

**School of Humanities  
Curtin Sustainability Policy Institute (CUSP)**

**The Use of Extension as a Tool to Improve Landholders' Adoption of  
Natural Resource Management Practices**

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**This thesis is presented for the Degree of  
Doctor of Philosophy  
of  
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# Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number HR RD-44-13.



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Lynda Braddick

Date: 12/8/2017

# Abstract

In the past few decades governments have been spending significant funding, encouraging landholders to adopt sustainable natural resource management practices with limited success. Researchers argue that policy interventions continue to be developed by policy makers and implemented by NRM support without fully understanding the diversity of landholders, the factors that influence their decision-making and the challenges they face in undertaking NRM practices. This thesis was designed to improve our understanding of how the role of extension influences, and in turn is influenced by these issues.

To improve the development of policy and programs, two studies were recently undertaken by the Australian Bureau of Agricultural and Resource Economics and Sciences to determine motivations for the key drivers of NRM adoption. They found the availability of support was a secondary driver to financial, environmental and personal motivation and recommended further research to better understand the influence of the providers of support. The objectives for this thesis arise from the comments and recommendations of these studies.

The current study investigated WA Wheatbelt landholders' adoption of NRM practices and the influence of the providers of support and the methods they use to encourage these activities. A Stages of Adoption model was developed based on a health-related Stages of Change model to investigate landholders' attitudes and behaviour. Concepts of the Theory of Planned Behaviour and personal and farm characteristics have also been used to measure influences on attitudes and behaviour. A mixed method study was implemented using a quantitative online and telephone survey followed by qualitative interviews to expand on quantitative data, and bivariate and thematic analysis.

The findings showed respondents' adoption stages of selected NRM practices reflected their attitude toward the practice achieving their main goals and provided evidence for the importance of the private and public benefits of a NRM practice to adoption. They highlighted the high adoption rates of practices that contribute to improving crop productivity in the region and the related dominance and use of private sector and other landholders' support, including grower groups, to support this industry. Moderate

adoption of native vegetation management practices with higher public benefits were shown and moderate motivation and use of groups funded by government NRM programs to encourage adoption of NRM practices was also indicated. The study was also consistent with theory, finding the stronger respondents' awareness, motivation to use and trust in the extension provider, the more likely they are to use their services. Findings and comments also suggest landholders with larger-scale farms are driving much of the research and extension; thereby maintaining traditional neoliberal values.

Respondents were found to prefer a range of different methods for delivery of information and advice about land management and as they progress through the stages of adoption their preferences for these methods of support changes. The accessibility and relevance of the methods of support being provided were also different for each category of NRM practice, and were in keeping with their attitudes and behaviour toward adoption for each category. The decline in government funding in recent decades and the abundance and relevance of information now available on the Internet and from media sources signals changes in the accessibility of information and methods of extension being provided.

Overall the findings build on evidence to support literature recommendations for NRM extension to understand the stages of adoption of NRM practices and the most beneficial and relevant methods to apply at each stage of their adoption and category of NRM practice, in order to provide a more targeted approach. They also support recommendations for NRM extension to develop a 'train the trainer' approach and make use of networks developed by key providers to access a greater cross section of landholders, and to include the most beneficial and relevant methods in this training so these providers can effectively undertake the processes required to improve adoption of NRM practices.

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# List of Abbreviations

Australian Bureau of Agricultural and Resource Economics and Sciences	ABARES
Association of Sustainable Agriculture, Australia	NASSA
Caring for Our Country	CfoC
Commonwealth Scientific and Industrial Research Organisation	CSIRO
Department of Agriculture and Food Western Australia	DAFWA
Department of Conservation and Land Management	CALM
Grains Research Development Corporation	GRDC
Meat and Livestock Australia	MLA
National Action Plan for Salinity and Water Quality Program	NAP
Natural Resource Management	NRM
Natural Heritage Trust	NHT
Pastoralists and Graziers Association	PGA
State Extension Leaders Network	SELN
WA Federated Farmers	WAFF



# Chapter 1 Introduction

The first chapter of this thesis provides a brief outline and definition of natural resource management (NRM) and extension. It explains the reason for the study and provides an overview of the government reports this thesis is based on. It also provides definitions for some of the terms used in this study and outlines the purpose, significance, structure and approach of the thesis.

## 1.1 Background

Extension is the process of enabling change in individuals, communities and industries involved with primary industries and natural resource management (NRM). Extension is concerned with building capacity for change through improved communication and information flow between industry, agency and community stakeholders. Extension seeks outcomes of capacity building and resilience in individuals and communities. Extension contributes to protecting, maintaining and enhancing the landscapes, livelihoods and lifestyles of all Australians (State Extension Leaders Network 2006, 3).

It is defined by Coutts et al. (2005, 7) as ‘the process of engaging with individuals groups and communities so that people are more able to deal with issues affecting them and opportunities open to them’, and by Marsh and Pannell (2000, 607) as one that includes: ‘public and private sector activities relating to technology transfer, education, attitude change, human resource development, and dissemination and collection of information’. A wide range of factors relating to ‘human activities and land use practices; management approaches; wider social, economic, political processes, and environmental change’ have driven landscape changes that now demand management of the natural resources (Patterson, Smith, and Bellamy 2013, 442).

Many land degradation problems occurred due to past government policy such as land clearing and more recently, advice resulting in overuse of fertilisers (DAFWA 2014; Vanclay 2004; Griffin nrm P/L 2000). However the subjective nature of land degradation often elicits disagreement among landholders, scientists and extension workers about acceptable rates of change (Pannell and Vanclay 2011) and expectations about investment for public versus private good (Marsh and Pannell 2000; Toyne and Farley 2000) making the role of NRM extension increasingly complex and difficult.

‘Private net benefits refer to benefits minus costs accruing to the private land manager as a result of the proposed changes in land management’. They do not include payments made as part of a policy intervention. Public net benefits means benefits minus costs accruing to everyone other than the private land manager’. They do not include the costs to landholders who undertake NRM practices (Pannell 2008, 225). The extent of private and public benefits arising from adoption of NRM practices differs with the individual landholder and their farm.

NRM problems are what have been termed ‘wicked’ problems as they generally include: ‘unclear, unstable and cross-sectoral issues; social complexity and shared responsibility; historical contingency; and systemic interconnectedness’ (Patterson, Smith, and Bellamy 2013, 443). NRM refers ‘both to the management of natural resources, and also to the issues themselves’. It includes a broad range of issues that affect primary production, biodiversity and habitat protection, including salinity and declining water quality and quantity; pest, weed and feral animal issues; and land degradation’ (SELN 2006, 9). In recent decades the Commonwealth government has taken greater responsibility for managing Australia’s natural resources with a shift in focus to delivering programs through regional and locally-based groups. Withdrawal of public extension services has encouraged greater involvement of non-government and private organisations (Marsh and Pannell 2000; Coutts et al. 2005; Hunt et al 2012) and created challenges for both private and public extension services (Ampt et al. 2015; Hunt et al. 2012; Sutherland et al. 2013; Stone 2005; Marsh and Pannell 2000).

Landholders have undertaken considerable work through government NRM programs; however their uptake has not been sufficient to mitigate land degradation (Allison and Hobbs 2006; Pannell et al. 2006; Barr and Cary 2000). Researchers argue that policy interventions continue to be developed by policy makers and implemented by NRM support without fully understanding the diversity of landholders, the factors that influence their decision-making and the challenges they face in undertaking NRM practices (Mallawaarachchi and Green 2013; Pannell and Vanclay 2011; Pannell et al. 2006). This thesis was designed to improve our understanding of how the role of extension influences, and in turn is influenced by these issues.

Research was undertaken in 2010 by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), to investigate drivers motivating

landholders to undertake NRM practices promoted under the Commonwealth government program, Caring for Our Country by Ecker et al. (2012) and a follow-up study was undertaken in 2012-13 by Kacans et al. (2014). The aim of these ABARES studies was to improve the development of policy and programs by finding out why landholders adopt particular practices and how best to support adoption of these practices. These authors found that financial and environmental motivations were the key drivers of NRM adoption while personal motivations (environmental and personal beliefs) had less of an influence. They also found the availability of support played an important secondary role in motivating the adoption of recommended practices. Their suggestions and recommendations for further research into the influence of the availability of support on landholder adoption of NRM practices form the foundation for this current study.

## 1.2 Purpose

The overall purpose of this research was to build on evidence used to guide the development of initiatives that support landholders in their adoption of NRM practices.

The two key questions were:

1. How do we improve understanding of the influence of support in motivating sustainable farm practices and how this might be improved?
2. How accessible and relevant are current support methods for different management practices?

Ecker et al. (2012) suggested that availability of support had an important role in enabling land management activities and recommended that further research focus on how to make support an effective tool that can influence decision-making. To develop this tool they recommended improvements to understanding the influence of NRM extension in motivating adoption of NRM practices, and to determine the accessibility and relevance of current methods of NRM extension for different management practices. The overarching aim of the study was therefore to understand how to make support an effective tool. To achieve this it was essential to understand: 1) the attitudes and goals of potential adopters, and 2) respondents' behaviour in relation to those goals. The following objectives for this study were therefore developed with these two aims in mind.

Aim one:

1. The first objective was to determine the stage of WA Wheatbelt landholders' adoption of specified NRM practices and their attitude toward the effectiveness of these practices in meeting their goals.
2. A range of different NRM extension approaches and methods have been developed over past decades to promote adoption of NRM practices and assist landholders with their change process. The second objective was to understand the stage of adoption where these methods are most beneficial.
3. The third objective was to determine the accessibility and relevance of the methods used to support adoption of the categories of NRM practices.

Aim two:

4. Much of the NRM extension provided to landholders is region-specific and has been developed over time for different purposes (Ecker et al. 2012). The fourth objective was therefore to ascertain the providers of NRM extension available to WA Wheatbelt landholders and to explore their influence on adoption of NRM practices and how that relates to other studies.
5. The fifth objective was to explore in greater depth the attitudes and behaviour of WA Wheatbelt landholders toward the providers of support and their methods of encouraging adoption of NRM practices in relation to existing studies, and improve understanding of the influence they have on their decision-making.

Objectives 1-4 are quantitative and Objective 5 is qualitative.

## 1.3 Significance

Extension agents are investments that add value and capacity to the communities that rely on them, providing vital accessible skills to stakeholders negotiating challenging circumstances. Retention of core agricultural extension capacity and expertise at regional levels should therefore be a strategic objective for rural community stakeholders, and industry and government policy makers (Hunt et al. 2011, 112).

The significance of this thesis lies in the unique perceptions of practical, contextualised, local data that will build on current knowledge, and assist policy-makers, researchers and those providing NRM extension to landholders to develop better strategies for increased adoption of sustainable land management practices.

### **Theory**

The development of a theoretical model using the Stages of Change Model (Prochaska, Norcross, and DiClemente 2013) adapted to suit stages of landholder adoption provides a theoretical contribution to knowledge. Combined with the concepts of the Theory of Planned Behaviour and the contextual factors, use of the framework has allowed us to understand the pattern of major changes that occur at the farm practice level and attitudes toward those who support these changes and the methods they use. As such this research has both theoretical and practical applications.

### **Policy**

The importance of NRM is highlighted in the Wheatbelt NRM strategy; 'Healthy natural resources are important to support current and future environments and community'. 'We derive our livelihoods from our environment. It provides us with food, and a place to live and connect' (Wheatbelt NRM 2014, n.p.). Government has expended considerable public resources to encourage uptake of NRM practices, yet leading researchers suggest policy-makers and scientists remain concerned at the extent of this adoption. They are also concerned that policy interventions continue to be developed by policy makers and implemented by NRM extension without fully understanding factors influencing adoption (Price and Leviston 2014; Botha and Coutts 2011; Pannell et al. 2011).

Consistent with a recent overseas study by Sutherland et al. (2013) it is argued there has been very little research undertaken to understand the influence that providers of

support and their methods have on improving the sustainability of agriculture. Key authors also inform us that local sources of information are likely to be more effective as they have greater relevance and applicability to local farm conditions (Llewellyn 2011). It follows then, that in order to better understand landholder adoption of NRM practices it is necessary to identify the stages of individual landholder's adoption and their perceptions and behaviour toward the people and organisations encouraging this adoption, and the methods they use to support them at a local level. By building on local, contextually relevant evidence used to guide the development of effective enabling strategies, this work aligns with government priorities to make agriculture more sustainable and productive.

This research also addresses recommendations and builds on evidence provided by the ABARES studies (Kacans et al. 2014; Ecker et al. 2012) to guide the development of policy initiatives that support landholders in their adoption of NRM practices. It was assisted by, and associated with Wheatbelt NRM staff and as such, my research links regional and national levels. It will therefore aid the regional level operation of the National Landcare program and the landholders involved by improving understanding of landholders' adoption of the NRM practices and their perceptions of those who implement the program and the methods they use.

### **Practical**

As suggested above the Stages of Adoption model provides a practical way for extension personnel to identify the stages of an individual landholder's adoption and their perceptions of the methods they use to support them at a local level. The study also improves understanding of respondents' attitudes and behaviour toward the people and organisations encouraging this adoption. Provision of this local, contextually relevant evidence can therefore be used by NRM extension to guide the development of effective enabling strategies.

Thus, the findings of this thesis provide a way for improved policy and regional and local interventions, which incorporate landholder perspectives, to be developed and implemented to better meet the goals of both landholders and the government.

## 1.4 Structure

This thesis consists of ten chapters, which present the four phases of the research and establish the contextual background, process, findings, discussion and conclusion of this research. Each chapter includes an introduction and summary of the results. Chapter one briefly introduces the reader to the research topic, and outlines the purpose, significance, structure and approach of the study. Chapter two is a synthesis of relevant literature in four sections. The aim of the literature review is to demonstrate the gaps in empirical evidence relating to the providers of support and their methods for the adoption of NRM practices. The chapter details the theoretical literature and the limited existing literature pertaining to the topic of the study, provides a brief summary of the key factors influencing the evolution of extension, and presents extension challenges to be investigated in this study.

Chapter three introduces readers to the study's framework. Firstly the Stages of Change model established by Prochaska, DiClemente, and Norcross (1992) is presented along with the adapted Stage of Adoption model developed for the current study; later found to be confirmed by Botha and Coutts (2011). The framework includes concepts arising from the literature that are used to represent concepts of the Theory of Planned Behaviour (Ajzen and Fishbein 1980) as well as the personal and farm characteristics that show their influence on respondents' NRM decision-making. The research methodology used in this study is outlined in Chapter four. Firstly the physical locality for the thesis is explained. This is followed by the research paradigm and an explanation of the design and purpose for the use of the methodology. Each stage in this method is then described. The sample, survey instrument design and data analysis for the quantitative phase of the study are detailed, followed by the second qualitative stages of interview guide development, implementation and analysis. How the study presented the data and complied with research ethics are outlined next followed by the procedures undertaken to enhance the reliability and validity of the research.

Chapters five, six and seven present the results, their interpretation, and comparison and discussion of their relationship with existing literature. This information is structured by presenting the explanatory variables first followed by the two themes of

the study in consecutive order. Graphs and tables are used to present the quantitative data and narrative quotes are used from the qualitative data to capture the voices of the participants. The following chapters eight and nine provide a general discussion of the information in the preceding chapter. Lastly, chapter ten summarises both the phases of the research and the results. It also defines the contributions this thesis has made to the literature, those providing support for the adoption of NRM practices and to NRM policy. The limitations of the study are specified and the researcher's aspirations for further research are offered for consideration. The thesis concludes with a brief outline of past policy approaches to NRM issues and potentially worthwhile strategies for both NRM extension and society at large going forward.

## 1.5 Approach of thesis

The thesis is based on the worldview of NRM which includes concepts of biodiversity and sustainability. Sustainable NRM is defined as; 'using, conserving and enhancing natural resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased' (Government of Western Australia 2003, 110). Reports highlight that the problem for defining sustainable agriculture is that environmental issues arise from land use so sustainability needs to be defined by the reasons and activities of people. Defining sustainability is therefore difficult because people have to agree on how they define it and what priority they give it (Howard and Larson 2009). Other studies have found that barriers to building knowledge related to sustainability include 'the lack of shared definitions of 'sustainability' and the lack of adequate measures of sustainability' (Ecker 2008, 83). The current study has a particular focus on Commonwealth government natural resource management (NRM) programs to encourage sustainable agriculture. This worldview has therefore been used as an orienting lens that shapes all aspects of the study.

The results of the research have been compared throughout with the results of the Ecker et al (2012) and Kacans et al. (2014) studies. It must be noted however that the follow-up survey in 2012 did not include the availability of support as a motivation, their respondents' included dairy and horticulture as well as broadacre landholders, and the suitability of the NRM practices differ with the region. As such, these factors need to be taken into consideration when interpreting the current research. A key



problem for this study was how to describe those who provide advice, information and assistance to landholders to support their adoption of NRM practices. Ecker et al (2012) referred to those working in this field as ‘NRM support providers’ but much of the literature describes the role as ‘agriculture extension’. However this may include a sole focus on productivity (Ampt et al. 2015). As such, ‘NRM extension’ has been used when it appeared appropriate and ‘extension’ or ‘providers of support’ in other instances. Consistent with Pannell et al. (2011, 12) the term ‘landholder’ has been used rather than ‘farmer’ ‘as many rural landholders are not farmers’.

## Chapter 2      Literature review

### 2.1      Introduction

The aim of the literature review is to demonstrate the gaps in empirical evidence relating to the providers of support and their methods for the adoption of NRM practices. The chapter firstly describes the results and implications of the ABARES studies for the current study. This is followed by a brief outline of adoption studies and the different approaches and theories involved in this vast field of literature that attempts to better understand landholder adoption attitudes and behaviour and how this relates to those providing support. The small number of studies, including those in the WA Wheatbelt, relating to the provision of support to landholders and the methods they use are presented next. This is followed by a brief summary of the three key factors influencing the evolution of extension, and presents the extension challenges investigated in this study. This chapter highlights the complex and difficult role for NRM extension in enabling change.

### 2.2      Adoption of practices

The reports this research builds on were undertaken for the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) in 2010 (Ecker et al 2012, 4) and a follow-up survey in 2012 to investigate changes that had occurred in this two year period (Kacans et al. 2014). These studies aimed to determine the drivers of practice change ‘based on selected practices under the Sustainable Farm Practices component of the Caring for our Country initiative’. The purpose was to provide information for policy and program development so that land management practices that reduce the impacts of land use could be improved, and to increase knowledge, skills and adoption of these practices. Their national studies of 1329 and 1493 respondents respectively, asked landholders about their behaviour and attitude toward the selected practices to understand their motivation for practice change (Table 7-1). Thus landholder motivations could be linked directly to adoption. The key findings are outlined in (Table 2-1) below.

Table 2-1: Key findings for studies by Ecker et al. (2012) and Kacans et al. (2014).

Key findings for Ecker et al (2012) and Kacans et al. (2014) studies
<ul style="list-style-type: none"> <li>• Financial and environmental factors (improves soil quality) were the most important motivators for adoption and personal motivations were slightly less. The availability of support was a secondary motivation, suggesting this support was sought after the decision had been made to adopt.</li> <li>• Approximately one-third of respondents received support for adoption of NRM practices, with the provider of support varying with the practice. Support was rated particularly important for adoption of new on-farm practices.</li> <li>• Around two-thirds of respondents were members of a group that supports NRM and these members were more likely to adopt NRM practices than non-members. Those who had participated in an Australian government program were also more likely to adopt NRM practices.</li> <li>• Most activities attended by respondents were delivered by private consultants or agribusiness agents, local farmer networks, Landcare groups and state government agencies.</li> <li>• The most influential methods of extension were focused on improving productivity or combined methods for achieving both productivity and NRM goals, with the most favoured methods being field days and training courses or workshops.</li> <li>• Environmental and personal motivations were the greatest influence for managing native vegetation. They also found that extension positively influenced setting groundcover targets and planting native vegetation.</li> <li>• Participation in extension activities and NRM programs and group membership all were found to influence NRM adoption, as well as income, farm size, age and education characteristics.</li> <li>• Funding and time were the key barriers to adoption.</li> <li>• Increases between the 2010 and 2012 surveys included adoption rates of selected NRM practices, group membership and recognition of Australian Government NRM programs.</li> <li>• Almost all respondents participating in Australian government NRM programs had either improved their skills and knowledge or changed their practice</li> </ul>

The implications of these findings are that NRM communication and engagement that promotes both private and public benefits by including financial, environmental and personal motivations is more likely to be effective in promoting adoption of NRM practices than communication and engagement that does not take account of these factors. The authors recommend ‘understanding the flows of information that support adoption’ to guide future investment in promotional activities (Kacans et al. 2014, 6). As such the evidence provided in the current study of the importance of the people and organisations involved in these information flows and the methods they use that are most effective in improving these flows will further aid future investment in promotional activities. Other studies have found similar results and also support these extension strategies (Prokopy, Towery, and Babin 2014; Wilkinson, Barr, and Hollier 2011).

The research for the current study has used the comments and recommendations provided by Ecker et al. (2012) to develop key questions (see Table 4-5), and together

with the second report (Kacans et al. 2014) the findings from the current study were then compared to highlight specific findings of the current study and to build on information provided by these studies.

NRM practices are acknowledged to be important for sustainable agriculture, yet despite extensive efforts by the providers of NRM extension the rate of their adoption is considered too low to be effective in reducing overall land degradation (Pannell et al 2011). Much of the literature therefore focusses on research to determine the factors or drivers that influence the behavioural changes required by landholders to achieve the desired environmental outcomes, and what this means for extension efforts to enable these changes. This substantial body of work finds a range of factors including; lifestyle, social benefits, land ownership goals, environmental stewardship, policy or practice characteristics and institutional barriers influence farmers' adoption or non-adoption of NRM practices, yet consistent with the ABARES studies, researchers also found that private financial motives are key drivers for adoption of these practices (Rocheouste et al. 2015; Kacans et al. 2014; Mallawaarachchi and Green 2012; Toric 2005; Cary, Webb, and Barr 2001).

Nevertheless, they also point out the importance of profitability in adoption is often overestimated and that factors such as risk and lifestyle are just as significant an influence on adoption, particularly for family farms. Investigating landholders' aspirations for increasing productivity, Wilkinson, Barr, and Hollier (2011) found only 16% were actively planning to increase their productivity while 38% were not interested. Yet researchers point out that having the financial capacity to adopt a practice is important for achieving their goals, which are an important tool for landholders' to achieve their aspirations (Pannell et al 2006; Vanclay 2004). In addition, Cary, Webb, and Barr (2001) found that perceptions of future financial security encourage landholders' investment in NRM practices rather than current financial positions. As such Mallawaarachchi and Green (2013) highlight growing recognition of the need to include productivity as a key goal in NRM policy and programs and as a basis for evaluation, so that both environmental and increased productivity goals are achieved simultaneously.

The relevance of this literature to the current study is that it demonstrates the complexity and difficulties for research, development and extension of NRM

practices. It also shows the need for providers of NRM extension to understand the complex biophysical, social, psychological and economic dynamics involved in landholders' decision-making for practice change. For instance a seminal paper by Pannell et al. (2006 and 2011) outlined the influences on the practice changes required by landholders to achieve the desired conservation outcomes and highlighted what this means for those working in extension to enable these changes. The value of this paper was the cross-disciplinary approach it took to encapsulate the broad range of perspectives and guide those wanting to enable landholders to adopt NRM practices. Three broad sets of issues were found to influence adoption:

- First, the learning process, involving improving knowledge for decision-making and acquiring the skills required to implement the practice.
- Second, sharing of decision-making and the social, cultural and personal influences on decisions. Decisions on adoption range from simple decisions generally made by the individual landholder to the more complex shared decisions involving the perspectives of others and family lifestyle goals. Personal influences on adoption include individual traits such as personality involving locus of control, attitudes toward risk and introversion-extroversion traits that influence landholders' vulnerability to stress and social connections. Physical, cultural and social links, including extension, affect adoption decisions as well as the circumstance of the landholder which involve a range of personal and farm characteristics.
- Third, the attributes of practices that affect their adoption. The two most important factors for landholder adoption are the relative advantage (the perceived benefits of adoption) and trialability (the ease of learning about the adoptability of the practice).

Pannell et al (2006 and 2011) argue for the need to apply what is already well established in the adoption literature. They emphasise the subjective, often intuitive nature of assessment, and the need for the NRM practice to fulfil landholders' expectation that it will assist them achieve their goals. They also emphasise that NRM extension needs to ensure the practice or technology is adoptable before proceeding with extension to promote its uptake. Of most relevance to this study were the social and extension influences on adoption synthesised in the following Table 2-2:

Table 2-2: Links between landholders and others and extension characteristics that may affect the adoption decision from Pannell et al. (2006 and 2011, 15).

<b>Links between landholders and others that may affect the adoption decision (Pannell et al. 2006 and 2011, 15)</b>
<ul style="list-style-type: none"> <li>• The existence and strength of landholders' social networks and local organisations and membership of organisations such as Landcare and catchment groups have been shown to be positively related to adoption.</li> <li>• The physical distance of both other adopters and the landholders' property from sources of information about the innovation is important due the relevance of the information or the amount of information they are exposed to.</li> <li>• A history of respectful relationships between landholders and advocates for the innovation, including scientists, extension agents, other landholders, and private companies, is positively related to adoption, through enhanced trust in the advice of the advocates.</li> <li>• Ethnic and cultural divisions within a landholder population can act as significant barriers to the flow of information about environmental innovations.</li> <li>• Extension, promotion and marketing programs by government workers and/or the private sector can be positively related to adoption.</li> <li>• Characteristics of extension agents that enhance effectiveness of extension include: <ul style="list-style-type: none"> <li>o Recognising their place within the complex web of information sources, with greater focus on credibility, reliability, legitimacy, and the decision-making process.</li> <li>o Recognising the limitations to their role. Their main contributions will be to accelerate the adoption process through raising awareness and, to some extent, changing perceptions of the relevance and performance of an innovation rather than increase the final extent of adoption (with some exceptions).</li> <li>o Developing credible, legitimate, trusted relationships is essential and takes time and effort to achieve.</li> </ul> </li> <li>• They recommend the use of: multiple methods and deliverers, peer networks and more individual than group-based approaches, and development of social norms that emphasise <u>mutual/reciprocal benefits</u>.</li> </ul>

Numerous studies and reports highlight the problems of many NRM programs in focusing on environmental benefits and not adequately including the private costs and benefits (Januchowski-Hartley et al. 2012; Pannell and Vanclay 2011; Cary and Roberts 2011). However Cary, Webb and Barr (2001) point to the difficulties for developing NRM practices with both private and public benefits and the problems for NRM extension of enabling their adoption. These authors explain that both the appropriateness and the relative advantage of a practice vary greatly with the geographic area, and are largely affected by the different technical characteristics of the practice, soils and climate conditions. There are therefore very few NRM practices that are applicable across all landscapes. They argue that landholders' perceptions of land degradation are often different from scientists' and landholders' difficulty with understanding the links between the recommended characteristics of NRM practices and the sustainability of their outcomes also limits adoption of NRM practices, even when they are likely to achieve their goals.

The role for NRM extension is therefore difficult as there are few NRM practices that have characteristics that offer economic advantages and are easily adopted. Many are complex, risky, difficult to trial, and require additional skills and knowledge. They may also be difficult to observe, provide few benefits for the landholder or provide mostly long-term benefits. Any significant changes from adoption of an NRM practice may take decades or even generations to occur, and often need to be facilitated by structural changes in the agricultural industry (Barr and Cary 2000). Llewellyn (2011) also found landholders' perceptions about the relative advantage of a practice were not always accurate and targeting certain perceptions held by non-adopters in extension activities that improved learning about the practice led to changes in their adoption decision-making.

