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Drivers of practice change in land management in Australian agriculture

Results of a national farm survey

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Contents

Summary.....	1
Key findings.....	1
Implications.....	2
Further research.....	3
1 Introduction	4
Background.....	4
Method.....	6
Report structure	7
2 Adoption of land management practices	8
3 Motivations for adoption.....	10
Financial motivations	15
Environmental motivations	20
Personal motivations.....	24
4 Support.....	29
5 Participation and learning	35
Barriers to participation.....	35
Learning activities.....	35
6 Industry-specific motivations	41
Dairy industry drivers.....	41
Horticulture industry drivers.....	43
7 Implications.....	48
Responding to farmer motivations	48
Engagement and communication	49
Support.....	50
Further research.....	51
Next steps.....	53
Appendix A: Adoption of management practices discussion	54
Adoption of crop land management practices	54
Adoption of native vegetation management practices	56
Adoption of grazing management practices.....	56
Adoption of weed management practices	57
References.....	58

Tables

Table 1 Adoption of land management practices: broadacre and dairy farmers.....	8
Table 2 Adoption of land management practices by industry	9
Table 3 Motivations for adoption of management practices for broadacre and dairy industries	12
Table 4 Motivations for each management practice, ordered by importance to respondents.....	14
Table 5 Importance of financial benefits in consideration of management practices.....	15
Table 6 Financial performance of adopters and non-adopters of crop management practices	16
Table 7 Financial performance of adopters and non-adopters of weed management practices.....	18
Table 8 Importance of financial motivations in adoption decisions: all practices.....	20
Table 9 Importance of environmental factors in consideration of management practices.....	20
Table 10 Importance of environmental motivations in adoption decisions: all practices.....	24
Table 11 Importance of personal motivations in consideration of management practices.....	24
Table 12 Importance of personal motivations in adoption decisions: all practices.....	28
Table 13 Importance of availability of support in consideration of management practices.....	29
Table 14 Delivery and funding of activities used to obtain management practice assistance	37
Table 15 Most commonly delivered activities by provider (excludes field days and agribusiness events)	38
Table 16 Awareness of and participation in Australian Government NRM programs.....	39
Table 17 Components of farm or property management plans and frequency of reference to these.....	40
Table 18 Importance of motivations for adopting land management practices: dairy and broadacre farmers.....	41
Table 19 Participation in Australian Government programs: dairy and broadacre farmers	43
Table 20 Factors limiting change in management practices: dairy and broadacre farmers	43
Table 21 Importance of motivations for adopting land management practices: horticulture farmers	44
Table 22 Importance of support motivations for horticulture farmers.....	45
Table 23 Involvement in groups: horticulture, broadacre and dairy farmers.....	46

Table 24 Awareness of Australian NRM programs: horticulture, broadacre and dairy farmers	46
Table 25 Factors limiting change in management practices: horticulture, broadacre and dairy farmers.....	47
Table A1 Adoption of land management practices by state	54

Figures

Figure 1 Financial motivations for uptake of crop management practices	15
Figure 2 Financial motivations for uptake of native vegetation management practices.....	17
Figure 3 Financial motivations for uptake of grazing management practices	18
Figure 4 Financial motivations for uptake of weed management practices	19
Figure 5 Environmental motivations for uptake of crop management practices	21
Figure 6 Environmental motivations for uptake of native vegetation management practices.....	21
Figure 7 Environmental motivations for uptake of grazing management practices	22
Figure 8 Environmental motivations for uptake of weed management practices.....	23
Figure 9 Personal motivations for uptake of crop management practices.....	25
Figure 10 Personal motivations for uptake of native vegetation management practices	26
Figure 11 Personal motivations for uptake of grazing management practices	27
Figure 12 Personal motivations for uptake of weed management practices	27
Figure 13 Type of support influencing uptake of crop management practices	30
Figure 14 Type of support influencing uptake of native vegetation management practices.....	31
Figure 15 Type of support influencing uptake of grazing management practices	32
Figure 16 Type of support influencing uptake of weed management practices.....	32
Figure 17 Involvement in groups and networks.....	33
Figure 18 Barriers to changing land management practices	35
Figure 19 Participation in activities for obtaining management practice information or advice	36
Figure 20 Percentage of farmers in each state indicating they had a farm plan or property management plan.....	40
Figure 21 Location of horticulture survey respondents by state	44
Figure A1 Adoption of crop management practices Australia-wide	55
Figure A2 Adoption of native vegetation management practices Australia-wide	56
Figure A3 Adoption of grazing management practices Australia-wide	57
Figure A4 Adoption of weed management practices Australia-wide (Weeds of National Significance)	57

Summary

ABARES surveyed 1329 farm managers in the broadacre, dairy and horticulture industries in 2010–11 to better understand what motivated farmers to implement sustainable farm practices. They were asked to indicate to what degree the adoption of specific soil and land management practices was influenced by a range of motivations. The survey asked about specific management practices in four areas:

- cropping
- grazing
- native vegetation
- weed management—specifically Weeds of National Significance (WoNS).

The motivations asked about included:

- financial
- environmental
- personal
- availability of support.

Farmers were also asked about a range of other factors and activities relevant to adoption of sustainable soil and land management practices, including key barriers and participation in programs and events.

Key findings

1. Financial and environmental motivations influence adoption of soil and land management practices. Farmers said decisions to adopt were influenced by financial, environmental and, to a lesser degree, personal motivations. Lack of funds was the main factor limiting farmers' ability to change their management practices, followed by available time and workload.

The drivers of land management practices differed between broadacre, dairy and horticulture industries. A key difference was that horticulturalists saw the target land management practices as largely motivated by environmental factors, compared with broadacre and dairy farmers for whom financial motivations were more influential. The exception, for all industries, was that environmental motivations were most important in influencing native vegetation management. Desire to protect the natural resource base was a motivation of high importance for farmers—this was the most important personal motivation across all land management practices investigated.

2. NRM support providers are important in enabling land management activities but play a secondary role in motivating land management practices. Compared with financial, environmental and personal motivations, the availability of support was less important in influencing adoption. This lends support to theories that suggest that actions are driven by internal, intrinsic motivations and that people seek external support once the

decision to act is made. Where support did influence decisions to adopt, Landcare and production groups were nominated as the most important sources of support. Private consultants were important in supporting crop and grazing management practices and horticulture generally. Regional natural resource management (NRM) facilitators were important for motivating native vegetation and grazing management practices. Government support was important for motivating weed and native vegetation management. Of the groups informing land management decisions, Landcare groups had the largest percentage of farmers involved, followed by local farming systems groups.

3. The way farmers accessed support differed for the three industries (broadacre, dairy and horticulture) and, to a limited degree, for different demographic groups.

Based on a pilot survey, availability of support was more influential for adoption for horticulturalists than for broadacre and dairy farmers. Reasons for this are unclear and this result would benefit from further research. Horticulturalists also said that private consultants were more important than NRM support providers in influencing adoption.

Horticulturalists were less likely to be involved in Landcare groups than broadacre and dairy farmers. Members of Landcare, local farming systems and production groups were more likely to have a university degree than those who were not members of these groups. Age was not a significant factor in involvement in Landcare and production groups. However, there was an association between age and involvement in farming systems groups—younger people and older people tend to be involved in farming systems groups to a greater degree than the Landcare and production groups.

4. Learning and development focused on productivity improvement was key to informing farmers about NRM practices. In the two years before the survey, most farmers had attended field days, which is a key method to obtain management practice advice. Training courses or workshops, trials and agribusiness events, in that order, were the next most important sources of management practice advice. Most events attended focused on productivity or combined NRM and productivity objectives. Property plans, which had been developed by one-third of farmers, were important primarily for financial or business activities, followed by management of weed threats. NRM activities were seen as a less important component of property plans by most respondents.

5. Australian Government NRM programs are well-known and farmers who participated in these programs are learning new skills and changing their management practices. The pre-existing National Landcare Program was the best-known of the programs farmers were asked about, followed by Regional Landcare Facilitators and FarmReady. The results on program recognition need to be further examined to determine any associations between recognition and age of program or program focus. Across all programs considered, most participants stated that they learned new skills or changed management practice as a result of participation.

Implications

Extension and communication activities on sustainable farm practices will have more influence if information relevant to all three motivational areas (financial, environmental and personal) is included. This finding needs to be integrated into NRM-related communications and engagement. For example, in addition to environmental messages, communication activities related to trials and demonstrations on sustainable practices could include

information on production benefits and/or potential time savings. Access to new or different information over time may influence farmers' motivation to adopt a given practice.

Using farmers' preferred or common interaction methods can help target efforts for improving land management. Different industry groups have different preferred sources of information and advice, and different extension providers tend to use particular strategies for communicating practice change information. Landcare, farming systems and production groups are important in influencing change. NRM programs may be able to work better with these groups to give NRM-related information to farmers. It is also important to acknowledge the different motivations of different industry groups and practices, as this can help to reach target audiences.

Further research

Further research is needed to:

- better understand the influence of support in motivating sustainable farm practices
- assess longitudinal changes in motivations, program recognition and program effectiveness
- assess how sustainable farm practices contribute to productivity
- understand how farmers assess how management practices contribute to productivity
- determine what types of support are available and how accessible and suitable current support is for different management practices
- explore the links between sustainable practices and improved productivity, which were associated with adoption of some practices investigated but not all.

1 Introduction

Background

This report presents findings from the second stage of the Drivers of Land Management Practice Change in Australian Agriculture project (also referred to as the Drivers of Practice Change project or DPC), which involved a national survey of farm managers in 2010–11. This was a supplementary survey to the Australian Agricultural and Grazing Industries Survey (AAGIS) and the Australian Dairy Industry Survey (ADIS). The project examined motivations for the uptake of land management practices based on selected practices under the Sustainable Farm Practices component of the Caring for our Country initiative, which is administered by the Department of Agriculture, Fisheries and Forestry (DAFF). This research was undertaken to provide information to support uptake of these practices outlined in Caring for our Country. The research also assists in assessing the knowledge and skills target for Caring for our Country.

For policy and program development, it is important to understand why farmers implement particular practices and how these motivations can be used to encourage adoption. Stage 1 of the project involved a qualitative study to identify key drivers of practice change in land management. Landholders, extension practitioners, practice change experts, policy staff and researchers reviewed factors influencing adoption at workshops representing Australia's major climatic zones. Local and regional information relevant to adoption of land management practices was also reviewed.

Six key drivers of land management practice adoption were identified:

- farm finances, profitability and income
- groups and networks
- information sources and provision (including who the sources are and how information was dispersed)
- incentives and external pressures (including subsidies and co-funding arrangements; tax deductions, rebates or credits; regulations; awards and other forms of recognition; and market-based incentives)
- personal motivations (including environmental motivations)
- market drivers (that is, market access based on sustainability credentials or environmental certification).

On this basis, a survey was developed that aimed to provide further quantitative evidence of the major factors influencing natural resource management (NRM) practice uptake.

Previous NRM surveys, including the Australian Bureau of Statistics' Australian Resource Management Survey (ARMS), were reviewed in developing this survey. This and other previous surveys about influences on practice change collected information on membership of groups and networks, areas of information provision, learning and development activities, and previous involvement in programs. In some cases, such as with the previous ABARE NRM surveys, socio-economic information such as farm income and other financial performance

information as well as age, education and other demographic information was collected. Information collected in previous surveys on factors that influence practice change was generally not directly linked to management practice uptake, and causal relationships were determined largely through statistical inference. This lack of survey data that directly links adoption with motivations for adoption is a notable gap in previous research.

The Drivers of Practice Change survey sought to link motivations directly to adoption, thereby eliminating the problem of making associations between potentially unrelated variables. In light of the gaps identified in previous surveys, the DPC survey focused on understanding farmers' motivations for practice change in direct reference to management practice adoption by asking farmers what they did and why.

The survey design and subsequent data analysis were developed to respond to key policy questions about the promotion and implementation of the Sustainable Farm Practice component of Caring for our Country. This included three target areas under the 2008–2013 plan (Caring for our Country Business Plan 2010–2011):

- improving management practices to reduce the risk of soil acidification, soil loss through wind and water erosion and increase the carbon content of soils or improve water quality (aquaculture only) by 2013
- increasing the number of farmers adopting activities that contribute to the conservation and protection of biodiversity by 6700 in 2013
- increasing the number of land managers and farmers who have demonstrated an improvement in knowledge and skills in natural resource management by 42 000 in 2013.

Project objectives

The primary objective of the DPC survey was to quantitatively assess the relative importance to farmers of a range of social and economic influences on uptake of land management practices on farms.

Other objectives included:

- investigate the pathways through which farmers access and use information on NRM
- indicate farmers' awareness of selected Australian Government NRM programs
- investigate the extent to which target groups identified under the Caring for our Country initiative are engaged in the initiative
- determine the best methods to promote participation of landholders in activities that contribute to achieving Caring for our Country goals
- explore landholder satisfaction with the different ways to deliver information on land management practices
- better understand the comprehensiveness of planning occurring at the property level.

Method

The Drivers of Practice Change survey was a supplement to the ABARES 2010–11 AAGIS and ADIS. The sample for the survey consisted of a random subsample of 1069 respondents from AAGIS and 260 from ADIS—a total of 1329 respondents. Survey data were cross-referenced at unit (individual) level to the comprehensive set of physical, financial, demographic and management data collected in the AAGIS and ADIS. Data were collected mostly via single-visit, face-to-face interviews, although some interviews were conducted by telephone where face-to-face interviews were not practical (Lubulwa et al. 2010). The draft survey questionnaire was tested during the week ending 2 July 2009. The survey data collection commenced on 14 July 2010 and continued until December 2010.

ABARES surveys target farming establishments based on the value of agricultural output from the farm (that is, an estimated value of agricultural operations (EVAO) of greater than or equal to \$40 000 per year). The surveys exclude farms with an EVAO of less than \$40 000, which in aggregate contribute less than 2 per cent to the total value of agricultural production in Australia. The survey frame (a population list of agricultural businesses) is drawn from the Australian Bureau of Statistics based on the Australian Business Register. All results are weighted unless indicated otherwise, to ensure the population is adequately represented (Lubulwa et al. 2010). Results are presented at the state level.

Survey participants were asked to indicate which of the selected practices they had adopted on their farms. This was followed with questions about how important different motivations were when choosing whether to adopt these practices. Categories for these were ‘financial or productivity benefits’, ‘personal motivations’, ‘environmental factors’ and ‘availability of support’. Questions about each of these motivations were followed by a subset of questions about specific motivations for each of the categories. Participants were asked to indicate which of these motivations was most influenced their decision to adopt the given practices. These motivations, which are the focus of this report, are discussed in the following chapter.

Categories of practices investigated (Table 1) were those generally accepted as representing sustainable land management practices, as determined through consultation with industry representatives and as outlined under the Caring for our Country initiative. One purpose of the project was to understand levels of adoption for these practices in the different industries. Practices included were crop management practices (including tillage and stubble management), native vegetation management (such as fencing of areas and planting), grazing management (including rotational systems) and weed management practices. Weed management in this report refers to management of Weeds of National Significance (Commonwealth of Australia 2010). Information was also collected on the sources of NRM information and farmers’ participation in activities that improved knowledge, skills and practices.

Horticulture pilot survey

A pilot survey was undertaken for the horticulture industry. This was a telephone survey and included a sample of 49 farmers. The survey implementation was managed by an external data collection company using computer-assisted telephone interviewing. Results from the horticulture pilot survey are included in Chapter 5 and other relevant sections of the report.

Report structure

The report is organised as follows. Chapter 2 reports adoption rates of sustainable practices across land management areas of cropping, grazing, native vegetation, weeds and horticulture. Chapter 3 discusses the theoretical literature on landholder adoption of new innovations, how this translates into the motivations discussed in this report and presents results on why landholders adopt a practice based on financial, environmental and personal motivations. Chapter 4 explores the role of support in the adoption of a new innovation. Chapter 5 presents findings on barriers to changing land management practices and landholder participation in learning activities that contribute to knowledge and skills in land management. Chapter 6 explores motivations for adopting new land management practices by industry group. Chapter 7 discusses the implications of the findings, including further research. Appendix A provides further detailed discussion on the adoption of land management practices, using survey results and published information on adoption rates.

2 Adoption of land management practices

To gather information about factors influencing uptake of sustainable soil and land management practices, information was collected about use of these practices on farm. Farmers were not asked about the extent of implementation of these practices, because the focus of the survey was whether or not a specific practice had been adopted and the drivers of adoption or continued implementation. Survey respondents were asked whether they had adopted or considered adopting a range of practices that were considered as recommended best practice within each of the industries. These practices were thought to be sustainable practices that were relatively well-known but not necessarily widespread. Uptake of practices was taken to mean continued adoption of previous practices as well as the adoption of new practices.

The survey found that the level of uptake of the nominated sustainable farm practices was generally between 40 and 50 per cent, except for uptake of native pasture and native vegetation management activities, which was lower (23 per cent and 38 per cent, respectively) (see Table 1). Adoption rates were comparable with those determined by other studies, including the ARMS 2007–08 and ARMS 2010–11.

Adoption results for the horticulture industry are not representative of the industry at the national level because they came from a limited pilot survey (see Table 2). Broadacre and dairy industry results are nationally representative. Consideration of adoption results should take into account that the nominated practices have different suitability in different regions.

A detailed discussion on adoption rates, including comparison to adoption rates reported in other studies, is provided in Appendix A. The focus of this report is on the motivations for adoption not adoption rates.

