understanding what makes them tick isn't it? Like what are they thinking ... and they won't tell you that straight up ... [not] until they sort of get a bit of a rapport with you.
... some [landholders] are quite enthusiastic, and their neighbours see a difference
… there is a fair bit of natural regeneration occurring – they recognize that is does

look better and that there are benefits, and which outweigh having the area fenced off.

[People want] information about what other issues are going on in the catchment ... how to better manage the riparian areas once the fences are in ... the CMA is working on the river and some of that technical information ... landholders need to and want to know more about how to make things work in the longer term.

Landholder visions or plans for the future

Interviewees were asked if they had any long-term plans for the way they used and managed their riparian areas.

Most of the non-participants tended to be more production-focused when considering how they would manage their riparian areas into the future. Their responses were typically framed by stating that they had no plans to change what they were doing. Where they talked about a future vision for their sites, they tended to speak primarily about seeking increased soil and bank stability and reduced weeds as is illustrated by the following quote.

Well, certainly part of fencing it off is stabilising the river banks and stuff and so with the growth of these trees if it's a case of having too many in there, just sort of having a more stable banks on the stream really.

One non-participant who had fenced off most of his riparian area to manage stock access to the frontage was also interested in seeing an increase in soil and bank stability, but also felt that some natural regeneration – primarily of trees – was desirable. Another non-participant who had completed extensive fencing along his property had long-standing and very strong interests in improving both the productivity of his property and the ecological functioning of the riparian areas. Despite plans to exit farming in the near future – his family hoped to see the next owner of the property maintain and continue to improve the creek frontage:

... when we leave here I would say that, you know, [I would like it if] the creek's in a better state than when we came ... our land's sort of our greatest asset and ... probably in a lifetime you make nearly as much out of capital appreciation as you do out of the projects you sell so I think it's, you know, I think looking after your land, improving your land, it's an important issue.

Many of the project participant interviewees had clear long-term visions for their riparian areas that were focused on improved conservation/ecological values and some recreational values. Two interviewees wanted their properties to stand as examples of good stewardship that could in turn, encourage other landholders to follow suit. Some interviewees also felt that those values went hand-in-hand with having a more productive property overall. Generally, these participants talked about being committed to leaving their riparian areas and their property in the best possible condition they could (e.g. "... leaving it as pristine as possible ..."). Several interviewees talked about removing weeds, facilitating regeneration of native vegetation, attracting native wildlife, and improving the recreational and aesthetic values of the riparian area – as is illustrated in the quotes below. This evidence

suggests these participants were committed to maintaining the ecological integrity/function of those areas. In other research we have identified the goal of "leaving the land in better condition" as a personal norm that almost all landholders ascribe to. While there are differences in individual interpretation of what "better condition" means, there are common threads that should guide communication and extension efforts. "Better condition" can involve improving the farm business, infrastructure or environmental health. It is also possible for NRM programs to establish new social norms and these can be powerful influences on landholder behaviour and lead to long-term commitment to program goals.

I'll probably fence off all of the creek so I can fully manage the whole creek frontage ... I'd probably plant a few more diversity of plants on it ... [it would be good to] maintain a diversity of trees and plants ... [then] you're going to have a diversity of birds and presumably that would also enhance the fish or insects, well the insects and then with the insects you've got food for fish so it's a complete cycle ... that's the thing about it at the moment - it is a very unique creek because it is a very, it has a lot of natural integrity and it's a very beautiful creek for most of it especially along my creek section of it, it's a very pretty creek. And there is a great diversity of birds and there is some diversity of animals from platypus to wallabies, I'm not sure about the fish or what's living in the water but I'd like to see that enlarged so that there is more platypus and, yeah, the … so I suppose my 10 year view would be to see a dynamic healthy diverse creek frontage.

The plan simply is to maintain in as pristine a condition as possible. If there are any weeds we will try and remove them. No revegetation, because there seems to be good regeneration under our current management. In 10 years we want to see it pretty much in condition that it is in at the moment. I can see a natural progression. The red gums are pretty much the only trees that grow down there. And then the reeds are significant. Also there is a lot of couch grass that holds the banks together and that is pretty significant.

Our long-term vision? ... not to change what we are doing now ... to enhance [the riparian area] ... we want to protect what is there ... and to try and encourage other landholders to protect and enhance river and anabranches ... if we sell [the property] we'd like to instil that vision onto the next owner ... but there's no guarantee.

4.0 Background data for respondents

4.1 Property data

Table 17: Property data
Loddon river health projects 2009 landholder survey (N=108)

Topics	n	% or median
Property size	105	125 ha
Distance the Loddon River runs along/through the property (one side)	99	1,000 m
Total length of Loddon River frontage, including both sides (if applicable)	46	2500 m
Have a riparian right for some part of the river frontage	86	56%
Have a Loddon River Crown Water Frontage	99	74%
Period of property ownership or management	105	15 yr
Property owned or operated by others in family	105	37%
Period property has been in family	57	60 yr
Property is the principal place of residence	106	55%
Period lived in the local district	93	30yr

Table 18: Property size
Loddon river health projects 2009 landholder survey, N=108

n=	median hectares	0 to 40 ha	41 to 160 ha	161 to 415 ha	416 to 850 ha	851 to 2,800 ha
105	125 ha	40%	16%	14%	18%	9%

Table 19: Distance Loddon River runs along/ through property (one side)
Loddon river health projects 2009 landholder survey, N=108

Distance in metres, % of respondents in each category							
n=	Median metres	0 to 500 m	501 m to 700 m	701 m to 2,100 m	2,101 m to 4,000 m	4,001 m to 7,000 m	7,001 m to 12,000 m
99	1000m	31%	3%	30%	13%	13%	7%

Figure 7: Property previously owned or operated by others in family
Loddon river health projects 2009 landholder survey, N=108 (n=105)

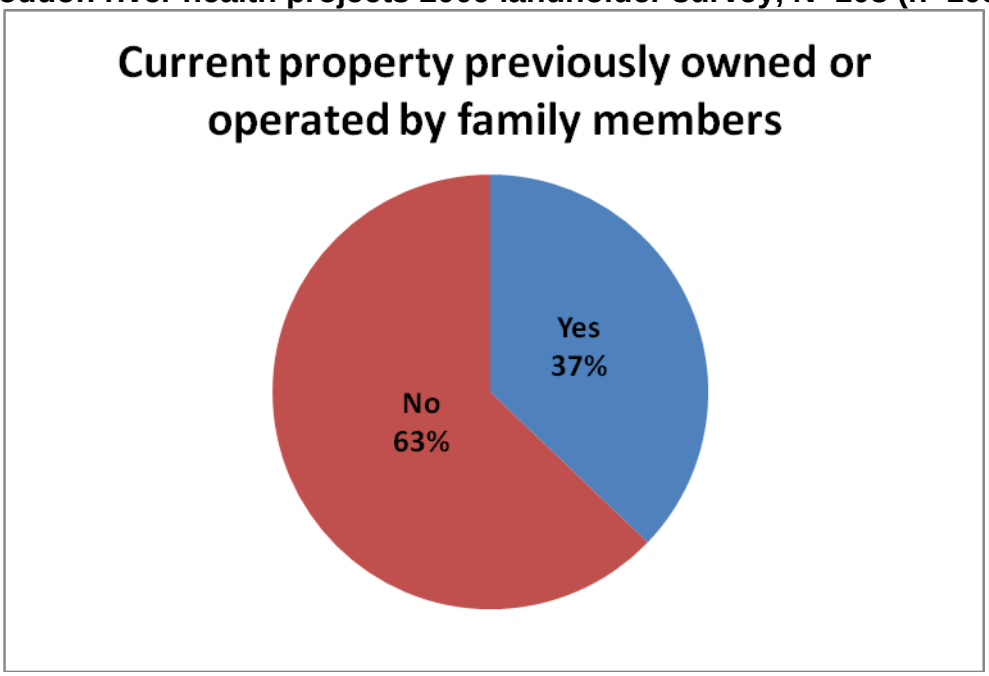
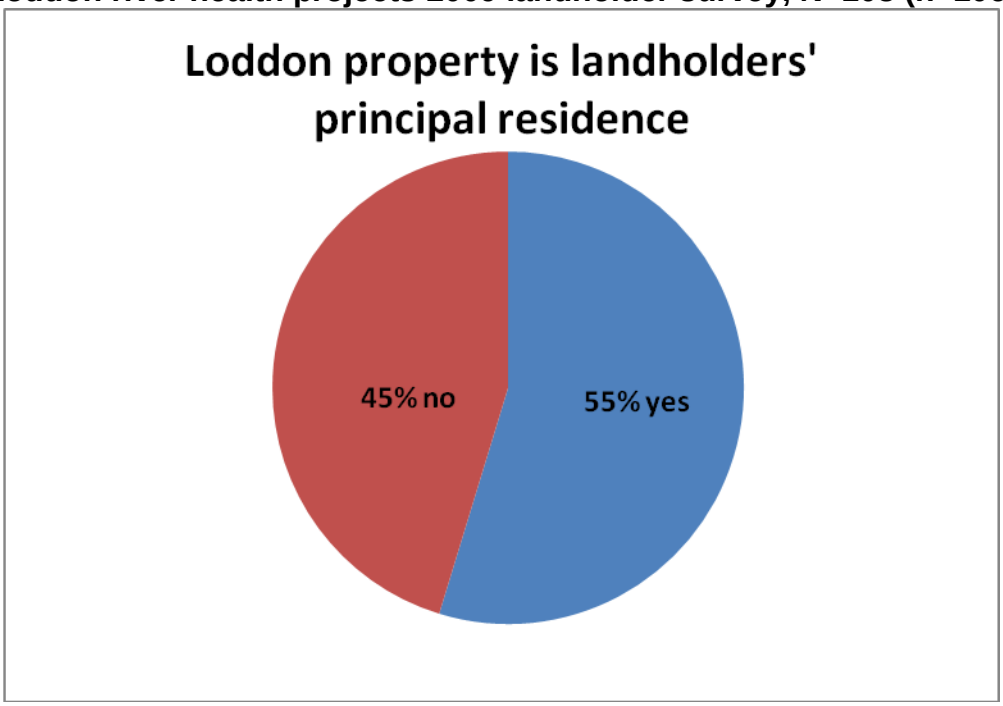


Figure 8: Property is the principal place of residence
Loddon river health projects 2009 landholder survey, N=108 (n=106)



4.2 Social data

Table 20: Social data
Loddon river health projects 2009 landholder survey (N=108)

Topics	n=	% or median
Age	100	55 yrs
Gender (% males)	104	90%
Farmer occupation	103	47%
Grazing as the main farming enterprise	97	33%
Irrigated some part of the property last year (2009)	104	39%
Hours per week worked on farming/property related activities over the past 12 months	99	25 hrs
The estimated number of days that landholders worked (paid) off-property in the past 12 months	95	0 days
Member of a local Landcare group	103	36%
Prepared a property management or whole farm plan	73	56%
Completed or updated the whole farm plan in the last 5 years	77	34%
Completed short course relevant to property management past 5 years	103	34%
The % of landholders that completed a short course and a property management plan in the past 5 years	82	70%
Net off-property income (after expenses and before tax) for landholder or partner last financial year (2008/2009)	96	68%
Total off-property income (before tax) for the of landholder or partner last financial year (2008/2009)	59	$35,000
Net on-property profit (income from the property exceeded all paid expenses before tax) last financial year (2008/2009)	99	36%
Total on-property profit (before tax) from the property last financial year (2008/2009)	33	$15,000
Family members interested in taking on the property in the future	96	42%
Agreed to a succession plan for transfer of the property to next generation	43	69%