Burton's observations about 'roadside farming' suggest many landholders may be influenced by their neighbours (Burton 2004). Researchers therefore emphasised the importance of influencing social norms by harnessing peer pressure using 'well-respected' landholders in the farming community. They stressed the importance of social networks in landholder adoption and the need for NRM extension to recognise, understand and work with the key influencers in these networks to improve levels of NRM adoption. In this way landholders are 'more likely to hear the same message from key nodes in their social network' (Prokopy, Towery, and Babin 2014, 4; Ecker et al. 2012). NRM behavioural and social norms include concepts such as: trust in agronomy advice, positive self-concepts and pro-environmental land management (Price and Leviston 2014).

Therefore adoption studies inform us that awareness of an environmental problem or NRM practice does not ensure adoption. In reality, adoption is influenced by a wide range of factors and is highly dependent on the context. Extension may provide landholders with the awareness, knowledge and skills to adopt a practice; however, this will only influence the rate of adoption of the practice (Kaine et al. 2011). They also highlight that NRM practices generally also need to provide adequate financial benefits (Rochecoste et al. 2015; Pannell et al 2011; Toric 2005; Cary, Webb and Barr 2001; Guerin and Guerin 1994), and there are very few market-drivers to encourage widespread adoption of these practices (Cary and Roberts 2011).

## 2.2.1 Psychological studies

Many adoption studies have been criticised for their focus on the characteristics of the practice or the landholder while not recognising the social and psychological characteristics that influence adoption of NRM practices (Price and Leviston 2014; Burton 2004). This critique has resulted in increased use of psychological models to measure landholder personal traits including locus of control and introversion-extroversion, which affect factors such as risk aversion and social networks (Pannell et al 2011). The psychological theory Myers Briggs Type Indicators classifies landholders according to their personality types and temperament to improve extension interventions.

Early research found that landholders are traditional, job oriented and conservative, as well as more introverted with lower 'emotional intelligence'. The findings suggest they are more likely to cope with the challenges of isolation and other lifestyle stresses. However they also suggest they may be resistant to new ideas, take longer to implement change and the profile is not conducive to learning in group situations. The individual approach would therefore better suit these personality types. Researchers also highlight the importance for those providing extension to be aware of the influence that personality style has on landholders' capacity to change (Strachan 2011; Shrapnel and Davie 2001). Ecker et al (2012) also warns that although they are important for NRM extension, the personality of many landholders indicates that group-based approaches are not appropriate for all engagement strategies.

Of interest was that a similar study was carried out to determine personality types in different levels of NRM decision-makers across Australia. The study found a difference in personality types between those working at the local and regional scales and those working at state and national scales. The authors suggest the findings point to differences in perspectives that may result in different approaches and solutions proposed to resolve the same problems, presenting substantial challenges for those working in NRM extension (Allison and Hobbs 2010). It also raises questions about the difference in personality types between individuals working in the private sector and those working in NRM and the potential challenges faced in working to develop solutions with these sectors. Based on the work of Strachan (2011), Nicholson and Long (2015) developed a simple method to determine landholder temperament types



so extension strategies can be better tailored for individuals. Different approaches to the problem can then be applied to suit the characteristics of four personality types. This method appears useful for NRM extension.

## 2.2.2 Environmental studies

### 2.2.2.1 *Behavioural studies*

The influence environmental attitudes have toward conservation behaviour is also an important factor in NRM extension, particularly as studies show that social norms can have a moderate influence on adoption of NRM practices (Bamberg 2003). Social norms are relevant for the current study as the people and organisations providing support for adoption of NRM practices make a direct contribution to the construction of social norms that landholders and others in their household identify with. Social psychological research designed to predict landholder NRM behaviour generally use the Theory of Planned Behaviour. This theory was developed by Ajzen and Fishbein (1980) and has become the dominant model for predicting, explaining and changing human social behaviour (Ajzen 2012) with many of these studies supporting the theory that positive environmental attitudes influence conservation behaviour.

They show that higher environmental concern elicits stronger environmental behaviours than weaker environmental concerns, and those with higher environmental concerns are influenced by perceived behavioural control whereas those with lower environmental concerns are influenced by social norms (Popenberg and Koellner 2013; Bamberg 2003). In this respect Australian studies on landholder environmental behaviour (Price and Leviston 2014) and NRM decision-making (Toric 2005) using the TPB theory show that perceived behavioural control was the strongest single predictor of behaviour and was more important than subjective norms where there was concern about the land resource or environmental issues.

Other studies show that landholders with strong environmental values are significantly more likely to adopt conservation practices (Curtis and Mendham 2011). A review of American adoption studies by Baumgart-Getz, Prokopy, and Floress (2012) found that a general environmental awareness was not a significant predictor of adoption but knowledge about the practical aspects such as landholders' own impacts and the efforts and goals of a project were important for influencing adoption. However Gill (2011),

points out that while landholders' acknowledgement of land stewardship reveals acceptance for environmental responsibility, their socioeconomic responsibilities often conflict with their need to provide for their families, thereby creating risks to the environment. This has important implications for NRM extension.

#### **2.2.2.2            *Identity studies***

Sociological studies that measure influences on conservation practices often use Identity theory (Stets and Burke 2000) applied to farming styles of productivist - 'roles that typify production dominate', non-productivist - roles involving 'diversification and emphasis on conservation' and conservationist – a landholder who 'focuses on environmental and life-style concerns' (Burton and Wilson 2006, 101-2). This theory is based on the idea that self-identity is a reflection of society's multiple, hierarchical social groups. Self-identity is therefore influenced by the social norms of these social groups or social networks. The security and self-esteem obtained from the group then influence the landholder by providing 'substantial motivation for future compliance with group norms' (Burton and Wilson 2006, 98).

Groth et al. (2015, 118) recently developed an occupational identity measure to apply in natural resource management contexts that included factors such as identity as a 'farmer', social networks and attitude toward the agricultural industry. They argue this is necessary due to the diverse trends in 'farming' as a result of multifunctional land use and assert that based on six dimensions they have developed a valid and reliable measure. However the model has yet to be tested in other research.

Researchers point out that identity studies based on farming styles have not always explained conservation adoption, nor been able to successfully predict future adoption rates (Pannell et al 2011; Wilkinson, Barr, and Hollier 2011). This may be due to the influence of factors such as social norms and risk perceptions on their productivist/conservationist identity. Researchers suggest that although landholders are assumed to have conservationist attitudes, they may in fact, pertain only to observable areas of natural environment i.e. bushland or wetlands, and they may continue to hold productivist attitudes toward the rest of their farm ( Hunt et al. 2013). Hence, they argue that landholders do not necessarily transpose their conservationist attitude toward the rest of their farm and may thus be only motivated to undertake NRM programs for productivist purposes.

They also suggest that landholders maintain these beliefs because identification with productivism provides security and ‘is vital in many instances for the maintenance of farmers’ self-esteem and perceptions of being a “successful” farmer’ (Burton and Wilson 2006, 107). Ecker et al. (2012) also found extension activities and events attended by landholders were mostly focused on productivity or had a combined NRM and productivity focus and suggested landholders may be unwilling to attend activities focused solely on NRM. However researchers also show that landholders are aware of the trade-offs they make with investment of their resources (Farmar-Bowers and Lane 2009).

Most studies use landholder identities of their personal and farm characteristics as variables to understand landholder adoption. One South African study by Conradie et al. (2013) used identity characteristics to explain landholder conservation behaviour and found that variables such as financial capacity and farm size were greater predictors of conservation than identity characteristics; highlighting the importance of incentives to conservation. Baumgart-Getz, Prokopy, and Floress (2012) analysed American adoption literature and found variables such as age, extension training, capital, % of income from farm and farm tenure are used by most American researchers to understand adoption behaviour. Personal and farm characteristics are generally used in behavioural studies (Burton 2004); however researchers emphasise the mixed findings with some of these measures of adoption (Pannell et al 2011).

Studies also show farm aspirations are an important measure for adoption. These measures include productivity, profitability, lifestyle and conservation (Byron et al. 2006) or their farming phases such as expansion, steady, growth constrained, winding down or selling out. However, authors suggest the strong motivation for financial profit shown in studies may sometimes be minor, and warn of the risks to oversimplifying the complexity of landholder identity (Watson and Watson 2014; Wilkinson, Barr, and Hollier 2011).

Researchers inform us how neoliberal government policy has helped to shape agrarian culture and landholder identity in recent decades (Gill 2011). Hunt et al. (2013) argue that policy has influenced farmers’ identity and encouraged acceptance of farming as a business; making efficiency important. The focus on profit has enabled new innovations and diversification for greater resilience, and environmental benefits such

as improving soils, and improved attitudes toward NRM. Yet, Carolan (2005) argues, the unequal allocation of private resources to productivist farming maintains its dominance and fails to reduce the barriers to more sustainable agriculture.

Studies now demonstrate that changes in land use are resulting in changes to social norms and the ‘good farmer’ identity (Sutherland and Darnhofer 2012) and that feedback processes involved in NRM have the potential to change social norms that can influence landholders’ identity with NRM; allowing landholders to balance the conflict between environmental conservation and productivity (McGuire, Morton, and Cast 2012). Even so, evidence from recent empirical studies show the traditional attitudes of food and fibre production remain a significant influence overall in agrarian culture for many landholders. For instance (Schirmer and Bull 2014) found social norms were the greatest predictors of forestry adoption for NSW landholders. They argue that in many countries it is more socially acceptable to plant small-scale forestry on marginal land than using productive land for large-scale plantings. Agrarian ideals are therefore dominated by food production with little consideration of climate change and landholder contributions to this problem. They emphasise the consistency of their results with international agrarian views of food production as a moral good.

Carolan (2005) also cautions about the differentiation of landholders into productivity and conservationist because of these changes occurring in recent years. He suggests that profitability is now an important goal for both traditional and ‘sustainable’ agriculture such as organic or holistic farm management, and that ‘sustainable’ agriculture has now become more industrialised in nature with some farms becoming more involved in the supply chain for their products. He maintains these agrarian ideologies will continue to change; as evidenced by Sutherland and Darnhofer (2012) above. It could be argued this shifting crossroad between traditional and ‘sustainable’ agriculture is potentially where NRM sits and as such highlights the importance of understanding landholder identity for effective extension services.

### 2.2.3 Stages of change model

Researchers highlight the incremental nature of change involving simple decisions that occur on a regular basis or more complex decisions that require major changes to farm management systems and involve much greater risk. In many instances adoption is only partial or incomplete, the practice or technology may be adopted in stages very

gradually, in a series of distinct stages, may be used differently on different properties or may be adapted for different situations. Complex changes require a wide range of providers and methods of support and can occur over long periods of time, sometimes generations. During this process difficulties may arise that result in dis-adoption and subsequent readoption if those problems are solved (Wilkinson 2011; Barr 2010).

Parminter (2011, 3) informs us the process of adoption of a technological innovation or practice is often inferred in studies as something that occurs all at once and is either not adopted or is adopted. He explains that, ‘changing previously established ways of doing things is more likely to involve several steps in a multi-stage process’. Each of these stages will require different approaches to NRM extension to motivate individuals to progress to the next stage. Researchers therefore emphasise the need for extension to ‘ensure that the right members of the family farm businesses are receiving the right services at the right time’ (Fulton and Vanclay 2011, 104); thus highlighting the importance of understanding landholder’s stage of adoption.

Many adoption models have been developed to improve understanding of the different stages involved. These models provide a framework for the types of planned extension interventions that may be most appropriate at the different stages of change. One of the first adoption models to be developed was the Diffusion of Innovations by Rogers (1983). This theory had a significant influence on the way extension was practised in Australia (Ampt et al. 2015). The model categorised the stage of landholder change by their willingness to adopt innovations. Innovators were most likely to adopt innovations, followed by early adopters, the early majority, the late majority and the laggards. By the 1990s this theory had become outmoded due to its top-down approach, but had yet to be replaced by new models (Vanclay and Lawrence 1995). A more contemporary version of the diffusion model categorised landholders as ‘innovative, progressive, middle of the road, resource poor (structural), and traditional’ (Kilpatrick and Johns 2003, 155).

Other stage of change theories are based on landholder decision-making and behaviour. In an extensive discussion paper on landholder adoption, Barr and Cary (2000, 2) provided a model based on the sub-tasks landholders undergo when making decisions about NRM practices. The model had eight stages in landholder decision-making: 1. anticipation of degradation, 2. seeing degradation, 3. seeking information,

4. weighing the alternatives and risks, 5. making a decision, 6. undertaking a trial, 7. making a change, 8. reaffirming the decision. A more simplified, Farm Practice Change Model was later developed by Nicholson et al. (2003) which relies on the development of social networks both with and between landholders to support decision-making processes (Figure 2-1). This model placed emphasis on social interactions involving only three stages: motivation, exploration and trialling, and the farm practice change stage. This model has been used by Wheatbelt NRM staff to implement a successful soil conservation program (Grasby 2011), and by England (2013) to determine the adoption process of grazing systems into mixed farming systems. The study found it was important to tailor different methods of NRM extension at the three different stages of adoption.



Figure 2-1: Farm Practice Change Model

Source: Grasby 2011, n.p.

Sutherland et al. (2012) argue that major change occurs in response to ‘trigger’ events. Concerned about the lack of a mechanism for explaining transition as a result of these events, these authors developed a conceptual model to measure how and why the transition process of UK and European landholders occurs. They briefly indicated the type of support most appropriate when change is required (Figure 2-2). They suggest landholders become dependent on maintaining the same practices due to the capital investment involved, until a triggering event occurs and they are forced to make a major change to their path.

Events such as farm succession, changes in landholders’ health, or new market opportunities or failures may serve as triggers for change. For many Australian landholders environmental problems such as salinity and climate change impacts may

also trigger changes. The advantage of this model is that by recognising these triggers, extension strategies and incentives can be linked to these major changes to motivate and encourage beneficial changes. They also suggest the cycle process may explain why some landholders benefit from the support that is provided more than others. The idealised cycle has five stages and triggers may occur at any stage of the process and result in deviations from the cycle. The length of time for each stage varies and a degree of overlap of the different stages often occurs.

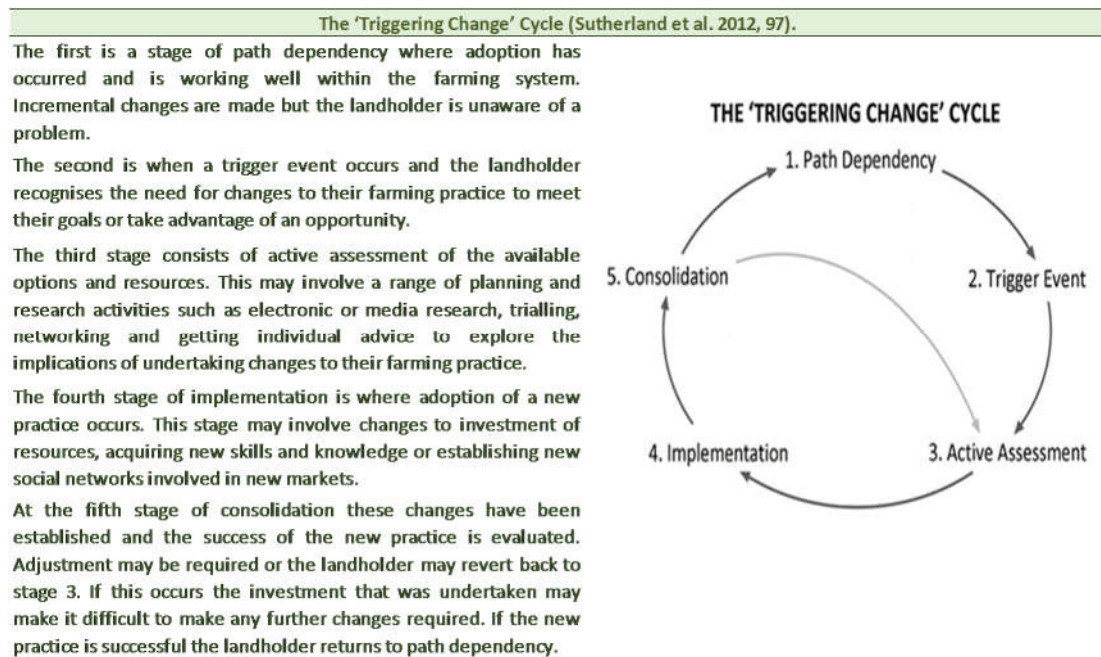


Figure 2-2: The 'Triggering Change Cycle'

Source: Sutherland et al. (2012, 97).

Simultaneously, practice change models were being developed for health systems. One such practice change model, used in this thesis, was developed by Prochaska in 1979 entitled the Transtheoretical or Stages of Change model; further developed in the 1980's by Prochaska and DiClemente (Prochaska and DiClemente 1983). Similar to the Sutherland et al. (2012) model, this model is used to determine someone's motivation and readiness to change behaviours detrimental to their health, thereby providing guidance for the types of planned interventions that may be most appropriate at the different stages of change. Their model emerged from the field of psychotherapy (Prochaska, DiClemente, and Norcross 1992), and has been used successfully by many studies to explain patterns in health related behaviours such as smoking, drug misuse, excessive alcohol consumption and sun exposure (Borschmann, Lines, and Cottrell 2012, 181). The use of models from other disciplines is recommended by leading

researchers as a way to ‘maintain contacts with other disciplines’ and to ensure that agricultural research fully utilises the advances occurring in ‘mainstream behavioural science’ (Burton 2004, 359).

However, few agricultural studies appear to have used this model. One WA study was found undertaken by the Department of Agriculture and Food WA. Guise, Gannaway, and Jones (2010) developed an extension model in 2004 for assessing small landholder programs, which included interventions based on social learning, building networks and site demonstrations ‘to establish new norms’. Their aim was to ‘attract [people] to the program, raise their awareness of appropriate practices, build their capacity to respond and then stimulate adoption of those practices’ (Guise, Gannaway, and Jones 2010, 149, 150).

Botha and Coutts (2011) also adapted the model to create a model almost identical to the one used in this current study (Figure 3-1), to argue for the need to understand landholder process of practice change to effectively accelerate adoption of NRM practices. They suggest extension needs to include not only provision of information but the factors that allow decision-makers to ‘play’ with the practice so they can be confident their decision will help them achieve their goals. They argue the process of ‘play’ occurs at various stages of the landholder practice change cycle and includes factors such as; on-farm trials, models, tools and the skills to use them, participatory processes using peer support, and experts to share information and use as a sounding board to work out their options. They provide a useful check-list for extension of the factors that impact on the adoption process they need to consider.

One study relevant to this research by Parminter (2011) applied both the TPB theory and the Stage of Change model (Prochaska, Norcross, and DiClemente 2013) to a framework to determine the influence of individual and social structures on landholder innovation. Innovation through personal experience has been found by studies to be favoured by landholders for learning (Moore and Renton 2002). Parminter (2011) argues that innovations are either developed by individuals to satisfy their personal social beliefs or to resolve problems using group-based solutions. Innovation is therefore being driven either by a desire to improve industry growth or it is a social activity driven by landholder aspirations to improve their farm environment and



achieve their goals. The study showed differences between different kinds of communities.

In the remote areas individual factors such as attitude, confidence and identity were important and individual extension advice to identify opportunities for change would prove most beneficial. Levels of social capital were important in areas with closer density where strengthening social networks would encourage innovation. Loosely coupled decision makers prefer mainly working with other landholders and learning from those outside their industry. Most WA Wheatbelt landholders live in these three categories and as such require different NRM extension methods than those living in close-knit communities. The study also found that industry structures and institutional arrangements influence the level of landholder's innovativeness. Of particular relevance for the current study was that Parminter (2011) found that as they move through the stages of change, landholders require different types of support to encourage successful behaviour change.

## 2.3 Providers of support and their methods

The literature exposed a general scarcity of empirical studies that have directly addressed questions relating to the use of NRM extension and their methods to encourage adoption of recommended agricultural practices. Most studies that were related to this subject failed to separate the providers of support with the methods used to support adoption so were limited in their use for comparison purposes. Some of the available studies are undertaken in other countries, are older and the methods used are mostly outdated (Ford and Babb 1989) or where the providers of support are different. One such American study, similar to the current study, investigated American beef cattle producers' preferences for providers and channels (or methods) of information about production (Vergot, Israel, and Mayo 2005) and appeared to reflect differences between crop producers and livestock producers.

The survey confirms the high influence of social norms from other landholder's attitudes and behaviour. A notable study of Belgium landholders' adoption of three NRM practices also found that other local landholders had a slight influence on adoption of these practices for most landholders (Wauters and Mathijs 2013). However, they found that local governments were the greatest influence, suggesting

the key referents of influence may not generally be involved in provision of NRM extension. Their results also highlight the importance of lower-level provision of support where the influence of social norms and reciprocity is greater (Marshall 2008; Rockloff and Moore 2006).

Three recent studies have asked similar questions to the current study about the providers of support and methods they use to assist landholders, perhaps highlighting a current demand for more information on this aspect of agricultural extension. An American study of landholders by (Prokopy, Towery, and Babin 2014) asked respondents to rate the influence of different providers of support on decision-making for adoption of agricultural practices. The results demonstrate the international rise in private sector extension and also highlight several factors concerning the difference between Australian and American extension. Private sector support in America includes some universities offering major agricultural extension services, as well as training, such as Purdue University which undertook the research; a move that has not as yet occurred to the same extent in Australia.

Also of note is that the study includes the influence of the landlord. Another American author found that landlords can have a significant influence on adoption of NRM practices (Carolan 2005). Many Wheatbelt landholders also lease land, however, no study in Australia was found that included this characteristic in research and this variable was not included in the current Wheatbelt study. This may be worth investigation. Carolan (2005) also suggested the lack of contact and influence by extension personnel for 40% of respondents was due to budgetary constraints reducing extension services, as well as the growing use of informational channels. These shifts in extension are also very relevant to the current study as similar policy and technology changes are occurring in both America and Australia.

A Canadian study by Tarnoczi and Berkes (2009) found that information and advice for practices to assist with climate change were accessed from a range of different providers of support and the diversity of these providers were important for innovation. The study also found that observability and trialability of a practice and individual advice were most important for adoption, and that most support came from the private sector with a distinct lack of support from the public sector. They argue that the most

useful providers are those who are accountable to landholders, or those that have a direct interest in their successful adoption and not those with their own profit motives.

A PhD study by McKenzie (2011) investigated innovation in NSW landholders and found independent trialling and testing was being carried out on a wide range of issues. The qualitative study also emphasised the time and resources required to undertake practice change and the need for landholders to continually observe and respond to the natural environment. Many issues raised by interviewees in this study have been expanded on by interviewee comments from the current study.

The usefulness of information sources for risk management in America has been studied by both Ngathou, Bukonya, and Chembezi (2006) and Rejesus et al. (2008). These studies found most respondents preferred printed material such as magazines and newsletters and expert advice. They also found older landholders were less satisfied with the information they received, suggesting improved targeting of this information. However, the increase in Internet use since these studies were conducted make these results somewhat out-dated.

### 2.3.1 WA Wheatbelt studies

Several studies were found that investigated WA Wheatbelt landholders' perspectives about extension and the methods they use. However many of these studies have a different focus such as provision of extension for productivity purposes (Parsons 2009) or environmental issues (Toric 2005) and use a limited mix of the providers and methods of support. Some also suffer from selection bias and therefore provide limited data for direct comparison with the current study.

Possibly the most relevant to the current study are the annual surveys undertaken by the Grains Research and development Corporation (GRDC) (Watson and Watson 2012; 2013; 2014; 2015). This Australia-wide corporation is the leading grains research organisation funded by grower levies. Their annual surveys are used for accountability purposes for GRDC and to measure trends in the Australian cropping industry. Although they are mostly focussed on improving productivity, these surveys provide some worthwhile data for comparison with the results of the current study.

This large Australian study is conducted by telephone and includes around 300 respondents from similar regions of the WA Wheatbelt as the current study. Questions of relevance to the current study include group membership, the use of private consultants, and the influence of providers of support on practice change. The GRDC 2014 survey found the majority of grain growers believed there was sufficient information available to them. However the researchers suggested further research into the use and type of information being accessed; something the current study has done.

A brief article was also provided from part of another Australian PhD study, by Wright et al. (2015), which investigated where WA grain growers get their information for general farm production and crop specific information, as well as the electronic sources they use. The study was undertaken at the same time and had around the same number of respondents as the current study. As with almost all other studies, the survey used a mix of both the providers of support and the methods they use to provide information and support. The results showed that landholders use different providers and methods of support depending on the type of information they are sourcing i.e. information from private consultants was rated most important for both types of information while agribusiness resellers was rated last of the 17 choices for general information but second for specific crop information. However, the variables were different for both these questions so it was not possible to compare all these providers and methods of providing information. Of interest was that the survey also found that smart phones and tablets were being used by almost all respondents under 50 years of age while only around half of those over this age owned this technology, suggesting that this form of medium is becoming highly important for extension. This thesis is yet to be completed.

Another study of relevance was undertaken by Toric in 2005 with 16 landholders in the West Mortlock Upper Yilgarn regions of the WA Wheatbelt. Using qualitative interviews based on the Theory of Planned Behaviour, the study provided evidence of the providers of support and their methods used by landholders for a range of environmental issues. Consistent with the ABARES studies, this study showed few interviewees mentioned providers of support as an influence on practice change and emphasised the limitations of NRM extension to adoption. Also similar to the ABARES studies this study found interviewees used different providers of support for

different environmental issues. However, the study results provide limited data about the use of different providers of support, particularly as most interviewees relied on their own knowledge or family support.

WA Wheatbelt studies investigating attitudes toward remnant vegetation and Landcare have been undertaken by Jenkins (1998) Kington and Pannell (2003) and Moore and Renton (2002). The Jenkins (1998) study compared results of a previous study undertaken a decade before and provides some interesting data on trends in previous decades. The study found the lack of available information was the greatest barrier to management. Of note was a significant increase in support from other landholders and decline in the use of the department of Conservation and Land Management services in this decade. Both studies also found over half the respondents rated other landholders as their main provider of information. Moore and Renton (2002) also found a difference in the use of providers of support and information between conventional and more alternative types of farm production. Both authors argue for greater localised information on native vegetation management. Kington and Pannell (2003) found little coordination between landholders to address larger-scale issues. Although these studies have a narrow topic, only investigating practices related to salinity and native vegetation, they provide some useful results for comparison.

Only one small study by Hollamby et al. (2013), was found that measured the stages of adoption in some areas of the WA Wheatbelt. This study used the stages of adoption provided by Pannell et al (2006) to track the changes of 61 farmers in the Northern Agricultural Region of WA over a period of 6 years. However there was little analysis of the data and few practices similar to the current study so the study is of limited relevance. A PhD study conducted partly in the Wheatbelt by Musawi (2013), an IT student, investigated landholders use of providers of support and methods to access information and how the delivery of this information could be improved. This study did not differentiate production and NRM oriented information; however along with Wright et al. (2015), the results were relevant to the current study as they provided evidence of the relative importance of the key providers and methods of support for WA landholders.

These studies inform the current research in that they provide evidence of landholder attitudes and use for a limited number of providers and methods of support that might

be used for some of the NRM practices examined in the current study; particularly those that included landholders in the WA Wheatbelt. As such these studies have some relevance. Few studies used an approach that enables extension to determine where landholders are in their adoption cycle or investigated both the providers and methods of support used to promote sustainable farming practices. None of these studies adequately inform us what landholders think about the accessibility and relevance of the extension methods provided or what they believe are the methods most suitable for each particular stage of adoption. This understanding is essential for effective extension as it allows the appropriate methods and strategies to be applied at the most beneficial stage of adoption.