Table 1 Adoption of land management practices: broadacre and dairy farmers

	Management practice	(%)
Crop management	No till or reduced tillage	59
	Periods of fallow adopted	36
	Retained stubble	56
Native vegetation management	Planted native pastures or encouraged regrowth	23
	Planted native vegetation or encouraged regrowth	38
	Fenced native vegetation to control stock access	41
Grazing management	Cell or strip rotational grazing	47
	Set minimum groundcover targets for long term	42
	Planted or maintained deep rooted perennial pastures	45
Weed management	Management of Weeds of National Significance	50

Table 2 Adoption of land management practices by industry

Practice area	Practice	Broadacre (%)	Dairy (%)	Horticulture (%)
Crop management	No till or reduced tillage	62	38	
	Periods of fallow adopted	41	11	
	Retained stubble	64	11	
Native vegetation management	Planted native pastures or encouraged regrowth	25	7	
	Planted native vegetation or encouraged regrowth	38	37	26
	Fenced native vegetation to control stock access	40	52	20
Grazing management	Cell or strip rotational grazing	42	85	
	Set minimum groundcover targets for long term	43	34	
	Planted or maintained deep rooted perennial pastures	44	52	
Weed management	Management of Weeds of National Significance	49	59	51
Horticulture	Minimising tillage or cultivations			39
	Controlled trafficking			20
	Reducing reliance on artificial fertilisers			67
	Use of cover crops, inter-row crops, mulching, matting or ground cover			65
	Using natural contours or constructing diversion banks			45
	Practices to optimise pesticide and fertiliser use			61
	Reduced frequency and amount of irrigation			82

3 Motivations for adoption

There is a large body of literature that addresses why landholders adopt conservation practices. Pannell and colleagues (2006) highlighted four major factors that can assist with understanding adoption of management practices: personal characteristics of the landholder, the social and environmental context within which they are operating, the nature of the practices, and the process of learning by the landholder. Literature also highlights the complex nature of interactions between these factors (Chouinard et al. 2006; Pannell et al. 2006; Farmar-Bowers & Lane 2006; Llewellyn & D’Emden 2009; Greiner et al. 2009; Greiner & Gregg 2011).

A study by Greiner and Gregg (2011) investigated the extent to which constraints and incentives affected the adoption of conservation practices by cattle graziers in northern Australia. It identified three major groups of motivating factors: economic/financial; conservation and lifestyle; and social motivation. A study by Maybery and colleagues (2005) identified the same three motivation categories. A US study (Chouinard et al. 2006) also identified three categories: pure profit maximising; ego-utility (where the environment is valued because of the direct benefits it provides); and obligations to others (for example, providing for future generations).

Farmar-Bowers and Lane (2006) described motivations as representing ‘the material aspirations or feelings that family decision-makers are trying to attain, or want to have on an ongoing basis during their lives’ (p. 1137). Adopting this definition, Greiner and Gregg (2011) suggested that farmers’ ability to live ‘according to their motivations’ is ‘moderated by constraints’ (or impediments) (p. 258). They suggested that policy that takes into account ‘soft values’ (rather than tangible short-term financial goals, for example) can be more effective. Greiner and Gregg (2011) undertook research to ‘provide empirical evidence to demonstrate that many farmers are profoundly driven by non-financial motivations’ (p. 258).

Building on these and other studies and the results of stage 1 of the project, this survey sought to better understand the mix of motivations influencing adoption of land management practices. These were grouped into four motivational areas:

- financial benefits (related to directly increasing income, including government incentives)
- environmental factors (related to improving environmental performance)
- personal motivations (related to improving non-financial personal and social outcomes)
- availability of support (related to the influence of support providers including community, government, peers and commercial consultants—not including financial support).

As well as these motivations, a number of other factors were explored in the study, including personal characteristics, information sources used by farmers to support adoption, and involvement in a range of activities relevant to land management practices. Consistent with previous studies, the influence of three of the factors considered by Pannell and colleagues (2006) (social and environmental context, personal characteristics and the nature of practices) on adoption of land management practices was explored. This study considered the influences of personal characteristics as motivating factors (for example, environmental

and personal beliefs) and also considered the influence of demographic characteristics, such as age and income. Three of the motivation categories in this study roughly equated to those investigated by Greiner and Gregg (2011), although 'availability of support' was an additional category.

The four motivation areas used in this study were assessed against the four categories of land management practices discussed in Chapter 2: crop management, grazing management, native vegetation management, and weed management (specifically Weeds of National Significance). The results show a mix of motivations for the different practices (Table 3).

Survey respondents rated the degree of influence of each of the four motivational areas, nominating 'to a great extent', 'to some extent' or 'not at all' for practices they were currently adopting or were considering. Table 3 shows the percentage of responses in each rating category for the land management practices investigated.

The results show that financial motivations, while important, combine with a range of other motivations to influence adoption of management practices. For all land management practices considered, financial and environmental motivations were the main factors influencing adoption. Personal motivations and the influence of support were rated next—there were generally low percentages for support.

For crop, grazing and weed management, financial motivations were chosen as influencing adoption 'to a great extent' more often than the other motivations. Environmental motivations were the next most frequently chosen as influencing adoption 'to a great extent'. For cropping, there was little difference between the numbers of respondents choosing financial motivations (38 per cent) and environmental factors (31 per cent). In contrast, for farmers implementing grazing and weed management practices, almost twice as many said financial benefits were important than those who said environmental benefits were important. One interpretation is that respondents saw a clearer connection between financial and environmental motivations for the selected crop management practices than they did for the other management practices. This was most likely due to the link between soil conservation and both financial and environmental benefits.

For those farm businesses undertaking native vegetation management practices, a higher proportion of farmers (32 per cent) noted environmental motivations as influencing this activity 'to a great extent' than those nominating financial motivations (17 per cent). This suggests that farmers feel native vegetation management has considerably less financial benefits than the other management practices.

Surveys have a limited scope to examine the wide ranges of influences on farming decisions and the effect of influences not addressed in this survey should not be underestimated. The results presented here represent respondents' assessment of the influence of particular kinds of motivations on the decision to adopt and, as such, each kind of motivation could have a greater or lesser influence at any one time depending on the circumstances or the practice under consideration. When considering availability of support as an influence (see Table 3), there are a number of factors that potentially affect the results. These factors are discussed in the Chapter 4.

Table 3 Motivations for adoption of management practices for broadacre and dairy industries

Adoption motivations	Crop mgt practices (%)			Native veg mgt practices (%)			Grazing mgt practices (%)			Weed mgt practices (%)		
	Great extent	Some extent	Not at all	Great extent	Some extent	Not at all	Great extent	Some extent	Not at all	Great extent	Some extent	Not at all
Financial benefits	38	45	17	17	45	38	49	41	10	43	45	12
Environmental factors	31	43	26	32	47	21	22	47	31	22	45	33
Personal motivations	11	30	59	13	38	49	11	32	57	18	39	43
Availability of support	6	29	65	9	29	62	6	20	74	6	23	71

Within the four motivational and practice areas, respondents were asked to select three motivations (referred to as 'motives') from up to six options that had been identified as influencing adoption of these practices, based on results of stage 1 of the project. These are examined in detail for each practice area in the following pages and are also summarised across all practices in Table 4.

There was considerable consistency within these results. For example, 'increased returns' appeared in the top three financial motives for all practices and 'improves soil quality' consistently ranked highly as an environmental motive for all practices except for weed management. 'Desire to protect natural resources' was consistently chosen as the most important of the personal motives for all practices. 'Landcare or farmer production groups' was the first preference chosen by the low number of respondents who indicated availability of support as a motivation.

Table 4 Motivations for each management practice, ordered by importance to respondents

	Financial	Environmental	Personal	Support
Crop management practices	Increased returns Reduced costs Provides grazing in adverse conditions	Improves soil quality Reduces soil loss Reduces water run-off	Desire to protect natural resources Reduction in workload Liked the technologies involved	Landcare or farmer production group Private consultant or agribusiness agent Peers or neighbours
Grazing management practices	Improved year-round feed ability Increased returns Increased land value	Improves soil quality Reduces water run-off Reduces soil loss	Desire to protect natural resources Recognition by neighbours and community Prepared to risk short-term production losses	Landcare or farmer production group Catchment Management Authority (CMA) / NRM region employed facilitator Private consultant or agribusiness agent
Native vegetation management practices	Provides shelter for livestock Increased land value Increased return	Improves soil quality Aligns with environmental goals and beliefs Provides habitat for fauna	Desire to protect natural resources Desire to improve amenity of the landscape Recognition by neighbours and community	Landcare or farmer production group CMA/NRM region employed facilitator Government extension officer
Weed management practices (WoNS)	Increased returns Cost of not acting too high Increased land value	Aligns with my environmental goals Corporate social and environmental responsibility Improved habitat for native fauna	Desire to protect natural resources Recognition by neighbours and community Fit in with practice of others in my community	Landcare or farmer production group Government extension officer Peers or neighbours

Financial motivations

Financial or production motivations were indicated as most influential on adoption decisions for three of the four management practice categories: crop, grazing and weed management (Table 5). In contrast, environmental motivations were indicated as stronger than financial motivations for the adoption of native vegetation practices.

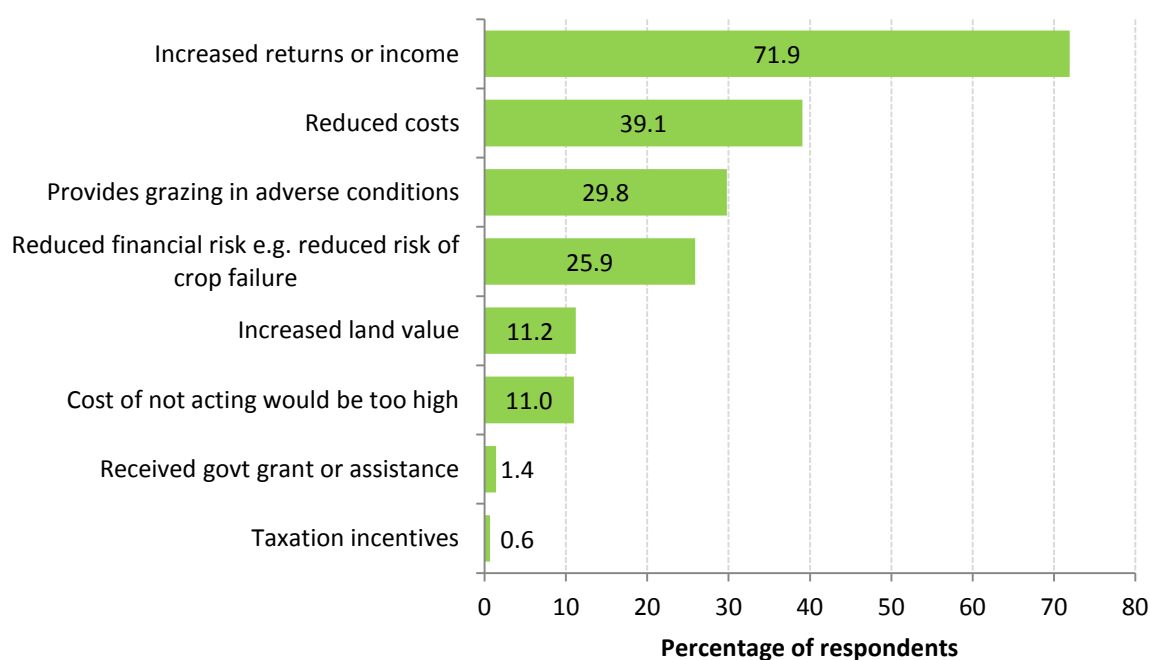
Table 5 Importance of financial benefits in consideration of management practices

	Crop mgt practices (%)	Native veg mgt practices (%)	Grazing mgt practices (%)	Weed mgt practices (%)
To a great extent	38	17	49	43
To some extent	45	45	41	45
Not at all	17	38	10	12

Financial motivations for crop management practice decisions

For farmers who said that financial motivations influenced adoption ‘to a great extent’ or ‘to some extent’, increasing returns was the most frequently stated financial motivation for adoption of the selected crop management practices, followed by reduced costs (Figure 1).

Figure 1 Financial motivations for uptake of crop management practices



Note: Respondents could nominate more than one option.

Farm businesses that had adopted a nominated crop management practice (see Table 1) more frequently had better farm financial performance than those that did not adopt these practices. A linear regression (using generalised least squares method) between adoption data and financial performance showed that farm businesses adopting the crop management practices tended to receive higher total cash receipts and higher farm cash income, and experienced lower business losses in the surveyed year (Table 6). They also had significantly larger properties.

There may be many reasons for this relationship and the nature of the link between adoption of the practices and profitability is not clear.

Table 6 Financial performance of adopters and non-adopters of crop management practices

		Adopters	Non-adopters
Rate of return	%	1.50	0.40 ^a
Farm cash income	\$	136 454	66 377 ^a
Area operated	ha	19 943	3 292 ^a

a. There was a significant difference between adopters and non-adopters at the 95% probability level.

Minimum tillage is generally associated with large investment in specific machinery, land preparation and crop management; for example, stubble seeding—seeding without breaking the sod. The capacity to invest in such machinery may be limited to larger operators, which may explain the link between those undertaking these cropping practices (usually on larger farms) and better financial performance.

After increased returns and reduced costs, providing grazing options and reducing financial risk were also reported as important financial motives for adoption of crop management practices. Results on the importance of financial motivations for adopting minimum tillage management practices are consistent with Llewellyn and D’Emden’s (2009) findings on the importance of reduced costs (fuel and labour) in influencing adoption of minimum tillage practices.

Financial motivations for native vegetation management practice decisions

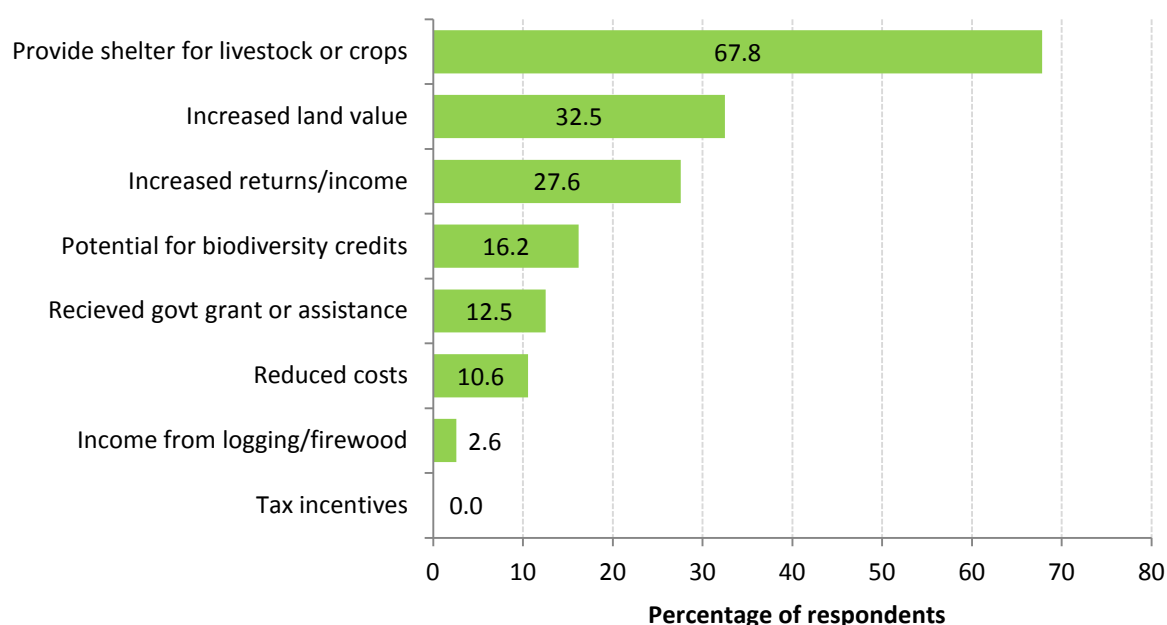
After environmental motivations, financial motivations were the next most highly ranked by farmers reporting adoption of the selected native vegetation management practices (see Figure 2). Nearly two-thirds of respondents indicated that financial or productivity benefits influenced them ‘to a great extent’ or ‘to some extent’. For farmers who said that financial motivations influenced adoption ‘to a great extent’ or ‘to some extent’, providing shelter for livestock was the most frequently chosen financial or production benefit of native vegetation management (68 per cent).

Increased land value was also important in influencing adoption of native vegetation management practices—almost one-third of farmers selected this motive. This demonstrates that, while retained native vegetation can be associated with foregone production and therefore reduced land value (Productivity Commission 2004), management and retaining of native vegetation can also be associated with increased land values.

Anticipated increased returns on investment or increased income was also important and the third most-frequently selected financial or productivity benefit (28 per cent). For financial incentives or grants, government grants or assistance was notably more important in motivating native vegetation management (13 per cent) than the other management practices. A possible explanation for this is that, because of the public benefits of native vegetation management, grants are more available for this activity than for cropping, grazing and weed management practices. Farmers adopting native vegetation management practices were also interested in the potential for biodiversity credits. This interest in incentives and credits does not imply that existing incentives are fully compensating production losses. Mendham and colleagues (2007) found that economic constraints were a barrier to native vegetation management and incentives

were considered inadequate where farmers perceived that a large production loss was likely. Tax incentives were the least influential of the financial motives listed.

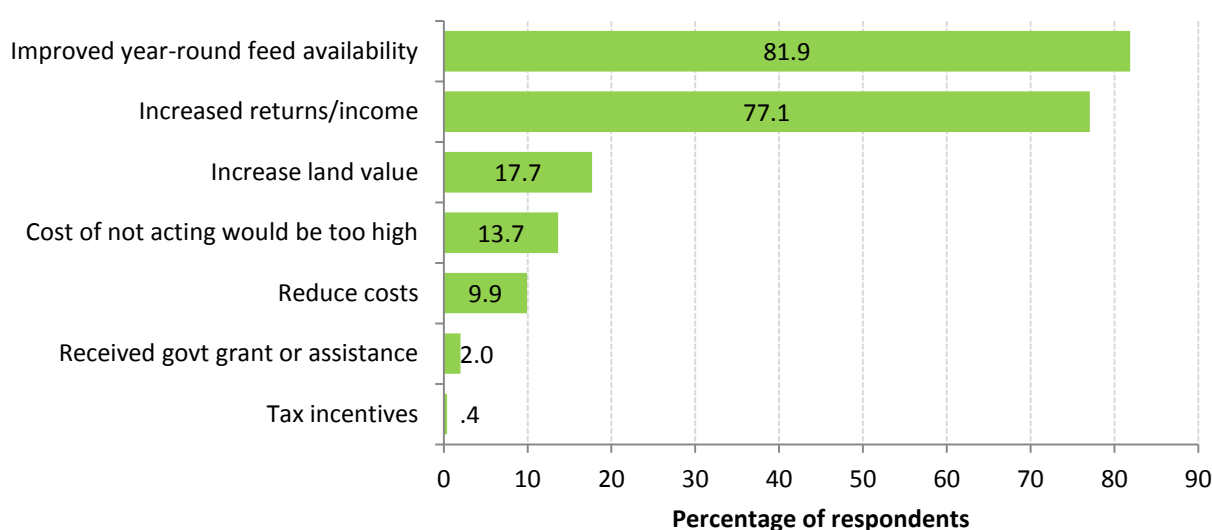
Figure 2 Financial motivations for uptake of native vegetation management practices



Note: Respondents could nominate more than one option.