Table 21: Age
Loddon river health projects 2009 landholder survey, N=108

Topic	n=	Median years	% aged 0 to 45 years	% aged 46 years to 65 years	% aged 66 years & above
Age	100	55 yrs	17%	63%	20%

Figure 9: Gender
Loddon river health projects 2009 landholder survey, N=108 (n=104)

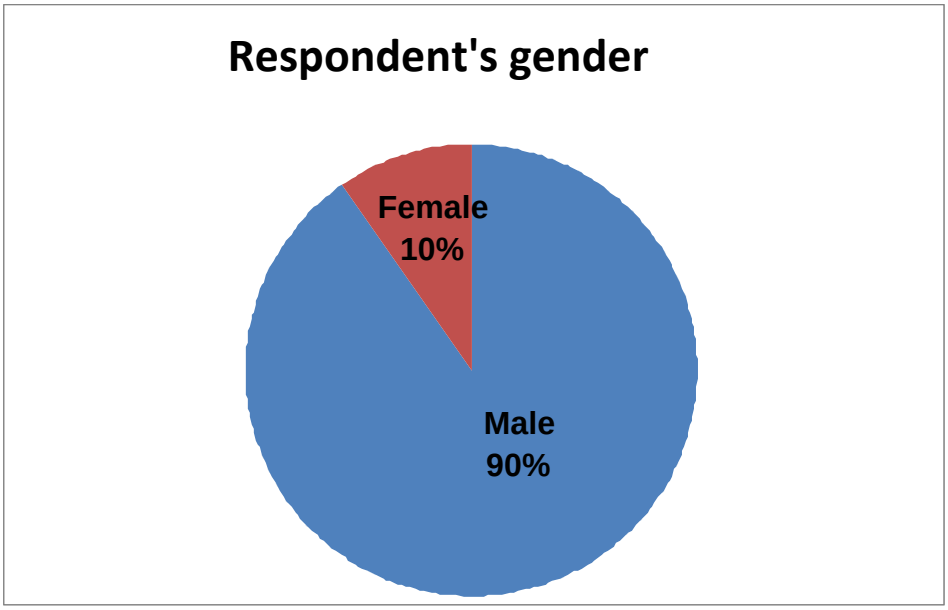


Table 22: Occupation
Loddon river health projects 2009 landholder survey, N=108

Occupation	n=	farmer	other agriculture	professional	retiree	trade
	103	47%	9%	17%	17%	11%

Figure 10: Farmer and other occupations
Loddon river health projects 2009 landholder survey, N=108 (n=103)

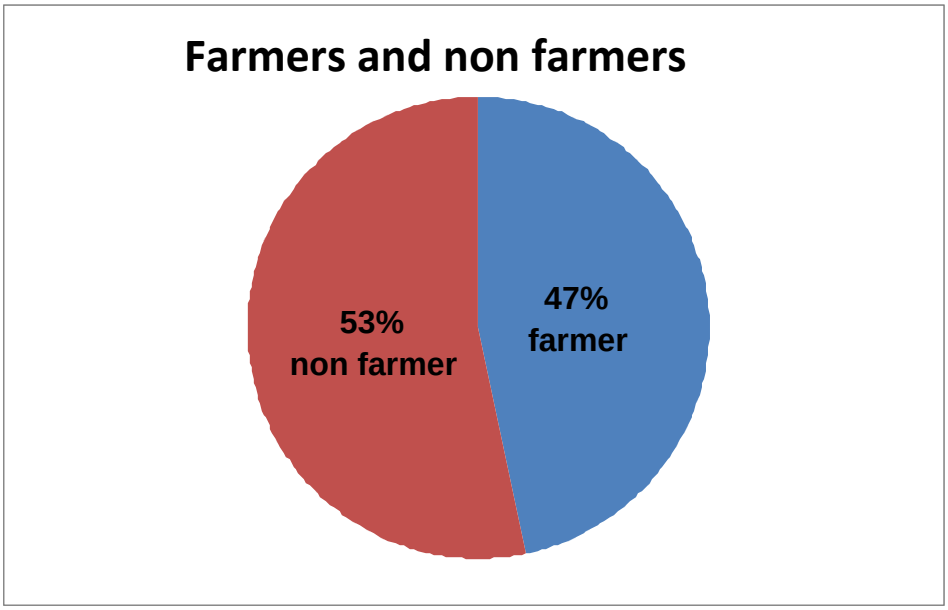


Table 23: Property enterprise mix
Loddon river health projects 2009 landholder survey, N=108

Mix	Mostly livestock grazing*	Mostly dairying*	Mixed crop and livestock	No enterprise	Mostly horticulture/ viticulture	Mostly cropping	other
n=97	27%	6%	38%	14%	3%	4%	7%

** Note: The 33% of respondent's main enterprise is livestock grazing, referred to as "stockers"*

Figure 11: Hours worked on farming/property activities past 12 months:
Loddon river health projects 2009 landholder survey, N=108 (n=99)

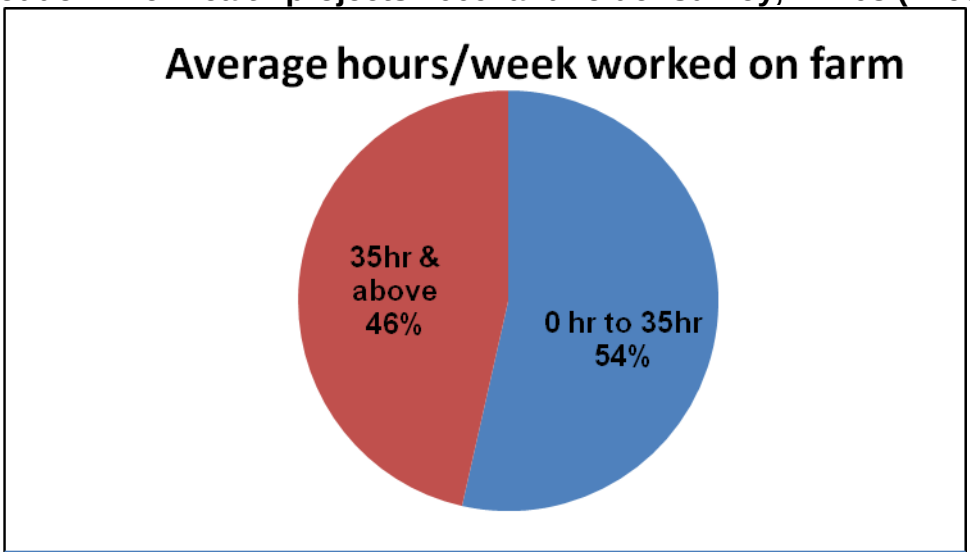


Figure 12: Days paid off-property work in the past 12 months
Loddon river health projects 2009 landholder survey, N=108 (n=95)

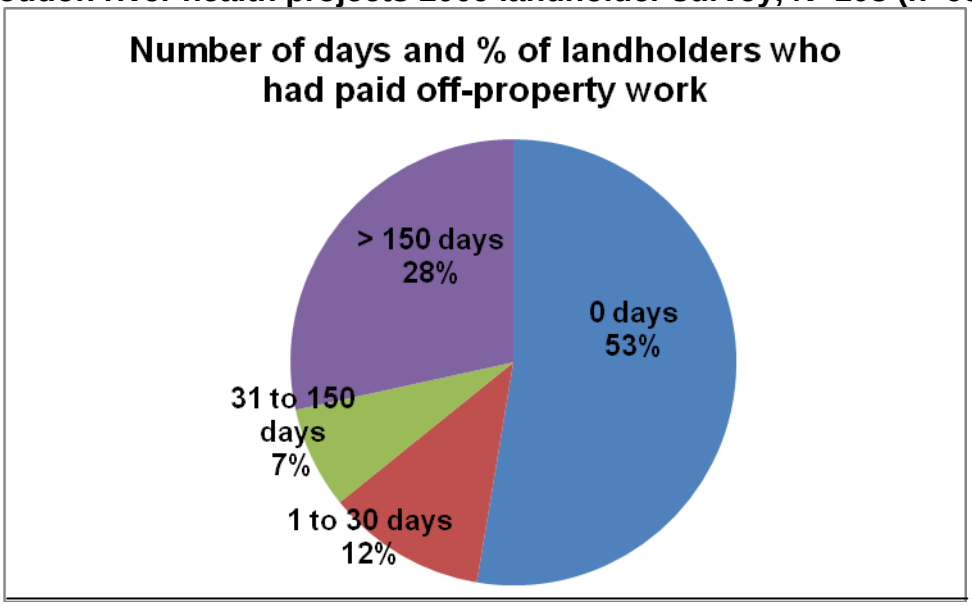


Table 24: Landcare participation
Loddon river health projects 2009 landholder survey, N=108

Topic	n=	% Yes	% No
Current member	103	36%	64%
Previous member	67	21%	79%
LC participant (current or had been a previous member)	103	50%	50%

Figure 13: Completed a short course relevant to property management
Loddon river health projects 2009 landholder survey, N=108 (103)

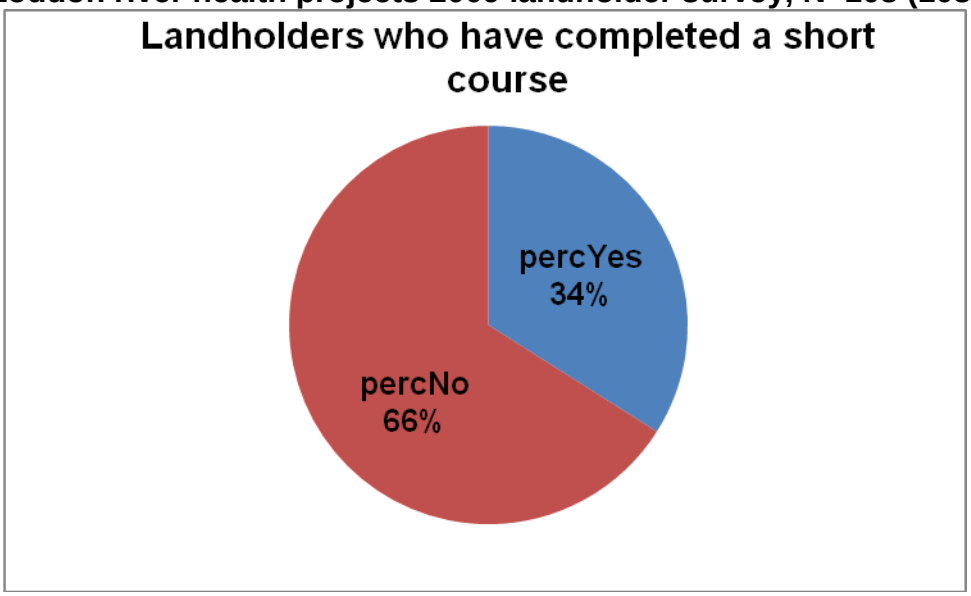


Table 25: Amount of on and off-property profit/income (2008/2009)
Loddon river health projects 2009 landholder survey, N=108