## 2.4 Evolution of extension

### 2.4.1 Introduction

Trends in extension have followed the increasingly complex changes in agriculture. Based on the concept of changing land use, the Post Productivist Transition (PPT), highlights three key processes the concept is based on: the government NRM policy focus on regulating and supporting public-good environmental and welfare issues; the withdrawal of public services and the rise in public sector support; and the multifunctionalism of landscapes that is challenging landholders' ideology of land use and development; and changing the role of extension (Argent 2011; Guise, Gannaway, and Jones 2010). These three issues are outlined in the following section.

### 2.4.2 NRM policy development

In response to growing land degradation through agricultural land use, and increasing demands for government action on environmental issues, the Commonwealth government legitimised and funded the Landcare movement with the introduction of the National Landcare Programme in 1990/91. This community-based program brought together stakeholders with different ideologies and became internationally renowned for changing environmental attitudes and knowledge. The program's aim was to promote sustainable agriculture by improving natural resource conservation and land management. It also focused on group delivery as a method of extension. Two Natural Heritage Trust programs followed with increased funding from the partial sale of Telstra (Curtis et al. 2014; Love 2013; Toyne and Farley 2000). The move was an

important paradigm shift in regional delivery of NRM that devolved responsibility for environmental issues to communities. State governments were retreating from their traditional role in agriculture with the introduction of user-pays models and outsourcing of extension services. The benefits of this move were seen to be the potential for the private sector to replace public sector research, development and extension (RD&E) where market forces allowed (Marshall 2008; Marsh and Pannell 2000).

Research and reviews of NHT1 revealed many problems and recommendations for change (Hajkowicz 2009; McVay, Hughes, and Lewis 2001; Barr and Cary 2000; Griffin nrm P/L 2000) and recognition that most of the environmental problems the initiative was designed to address were ‘increasing in severity and scale’ (Toyne and Farley 2000, vii; Hicks 2006). The new government brought changes in the form of Natural Heritage Trust Two (NHT2). Salinity had become a major concern so the National Action Plan for Salinity and Water Quality Program (NAP) was introduced in 2000/01. The NAP program involved a new approach to NRM based on scientifically-informed, regionally identified environmental assets, which were then targeted in accredited regional plans (Curtis et al. 2014).

Bilateral agreements between the Commonwealth and state governments established regional delivery of programs and funding arrangements through 56 catchment management authorities/regional NRM groups across Australia (Allison and Hobbs 2006). There were six groups in WA: Wheatbelt NRM Inc, Perth Region NRM, The South West Catchments Council, South Coast NRM, The Northern Agricultural Catchments Council, Rangelands NRM WA (Figure 2-3). The Peel Harvey Catchments Council was added in 2014 as a sub-group.

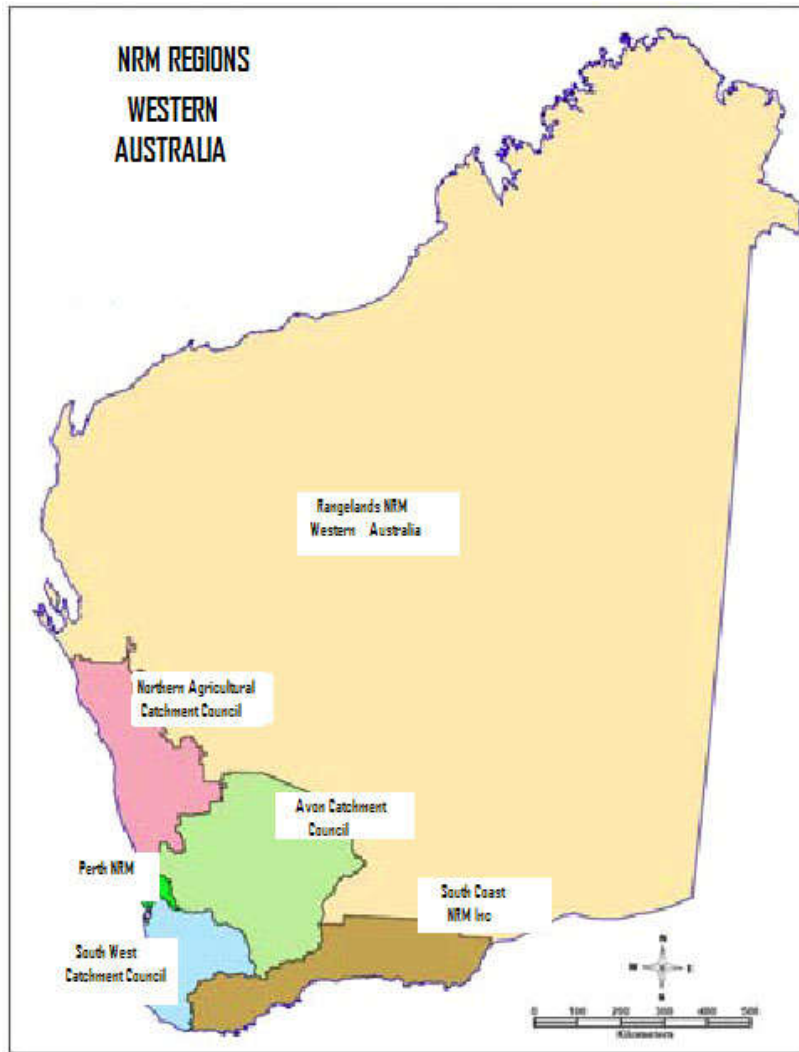


Figure 2-3: Map of the six regional NRM groups in Western Australia.

Source: [www.nrm.wa.gov.au](http://www.nrm.wa.gov.au).

The agreements identified regional groups as the primary mechanism for delivering NRM policies and their responsibility for significant funding greatly changed the dynamics of power (Bellamy 2006; Moore and Rockloff 2006). Devolving responsibility for on-ground investment to regional groups also had many problems and ‘placed an enormous burden’ on both the regional NRM groups and their communities (Keogh, Chant, and Frazer 2006, 9). Regional NRM groups were now charged with developing regional-level strategic plans and investment strategies, and governed by community-based boards, they were responsible for channelling Federal and State funding to deliver NRM outcomes, designed to fit national and state priorities (Robins and Dovers 2007).



The 'experimental' nature and dynamic policy of these programs, combined with radical changes in the focus, levels and responsibility for investment in land management, produced both positive and negative outcomes for those working in NRM support. Unrealistic expectations and limited program resources brought difficulties for all stakeholders (Robins and Dovers 2007; Rockloff and Moore 2006; Keogh, Chant, and Frazer 2006). By the end of NHT2 the approach had developed into a complex 'nested' system carried out at national, state, regional and local levels across a wide range of sectors (Marshall 2008; Bellamy 2006) and the approach was considered to be working well overall (Robins and Dovers 2007; McVay et al. 2008). With the failure of many remedial treatments to the environmental problems, and the achievement of tangible outcomes remaining a key problem (Clayton, Dovers, and Harris 2011; Hajkowicz, 2009; Allison and Hobbs 2006) reviewers recommended even greater strategic targeting of national priority assets (McVay et al. 2008).

This extensive learning process laid the foundations for the introduction of the next program Caring for Our Country (CfoC) in 2008 (Figure 2-4). The use of business plans and programs focussed on national priorities were developed to refocus and increase targeting for this program (Curtis et al. 2014). Interventions were based around key assets as a way of targeting practices with greater public good (Morrison et al. 2010) and landholders were paid to be environmental stewards (Clayton, Dovers and Harris 2011). Consistent with a move to a more centralised approach, the CfoC program increased competitiveness by introducing an open tender system with a strong focus on monitoring and evaluation (Morrison 2010). The NAP was discontinued (Pannell and Roberts 2010). In WA there was no formal state Landcare structures, but there were around 40 Land Conservation District Committees in operation in 2011, supported by the WA State government and regional NRM groups (Australian Landcare Council 2012). A study by Simpson and Clifton (2010) found WA Landcare groups had static or reduced membership and required government support and assistance from Landcare facilitators to continue to function effectively.

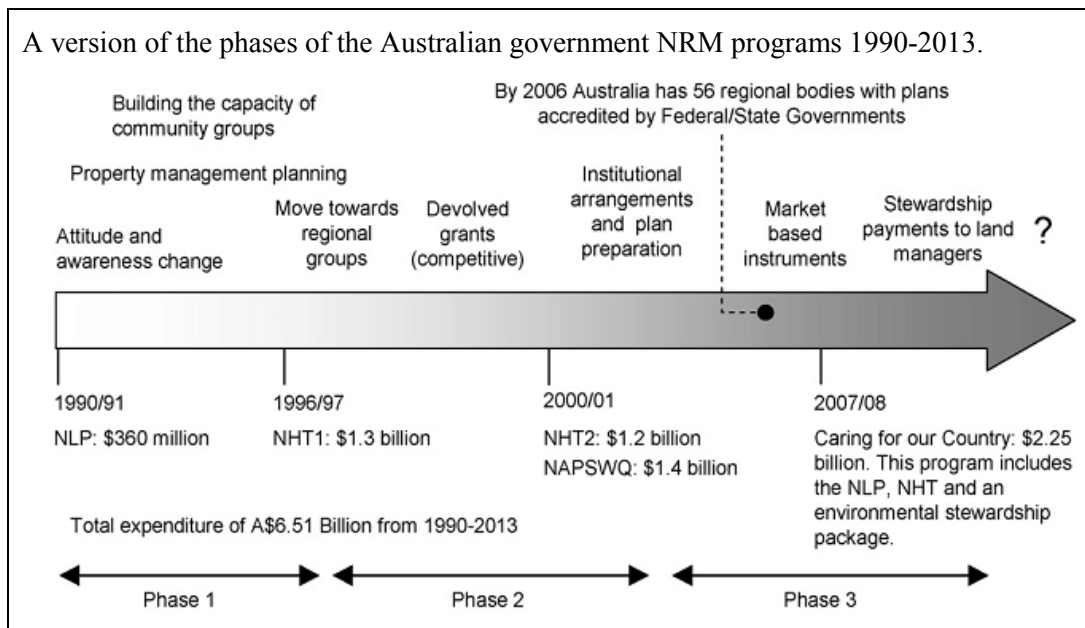


Figure 2-4: Key changes in the Australian NRM programs - 1990-2013.

Source: Hajkowicz 2009, 472.

An assessment of the NAP by Pannell and Roberts (2015, 5) found the targeted approach had not improved environmental outcomes as it completely failed to target its investments. Market-based mechanisms have been successful in some instances and NRM extension has raised awareness of environmental issues. However reliance on low-cost voluntary approaches have been unsuccessful for more complex issues such as dryland salinity. Marshall (2008) also concluded that limited autonomy for regional groups has restricted their effectiveness and ability to develop trusting relationships with landholders.

Overall, researchers indicate the environmental impacts continued despite all the funding provided by government NRM programs (Farmar-Bowers, Higgins, and Millar 2013; Clayton, Dovers and Harris 2011). With the change in government in 2014, CfoC was integrated into a revamped National Landcare Programme with reduced funding over the next 4 years (Department of Environment and Department of Agriculture 2014). The change highlighted landholder discontent with NRM programs (Environment and Communications References Committee 2014).

During the period from the start of Commonwealth government NRM programs in 1990 to the end of 2013, significant public monies have been invested in the development of programs to improve the way NRM is managed with over \$8 billion spent within Australia (Tennent and Lockie 2014). Key concerns from a recent senate

report show that many issues raised in previous programs remain (Environment and Communications References Committee 2014). Reviewers argue the assumptions underlying the programs ‘that well- informed land managers will deliver favourable environmental outcomes’ are problematic as they do not take into account the competitive pressures faced by land managers. They draw attention to CfoC’s business approach of using market-based instruments and incentivised payments to encourage adoption of NRM practices. These initiatives are premised on the worldview of treating environmental degradation as a market failure, to be addressed using market-based mechanisms and their success is yet to be comprehensively assessed. They also point out the costs of establishing the complex institutional arrangements under the regional delivery approach have been high and although questions remain about their effectiveness, they will continue to shape NRM in the future (Tennent and Lockie 2014).

Others argue the unwillingness of governments to effectively devolve responsibility for regional development to the regions is problematic and creates uncertainty for regions. Poor policy evaluation and the influence of electoral cycles have resulted in discontinued and duplicated projects and ‘a general disconnect between theory, policy and practice that continues to this day’. They call for a new paradigm based on ‘creative, locally-driven and centrally-funded regional development’(Collitis 2015, 31, 35). These policies have been shaped by, and in turn contributed to, current attitudes and values held by landholders that create challenges for NRM extension as highlighted by the following authors:

While there is evidence that most rural landholders in Australia have a stewardship ethic and practise good stewardship there is a cohort (about 30 per cent) that are more committed to short-term economic gain rather than the long-term health of the land and that hold strong views about the rights of private property owners to act as they see fit. There is even more widespread reluctance (about 40 per cent) to accept a duty of care for biodiversity conservation. These beliefs and attitudes shape landholder responses to Landcare, regional NRM and water reform. The NHT focus on investing public funds where there was a clear public benefit meant that NRM prioritised biodiversity conservation over maintaining profitable agriculture, and this has reinforced negative perceptions of NRM amongst some rural landholders. There is also evidence that regional NRM staff have different values (i.e. much greener) than the rural landholders they are attempting to engage and this difference in values is likely to lead to distrust unless acknowledged and addressed (Curtis et al. 2014, 189).

Nevertheless, NRM extension providers have played a critical role in changing landholder practices to reduce agricultural impacts on the land. Working alongside advisors assisting landholders to increase their productivity, they were an important resource for landholders in times of stress or crisis. By understanding the larger picture they have been able to play an important role in the information gathering process landholders use to make complex decisions for the future and provide tools and training that streamline their farming systems (McGuckian and Rickards 2011), enabling many to continue to thrive in a complex and dynamically evolving industry.

### 2.4.3 Change in public and private sector support

A key highlight from the current review of extension literature was the significant shifts in paradigmatic assumptions that occurred over the last few decades, clearly demonstrated in the changes in both approaches and methods used by extension personnel (Table 2-3). Up until the early 1960s the transfer of technology approach, based on the Diffusion of Innovations (Rogers 1983) dominated where scientists and landholders worked in isolation and extension was to promote the adoption of technologies developed by science. Agricultural extension provided by state governments to improve productivity had been the primary provider of extension for landholders (Vanclay 2004). The problem was that most agricultural research was undertaken by scientists on research station, where conditions were very different from farms. Some technologies were not able to be adapted to suit farming conditions and local knowledge was either not considered or collected and adapted by scientists (Röling and Pretty 1996).

Changes in agricultural ideologies and rationales during the 1970s and 1980s (Smith and Pritchard 2014) influenced change to a Resource Model for extension where technology was produced to suit the complete farming system. This period is also known as the farming systems or systems thinking, period (State Extension Leaders Network (SELN) 2006). Resource-conserving technologies and practices were being promoted for sustainable farming to replace reliance on pesticides and fertilisers (Scoones, Thompson, and Chambers 2008). Changes in the philosophy of government extension services heralded in the privatisation of extension. Government extension was now being reduced to public-good services and user-pays systems for government advisory services, and private/public partnerships were being introduced; presenting challenges for all involved (Rivera and Cary 1997). Landholders' knowledge was being recognised as important and scientists were conducting research on landholders' property, but participation by landholders remained mostly passive (Röling and Pretty 1996).

Growing criticisms led to alternative extension models based on empowering communities and landholder-driven research. The 1990s focused on collaboration, recognition of farmer knowledge, and 'bottom-up farmer centred approaches' (Scoones, Thompson, and Chambers 2008, 2). It also brought a change in philosophy about the role of extension with the introduction of environmental extension. This brought concerns about the conflicting role of environmental extension between meeting landholders' goals and the perceived national environmental interests (Barr and Cary 2000; Marsh and Pannell 1998). Landcare programs were introduced by government to support more sustainable agriculture. These NRM models had a greater focus on collaboration with the private sector, and targeted government spending encouraged public/private partnerships driven by policy based on user-pays models, outsourcing and cost recovery. This move increased the private sector role in research and extension allowing greater private sector input into the direction of public policy and research and boosted private sector investment (Marsh and Pannell 1998; 2000). NRM extension were therefore becoming increasingly diverse with the use of a broader range of methods, tools and processes to assist a broader range of clients, in more diverse settings (SELN 2006). Simultaneously a 'public/private benefit' debate arose around the private benefits of public investment (Love 2013).

The 2000s witnessed significant changes in the models and methods for extension. Farming is now recognised as a social activity and ideology has moved from a sole focus on the biophysical to the integration of socio-economic aspects of agriculture (Hunt et al. 2012; Vanclay 2004). Participatory methods based on group-based social learning and adaptive management processes are used to build community capacity and deliver the ‘sustainability aspects of production and NRM’ (SELN 2006, 3). The private sector have become well established, with many retail advisors employed by fertiliser or chemical companies as well as private consultants (Keogh and Clementine 2014) and extension is now driven by farmer’s agendas (Scoones, Thompson, and Chambers 2008). Government policy has attempted to redress the negative impacts of the neoliberal approach (Smith and Pritchard 2014) including greater participation of Indigenous communities in NRM (Australian Government Land and Coasts 2012a).

Landholders developed an alliance of grower groups, actively forming partnerships, engaging in research and extension and forming networks. They have increased landholder participation, improved access to information and links to industry businesses, and play an important role in research and implementation of NRM programs. They now share the role of NRM extension with Landcare and regional NRM groups, but also share similar challenges (Gianatti and Carmody 2007; Stone 2005). Extension is now part of a package of policy instruments that include; regulations, incentives, R&D and voluntary agreements (SELN 2006).

Table 2-3: Four stages of extension approaches and their application to extension activities over time.

Changing approaches to agricultural research, development and extension			
Transfer of technology	Resource approach to extension	Farmer First: participatory approach	People-centred innovation and learning
Do to approach	Do for/do with approach	Do with approach	Farmer-driven approach
Up to 1960s	1970s – 1980s	From 1990s	2000s
Supply through pipeline	Learn through survey	Collaborate in research	Multi-stakeholder processes, messy partnerships, collaborators, entrepreneurs
Training and visit system	Farmers objects of study and sources of information	Works with farmers	Farmer organised groups setting agenda, exerting demand: “the boss”
Technology has the answers	Information pool, all have access	Identify farmers needs	Multiple stakeholders and complex connections, scientists one of many sources of ideas
Farmers only see extension, not scientists	All stakeholders are extensionist	Participation approach Uses facilitative process, consensus data	Beyond the farm gate – multifunctional agriculture, livelihood/food systems and value chains across multiple scales, from local to global; long time frames
Research stations, field days, field plot experiments, on-farm irrigation checks	Farmlets study, field plot experiments, on-farm irrigation checks, farm demo sites, nitrogen experiments	Research conducted on farm, nitrogen experiments, farm demo sites, farmlets study, on-farm irrigation checks	Politics of demand, shared learning and change
Diffusion of Innovations, early adopters, laggards Targets innovators, farmers role to learn, adopt, conform	Uses all traditional extension methods adult learning and self directed learning	Listen to and help groups through problems	Social innovation networks centred on co-development
Technology packages	Modified packages to overcome constraints	Joint production of knowledge	Market-based incentives
Financial incentives	QDA schemes, awards programs, Financial incentives	QDA schemes Financial incentives	Change required: Institutional, professional and personal change; opening space for innovation
Change required: farmer behaviour	Change required: scientists knowledge	Change required: scientist-farmer relationships	Sustainability: Championed – and multidimensional, normative and political
Sustainability: Undefined	Sustainability: Important	Sustainability: Explicit	Traditional methods combined with electronic/ internet; websites, e-news, social media, webinars, mobile apps/email enquiries
Farmer visits, study tours, awards programs, workshops, news articles, discussion groups, TV, newspapers/printed media, telephone enquiries	Farmer visits, study tours, workshops, news articles, discussion groups, case studies, conferences, websites, TV, newspapers/printed media, telephone enquiries	Field days, farm demonstrations, workshops, discussion groups, case studies, stories, conferences, websites, TV, newspapers/ printed media, telephone enquiries	

Adapted from: Scoones, Thompson, and Chambers (2008, 4); Jessen 2002 in Warren et al. (2005,3).

Research has found agricultural advisors develop social network systems to service the different queries and demands they encounter. However, these are often fragmented and the availability and flow of relevant, quality information and advice remains a key issue with high costs, bias and control of information disadvantaging traditional landholders. They often lack effective translators of technical information and strategic leadership, and landholders are sometimes confused about where to access support (Turner et al. 2013; Love 2013; Hunt et al. 2012; Stone 2005). Concerns have been raised about the future supply of private and public extension due to loss of trained government agency personnel, costs of training recruits in the private sector and lack of agricultural extension education in universities (Ampt et al. 2015; Stone 2005). The cost of access to private support for the majority of landholders and their ability or willingness to fund this sector is also a major concern. (Wilkinson, Barr, and Hollier 2011; Faure, Desjeux, and Gasselin 2012).

Alternatively, concerns were also raised about environment and food safety issues being adequately addressed by private sector extension. Others suggest the private sector has failed to fill many gaps left by public sector service provision of RD&E services and that RD&E markets remain dominated by the public sector, and hence lacks diversity (Hunt et al. 2014; Stone 2005), prompting calls for greater collaboration between government and private sectors (Coutts et al. 2005). Others argued there has been an increase in private-public partnerships, however the need for government to have responsibility for public benefit outcomes remains (Keogh and Clementine 2014; Klerkx and Jansen 2010).

The last decade has seen a growing complexity and sophistication in the role of extension. Authors suggest that agricultural extension has become a ‘multi-faceted, multi-purpose, multi-scaled and multi-disciplinary field’ that includes extension for NRM (Ampt et al. 2015, 157). It is now focused on enabling innovation rather than ‘selling’ information and recognising that all actors in the system are part of the innovation process to increase the reach, rate and effectiveness of changes taking place (Coutts 2015). They now work as part of multi-disciplinary teams involved in complex projects that take a regional approach (Lemerle et al. 2015; O’Kane 2009) and communicating the results to a wider audience has become important (Edwards et al. 2013). The complex nature of the work continues to raise arguments about the need to



redefine and reconceptualise the role to provide a clearer identity for the people working in the field and their institutions (Ampt et al 2015).

Some researchers suggest extension now has a brokering role (Koutsouris 2012; Wheatbelt NRM 2013a). They suggest the role of a service broker is one that ‘considers the whole suite of present and potential product and service opportunities and actively matches needs to products and services, acting in the best interests of the client’ (Fulton and Vanclay 2011, 97) and describe their brokering role as ‘conduits or connectors of information, knowledge and people in both vertical and lateral networks’. They argue for increased investment for developing long-term relationships and improved extension change management skills to better integrate production and environment and catalyse change (Ampt et al 2015, 161).

Others argue extension should now be thought of as ‘a “function” for facilitating innovation and change’ rather than a distinct role (Coutts 2015, 4) and that their reach now includes not only the farm itself but also factors such as supply chains, beyond the farm gate. They suggest the need for a paradigm change for extension that incorporates shared views about who requires extension, clear RD&E priorities and proficient planning for workplace learning and support (Murphy, Nettle, and Paine 2013). Researchers now advocate those providing NRM extension need to ‘be on the ground co-innovating and collaborating with the aim of influencing change in themselves, their partner communities, and the organisations in which they work’ (Ampt et al. 2015, 158).

#### 2.4.4 Multifunctionalism of landscape

One of the key drivers behind change in both farming and extension is the multifunctionalism of land use. The abandonment of marginally productive country has encouraged Indigenous-owned and conservation land to be established. The intensification of large scale cropping and amalgamation of farms, mostly in the inland regions, has also reduced the number of landholders and their farming communities. At the same time amenity values are driving the development of ‘alternative, particularly boutique, farm industries’ where increased migration has occurred. The rise in different concepts of ‘ideal rural’ are creating conflict and divisive factions as each sector attempts to establish their version of idealised land-use (Argent 2011, 25).

Argent (2011, 183) informs us that changing patterns of settlement have created a geography of rural land use that has become complex and varied ‘producing many different “rurals”, each with varying developmental capacities’. Much of this development has occurred in the higher rainfall regions near the coast and urban centres where farm size has decreased in response to increasing land values and agriculture has been replaced by smallholders, rural-lifestyle blocks and hobby farming. They include rural amenity, peri-metropolitan and small farm areas (Argent 2011, 187). These landholders have very diverse values and interests. Some have strong environmental ethics and are interested in biodiversity conservation and sustainable agriculture (Meadows, Emtage, and Herbohn 2014). These farms involve a range of different types of production in the WA Wheatbelt including; agroforestry, viticulture, tourism, genetic breeding, fodder and tree crops. Some farms use less chemicals and technology, allow traceability of products and lower transport and distribution costs (Paül and Haslam-McKenzie 2010).

Yet many of these small-scale landholders are part-time farmers or non-farmers and absentee property owners (Curtis and Mendham 2011; Clayton, Dovers, and Harris 2011; Guise, Gannaway, and Jones 2010; Pannell et al 2006). Researchers also suggest that having different career paths to ‘farmers’ might influence how they view rural land use (Farmer-Bowers and Lane 2009). They adopt different NRM practices from full-time, larger-scale landholders and their systematic difference and different aspirations are creating conflicts over the management of natural systems. Although many have strong environmental ethics, their skills, knowledge and time to learn about and undertake NRM are often limited and many have no knowledge or experience with NRM or those providing this type of support. Strategies to promote NRM therefore requires alternative planning and methods to those provided to traditional landholders (Meadows, Emtage, and Herbohn 2014; Prokopy, Towery, and Babin 2014; Guise, Gannaway, and Jones 2010)

Other smaller-scale farms have driven a rise in alternative methods used to provide more sustainable farming. Support for these methods includes Holistic Resource Management based on regenerative agricultural practices and Grazing for Profit that focusses on the three tiers of sustainability, the social, environmental and economic. These are globally recognised approaches that are considered to significantly influence

what Ampt et al (2015, 159) terms ‘a community of practice of eco-innovators’. These new ideologies in environmental management have led to increased regulatory requirements; facilitating demands for new types of extension expertise such as ecology and animal health (Klerkx and Proctor 2013). These multifunctional changes in production and land use potentially challenge the productivist - conservationist divide and highlight the complex diversity of demands for extension services.

## 2.5 Future challenges for NRM extension

Several emerging issues arising from the literature serve to illuminate some of the challenges to developing strategies for more effective NRM extension. Some of these issues are outlined in this section under three main titles. These issues were included in the interviews and are part of the discussion.

### 2.5.1 NRM versus production support

The first issue raised by many researchers was that landholder’s demand-driven push for production-focussed extension services will prevent independent advice being provided where their commercial interests override public-good outcomes, and that activities with high public-good outcomes will not be undertaken without some form of remuneration (Ampt et al. 2015; Sutherland et al. 2013). However, few studies have investigated this issue. One earlier study by Griffin nrm P/L (2000) was undertaken with Kondinin group members and off-farm and supply chain agribusinesses staff that examined perceptions about the provision of NRM information by private services, input suppliers, industry groups and the public sector. While there were several biases with this survey, they found that landholders preferred public sector advice about NRM, and overall they ‘perceived a reasonably strong division’ between the production information provided by private and retail suppliers and NRM information provided by the public sector. However where there were favourable policy mechanisms or an economic advantage to an NRM practice, agribusiness were shown to be involved in bridging this divide (Griffin nrm P/L 2000, 8).