Financial motivations for grazing management practice decisions

For farmers who said that financial motivations influenced adoption 'to a great extent' or 'to some extent', the main financial motivations for grazing management practices included year-round availability of feed (most likely through cell or strip rotation grazing) (82 per cent) and the perceived increase in returns/income (77 per cent). Increased land value (18 per cent) was the third most nominated motivation, but was well behind the other two (Figure 3). In contrast to crop management practices, there was no association found between financial performance and the adoption of grazing management practices. This does not imply that grazing management practices are not associated with increased profitability, as there are many other variables to consider. Compared with benefits from crop management practices, benefits derived from grazing management practices are relatively long term and longitudinal data may be required to demonstrate this association.

Figure 3 Financial motivations for uptake of grazing management practices

Note: Respondents could nominate more than one option.

Financial motivations for weed management practice decisions

The survey results indicate that the adoption of weed management practices was seen as linked to farm returns. Of the farmers who said that financial motivations influenced adoption ‘to a great extent’ or ‘to some extent’, nearly 76 per cent nominated increased returns as a motive for weed management. The cost of not acting, which likely refers to the cost of weed-related effects, was also an important consideration (64 per cent) (see Figure 4).

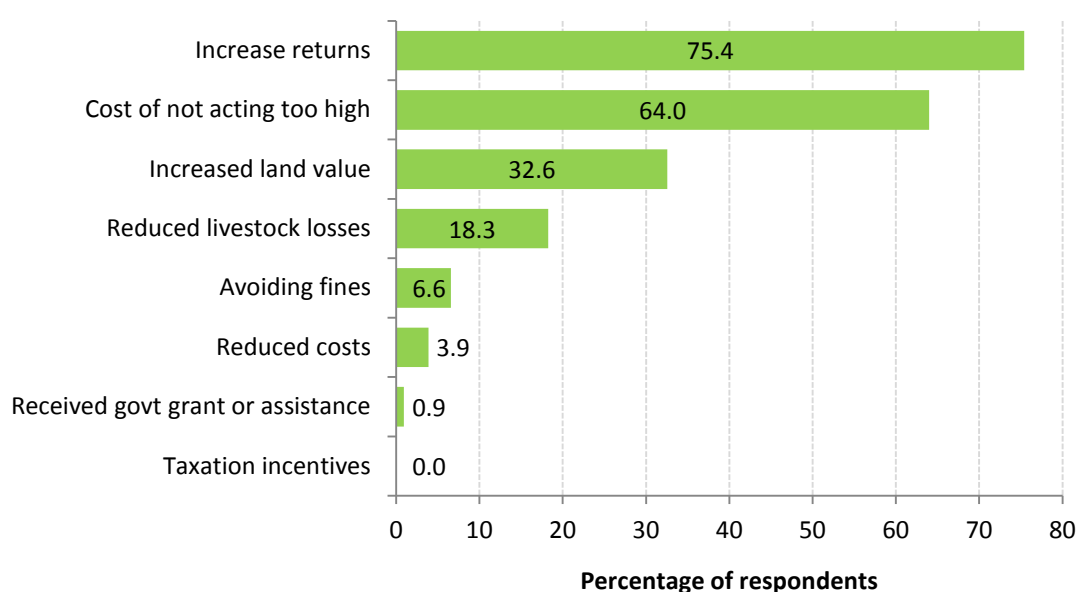
A linear regression (using generalised least squares method) between adoption data and financial performance showed there was a significant difference between the financial performance of farm businesses that had adopted weed management practices and those that had not (Table 7). The relationship between these two factors requires further investigation—this result may be related to financial capacity to implement these practices or a range of other factors, such as management priorities and labour availability. Farm size was not significantly different between adopters and non-adopters of weed management practices.

Table 7 Financial performance of adopters and non-adopters of weed management practices

		Adopters	Non-adopters
Rate of return	%	1.40	0.70 ^a
Farm cash income	\$	140 058	80 031 ^a
Area operated	ha	10 513	8 412

^a. There was a significant difference between adopters and non-adopters at the 95% probability level.

Increased land value was listed by nearly one-third of respondents (33 per cent) as being an important financial motive for weed management.

Figure 4 Financial motivations for uptake of weed management practices

Note: Respondents could nominate more than one option.

Financial motivations for all management practices

Farmers indicated that the main financial motivations for adoption across all land management practices were increased returns, reduced costs and increased land value. Of the farmers who said that financial motivations influenced adoption 'to a great extent' or 'to some extent', increasing returns was the most important financial motivation for cropping practices (72 per cent) and weed management practices (75 per cent), and was the second most important for grazing practices (77 per cent). Only 28 per cent of farmers noted financial benefits as a motivation for adopting native vegetation management. More than half of farmers said lack of funds was stopping them from adopting new management practices.

For farmers implementing grazing management practices, the most important financial benefit was improved fodder availability. For native vegetation management, providing shelter for livestock was the most important.

Increased land value as a result of improved land management was seen as a financial benefit for grazing, native vegetation and weed management practices, but not for cropping practices. This supports the view that farmers associate increased land value with increased environmental effort in grazing management, weed management and native vegetation management. These practices result in visual and aesthetic outcomes that do not result from crop management practices. Such an association with aesthetic outcomes of native vegetation management and increased land values has been observed in previous studies (Mallawaarachchi & Szakiel 2007).

The importance of specific motives is summarised in Table 8, based on those selected by more than 30 per cent of farmers who answered the survey ('high importance') and those selected by less than 10 per cent ('low importance'), with the remainder seen as 'moderate importance'.

Table 8 Importance of financial motivations in adoption decisions: all practices

High importance	Moderate importance	Low importance
Increased returns	Cost of not acting too high	Taxation incentives
Increased land value (native vegetation, weed management)	Increased land value (grazing, cropping)	Received government grant or assistance
Reduced costs (cropping)	Reduced financial risk (cropping)	Reduced costs
Provides grazing in adverse conditions (cropping and grazing)	Reduced livestock losses (weed management)	
Provides shelter for livestock (native vegetation)	Potential for biosecurity or stewardship credits (native vegetation)	
Cost of not acting too high (weed management)	Received government grant or assistance (native vegetation)	

Note: Where motivations applied to a specific practice but not generally to all practices, that practice is in brackets. Grants and assistance may have been rated as a medium/ low importance motivation because of low availability.

Results showing that grants and assistance were considered as a low importance motivation could demonstrate lack of availability of grants for cropping, grazing and weed practices or lack of successful grant applications, rather than low importance of this as a motivation.

Environmental motivations

Environmental factors were the most influential motivations for adopting native vegetation practices and the second most influential for adoption decisions for cropping, grazing and weed management practices (Table 9).

Table 9 Importance of environmental factors in consideration of management practices

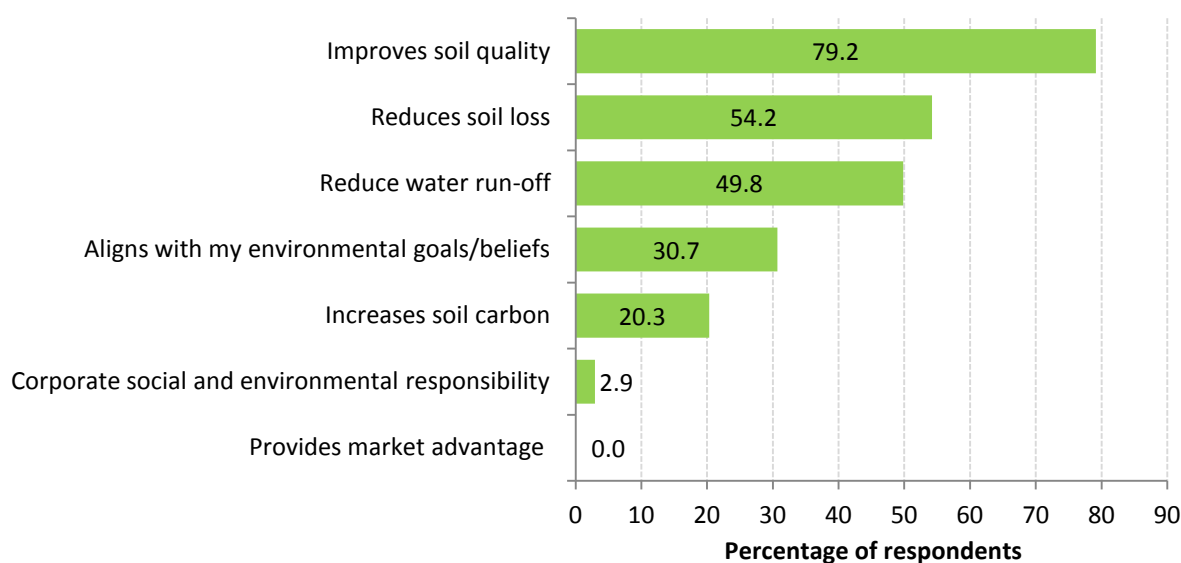
	Crop mgt practices (%)	Native veg mgt practices (%)	Grazing mgt practices (%)	Weed mgt practices (%)
To a great extent	31	32	22	22
To some extent	43	47	47	45
Not at all	26	21	31	33

Environmental motivations for crop management practice decisions

Of the farmers that said environmental factors influenced their uptake of crop management practices 'to a great extent' or 'to some extent', the majority of respondents (79 per cent) indicated that improving soil quality was a key motive. The next most important motives were reducing soil loss (54 per cent) and reducing water run-off (50 per cent). After these, the next most important motive was alignment with environmental beliefs/goals, which was selected by nearly one-third of farmers (Figure 5).

Results from a study by Llewellyn and D'Emden (2009) also indicate that soil conservation (as well as reduced fuel and labour costs) was a primary reason given for adopting no-till practices. Soil moisture management was the next most highly ranked reason (Llewellyn & D'Emden 2009).

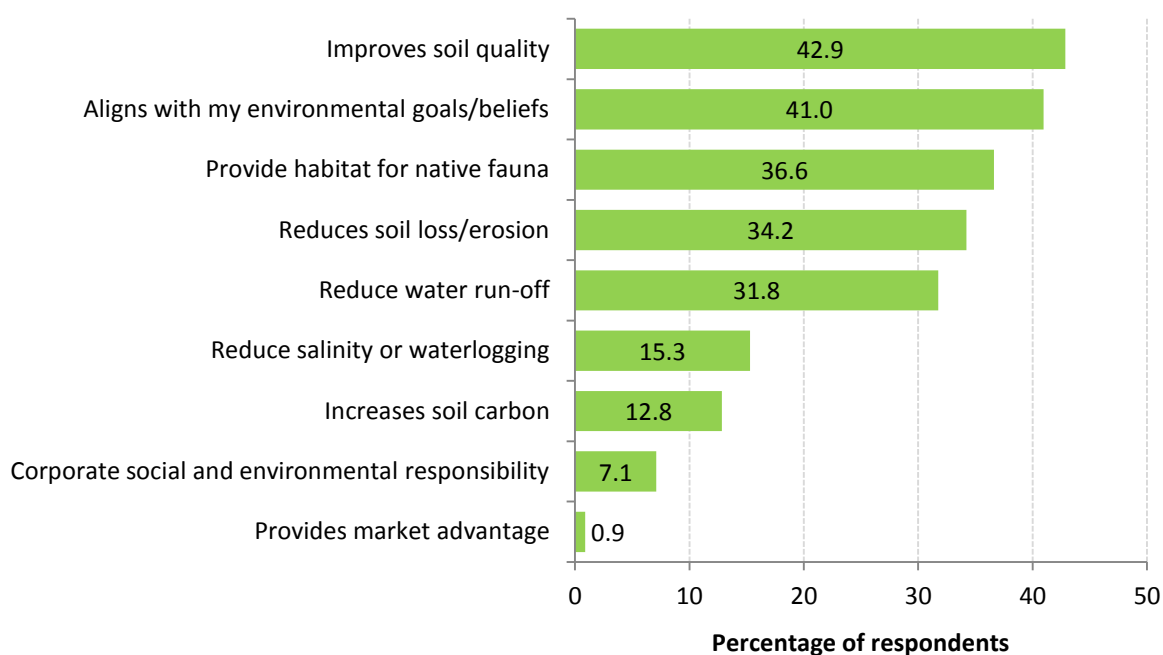
The extent to which the most frequently chosen motives (reducing soil loss, reducing run-off) closely align with financial benefits was not explored in this study and requires further consideration.

Figure 5 Environmental motivations for uptake of crop management practices

Note: Respondents could nominate more than one option.

Environmental motivations for native vegetation management practice decisions

For farmers who said that environmental motivations influenced adoption 'to a great extent' or 'to some extent', the highest ranked environmental motivations for native vegetation management practice adoption included improvement to soil quality, alignment with environmental beliefs/goals and providing habitat for native fauna (Figure 6). Perceived reductions to soil loss and water run-off as a result of adopting native vegetation management practices were also commonly identified as key motives.

Figure 6 Environmental motivations for uptake of native vegetation management practices

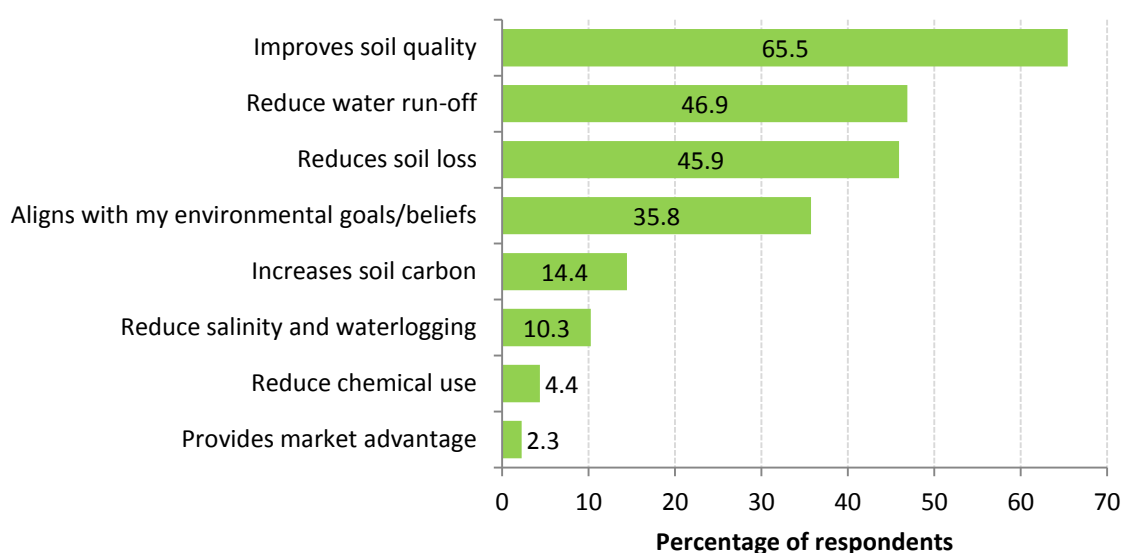
Note: Respondents could nominate more than one option.

A corresponding study also undertaken by ABARES, using a sub-sample of the population considered in the Drivers of Practice Change survey, asked further questions about why farmers were managing native vegetation. Of those respondents undertaking native vegetation management, 84 per cent were motivated by on-farm production and/or environmental benefits, one-third were motivated by environmental outcomes, 29 per cent considered landscape outcomes and 20 per cent considered connectivity with neighbouring properties (Harris-Adams, Townsend & Lawson 2012)

Environmental motivations for grazing management practice decisions

Of the farmers who said that environmental motivations influenced adoption 'to a great extent' or 'to some extent', over 65 per cent indicated that the main environmental motive for adopting grazing management practices was the perceived improvement to soil quality. Reductions in water run-off and soil loss were equally important environmental motivating factors (Figure 7). The top three motives for grazing were the same as for crop management practices. Over one-third of farmers implementing grazing management practices also indicated that alignment with environmental goals/beliefs was an important motive, which was similar to the response for crop management practice adoption.

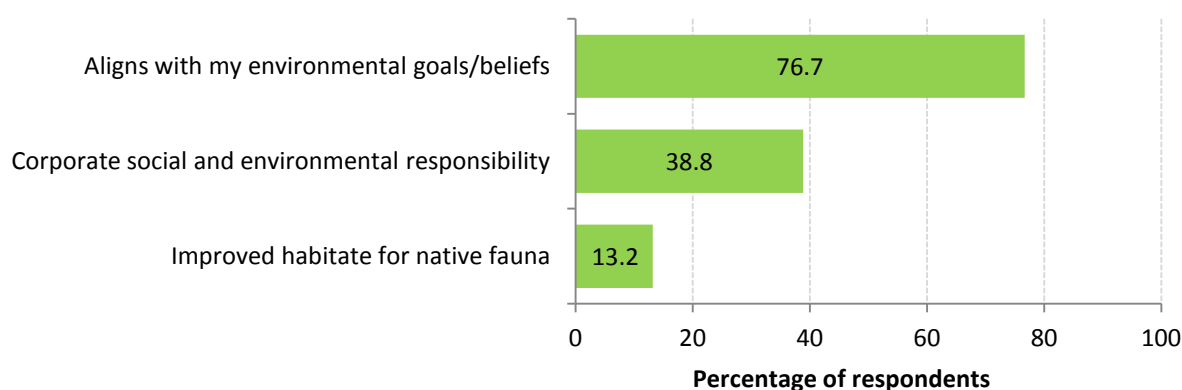
Figure 7 Environmental motivations for uptake of grazing management practices



Note: Respondents could nominate more than one option.