On-property profit			Off-property income		
36% reported a profit			68% reported off-property income		
n	range	% in range	n	range	% in range
33	Less than $10,000	15%	59	Less than $10,000	10%
33	$15,000	39%	59	$15,000	14%
33	$25,000	9%	59	$25,000	22%
33	$35,000	6%	59	$35,000	8%
33	$45,000	6%	59	$45,000	7%
33	$55,000	9%	59	$55,000	5%
33	$60,001 to $100,000	12%	59	$60,001 to $100,000	15%
33	Above $100,000	3%	59	Above $100,000	19%
33	**Overall**	**$15,000 median**	**59**	**Overall**	**$35,000 median**

Figure 14: Involved in property management planning
Loddon river health projects 2009 landholder survey, N=108 (n=73)

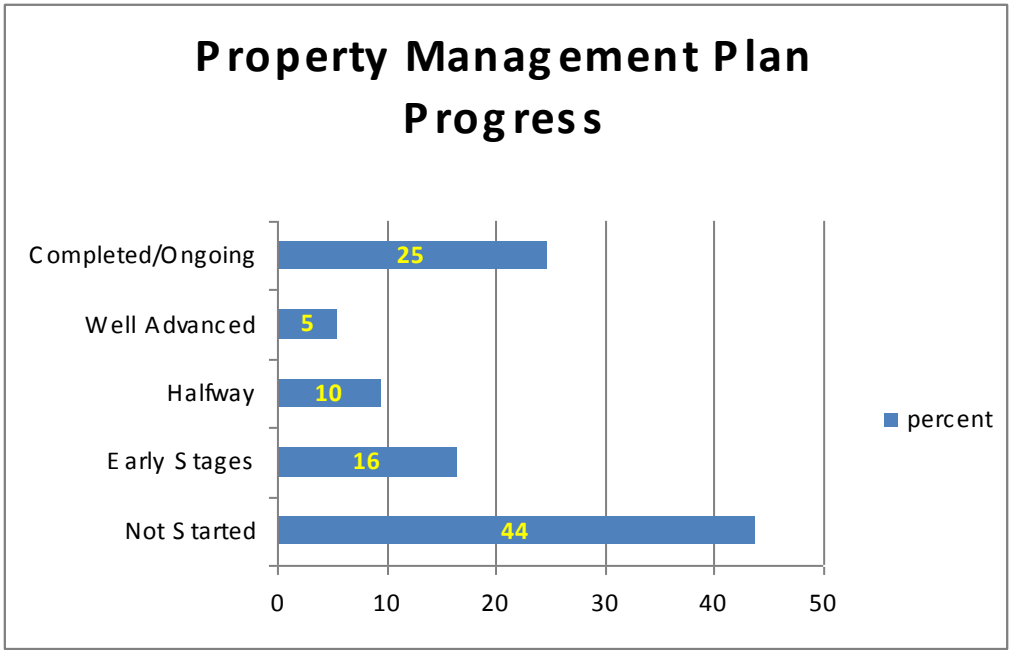
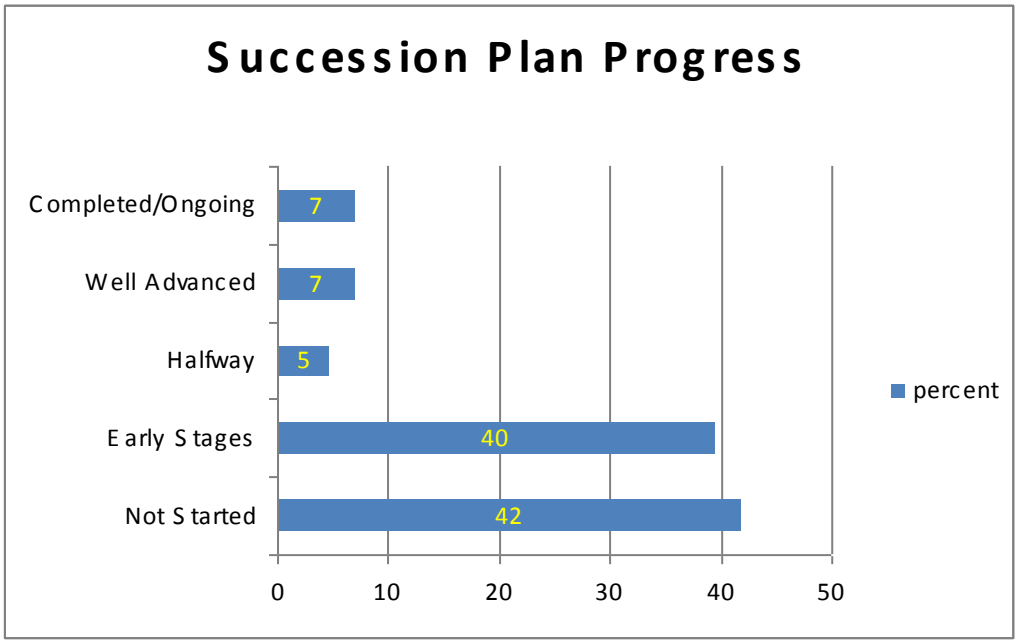


Figure 15: Involved in property succession planning
Loddon river health projects 2009 landholder survey, N=108 (n=43)



4.3 Other survey topics

Table 26: Assessment of property issues
Loddon river health projects 2009 landholder survey, (N=108)

How important are these issues for your property?	n=	% N/A	% not important	% some	% important	mean score
Rising cost of farming inputs undermining financial viability	103	18%	9%	8%	65%	4.08
Having the right to use surface or ground water for irrigation	103	17%	11%	7%	66%	4.06
Impact of changing rainfall patterns on property viability	103	8%	10%	16%	67%	3.95
Uncertain/low returns limiting capacity to invest in property	103	20%	12%	15%	53%	3.72
The cost of managing weeds and pest animals affecting profitability	103	8%	26%	17%	49%	3.34
The right to increase on-property water storage	103	14%	30%	17%	39%	3.12
Salinity undermining long-term productive capacity	103	21%	31%	17%	31%	3.07
Declining soil health (e.g. declining fertility or structure)	103	11%	36%	18%	35%	3.03
Availability of labour for important on-property work	103	19%	34%	13%	34%	2.88
State/ local government planning rules limiting your ability to subdivide	103	24%	38%	14%	24%	2.74

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

Photo: R. Sample

Table 27: Assessment of district issues
Loddon river health projects 2009 landholder survey, N=108

How important are these issues for your district/ catchment?	n=	% N/A	% not important	% some	% important	mean score
Getting the balance between water for the environment, agriculture, town water supply and recreation	103	4%	2%	10%	84%	4.36
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	103	8%	17%	7%	69%	3.93
The effects of increased ground and surface water extraction	103	8%	15%	12%	66%	3.91
Growth of in-stream vegetation affecting the Loddon River	103	6%	18%	16%	60%	3.73
The impact of recent and future clearing of native bush and grasslands	103	8%	27%	16%	50%	3.55
Increasing land prices constraining opportunities for farmers to expand their properties	103	9%	28%	24%	39%	3.10

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

Photo: R. Sample

Figure 16: Assessment of river health issues
Loddon river health projects 2009 landholder survey, N=108 (n=103)

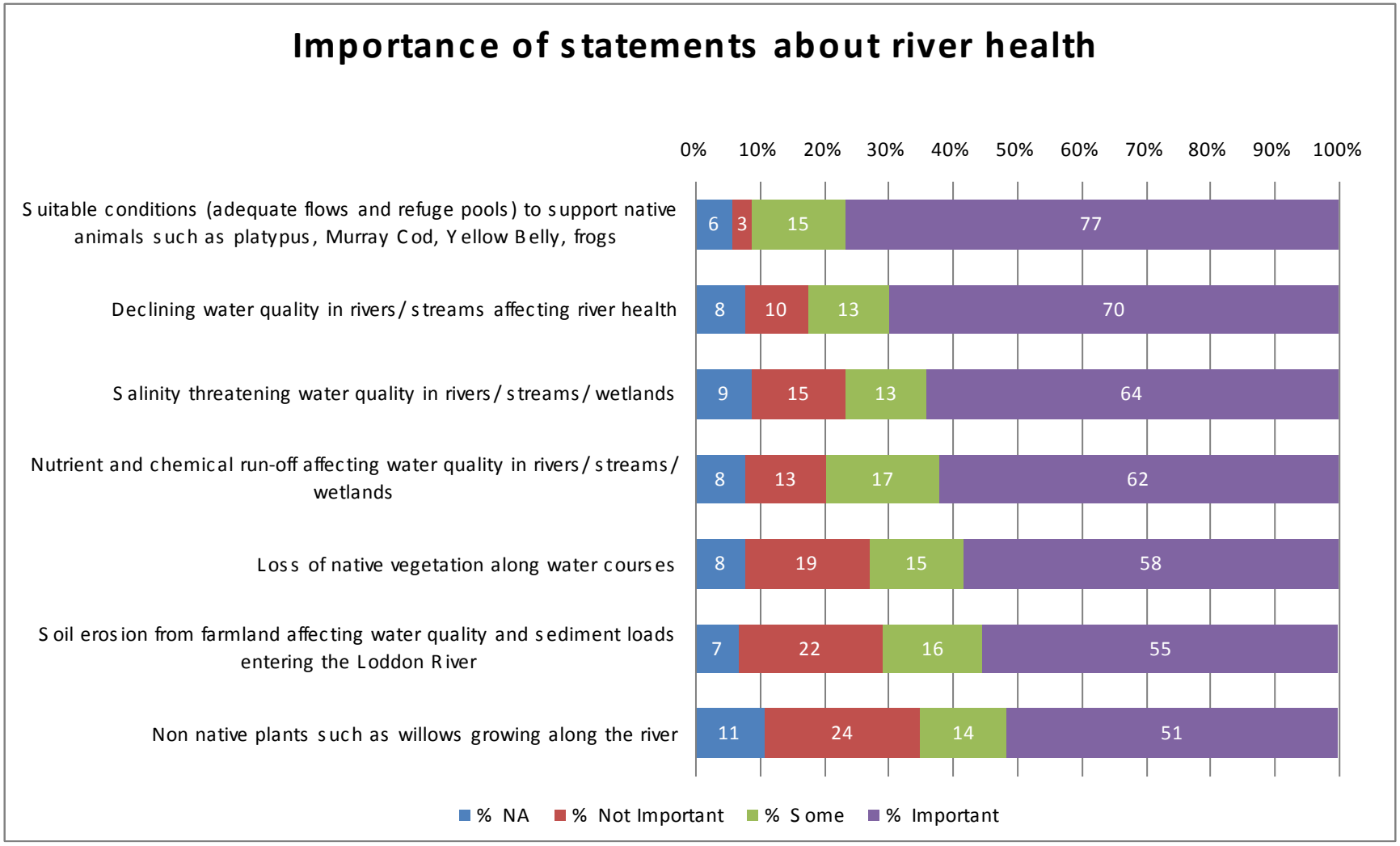


Table 28: Values
Loddon river health projects 2009 landholder survey, N=108

Why the Loddon River and adjoining land is important to you? (environmental, economic, and social values)	n=	% N/A	% not important	% some	% important	mean score
Provides habitat for native birds	104	3%	4%	8%	86%	4.40
Is an attractive area of the property	104	3%	2%	10%	86%	4.39
Is a peaceful place to be	104	3%	5%	10%	83%	4.29
Place where native animals live on land	103	2%	11%	17%	70%	3.99
Adds to the market value of the property	104	5%	8%	19%	68%	3.98
Is a habitat corridor (allowing wildlife to move between areas)	103	2%	12%	17%	69%	3.88
Vegetation on the frontage holds the banks and stops erosion	104	3%	13%	18%	65%	3.85
I rely on the river for irrigation water	105	50%	11%	7%	32%	3.70
Provides a place for recreation for me, my family and friends	105	6%	16%	19%	59%	3.69
Provides a source of nutrients for in-stream plants and animals	104	8%	15%	22%	55%	3.65
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	102	3%	20%	21%	57%	3.64
Provides access to water for stock	105	30%	26%	9%	36%	3.36
In-stream vegetation traps and stabilises sand/gravel	104	11%	25%	16%	48%	3.32
Provides important shade and shelter for stock	104	28%	26%	12%	35%	3.28
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	103	17%	26%	18%	38%	3.18
A place for me, my family and friends to fish	105	18%	35%	15%	31%	2.99
Provides additional land for grazing stock, particularly in summer	104	38%	32%	10%	20%	2.77
Provides timber for fence posts and fire wood	103	48%	33%	13%	7%	2.11
Stewardship scale item	**n**	**% N/A**	**disagree/ strongly disagree**	**not sure**	**agree/ strongly agree**	**mean score**
Reduced production in the short-term is justified where there are long-term benefits to the environment	103	5%	10%	21%	64%	3.73