Later research has also found a lack of information being provided about NRM by private extension providers (Hunt et al. 2011; Hunt et al. 2012). Studies have shown the private sector are not proactive in promoting NRM as the market forces driving this role are insufficient. Advice on NRM and environmental monitoring amongst

private services was rated of low importance and they did not believe they had a big role to play in NRM extension, raising questions about ‘the need for training and/or accreditation systems for private-sector advisors’ to improve the sustainable management of farms (Keogh and Clementine 2014, 36; Botha, Coutts, and Roth 2008). This question was put to interviewees in the current study.

Freeman (2011) points out that NRM extension involves greater conflict than extension to improve agricultural production and also demands more negotiation; a process that may discourage many private-sector providers focussed on earning an income. Exacerbating the problem is the lack of capacity of those working in NRM extension and the limitations of the professional development available to them (SELN 2006; Wheatbelt NRM 2014). Researchers also argue the private sector have insufficient connection with public sector R&D and are not well integrated in policy and industry structures for future development and management of extension. These researchers call for greater collaboration between public and private sectors to better integrate NRM with production practices (Ecker et al. 2012; Pannell et al. 2011; Coutts et al. 2005; Stone 2005).

The focus of public sector extension is also being questioned. Government agencies are also increasingly focussed on productivity, and public funding is being directed to increasing production in the high income farming segment, often at the expense of NRM and social considerations. Researchers argue for extension changes from a broad farm system productivity approach to one that differentiates both extension methods and messages. They recommend that private consultants and retail suppliers be engaged as intermediaries to supply public sector information to the higher income, production oriented farming segment, while those in the largest, productivity constrained segment are serviced directly through greater public sector extension. The aim is to better incorporate and assist those segments of the farming industry less able or willing to improve productivity at the expense of social and environmental factors (Wilkinson, Barr, and Hollier 2011).

## 2.5.2 Information commodification, control and bias

Provision of relevant, quality information and advice remains a key role for extension; however a number of issues persist. With the growth of private consultants, intellectual property ownership and competition has made knowledge a commodity, which can

result in vesting knowledge and power in the hands of a few and reduce the flow of information (Hunt et al. 2011; Pannell et al. 2011; Stone 2005). Researchers also point out that as consultants are ‘keepers of knowledge’, it is necessary for landholders to use their services to obtain the knowledge. Further adoption therefore relies on their engagement with non-users or partial users of the practice who may not be willing or able to pay for their services (McRobert and Rickards 2010). Studies also show landholders’ concern for the ‘lack of independence, or potential bias in the advice they receive’ (Hunt et al. 2014, 136) particularly from agribusiness agents relying on sales commission for their income. Researchers highlight that normative influences on providers of information such as the use of small numbers of consultants, who are educated in similar institutions that rely on similar information sources, may drive uniformity in agriculture (Farmar-Bowers 2003), stifling new ideas and innovation. However, the growth of access to information on the internet may override any long-term control of information.

Studies in improving innovation (Stone 2005) and productivity in farming (Wilkinson, Barr, and Hollier 2011) have raised concerns about the profit-driven bias by private consultants and agribusiness agents to target extension to profitable farm businesses that have the ability to pay for their products and services. They find that private consultants are used mostly by landholders with large-scale farms who view farming as a business enterprise. These are usually younger landholders with a substantial gross income from the farm. They are generally fully aware of the bias from agribusiness advisors and prefer long-term, trusting relationships with experienced private advisors.

However, traditional landholders with lower income from the farm who are unable or unwilling to pay for private services rely on increasingly scarce public-funded extension services or agribusiness advisors and are sometimes unaware or accept the bias in their information. Isolation from their peers due to increased workloads exacerbates this situation. This large sector of agriculture is thus disadvantaged in the access of information to assist them to improve their productivity or land management practices. Private consultants themselves are also concerned about maintaining the integrity of information in the face of private funding agendas and promotion of commercial products (Botha, Coutts, and Roth 2008) ie chemical company representatives may provide excessive application rates to enhance their sales

commission. Concerns have therefore been raised amongst some researchers about the ability of some private sector providers to deliver equitable, unbiased support (Keogh and Clementine 2014).

### 2.5.3 Trust, credibility and power

Pannell et al. (2011, 28) argue that providers of extension need to focus more on ‘credibility, reliability, legitimacy, and the decision-making process’. Legitimacy and credibility needs to be earned through building trusting relationships that respect landholder goals, as without trust, extension can only provide information and not influence change. Evidence has been found that landholder trust in extension advice and their willingness to be influenced by it directly influences NRM adoption and the effectiveness of NRM extension (Price and Leviston 2014) and that credibility of the advisor is more important than independent advice (King and Nettle 2013). However building trusting relationships often presents problems for NRM extension. Faure, Desjeux, and Gasselin (2012, 462) point out that besides their role of improving farm profitability, extension providers also have an important role of improving social networks between landholders, R&D, and other sectors of the society. They suggest the capacity of extension to respond to these ‘diverse and at times contradictory expectations’ is limited.

Other researchers have also found landholders often receive conflicting messages due to different extension paradigms (Griffen nrm P/L 2000). Barr (2010, 129) explains the problem for extension in developing landholder trust has been ‘the shift in emphasis of government-funded extension away from productivity and towards conservation outcomes’. He argues this move changed the traditional ‘social contract’ between agriculture extension agents and landholders, resulting in loss of trust and credibility and reducing their ability to influence decision-making. This author therefore recommends conflict resolution be included in extension training. Pannell et al. (2011) also warn of the problem of losing trust due to promoting a practice that conflicts with landholders’ goals and emphasise the extensive time involved in developing trusting relationships; Wilkinson, Barr, and Hollier (2011) suggest this takes 10 or more years to establish. Pannell et al. (2011, 30) advise that extension can influence the credibility, trust and confidence of the landholder by : (i) their authority, technical expertise and communication skills (ii) landholder perceptions of the

similarities ie local resident or past farming experience (iii) personal relationships they have with landholders (iv) shared values - their acknowledgement of/empathy with landholders' circumstances and issues.

McRoberts and Rickard (2010) found private advisors also face similar problems developing trusting relationships with non-users of a practice or technology due to landholder's farming style. The type of decisions made about a practice or technology, attitudes toward paying for advice, and perceptions about whether their goals were being respected or not by the advisor, affected the building of trusting relationships; a particular problem when private advisors were 'gatekeepers' of information about a NRM practice. Landholders who may not be willing or able to pay for private services may therefore become isolated from new innovations and more dependent on their traditional practice.

The role of extension in participatory processes with landholders and other disciplines involves managing the power dynamics. Fleming and Vanclay (2009) argue that discourse is used to dominate or as a form of resistance to those in power. Multidisciplinary teams in particular involve different types of discourse arising from the different types of expertise represented by these discourses; highlighting the disparities of power and the need to understand and manage these competing discourses (O'Kane 2009). Kelly (2011, 161) argue power relationships in NRM are 'often contentious and fraught with emotion' yet often overlooked and rarely discussed. The challenges involve managing the desire of those in positions of control to maintain or change the status quo, and assign roles and responsibilities for resource use.

## 2.6 Summary

Chapter two synthesises relevant literature in four sections. It provides a brief outline of previous literature on the topics of the thesis and demonstrates the gaps in empirical evidence relating to the providers of support and their methods for the adoption of NRM practices. The chapter details the theoretical literature and the limited existing literature pertaining to the topic of the study, provides a brief summary of the key factors influencing the evolvement of extension, and presents the extension issues arising from the literature, investigated in this study.

## Chapter 3      Theoretical Framework

### 3.1      Introduction

This chapter outlines the theoretical framework used in this research and the reasons for its use. The framework is underpinned by the well-recognised theoretical model, the Stage of Change Model and concepts relating to the Theory of Planned Behaviour. This theory was used to guide the design of this study and is discussed from both a technical perspective and in terms of its relevance to this study. Personal and farm characteristics were also included in the framework to measure the contextual influences on landholder attitudes, motivation and behaviour. These characteristics, conceptual variables and model made up the theoretical framework used to organise ideas about the factors and their relationships that are the subject of the investigation.

### 3.2      Stages of Change model

The Stages of Change Model, (Prochaska, Norcross, and DiClemente 2013) was adapted to assess landholders stages of adoption of NRM practices in the WA Wheatbelt. Use of the model allows us to understand the pattern of transitional changes that exists at the farm practice level in the Wheatbelt as well as the extension methods that landholders themselves consider beneficial at each stage. This proven theory will thus ‘help to pinpoint where the participants are on the continuum of change’ (National Cancer Institute 2005, 16) and the extension methods most beneficial at each stage.

Fundamental to the model is the notion that different interventions are more or less effective in different stages of change, so there are ‘particular processes to be applied or avoided at each stage of change’ (Prochaska and Norcross 2001, 444). Insight into someone’s motivation and readiness to change, provides guidance for the types of planned interventions that may be most appropriate at the different stages of change Prochaska, Norcross, and DiClemente (2013). By understanding the stage of the landholder’s practice, it also helps to explain why respondents are not taking part in a program or practice (National Cancer Institute 2005).

The model has limitations, however, when applied to adoption of an agricultural practice or technology. This process is more complex than many health-related



behavioural issues and as discussed above in section 2.2.3, the continuous nature of adoption makes it difficult to define when adoption actually occurs. It is therefore difficult to develop a model that captures every instance of adoption, separates out steps that appear inseparable and encompass the potential order of stages that may occur. In addition to this, extension interventions may not even be feasible or necessary (Curtis and Mendham 2011).

Yet, as other researchers acknowledge, recognising and capitalising on the patterns of change is important for both policies and extension strategies oriented towards incentivising and enabling major change in farming practices, and may help to understand the differences in the extent and rate of adoption (Sutherland et al. 2012). The purpose of assigning stages of adoption is therefore not to be definitive but to examine trends and provide a tool to effectively base policy and extension strategies for adoption of NRM practices.

Prochaska and Norcross (2001) and Pannell et al. (2006) both indicate that in general, there are two learning processes that have traditionally been found important by researchers to generate change. The first occurs at the precontemplation and contemplation stages where information is collected, integrated and evaluated by extension to gradually increase the landholder's ability to undertake the decision-making process. The second is the 'learning-by-doing' or preparation stage of skill development that allows a landholder to implement the practice. The learning process is therefore ongoing as circumstances and knowledge change. Under the Stages of Change Model, there are five stages that people spiral through, moving both forward and backward in the process, and each stage involves a multitude of attitudes, intentions and behaviours. The table below shows attitudes at these stages adapted from Prochaska, Norcross, and DiClemente (2013) and also includes relevant stages outlined in Pannell et al. (2011) (in brackets), and incorporates their information relevant to landholders (Table 3-1).

Table 3-1: Attitudes at the stages of change adapted from Prochaska, Norcross, and DiClemente (2013, 10-11) and stages of adoption from Pannell et al. (2011, 13).

Attitudes at the stages of change adapted from Prochaska, Norcross, and DiClemente 2013 10-11 and stages of adoption from Pannell et al. 2011, 13.	
Precontemplation (Awareness of the problem or opportunity).	In this stage individuals are generally unaware or have little awareness of their problem and are not considering changing their practice. Family, friends or neighbours may be aware of the problem and may try to influence them to change but individuals are unwilling to recognise the problem or adjust their practice. They may consider they do not have the skills to undertake the required practice, they do not want to be forced into undertaking the practice, or they may not believe their current practices relate to the problem or the proposed practice will solve the problem.
Contemplation (non-trial evaluation)	Individuals are aware of the problem, are undertaking research, and are seriously resolved to do something about it, but have not yet committed to take any action. They will have taken ownership of the problem and will be evaluating the costs and benefits of their current practices and the practice required to overcome the problem.
Preparation (Trial evaluation)	At this stage individuals are organising their plan of action and contemplating implementation in the near future. They will be assessing their level of knowledge and skills required to change their behaviour and identifying the risks involved and the strategies required to manage high risk areas. Most will be making small organisational and behavioural changes but have not yet finalised their criteria for action.
Action (Adoption)	Individuals are implementing their plan. They are taking action to overcome their problem by modifying their practice or undertaking new practices. They are showing clear evidence of behaviour change and spending considerable time and energy in their commitment to bring about change.
Maintenance (Review and modification)	In this stage the required behaviour and lifestyle changes have been made by individuals and they are now focussed on maintaining their practice routines, however this stage was combined with the Action stage in this framework.
Individuals do not generally move in a linear fashion through these stages of change but will often revert back to contemplation or preparations stages before taking action. Due to the complexity and long time span of environmental change, lack of positive feedback and motivation may result in some individuals failing to maintain their change in behaviour. They may however, again undertake preparation and action for change at a later time.	

### 3.2.1 Stages of adoption model

An integrative model of the traditional Stages of Change model and the adoption process was developed for this research to identify patterns in landholder practice change and the stages where NRM extension for adoption of NRM practices is most beneficial (Figure 3-2). The adapted model consists of six stages of change, and was developed with the assistance of Wheatbelt NRM staff. Four of the stages from Prochaska, Norcross, and DiClemente (2013) were used; Precontemplation (not considering), Contemplation (thinking about it), Preparation (planning and trialling) and Action (currently doing). In this model the Precontemplation stage may also include rejection by those who have researched the practise and found it will not advance their goals. The stage of maintenance (Prochaska, Norcross, and DiClemente 2013) or review and modification (Pannell et al. 2011) was considered something that

landholders would be undertaking when they are ‘currently doing the practice’ and would be more difficult for respondents to separate out as a distinct stage. Therefore this stage was included in the Action stage of the model.

After discussion with Wheatbelt NRM staff, another stage ‘interested but currently unable to’ was added so as to better suit the ‘realities’ of farming. This ‘Interest’ stage may be due to a range of impediments including, lack of finance, knowledge and/or skills, technology problems, family circumstances, market or environmental conditions that prevent or postpone their move to the next stage. This stage may include respondents who have adopted the practice previously and are waiting for the right conditions to re-adopt the practice again. As such Botha, Coutts, and Roth (2008) suggest it can be seen as both an opportunity and a barrier to change.

The Stage of Adoption model used in the current study also included a stage developed by Pannell et al (2006, 2011). These authors found that landholders undergo six stages in their decision-making for adoption of conservation practices including non-adoption or dis-adoption. This ‘Dis-adoption’ or ‘Rejection’ stage (done but found not worthwhile) occurs if local trials or adoption results demonstrate that the practice will not advance the landholder’s goals. If after initial adoption ‘economic circumstances change or a superior replacement technology or practice becomes available’, the practice may also be ‘scaled down and eventually discontinued’ (Pannell et al. 2011, 14).

I discovered at a later stage in the development of the current thesis that Botha and Coutts (2011) developed a similar Stage of Adoption Model to the model used in this Wheatbelt study. This coincidence supports the integrity of the shared model (Figure 3-1). The main difference between the two models was that the planning and trialling stages were combined in the current study to reduce respondent fatigue and it was thought these stages were similar and would require similar intervention methods. Botha and Coutts (2011) propose the pre-adoption stages of, interested but unable, planning and trialling are interesting as they demonstrate the spiralling effect of the change process (shown by the dotted line) where people often move backward and forward before they make the decision whether to adopt or not. They suggest this is an area of ‘play’ where people actively consider the relative advantage and compatibility of the practice with their farming system. Consistent with Pannell et al (2011), these

authors highlight the importance of the stages of play, particularly trialling, to landholders' learning and potential adoption.

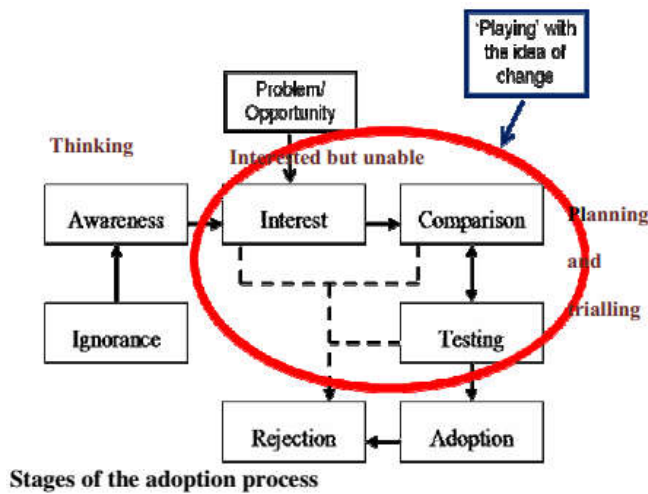


Figure 3-1: Stages of Change model adapted by Botha and Coutts (2011, 3) to measure landholder stage of adoption.

The following model represents the framework used in this research study. The dotted line demonstrates the stages where spiralling (or play) occurs (Figure 3-2).

### Thesis Framework

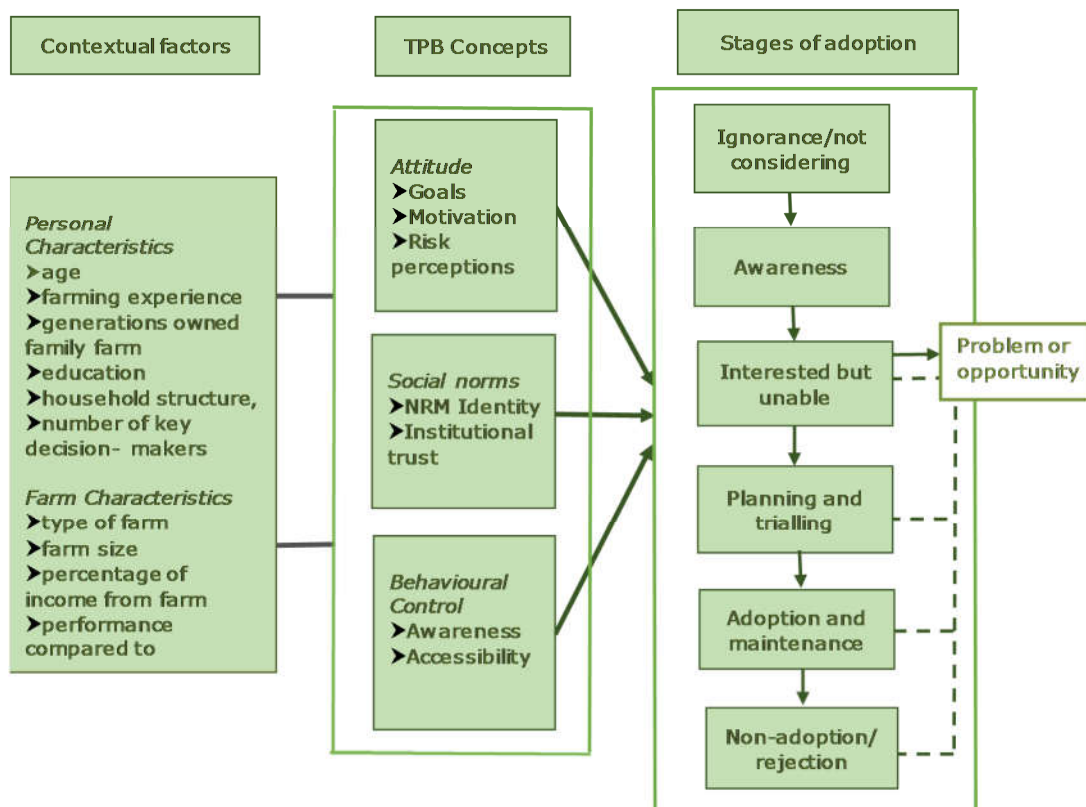


Figure 3-2: Conceptual framework for thesis

Source: Adapted from Prochaska, Norcross, and DiClemente 2013; Pannell et al. 2006; Botha and Coutts 2011, 3.

### **3.2.1.1                    *Recommendations for intervention***

Prochaska, Norcross and DiClemente (2013) developed 10 interventions recommended to progress people in the change process. Markham et al. (2006) also developed a summary of the steps that can be used in a similar framework developed specifically in relation to extension. The following Table 3-2 demonstrates how these steps fit with those stages of change provided by Prochaska, Norcross and DiClemente (2013).

Table 3-2: Recommended interventions to progress landholders' stages of change.

Recommended interventions to progress landholders' stages of change. Adapted from Prochaska Norcross and DiClemente 2013; Markham et al. 2006 and Pannell et al. 2006.				
	Stage of Change Process	Definition: Intervention	Stage of Extension	Steps for Extension
Pre-contemplation to contemplation stages	Consciousness Raising	Increasing awareness of the problem or opportunity. In this context, 'awareness' means not just awareness that an innovation exists, but that it is potentially of practical relevance to the landholder.	Engagement	Developing the relationship and building trust Clarify the issue at first contact Get to know their background Preparation prior to visit Quick wins to boost confidence and trust
	Emotional arousal (or dramatic relief)	Emotional arousal about the problem or opportunity, whether positive or negative arousal.		
Contemplation to preparation stages	Environmental Re-evaluation	Reappraisal to realise how their management affects the problem and how adoption of the beneficial practice will achieve desired outcomes. Self reappraisal to realise they have, or are able to develop or obtain the skills, knowledge and resources to undertake the required practices/s to meet their goals.	Issue identification	Goal clarification of key decision makers Clarification of values that motivate behaviour Agreement of farm business goals Farm resources Skills and abilities of farm manager and staff Overall assessment of farm performance
	Self-reevaluation			
Preparation to action stages	Social Liberation	Understanding of environmental and social opportunities that exist to show society is supportive of the practice. Commitment to change behaviour based on the belief that achievement of the practice is possible and desirable.	Options	Clarify issue in relation to observations Agreement on issues to be tackled Agree on what a successful outcome will be Brainstorm and explore potential solutions Assess feasibility of solutions Set immediate next steps
	Self-Liberation			
	Reinforcement management	Providing encouragement and support for positive practice change Finding supportive relationships and assistance that encourage the desired change.		Action Plan
Helping relationships				
Action stage	Counter-Conditioning	Substituting beneficial practices and attitudes for previous management practices and attitudes.	Practice Change	Assessing the priority of tasks Evaluating the product choice options Reviewing the timing of the farm operation Analysing the method of task execution Monitoring cash flow and timing and allocation of feed resources.
	Stimulus Control	Re-engineering the environment to have reminders and cues that support and encourage the beneficial practice and remove those that discourage adoption.		

Adapted from Prochaska Norcross and DiClemente 2013; Markham et al. 2006 and Pannell et al. 2006.

### 3.2.2 Conceptual variables

Concepts arising in the literature were used in the current study as variables to measure the concepts in the Theory of Planned Behaviour (Figure 3-3). The Theory of Planned Behaviour (TPB) was developed by Fishbein and Ajzen to predict behaviour in three ways: our attitude toward the outcomes of performing the behaviour and our evaluation of how much we value those outcomes; the subjective norms which influence our perceptions of social pressures associated with behaviour and our belief in whether we should or should not perform a specific behaviour; and our perceived behavioural control which consists of our perception of how easy or difficult it is to perform a particular behaviour (self-efficacy). The stronger the intention, the more likely the person is to perform the behaviour (Fishbein and Ajzen 2010; Ajzen and Fishbein 1980).

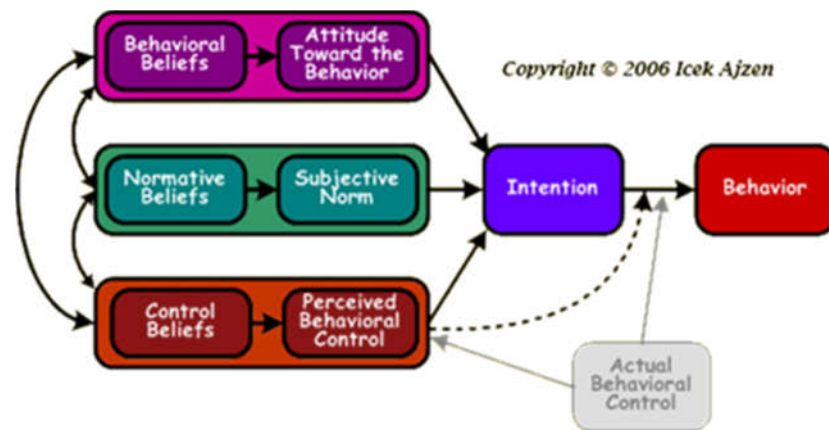


Figure 3-3: Diagram of the Theory of Planned Behaviour

Source: Fishbein and Ajzen 2010, 1.

The key concepts that arose from the literature were used to develop the TPB concepts. Attitudes toward the NRM practices were measured using landholders' main goals, their intention toward using the providers of support was measured using motivation and their attitude toward using them was measured by risk perceptions (Price and Leviston 2014; Ecker et al. 2012; Pannell et al. 2011). NRM identity and institutional trust were used in relation to social norms influencing landholder attitudes, and awareness of the providers of support and accessibility to the methods of support were used as measures of control behaviours.

The TPB concepts were also evidenced in the different stages of the stage of change model and included in discussion. Trust, risk perceptions and self-identity were also

used in a hypothesised model of pro-environmental land management developed by Price and Leviston (2014). Consistent with their research the current study involves complex behaviours and motivations in relation to management of natural resources. As such it was inappropriate to use the TPB model, designed for single action behaviours that are controllable, and assessing the large number of variables required for this model would have been onerous for respondents. Instead, the following concepts relating to attitude, subjective norms and behavioural control have been used.

### **3.2.2.1 Goals**

Other researchers have used landholders' desire to attain their goal in adoption models. They show that extension can influence adoption through facilitating the setting and striving for goals (Kaine et al. 2013; Marshall 2008). Pannell et al. (2011) argue that adoption will only occur when the landholder perceives the NRM practice will meet their economic, social and environmental goals. They suggest five types of goals guide family decisions; '(i) material wealth and financial security; (ii) environmental protection and enhancement (beyond that related to personal financial gain); (iii) social approval and acceptance; (iv) personal integrity and high ethical standards; and (v) balance of work and lifestyle'. However, they also point out that family priorities may influence the relationship between adoption and landholders' goal for their farming business. Perceptions of land degradation and difficulties understanding the benefits from recommended practice outcomes, may also limit adoption of NRM practices, even when they are likely to achieve landholders' goals (Cary, Webb and Barr 2001).

Studies have highlighted the important goal of profit to adoption, yet Pannell et al (2011, 5) argue this may not be the core goal for landholders but will be important for achieving their higher order goals such as lifestyle and maintaining the family farm. They therefore recommend that providers of NRM extension recognise the difficulty and ethics of changing landholders' goals, and as such understand the limitations in their role as enablers of change. Ecker et al (2012, 52) also highlight the need to understand the compatibility of the NRM practice with landholders' personal and farm business goals and suggest this understanding improves the effectiveness of NRM extension. They argue that 'Goals and motivations are both significant in explaining adoption decisions'. As such the concept of 'meeting their main goals' was used to measure the importance of the NRM practice with respondents' stage of adoption.



### **3.2.2.2                    *Motivation***

According to Ajzen (2012, 15) ‘normative belief is weighted (multiplied) by the person’s motivation to comply with the referent’s perceived expectation’. Motivation to use a provider of support therefore infers the person or organisation is important to the landholder and the landholder will likely undertake the practice the person or organisation thinks they should, if it is within their capacity to do so. As such the use of motivation as a measure of intention allows inferences to be drawn about the normative influence of the person or organisation providing the support for adoption of NRM practices.

Motivation is also shown to be directly associated with the framework concepts of goals and risk perceptions by Greiner and Gregg (2011, 258). These authors argue for a distinction to be made between goals and motivation. Goals, they suggest, are ‘short term tangible objectives and means to an ends’ while motivation is an end in itself. Goals are therefore the tools used to achieve higher order aspirations that provide the motivation to drive adoption of NRM practices. They also suggest that motivational aspirations are constrained by perceptions of risk and uncertainty, with their study highlighting the critical role this plays in farm management.