Environmental motivations for weed management practice decisions

For the farmers who said that environmental motivations influenced adoption 'to a great extent' or 'to some extent', alignment with environmental goals/beliefs was the primary environmental factor influencing the adoption of weed management practices (77 per cent), followed by having a sense of corporate social and environmental responsibility (39 per cent) and providing improved habitat for native fauna (13 per cent)(Figure 8).

Figure 8 Environmental motivations for uptake of weed management practices

Note: Respondents could nominate more than one option.

Environmental motivations for all management practices

Farmers were motivated by benefits accruing to the farm business (or an 'ego-utility' focus, see Chouinard et al. 2006) in adopting crop management practices as indicated by their relative ranking of motivations such as 'improvement of soil quality', 'reduction of soil loss' and 'reduction of water run-off'.

These motivations are relevant to the objectives of the Sustainable Farm Practices component of Caring for our Country targets—to reduce soil loss through wind and water erosion.

Respondents also indicated increasing the carbon content of soils (not a target for Sustainable Farm Practices 2012–2013) was important—between 13 per cent of respondents for native vegetation management practices and 20 per cent for crop management practices. The objective of addressing soil acidity, also a Sustainable Farm Practices target, was not directly investigated in the survey.

Environmental motivations across all management practice categories are listed in Table 10. Motivations for weeds and native vegetation management were aligned with public good aspects such as environmental goals/beliefs, corporate social and environmental responsibility and improved habitat for flora and fauna. Motivations for crop and grazing management practices were more production-focused (for example, improves soil quality, reduces soil loss and water run-off), although these also have broader public good aspects to them.

The relationship between production benefits and desire to protect the environment has been explored by Bewsell and Kaine (2006). They suggested that environmentally-focused practices must 'address specific on-farm needs' (p. 1) to succeed, and inferred from their results that attitudes to the environment may not be a strong influence in farmer decision-making.

Results from this survey suggest that environmental beliefs do influence decision-making. The motivation 'aligned with environmental goals/beliefs' (these goals/beliefs were not specified) was the most important motivation for weed management and the second most important for native vegetation management. However, the influence of personal environmental beliefs in practice adoption is strongly affected by context (Bewsell & Kaine 2006; Payne & Bewsell 2006).

A summary of environmental motivations across all land management practice areas is shown in Table 10.

Table 10 Importance of environmental motivations in adoption decisions: all practices

High importance	Moderate importance	Low importance
Improves soil quality	Increases soil carbon	Reduces chemical use
Reduces soil loss	Reduces salinity and water logging	Provides market advantage
Aligns with environmental goals and beliefs		Corporate and social responsibility
Reduce water run-off		
Provides habitat for fauna (native veg management)		
Corporate social and environmental responsibility (weed management)		

Note: Where motivations applied to a specific practice but not generally to all practices, that practice is in brackets.

Personal motivations

The interest in personal motivations in this study stems from the widely held belief that the lifestyle of farming can influence decisions on farm. Personal influences may stem from interactions within the community (for example, Marshall 2010), family ties (for example, Fulton & Vanclay 2010), environmental stewardship motives (Mallawaarachchi et al. 1999; Chouinard et al. 2006) and wanting to improve on-farm work-life balance.

In the survey, farmers ranked personal motivations as important ‘to a great extent’ less frequently than financial and environmental motivations, with only minor differences between management practices (Table 11).

Table 11 Importance of personal motivations in consideration of management practices

	Crop mgt practices (%)	Native veg mgt practices (%)	Grazing mgt practices (%)	Weed mgt practices (%)
To a great extent	11	13	11	18
To some extent	30	38	32	39
Not at all	59	49	57	43

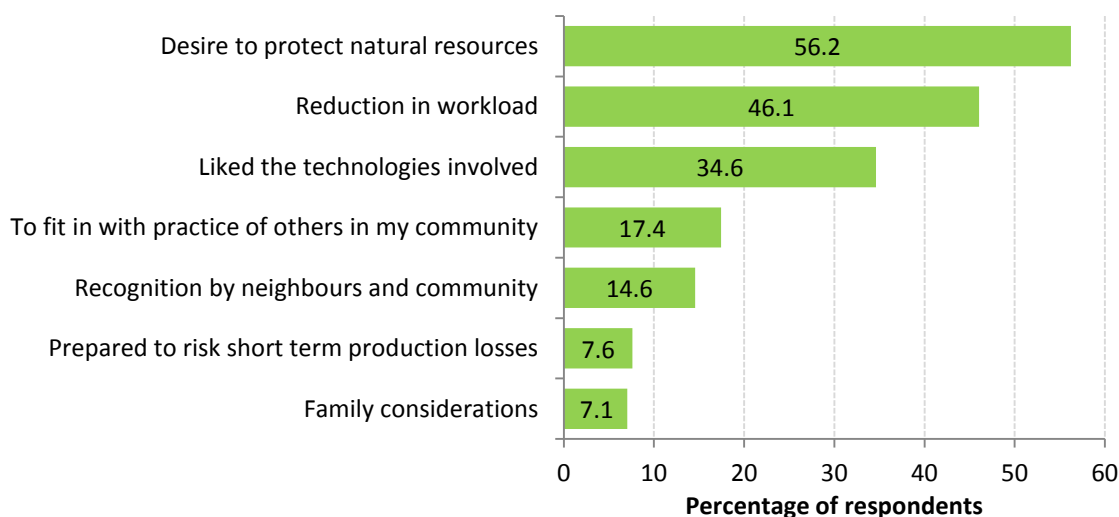
Personal motivations determined in stage 1 of the study were explored through the survey. They related to environmental stewardship ethics; relationships with family, neighbours and community; personal interest (for example, interest in technology); and reducing work load.

Some personal motivations overlap with financial motivations. Reducing workload can reduce financial burden but also can allow an improved lifestyle—therefore, it is both a personal and a financial motivation. The motivation of ‘prepared to risk short-term production losses’ also represents an overlap with financial considerations and risk preparedness can likewise be considered a personal and financial motivation. New management practices will not always return a profit immediately, so farmers may need to forgo short-term profit. In reference to sustainable farm management practices, Vanclay (2011) notes that ‘if farmers based their adoption decision solely on economic criteria, there would be very little adoption’ (p. 59). Hence, although there is overlap between some of the personal and financial motivations, it was considered worthwhile to consider both these factors in the survey.

Personal motivations for crop management practice decisions

For farmers who said that personal motivations influenced adoption 'to a great extent' or 'to some extent', the most important personal motivations for adopting crop management practices included the desire to protect natural resources (56 per cent), reduction in workload associated with the practice (46 per cent), and liking the technologies involved (35 per cent).

Figure 9 Personal motivations for uptake of crop management practices

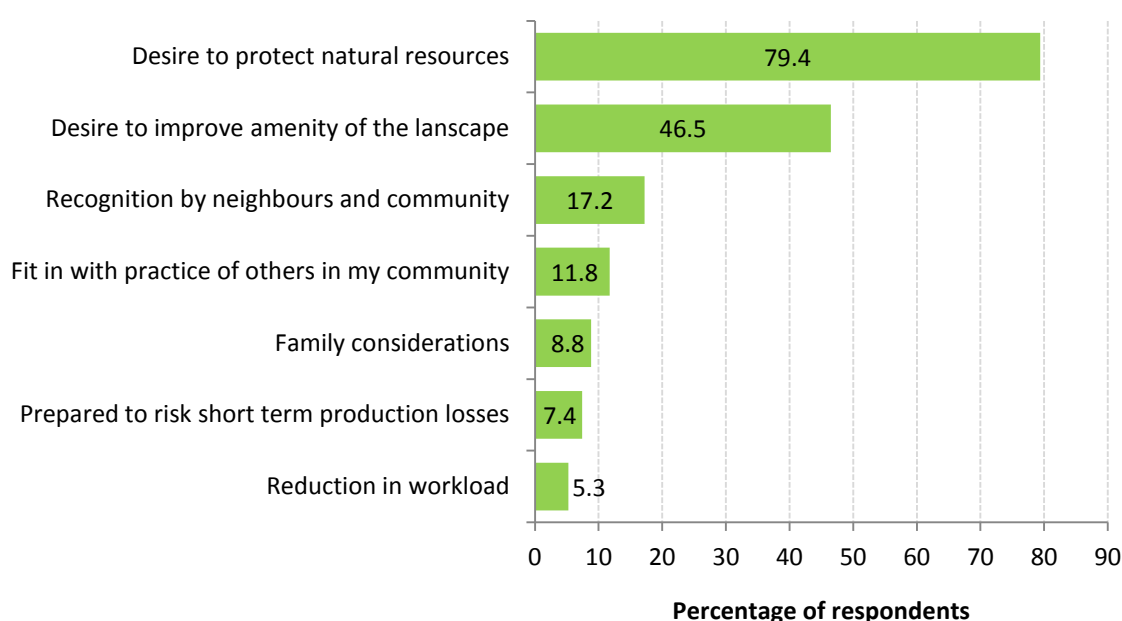


Note: Respondents could nominate more than one option.

Personal motivations for native vegetation management practice decisions

As for the other practices, personal motivations were the third most frequently chosen influence for native vegetation management, after environmental motivations, which were the most important, and financial motivations. However, the difference between the importance of financial and personal influences for native vegetation management is less than for the other more production-related management practices. The relative importance of personal motivations for adopting native vegetation management practices is supported by Mendham and colleagues (2007), who found landholders' personal values or goals were important.

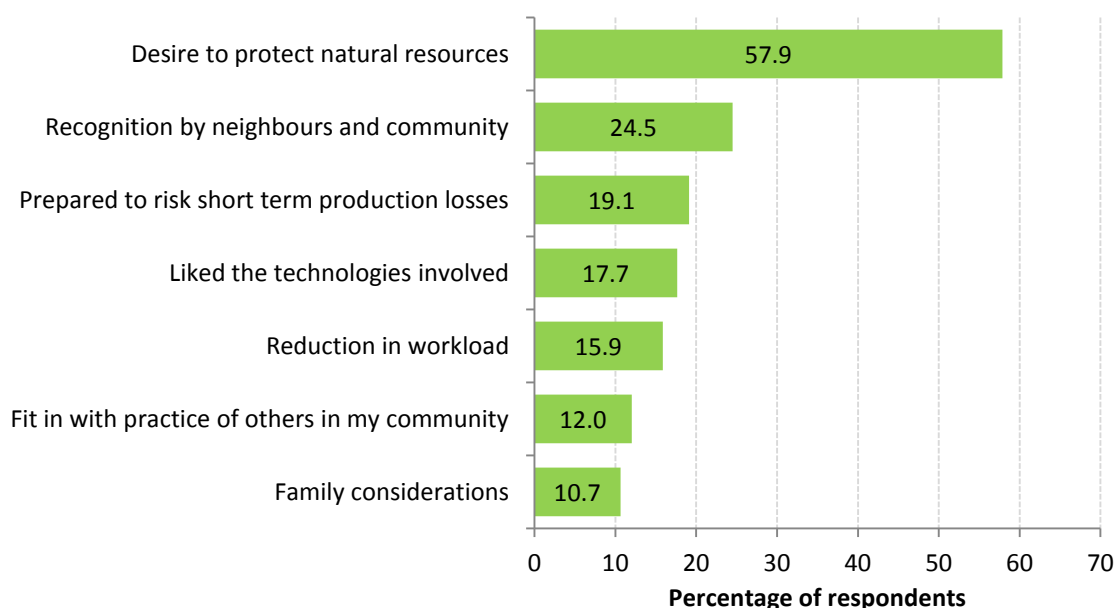
For farmers who said that personal motivations influenced adoption 'to a great extent' or 'to some extent', the desire to protect natural resources was the main personal motivation for adopting native vegetation management practices (79 per cent), followed by a desire to improve the amenity of the landscape (46 per cent), and recognition by neighbours and the community (17 per cent). The importance of positive recognition from others is supported by Mendham and colleagues (2007), who found that farmers perceived that they were harshly judged by the broader community and that their conservation works went unrecognised.

Figure 10 Personal motivations for uptake of native vegetation management practices

Note: Respondents could nominate more than one option.

Personal motivations for grazing management practice decisions

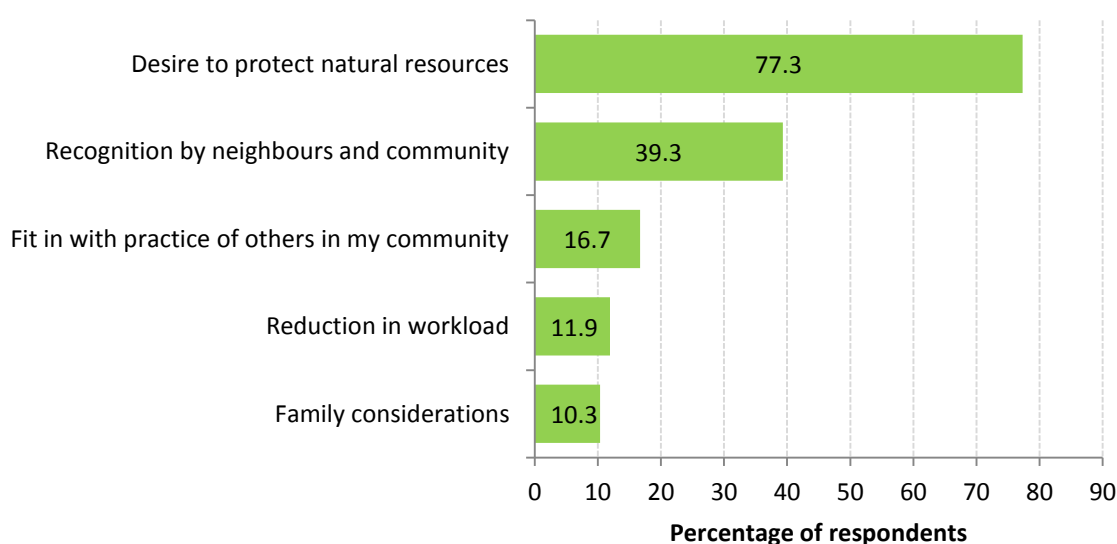
For farmers who said that personal motivations influenced adoption 'to a great extent' or 'to some extent', the desire to protect natural resources was the most frequently selected personal motivation for adopting grazing management practices. Recognition by neighbours and community was also a strong influence for 24 per cent of farmers—this is a higher percentage than for both native vegetation management and crop management practices. Farmers also indicated they were prepared to risk short-term production losses (19 per cent) by adopting grazing management practices. This may indicate the perception that the eventual gains from these practices will outweigh the initial risks for grazing management practices, compared with native vegetation and crop management practices, which both rated lower on this personal motivation.

Figure 11 Personal motivations for uptake of grazing management practices

Note: Respondents could nominate more than one option.

Personal motivations for weed management practice decisions

For farmers who said that personal motivations influenced adoption 'to a great extent' or 'to some extent', the desire to protect natural resources (77 per cent) was a key personal motivation for adopting weed management practices. Recognition by neighbours and community was indicated as a motivating factor by nearly 40 per cent, followed by fitting in with community practices (17 per cent).

Figure 12 Personal motivations for uptake of weed management practices

Note: Respondents could nominate more than one option.

Personal motivations for all management practices

Overall, the personal motivation 'desire to protect natural resources' was consistent across all management practices, indicating a strong environmental stewardship ethic among farmers.

Personal factors not only motivated uptake but also limited it, with 44 per cent of farmers saying that available time/workload limited their ability to make changes to management practices. Age was also seen as a limiting factor—27 per cent of farmers said this was a barrier.

Table 12 summarises personal motivations across all management practices.

Table 12 Importance of personal motivations in adoption decisions: all practices

High importance	Moderate importance	Low importance
Desire to protect natural resources	Recognition by neighbours and community	Reduction in workload (native vegetation management)
Liked the technology (crop management)	Fit in with practice of others in my community	
	Reduction in workload	
	Family considerations	
	Prepared to risk short-term losses	
	Liked the technology	

Note: Where motivations applied to a specific practice but not generally to all practices, that practice is in brackets.

4 Support

The survey results indicate that NRM support providers, particularly Landcare and production groups, are important in supporting farmers to adopt management practices, but are less involved in motivating decisions to adopt than other motivations. Farmers in this study reported that, in general, the availability of support for change did not greatly influence their consideration of land management practices (Table 13). Around 20 to 30 per cent of respondents indicated that support influenced their adoption decisions to some extent.

Table 13 Importance of availability of support in consideration of management practices

	Crop mgt practices (%)	Native veg mgt practices (%)	Grazing mgt practices (%)	Weed mgt practices (%)
To a great extent	6	9	6	6
To some extent	29	29	20	23
Not at all	65	62	74	71

A range of factors can affect this observed result, and interpretation of ‘availability of support’ as a motivation for NRM practice adoption needs to consider the following:

- Options explored in the survey included non-financial support from groups, peers, consultants and government.
- Decision-making theories suggest that support is secondary to intrinsic motivations in decision-making processes (that is, people seek support once they have decided to adopt).
- The nature of support was not examined.
- The meaning of support to different farmers is likely to vary.

The extent to which farmers were aware of support available for the management practices considered in the survey is unknown. It is also unclear from the data whether the differences noted by respondents in the importance of different forms of support were based on their preferences or the availability of that support type.