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

Table 29: Knowledge of different topics
Loddon river health projects 2009 landholder survey, N=108

Knowledge Topics	n=	N/A	no/ very little knowledge	some knowledge	sound/ very sound knowledge	mean score
The effects of unrestricted stock access to water ways	103	13	7%	36%	45%	3.60
The production benefits of retaining native vegetation on farms	101	7	10%	37%	47%	3.52
How to manage ground cover on paddocks used for grazing to minimise soil erosion and resulting sedimentation of water ways	103	17	10%	34%	40%	3.49
The role of environmental flows in the Loddon River to maintain a healthy river system	103	5	17%	36%	42%	3.41
The ability of perennial vegetation and standing stubble to improve the quality of runoff water	102	5	14%	42%	39%	3.39
The role of large logs and river side vegetation in supporting native fish species	104	5	14%	43%	38%	3.37
The role of river frontages as corridors supporting the movement of animals from one area to another	103	8	14%	44%	35%	3.32
The contribution of floodplain wetlands towards the health of the Loddon River	101	3	31%	31%	36%	3.09
How to prepare a farm or property plan that allocates land use according to different land classes	102	11	30%	27%	31%	3.03
Predicted impact of climate change on river flows in the Loddon catchment	100	4	30%	46%	20%	2.84
How to access information about government support for landholders to better manage Crown Land river frontages	102	6	49%	28%	17%	2.54

Note: mean is where 1 = strongly disagree through to 5 = strongly agree

Table 30: Attitudes to stakeholder roles and responsibilities
Loddon river health projects 2009 landholder survey, N=108

Your views about aspects of land & water management	n=	N/A	disagree/ strongly disagree	not sure	agree/ strongly agree	mean score
Landholders should be paid for providing environmental services that benefit the wider community (e.g. Managing habitat for native animals)	105	1%	5%	18%	76%	4.07
New owners should abide by agreements entered into by previous owners where public funds have paid for land protection or conservation work	104	6%	7%	16%	71%	3.94
Governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Land Frontage leases	103	2%	18%	26%	53%	3.40
Landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	103	2%	18%	29%	50%	3.34
In most cases, the public should have the right of access to river frontages that are managed by private landholders	104	2%	38%	26%	34%	2.82

Note: mean is where 1 = strongly disagree through to 5 = strongly agree

Photo: R. Sample

Table 31: Long-term property plans
Loddon river health projects 2009 landholder survey, N=108

Likelihood your long-term plans will involve: 5 to 20 years	n	% N/A	% unlikely	% not sure	% likely	mean score
I will live on the property for as long as possible	87	14%	5%	20%	62%	3.97
Ownership of the property will stay within the family	88	1%	16%	36%	47%	3.46
I will reduce the extent of my off-property work	85	49%	12%	16%	22%	3.21
The property will be sold	87	9%	28%	30%	33%	3.04
The enterprise mix will be changed to more intensive enterprises	87	26%	33%	24%	16%	2.61
The enterprise mix will be changed to reduce my farm workload	88	26%	34%	25%	15%	2.60
All or some part of the property will be placed under a conservation covenant	84	19%	37%	29%	15%	2.49
Additional land will be purchased, leased or share farmed	87	16%	41%	24%	18%	2.48
I plan to introduce/ expand irrigation on my property	86	20%	44%	17%	19%	2.33
I will sell all or part of my irrigation water entitlement	86	27%	42%	17%	14%	2.30
I will seek additional off-property work	85	29%	44%	14%	13%	2.25
The property will be subdivided and part of the property sold	87	23%	53%	18%	6%	1.90
All or most of the property will be leased or share farmed	88	26%	58%	14%	2%	1.77

Note: mean is where 1 = strongly disagree through to 5 = strongly agree

Table 32: Confidence in/acceptability of recommended practices Loddon river health projects 2009 landholder survey, N=108

Your views about aspects of management of waterways and adjoining land in your district	n=	N/A	disagree/ strongly disagree	not sure	agree/ strongly agree	mean score
Dead trees or timber on the ground in river frontages are important habitat for native birds and animals	105	1%	9%	9%	82%	4.01
Areas of native vegetation along waterways with limited stock access are able to trap nutrients before they enter waterways	104	4%	4%	23%	69%	3.91
Removing willows is an important part of work to improve the condition of native vegetation on river frontages	105	13%	13%	11%	62%	3.79
The time and expense involved in watering stock off-stream is justified by improvement in river water quality	104	5%	9%	27%	60%	3.72
Intensive grazing for short periods is usually better than set stocking for retaining native vegetation in paddocks with river frontages	105	4%	9%	34%	53%	3.58
Domestic stock have had substantial impact on the stability of the river bank	104	3%	19%	26%	52%	3.46
Fencing river frontages is not practical because floods will damage fences ***	105	4%	50%	18%	29%	2.67
Grazing of domestic stock has had little impact on the existence and diversity of native vegetation on river frontages ***	104	5%	45%	26%	24%	2.63

**** These items are expressed in the negative. That is, those that agreed with the statement were expressing that they disagreed with the recommended practice.*
Note: mean is where 1 = strongly disagree through to 5 = strongly agree

Photo: R.Sample

Table 33: Implementation of recommended practices, activities undertaken
Loddon river health projects 2009 landholder survey, N=108

Survey item	n=	n yes	% yes	% no	% N/A	median those who said yes
Practices undertaken during your management						
Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)	102	61	60%	There was no yes/no option		1,500 m
Area of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)	102	53	52%			20 ha
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) during your management of the property (number of trees)	102	29	28%			300 plants
Removed willows during your management of the property	102	13	13%	29%	58%	na
Removed willows and replaced them with native vegetation during your management of the property	102	3	3%	36%	61%	na
Placed large woody debris or snags in the water way as fish habitat	102	6	6%	67%	26%	na
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property (number) ***	68	37	54%	There was no yes/no option		5
Practices undertaken in the last 5 years (since early 2005)						
Number of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank) (number of trees)	102	17	17%	There was no yes/no option		200 plants
Length of fencing erected near the river to manage stock access to the water way (metres) ***	68	30	44%			2,500 m
Willows removed	102	9	9%	28%	63%	NA
Willows removed and replaced with native vegetation	102	3	3%	38%	59%	NA
Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property (number) ***	102	6	6%	67%	26%	NA
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth	68	29	43%	57%	0%	NA
Days per year poisoning/removing woody weeds (gorse, blackberries or willow regrowth)	101	94%	47%	22%	32%	5 days

Practices undertaken this year (2009)						
Survey item	**n=**	**n that said yes**	**% yes**	**% no**	**% N/A**	**median of those who said yes**
During 2009, did stock graze any part of your river frontage for more than a week at a time? (Circle YES or NO) ***	45	45	100%	0%	0%	NA
During 2009, did stock access drinking water from any part of your river frontage for more than a week at a time? ***	67	32	48%	52%	0%	NA
Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth	67	29	43%	57%	0%	NA
Days per year poisoning/removing woody weeds (gorse, blackberries or willow regrowth)	37	37	100%	0%	0%	5 days

*** *Statements where only responses from those landholders that were identified as having a livestock enterprise were used*

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5.0 REFERENCES

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6.0 APPENDICES

Appendix 1: Summary of relationships between river health project participation and intermediate outcomes

Awareness of issues (Pairwise comparison results ranked in "order of merit")

Declining water quality in rivers/ streams affecting river health	
Personal	*Overall rank*
More days of paid off-property work last 12 months	14
Yes, had a net on-property profit (income from your property exceeded all paid expenses before tax) last financial year (2008/2009)	19
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	22
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides a source of nutrients for in-stream plants and animals	8
Vegetation on the frontage holds the banks and stops erosion	9
Is a habitat corridor (allowing wildlife to move between areas)	11
Place where native animals live on land	12
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	13
Is an attractive area of the property	17
In-stream vegetation traps and stabilises sand/gravel	21
Stewardship (held value) (more important rating to this statement about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	6
Attitudes	
Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	20
Long-term plans	
All or some part of the property will be placed under a conservation covenant	18
Property issues (more important rating to these statements)	
Declining soil health (e.g. declining fertility or structure)	5
Salinity undermining long-term productive capacity	10
The cost of managing weeds and pest animals affecting profitability	15
Rising cost of farming inputs undermining financial viability	16
District Issues (more important rating to these statements)	
The effects of increased ground and surface water extraction	1
The impact of recent and future clearing of native bush and grasslands	2
Growth of in-stream vegetation affecting the Loddon River	3
Getting the balance between water for the environment, agriculture, town water supply and recreation	4
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	7

Results from regression modelling for: *Declining water quality in rivers/ streams affecting river health*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health projects implemented by the North Central CMA and DPI during last five years
2. More important rating to the issue: Increasing land prices constraining opportunities for farmers to expand their properties
3. More important rating to the issue: The impact of recent and future clearing of native bush and grasslands

The amount of variance in the dependent variable explained by the model: R^2=46.5%.