Ecker et al (2012, 52) also used landholder motivations as a measure to ‘determine past or intended adoption of land management practices’. The use of motivation to measure attitudes toward the use of different providers of NRM support in the current study therefore builds on this understanding of motivations in landholder decision-making. Qualitative research further explained landholders’ motivations for their use of the providers of support.

### **3.2.2.3                    *Risk perceptions***

Many authors highlighted the importance of risk to decision-making (Pannell and Vanclay 2011; O’Kane 2009; Cary, Web and Carr 2001). According to Pannell et al. (2011, 18), the higher the level of risk aversion, the greater the tendency is to adopt an NRM practice that is perceived to reduce risk. They also emphasise the stress involved for landholders in making decisions with important consequences involving high levels of risk. They suggest that most decision-makers cope with this stress by seeking more information and support from both their family members and others in their

social community. This would include those working in extension. They suggest that decision-making for adoption of NRM practices is particularly uncertain as the long time-lags involved in undertaking many NRM practices provides opportunity for unexpected developments to occur, such as market and technology changes or natural hazards such as fire or pest damage. However, learning through trialling and extension have been found to reduce risk due to skill improvement and ‘accelerated learning about new practices’ (Hunt et al. 2011; Ghadim, Pannell, and Burton 2005)

According to Nicholson (2015), Australian agriculture experiences high levels of risk and while most landholders have developed ways to effectively cope with these risks, he points to extensions’ lack of understanding about the meaning of risk and the need to include risk extremes in their interactions with landholders. The challenge for NRM extension they argue, is to understand the attitudes toward risk of individual landholders and ensure the support they provide continually matches the landholder’s goals. Although perceived risk of adoption were found by Baumgart-Getz, Prokopy, and Floress (2012) as having reduced as NRM practices have become more widely used, the support provider’s understanding of the risks involved in adoption of NRM practices was still considered to be a useful measure of attitude toward the use of the different providers of support. Therefore, respondents were asked to rate how well they believed those providing support for adoption of NRM practices understand the risks involved for them in adoption of NRM practices.

#### **3.2.2.4                    *Social norms***

The Theory of Planned Behaviour (TPB) is a key theory used to examine norm-related constructs (Ajzen and Fishbein 1980). The theory is used to predict beliefs about what important others would expect us to do, together with our motivation to comply with these expectations. Our normative beliefs about the people who are important to us create a norm from which our perceptions of social pressures arise, termed subjective norms, which may or may not influence our behaviour (Ajzen 2012). However our perceptions may not necessarily be what others consider we should do. As such it is not necessarily the norms of society that influence our behaviour but our *perception* of those norms (Fishbein and Ajzen, 1980). Our subjective or social norms therefore provide our motivation to comply with what most people who are important to us think

about us performing a behaviour. This suggests that landholders continually confirm their behavioural intentions with the actual or perceived behaviour of their neighbours.

Ecker et al (2012) also found that social norms were a moderate influence in regards to factors such as recognition by neighbours and the farming community, and how well the practice fitted with the practice of others in their community. Thus, Burton (2004) argues it is important to measure both attitudes and social norms. Social norms were therefore explored in this study using identity with other local landholders' attitudes toward NRM and institutional trust.

#### **3.2.2.4.1            *NRM Identity***

The importance of identity with the environment and NRM has been highlighted in the previous chapter. Burton (2004, 365) suggests landholders' self-identity also influences their farming options and argues that attitudes about self-identity can be influenced by salient reference groups. He therefore argued for the use of identity to be included in behavioural studies, particularly where important reference groups threaten key cultural symbols related to self-identity; as is sometimes the situation with NRM.

A key aspiration for providers of NRM extension is to influence social norms so landholders have positive attitudes toward adopting NRM practices. A leading adoption theory, the Diffusion of Innovation, is premised on the assumption that as more people move in the prevailing direction of others, social norms become increasingly influential. As such the use of peers to persuade others to identify with them and adopt a practice is a key extension strategy (Rogers 2003). Other researchers inform us that social norms are constructed by landholders' identity with good farm management through association with their agrarian culture (Pannell et al. 2011). A problem for NRM extension therefore appears to be the dominant agrarian cultural attitudes toward productivity (Parminter 2011). Authors suggest this attitude is so pervasive it is not even questioned, and that environmental conservation is often viewed as alternative, with environmental information less accessible and not well understood (Farrar-Bowers and Lane 2009).

However recent research has found that multifunctional landscapes are influencing changes in occupational identities by broadening the range of social norms on what

constitutes a ‘good farmer’ (Sutherland and Darnhofer 2012; Groth et al. 2015). Thus the increase of small-holdings may be influencing attitudes and identity with the environment and NRM practices. The measure of NRM identity was therefore included to investigate whether social norms influence adoption of NRM practices, or the use of the providers of support and their methods of support.

#### **3.2.2.4.2            *Institutional Trust***

McKenzie (2011) also emphasised the importance of goals and motivation to decision-making but stressed that institutional factors are also important for explaining decisions or behaviour. According to Price and Leviston (2014) norm activation models have demonstrated that attitudes toward ‘policy initiatives, trust in institutions and trust in other citizens’ may influence awareness and behaviour. An exploration of the challenges for the community-based approach of governance within the NRM system by Marshall (2008) showed landholders trust in the regional delivery model influenced their adoption plans for most of the NRM practices in the study. It also found that lower-level groups in the regional delivery system directly engaged with the landholders were where trust was established. Changes in this trust greatly affected landholders’ plans for adoption, suggesting a strong trusting relationship between landholders and their local or regional groups was essential for adoption of the NRM practices.

Landholder comments in Marshall (2008) also showed continued mistrust of government and scepticism of the governments’ motives for developing the regional delivery system. Some also showed antagonism toward government due to the imposition of land clearing regulations. Similar responses have been found in research undertaken in the WA Wheatbelt in relation to protection of remnant vegetation. These authors highlight the irresponsibility of this action in view of increasing salinity issues (Kington and Pannell 2003). Marshall (2008) found this mistrust and antagonism was being transferred to regional NRM groups who were considered to be part of the bureaucracy, which influenced landholders’ subsequent adoption of NRM practices. As such Marshall (2011) argues it is the extent that the trust involves the motivation to reciprocate the support they receive from regional NRM groups that will encourage them to adopt NRM practices.

In a bio-security study of WA landholders, Palmer, Fozdar, and Sully (2009, 362) also found a lack of trust and credibility impacted on advisors and organisations associated with the government, particularly with regulators of environmental conditions. Highlighting the importance of trust in the provider of information they suggest ‘the messenger may be of more importance than the (scientific) content of the message’. As such, institutional trust is an essential component of motivation to use the providers of support and was therefore included as an explanatory variable in this survey.

### **3.2.2.5                    *Control barriers***

The intention or motivation to perform a behaviour is influenced by perceived behavioural controls or constraints (Ajzen 1991) which consists of our perception of how easy or difficult it is to perform a particular behaviour. The point here is that behavioural outcomes are dependent on both the motivation (intention) and the ability or opportunity (behavioural control). As such learning and adoption is highly likely to be regulated by measures used in the current study, awareness of providers of support for adoption of NRM practices and accessibility of their services.

#### **3.2.2.5.1                *Awareness***

Empirical studies have shown that large-scale, more innovative landholders have greater awareness of the specialist advisors available to assist them while more traditional landholders use their services less, and researchers suggest the availability of products and services may differ between these segments (Wilkinson, Barr, and Hollier 2011; Stone 2005). Research into small-scale farms has also found low levels of awareness of the NRM programs available to them. This resulted in procrastination about engaging with NRM problems or maintained their aversion to getting support from NRM extension providers (Meadows, Emtage, and Herbohn 2014). These results suggest awareness of the services available may present significant barriers to adoption of NRM practices. Factors such as the control and bias of information provided by some private extension services (McRoberts and Rickard 2010; Coutts et al. 2005) and the low importance for including NRM information in their advice (Keogh and Clementine 2014) also make it important for landholders to be aware of the type and quality of services provided by different extension providers. As such the level of awareness of services provided by the providers of support was explored to determine the level this barrier may affect the use of these services.

### **3.2.2.5.2            *Accessibility***

Ecker et al. (2012) recommended investigating the accessibility and relevance of the methods provided by the different providers of support. They pointed to the limitations in accessibility of extension due to personality traits and remoteness, and the implications for accessibility of funding on adoption. Costs of paying private sector information and advice also limits accessibility to their support for some landholders (Wilkinson, Barr, and Hollier 2011 McRobert and Rickards 2010). (Fulton and Vanclay (2011, 104) point out the plethora of services and funding opportunities available to landholders but argue the accessibility of these services is often limited, leading to ineffective extension outcomes. As such the accessibility of the methods used by providers of support investigated in this study provides a measure of the barriers to NRM extension influence on the adoption of NRM practices.

### **3.2.2.6                *Personal and farm characteristics***

Past agricultural studies on adoption and extension providers and methods have shown personal and farm characteristics to have a significant influence on all aspects of landholders' decision-making (Pannell et al. 2011; Donnelly et al. 2009; Marshall 2008; Rejesus et al. 2008; Burton 2004; Bamberg 2003). In their review of current literature, Pannell et al. (2011, 17) found that 'every measurable characteristic of farms and farmers has been found to be statistically related to some measure of adoption of some innovation'. Burton (2004, 360) point out that agricultural studies aimed at examining landholder decision-making generally include 'additional relevant data on farm structure, economic situation, successional status, etc.' as it allows researchers to understand the structural and economic factors that influence the motivational preferences of landholders.

Fulton and Vanclay (2011) highlight the importance of measuring the personal and farm characteristics. They explain that changes to the farming family and farm management practices affects the natural resources of the farm, which in turn affects the farm income and the farm. As such the values placed on adoption of an NRM practice varies with the personal and farm context and the subject of the research. By understanding which personal and farm characteristics influence adoption practices, extension strategies can be developed that better target those landholders who are more likely to undertake adoption. For instance Curtis and Mendham (2011, 165) found that

respondents who received most of their income from their property, were much more likely to adopt most NRM practices. Similarly, Conradie et al. (2013) found that financial factors were significantly stronger in explaining participation in conservation than any self-identity variable. These characteristics are therefore used in the current study to determine how they influence the attitudinal, motivational and behavioural preferences related to the practices, people and organisations as well as the extension methods involved in this study.

### 3.3 Summary

The Stage of Change model developed for the health industry was adapted to measure stages of change in landholder adoption of NRM practices. Limitations have been recognised in relation to the complexity of adoption; however the model does allow recognition of patterns and understanding of the extent and rate of adoption, and provides a tool to improve extension practices. The adapted model I developed for this thesis used four stages taken from the Stage of Change model and two from other sources and has been used in this study to measure both the transitional processes of adoption and the extension methods that respondents consider beneficial at each stage. A table of extension interventions recommended to progress individuals in the change was also developed for this thesis. Key concepts relating to the TPB that arose from the literature were used to develop the framework. Concepts of goals, motivation and risk perceptions were used to measure attitude, landholder identity and institutional trust were included in the framework to measure the influence of social norms, and awareness and accessibility were used as behavioural control measures to determine their influence on the use of the providers and their methods for support. Personal and farm characteristics were included to understand how contextual factors influence the attitudes and behaviour of landholders.

# Chapter 4      Research Methodology

## 4.1      Introduction

The fourth chapter situates the thesis in the WA Wheatbelt. Agriculture in the region is explained and information on the changes that have occurred over past decades is provided. These include agricultural production, environmental impacts of agriculture, global market and government policy impacts on agriculture and rural communities in the region and the current tensions arising from changing land use and climate change. The extension network available to landholders in the region is also briefly explained. The chapter also describes the rationale for using the mixed methods approach and why it is appropriate for studying the research questions and objectives outlined in Chapter one. It describes how mixing between the interpretivist approach of the qualitative paradigm and the positivist approach of the quantitative paradigm occurs and provides a step-by-step account of the methods used in conducting the two phases of the research, as well as the analysis procedures and structure for reporting the data. It also details the validity, representation and legitimacy of the study and ethical considerations.



## 4.2 WA Wheatbelt region



Figure 4-1: Map of WA Wheatbelt region

Source: Government of Western Australia (2014, 4).

The above map does not cover the northern and south-eastern reaches of the WA Wheatbelt but was chosen for the reasons outlined in section 4.4.1.1. According to the Government of Western Australia (2014), the WA Wheatbelt region covers 154,862 square kilometres with a diverse geography and a population of around 75,000 people. In 2008-09 there were around 4,200 agricultural enterprises covering 11.2 million hectares. Broadacre crops, produce around 80% of the gross value of agricultural production for the region, and livestock the other 20%. Wheat, barley and canola were the main crops grown in 2013-14. (Government of Western Australia 2011; 2014). Western Australia usually exports between 80-90% of the grain it produces, which is a key part of the 10-15% that Australia contributes to global wheat consumption. The industry is considered to be amongst the most efficient in the world (PricewaterhouseCoopers 2011).

Most farms in the WA Wheatbelt are a mix of cropping and sheep production. The advantage of mixed farming is that it provides relatively stable cropping and livestock production and the ability to reversibly change the mix of wheat or wool production in response to changes in commodity markets (Kirkegaard et al. 2014). The last few decades have seen many landholders decrease their livestock production and move into cropping, particularly in the eastern regions of WA (Llewellyn, D’Emden, and Gobbett 2009). This is often done to become more efficient by specialising in one product or if there is a preference for one type of production (McKenzie 2011). It may also occur due to shifts in relative profitability. While the average size of Australian farms decreased in recent years, large-scale WA farms have been expanding and increasing the area of land sown to crops while smaller farms have been growing less crops. WA Wheatbelt landholders had significantly larger crops in 2014 and 2015 than previous years (Watson and Watson 2014: 2015).

The effects of agricultural development in the Wheatbelt has created huge challenges for the sustainability of the industry and the environment. Large-scale land clearing, much of it driven by government policies providing incentives for land clearing, has reduced native vegetation to around 30% (ranges from 6% to 99%) of its original cover causing fragmented ecosystems, and extensive degradation of soil, biodiversity and water systems (Jenkins 1998; Allison and Hobbs 2006; Wheatbelt NRM 2014). Nature conservation reserves cover only six per cent of the region and the 50,000 remnants of native vegetation on private land, consist mostly of less than 20ha in size (Government of Western Australia 2017). The following graph shows the disproportionate distribution of remnant native vegetation in the Wheatbelt with most of it within the Great Western Woodlands, which covers 16 million hectares (Department of Parks and Wildlife 2010).

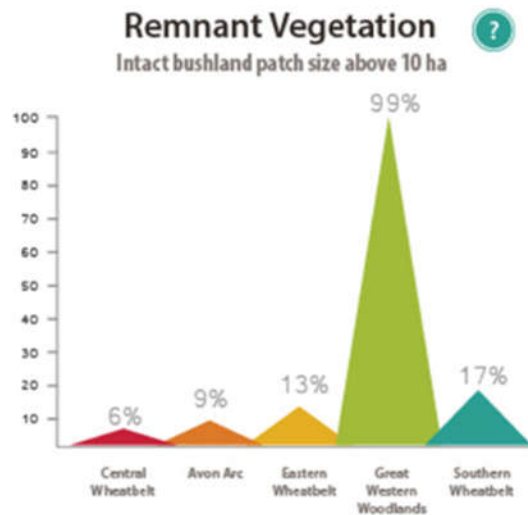


Figure 4-2: Percentage of remnant vegetation within the Wheatbelt NRM region.

Source: (Wheatbelt NRM 2015)

The soils in the Wheatbelt are also sandy, highly weathered and generally with low fertility. Moderate to high levels of soil acidity, wind and water erosion, soil compaction and soil water repellence affect a large area of the agricultural land. These impacts cause moderate to high on-farm costs, including significant losses in crop production, and increases in soil erosion and nutrient leaching. Other issues include ‘weed introduction, changes to natural fire regimes and potential cumulative impacts associated with agricultural chemicals’ (DAFWA 2014; Wheatbelt NRM 2013c; Wheatbelt NRM 2014,1).

Land clearing has also resulted in salinity which threatens the environment and infrastructure, and government policy initiatives have failed to resolve many persistent problems (Allison and Hobbs 2006). Mitigation costs are often unviable, annual on and off-farm costs are very high (DAFWA 2014) and there are few profitable perennial plant options available to mitigate salinity for much of this land (Bathgate and Pannell 2002). Soil acidity has also become a problem in recent years. It is estimated around 80% of topsoils and 50% of subsoils are affected and costs to agriculture are considerable (Wheatbelt NRM 2013a).

However, researchers have found that although many landholders value their environment, they often underestimate or fail to recognise the impacts agriculture places on the environment and the contribution ecosystems make to farming systems (Wheatbelt NRM Strategy 2014; Jenkins 1998). Environmental issues are of particular concern in remote areas of the Wheatbelt with fewer social services. Research shows

they are linked to increases in landholder health risks including mental health, asthma and heart disease (Speldewinde et al. 2011; Shrapnel and Davie 2001). Many economic, environmental and social indicators for agriculture in the Wheatbelt show declining trends and increasing stressors for the resilience of the industry and communities (Wheatbelt NRM 2013a). Research for the current Wheatbelt NRM strategy found the following issues were of concern to landholders in the region (Table 4-1).

Table 4-1: Key issues of current concern in the WA Wheatbelt.

Key Resource Issues of Concern in the WA Wheatbelt			
Theme	Resource Issue	Controlling Variables	Drivers
<b>Ecosystem Health</b>	Species viability (abundance and richness)	Cleared land	Land clearing and Climate Change
		Fragmentation	Over grazing, feral & weed invasions, fire frequency, climate change, land clearing
		Organic carbon	Land use and land clearing
<b>Soil Health</b>	Soil productivity	Acidity	Fertiliser use efficiency and lime application
		Sedimentation	Waterway and riparian management
<b>Aquatic Health</b>	River function (Avon River and major tributary)	Eutrophication	Fertiliser use efficiency and climate
		Acidity	Deep drainage
<b>Community Health</b>	Agriculture industry viability	Farm financial viability	Input costs, market price, climate, government, management decisions
	Community viability	Population trend	Farm amalgamation, employment, high school, aging community, government policy
<b>Whole of System Health</b>	System viability	Salinity	Climate, land use (perennial vegetation), land clearing
	Catchment water availability	Drying Catchment	Climate change, land clearing

Source: Adapted from Wheatbelt NRM 2014, 3.

Climate change is a key concern for future biodiversity and wheat production in the region. Recent Bureau of Meteorology and CSIRO predictions show ‘Average rainfall in southern Australia is projected to decrease, with a likely increase in drought frequency and severity’ (Bureau of Meteorology and CSIRO 2014, 15). Rural community sustainability has also been affected by changes in recent decades. Farm amalgamations and the impacts of government policies have resulted in loss of services, and reductions in employment, education or social opportunities, leading to high levels of out-migration of young people in search of better opportunities; creating farm succession problems. One of the major challenges now facing Wheatbelt regions is the effects of an aging population (Tonts and Haslam-McKenzie 2005). Two examples below (Figure 4-3) show the increasing age of farmers in the decade between

1986 and 1996, and the higher ratio of people aged over 40 years living in regional versus urban areas.

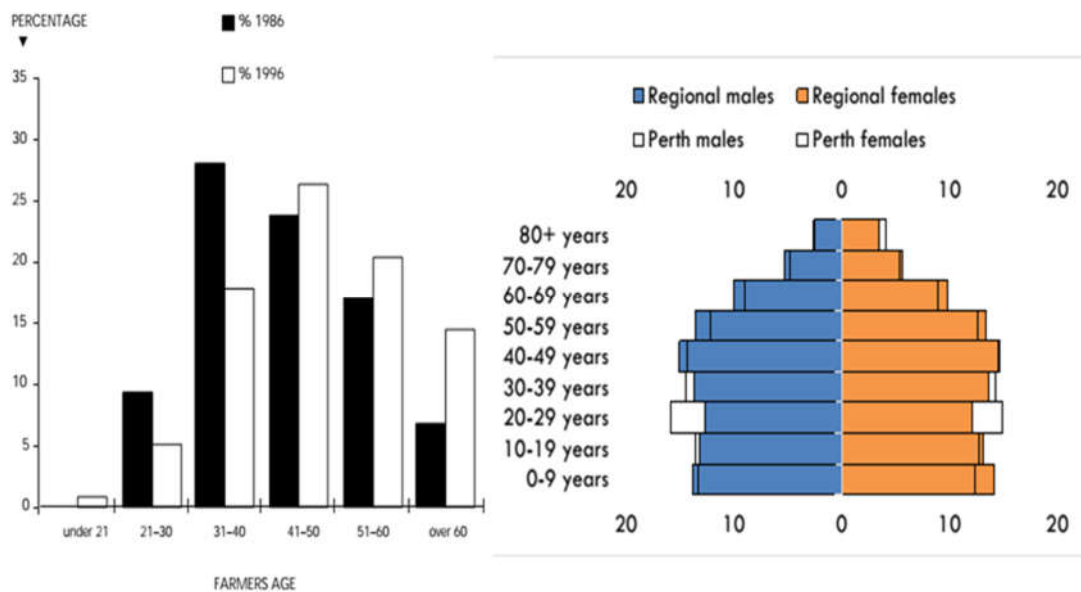


Figure 4-3: Percentage of WA Wheatbelt landholders in each age category in 1986 and 1996 and population structure of the WA Wheatbelt compared to Perth in 2014.

Source: Regional Australia Institute 2014, 12; Jenkins 1998, 22.

However the impacts on communities are uneven with many inland communities remaining highly dependent on agriculture (Davies and Tonts 2009). Significant growth in the number of smaller farms in recent years has contributed to a large variety in farm size and land-use across the Wheatbelt region. In WA the number of small landholder properties ranging from 1 to 100 ha increased by more than 20 per cent to over 55,000 in the decade to 2010. Most of these farms are nearer the large urban centres and many of these landholders are retired or derive most of their income off-farm. Many of them undertake a wide variety of agricultural or conservation activities (Guise, Gannaway, and Jones 2010, 147).

A wide range of support providers for both production and land management are available to landholders in the WA Wheatbelt. This includes private consultants working for service fees, and agribusiness agents working for retail businesses that service the agricultural industry's needs. For the purpose of this research, private sector support is broadly defined as those individuals and organisations which receive no government financial assistance and are outlined in the following table. Information about private WA crop advisors is also provided.

Table 4-2: Definition and description of WA private consultants and agribusiness

Private consultants/agribusiness agents
<ul style="list-style-type: none"> <li>▪ Suppliers of products such as fertiliser, chemical suppliers and equipment suppliers e.g. CSBP, Monsanto, NuFarm, Bayer, Netafim</li> <li>▪ Resellers with personnel who are both experienced and inexperienced and have multifaceted businesses, e.g. Landmark, Elders</li> <li>▪ Private consultants such as agronomists, hydrologists, biologists, marketers, farm financial advisers, veterinarians and specialists (e.g. irrigation and genetics - AFS agriculture) and those with forestry and plant expertise. Includes personnel with varying degrees of experience</li> <li>▪ Specialist management consultants, e.g. Farmanco, Planfarm, as well as holistic, organic and regenerative management specialists.</li> <li>▪ Dealers, e.g. Case IH, John Deere</li> <li>▪ Technical associations and research, development and marketing groups, e.g. GRDC, Kondinin Group</li> <li>▪ Bankers, accountants (adapted from Stone 2010, 38).</li> </ul> <p><i>WA crop advisors:</i> The estimated number of crop advisors for WA is around 40 retail advisors and 60 independent advisors. This is far less than other states ie NSW has a total of 738 advisors and SA has total of 606. Research showed ‘the ‘typical’ crop advisor is male, aged in his mid to late thirties, is a university graduate and has had between 10-15 years of experience as a crop advisor. Sixty per cent work full-time as crop advisors and service an average of approximately 30 clients who are located within a 150 kilometre radius of the advisor’s home base’. Most provide individual advice on ‘herbicide and pesticide recommendations, crop nutrition advice and herbicide resistance strategies’ (Keogh and Clementine 2014, v-vi).</p>

The state government agencies, particularly the agricultural and conservation departments, and local government also, continue to provide research, advice and funding or in-kind assistance to landholders for production and land management purposes. Non-government organisations including Greening Australia, Men of the Trees, Geographical association of Western Australia (GAWA), Birds Australia and the World Wide Fund for Nature (WWF) assist with conservation, revegetation and building local flora and fauna knowledge. Grower groups include many local area groups such as the Facey Group in the Dalwallinu area and Liebe Group in the Wickepin area, as well as groups supporting specific land management practices such as WA No-Till Farmers Association (WANTFA), The Oil Mallee Association (OMA), The Australian Sandalwood Network and Avongro who support agroforestry in the Wheatbelt region. These organisations provide information, advice and extension services in their region.





Figure 4-4: Map of Grower Groups in the Wheatbelt NRM region.

Source: <http://www.wheatbeltnrm.org.au/our-information/maps>

Research institutions including the CSIRO and universities continue to provide limited research and development while the Grains Research Development Corporation (GRDC) now takes a key role in servicing and funding much of the research needs of Wheatbelt grain growers and Meat and Livestock Australia (MLA) service the livestock industry. Other national industry groups and associations such as the National Farmers Federation (NFF), Grains Industry Western Australia (GIWA), National Association of Sustainable Agriculture, Australia (NASAA), Australian Forest Growers (AFG) also provide R&D, training and funding support as well as government lobby support for their respective industries.

Landcare and Regional NRM groups provide NRM extension for natural resource management to landholders in the region. One of these organisations, the regional group Wheatbelt NRM, covers most of the region and has been actively promoting NRM through past government-funded programs (section 2.4.2) (Allison and Hobbs 2006; Wheatbelt NRM 2014). The Northern Agricultural Catchment Council (NACC) is responsible for NRM in the North West corner of the Wheatbelt, while the South West Catchment Council (SWCC) covers the south-west corner. The South Coast NRM group is responsible for the south-eastern Wheatbelt region which is not included in the map used for this study. These groups were formerly established by the Federal Government around 2002 (Simpson and Clifton 2010).

### 4.3 Research paradigm, design and purpose

The research uses an explanatory sequential mixed methods design to explain the relationships among the study variables (Figure 4-5). The data were collected using an intermethod mix where two or more methods are used sequentially ie survey questionnaire followed by interviews (Creswell 2012; 2014; Collins and O’Cathain 2009). In the initial phase quantitative data were collected using an on-line survey of WA Wheatbelt landholders developed with Qualtrics software and distributed via NRM and Grower group e-newsletters, NRMOs and private consultant emails, and flyers. Contact information from visitors to the Wheatbelt NRM, Dowerin field day stall and the Internet were also used to access respondents. Chi-squares, cross-tabulation tables and Pearson’s correlations were used to explore the relationships between the study variables and to discover any anomalies that arose. As the basic objective of the research was explaining the association between or among the variables, the correlation design for this study was explanatory with the qualitative methods embedded in the quantitative design (Creswell 2012).

Participants and questions for qualitative data collection in the second phase were identified from the analysed quantitative data and the literature review. An interview guide was developed and the qualitative data from these interviews was used to explain or elaborate on the quantitative data. The mixed method approach therefore used the second qualitative database to expand or explain the understanding obtained in the previous quantitative database (Creswell 2012, 2014; Collins and O’Cathain 2009). According to Fetters, Curry and Creswell (2013, 2140) integration occurred through ‘connecting’ at the method level where ‘one database links to the other through sampling’ with partial mixing of the methods. Qualitative participants were purposively selected from the survey respondents based on the issues they raised and demographic criteria. The questions used in the research were therefore both inductive and deductive, the data collection and analysis strategies were statistical and thematic, with inferences drawn from within the quantitative and qualitative strands (Creswell and Tashakkori 2007).