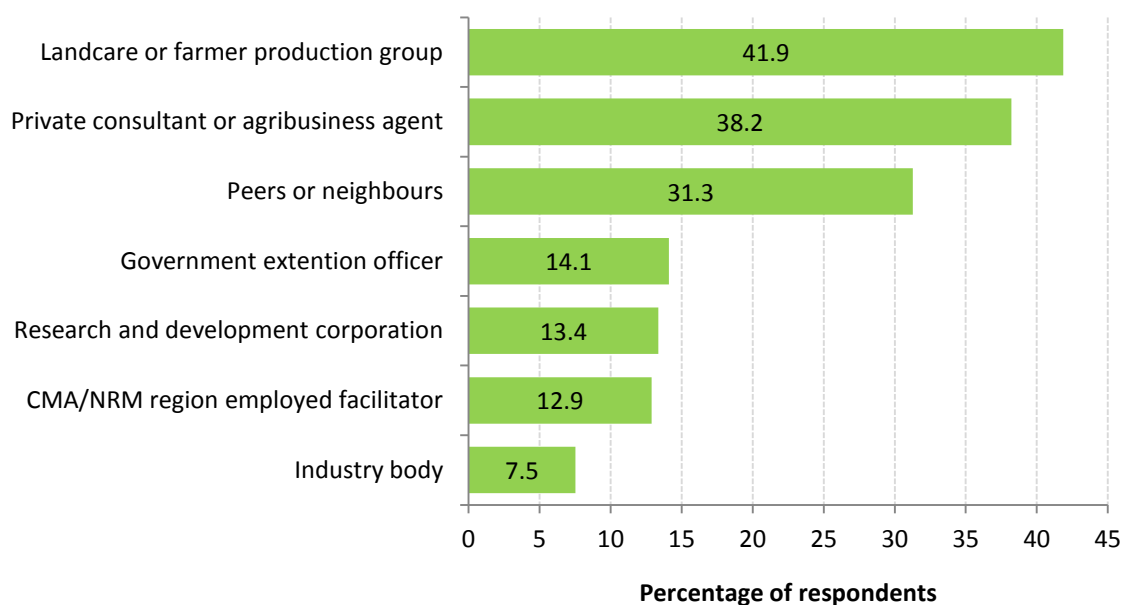
Taking these factors into account, across all land management practices, Landcare and production groups were indicated as the most important sources of support. This study’s findings are consistent with previous studies (for example, Marshall 2008), indicating that community-based or local approaches can motivate farmers. Availability of support for the specific management practice areas is discussed below.

The association between farmers’ motivations for adoption and availability of support may depend on how accessible policy mechanisms or provisions (such as grants, assistance payments and in-kind support) are for each of the management practice categories. For example, only 1 per cent of farmers said that receiving a government grant or assistance motivated them to adopt weed management practices. However, it is not known whether government grants were widely available or whether they were easily accessible for the respondents. Further research is needed about what types of support are available and how accessible and suitable these types of support are for the nominated management practice categories or for farmers in different industries and locations.

Availability of support as motivation for crop management practice decisions

Sixty-five per cent of farmers indicated that availability of support did not influence their uptake of crop management practices. Of the 35 per cent who did say support influenced them, Landcare or production groups (42 per cent), private consultants or agribusiness agents (38 per cent), and peers and neighbours (31 per cent) were the most important sources of support (Figure 13).

Figure 13 Type of support influencing uptake of crop management practices

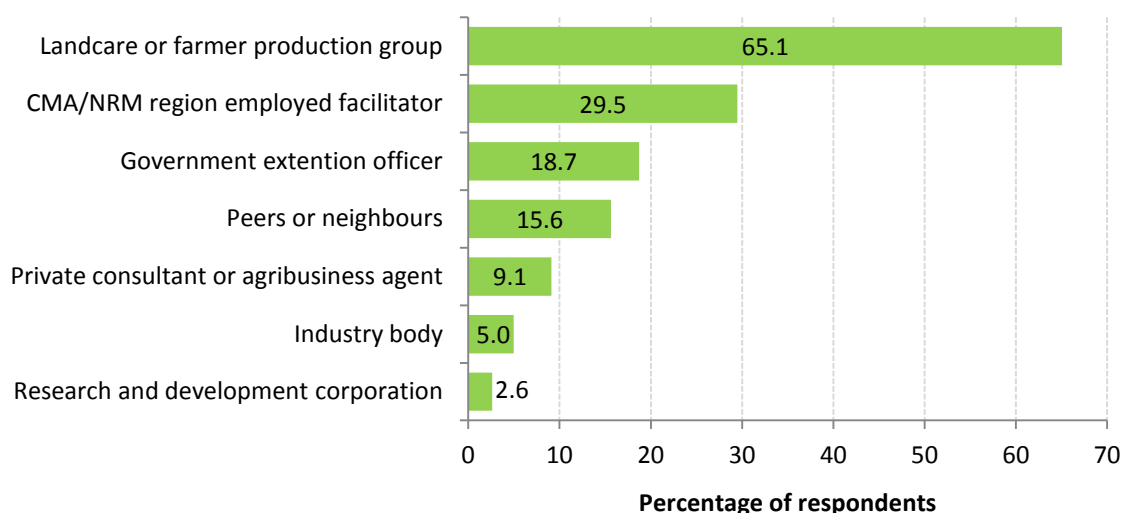


Note: Respondents could nominate more than one option.

Llewellyn and D’Emden’s (2009) study identified some core differences in the way no-till users and non-users accessed support. For example, their study found that no-till users were more likely to obtain advice from consultants than non-users. No-till non-users had a greater preference for livestock, were less likely to have someone with a higher level of formal education managing the farm, were less likely to see the production benefits of the practice and were more likely to have older seeding machinery (Llewellyn & D’Emden 2009).

Availability of support as motivation for native vegetation management practice decisions

Availability of support was a slightly more important influence on the adoption of native vegetation management practices than for the other management practice categories. For respondents who indicated availability of support as an influence, Landcare or production groups (65 per cent) were the primary form of support, followed by CMA/NRM region facilitators (29 per cent), and government extension officers (19 per cent). There is a difference in the forms of support nominated here compared with cropping—CMA/NRM region facilitators and government extension officers were perceived as more knowledgeable about vegetation management than private consultants and peers/neighbours.

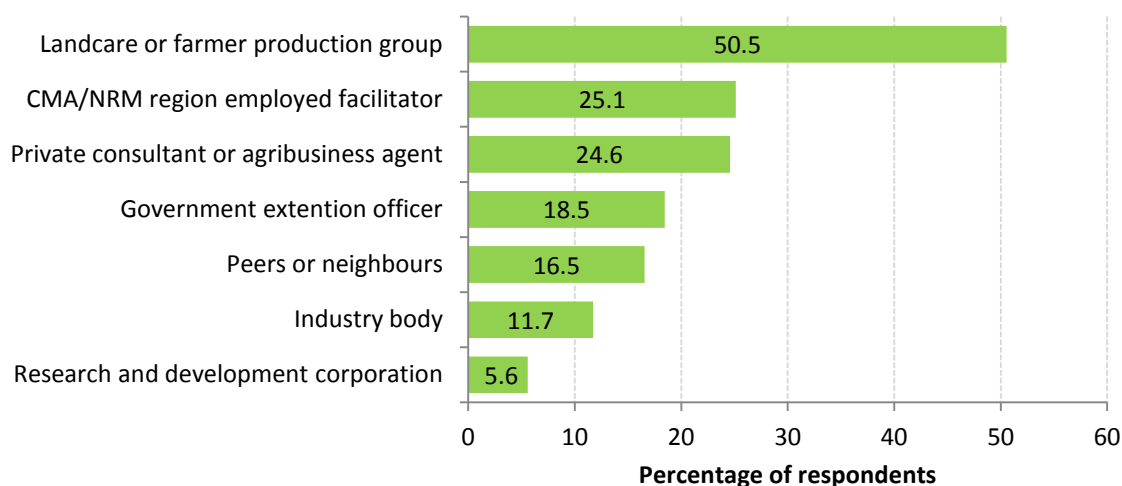
Figure 14 Type of support influencing uptake of native vegetation management practices

Note: Respondents could nominate more than one option.

Factors influencing adoption of vegetation management practices considered by Mendham and colleagues (2007, p. 46) included not knowing where to go to find out about it, and the need for one-to-one extension. This suggests that Landcare or production groups are an important source of information about native vegetation management compared with private consultants, industry bodies and research and development corporations. There is an opportunity for industry bodies and research and development corporations to provide more information on native vegetation management.

Availability of support as motivation for grazing management practice decisions

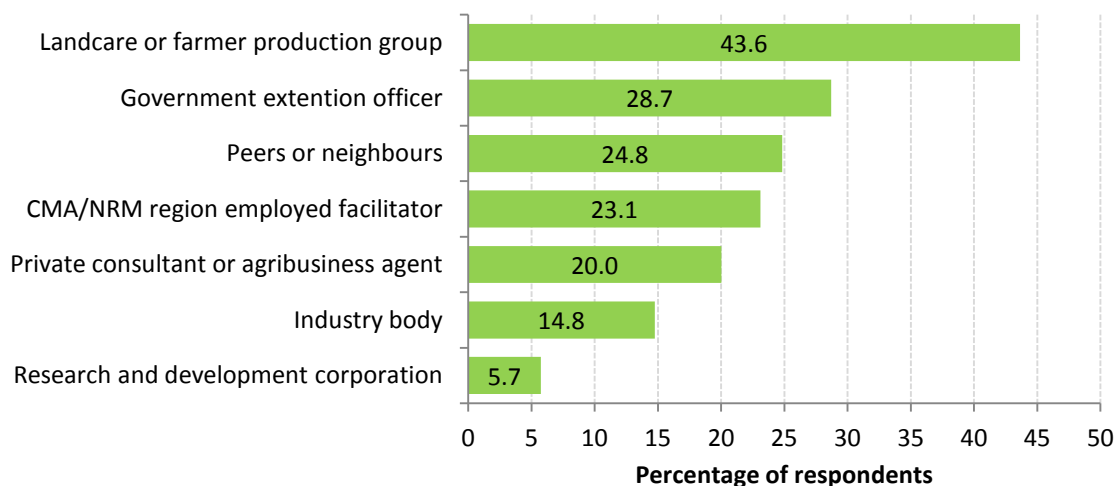
For the majority of respondents (73 per cent) availability of support was not an influence on the uptake of grazing management practices. The remainder who considered support did influence them 'to a great extent' (6 per cent) or 'to some extent' (20 per cent), nominated Landcare or production groups (50 per cent), CMA/NRM region employed facilitators (25 per cent), and private consultants or agribusiness agents as the most important sources of support (25 per cent).

Figure 15 Type of support influencing uptake of grazing management practices

Note: Respondents could nominate more than one option.

Availability of support as motivation for weed management practice decisions

Of the farmers who said they were managing or considering managing Weeds of National Significance, 71 per cent indicated that availability of support was 'not at all' a factor in weed management. However, of those that did indicate support as a factor, 44 per cent selected Landcare or production groups, 29 per cent selected government extension officers, and 25 per cent selected peers or neighbours. As noted earlier, Landcare and production groups are a key source of support for adopting all management practices considered in the survey.

Figure 16 Type of support influencing uptake of weed management practices

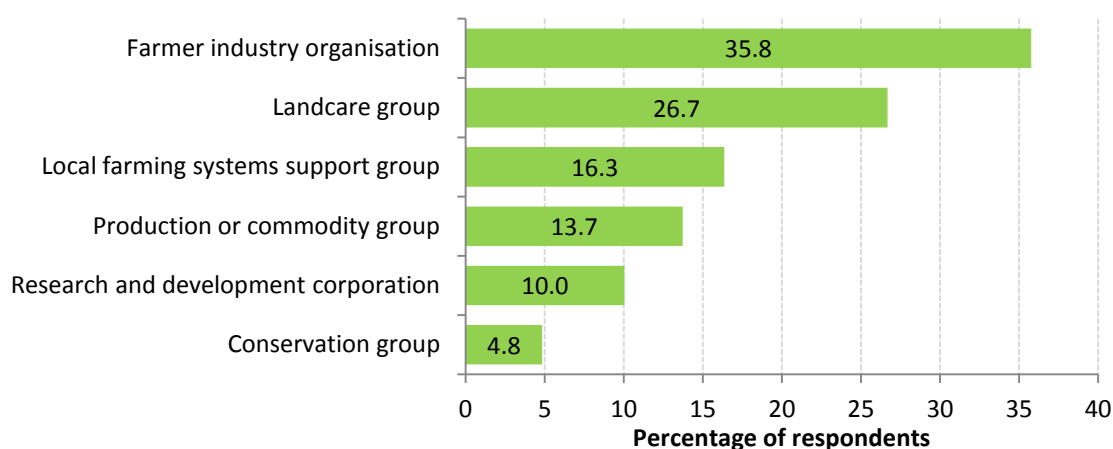
Note: Respondents could nominate more than one option.

Importance of Landcare, production and farming system groups

For farmers who said that support influenced adoption 'to a great extent' or 'to some extent', Landcare and production groups were the most important of the support options provided. This indicates the relative importance of these groups in influencing change. This view is supported by the analysis of farmer involvement in groups and networks in this survey (Figure 17)

Involvement included farm industry organisations (35 per cent of farmers), Landcare groups (27 per cent), farming systems groups (16 per cent), and production groups (14 per cent).

Figure 17 Involvement in groups and networks



Note: Respondents could nominate more than one option.

According to Nelson and colleagues (2004), in 2001–02 there were around 4500 Landcare groups Australia-wide and 37 per cent of broadacre and dairy farm businesses were involved in Landcare. This is higher than the 26 per cent involved in Landcare groups based on the current survey. Results from the ABS Land Management and Farming Survey more closely reflect this survey's response rates, with 20 per cent and 19 per cent of respondents indicating membership of a Landcare group in 2007–08 and 2009–10, respectively. The results suggest that Landcare involvement has remained at similar rates since 2007–08, despite a change in funding arrangements to these groups in recent years (ABS 2009).

One factor that may explain the difference in farmers involved in Landcare groups is the emergence of local farming systems support groups since the late 1990s (following the Decade of Landcare initiative) (Gianatti & Carmody 2007). These groups, focused largely on holistic management principles, may incorporate both conservation and production activities, are participatory in nature and are focused on 'defining and solving problems through involvement with farmers' (Gianatti & Llewellyn 2003). Results from the current survey show these groups are the second most frequently cited group (16 per cent) farmers are involved in, after Landcare groups.

Characteristics of group members, including age and education, were explored using chi-squared tests to identify statistically significant associations. These demographic tests used a non-weighted sample and are not necessarily representative of the total farming population.

Statistical analyses on this basis indicate there was a significant association between formal education and involvement in Landcare, local farming systems and production groups. The analyses suggest that the farmers participating in all the above groups are more likely to have a university degree than farmers not involved in these groups.

The formal educational level of farmers' spouses was also associated with involvement in farming systems or production groups, but not involvement in a Landcare group. Those involved in farming systems or production groups were more likely to have a spouse who was tertiary educated than those who were not.

When considering the association between age and involvement in these groups (also using the non-weighted sample data), there were no significant associations between Landcare or production group participation and age. However, there was a significant relationship between age and involvement in local farming systems groups.

Other support

Peers and neighbours are important sources of support in crop management and weed management, with 31 per cent and 25 per cent of farmers, respectively, selecting these sources.

Rather than providing direct support, governments now define legislative requirements and provide extension services focused on specific areas. This is due to the worldwide trend away from government-funded extension to private extension that began in the mid-1990s (Marsh & Pannell 1998). The Decade of Landcare initiative, for example, resulted in the development of community-based Landcare groups that provided a group participatory model for extension (Gianatti & Carmody 2007). These models were designed to reflect farmer learning preferences and also allow governments to reduce spending on a service with private good characteristics (Vanclay & Lawrence 1995; Cary et al. 2002; Marsh & Pannell 1998). This was apparent in the survey as respondents assigned high importance to government extension in weed management and native vegetation management. It is suggested that these practices have higher public good characteristics and so are more likely to attract funding and information support from government. An example of this is the Environmental Stewardship Program for encouraging on-farm conservation, administered by the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). Such market-based instruments are designed to support the sustainability of ecosystem services (Australian Government 2012).

Among other sources of support, regional NRM groups / CMAs were most important in influencing adoption of grazing and native vegetation management practices. The survey analysis generally supports the view that the adoption of practices is motivated by the perceived benefits of a management practice to farmers (for example, production or financial benefits) rather than the influence of extension as a form of support. Barr and Cary point out that extension has 'limited potential to reduce the problems of lack of profitable options' (Pannell 1998).

5 Participation and learning

Barriers to participation

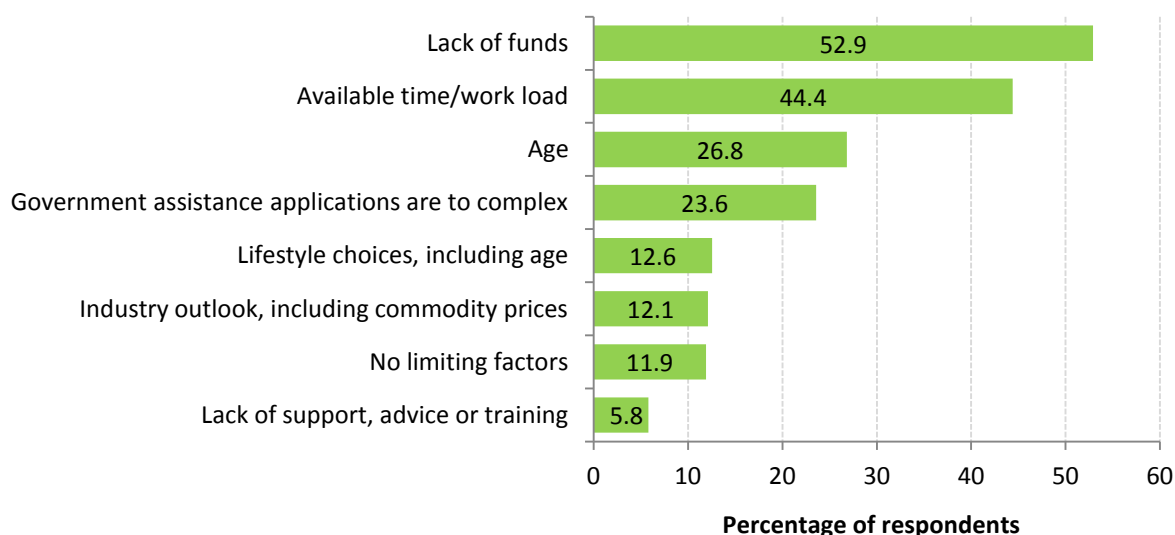
Farmers reported a number of barriers to making changes to management practices. Of the options provided, lack of funds and available time/workload were the most commonly identified factors (Figure 18). Age was the third most reported limiting factor, and complexity of government assistance applications was reported by around one-quarter of respondents.

These results concur with the 2006–07 ARMS, which found that the most common reasons given for not improving NRM practices were lack of financial resources (79 per cent) and lack of time (63 per cent). In the ARMS, age and/or ill health was given as a barrier by 22 per cent of agricultural businesses nationally.