Awareness of issues (Pairwise comparison results ranked in "order of merit")

Soil erosion from farmland affecting water quality and sediment loads entering the Loddon River	
Personal	*Overall rank*
More days of paid off-property work last 12 months	16
Shorter period of residence in local district	20
Younger age	22
Shorter period of family ownership or operation of property	27
Didn't have a net on-property profit (income from your property exceeded all paid expenses before tax) last financial year (2008/2009)	31
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	36
Absentee resident (property not principal residence)	38
Attached values (more important rating to these statements about the Loddon River on their place)	
Vegetation on the frontage holds the banks and stops erosion	5
Provides a source of nutrients for in-stream plants and animals	7
Is a habitat corridor (allowing wildlife to move between areas)	10
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	12
Place where native animals live on land	13
Is a peaceful place to be	18
Is an attractive area of the property	19
In-stream vegetation traps and stabilises sand/gravel	25
Provides a place for recreation for me, my family and friends	33
Provides habitat for native birds	34
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	35
Stewardship (held value) (more important rating to this statement about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	17
Attitudes	
Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the	15

environment	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	21
Short-term plans	
Additional land will be purchased, leased or share farmed	28
Long-term plans	
Additional land will be purchased, leased or share farmed	29
All or some part of the property will be placed under a conservation covenant	30
Property issues (more important rating to these statements)	
Declining soil health (e.g. declining fertility or structure)	6
Salinity undermining long-term productive capacity	8
The cost of managing weeds and pest animals affecting profitability	11
Rising cost of farming inputs undermining financial viability	14
The right to increase on-property water storage	23
Uncertain/low returns limiting capacity to invest in property	24
Impact of changing rainfall patterns on property viability	32
Availability of labour for important on-property work	37
District Issues (more important rating to these statements)	
The impact of recent and future clearing of native bush and grasslands	1
The effects of increased ground and surface water extraction	2
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	3
Growth of in-stream vegetation affecting the Loddon River	4
Getting the balance between water for the environment, agriculture, town water supply and recreation	9
Increasing land prices constraining opportunities for farmers to expand their properties	26

Results from regression modelling for*: Soil erosion from farmland affecting water quality and sediment loads entering the Loddon River*

Using multiple linear regression modelling, these variables provided the "best" model:

1. More important rating to the issue: Impact of changing rainfall patterns on property viability
2. More important rating to the issue: Increasing land prices constraining opportunities for farmers to expand their properties
3. Whether the property returned a net profit (income from your property exceeded all paid expenses before tax) last financial year (2008/2009)
4. More important rating to the value: Is an attractive area of the property
5. Longer period of residence in district

The amount of variance in the dependent variable explained by the model: R^2=77.1%

Awareness of issues (Pairwise comparison results ranked in "order of merit")

Suitable conditions (adequate flows and refuge pools) to support native animals such as platypus, Murray Cod, Yellow Belly, frogs	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	23
More days of paid off-property work last 12 months	24
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	1
Place where native animals live on land	2
Provides a source of nutrients for in-stream plants and animals	5
Vegetation on the frontage holds the banks and stops erosion	6
Provides habitat for native birds	7
Is an attractive area of the property	8
In-stream vegetation traps and stabilises sand/gravel	9
Is a habitat corridor (allowing wildlife to move between areas)	10
Is a peaceful place to be	11
Provides a place for recreation for me, my family and friends	15
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	26
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	13
Attitudes	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	12
Agreed that new owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work	20
Short-term plans	
Not intending to subdivide and sell part of the property	18
Ownership of the property will stay within the family	19
All or some part of the property will be placed under a conservation covenant	22
Long-term plans	
All or some part of the property will be placed under a conservation covenant	17
Property issues (more important rating to these statements)	
Salinity undermining long-term productive capacity	21
District Issues	
The impact of recent and future clearing of native bush and grasslands	3
The effects of increased ground and surface water extraction	4
Growth of in-stream vegetation affecting the Loddon River.	14
Getting the balance between water for the environment, agriculture, town water supply and recreation	16
Increasing land prices constraining opportunities for farmers to expand their properties	25

Results from regression modelling for: *Suitable conditions (adequate flows and refuge pools) to support native animals such as platypus, Murray Cod, Yellow Belly, frogs*

Using multiple linear regression modelling, these variables provided the "best" model:

1. More important rating for value: Place where native animals live on land
2. More important rating to issue: Increasing land prices constraining opportunities for farmers to expand their properties
3. More days of paid off-property work in the past 12 months

The amount of variance in the dependent variable explained by the model: R^2=48.7%.

Knowledge of river health related topics (Pairwise comparison results ranked in “order of merit”)

How to access information about government support for landholders to better manage Crown Land river frontages	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	1
Member of local Landcare group	2
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	3
Completed a short course relevant to property management in past 5 years (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze)	4
Either a former member or current member of a Landcare group	7
More hours per week worked on farming/property related activities over the past 12 months	8
Property management plan was completed or updated in past 5 years	14
Involved in property management planning	17
Property	
Larger property size	6
Longer distance that the Loddon River runs along/ through the property. (one side)	11
Property previously owned or operated by others in family	15
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides important shade and shelter for stock	5
Provides habitat for native birds	19
Provides access to water for stock	22
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	16
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	9
Agreed that governments must take more responsibility for ensuring	21

landholders meet their responsibilities under Crown Frontage Licences	
Long-term plans	
Unlikely that ownership of the property will stay within the family	18
Property issues (more important rating to these statements)	
Availability of labour for important on-property work	10
Impact of changing rainfall patterns on property viability	20
District issues	
Increasing land prices constraining opportunities for farmers to expand their properties.	12
Getting the balance between water for the environment, agriculture, town water supply and recreation	13

Results from regression modelling for: *How to access information about government support for landholders to better manage Crown Land river frontages*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health projects implemented by the North Central CMA and DPI in the past five years
2. Larger property size
3. More important rating to the issue: Increasing land prices constraining opportunities for farmers to expand their properties
4. More important rating to the value: Provides habitat for native birds

The amount of variance in the dependent variable explained by the model: R^2=38.8%.

Knowledge of river health related topics (Pairwise comparison results ranked in “order of merit”)

The role of river frontages as corridors supporting the movement of animals from one area to another	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	3
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	1
Fewer days of paid off-property work last 12 months	22
More hours per week worked on farming/property related activities over the past 12 months	15
Member of local Landcare group	20
Either a former member or current member of a Landcare group	8
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in the past 5 years	18
Property	
Have a riparian right for some part of the river frontage	14
Attached values (more important rating to these statements about the Loddon River on their place)	
Is an attractive area of the property	19

Provides habitat for native birds	5
Is a habitat corridor (allowing wildlife to move between areas)	4
Place where native animals live on land	9
Provides a source of nutrients for in-stream plants and animals	2
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	13
In-stream vegetation traps and stabilises sand/gravel	6
Vegetation on the frontage holds the banks and stops erosion	17
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	10
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	25
Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	29
Short-term plans	
All or most of the property will be leased or share farmed	7
Will sell all or part of their irrigation water entitlement	21
The property will be sold	30
The property will be subdivided and part of the property sold	27
Additional land will be purchased, leased or share farmed	28
Long-term plans	
All or most of the property will be leased or share farmed	23
The property will be sold	11
Property issues (more important rating to these statements)	
The cost of managing weeds and pest animals affecting profitability	26
District issues	
Getting the balance between water for the environment, agriculture, town water supply and recreation	16
Increasing land prices constraining opportunities for farmers to expand their properties	12
Growth of in-stream vegetation affecting the Loddon River.	24

Results from regression modelling for: *The role of river frontages as corridors supporting the movement of animals from one area to another*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years
2. More important rating for the value: Is a habitat corridor (allowing wildlife to move between areas)
3. More hours per week worked on farming/property related activities over the past 12 months

The amount of variance in the dependent variable explained by the model: R^2=48.6%.

Knowledge of river health related topics (Pairwise comparison results ranked in "order of merit")

The contribution of floodplain wetlands towards the health of the Loddon River	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	2
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	7
More hours per week worked on farming/property related activities over the past 12 months	1
Member of a local Landcare group	19
Either a former member or current member of a Landcare group	13
Farmer by occupation	11
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in last 5 years	6
Involved in property planning	15
Property	
Larger property size	5
Longer distance that the Loddon River runs along/ through the property (one side)	4
Property is the principal place of residence	21
Attached values (more important rating to these statements about the Loddon River on their place)	
Is an attractive area of the property	23
Provides habitat for native birds	3
A place for me, my family and friends to fish	22
Place where native animals live on land	9
Provides a source of nutrients for in-stream plants and animals	10
Vegetation on the frontage holds the banks and stops erosion	17
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	16
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	8
Long-term plan	
Less likely to seek additional off-property work	14
The property will be sold	20
Property issues (more important rating to these statements)	
The cost of managing weeds and pest animals affecting profitability	24
District issues	
Getting the balance between water for the environment, agriculture, town water supply and recreation	18
Increasing land prices constraining opportunities for farmers to expand their properties	12

Results for regression modelling for: *The contribution of floodplain wetlands towards the health of the Loddon River*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health projects implemented by the North Central CMA and DPI in the past five years
2. More hours per week worked on farming/property related activities over the past 12 months

The amount of variance in the dependent variable explained by the model: R^2=42.9%.

Knowledge of river health related topics (Pairwise comparison results ranked in "order of merit")

The role of large logs and river side vegetation in supporting native fish species	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	6
More hours per worked on farming/property related activities over the past 12 months	12
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	13
Either a former member or current member of a Landcare group	15
Member of a local Landcare group	19
Completed or updated a property plan in the last 5 years	27
Property	
Larger property size	16
Property principal place of residence	22
Have a riparian right for some part of their river frontage	23
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	1
Provides habitat for native birds	2
Place where native animals live on land	3
A place for me, my family and friends to fish	8
Vegetation on the frontage holds the banks and stops erosion	9
Provides a source of nutrients for in-stream plants and animals	10
Is an attractive area of the property	11
Adds to the market value of the property	14
Is a habitat corridor (allowing wildlife to move between areas)	21
Provides a place for recreation for me, my family and friends	24
In-stream vegetation traps and stabilises sand/gravel	25
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	7

Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	4
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	5
Property issues (more important rating to these statements)	
The cost of managing weeds and pest animals affecting profitability	17
Impact of changing rainfall patterns on property viability	26
District issues	
Increasing land prices constraining opportunities for farmers to expand their properties	18
Growth of in-stream vegetation affecting the Loddon River	20

Results from regression modelling for: *The role of large logs and river side vegetation in supporting native fish species*

Using multiple linear regression modelling, these variables provided the "best" model:

1. More important rating to the value: Place where native animals live on land
2. Property is the principal place of residence
3. Larger property size
4. Agreed with the statement that: Landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)

The amount of variance in the dependent variable explained by the model: R^2=45.5%.

Knowledge of river health related topics (Pairwise comparison results ranked in “order of merit”)

The ability of perennial vegetation and standing stubble to improve the quality of runoff water	
Personal	*Overall rank*
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in last 5 years	1
More hours worked on farming/property related activities over the past 12 months	2
Either a former member or current member of a Landcare group	6
Farmer by occupation	8
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	9
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	10
Member of a local Landcare group	19
Fewer days involved in paid off-property work in the past 12 months	21
Irrigated some part of your farm last year	26
Property	
Longer distance that the Loddon River runs along/ through their property. (one side)	4

Larger property size	6
Have a riparian right for some part of their river frontage	12
Longer period that the property has been in their family	17
Have a Crown Water Frontage on this or other land on the Loddon River	20
Property is the principal place of residence	24
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides important shade and shelter for stock	3
Adds to the market value of the property	11
Provides access to water for stock	15
I rely on the river for irrigation water	16
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	13
Short-term plans	
Unlikely to change the enterprise mix to reduce my farm workload	23
Long-term plans	
Unlikely that ownership of the property will stay within the family	25
Property issues (more important rating to these statements)	
Availability of labour for important on-property work	5
The cost of managing weeds and pest animals affecting profitability	14
Having the right to use surface or ground water for irrigation	22
Salinity undermining long-term productive capacity	27
District issues	
Increasing land prices constraining opportunities for farmers to expand their properties.	18

Results from regression modelling for: *The ability of perennial vegetation and standing stubble to improve the quality of runoff water*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Federal or State government programs, the North Central CMA or DPI supported work on their river frontage in the past five years
2. More hours per week worked on farming/property related activities over the past 12 months
3. Member of a local Landcare group

The amount of variance in the dependent variable explained by the model: R^2=37.8%.