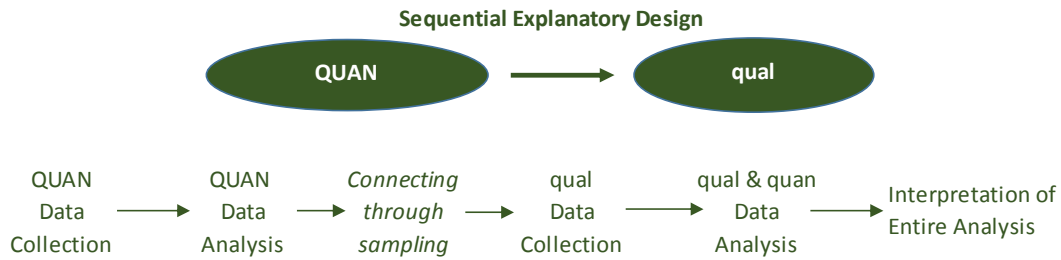


Figure 4-5: Phases of the mixed method research approach.

Note: Capitalisation indicates a weight or priority on the quantitative data, analysis, and interpretation in the study. Adapted from Creswell (2009, 209).

There has been much debate over the growing use of combined quantitative and qualitative research (Creswell and Plano Clark, 2007) but in recent years mixed method studies have increased in agricultural research (Wauters and Mathijs 2013; Wells 2011; Jackson 2008). Mixed methods are defined as ‘a methodology for conducting research that involves collecting, analysing, and integrating (or mixing) quantitative and qualitative research (and data) in a single study or a longitudinal program of inquiry’ (Creswell 2009, 6). Creswell and Plano Clark, (2007, 5) also describe it as ‘a research design with philosophical assumptions as well as methods of inquiry’. Data are therefore collected for the purpose of the inquiry, which does not rely on particular methods or mixes of methods.

The research objectives and measures of the effects made it important to use a positivist approach to examine the broad trends using quantitative methods, particularly in relation to policy objectives. It was equally important to use an interpretive approach to explore more deeply and comprehensively the individual issues using qualitative interviews; thus providing a voice for participants to be heard within the setting in which they engage with their problems. Both quantitative and qualitative methods were therefore used to provide a more comprehensive understanding of the issues than either one by themselves would provide (Creswell 2014). As such it was an appropriate methodology to produce suitable results for the research questions and objectives of this study.

The challenges of undertaking a mixed method study include ‘the need for extensive data collection, the time-intensive nature of analysing both text and numeric data and the requirement for the researcher to be familiar with both quantitative and qualitative forms of research’ Creswell (2009, 205). Other issues include page and word limitations for both thesis and journals. There are also a range of sampling issues for

sequential designs which include, deciding on ‘what results from the first phase to use in the follow-up phase, choosing samples and estimating reasonable sample sizes for both phases, and interpreting results from both phases’ (Creswell et al. 2011,8).

Wisdom et al. (2012) also point to the need for rigour and transparency in both methods and the need to adequately define the specific designs and methods used, particularly as mixed methods is relatively new and some may not be familiar with the approach. Issues with analysis and interpretation of results include; ‘the unequal emphasis placed on each dataset by the investigator or team, the accuracy or validity of each dataset, and whether philosophies related to quantitative or qualitative research can or should be combined’ (Creswell 2011,8). Attempts were made to take these challenges into account and limit their impact by adhering to the established standards for both quantitative and qualitative research.

## 4.4 Survey methods

Phase one of this research project involved an extensive literature review to investigate how other researchers had defined and examined similar objectives to this study in both agricultural extension and natural resource management. Using the ABARES studies (Eckers et al. 2012; Kacans et al. 2014) as a guide, a wide range of literature in different disciplines were reviewed to determine the concepts embedded in attitudinal and behavioural change. A model for the stage of change in landholder adoption was then developed. A framework was constructed based on contextual factors, the theory and concepts arising from the literature, and the Stage of Adoption model (Figure 3-2). An online survey was then assembled to measure the objectives of the study outlined in chapter one using this framework.

### 4.4.1 Quantitative

An Internet-based survey using Qualtrics software was developed for the quantitative phase of the study. Research has found few differences in responses to different quantitative survey modes (Hooley, Wellens, and Marriott 2012; Fleming and Bowden 2009). The advantages and disadvantages of online surveys are contested and continually changing. Potential advantages for online surveys are outlined by Hooley, Wellens, and Marriott (2012, 43) and include the use of online surveys to overcome geographic barriers and reduce research costs; two key considerations for this research.

Disadvantages of online surveys include inadequate Internet services in rural regions. However little could be done to assist this problem apart from containing the size of the survey.

A shortened website link or url was developed for the flyers to provide easy access to the survey. Due to ‘the risk of attracting invalid or non-representative responses through the use of a generic online survey link’ (Carrington and Pereira 2011) a password was included in the flyer. The survey was opened in March 2014 and closed in March 2015. To encourage participation a Bunnings gift voucher of \$20 was provided to each respondent requesting it by including their email address. Studies have found ‘in general there are no systematic differences between the incentivized and the control group concerning response quality’ (Grauenhorst, Blohm, and Koch 2016, 266). Respondents were also asked to provide contact information if they would like to take part in the following interview process. All other email addresses were then deleted from the surveys.

#### ***4.4.1.1 Sample***

The Wheatbelt region was chosen for this study due to the researcher’s understanding of the region resulting from experience working with staff at Wheatbelt NRM and extensive travel throughout the region. The boundaries of the Western Australian government map (Figure 4-1) used in the study was chosen firstly because it was the best map available and covers most of the area recognised by landholders as the Wheatbelt region. Secondly, as there are some landholders within the Wheatbelt NRM boundaries who have not heard of the Wheatbelt NRM group, (this was confirmed by survey respondents’ comments), it would not have been useful to use their delineated region.

The sample method had a parallel relationship as the qualitative sample was drawn from the same population of interest as the quantitative component and used multi-stage purposeful random sampling for the quantitative phase of the study and purposive sampling for the qualitative phase (Onwuegbuzie and Collins 2007). Consistent with Onwuegbuzie and Collins (2007, 288) recommendations to ensure analysis results had moderate effect sizes for the quantitative correlational study, the aim was to obtain at least 82 participants for a two-tailed hypotheses and 12 for the qualitative interviews. These sample sizes ‘represent sizes for detecting moderate

effect sizes with .80 statistical power at the 5% level of significance'. By adhering to recommended sample sizes it was believed that effect size bias would be reduced. Data were collected from 85 landholders, ranging from Badgingarra in the north of WA to Wagin in the south and Southern Cross in the east.

**4.4.1.1.1 Sample Representation**

Post codes were requested to ensure they were within the Wheatbelt delineated region for this study. The distribution of postcodes from the surveys suggest that the sample of WA Wheatbelt landholders is reasonably representative of the region (Figure 4-6).

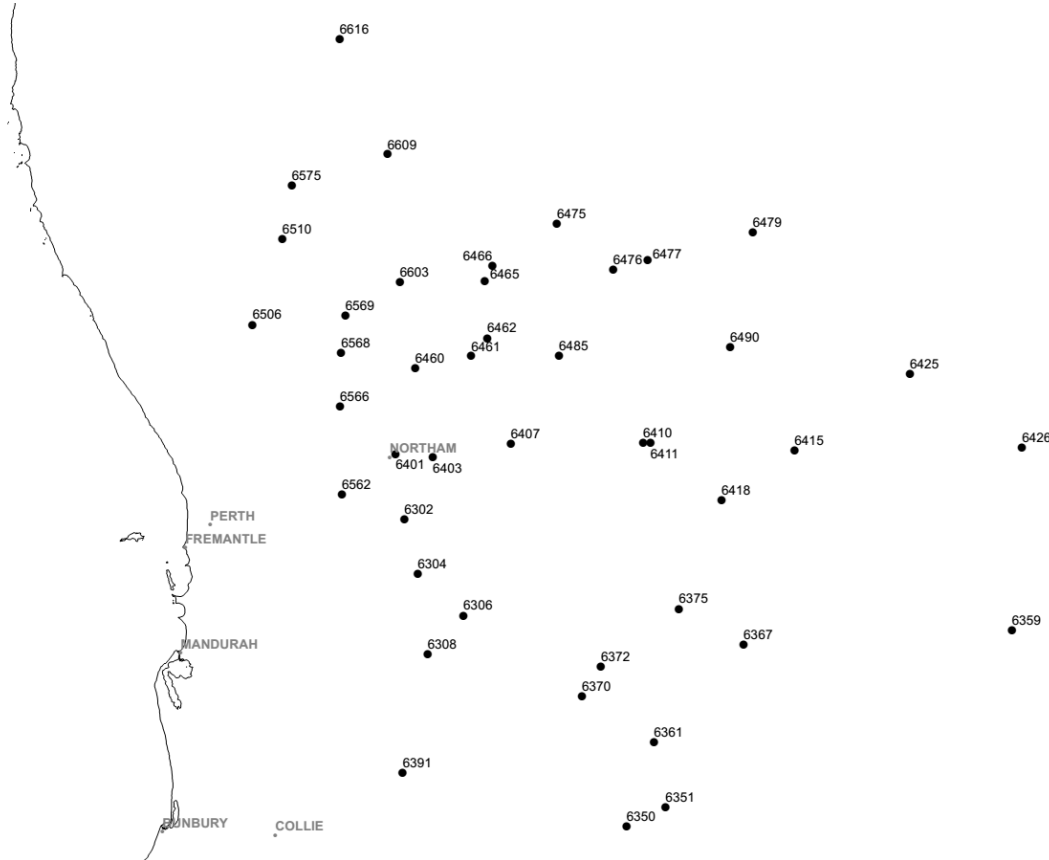


Figure 4-6: Spread of respondents' postcodes.

However, the intent of my research was to survey a broad range of farmers, not a representative sample as it was considered too difficult to get enough participants to undertake the survey online using indirect contact methods. According to the WA government, in 2008-09 there were around 4,200 agricultural enterprises in this region (Government of Western Australia 2011). Obtaining a representative sample would therefore have been difficult in the current climate of survey fatigue. This is due to respondents' doing complex surveys online with little feedback (Bennett and Sid Nair

2010) and ubiquitous use of online surveys, flawed surveys (Fleming and Bowden 2009), resulting in reduced response rates (Watson and Watson 2015). It would also have prevented an incentive of \$20 being used due to the high cost.

Participant access through local NRM and Grower Group networks assisted response rates (Bennett and Sid Nair 2010), eliminated the need for email access and provided anonymity to participants, but also likely attracted respondents with more positive NRM attitudes. Computer literacy was also necessary to complete the online survey, creating barriers for some landholders. However in 2007-08, 73% of Western Australian farmers were using the Internet (ABS 2009) and this use has likely increased today. These biases were minimised with the use of the Internet and white pages to obtain further contacts and most of these respondents (28%) completed telephone and mailed surveys to improve representation. A request was also made to use the Department of Agriculture stall at the Dowerin field days but this was declined. Thirty four respondents started, partially completed the survey or were not valid, 37 completed the online survey, plus 132 telephone contacts, resulted in a total of 203 contacts and 85 completes (Table 4-3) making a response rate of around 40%.

Table 4-3: Methods and sample for Wheatbelt NRM survey.

<b>Methods and sample for Wheatbelt NRM survey</b>	
E-newsletter and NRMO distribution	37 online respondents
Dowerin Field days contacts	56 contacted for 13 online surveys 18 telephone surveys, and 2 hard copy surveys
Internet and white pages	76 contacted for 6 phone surveys, 8 online surveys and 1 hardcopy
One respondent from outside the Wheatbelt boundary and one duplication was not included	

#### **4.4.1.2 Quantitative instrument design**

This study arises from the ABARES studies by Ecker et al. (2012) and Kacans et al. (2014) which are outlined in the previous chapter (2.2). Table 4-4 outlines the current study's theories, models, concepts and topics used in the quantitative instrument and shows how they link to the current study's objectives. See Appendix B.4 for quantitative instrument. Several survey questions in the current study were constructed in response to the Ecker at al. (2012, 3, 29) comments and recommendations and these are shown in Table 4-5.

The survey instrument used the NRM practices and providers of support in Ecker et al (2012) and with the assistance of Wheatbelt NRM staff, these were adapted to suit the WA Wheatbelt situation (Appendix A). The Stages of Change model (Prochaska, Norcross, and DiClemente 2013) was adapted to suit landholder adoption, the TPB concepts drawn from literature (Ajzen 1985) (section 3.2.1) and the Ecker et al. (2012) comments and recommendations, were all used to construct the instrument. The questions measuring institutional trust and many of the demographics were drawn from Marshall (2008) and Donnelly et al. (2009).

The survey was constructed on two themes. The first theme was based on the first three objectives for the study. The adapted Stage of Adoption model was used to define the stage of respondents' NRM practice, the stage when support is most beneficial as well as the stages when the methods used are most beneficial. The accessibility and relevance of these methods of support were also examined. The second theme based on the fourth study objective used the TPB concepts and explored respondents' awareness, use and perceptions toward the providers of support. The fifth qualitative objective was the basis for both themes. In this way, information was gathered to better understand WA Wheatbelt landholders' attitude and behaviour toward selected NRM practices as well as the people and organisations supporting NRM adoption and the methods they use. Open-ended questions were also included to add to the qualitative narrative.

Ecker et al. (2012) showed very little difference nationwide between the adoption of the two practices, no-till (58.0%) and stubble retention (55.7%), and as such no-till and stubble burning were combined to reduce respondent fatigue. GRDC is an industry body but was discussed as an R&D organisation due to their high profile in this field. Many industry organisations ie GRDC, MLA have multiple roles including R&D, funding and lobbying the government and highlight the difficulty of defining 'extension' (Ampt et al. 2015; Murphy, Nettle, and Paine 2013). Investigation of the use of the providers of support for each category of NRM practices or group membership was not included as Ecker et al. (2012) had measured these and results were included in discussions. Television and radio were not included due to their limited use by regional NRM groups and studies have found them to be generally of

low importance as methods for providing information to WA Wheatbelt landholders (Musawi 2013).

#### **4.4.1.2.1            *Quantitative data analysis***

Telephone data and mailed survey data were entered directly into an online survey and hard-copy surveys destroyed. The quantitative survey data were assessed to determine any missing data, coding errors or other anomalies, which were traced back to the original dataset and corrected. This also involved removing partially completed and duplicated surveys and recontacting respondents where possible with missing data. The results were analysed in two steps. A report was generated using Qualtrics with tables showing the total number of responses and summary statistics for all variables. The raw data were then downloaded and pivot tables and graphs using Excel were constructed which were used to illustrate the Qualtrics report. This was distributed to respondents through the Wheatbelt NRM and other NRM e-newsletters to seek any feedback necessary regarding the fidelity of the content.

Further analysis was undertaken using single variable frequency analysis, cross-tabulation analysis and Chi-square statistic to test whether the variables were statistically significant using Qualtrics software. A significance level of .05 was used with a 95% confidence in the likelihood of findings not being due to chance. Pearson's correlation coefficients were also computed in Excel to measure the strength and direction of linear associations between the two variables (Creswell, 2012).

The aim was not to establish causation but to highlight the important relationships between the variables. These tests used non-weighted samples and are therefore not representative of the total WA Wheatbelt landholder population, although comparison with other studies suggest further research may confirm some results. Factor analysis was also attempted for some questions but factor loadings were not high enough so the data were not suitable for further analysis. The set of questions on the accessibility and relevance of the methods of support suffered from 'straight-line' as large numbers of consecutive items shared the same scale and several respondents ticked the same response for all methods i.e. all somewhat easy or somewhat relevant (Downes-Le Guin et al. 2012). However the results do show overall trends in accessibility and relevance of support for the selected practices.

#### 4.4.2 Qualitative instrument

A semi-structured qualitative interview guide was constructed using issues arising from existing literature and analysis of the quantitative research (Appendix B.5). This phase was undertaken largely to explore the attitudes and behaviour toward the providers of support and was an opportunity for respondents to expand on their responses in the quantitative survey. Only one question was asked about the methods they use and this related to Internet use. This question arose from the low responses for social media. After attending the Australasia-Pacific Extension Network (APEN) conference where the focus of many presentations was on extension's use of the Internet it also appeared important to explore this phenomenon with interviewees. The semi-structured interview guide was flexible enough to allow important issues raised during the interview process to be added to the interview guide.

Respondents were firstly reminded of the NRM practices included in the survey to ensure they were discussing the same topic and were 'on the same page' as the interviewer. They were asked to reflect on changes that have occurred in recent decades to the support that has been provided to them for land management. This opening question was used to stimulate thinking, and to encourage respondents to reflect on what provision of support means for them today. They were then asked to describe their attitudes toward the individuals and organisations assisting WA Wheatbelt landholders and how they had used the information, advice or assistance they had received in the past five years to assist them with decision-making for land management. This question was applied to each of the nine different providers of support used for the study. They were also asked to provide any examples that might be useful to describe this support as a way of providing personal narratives of the support they had received.

Themes that arose from the literature and survey comments were also included in these questions. These included: landholders sharing information (Sutherland et al. 2013, Pannell et al. 2011; Burton 2004), the costs of accessing private consultants (Stone 2005; Hunt et al. 2012) the problem of them controlling information (Love 2013; Stone 2005; Marsh and Pannell 1998, 2000), and the need for accreditation systems (Keogh and Clementine 2014), group membership, and the support provided by these groups (Fleming and Vanclay 2009; Toric 2005), the availability and bias in retail business



advice (Stone 2005; Love 2013; Hunt et al. 2012; Sutherland et al. 2013), the environmental bias in NRM support (Barr 2010; Pannell et al. 2011) and how they felt about the increasing use of Internet-based approaches to extension.

Urbanisation of conservation groups (Allison and Hobbs 2006) was also emphasised by interviewees and was subsequently added to the interview guide. The influence of other landholders on their land management practices was highlighted in many studies (Wright et al. 2015; McKenzie 2011; Pannell et al. 2011) and also included, to explore in greater depth the findings from the survey question relating to NRM identity and social norms. Interviewees were lastly asked their thoughts on the role of government in landholders' land management. The interview guide was pilot tested with one landholder that was not recorded and some minor alterations were made to the instrument.

#### **4.4.2.1 *Sample and data collection***

A list of names and email addresses was collated from survey participants who gave permission to be contacted for interviews. Next a list of 25 respondents who had made relevant comments relating to the issues raised in the literature, the study's objectives and themes arising from the survey analysis were chosen to further explore their attitudes and behaviour on the chosen topics. As the interviews from these respondents were collected it was then possible to analyse their demographic factors. Respondents with particular personal and farm characteristics that were missing were then targeted to ensure the interview sample was representative of the survey respondents, making 13 interviews in total (Table 4-6).

Participants were contacted by telephone or email and the permission slip and information sheet were emailed to them. At a time of their convenience the prearranged interviews were undertaken using Skype at Curtin University and ranged between 40 minutes to over an hour. The use of Skype was both cost and time efficient compared to travel. On the other hand, the lack of benefits from face-to-face interviews such as observation of surroundings and non-verbal communication (Neuman 2000) was a disadvantage.

Table 4-4: Models theories, concepts and topics included in the quantitative instrument

Quantitative instrument
<ul style="list-style-type: none"> <li>• Gender  Screeners adapted from (Donnelly et al. 2009, 78) to ensure participants were either a main or joint decision-maker for a WA Wheatbelt farm, directly related to the main decision-maker or extensively working for one</li> </ul>
<p><b>Stage of Adoption Model</b></p> <ul style="list-style-type: none"> <li>• Adapted Stage of Change model used to assess adoption in relation to 13 different NRM practices (see Appendix Table 7-1). Model used to assess when support is most beneficial in two questions. Firstly using a 5 point scale from 'no benefit' to 'very beneficial' (or 'unsure'), rate when support is most beneficial using the four main stages, 'thinking about', 'trailing or planning', 'interested but currently unable' and 'currently doing' (3.2.1).</li> </ul>
<p><b>Methods of support</b></p> <ul style="list-style-type: none"> <li>• Secondly rate 17 methods of support (5-17) with a multi-choice question using the four main stages of adoption, plus another, 'would not find useful' (Objective 2).  NRM practices combined into five categories (conservation agriculture, agroforestry, native vegetation management, sustainable grazing and managing Weeds of National Significance), to rate accessibility and relevance of 17 methods of support. Firstly rate accessibility using a five point scale from 'difficult' to 'easy' (or 'unsure/don't practice') and for their relevance ranging from 'not relevant', to 'relevant' (or 'unsure/don't practice') (3.2.2.5.2; Objective 3).</li> </ul>
<p><b>Behaviour</b></p> <ul style="list-style-type: none"> <li>• <i>NRM</i> - Behaviour toward NRM practices assessed using stages of change, as above (Objective 1).  <i>Providers of support</i> - Firstly rate awareness of nine providers of support using a four point scale; 'not sure of the support', 'somewhat aware of support', 'mostly aware' and 'fully aware of support provided'. (3.2.2.5.1)</li> <li>• Secondly respondents aware of providers of support; tick providers they had received support for land management from in the last five years (Objective 4). Contd....</li> </ul>

### **Attitudes**

- *NRM practices* - Using a five point scale from 'no help', to 'help greatly' or 'unsure' rate how strongly implementing each practice on their farm would assist them to achieve their main goals. (3.2.2.1; Objective 1)  
*Providers of support* - How well support providers understand the risks involved for respondents in undertaking land management practices (3.2.2.3) on a five point scale ranging from 'definitely don't understand', to 'definitely understand' or 'unsure'.
  - Respondents who had used the providers of support; rate motivation to use them on a five point scale from 'not at all' to 'strongly' (3.2.2.2)  
*Open-ended questions* - Respondents only slightly motivated to use providers of support asked to explain why.
    - - Respondents asked the benefits of the support they had received, apart from financial benefits.
    - Respondents asked how support provision could have been improved.  
*Regional NRM groups* - the influence these groups had on respondents' NRM practices using a five point scale from 'not at all', to 'all' or 'unsure'.
  - Rate overall preference of support they had received on a five point scale from 'preferred support used' to 'would have always preferred other support'.  
Those who preferred other support; asked to explain why in open-ended question (Objective 4).

### **Funding**

- Which NRM practices they had received government funding for in the past.
- The likelihood of undertaking the practice without the funding, assessed on a 4 point scale from 'unlikely' to 'likely' (Objective 4)

### **Explanatory variables**

- Social norms in relation to NRM (3.2.2.4.1; 3.2.2.4.2)* -Rate on five point scale from 'not important' to 'very important' the importance of NRM to other farmers in local community.  
Rate the similarity of their attitudes toward NRM with that of other landholders in their local community on a six point scale from 'exactly the same as other local farmers' to 'very different from other local farmers',
- *Social norms in relation to institutional trust (3.2.1.7)* - Rate on a five point scale from 'strongly disagree' to 'strongly agree', using five negative and positive statements from Marshall (2008) about community care and autonomy of regional NRM groups, their attitude toward the regional delivery approach and their attitude toward the commonwealth government commitment to community empowerment.

### **Personal and farm characteristics**

- Ten personal and farm characteristic (3.2.2.6); age, type of farm, farm size, farming experience, generations of family farm, education, household structure, number of key decision-makers, percentage of income from farm and performance compared to neighbours (Baumgart-Getz, Prokopy, and Floress 2012; Pannell et al 2011; Donnelly et al. 2009; Marshall 2008; Toric 2005; Jenkins 1998).
-

Table 4-5: Recommendations and comments by Ecker et al. (2012, 3, 29) and how they were addressed in the current study

Study questions that address the recommendations and comments by Ecker et al. (2012, 3, 29).		
Recommendations and comments	Questions	How they were addressed
Page 3. 'better understand the influence of support in motivating sustainable farm practices'.	(Q8 - Q14)	Respondents were asked to rate the extent of awareness and use of selected providers of support, the benefits they received from the support they used and how this support could be improved. They were also asked to rate their motivation to use the support providers and how well they believed these support providers understand the risks for them in adopting NRM practices.
Page 3. 'determine what types of support are available and how accessible and suitable current support is for different management practices'	(Q17 - Q26)	Respondents were asked to rate the accessibility and relevance of 17 methods of support for five categories of NRM practices (conservation agriculture, agroforestry, native vegetation management, sustainable grazing and managing Weeds of National Significance).
Page 29. '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'.	(Q27 - Q28)	Respondents were asked their overall preference for the support they had received. Those that would have preferred other support were asked to explain the type of support they would have preferred and why this was not available.
Page 29. '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'.	(Q3 - Q4 & Q12)	Respondents were asked their level of motivation for using the providers of support. They were also asked the NRM practices they had received government grants for as well as the likelihood of them undertaking the practice without the funding. Analysis was then undertaken to find any associations.

Table 4-6: Interviewee profiles from qualitative data collection phase

Interviewee Profiles from Qualitative Data Collection Phase.										
Age	Decision-makers	Education	Experience	Farm Performance	Farm Size	Farm Type	Gender	Generations	Household	Income
66-75	3	Uni	30yrs	Better	3000ha+	Crop-sheep	M	2	Empty nest	75-100%
56-66	2	Complete sec	30yrs	Better	3000ha+	Cropping	M	3	Empty nest	75-100%
41-55	2	Uni	4-8yrs	DK	1-499ha	Agroforestry	F	1	Couple	Up to 25%
26-40	4	Trade-tech	21-30yrs	Better	1-2000ha	crop-sheep-hay	M	3	Family<16yrs	75-100%
26-40	2	Trade-tech	30yrs	Average	500-1000ha	Crop-sheep	M	3	Family <16yrs	75-100%
26-40	4	Trade-tech	21-30yrs	Average	3000ha+	Crop-sheep	F	4	Family <16yrs	75-100%
41-55	3	Some sec	30yrs	Average	1-2000ha	Crop-sheep-forest	M	3	Family >16yrs	75-100%
56-66	2	Trade-tech	30yrs	Better	1-2000ha	Crop-sheep	M	2	Couple	75-100%
41-55	3	Complete sec	30yrs	Below Ave	1-2000ha	Cropping	M	3	Empty nest	75-100%
41-55	1	Uni	21-30yrs	Better	3000ha+	Crop-sheep	M	3	Family <16yrs	75-100%
41-55	2	Complete sec	4-8yrs	Average	1-2000ha	Cropping	M	1	Family <16yrs	25-50%
41-55	2	Refused	30yrs	Better	3000ha+	Cropping	M	4	Family >16yrs	75-100%
56-66	3	Some sec	30yrs	Average	2-3000ha	Crop-sheep	F	2	Empty nest	50-75%

#### **4.4.2.2                      *Qualitative Data Analysis***

Thematic analysis of qualitative data were undertaken after the interviews were completed. Using NVivo software I combined and manually coded data from both the survey and interviews in two ways. Firstly the data were coded into responses about the different providers of support and secondly into themes and sub-themes arising from the data. The themes were then cross referenced with issues raised in the literature. This highlighted the relationships of the data to current literature and validated the choice of themes with reference to the literature. The data were used to explain and enhance the quantitative findings, to explain landholders responses to the issues raised in the literature and to fulfil the study's objectives. This process combined the interpretations of both the qualitative and quantitative findings into one. As such the process involved moving back and forth between inductive and deductive logic (Onwuegbuzie, Johnson, and Collins 2009).