Lack of support, advice or training was only identified as a limiting factor by 6 per cent of farmers responding to this survey. This aligns with the low importance assigned to support as a driver of practice change, as discussed earlier. This result is consistent with support being a secondary motivation that has influence after the decision to adopt has been made. The results also highlight that adoption is influenced by people's capacity (financial, time, labour) to take up a management practice. Price signals, as indicated through the 'industry outlook' option, were not a barrier for most respondents.

Barriers are also discussed in Chapter 6 for the three industry groups considered in the study.

Figure 18 Barriers to changing land management practices



Note: Respondents could nominate more than one option.

Learning activities

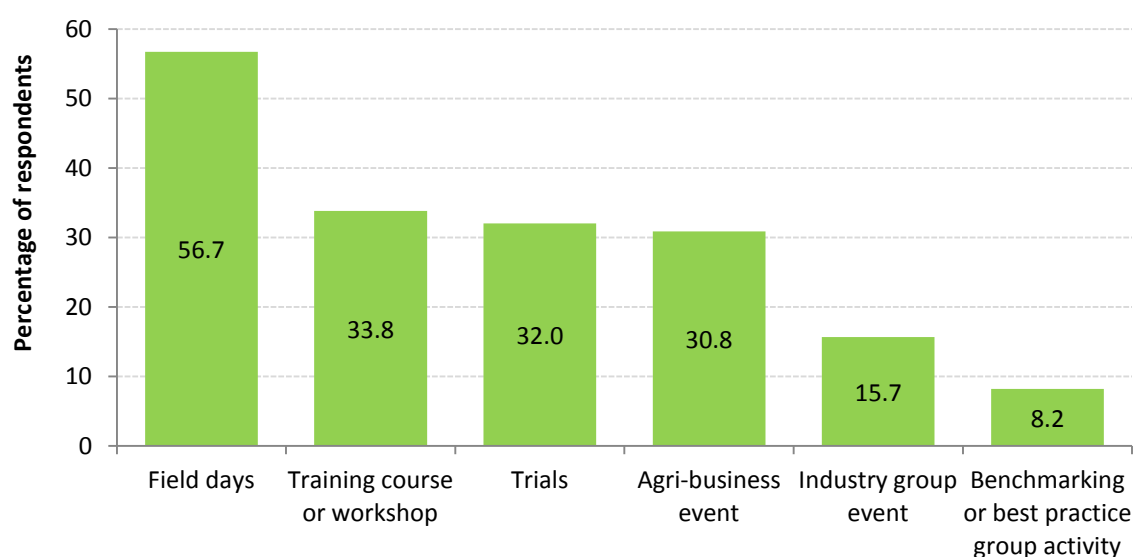
Participation in activities that contribute knowledge and skills are generally thought to enhance adoption when these activities focus on the target practices. For example, Llewellyn and D'Emden (2009) found that participation in relevant seminars, field days and workshops was positively correlated with uptake of minimum till practices.

Farmers were asked if they had obtained management practice information from a set of nominated learning activities over the past two years, and also whether they had used the management practice information.

Almost all respondents had attended an activity to gain information or advice about management practices. Results indicate that many attended more than one activity. There were very few people who did not attend a learning activity.

‘Field days’ were attended by 57 per cent of farmers and represented the most frequently attended activity. These were followed by ‘training course or workshop’ (34 per cent of farmers attending), ‘trials’ (32 per cent) and ‘agribusiness events’ (31 per cent). ‘Industry group events’ and ‘benchmarking or best practice group’ activities were the least attended activities at 16 per cent and 8 per cent, respectively (Figure 19).

Figure 19 Participation in activities for obtaining management practice information or advice



Note: Respondents could nominate more than one option.

When asked if they used the information from the activity attended, 62 per cent of respondents who attended field days used the information and 41 per cent attending training courses or workshops used the information. Of those attending trials, 32 per cent indicated they used the information, and 38 per cent attending agribusiness events used the information. Benchmarking or best practice group events and industry group events were activities from which the fewest respondents indicated they used information—8 per cent and 21 per cent, respectively.

Farmers were also asked to nominate the main focus of the activity or activities they attended. The majority of these activities were production-focused (64 per cent), followed by a combination of production and NRM/environmental focus (31 per cent). Only 2 per cent of activities attended were solely focused on NRM/environmental matters. This highlights the importance to farmers of a production focus to information and extension activities, which supports the survey results indicating financial drivers (including increased production) as an important motivation. Nearly one-third of respondents indicated a combined production and NRM/environment focus for their activities, highlighting that a combination of financial and environmental motivations are important to farmers.

Farmers were asked to identify the delivery agent and the funding source for activities they attended (see Table 14). Responses to this question were collated across all activities except field days and industry group activities. This was due to a data collection issue. Overall, private consultants or agribusiness agents were the most common delivery agents (20 per cent) and source of funding (15 per cent) for activities. Local farmer groups (13 per cent) and state governments (12 per cent) were the next most frequently nominated delivery agents. The Australian Government was regarded as delivering 6 per cent and funding 11 per cent of the activities nominated.

Table 14 Delivery and funding of activities used to obtain management practice assistance

Delivery agent	Activity delivered by (%)	Activity funded by (%)
Private consultant/agribusiness agent	20	15
Local farmer group	13	10
State government	12	10
Australian Government	6	11
Regional NRM group/CMA	4	4
Landcare group	3	2
Other	3	3
Local government	3	4
Do not know	3	9

Note: These results cover all activities except field days and industry group events for which these data were not collected.

Table 15 provides details about which activities were delivered by each delivery agent. Training courses were delivered by private consultants/agribusiness agents, NRM groups/CMAs, Landcare groups and the Australian Government. Trials were mainly delivered by state government, private consultants, NRM groups/CMAs, local farmer groups and, to a lesser extent, the Australian Government and Landcare groups. Benchmarking or best practice activities were delivered by consultants, state government and the Australian Government.

These results indicate the importance of private consultants/agribusiness agents and local farmer groups in delivering management practice information because these were seen as delivering more activities than Landcare groups. However, this information is affected by the information for field days and agribusiness events being omitted. For field days, in particular, it is likely that local farmer groups, regional NRM/CMA and Landcare groups may have been key delivery agents. This is supported by survey results that indicate that support is provided by these groups (Figures 13 to 15) and that there is participation in these groups (Figure 17).

Over 90 per cent of farmers said they had incorporated the outcomes of the activity they had attended, including training courses or workshops (94 per cent), trials (91 per cent), industry group events (95 per cent), and benchmarking or best practice group activities (99 per cent). An average of 96 per cent of farmers said they would use the provider of the activity again.

Table 15 Most commonly delivered activities by provider (excludes field days and agribusiness events)

Provider	Activities provided in order of frequency		
Private consultant/agribusiness agent	1. Training course or workshop (38%)	2. Benchmarking or best practice group activity (32%)	3. Trials (28%)
Local farmer group	1. Industry group event (27%)	2. Benchmarking or best practice group activity (21%)	3. Trials (16%)
State government	1. Trials (24%)	2. Industry group event (19%)	3. Benchmarking or best practice group activity (18%)
Australian Government	1. Benchmarking or best practice group activity (11%)	2. Training course or workshop (9%)	3. Trials (8%)
Regional NRM group/CMA	1. Trials (10%)	2. Training course or workshop (7%)	3. Industry group event (4%)
Landcare group	1. Training course or workshop (11%)	2. Trials (7%)	3. Industry group event (2%)
Local government	1. Industry group event (4%)	2. Trials (2%)	3. Training course or workshop (2%)

Note: Percentages refer to the number of farmers who said that the activity they attended was delivered by this provider. Field days and agribusiness events are not included as these data were not collected for those activities.

Involvement in Australian Government programs

The awareness of and participation in a number of Australian Government programs was examined and the results are presented in Table 16. The program most familiar to respondents was the pre-existing National Landcare Program—92 per cent awareness. Although this is not currently a formal program, respondents still recognised it. The National Landcare Program was included to compare with more recent programs.

The next most frequently recognised initiative was the Regional Landcare Facilitators at 52 per cent. However, this could also reflect potential recognition of the general terms ‘regional’, ‘Landcare’ and ‘facilitator’. Caring for our Country was recognised by 29 per cent of farmers.

Of the programs considered, FarmReady had the highest number of farmers participating (40 per cent), followed by the Regional Landcare Facilitators (36 per cent) and the National Landcare Program (36 per cent).

The conditional probability column in Table 16 refers to the likelihood of the events interacting with each other to produce an outcome. That is, individuals (1) were aware of Australian Government programs, (2) participated in them, and (3) made changes as a result of participation. The conditional probability indicates the overall influence of each program, based on responses from the survey sample. Percentages shown in Table 16 refer to the probability that the program has had an impact across the sample. The National Landcare Program was most likely to have had an impact, followed by the Regional Landcare Facilitators and FarmReady.

Where people were involved in the programs listed, they generally reported positive outcomes. Most farmers said that participation had led to a change in practices, skills or knowledge—ranging from 73 per cent for Reef Rescue to 100 per cent for the Sustainable Farm Practice Facilitator initiative.

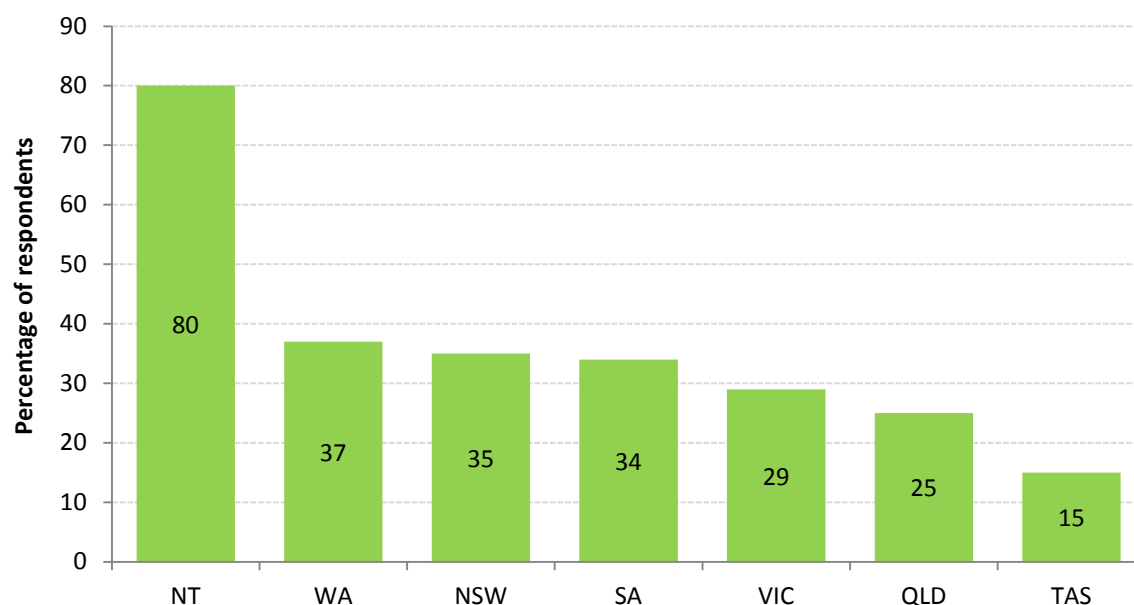
Table 16 Awareness of and participation in Australian Government NRM programs

	Aware (%)	Participated (%)	Practice change or improved skills and knowledge as a result of participation (%)	Conditional probability (likelihood of being aware, involved and making changes) (%)
Caring for our Country	29	16	80	3.8
Reef Rescue	19	5	73	0.7
National Landcare Program	92	36	80	26.2
FarmReady	32	40	95	12.1
Australia's Farming Future	22	7	89	1.3
Sustainable Farm Practice Facilitators	18	16	100	3.0
Regional Landcare Facilitators	55	36	94	18.7
National Landcare Facilitator	31	8	97	2.6

Farmers said that participation in programs and initiatives benefited them through gaining skills and knowledge (43 per cent), implementing on-ground works (30 per cent), changing management practices (16 per cent), and improving community interaction (13 per cent).

Property planning

Farmers were asked whether they had a written farm plan or property management plan and what information the plan contained. Across all respondents, 31 per cent indicated they had a written property plan. There was some variation across states—with farmers from Western Australia, New South Wales and South Australia were most likely to have a property plan (Figure 20). There are a range of definitions of what constitutes a property plan, and numerous different approaches to farm planning being used by extension and delivery agents, so this part of the survey aimed to determine what aspects of farm planning farmers considered most useful. Farm production activities and farm financial or business activities were the most common components of farm plans—over three-quarters of farmers' plans including these. This was followed by management of natural resources (51 per cent), people management (46 per cent), and management of major weed threats (45 per cent).

Figure 20 Percentage of farmers in each state indicating they had a farm plan or property management plan

For farmers with plans, the most frequently referred to component was farm financial or business activities, with 35 per cent of respondents saying they always referred to this when making decisions. This was followed by management of weed threats, which was noted as being always referred to by 27 per cent of farmers. Overall, there was wide use of farm plans—only 2 to 9 per cent of farmers said they never referred to certain aspects of the plan (Table 17).

Table 17 Components of farm or property management plans and frequency of reference to these

	Farm production activities (%)	Management of natural resources (%)	Farm financial or business activities (%)	People management (%)	Management of major weed threats (%)
Contain information on	77	51	76	46	45
Refer to when making decisions—always	23	14	35	18	27
Refer to when making decisions—sometimes	70	80	63	73	68
Refer to when making decisions—never	7	6	2	9	5

6 Industry-specific motivations

This section explores the differences in adopting land management practices for the three industry groups considered—dairy, broadacre and horticulture. It aims to provide information for targeting NRM related approaches and communications to these different industries.

The analysis in the previous sections considers the influences for broadacre and dairy respondents combined, whereas this section identifies differences between the influences for dairy and horticulture businesses compared with broadacre. The results from broadacre farm businesses are used as the basis to demonstrate these differences.

Dairy industry drivers

The following discussion compares dairy and broadacre farmers to highlight influences that are specific to the dairy industry. Dairy farmers were surveyed as described using a nationally representative sample (N=260). The majority of dairy farms in the sample were located in Victoria (67 per cent), followed by New South Wales (11 per cent). The average dairy farm size was 256 hectares. Adoption of land management practices by dairy farmers has been discussed in Chapter 1. In comparison to broadacre farm businesses, dairy farmers made greater use of rotational grazing, were more likely to fence native vegetation, and reported lower levels of adoption of crop management practices. This lower adoption of crop management practices is likely to be because cropping is a subsidiary activity for dairy farmers, so investment in infrastructure, for activities such as minimum till, is less likely.

As for broadacre farm businesses, dairy farmers reported that considerations about adopting crop, grazing and weed management practices were influenced mainly by financial motivations, then environmental motivations. There is a comparison of results for each industry in Table 18. Environmental motives were the primary influences for adopting native vegetation management practices for both broadacre and dairy farmers (Table 18). Financial motivations for grazing management practices were important for most dairy farmers (75 per cent) and financial motivations for crop management practices were less important (26 per cent).

Table 18 Importance of motivations for adopting land management practices: dairy and broadacre farmers

	Crop mgt practices (%)		Native veg mgt practices (%)		Grazing mgt practices (%)		Weed mgt practices (%)	
	Broadacre	Dairy	Broadacre	Dairy	Broadacre	Dairy	Broadacre	Dairy
Financial	40	26	17	19	45	75	42	47
Environmental	33	16	32	28	24	15	23	15
Personal	12	5	9	7	9	18	18	16
Support	7	3	9	9	7	5	5	13

A higher proportion of dairy farmers (13 per cent) considered availability of support as an influence in considering adopting weed management practices, compared with only 5 per cent of broadacre farmers. Personal motivations were identified as important for 18 per cent of dairy farmers adopting grazing management practices, compared with 11 per cent of broadacre farmers. Personal motivations for weed management practices for dairy farmers (16 per cent) were similar to those for broadacre farmers (18 per cent).

For dairy farmers, increased returns were the most important financial motivation for crop, grazing and weed management practices. Dairy farmers considered that providing grazing fodder year-round was the second most important motivation for grazing and crop management practices. In comparison, broadacre farmers said providing grazing fodder was the most important financial motivation for the same practices.

As for the other industry groups, dairy farmers also said that providing shelter for stock was the most important of the financial motivations for native vegetation management. It was even more important for dairy farmers than for broadacre farmers, with 80 per cent of dairy farms choosing this compared with 66 per cent of broadacre farmers. For weed management practices, dairy farmers said the second most important financial motivation (after financial returns) was 'cost of not acting too high'. Increased land value was also an important financial motivation for dairy farmers to adopt all practices. Environmental motivations for adopting practices were similar to the other industry groups and related to improving soil quality, reducing run-off and soil loss.

Compared with broadacre farmers, for whom the desire to protect natural resources was the most important personal motivation for adopting all new practices, dairy farmers selected this as the most important personal motivation for native vegetation management only.

Dairy farmers chose reduction in workload as the most important personal motivation for adopting crop and grazing management practices. This reflects the pressures on dairy farmers to reduce time spent working. The importance of considering already demanding workloads for dairy and horticultural businesses was also highlighted during stage 1 of this project. For dairy farmers, recognition by neighbours was the most important personal motivation for adopting weed management practices.

Where availability of support was an influence, Landcare and production groups were the most important influence across all management practices for dairy farmers, as was the case for broadacre farmers.

A lower percentage of dairy farmers had written property plans (23 per cent) than broadacre farmers (32 per cent). People management was the most referred to component of property plans for dairy farmers, with 35 per cent referring to this always, followed by weed management threats (33 per cent), and farm financial activities (31 per cent). In comparison, broadacre farmers chose farm production activities (79 per cent), farm financial management activities (75 per cent), and management of natural resources (52 per cent).

Dairy farmers' awareness of Australian Government NRM programs was similar to broadacre farmers, except for the National Landcare Facilitator initiative which was less recognised by dairy farmers—20 per cent compared with 33 per cent of broadacre farmers. Participation in Australian Government programs differed between dairy and broadacre farms. Fewer dairy farmers were involved in FarmReady and more were involved in the National Landcare Program, Australia's Farming Future and the Regional Landcare Facilitators than broadacre farmers (Table 19).