Knowledge of river health related topics (Pairwise comparison results ranked in “order of merit”)

The role of environmental flows in the Loddon River to maintain a healthy river system	
Personal	*Overall rank*
More hours worked on farming/property related activities over the past 12 months	2
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling,	5

Prograze) in past 5 years	
Either a former member or current member of a Landcare group	6
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	7
Member of a local Landcare group	13
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	15
Property	
Have a riparian right for some part of their river frontage	9
Longer distance that the Loddon River runs along/ through their property (one side)	17
Larger property size	24
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides habitat for native birds	1
Place where native animals live on land	10
Is an attractive area of the property	14
Provides a source of nutrients for in-stream plants and animals	18
Vegetation on the frontage holds the banks and stops erosion	20
Adds to the market value of the property	21
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	8
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	3
Short-term plans	
All or most of the property will be leased or share farmed	12
Long-term plans	
The property will be sold	11
Not seeking additional off-property work	22
Property issues (more important rating to these statements)	
The cost of managing weeds and pest animals affecting profitability	16
Impact of changing rainfall patterns on property viability	19
District Issues	
Increasing land prices constraining opportunities for farmers to expand their properties.	4
Getting the balance between water for the environment, agriculture, town water supply and recreation	23

Results from regression modelling for: *The role of environmental flows in the Loddon River to maintain a healthy river system*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in past 5 years
2. More important rating for the value: Provides habitat for native birds
3. Larger property size

The amount of variance in the dependent variable explained by the model: R^2=44.9%.

Knowledge of river health related topics (Pairwise comparison results ranked in "order of merit")

How to prepare a farm or property plan that allocates land use according to different land classes	
Personal	*Overall rank*
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in past 5 years	1
More hours worked on farming/property related activities over the past 12 months	2
Involved in property management planning	6
Completed or updated property plan in the last five years	7
Farmer by occupation	8
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	11
Member of a local Landcare group	12
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	16
Either a former member or current member of a Landcare group	19
Property	
Larger property size	4
Longer distance that the Loddon River runs along/ through their property. (one side)	5
Have a riparian right for some part of their river frontage	10
Have a Crown Water Frontage on this or other land on the Loddon River	18
Attached values (more important rating to these statements about the Loddon River on their place)	
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	15
Provides important shade and shelter for stock	22
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	14
Short-term plans	
Unlikely to seek additional off-property work	20
Property issues (more important rating to these statements)	
Availability of labour for important on-property work	3
The cost of managing weeds and pest animals affecting profitability	9
Having the right to use surface or ground water for irrigation	17
Uncertain/low returns limiting capacity to invest in property	21
District Issues	
Increasing land prices constraining opportunities for farmers to expand their properties.	13

Results from regression modelling for: *How to prepare a farm or property plan that allocates land use according to different land classes*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in past 5 years
2. Larger property size
3. Have a Crown Water Frontage on this or other land on the Loddon River

The amount of variance in the dependent variable explained by the model: R^2=45.6%.

Knowledge of river health related topics (Pairwise comparison results ranked in "order of merit")

The effects of unrestricted stock access to water ways	
Personal	*Overall rank*
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in past 5 years	2
Either a former member or current member of a Landcare group	3
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	8
More hours worked on farming/property related activities over the past 12 months	14
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	19
Member of a local Landcare group	21
Property	
Have a riparian right for some part of your river frontage	15
Larger property size	17
Longer distance that the Loddon River runs along/ through their property. (one side)	18
Attached values (more important rating to these statements about the Loddon River on their place)	
Adds to the market value of the property	6
Is an attractive area of the property	7
Vegetation on the frontage holds the banks and stops erosion	9
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	10
Provides a source of nutrients for in-stream plants and animals	13
In-stream vegetation traps and stabilises sand/gravel	12
Is a habitat corridor (allowing wildlife to move between areas)	22
Provides important shade and shelter for stock	26
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	5

Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	1
Long-term plans	
Additional land will be purchased, leased or share farmed	24
Property issues (more important rating to these statements)	
The cost of managing weeds and pest animals affecting profitability	16
Salinity undermining long-term productive capacity	23
Availability of labour for important on-property work	25
District Issues	
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	4
Increasing land prices constraining opportunities for farmers to expand their properties	11
The effects of increased ground and surface water extraction	20

Results from regression modelling for: *The effects of unrestricted stock access to water ways*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Member of a local Landcare group (current or past)
2. More important rating to the value: Adds to the market value of the property
3. More important rating to the issue: Increasing land prices constraining opportunities for farmers to expand their properties
4. Agreed with the statement that: Landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)

The amount of variance in the dependent variable explained by the model: R^2=56.4%.

Knowledge of river health related topics (Pairwise comparison results ranked in "order of merit")

The production benefits of retaining native vegetation on farms	
Personal	*Overall rank*
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in past 5 years	1
More hours worked on farming/property related activities over the past 12 months	3
Either a former member or current member of a Landcare group	5
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	10
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	24
Involved in property management planning	33
Member of a local Landcare group	35
Property	
Larger property size	13
Have a Crown Water Frontage on this or other land on the Loddon River	15
Longer distance that the Loddon River runs along/ through their property. (one side)	16
Property is the principal place of residence	25
Have a riparian right for some part of your river frontage	31
Attached values (more important rating to these statements about the Loddon River on their place)	
Vegetation on the frontage holds the banks and stops erosion	2
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	7
Provides habitat for native birds	8
A place for me, my family and friends to fish	9
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	11
In-stream vegetation traps and stabilises sand/gravel	17
Place where native animals live on land	18
Provides a source of nutrients for in-stream plants and animals	19
Is a peaceful place to be	22
Is an attractive area of the property	28
Adds to the market value of the property	30
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	21
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	6
Short-term plans	
The property will be sold	34

Long-term plans	
The property will be sold	23
Unlikely that the property will stay within the family	27
Property issues (more important rating to these statements)	
The cost of managing weeds and pest animals affecting profitability	4
Availability of labour for important on-property work	14
Having the right to use surface or ground water for irrigation	20
Salinity undermining long-term productive capacity	26
Impact of changing rainfall patterns on property viability	32
District Issues	
Increasing land prices constraining opportunities for farmers to expand their properties	12
Growth of in-stream vegetation affecting the Loddon River.	29

Results for regression modelling for: *The production benefits of retaining native vegetation on farms*

Using multiple linear regression modelling, these variables provided the "best" model:

1. More hours per week worked on farming/property related activities over the past 12 months
2. Member of a local Landcare group (current or past)
3. More important rating to the value that: In-stream vegetation traps and stabilises sand/gravel

The amount of variance in the dependent variable explained by the model: R^2=58.8%.

Knowledge of river health related topics (Pairwise comparison results ranked in “order of merit”)

Predicted impact of climate change on river flows in the Loddon catchment	
Personal	*Overall rank*
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in past 5 years	3
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	12
Either a former member or current member of a Landcare group	13
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	15
Property	
Has a management plan for the works area	20
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides a source of nutrients for in-stream plants and animals	10
In-stream vegetation traps and stabilises sand/gravel	14
Is an attractive area of the property	19
Provides habitat for native birds	21
Is a habitat corridor (allowing wildlife to move between areas)	22
Acts as a filter catching sediment and/or nutrients in overland flows before	23

they reach the river	
Attached values (less important rating to these statements about the Loddon River on their place)	
Provides additional land for grazing stock, particularly in summer	18
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	6
Short-term plans	
All or most of the property will be leased or share farmed	2
The property will be subdivided and part of the property sold	7
Unlikely to reduce the extent of off-property work	16
Long-term plans	
Does not plan to introduce/ expand irrigation on the property	4
The property will be sold	5
Unlikely that the property will stay within the family	9
Property issues	
Impact of changing rainfall patterns on property viability	11
The cost of managing weeds and pest animals affecting profitability	17
District issues	
Getting the balance between water for the environment, agriculture, town water supply and recreation	8
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	1

Results from regression modelling for: *Predicted impact of climate change on river flows in the Loddon catchment*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Federal or State government programs, the North Central CMA or DPI supported work on their river frontage in the past 5 years
2. More important rating to the value: In-stream vegetation traps and stabilises sand/gravel
3. Agreed with the value statement that: Reduced production in the short-term is justified where there are long-term benefits to the environment
4. Long-term plan is unlikely for ownership of the property to stay within the family

The amount of variance in the dependent variable explained by the model: R^2=47.1%.

Confidence in recommended practices (Pairwise comparison results ranked in "order of merit")

The time and expense involved in watering stock off-stream is justified by improvement in river water quality	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	5
Member of a local Landcare group	10
Either a former member or current member of a Landcare group	13
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) in past 5 years	21
Property	
Property enterprise types	9
Property is the principal place of residence	24
Attached values (more important rating to these statements about the Loddon River on their place)	
Vegetation on the frontage holds the banks and stops erosion	2
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	6
Place where native animals live on land	7
Is a habitat corridor (allowing wildlife to move between areas)	16
In-stream vegetation traps and stabilises sand/gravel	17
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	22
Attached values (less important rating to these statements about the Loddon River on their place)	
Provides timber for fence posts and fire wood	18
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	3
Attitudes	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	1
Agreed that new owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work	15
Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	19
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	20
Property issues (more important rating to this statement)	
Impact of changing rainfall patterns on property viability	12
Declining soil health (e.g. declining fertility or structure)	23

District Issues

Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	4
Growth of in-stream vegetation affecting the Loddon River	8
The impact of recent and future clearing of native bush and grasslands	11
The effects of increased ground and surface water extraction	14

Results from regression modelling for: *The time and expense involved in watering stock off-stream is justified by improvement in river water quality*
Using multiple linear regression modelling, these variables provided the "best" model:

1. More important rating for the value: Vegetation on the frontage holds the banks and stops erosion
2. The farming enterprise(s) on their property
3. Property is the principal place of residence
4. Agreed with the statement that: Landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment

The amount of variance in the dependent variable explained by the model: R^2=56.4%.

Confidence in recommended practices (Pairwise comparison results ranked in "order of merit")

Areas of native vegetation along waterways with limited stock access are able to trap nutrients before they enter waterways	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	4
Member of a local Landcare group	7
Completed or updated a property management plan in the last 5 years?	10
Either a former member or current member of a Landcare group	15
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	20
Property	
Longer time that the property has been in their family	21
Attached values (more important rating to these statements about the Loddon River on their place)	
Vegetation on the frontage holds the banks and stops erosion	1
Is a habitat corridor (allowing wildlife to move between areas)	9
Place where native animals live on land	11
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	12
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	13
In-stream vegetation traps and stabilises sand/gravel	17
Provides a source of nutrients for in-stream plants and animals	18
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are	2

long-term benefits to the environment	
Attitudes	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	3
Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	5
Agreed that new owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work	8
Property issues (more important rating to this statement)	
State/ local government planning rules limiting their ability to subdivide	16
District Issues	
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	6
The impact of recent and future clearing of native bush and grasslands	14
The effects of increased ground and surface water extraction.	19

Results from regression modelling for: *Areas of native vegetation along waterways with limited stock access are able to trap nutrients before they enter waterways*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health programs implemented by the North Central CMA and DPI during the past 5 years
2. More important rating to the value: Vegetation on the frontage holds the banks and stops erosion

The amount of variance in the dependent variable explained by the model: R^2=26.4%.