#### **4.4.3                      Data presentation**

Leech (2012, 876) suggests an interesting way to present a dominant status design is 'by mixing and integrating the two components, yet giving the dominant component more emphasis.' Therefore in the current study the "Results" section was combined with a preliminary "Discussion" section (Neuman 2000, 472) instead of the traditional display for quantitative dominant status designs. This was done in order to fulfil a key purpose of the thesis which was to build on current literature, particularly the ABARES studies. It allowed the results to be directly compared with other studies and to use the results to explain in greater depth the issues discussed in the literature and how they are directly related to, and impact on, many landholders in the WA Wheatbelt region. It also highlighted the data that contributed to new knowledge and understanding of the study's topics. It therefore provided a more unified presentation of how the study's data builds on existing literature and knowledge for the reader.

As the study had two distinct themes, theme one was presented first followed by discussion in relation to other studies and the qualitative data. Excel graphs and tables were presented to convey statistical results and de-identified narrative was used to convey qualitative comments. Theme two was then presented followed by the discussion and qualitative data. The next chapter is comprised of a 'General Discussion' to bring the main features and elements together to generate a cohesive

whole. As most of the comparison between findings and the literature has been completed in the Results chapter the General Discussion consists mostly of an overarching summary and discussion of the findings.

#### 4.4.4 Ethical Compliance

Ethical considerations were undertaken based on the Australian Code for the Responsible Conduct of Research and the Association of Internet Researchers Ethics Guide (Markham and Buchanan 2012), with Curtin University Ethics Committee approval. This included an information sheet outlining the purpose of the research, confidentiality and participation rights, data handling and storage procedures, the risks and benefits of participation in the study and the contact details. Terms and conditions of accepting the \$20 Bunnings gift voucher were also included (Appendix B.3). These were embedded in the survey. Information and consent slips were given to participants before interviewing and transcripts provided afterward for verification. All emails provided for the \$20 voucher were deleted after the vouchers were emailed to respondents apart from those who had provided permission to contact for interviews.

The use of the Internet for social research is a new and evolving phenomenon with considerable debate about the ethics but it is generally agreed the same offline research ethics can be applied to online research ethics (Eynon, Fry, and Schroeder 2008). For security purposes the survey data were placed on the Curtin database and the data were transcribed by the researcher. Farming is often a very stressful lifestyle affecting the mental health of landholders (Speldewinde et al. 2011). The ethics approval therefore included specifications for how to deal with an interviewee who became distressed about the topic during the interview with links to appropriate support websites and phone contacts. Survey findings are presented as aggregated data or de-identified narrative. Respondents were informed the data is stored at Curtin University in accordance with the Western Australian University Sector Disposal Authority (WAUSDA) protocols and that any domain names or other personal identifiers were deleted from responses before storing or publishing information. The co-operation and contribution of all participants were acknowledged in my thesis (National Health and Medical Research Council and Australian Research Council 2007).

#### 4.4.5 Validity, representation and legitimisation

Several procedures enhanced the reliability and validity of the research. Control measures of personal and farm characteristics were identified from previous literature to ensure all relevant predictors were considered. As the aim of the analysis was to find out the relationships among the variables and the significance of these relationships, the chi square and cross tabulations were chosen as statistically valid measures for analysis (Creswell 2012). The goal of the research was not prediction but to understand complex phenomena. It was therefore not necessary for the results to be representative of the total WA Wheatbelt landholder population. The qualitative sample was sufficient to provide ‘a thick, rich description’ and as such increased validity (Onwuegbuzie and Collins 2007).

The draft survey instrument was evaluated by two supervisors for appropriateness, effectiveness and variable validity (Onwuegbuzie and Collins 2007). Several modifications were made to the survey after feedback. The survey instrument was then tested for face, content and predictive validity, and to ensure the language was appropriately captured (Neuman 2000) by conducting a pilot test using two landholders working for Wheatbelt NRM. Further modifications were subsequently made after their feedback. Triangulation of online, telephone and mailed data responses were checked for response bias and consistency.

Duplicate and non-representative responses for the survey were minimised with the use of screening questions, email addresses, postcodes and a unique id assigned to each email address. These methods were not infallible, as respondents may have had several email addresses and the supply of a post code relied on respondent’s honesty. The selection of qualitative participants from the quantitative sample improved the study rigour. These respondents were a sub-sample of the survey population so the identical relationship between the samples enhanced validity and allowed legitimate inferences to be made (Onwuegbuzie and Collins 2007).

The qualitative instrument was pilot tested with one interviewee for validity and interview transcripts were emailed to all interviewees and they were asked to verify the accuracy. Researcher bias in both the telephone surveys and interviews was moderated due to the extensive interview experience and training of the researcher.

The qualitative data were compared with the quantitative data, similar to triangulation, to confirm or contradict results. The researcher has had farming experience, considerable experience in sustainable development study and both quantitative and qualitative methods. As such, an understanding of the situation and its challenges were brought to the project (Collins and O’Cathain 2009).

## 4.5 Summary

The research paradigm and the rationale for using the mixed methods approach were explained in this chapter and why the approach is appropriate for studying the research questions and objectives. Both quantitative and qualitative instruments, samples, analysis and presentation of the data were explained along with the validity, representation and legitimisation of the study and ethical considerations.



# Chapter 5      Results, interpretations and discussion

## 5.1      Introduction

This chapter presents the results from analysis of both quantitative and qualitative data. The results for explanatory variables including personal and farm characteristics, NRM identity and institutional trust are presented first followed by theme one results showing the stage of respondents' adoption and when methods of support are most beneficial. The accessibility and relevance of the methods of support are also included in theme one, followed by interviewee comments. Theme two results include the awareness and use of the providers of support, motivation to use the providers and attitudes toward support providers understanding of adoption risks for landholders. This section also includes the influence of regional NRM groups and funding on respondents' attitude and behaviour. Interviewee comments as well as the benefits and barriers to the use of support providers conclude this chapter.

A  $\chi^2$  test was undertaken to reject the null hypothesis of the relationships between the variables at the .05 level of significance. These results should have expected values of five or more (Burton 2004), however all results showed expected frequencies were less than five so it is important to note that these results are indicative only and cannot be generalised to the WA Wheatbelt community. Statistically significant relationships as well as trends in data are commented on and the results compared with findings from other relevant studies and discussed. However, a range of factors including: changes in the availability of the providers of support and the methods used over time, composition of the survey sample, the focus of the study and phrasing of questions, environmental and seasonal conditions and year the survey was conducted as well as the mix in the types of production in these studies, all limit comparison. It also needs to be acknowledged that these studies, like the present Wheatbelt study, may be biased either by sample and prestige bias (Creswell 2014). However broad trends have been compared. Interviewee comments are presented in narrative form to allow respondents' perceptions to expand on issues arising from the literature and survey results.

## 5.2 Explanatory Variables

### 5.2.1 Personal and farm characteristics

Nine personal and farm characteristics were used in the current study to determine their influence on the attitudes and behaviour of respondents and to build a profile of the respondents. Analysis of the personal and farm characteristics shows the relationships between these characteristics which are used to build the profiles (Table 5-1). Comparison with other studies also demonstrates how the respondents in the current study conform or differ from these findings and how the profile of landholders has changed in the last decades. This profile contributes to understanding about the respondents by providing a coherent story about who they are. It allows those working in NRM policy and extension to understand the need for flexibility in their approaches.

Although two females provided a response as the main decision-maker, it was found they both shared decision-making with another person at a later question which specifically asked about key-decision-makers. Therefore limited gender analysis was undertaken.

Table 5-1; Relationships between personal and farm characteristics.

Relationships between personal and farm characteristics		
Age	Experience	( $\chi^2$ 25, N= 85 = 61.56, p<.00)
	Generations	( $\chi^2$ 20, N= 85 = 57.19, p<.00)
	Household	( $\chi^2$ 30, N= 85 = 59.47, p<.00)
	Farm income	( $\chi^2$ 15, N= 85 = 26.08, p<.04)
Farm Type	Key Decision-makers	( $\chi^2$ 16, N= 85 = 26.96, p<.04)
Farm Size	Generations	( $\chi^2$ 16, N= 85 = 46.70, p<.00)
	Farm income	( $\chi^2$ 12, N= 85 = 45.13, p<.00)
Experience	Age	( $\chi^2$ 25, N= 85 = 61.56, p<.00)
	Household	( $\chi^2$ 30, N= 85 = 63.96, p<.00)
	Farm income	( $\chi^2$ 15, N= 85 = 31.77, p<.01)
Generations owned farm	Age	( $\chi^2$ 20, N= 85 = 57.19, p<.00)
	Farm size	( $\chi^2$ 16, N= 85 = 46.70, p<.00)
	Household	( $\chi^2$ 24, N= 85 = 36.67, p<.05)
	Farm income	( $\chi^2$ 12, N= 85 = 33.26, p<.00)
Education	Nil	
Household	Age	( $\chi^2$ 30, N= 85 = 59.47, p<.00)
	Experience	( $\chi^2$ 30, N= 85 = 63.96, p<.00)
	Generations	( $\chi^2$ 24, N= 85 = 36.67, p<.05)
	Farm income	( $\chi^2$ 18, N= 85 = 35.19, p<.01)
	Performance	( $\chi^2$ 18, N= 85 = 29.08, p<.05)
Key Decision-makers	Farm type	( $\chi^2$ 16, N= 85 = 26.96, p<.04)
Farm income	Age	( $\chi^2$ 15, N= 85 = 26.08, p<.04)
	Farm size	( $\chi^2$ 12, N= 85 = 45.13, p<.00)
	Experience	( $\chi^2$ 15, N= 85 = 29.61, p<.01)
	Generations	( $\chi^2$ 12, N= 85 = 33.26, p<.00)
	Household	( $\chi^2$ 18, N= 85 = 35.19, p<.01)
	Performance	( $\chi^2$ 9, N= 85 = 28.48, p<.00)
Farm Performance	Household	( $\chi^2$ 18, N= 85 = 29.08, p<.05)
	Farm income	( $\chi^2$ 9, N= 85 = 28.48, p<.00)

### 5.2.1.1 *Age*

Most respondents were males (74%) and only 26% were females. This is similar to landholder studies in other areas of Australia (Price and Leviston 2014). Most (67%) of landholders undertaking the survey were aged between 26 and 55 years with most of these (63% of the 67%) in the 41-55 year age bracket. An interesting feature of the age and gender of respondents was that those in the 26-40 year age group were almost equally male and female while those in the older groups were mostly male (Figure 5-1). This likely reflects a combination of the growing trend for younger women to have a greater voice in agriculture (Howard, Stelling, and Mahoney 2015) and/or a

greater aversion of younger males to complete a survey. It may also be a reflection of the tendency for solo mothers to leave the farm (ABS 2012).

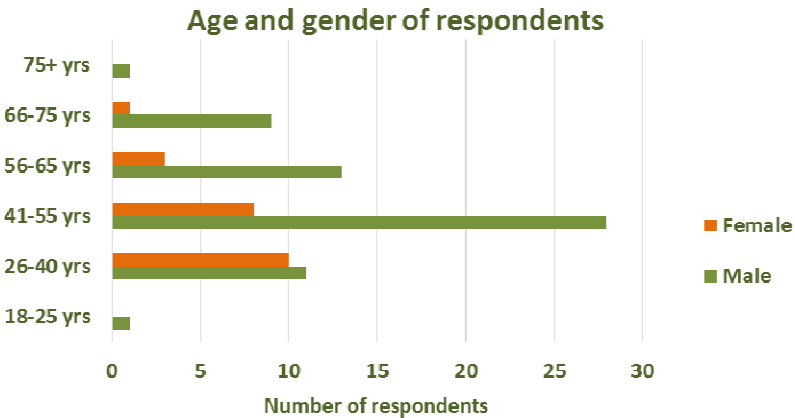


Figure 5-1: Relationship between age and gender of respondents

The industry organisation highly relevant for most WA Wheatbelt landholders is the GRDC which undertakes an annual survey with Australian grain growers investigating factors in relation to grain production. Their survey includes economic, social and environmental issues. Comparison of ages with the GRDC surveys (Table 5-2) shows the age structure of the current survey was slightly different to the GRDC survey age structures suggesting the age structure of the current survey may be representative of all WA Wheatbelt landholders, not just grain growers. However the results enable a relatively accurate comparison of results with the GRDC 2012 to 2015 surveys.

Table 5-2: Comparison of GRDC and Wheatbelt survey age groups.

Wheatbelt survey 2014-15		2012 GRDC survey results for WA		2015 GRDC survey results for WA	
18-40 yrs	26%	18-39 yrs	22%		19%
41-60 yrs	52%	40-59 yrs	60%		60%
60+ yrs	22%	60+ yrs	18%		21%

Source: Watson and Watson 2012; 2013; 2014:2015.

As would be expected, age was significantly related to respondents’ farming experience, generations of farm ownership, household structure and income from the farm and these are explained below.

### **5.2.1.2**                      *Farm Type and farm size*

In the current study, most respondents' farms were over 1000ha with 24% under 1000ha, 41% between 1000-3000ha and around a third (35%) of the farms over 3000ha. The average farm size was around 2000ha which is consistent with the average Australian mixed-farm sizes of around 2000ha (Kirkegaard et al. 2014) but is inconsistent with GRDC research showing the average WA grain growing farm size to be 4000ha and suggests the survey may have a good representation of multifunctional land use. The GRDC survey (Watson and Watson 2015, 15) shows farms, particularly the large farms owned by young landholders, have expanded from 20% to 29% since 2012. Other studies have found that property size often positively influences adoption of NRM practices due to economies of scale and financial capacity (Marshall 2008; Cary, Webb, and Barr 2001). However the dominance of productivist identities within social norms may also mediate this influence (RocheCouste et al. 2015; Burton and Wilson 2006).

Results showed there was a high proportion of respondents who were mixed wheat/sheep farming with almost all respondents undertaking cropping (91%) and many raising sheep for wool (62%) and meat (61%). Other types of production included three farms undertaking agroforestry or environmental forestry, as well as others growing clover, citrus, hay and exporting sheep embryo. The high percentage of mixed farming is consistent with industry reports suggesting around 20% of income comes from livestock and/or wool and the rest is from crops (Watson and Watson 2014). Relationships for farm size included farming generations and income, and farm type was significantly related with the number of key decision-makers. These are explained in their respective characteristics.

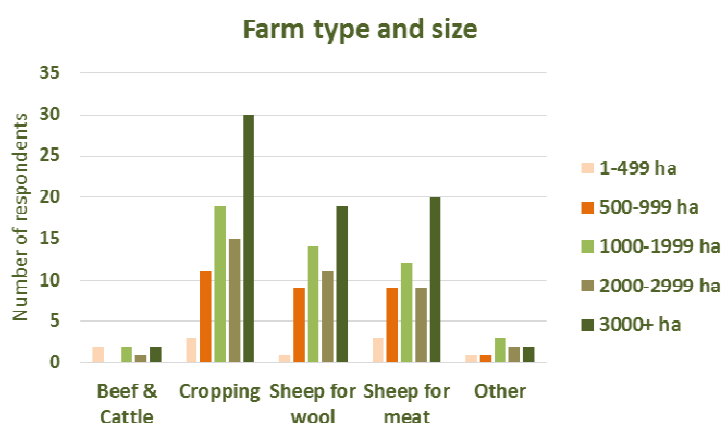


Figure 5-2: Type of farm production and size of farm in hectares

Although not significantly related, Figure 5-2 shows the mix of farm size and the type of production and highlights the amalgamation of farming for crop production. Farm size and age was not significantly related either but analysis shows that respondents aged 41-55 years owned a fairly even spread of the farm sizes, while many younger landholders aged 26-40 years and those over 56 years owned farms under 3000ha. It also showed many of those over 65 years (82%) owned the small farms under 1000ha (Figure 5-3).

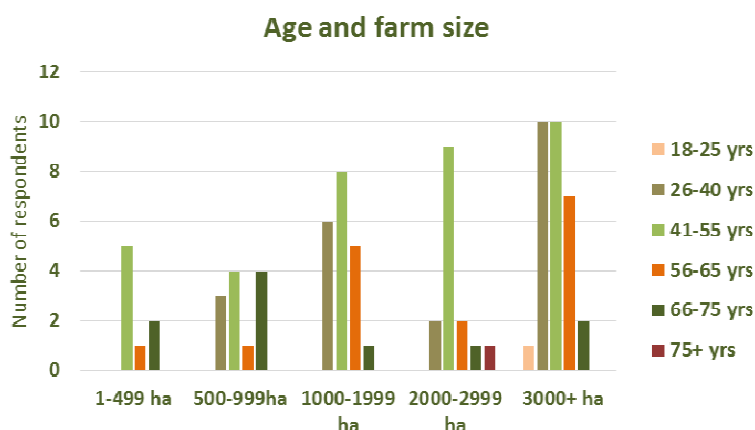


Figure 5-3: Distribution of respondents' ages and farm size

### 5.2.1.3 Farming experience

Most respondents had been farming for more than 20 years with 21% farming for 21-30 years and half of respondents (49%) farming for more than 30 years. Jenkins (1998) also found that most respondents had between 21-45 years farming experience.

Analysis of farming experience showed significant relationships with age, household and the percentage of income derived from the farm. As would be expected farming experience increased with age, and income also showed a distinct increase in the percentage of income earned from the farm with increasing farming experience; highlighting the importance of age and farming experience to income. Household structure showed a similar pattern with younger household structures showing less experience than older families and empty nesters. Although a corresponding relationship was not found with the education variable, analysis also showed education levels decreased with increased farming experience.

Marshall (2008) found that farming experience was negatively related to some NRM practices. However analysis for the current survey did not show significant correlations for this variable. Researchers suggest older landholders may have reduced incentives for adoption when family succession is not an option. They also suggest that age and health may be correlated with adoption of conservation practices. However research has found that overall, studies show mixed relationships between adoption and age, stage of life or farming experience (Curtis and Mendham 2011; Pannell et al. 2011).

#### **5.2.1.4                      *Generations owned farm***

Respondents were asked how many generations of their family had owned their farm including themselves. Most landholders were first (24%), second (28%) or third (29%) generation landholders. Two landholders who had been on their farm for five or more generations lived in the Kellerberrin and Corrigin regions. A comparison with Jenkin's 1996 survey shows the generational shift in farms from second generation to fourth generation in the last two decades (Figure 5-4). Of note is that third generation ownership has moved to fourth generational ownership which may lead to more farms in the future with fifth generational ownership.

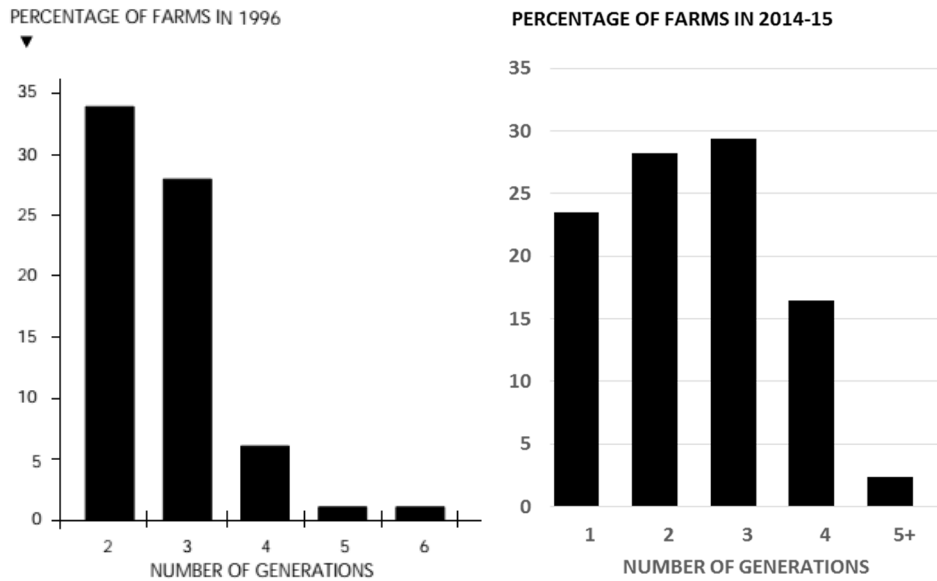


Figure 5-4: Comparison of the number of generations which have operated the surveyed farms expressed as a percentage of the total number of farms surveyed between Jenkins (1998) on left and current study on right.

Baumgart-Getz, Prokopy, and Floress (2012) found that heritage in relation to family succession was an indicator used in many American models to measure adoption of best management practices. In the current study age was shown to be significantly related with generations of family-owned farming. Analysis showed higher than expected numbers of older landholders aged over 55 years with first or second generation-owned farms (63%).

Significant relationships were also shown between farm size and percentage of income derived from the farm, with generational farm ownership (Table 5-1). Relationships with the farm size showed high frequencies of respondents were first or second generation owners of small farms (52%). Results also showed 82% of landholders over 65 years had farms less than 3000ha and 64% of these had first or second generation-owned farms. Results for the percentage of income from the farm showed nearly all second, third and fourth generation farm owners earning more than 75% of their income from the farm whereas first generation owners were equally split between those earning less than 50% of their income from the farm and the others earning more than 75%.

These findings reflect the growth of smallholdings discussed in 2.4.4, with analysis showing many of these belonging to couples and older landholders (Figure 5-3) who



may not rely solely on the farm for their income. This may have implications for extension as studies have shown newer owners often have lower awareness and adoption of NRM practices (Curtis and Mendham 2011) and older aged landholders are less inclined to take part in NRM activities (Foskey and Avery 2003). The findings of analysis with households also indicate many larger farms are being retained by families, suggesting that farm amalgamation is being undertaken to support the next generation of the family. Research shows that farms that are able to be passed onto the next generation are significantly more likely to adopt NRM practices (Curtis and Mendham 2011).

#### **5.2.1.5                      *Education***

There was a variance in education levels with just over one third (36%) having completed secondary and another third (34%) having completed a university degree or diploma. When compared to the survey results of Coates (1986) and Jenkins (1998) as reported in Jenkins (1998, 23) it is clear that the education levels of Wheatbelt landholders has increased with no respondents in the current Wheatbelt survey with only primary school level education and a significantly higher percentage now with university degrees or diplomas (Figure 5-5). Agricultural college was not included in the current study and as such respondents may have included this qualification in trade/technical qualifications. These results reflect recent Australian data showing increasing numbers of landholders with formal educational qualifications over the three decades to 2011 (ABS 2012).

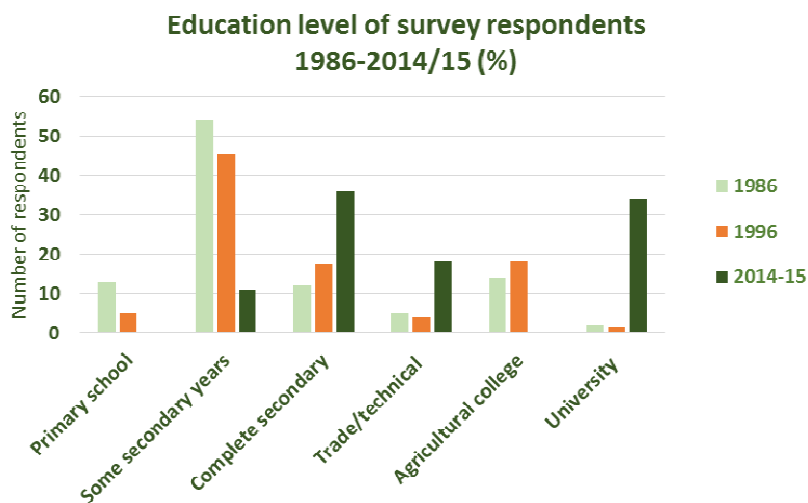


Figure 5-5: Education level of survey respondents in Jenkins (1998) and the current 2014-15 survey.

Previous studies have found mixed results for the influence of education on NRM and tend to relate to what ‘education’ variables are used. For instance Kacans et al. (2014) found higher formal education levels positively influenced adoption of most practices, and Marshall (2008) found formal education positively related to planting perennial vegetation but negatively related to controlling pests and weeds. Conradie et al (2013) used formal schooling to show that education has a positive influence on conservation with a 1% increase in education leading to an almost doubling of the likelihood of participation in conservation. Price and Leviston (2014) found positive relationships with adoption and those who had formal agricultural qualifications.

Other researchers point to landholders’ low emphasis on formal education and the importance of experience-based knowledge for farming, highlighting the problem for NRM extension promoting practices that are largely science based (Sutherland et al. 2013). Pannell et al. (2011) argue levels of formal education have less influence on adoption than relevant training, while Kilpatrick and Johns (2003) suggest formal education is an inadequate measure as a lot of learning is undertaken through informal training, which is difficult to measure. However these authors point to studies showing the catalysing effects of both formal and informal education on decision-making and resilience to change. The current study may therefore have benefited from including training as a variable.

Although not significantly related analysis of age with education provides a profile of these characteristics of respondents (Figure 5-6). They show the increasing trend for younger landholders to obtain higher education levels, the emphasis on farming experience for many in the middle age groups and a relatively even spread of education levels for those in the older age groups.

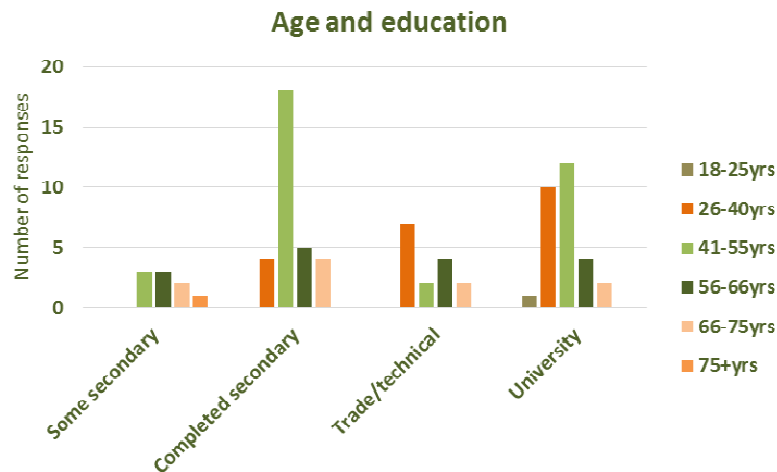


Figure 5-6: Analysis of age and education.

The GRDC surveys show there may be a decline in landholders undertaking training showing 54% in 2010, 62% in 2012, 56% in 2013 and 50% in 2014. This question was not asked in 2015. Of note was the 2014 GRDC survey (Watson and Watson 2014) which found a higher percentage of landholders in WA that undertake training compared to eastern states, while (Bellamy 2007) found the greatest increase in university qualifications was amongst women. The current study confirmed this with 50% of female respondents (55% aged under 40 yrs), and 29% of males with university qualifications (72% aged over 40 yrs).

### 5.2.1.6 *Household structure*

The households consisted of one third of young families with most children under 16 years (38%), and another third empty-nesters (32%) with the children all left home. They also showed that 53% of respondents were families. This result is not consistent with ABS (2012) data showing almost half (48%) the farming families in Australia were comprised of a couple living by themselves. It was more difficult to find studies that included household structure as a variable; however, in the current study five significant relationships were found (Table 5-1).

Age, experience in farming, generations owned farm, income and farm performance were related with household structure. These results were as would be expected ie younger, less experienced respondents in households with young children and more experienced respondents in older family and empty nest households. Most households overall were earning more than 75% of their income from the farm. However households with couples were shown to be younger less experienced and earning less income from the farm than other households. Two-person households of couples and empty-nesters were mostly first and second generation landholders while families were mostly second, third or fourth generational owners (Figure 5-7). Taking other relationships into consideration, these relationships suggest that many of the smaller farms may be owned by both young and old couples rather than families. They also show the succession of farms to young families.