Table 19 Participation in Australian Government programs: dairy and broadacre farmers

	Dairy (%)	Broadacre (%)
Caring for our Country	4	18
National Landcare Program	39	35
FarmReady	17	42
Australia's Farming Future	23	23
Sustainable Farm Practice Facilitators	6	18
Regional Landcare Facilitators	45	35
National Landcare Facilitator	3	9

Factors limiting the take-up of management practices by dairy farmers mostly matched those selected by broadacre farmers, with lack of funds and available time / workload being most important. However, broadacre farmers chose 'age' as the next most important limitation, and dairy farmers chose 'government assistance applications are too complex'. Dairy farmers were generally younger, with 39 per cent of dairy respondents 50 years old or under compared with 27 per cent of broadacre respondents. Lack of support, advice and training was more of a barrier for dairy farmers at 11 per cent than for broadacre farmers at 5 per cent (Table 20).

Table 20 Factors limiting change in management practices: dairy and broadacre farmers

Limiting factors	Dairy (%)	Broadacre (%)
Lack of funds (including government assistance)	60	52
Available time or workload/labour issues	49	44
Government assistance applications are too complex	38	22
Age	20	28
Lifestyle choices	20	12
Industry outlook (including commodity prices)	16	12
No limiting factors	15	12
Lack of support, advice or training	11	5

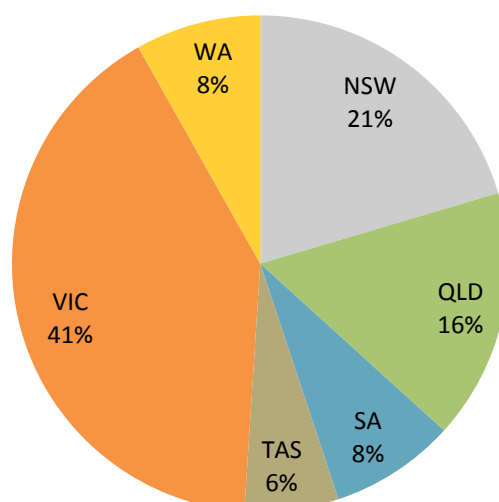
The characteristics of dairy farm businesses may have influenced their adoption preferences. In particular, dairy farm businesses are year-round operations where continuity of feed supply and maintaining a productive environment for dairy cows is important at all times. They also tend to operate their land more intensively so setting aside larger areas for vegetation management may have relatively higher opportunity costs.

Horticulture industry drivers

A pilot study was conducted to trial the use of the Drivers of Practice Change survey instrument with horticulturalists. The sample was evenly distributed across non-nursery horticultural business types and geographical areas. As a pilot survey, the sample size (N=49) was not statistically representative of the industry and as it was a separate survey cannot be directly statistically compared with the Drivers of Practice Change survey. As these results are not nationally representative, unlike the results presented on broadacre and dairy farm businesses in this report, caution is required when interpreting specific results. The survey was delivered as a phone survey in May/June 2011. Figure 21 shows the location of survey respondents by state

as a percentage of all respondents. Of the 49 respondents, 30 (61 per cent) indicated they were producing one type of product and 19 (39 per cent) were producing two. Products included vegetables, grapes, kiwi fruit, apples and pears, stone fruit, olives, citrus fruit, berries and other unlisted horticultural fruits. More people were producing grapes (15 people) and vegetables (11 people) than the other products.

Figure 21 Location of horticulture survey respondents by state



For the pilot survey, average farm size was 271 hectares and the median was 53 hectares. Of those interviewed, 88 per cent were men and 12 per cent were women. Horticulturalists were asked about a different set of practices to the broadacre and dairy respondents, except for native vegetation and weed management practices (Table 21). Adoption results for all industries are listed in Chapter 1.

Horticulturalists selected environmental motivations as the major influence for adopting all the management practices considered (Table 21). This contrasts with broadacre and dairy farmers, who chose financial drivers as the greatest influence for all but native vegetation management practices. The reasons for this difference between industries require further research.

The availability of support was also different for horticulturalists. More horticulturalists said that this influences their decisions to adopt land management practices than broadacre and dairy farmers. Again, the differences between industries require further investigation.

Table 21 Importance of motivations for adopting land management practices: horticulture farmers

	Soil mgt practices (%)	Native veg mgt practices (%)	Run-off mgt practices (%)	Weed mgt practices (%)
Financial benefits	39	10	35	25
Environmental factors	67	35	42	44
Personal motivations	20	16	19	36
Availability of support	20	19	15	19

Horticulturalists had similar financial motivations to broadacre and dairy farmers, with increased returns and reduced costs the most important. For native vegetation management, providing shelter for livestock was the most important financial motivation for horticulture

farmers, as it was for the other industry groups, despite the expectation that horticulturalists would have less focus on livestock.

Environmental motivations of horticulturalists were similar to those selected by broadacre and dairy farmers, with the most important being to improve soil quality, reduce soil loss and reduce water run-off. As for dairy farmers, a key personal motivation for horticulturalists was reduced workload, which was the most important motivation for soil management practices. Also, while 'aligns with personal beliefs' was nominated as the most important personal motivation by broadacre and dairy farmers, this was less important to horticulturalists. Family considerations were more important to horticulturalists than the broadacre and dairy groups.

A clear difference between horticulturalists and broadacre/dairy farmers was the way they accessed support. Private consultants or agribusiness agents were selected by horticulturalists as the most important support influence for all management practices (Table 22), compared with Landcare and production groups for broadacre/dairy.

For native vegetation management, the next most important support influence after private consultants and agribusiness agents was government extension officers. Landcare and production groups were still nominated as a support influence but were ranked equal third for native vegetation management (with research and development (R&D) organisations), third for soil management practices, and equal second for run-off management. Government extension officers ranked equal first for weed management practices and second for native vegetation management and run-off management practices. Peers or neighbours ranked second for soil management practices and run-off management practices and third for weed management. Industry bodies and R&D organisations typically ranked third or lower.

Table 22 Importance of support motivations for horticulture farmers

	1	2	3
Soil mgt practices	Private consultants or agribusiness	Peers or neighbours	Landcare and production groups
Native veg. mgt practices	Private consultants or agribusiness	Government extension officers	Landcare and production groups/ R&D organisations
Run-off mgt practices	Private consultants or agribusiness	Landcare and production groups/ Peers or neighbours/ Government extension officer	Industry body
Weed mgt practices	Private consultants or agribusiness/ Government extension officer	Landcare and production groups	Peers or neighbours

Only 8 per cent of horticulturalists were involved in Landcare groups, compared with 26 per cent of broadacre farmers and 35 per cent of dairy farmers. Association with other groups that provide support for land management decisions was the same or close to the same for horticulturalists and broadacre/dairy farmers (Table 23).

Table 23 Involvement in groups: horticulture, broadacre and dairy farmers

	Horticulture (%)	Broadacre (%)	Dairy (%)
Farmer industry organisation	35	34	46
Local farming systems support group	14	15	23
Production or commodity group	12	13	19
Research and development corporation network	12	10	11
Landcare group	8	26	35
Conservation group	4	5	3

Note: These results are not directly comparable between horticulture and broadacre/dairy because of different collection and weighting methods used in the latter, and are provided as a guide only.

As for broadacre and dairy farmers, field days were the most commonly selected activity to obtain management practice advice for horticulturalists—67 per cent attended these in the past two years. Training courses/workshops, trials and agribusiness events or meetings were all equally attended, with 51 per cent selecting these. Overall, these results were similar to broadacre and dairy. More horticulturalists had farm plans (41 per cent) than broadacre (31 per cent) and dairy farmers (23 per cent).

Awareness of Australian NRM programs was similar between horticulture and broadacre and dairy farmers, with some exceptions (Table 24). A finding that requires further investigation is that a larger proportion of horticulturalists were aware of Sustainable Farm Practice Facilitators (37 per cent). This could reflect respondents' recognition of the term rather than knowledge of the actual program. Participation rates for the Sustainable Farm Practice Facilitators initiative was 18 per cent and 6 per cent for the broadacre and dairy industry groups, respectively. Participation in the pre-existing National Landcare Program was lower for horticulturalists at 18 per cent compared with 36 per cent for broadacre/dairy farmers.

Table 24 Awareness of Australian NRM programs: horticulture, broadacre and dairy farmers

	Horticulture (%)	Broadacre (%)	Dairy (%)
Caring for our Country	20	18	23
National Landcare Program	84	92	91
FarmReady	33	42	28
Australia's Farming Future	22	22	21
Sustainable Farm Practice Facilitators	37	18	15
Regional Landcare Facilitator	41	35	60
National Landcare Facilitator	39	9	20

Note: These results are not directly comparable between horticulture and broadacre/dairy because of different collection and weighting methods used in the latter, and are provided as a guide only.

Horticulturalists felt they had different limitations in their ability to make changes to management practices compared with broadacre and dairy farmers. Corresponding with earlier reported results on the importance of decreasing workload as a driver for adoption, horticulturalists said available time or workload/labour issues was the most important limitation (Table 25) and lack of funds was the second most important limitation. For broadacre and dairy farmers, this order was reversed. The influence of industry outlook was also

considered a greater limitation for horticulturalists than broadacre and dairy farmers. A slightly higher proportion of horticulturalists saw the complexity of government assistance applications as a limitation. More horticulturalists said that lack of support, advice or training was a limitation—10 per cent compared with 6 per cent of broadacre/dairy farmers (Table 25). This is supported by results from the stage 1 of the project, when horticulturalists said support was a greater driver of adoption than broadacre/dairy farmers. Lifestyle choices were also seen as more of a limitation for those in horticulture industries compared with broadacre, which may relate to earlier results that showed family considerations as an important driver of adoption for horticulturalists.

Table 25 Factors limiting change in management practices: horticulture, broadacre and dairy farmers

Limiting factors	Horticulture (%)	Broadacre (%)	Dairy (%)
Available time or workload/labour issues	57	44	49
Lack of funds (including government assistance)	51	52	60
Industry outlook (including commodity prices)	35	12	16
Government assistance applications are too complex	31	22	38
Lifestyle choices	22	12	20
Lack of support, advice or training	10	5	12
Age	20	28	21
No limiting factors	8	12	15

Note: These results are not directly comparable between horticulture and broadacre/dairy because of different collection and weighting methods used in the latter, and are provided as a guide only.

The relatively high land use intensity of horticulture operations, sensitivity and exposure to international markets and labour shortages for seasonal work may have contributed to the differences between horticulture and the other two industries.

7 Implications

The results of the survey highlight a number of factors that are important to better understand influences on the uptake of land management practices on farm. The implications of this study are described in the following section. This study informs four key areas relevant to sustainable agriculture/natural resource management: responding to farmer motivations; engagement and communications (including the effectiveness of government programs); provision of support; and further research. These implications are discussed briefly below.

Responding to farmer motivations

This study aimed to build on current understanding of the importance of financial motivations and largely anecdotal evidence of the importance of personal influences for adopting sustainable farm practices. The study demonstrated that decisions to undertake land management practices are influenced by a combination of motivations. These motivations were ranked according to the degree of influence on land management practice decisions. A consistent pattern emerged showing that farmers make decisions about adopting sustainable farm practices taking into account:

- 1) financial benefits and constraints
- 2) environmental factors
- 3) personal objectives and circumstances.

The results indicate that extension, communication and engagement activities should include information relevant to all three motivational areas—financial, environmental and personal. For example, farmers considering adoption of land management practices would find the following information useful in their decisions:

- potential for increased returns, reduced costs or increased land value, and other information about financial benefits of specific practices (for example, the value of native vegetation in providing shelter)
- potential for increased soil quality, reduced run-off and soil loss and potential for improved habitat
- how undertaking the practice will support people's environmental stewardship goals and provide positive reinforcement, including being recognised by others in the community, and how the practice can support or improve lifestyle goals (other than financial).

There is overlap between these motivational areas, such as achieving increased returns from reducing soil loss. Some individuals were not motivated by environmental factors in their uptake of land management practices and so are unlikely to be attracted to information that solely focuses on the environmental benefits of these activities. Likewise, some individuals were primarily motivated by environmental factors. This diversity of motivations needs to be integrated into NRM-related communications and engagement. For example, in addition to environmental messages, communication activities related to trials and demonstrations on sustainable practices could include information on production benefits and/or potential time savings (particularly for the dairy and horticulture sectors).

Integrating NRM and productivity

Most farmers reported that activities and events they had attended in the past two years had a productivity focus, or a combined NRM and productivity focus. Very few activities were identified as solely about NRM. This indicates that NRM engagement and information provision activities are being delivered in an integrated manner, but could also indicate that producers are unwilling (or uninterested) to attend training activities solely focused on NRM. This is supported by the emphasis placed on the combination of financial and environmental motivations in our results. Given that motivations for land management practice are related to financial, environmental and personal objectives, extension models that integrate all of these motivations are likely to give landholders more confidence to adopt. Results also highlight that farmers see a link between managing the resource base through NRM practices and longer-term productivity. This is shown through the prevalence of 'protecting the natural resource base' as a personal motive for the adoption of all practices explored in this study.

Engagement and communication

Targeting NRM extension, communication and engagement

Acknowledging the factors that motivate farmers and using preferred or common interaction methods to engage farmers can help target efforts for improving adoption of land management practices. Providing broadbrush information is rarely sufficient, and the information gathered from this survey and other research can help create more targeted engagement relevant for time-constrained farmers.

NRM extension and information providers already know that tailoring approaches to different industries and demographic groups are necessary to engage people. The results of this study indicate that different industry groups have their preferred sources of information and advice. Acknowledging the different motivations for different industry groups in the context of these communications is important for improving efforts to reach target audiences.

Additionally, different NRM support providers tend to use particular strategies for communicating practice change information. Farmers said that Landcare, farming systems and production groups were the most influential in adoption decisions, with the exception of horticulturalists who said consultants were most influential. NRM programs can channel information to farmers through these groups, which may be more effective than a general approach. Characteristics of the Landcare approach include farmers learning from each other, group-based learning processes and practical, field-based approaches (such as trials). Some of these characteristics are shared by the farming systems and production groups (for example, the group-based approach). These farming systems and production groups also focus on a particular way to view farming (such as systems based) and/or an emphasis on particular outcomes (such as increased production). These approaches don't necessarily target the specific needs of individual farmers.

Consultants are important in promoting sustainable practice, particularly in cropping, dairy and horticulture. Understanding that many farmers are receiving NRM-related advice from consultants is important—consultants need to be given relevant information so they can effectively link NRM and production outcomes for their clients.

Different support providers appear to be influential in specific practices. Consultant advice was shown as more important for influencing crop management practice adoption than the other practices considered (grazing, native vegetation and weed management). Government extension was noted as more important in supporting native vegetation and weed management than the

other practices. NRM region facilitators were more important for influencing native vegetation and grazing management relative. This information has implications for resourcing support activities, considering there are gaps in knowledge associated with the issue of support.

Building on research (Rogers 2003; Pannell et al. 2006) that considers the attributes of different practices (for example, relative advantage and trialability) and how these can affect adoption, this study determined that different practices are also associated with different motivations. For example, taking an interest in technology was a highly ranked motivation for adopting crop management practices. In this case, the attraction of farmers (particularly croppers) to new technologies provides an opportunity to develop innovative communication projects that encourage practice change or allow information to be shared. Understanding what features of the practice hold interest and have compatibility with both personal and farm management styles can assist in effective extension. This can also be combined with an understanding of the particular learning styles and preferences of farmers to improve the effect of extension (Kilpatrick et al. 1999; Kilpatrick & Johns 2003; Kilpatrick & Rosenblatt 1998; Kilpatrick & Williamson 1996; Thompson & Reeve 2011).

Field days were the most frequently attended extension and information provision activity. The importance of field days also concurs with the importance of trialability as a key factor in adoption. Workshops and training activities were the next most frequently attended activities. Consultants and agribusinesses are the most common providers of these activities and productivity is the main focus. Learning preferences need to be considered when developing government programs. These activities provide an opportunity to reach wide audiences and need to be part of a strategy for engagement in NRM that meets farmer needs.

Support

Involvement in groups

Landcare and production groups were the most influential source of support and membership for farmers. These groups provide an effective environment to support practice change. The results suggest farmers have a positive view of Landcare (and other groups), as demonstrated through continued membership and participation. This is also demonstrated by the continued high recognition of the National Landcare Program, a program that ceased in June 2008. The results also confirm research by other authors that farmers prefer to learn from other farmers, particularly where the results of trials can be seen (see Pannell's and Kilpatrick's works in particular).

This importance of groups is also affected by the shift to group-based extension over the past 15 years (Marsh & Pannell 1998 in Pannell et al. 2006). Growth in NRM and production groups depends on the usefulness of these groups in social networking, using adult learning principles and encouraging participation (Chamala & Keith 1995; Knowles 1984 and Roling 1998 in Pannell & Vanclay 2011). This growth is also affected by budgetary considerations and the move away from one-on-one government extension models (Pannell & Vanclay 2011).

Group-based extension does not suit everyone; it favours those who are more extroverted (Schrapnel & Davie 2001 in Pannell & Vanclay 2011). Group-based learning is also not possible for everyone, such as for farmers in rangelands and remote areas for whom travel to attend regular group activities is difficult. Results from the survey about the importance of groups in influencing adoption need to be considered in this context of learning preferences and accessibility. That is, groups are clearly important, but not the answer to all NRM engagement objectives or farmer needs.

Group involvement was shown to be influenced by demographics. There was a clear link between involvement with Landcare, production and farming systems and level of education—a high proportion of people involved in these groups were tertiary qualified. Further investigation into this relationship would be useful to determine whether this is a peer group association, or whether group promotion and recruitment methods have attracted individuals with university educations. Broadacre and dairy farmers are also more likely to be involved in Landcare groups than horticulturalists; the reasons for this should be researched further so that future programs for horticulture can meet that industry's needs. Landcare arguably started in the broadacre regions (for example, Land Conservation District Committees started in the WA wheatbelt in the 1980s and earlier), and this influence may remain today. There may be a need for new and different communication methods to ensure opportunities for all in NRM-related groups, including attention to industry, location, gender, cultural background, and educational background and learning preferences.