Confidence in recommended practices (Pairwise comparison results ranked in "order of merit")

Dead trees or timber on the ground in river frontages are important habitat for native birds and animals	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	6
Property	
Less likely that property has been owned or operated by others in their family	17
Property enterprise types	20
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	2
Is a habitat corridor (allowing wildlife to move between areas)	4
Place where native animals live on land	3
Provides a source of nutrients for in-stream plants and animals	5

Vegetation on the frontage holds the banks and stops erosion	9
Provides habitat for native birds	10
In-stream vegetation traps and stabilises sand/gravel	11
Provides a place for recreation for me, my family and friends	15
Is a peaceful place to be	16
Attached values (less important rating to these statements about the Loddon River on their place)	
Provides timber for fence posts and fire wood	12
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	1
Attitudes	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	7
Agreed that new owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work	18
Short-term plans	
Unlikely that the property will be subdivided and part of the property sold	19
Long-term plans	
Unlikely that the enterprise mix will be changed to more intensive enterprises	14
District issues (more important rating to this statement)	
The impact of recent and future clearing of native bush and grasslands	8
The effects of increased ground and surface water extraction.	13

Results from regression modelling for: *Dead trees or timber on the ground in river frontages are important habitat for native birds and animals*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Agreed with values statement that: Reduced production in the short-term is justified where there are long-term benefits to the environment
2. More important rating to the value: Provides woody matter such as snags that offer protection for fish and other animals that live in the river

The amount of variance in the dependent variable explained by the model: R^2=27.7%.

Confidence in recommended practices (Pairwise comparison results ranked in "order of merit")

Domestic stock have had substantial impact on the stability of the river bank	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	15
Received a net off-property income (after expenses and before tax) last financial year (2008/2009)	20
More days involved in paid off-property work in the past 12 months	21
Higher amount of total off-property income (before tax) for them and their	23

partner last financial year (2008/2009*)*	
Attached values (more important rating to these statements about the Loddon River on their place)	
Vegetation on the frontage holds the banks and stops erosion	2
Place where native animals live on land	3
In-stream vegetation traps and stabilises sand/gravel	8
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	9
Is a habitat corridor (allowing wildlife to move between areas)	10
Provides a source of nutrients for in-stream plants and animals	11
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	13
Is an attractive area of the property	16
Provides habitat for native birds	22
Attached values (less important rating to these statements about the Loddon River on their place)	
Provides timber for fence posts and fire wood	24
Provides important shade and shelter for stock	25
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	1
Attitudes	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	7
Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	12
Agreed that new owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work	17
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	26
Property issues (more important rating to this statement)	
Declining soil health (e.g. declining fertility or structure)	18
District Issues	
The effects of increased ground and surface water extraction	4
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	5
The impact of recent and future clearing of native bush and grasslands	6
Growth of in-stream vegetation affecting the Loddon River.	14
Getting the balance between water for the environment, agriculture, town water supply and recreation	19

Results from regression modelling for: *Domestic stock have had substantial impact on the stability of the river bank*

Using multiple linear regression modelling, these variables provided the "best" model:

1. More important rating for issue: Expected reductions in stream flows as a result of upstream landholders increasing on-property dams
2. More important rating for value: Provides woody matter such as snags that offer protection for fish and other animals that live in the river

The amount of variance in the dependent variable explained by the model: R^2=47.1%.

Confidence in recommended practices (Pairwise comparison results ranked in "order of merit")

Fencing river frontages is not practical because floods will damage fences *(agreement with this statement reflects a lack of confidence in fencing as a recommended practice).* Higher scores for confidence in fencing were linked to the following independent variables.	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	14
Property	
Property enterprise types	19
Attached values (more important rating to these statements about the Loddon River on their place)	
Vegetation on the frontage holds the banks and stops erosion	3
Place where native animals live on land	4
Provides habitat for native birds	6
Is an attractive area of the property	10
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	13
Provides a source of nutrients for in-stream plants and animals	15
Is a habitat corridor (allowing wildlife to move between areas)	18
Is a peaceful place to be	20
Acts as a filter catching sediment and/or nutrients in overland flows before they reach the river	22
In-stream vegetation traps and stabilises sand/gravel	23
A place for me, my family and friends to fish	26
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides important shade and shelter for stock	9
Provides access to water for stock	16
I rely on the river for irrigation water	24
Stewardship (held value) (more important rating to these statements about the Loddon River on their place)	
Agreed that reduced production in the short-term is justified where there are long-term benefits to the environment	2
Attitudes	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	1
Agreed that new owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work	7

Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	12
Long-term plans	
More likely to plan to introduce/ expand irrigation on my property	8
More likely to plan change to a more intensive enterprise mix	17
Property issues (more important rating to this statement)	
Impact of changing rainfall patterns on property viability	11
District Issues	
The impact of recent and future clearing of native bush and grasslands	5
Getting the balance between water for the environment, agriculture, town water supply and recreation	21
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	25
Growth of in-stream vegetation affecting the Loddon River.	27

Results from regression modelling for: *Fencing river frontages is not practical because floods will damage fences*

Using multiple linear regression modelling, these variables provided the "best" model:

1. More important rating for the value: Place where native animals live on land
2. More important rating for the issue: Growth of in-stream vegetation affecting the Loddon River
3. The farming enterprise(s) on their property

The amount of variance in the dependent variable explained by the model: R^2=36.2%.

Implementation of recommended practices

Practices implemented during the period of management (Pairwise comparison results ranked in "order of merit")

Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	2
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	3
Property	
Property owned or operated by others in their family	4
Longer period owned or managed at least some part of the property	9
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides habitat for native birds	8
Is an attractive area of the property	11
Short-term plans	
The property will be subdivided and part of the property sold	5
Intends to sell all or part of their irrigation water entitlement	6
Less likely to reduce the extent of their off-property work	10
Long-term plans	
Intend to sell all or part of their irrigation water entitlement	1
The property will be sold.	7

Results from regression modelling for: *Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property*
Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years
2. More important rating to the value: Provides habitat for native birds
3. Property owned or operated by others in your family

The amount of variance in the dependent variable explained by the model: R^2=34.3%.

Practices implemented during the period of management (Pairwise comparison results ranked in "order of merit")

Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)	
Personal	*Overall rank*
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	3
More hours worked on farming/property related activities over the past 12 months	4

Either a former member or current member of a Landcare group	5
Farmer by occupation	7
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) last 5 years	9
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	10
Higher dollar value for government contributions to work on their frontage over the past 5 years	11
Irrigated some part of their farm last year	15
Member of a local Landcare group	18
Younger age	21
Property returned a net profit (income exceeded all paid expenses before tax) last financial year (2008/2009)	22
Lower number of days involved in paid off-property work in the past 12 months	24
Property	
Longer distance that the Loddon River runs along/ through their property (one side)	1
Have a riparian right for some part of their river frontage	6
Have Crown Water Frontage on this or other land on the Loddon River	13
Property is principal place of residence	16
Longer period owned or managed at least some part of the property	20
Longer time that the property has been in their family	28
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	12
Short-term plans	
The property will be subdivided and part of the property sold	8
Intend to sell all or part of my irrigation water entitlement	25
Additional land will be purchased, leased or share farmed	27
Long-term plans	
The property will be sold	14
Less likely to seek additional off-property work	17
q3sell2, I will sell all or part of my irrigation water entitlement	26
Property issues (more important rating to this statement)	
Availability of labour for important on-property work	19
District issues	
The effects of increased ground and surface water extraction	2
Increasing land prices constraining opportunities for farmers to expand their properties.	23

Results for regression modelling for: *Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Longer distance that the Loddon River runs along/ through your property. (one side)

2. Agreed with the statement that: Landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)
3. Member of a local Landcare group (current or past)

The amount of variance in the dependent variable explained by the model: R^2=55.6%.

Practices implemented during the period of management (Pairwise comparison results ranked in "order of merit")

Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)	
Personal	*Overall rank*
Member of a local Landcare group	2
Either a former member or current member of a Landcare group	3
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	4
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	6
Property	
Larger property size	1
Property Issues (less important rating to this statement)	
Rising cost of farming inputs undermining financial viability	5
Uncertain/low returns limiting capacity to invest in property.	7

Results from regression modelling for: *Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Larger property size
2. Member of a local Landcare group

The amount of variance in the dependent variable explained by the model: R^2=33.5%.

Practices implemented during the period of management (Pairwise comparison results ranked in "order of merit")

Amount of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)	
Personal	*Overall rank*
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	1
Previously a member or involved with a local Landcare group	3
Completed a short course relevant to property management (e.g., farm$smart, grain marketing, property planning, chemical handling, Prograze) last 5 years	5
Property is principal place of residence	7
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	11
Male gender	12

Property	
Larger property size	2
Have a Crown Water Frontage on this or other land on the Loddon River	4
Property has been owned or operated by others in their family	6
Have a riparian right for some part of their river frontage	10
Attached values (less important rating to these statements about the Loddon River on their place)	
Provides a source of nutrients for in-stream plants and animals	8
Property Issue	
Rising cost of farming inputs undermining financial viability	9

Results from regression modelling for: *Amount of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)*

Using multiple linear regression modelling, these variables provided the "best" model:

1. More important rating for the value: Provides a source of nutrients for in-stream plants and animals
2. Have a Crown Water Frontage on this or other land on the Loddon River

The amount of variance in the dependent variable explained by the model: R^2=7.3%.

Practices undertaken in the last 5 years (since early 2005) (Pairwise comparison results ranked in “order of merit”)

Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	2
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	3
Member of a local Landcare group	4
Completed or updated a property management plan in the last five years?	5
Less likely to be a farmer by occupation	7
Property	
Larger property size	1
Property Issue (less important rating to this statement)	
Rising cost of farming inputs undermining financial viability.	6

Results from regression modelling for: *Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in any Loddon river health projects implemented by the North Central CMA and DPI in the past 5 years

The amount of variance in the dependent variable explained by the model: R^2=10.8%.

Practices undertaken in the last 5 years (since early 2005) (Pairwise comparison results ranked in "order of merit")

Length of fencing erected near the river to manage stock access to the water way	
Personal	*Overall rank*
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	1
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	3
Property	
Larger property size	2
Longer distance that the Loddon River runs along/ through their property. (one side)	4
Property been owned or operated by others in their family	6
Have a Crown Water Frontage on this or other land on the Loddon River	9
Attached values (more important rating to these statements about the Loddon River on their place)	
Is an attractive area of the property	8
Provides habitat for native birds	11
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	13
Attitudes	
Agreed that landholders should be paid for providing environmental services that benefit the wider community (e.g. managing habitat for native animals)	10
Short-term plans	
The property will be subdivided and part of the property sold	7
Long-term plans	
The property will be sold	5
Property issues (more important rating to this statement)	
Impact of changing rainfall patterns on property viability	12
District issues	
Increasing land prices constraining opportunities for farmers to expand their properties.	14

Results from regression modelling for: *Length of fencing erected near the river to manage stock access to the water way*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Federal or State government programs, the North Central CMA or DPI supported work on their river frontage in the past 5 years
2. Have a Crown Water Frontage on this or other land on the Loddon River

The amount of variance in the dependent variable explained by the model: R^2=47.5%.

Practices undertaken in the last 5 years (since early 2005) (Pairwise comparison results ranked in "order of merit")

Days spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	1
Non-farmer occupation	3
Less likely that property owned or operated by others in their family	4
Absentee owner (property not principal place of residence)	6
Property	
Property enterprise types	8
Attitudes	
Agreed that in most cases, the public should have the right to access publicly owned river frontages that are managed by private landholders	5
Property Issues (less important rating to this statement)	
Salinity undermining long-term productive capacity	7
Rising cost of farming inputs undermining financial viability.	2

Results from regression modelling for: *Days spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth*
Using multiple linear regression modelling, these variables provided the "best" model:

1. Agreed with the statement that: The public should have the right to access publicly owned river frontages that are managed by private landholders
2. Property owned or operated by others in their family

The amount of variance in the dependent variable explained by the model: R^2=24.4%.

Practices undertaken in the last 5 years (since early 2005) (Pairwise comparison results ranked in "order of merit")

Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands	
Personal	*Overall rank*
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5	1
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	2
Property	
Larger property size	8
Attached values (more important rating to these statements about the Loddon River on their place)	
Provides habitat for native birds	4
Is an attractive area of the property	5
In-stream vegetation traps and stabilises sand/gravel	6
Place where native animals live on land	9

Short-term plans

The property will be subdivided and part of the property sold	3
Intend to sell all or part of their irrigation water entitlement	7
Long-term plans	
Unlikely to seek additional off-property work.	10

Results from regression modelling for: *Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years
2. More important rating to the value: Provides habitat for native birds

The amount of variance in the dependent variable explained by the model: R^2=22.8%.

Practices implemented this year (2009) (Pairwise comparison results ranked in "order of merit")

Spent time poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	2
Members of local Landcare groups were less likely to undertake this work	9
Attached values (more important rating to these statements about the Loddon River on their place)	
Is a peaceful place to be	1
Provides a place for recreation for me, my family and friends	3
Provides habitat for native birds	4
A place for me, my family and friends to fish	6
Provides a source of nutrients for in-stream plants and animals	7
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	10
Long-term plans	
All or some part of the property will be placed under a conservation covenant	5
Less likely that the property will be subdivided and part of the property sold	8

Results from regression modelling for: *Spent time poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years
2. More important rating to the value: Is a peaceful place to be
3. More important rating to the value: Provides habitat for native birds

The amount of variance in the dependent variable explained by the model: R^2=27.2%

Practices implemented this year (2009) (Pairwise comparison results ranked in "order of merit")

Amount of time (days per year) spent time poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth	
Personal	*Overall rank*
Involved in Loddon river health projects implemented by the North Central CMA and DPI during the past 5 years	3
Long-term plans	
Unlikely the property will stay within the family	1
Unlikely that additional land will be purchased, leased or share farmed.	2

Results from regression modelling for: *Amount of time (days per year) spent time poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth*

There were insufficient cases (number of respondents across the various items) to complete the regression modelling process.

Appendix 2: Relationships between independent variables and implementation of recommended practices by non-participants (in river health projects)

Practices undertaken during your management

There were no significant relationships between the independent variables included in the survey and three practices assessed over the management period:

- Removed willows;
- Removed willows and replaced them with native vegetation; and
- Placed large woody debris or snags in the water way as fish habitat.

Practices undertaken during your management (Pairwise comparison results ranked in "order of merit")

Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property	
Personal	*Overall rank*
Property returned a net profit (income exceeded all paid expenses before tax) last financial year (2008/2009)	4
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	7
Property	
Longer period owned or managed at least some part of the property	2
Property owned or operated by others in their family	3
Attached values (less important rating to this statements about the Loddon River on their place)	
A place for me, my family and friends to fish	1
Attitudes	
Agreed that in most cases, the public should have the right to access publicly owned river frontages that are managed by private landholders	5
Property Issue (more important rating to this statement)	
Rising cost of farming inputs undermining financial viability	8
District issues (less important rating to these statements)	
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams.	6

Results from regression modelling for: *Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands during your management of the property*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Property owned or operated by others in their family
2. More important rating for issue: Expected reductions in stream flows as a result of upstream landholders increasing on-property dams.

The amount of variance in the dependent variable explained by the model: R^2=29.4%.

Practices undertaken during your management (Pairwise comparison results ranked in "order of merit")

Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)	
Personal	*Overall rank*
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	2
More hours worked on farming/property related activities over the past 12 months	4
Previously a member or involved with a local Landcare group	5
Farmer by occupation	7
Property	
Longer distance that the Loddon River runs along/ through their property. (one side)	1
Have a riparian right for some part of their river frontage	3
Larger property size	9
Attached values (less important rating to this statements about the Loddon River on their place)	
Provides a place for recreation for me, my family and friends	10
Short-term plans	
Additional land will be purchased, leased or share farmed	6
The property will be subdivided and part of the property sold	11
Property Issues (more important rating to this statement)	
The cost of managing weeds and pest animals affecting profitability.	8

Results from regression modelling for: *Distance along the river where the frontage is fenced and this allows you to manage stock access to the water way (meters)*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years
2. Distance that the Loddon River runs along/ through their property. (one side)
3. More important rating to the issue: The cost of managing weeds and pest animals affecting profitability.

The amount of variance in the dependent variable explained by the model: R^2=45.9%.

Practices undertaken during your management (Pairwise comparison results ranked in "order of merit")

Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)	
Personal	*Overall rank*
Higher dollar value for government contributions to work on their frontage over the past 5 years	2
Either a former member or current member of a Landcare group	3
Started a WFPlan or completed a short course in the past 5 years	4
Member of a local Landcare group	10

Property	
Larger property size	1
Attitudes	
Agreed that governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences	6
Agreed that landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment	8
Agreed that in most cases, the public should have the right to access publicly owned river frontages that are managed by private landholders	9
Short-term plans	
Additional land will be purchased, leased or share farmed	7
Long-term plans	
The property will be subdivided and part of the property sold.	5

Results from regression modelling for: *Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)*
Using multiple linear regression modelling, these variables provided the "best" model:

1. Larger property size
2. Agreed with statement that: Landholders should expect to be legally responsible for managing their land in ways that do not cause foreseeable harm to the environment
3. Agreed with the statement that: Governments must take more responsibility for ensuring landholders meet their responsibilities under Crown Frontage Licences
4. Agreed with the statement that: In most cases, the public should have the right to access publicly owned river frontages that are managed by private landholders
5. Member of a local Landcare group.

The amount of variance in the dependent variable explained by the model: R^2=75.2%.

Practices undertaken during your management (Pairwise comparison results ranked in “order of merit”)

Amount of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)	
Personal	*Overall rank*
Not involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	1
Previously a member or involved with a local Landcare group	2
Male gender	4
Attached values (less important rating to these statements about the Loddon River on their place)	
Provides woody matter such as snags that offer protection for fish and other animals that live in the river	3
Provides important shade and shelter for stock	5
Attitudes	
Agreed that new owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection	6

or conservation work.	

Results from regression modelling for: *Amount of land along the river fenced for natural regeneration of native vegetation during your management of the property (hectares)*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Lower rating to the value: Provides woody matter such as snags that offer protection for fish and other animals that live in the river
2. Agreed that: New owners should abide by agreements entered into by previous owners where public funds (tax-payer) have paid for land protection or conservation work

The amount of variance in the dependent variable explained by the model: R^2=19%.

Practices undertaken in the last 5 years (since early 2005)

There were no significant relationships between the independent variables included in the survey and three practices assessed over the management period:

1. Removed willows;
2. Removed willows and replaced them with native vegetation; and
3. Time spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth.

There were insufficient numbers of respondents to reliably interpret results from the pairwise comparisons based on the Days spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth during the last 5 years.

Practices undertaken in the last 5 years (since early 2005) (Pairwise comparison results ranked in “order of merit”)

Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)	
Short-term plans	*Overall rank*
Intend to reduce the extent of off-property work	2
All or some part of the property will be placed under a conservation covenant	3
Long-term plans	
All or some part of the property will be placed under a conservation covenant	1

Results from regression modelling for: *Amount of trees/shrubs planted, including by direct seeding, along the river frontage (within 40m of each bank)*

The results from the modelling process have not been included because the resulting model only included one variable and that variable explained a very small amount of the variance in the recommended practice.

Practices undertaken in the last 5 years (since early 2005) (Pairwise comparison results ranked in "order of merit")

Length of fencing erected near the river to manage stock access to the water way	
Property	*Overall rank*
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	1
Property owned or operated by others in their family	3
Longer distance that the Loddon River runs along/ through their property. (one side)	4
Short-term plans	
The property will be subdivided and part of the property sold.	2

Results from regression modelling for: *Length of fencing erected near the river to manage stock access to the water way*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years
2. Longer distance that the Loddon River runs along/ through their property (one side).

The amount of variance in the dependent variable explained by the model: R^2=25%.

Practices undertaken in the last 5 years (since early 2005) (Pairwise comparison results ranked in "order of merit")

Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands	
Personal	*Overall rank*
Less likely to have prepared a property management or whole farm plan that involved a map and/or other documents that addressed the existing property situation and included future management and development plans	1
Involved in programs funded by the Federal or State government, the North Central CMA or DPI that supported work on the river frontage in past 5 years	2
District issues (less important rating to these statements)	
Expected reductions in stream flows as a result of upstream landholders increasing on-property dams	3
Growth of in-stream vegetation affecting the Loddon River.	4

Results from regression modelling for: *Number of off-river/ wetland stock watering points established where stock previously accessed water from the river or wetlands*

The results from the modelling process have not been included because the resulting model only included one variable and that variable explained a very small amount of the variance in the recommended practice.

CRP undertaken this year (2009)

There were no significant relationships between the independent variables included in the survey and three practices assessed over the past 12 months:

1. Did stock graze any part of your river frontage for more than a week at a time?;
2. Did stock access drinking water from any part of your river frontage for more than a week at a time?; and
3. Days spent poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth moved willows and replaced them with native vegetation.

CRP undertaken this year (2009) (Pairwise comparison results ranked in "order of merit")

Time spent time poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth	
Property	*Overall rank*
Have a Crown Water Frontage on this or other land on the Loddon River	5
Attached values (more important rating to these statements about the Loddon River on their place)	
Is a peaceful place to be	1
A place for me, my family and friends to fish	3
Attached values (less important rating to this statements about the Loddon River on their place)	
Provides access to water for stock	4
Long-term plans	
All or some part of the property will be placed under a conservation covenant	2
Unlikely the property will be subdivided and part of the property sold	6

Results from regression modelling for: *Amount of time spent time poisoning or physically removing woody weeds such as gorse, blackberries or willow regrowth (days)*

Using multiple linear regression modelling, these variables provided the "best" model:

1. Have a Crown Water Frontage on this or other land on the Loddon River
2. Higher rating to the value: Is a peaceful place to be.

The amount of variance in the dependent variable explained by the model: R^2=28%.