Recognition of programs

Recognition of programs is problematic because this could also signify recognition of well-known keywords such as Landcare (for example, in Regional Landcare Facilitator). Another problem is that people may not know which agent is hosting, much less funding, the activity they are involved in. Branding for recognition is a long-term process and the branding of a program may be a low priority for farmers involved. Differences in recognition levels between industry groups are not easily explained and would require further exploration. It is likely that many farmers participate in and benefit from NRM programs without knowing the origin of that program. This is an area for future research to understand how recognition influences participation and/or membership and adoption. The results showed that most people who participated in Australian Government NRM programs were satisfied with that involvement.

Further research

A number of gaps in knowledge were revealed, as well as the need for longitudinal data to assess longer-term influences on practice change.

Monitoring objectives for sustainable agriculture requires ongoing research and data collection. With multiple influences on adoption, including financial, environmental, social and personal influences, as well as characteristics and benefits of the specific practice, future research needs to focus on identifying linkages between initiatives and adoption outcomes. Some important areas for further investigation that have emerged from this study are discussed below.

Links between land management practices and farm financial performance

Farm businesses adopting crop and weed management practices were more frequently associated with better farm financial performance than those that did not adopt these practices. No such association was determined for farm businesses implementing grazing or native vegetation management practices. Because there are many other variables to consider, this result requires further investigation to clarify the link between these management practices and farm financial performance. Further investigation is required to determine more about the nature of this relationship (that is, whether more farmers implement these practices because they are already profitable, or whether these practices support profitable businesses). This may include research to better understand the links between sustainable practices and improved productivity.

Links between motivations and practice change

This study recorded motivations about past or intended adoption of land management practices. That is, respondents were asked to nominate which motivations had led them to implement or consider implementing the practices, and so their responses were a rationalisation made later about why they undertook a practice. This tells us little about the process of reasoning that led to the change, including the factors and considerations that were weighed up in the decision process. In-depth qualitative research on how these motivations actually interact with decisions on land management at an individual farm level over time could shed more light on the complex relationship between motivations and uptake of these practices. For example, this could involve assessing the degree to which people's actions concur with earlier stated intentions. Given this study focused on drivers for farmers who had adopted or had considered adopting specific land management practices, another area for future exploration is understanding reasons for non-adoption.

Understanding the role of support in land management practice

To understand what makes support effective, its role in decision-making needs to be investigated further. Adoption is influenced by inter-relatedness with others. Pannell and Vanclay (2011, p. 3) commented that 'networks, physical proximity, relationships and the actions of government programs' all play a role in influencing adoption.

In this study, the role of support mechanisms was framed as 'availability of support' in the survey (for example, groups, consultants, peers and government) and was found to be less influential than financial, environmental and personal motivations in land management practice decisions. Nevertheless, between 20 and 30 per cent of respondents still indicated support was influential 'to a great extent' or 'to some extent' in their adoption decisions (depending on the practice). Given that support did not appear as a 'driver' of land management practice decisions in the same way as the other motivations, the interaction of support and financial, environmental and personal motivations warrants further attention.

Greiner and Gregg (2011) identified a distinction between goals and motivations, with goals defined as short-term tangible objectives that provide a means to an end. In contrast, motivations are ends in themselves (ibid). Goals and motivations are both significant in explaining adoption decisions (Ahnström et al. 2009; Kancans et al. 2008; De Graaff et al. 2008; Pannell et al. 2006; Kessler 2006; Maybery et al. 2005; Torkamani 2005). However, goals, such as making money, are usually only tools for achieving higher order aspirations (or motivations) such as securing family lifestyle (Pannell et al. 2006).

This suggests that support might be better considered as a tool to be used to achieve particular goals rather than a motivation. The focus on support needs to be on how to make it effective as a tool that can influence decision-making within the framing of intrinsic motivations (that is, financial, environmental and personal motives).

The types of support respondents ranked most highly in importance may have been selected based on either availability or preference for particular types of support and, as such, more information is required on this. Support includes seeking advice and information, so services provided by consultants, vets, production groups and extension programs in general (public or private) are all forms of support. A number of issues arise for further exploration to allow a better understanding of the results on support. This includes:

- more information about the nature of support farmers are accessing

- better understanding of the meaning of support among farmers—for example, whether NRM support mechanisms such as groups and R&D organisations create an enabling environment over the long term that is no longer viewed as support
- clarifying the extent to which farmers are aware of support available to assist implementation of sustainable land management practices
- identifying whether support types that rated highly as influential on adoption were more preferred by farmers, or were simply more available to farmers
- differences in support needs between industries—for example, more dairy and horticulture farmers reported ‘a lack of support and advice’ as a barrier to uptake than broadacre farmers
- understanding of farmer preference for autonomy and self-direction in farm management and the potential effect of this on their willingness to access support
- understanding of perceptions and accessing of support by non-adopters.

Targeting investment in NRM support

In the Drivers of Practice Change survey, farmers said that the availability of support was a more important influence in adoption decisions about native vegetation management practices (which potentially result in greater public benefits) than those with greater productivity benefits (that is, grazing and crop management practices). There was also a relationship between adopting some management practices (crop and weed management) but not others (grazing and native vegetation management) and improved financial status. Further investigation is required to explain these findings and determine what this means for targeting NRM support.

Next steps

The next stage of this project will involve a repeat of the national survey, which will build on this baseline data to explore trends occurring within the timeframe of Caring for our Country, and will assess, where possible, gaps highlighted above. This will gather further evidence on the relative importance of drivers of adoption relevant to the Caring for our Country Sustainable Farm Practice outcomes. This information can also be used to guide the development of initiatives to assist farmers and land managers to adopt sustainable farm practices in the future, as well as methods to engage farmers in these initiatives.

Appendix A: Adoption of management practices discussion

This appendix details results on farmer adoption of land management practices and gives references for published information on adoption rates. All results are weighted to ensure representativeness of the population in each geographic unit surveyed.

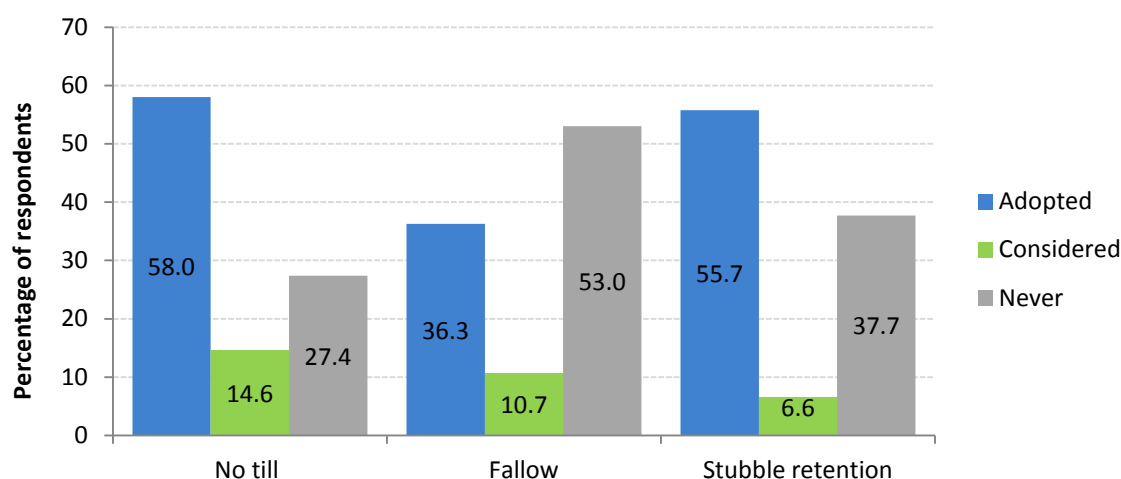
Adoption of land management practices varied widely across states. Table A1 presents adoption of land management practices by jurisdiction.

Table A1 Adoption of land management practices by state

	Practice	NSW (%)	Vic. (%)	Qld (%)	SA (%)	WA (%)	Tas. (%)	Average (%)
Crop management	No-till	67	44	49	85	67	35	58
	Stubble retention	75	30	64	71	70	31	57
Native vegetation management	Fallow periods used	56	17	63	51	10	41	40
	Native pastures encouraged/planted	35	13	31	14	11	15	20
	Native vegetation maintenance and management	43	38	26	52	31	39	38
	Fencing native veg	37	46	22	55	56	45	43
Grazing management	Cell or rotational grazing	52	43	55	56	26	68	50
	Minimum groundcover targets set	47	22	67	47	41	45	45
	Deep rooted perennials	55	49	52	24	15	34	38
Weed management	WoNS management	49	58	72	30	17	67	49

Adoption of crop land management practices

Crop management practices considered in the DPC survey included no/minimum till, fallowing and stubble retention. The average uptake of no-till / minimum till was 58 per cent Australia-wide, although this rate varied across the states (Table A1).

Figure A1 Adoption of crop management practices Australia-wide

The variation in adoption of no-till / minimum till across states is the result of a range of factors, such as climate and crop type (for example, certain climates and crops require different techniques for managing soil). The result is validated by similar findings in other research, with Llewellyn and D'Emden (2009), for example, reporting high rates of adoption of minimum till in South Australia. Their studies found that 90 per cent of grain producers adopted some degree of no-till practices, which closely matches the 85 per cent found by the DPC survey (Table A1). This result also concurs with findings from BRS Landholders surveys, which found 90 per cent uptake in South Australia and 33 per cent uptake in Tasmania. Information from ABARE farm surveys from 2001–02 to 2006–07 suggest a national average of 69 per cent of relevant farms having adopted conservation tillage. According to the 2007–08 Australian Resource Management (ARM) survey, 53 per cent of agricultural businesses preparing land for crops or pastures reported using zero-tillage. This increased to 54 per cent in the 2009–10 ARM survey (ABS 2009). Differences between results for the various surveys can be related to several factors, such as composition of the survey sample, phrasing of the question, areas under cropping, seasonal conditions, and year the survey was conducted. It is not possible to identify which factors had most impact.

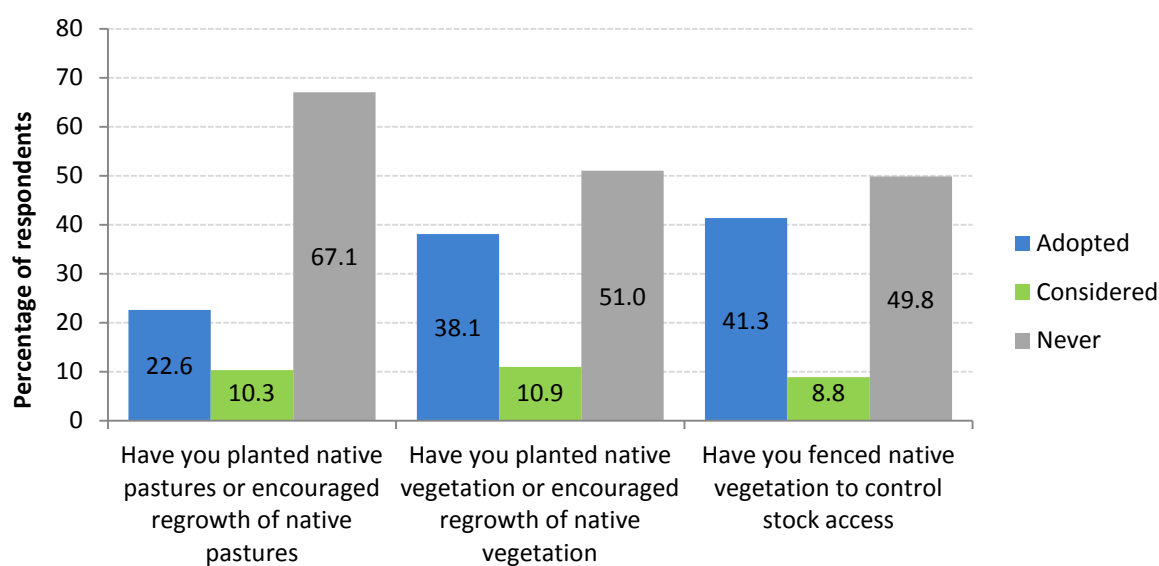
Fallowing had an average uptake of 36.3 per cent Australia-wide. Results of the ARM survey for 2007–08 support this, with 40.5 per cent of respondents Australia-wide reported as leaving land fallow. Karunaratne and Barr (2001) reviewed conservation crop management practices in the north-central region of Victoria and noted that it is difficult to measure adoption of fallow practices due to the effects of seasons on the mix of cropping and grazing that might occur and the differing lengths of fallow. Their review of studies, including ABS surveys from 1994 to 1997, showed an upward trend in adoption with an increase from 17.3 per cent to 33 per cent. Fallowing was found to be more common in the Mallee and northern Wimmera regions.

Stubble retention had an uptake of 55.7 per cent Australia-wide. ABARE farm survey data mentioned above indicate that stubble retention was adopted on 83 per cent of relevant farms, while the ARM survey for 2007–08 reported stubble retention at 43 per cent. Karunaratne and Barr (2001) found that stubble retention was a relatively uncommon practice, though they noted a move away from burning stubble to incorporation by those who did employ this practice. These results indicate the need for longitudinal surveying to monitor practice change over time.

Adoption of native vegetation management practices

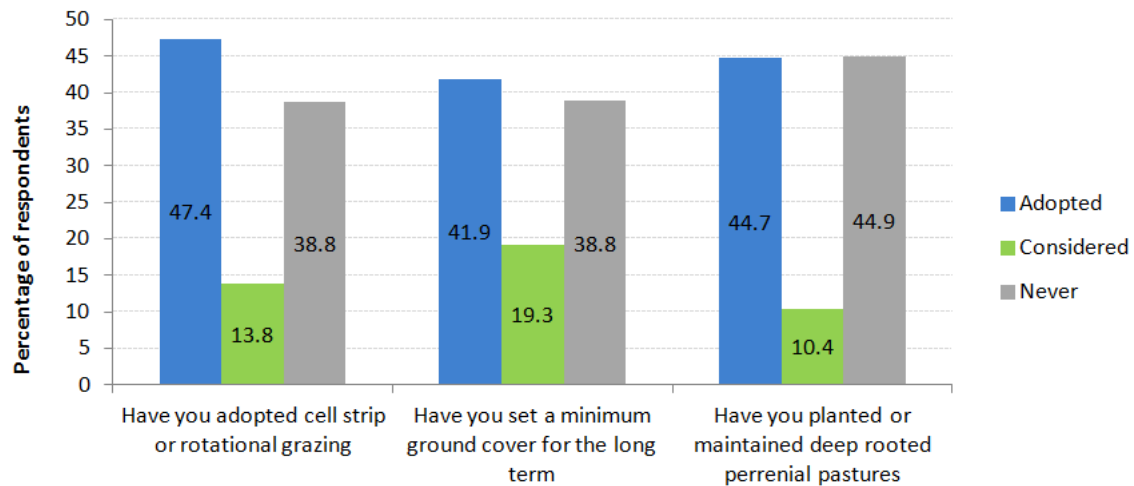
The adoption of native vegetation management practices varied widely between states. The average adoption of practices that encourage growth or planting of native pastures was 23 per cent, and the highest rates were in New South Wales and Queensland. There were higher average adoption rates of native vegetation establishment/maintenance or fencing at 38 per cent and 41 per cent, respectively, Australia-wide. As a comparison, 66 per cent of all agricultural businesses responding to the 2007–08 ARMS reported having native vegetation on their holding and 51 per cent of these (33 per cent of the total) reportedly protected their native vegetation for conservation purposes. This shows that, across the two surveys, there were similar land management practices related to protecting native vegetation.

Figure A2 Adoption of native vegetation management practices Australia-wide



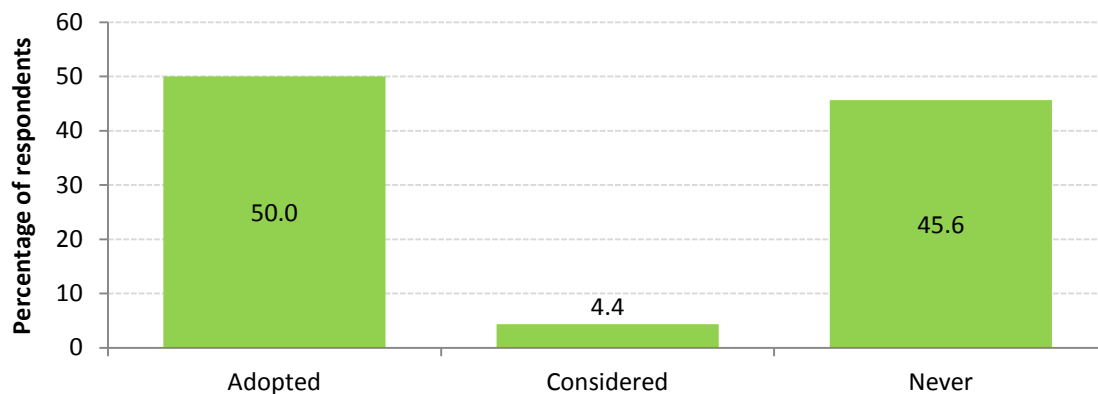
Adoption of grazing management practices

Less than half of all respondents reported that they had adopted the grazing management practices of maintaining a minimum level of ground cover (41.9 per cent), cell or rotational grazing (47.4 per cent) and planting deep rooted perennials (44.7 per cent) (see Figure A3). This result concurs with the ARM 2006–07 survey, which reported that 45.3 per cent of farmers undertook grazing management to manage soil erosion. There was considerable variation between grazing management practices in different states. These differences may be related to factors such as soil, climate and stocking rates, which can affect how land is managed by individual farmers.

Figure A3 Adoption of grazing management practices Australia-wide

Adoption of weed management practices

Management of Weeds of National Significance, for which the species were listed, was adopted by 50 per cent of farmers (Figure A4). Because the DPC survey questions only considered the management of WoNS, this information cannot be compared against ARMS data, which considered all weed species. A study by Raphael and Baker (2008) found that 60 of 150 landholders who responded to their survey had heard of the WoNS program, but only 17 were involved in managing one or more WoNS species. Most respondents to Raphael and Baker's study were involved in grazing.

Figure A4 Adoption of weed management practices Australia-wide (Weeds of National Significance)

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