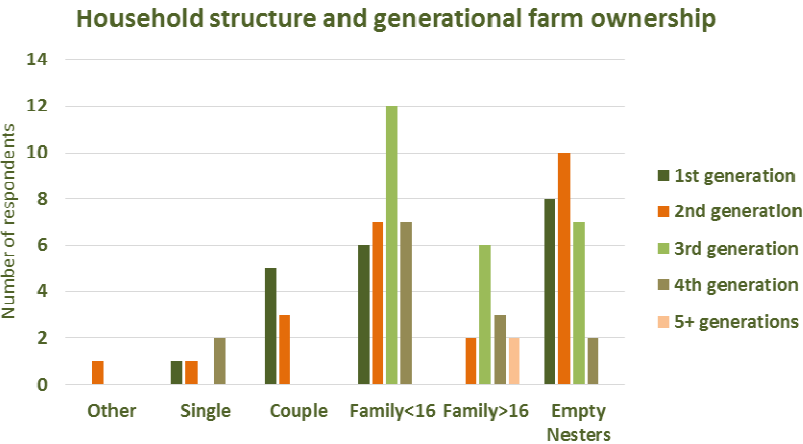


Figure 5-7: Household structure and generational ownership of farms

Literature also highlighted that household structure has important implications for NRM as factors such as the number of children have a significant influence on decision-making (Cary, Webb, and Barr 2001). Vanclay (2004) also emphasises the importance of women in the household to farm survival and how the life cycle of a farm family affects their financial situation, including children’s education needs. Whether the farm will be passed on to children or not also reflects how young families may be more committed to the sustainability of the farm. Some studies have also shown lower opportunity costs of family labour on small farms result in greater adoption of NRM practices (Marshall 2008).

### 5.2.1.7 *Key decision-makers*

Eighty-eight percent of respondents who completed the survey were the main or joint decision-makers. Respondents consisted mostly of two key decision makers (45%) or three key decision makers (29%). Analysis between key decision-makers found farm type was related, showing less than expected households with two key decision-makers for mixed wheat and sheep farming and more than expected with three or four decision-makers (Figure 5-8). The results also highlight that succession is an ongoing process on many of these farms.

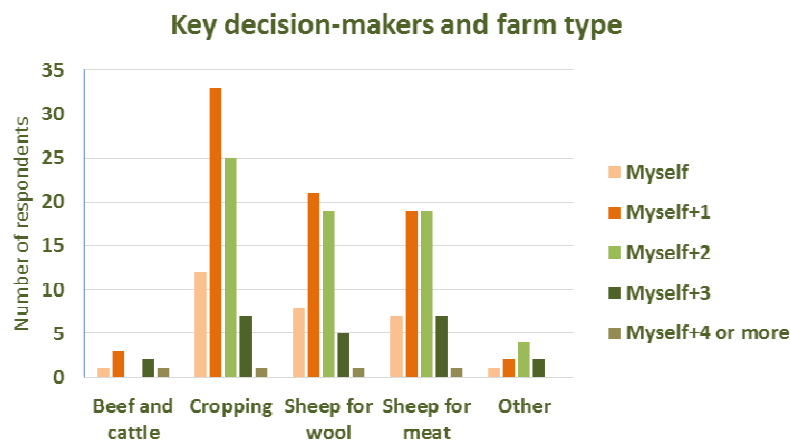


Figure 5-8: Number of key decision-makers and type of farm production.

Fewer studies were found using this characteristic as a measure of influence. However one study of the sources of learning for 85 Australian landholders (Kilpatrick and Johns 2003) found that the number of key decision-makers was related to how respondents sourced their information. Landholders who were single tended to use more local providers of information, those who were working with unrelated decision-makers tended to access networks more, while farms with couples who were decision-makers tended to use a range of providers for extension, highlighting the need for a diversity of extension methods for effective outcomes. Investigating decision-making for climate change issues Donnelly et al. (2009) found that secondary decision makers had a significant influence on final decisions and as the majority of these were women, they highlighted the need to include women in strategies to address climate change.

### 5.2.1.8 *Percentage of income from farm*

Only a small percentage (12%) of respondents receive 25% or less of their income from the farm while 74% receive 75-100%. As expected income from the farm showed significant relationships with farm size and age with farm income increasing with both farm size and age. Most smaller-scale farms receive less than 50% of income from the farm and the large farms receive more than 75% income from the farm (Figure 5-9).

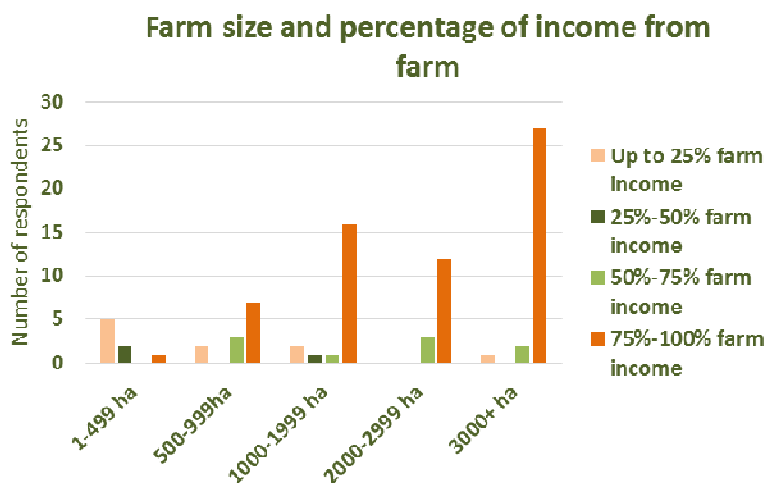


Figure 5-9: Relationship between farm income and farm size

Other WA Wheatbelt research also shows high percentages of respondents deriving most of their income from the farm. Jenkins (1998) found 91% of respondents derived 90% or more from the farm itself and research from the grain industry indicated only 6% of income is derived off-farm (Watson and Watson 2014). Their study also showed that large-scale farms are significantly more likely than smaller-scale farms to make a profit (Watson and Watson 2015). In a study of Victorian landholders Wilkinson, Barr, and Hollier (2011) indicated a significant reduction in beef production as the gross farm income increased and the results of this study also showed only 6% were producing beef. Their study also showed the majority of beef producers earned under \$50,000 annually, had the greatest off-farm income and were the lowest users of services and information provided by support.

Wilkinson, Barr, and Hollier (2011, 10) also found that compared to Australian incomes there were more low income farm households than high income households and only a small number with moderate incomes. One third of their respondents were

from ‘low income and farm-dependent households’ with \$50,000 as the cut-off point where landholders earning less than this would be more inclined to undertake off-farm income activities. These estimates are likely similar for WA Wheatbelt landholders. Almost half of their respondents were interested in increasing the productivity or scale of their farm, although the majority of these did not have the capacity to do so. The authors point out that even small increases in productivity would improve the financial security of these farms. ABS 2009-10 data reveals that farmers tend to work longer hours than other self-employed Australians but their average weekly disposable income is considerably lower. However, the ownership and management of farming presents difficulties for accurately determining personal and farm income, particularly as wealth may also be invested elsewhere for use when seasonal conditions require it. Many landholders may also have much higher worth in their assets than the average Australian with 71% of farmers in the top 20% of wealth distribution (ABS 2012, n.p.).

The current study did not investigate respondents’ income levels. However, Wilkinson, Barr, and Hollier (2011, iii) found ‘the average financial scale of farms decreases with age’. These authors also suggest that ‘older people on small farms are willing to remain in farming despite low incomes, whilst young people choose to enter farming only if the farm has sufficient scale to earn them a high income’; which is likely true for WA Wheatbelt landholders. Wilkinson, Barr, and Hollier (2011) also found that many farm-dependent respondents were more inclined to live on less when farm income was low than to get off-farm income. Other research has found significant positive relationships between those households reliant on the farm for income and adoption of some NRM practices (Curtis and Mendham 2011). However Pannell et al. (2011) suggest reliance on off-farm income may have mixed influence on adoption of practices, with increased financial security encouraging adoption, while those practices with greater management demands on landholder’s time may actually decrease adoption.

#### **5.2.1.9 *Farm performance compared to neighbours***

Most rated their farm as better (32%) or the same (44%) as their neighbours. Only 13% rated their farm as below the local average. However 30% of respondents with smaller-scale farms did not know how well their farm performed compared to their neighbours. Farm performance was significantly related with the percentage of income from the

farm (Figure 5-10). Analysis showed 60% of farms that were average or better than their neighbours get 75-100% of their income from the farm.

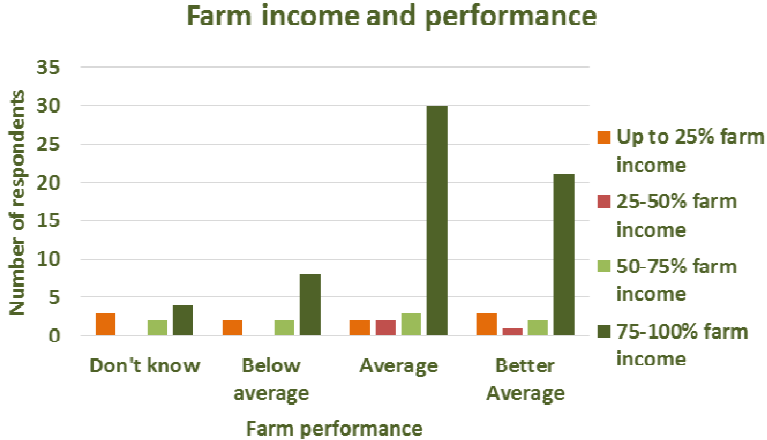


Figure 5-10: Relationship between percentages of income derived from farm and farm performance compared to neighbours.

Cary, Webb, and Barr (2001) found that expectations that the farm would make a profit in the future was a greater influence on investment and adoption decision than current financial status. It was therefore those landholders who felt secure about their future financial position that were more likely to invest in NRM practices. As such, those landholders with below average farm performance might be expected to have reduced adoption of NRM practices. However farm performance showed no significant relationship when analysed with the stages of adoption. Farm performance and household structure were also related but this result may have been influenced by the number of couples and empty nesters who were unsure about their farm’s performance compared to their neighbours. However when considered with household relationships above it suggests that these households may be unsure as they own the smaller-scale farms with different types of production.

Overall, these results provide an overarching profile of the respondents who participated in the current study.

## 5.2.2 Social norm influences

### 5.2.2.1 *NRM identity*

To assess NRM social norms (3.2.2.4) this question aimed to explore the relationship between respondents’ attitudes toward NRM and their neighbours. Respondents were



asked how important they believed NRM was to other farmers in their local community and how much their attitudes coincided. Most respondents believed other landholders thought NRM or certain aspects of it were important. Forty eight per cent of respondents believed other landholders' attitudes toward NRM were very important or important and only 17% of respondents thought NRM was not very important to other landholders. Many (62%) believed they had the same or similar attitudes toward NRM as other local landholders while the other 38% considered they were different. A  $\chi^2$  test showed the similarity between respondents' perceptions of other landholders attitudes toward NRM and their own were marginally significant  $p > .07$ .

Variables were merged to illustrate the strength of the relationship between respondent's belief in other farmers' attitudes toward NRM and their own (Figure 5-11). Results showed nearly half of the respondents believe other landholders think NRM is important with nearly a third of respondents also believing NRM is important. Just over one third believe other local landholders consider some NRM aspects are important and some not with 10% believing differently, and 17% of respondents believe other local landholders think NRM is not very important and 5% agree. The overall tendency was therefore to support social norms on the importance of at least some aspects of NRM.

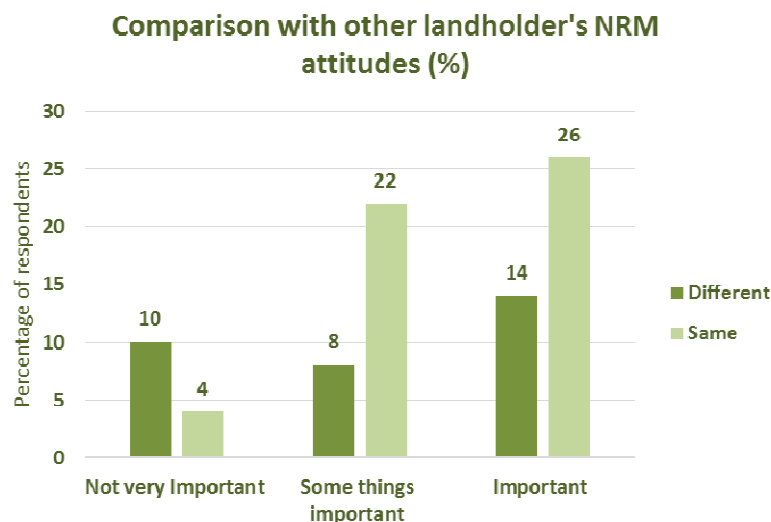


Figure 5-11: Merged responses of attitudes toward other landholders' belief in importance of NRM and similarities of respondents' attitudes.

Unfortunately the construction of these questions prevented further analysis; however they do highlight the difference in respondent perceptions about the social norms

relating to NRM, and their association with those norms. The marginal relationship points to the benefit of further research to explore the influence of social norms toward NRM attitudes and adoption of NRM practices, particularly into why and how respondents disagree with their perceptions about other landholders.

#### **5.2.2.1.1          *Discussion and interview comments***

The ABARES studies confirmed that social norms influenced personal factors motivating adoption of NRM practices with respondents rating recognition by neighbours and their community (particularly for grazing and Weeds of National Significance (WoNS) management) and a desire to fit in with what other landholders were doing in their local community as moderately important motives; this result highlights the influence of other landholders on NRM decision-making (Ecker et al. 2012). The mixed views in the current study about the overall importance of NRM reflects literature outlining production and environmental conflicts (McGuire, Morton, and Cast 2012) as well as literature on the influence of environmental attitudes on adoption (Price and Leviston 2014; Bamberg 2003). They may also echo some confusion about what NRM consists of. For instance, research undertaken by Howard and Larson (2009) investigated attitudes in the Northern Agricultural Region about the understanding of NRM definitions and found between 67% and 80% gave correct answers.

Toric (2005) also argued there is a dichotomy between the conservation elements of NRM such as native vegetation management - which the ABARES studies show have a high environmental motivation - and other NRM practices that provide improved productivity and therefore have a higher financial motivation. These motivations influence respondents' intentions to adopt the selected NRM practices depending on their productivist-conservationist identity. One interviewee in the current study believed landholders are either one or the other and it is difficult to mix the two ideologies.

I tend to think you're a bit one way or the other. I don't know how you knit both together because the really good farmers are ruthless money-makers and the environmental farmers don't really care if they're the not the richest farmer going around, but they like to see the cockatoos, the red tail and black tail cockatoos or they've seen a numbat or an echidna on their farm or wedge tailed eagle and that

makes them happy. But I think they tend to be one or the other somehow (male 41-55 yrs).

Interviewees in the Toric (2005) study also expressed concerns about the limited NRM being undertaken by landholders overall. Many survey respondents and interviewees in the current study also expressed similar attitudes and concerns. Note: the term 'Landcare' is used by participants when referring to either the Landcare movement, NRM or environmental issues. The following two comments highlight an ideological shift. They lament how a positive attitude toward the environment has been replaced in some instances by the drive for profit and further land clearing. They also suggest this change is mainly generational with younger landholders focussing on increasing profit rather than maintaining the natural resources.

...people are not concentrating so much...on Landcare except for the productive side...which isn't so obvious such as putting on lime. They are after what turns a buck and not so much looking after the remnant vegetation or putting in some trees...Now I look over the fence at the bigger and successful farmers and they're pushing out not only fence lines but pushing in banks and taking out individual trees and small clumps of remnant vegetation...(male 56-66 yrs).

Young farmers today don't care about the land because it doesn't make any money. They are just focussed on getting bigger and faster. Many of the old farmers who were in Landcare are gone. It costs time and money for Landcare and nobody cares anymore. They just want to become businessmen and want to see how big they can get and how much money they can make. They are not putting anything back into the land (female 26-40 yrs).

Other interviewee comments were consistent with literature on the dominance of productivism and the conundrum of private versus public support for NRM, or as (Gill 2011, 129) describes it the 'contested attribute' of responsibility in 'the relationship between citizen and State'. Both survey respondents and interviewees highlighted the importance for an NRM practice to have an economic benefit with one interviewee commenting, 'We don't have a bottomless pit. It has to be a bottom line that we're making money out of' (male 41-55 yrs). The following interviewee suggested this was particularly a factor during dry seasons and highlighted the issue of urban versus rural responsibility for NRM by expressing the view that urban people who demand conservation by rural landholders need to share the costs.

Landcare will not be undertaken by farmers unless there is an economic benefit and it tends to be left off the budget altogether in drought years. If those in the city

want those in the country to undertake Landcare, like tree planting and fencing off areas, they will have to help with the cost in some way (male 41-55 yrs).

The Wheatbelt NRM strategy (2013b) also highlighted the importance of understanding the problem of meeting broader community expectations when most NRM funding comes from landholders and their local communities.

Differences in NRM attitudes also result in difficulties between landholders practising conservationist methods and those providing support. For instance, one interviewee in the McKenzie (2011) study with a 'regenerative agriculture' enterprise believed government extension staff had different values and were therefore not supportive and were waiting for him to fail. He wanted extension staff to consider alternative forms of agriculture, such as regenerative agriculture, rather than focussing solely on productivity and promote these approaches using their networks. Similarly a female interviewee (26-40 yrs) in the current study practicing organic methods found one private consultant they engaged wanted them to use genetically modified crops and informed them that if they did not use them he was 'not going to come and see us ever again'. The interviewee argued this was 'not part of our program'.

Another male interviewee (66-75 yrs) highlighted the difficulties faced by many landholders toward their juxtaposed position about property rights and the utilitarian use of the land, and conservationism. Consistent with Jenkins (1998) study he described how the conditions attached to government funding for replanting and fencing native vegetation were onerous suggesting landholders appreciate trees, but putting caveats over them takes away their right to own them and 'to be part of' their area of native trees. He argued that government should be providing landholders with incentives to replant 'critically endangered' species. However, he was upset about the attitude of other landholders as he believed a lot of landholders consider trees need to be protected but only on other landholder's farm. This was because he had recently purchased a small area of land and wanted to clear-fell regrowth on it but other landholders on the council had voted against his application.

Just as it is difficult to understand the importance of species contribution to an ecosystem (Jenkins 1998), interviewee comments suggest it is equally difficult to understand how our own actions contribute to land degradation and ecosystem decline. As (Mallawaarachchi and Green 2013) point out 'Each land user may only emit small

amounts of undesirable by-products; however, at a catchment or regional scale, or over time, they collectively may generate significant levels of material sufficient to cause environmental harm'. His comments reflect the premise behind Hardin's Tragedy of the Commons (Hardin 1968) and highlight the problems for those promoting adoption of native vegetation conservation practices.

Comments about Landcare groups suggest many landholders have moved away from the ideology this program was based on. Several spoke about the decreasing importance landholders now attach to the type of environmental issues Landcare evolved to remediate, illustrating a major decline in motivation that highlights attitudinal challenges faced by NRM extension. Interviewees argued they have completed all the activities required to improve the environment on their land. The following interviewee, consistent with Burton and Wilson (2006), implies that Landcare activities are for un-arable land, which most landholders consider is only a small percentage of their farm. He discusses how the Landcare movement started strongly with many landholders actively involved in government programs, but the movement has declined since then.

Most farmers' attitude is 5% of my farm's unproductive. Landcare became very strong, there was a lot of government money around, they fenced it, they planted trees on it, some lived some died, they've adopted no-till, they've got rid of the sheep, some of them...Some of them say "Well I've done as much Landcare on my farm as I sort of can". I adopt new technologies that come on board, but I've done something with most of my un-arable land. I've fenced off what I can...But it took off with a bang and the heats gone out of it a bit (male 41-44 yrs, 1000-2000ha).

The second interviewee clearly emphasises the contrasting definitions of NRM, discussing notions of Landcare as all about planting trees purely for remedial purposes and also suggests this work has been completed. He argues that apart from current feral animal eradication programs, there is little landholders need to do anymore about environmental issues. These comments also confirm literature suggesting many Landcare groups were developed for productive purposes (Griffin nrm P/L 2000) and points to reasons why membership has declined.

Landcare's just gone off the radar and some of that is because it's finished if you like...I won't plant another tree on my property because that's a Landcare thing, planting trees. We've planted more than enough so that's done, and with this drying

climate it's becoming obvious it isn't as threatening as it was 15 years ago when Landcare and salinity were in bed together, so that was more the productive land issue...personally what else, can you do? Let's worry about the feral cats and foxes, that's a good thing, you have to be passionate about a few things like that, otherwise, there's not much to be done, I feel (male 55-66 yrs).

Other interviewees expressed their opinions about why many landholders are not doing more to manage their natural resources. One male interviewee (41-55 yrs) believed that 'Even though the funding provides for a certain amount of labour input' increased workloads involved in large-scale farming today and the reduction in available labour were 'a pretty significant part of people's psychology with doing other stuff'. McKenzie (2011) comments also suggested shortage of skilled labour was a problem for landholders, particularly with many wives working off-farm and children not returning after completing their education to help on the farm. Another interviewee believed it was the physical presence of Landcare staff involved in organising events within the local community that encouraged landholders to undertake NRM practices. He suggested that without this extension work landholders were having to motivate themselves to learn about NRM and this was why they were not doing as much to manage their natural resources as they were 15 years ago.

...that's the biggest change, there's no physical presence anymore. Whereas 15 years ago there was definitely a physical presence because we had a Landcare officer that was in the community and was always around, organising field days, field walks, trial sites, all this sort of stuff so it was in your face. Now that we don't have the local Landcare coordinators on the ground it's more up to the individual farmers to avail themselves of the information rather than being forced. And I reckon that's where you'll see the drop-off as there's no one pushing them anymore (male 41-55 yrs).

This comment highlights concerns in the literature about the change from traditional push-driven extension approach, to landholder's pull-driven information exchange and the need for greater balance in information exchange (Ampt et al. 2015). Overall interviewee comments highlight the many difficulties faced by NRM extension in promoting adoption of NRM practices.

### **5.2.2.2                    *Institutional trust***

Based on Marshall (2008), this question asked respondents about regional NRM groups, the regional delivery approach and the Commonwealth government (Figure

5-12). It was included to measure respondent trust in the institutions involved in NRM as the literature suggests this has been found to influence landholder attitudes and behaviour (section 3.2.2.4.2).

### **Regional NRM groups**

Overall, respondents were positive that regional NRM group staff care about the community with 76% agreeing or strongly agreeing. However they were mostly undecided (39%) or disagreed (27%) that regional NRM groups were a rubber stamp for the government. A moderate positive correlation of  $r= 0.407$  was found between this question and another rating the influence of regional NRM group staff on the adoption of NRM practices (section 7.4). The correlation suggests that trust that regional NRM group staff care about their community moderately influences adoption of NRM practices.

### **Regional Delivery**

Around half the respondents agreed (49%) or were undecided (31%) that the regional approach is a way for governments to hand over responsibilities for difficult issues. They were also quite mixed in their attitude toward regional delivery being a way to transfer NRM costs onto volunteers with 35% agreeing, 28% disagreeing and 45% undecided.

### **Commonwealth government**

More people were also undecided (45%) than agreed (33%), while 22% disagreed with the statement that the Commonwealth government is committed to community empowerment to solve their own land management problems.

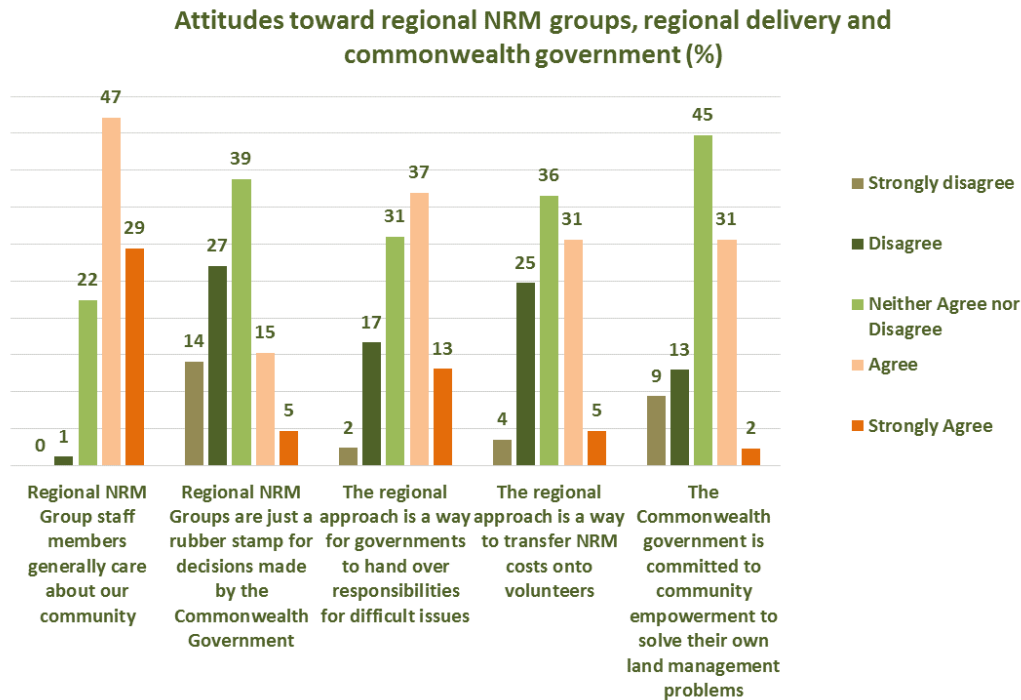


Figure 5-12: Attitudes toward regional NRM groups, regional approach and Commonwealth government.

#### 5.2.2.2.1 Discussion and interview comments

The evidence of trust shown in survey responses indicating regional NRM groups care for their community and regional groups have moderate influence on adoption suggests that many respondents have developed reciprocity strategies of trust with these regional groups despite the bureaucratic and compliance barriers. Marshall (2008) found trust in regional NRM bodies only occurred where there were no sub-regional bodies that had built reciprocal relationships. In the instances where these bodies existed, there was a negative relationship between regional NRM group trust and adoption of NRM practices. His results for regional NRM group autonomy, the regional delivery model and government empowerment to communities were also mixed.

Overall Marshall (2008) found that institutional trust does influence adoption of NRM practices and recommended NRM extension foster attitudes of independence from government assistance. Factor analysis was also attempted for this question but showed factor loadings were not high enough so the data were not suitable for further analysis. This question was therefore not able to effectively measure whether respondent attitudes toward NRM institutions influence their attitudes or behaviour



toward adoption of NRM practices or the providers of support for these practices. However the results do point to possibilities that further research may provide evidence for this hypothesis.

Garforth et al. (2003) propose that if landholders perceive that government policy is not in their interests they will be wary of their services, particularly if they are delivered by government agencies, and studies have indicated experiences with government-led participatory processes affect attitudes. These include a recent study of central WA Wheatbelt landholders investigating how to improve community engagement in social learning in NRM which found a lack of institutional trust reduced information flows; thereby impeding the adoption of NRM practices (Thompson 2013). While a study of Queensland graziers found many felt marginalised by participatory processes for a number of reasons, many of which were underlined by unequal distributions of power (Moffatt 2005).

Gill (2011, 131) informs us that the way landholders define and experience government versus individual responsibility 'contributes to their resistance to some policy initiatives' and that 'localised resistance to policy initiatives [is] grounded in the inherent conservatism of farmers and rural communities' (Gill 2011, 139). Survey and interview comments provide further insight into these attitudes. Overall, there were fewer positive than negative comments about regional NRM groups or the government but as suggested by one female (56-66 yrs) interviewee 'people would be more likely to say what's the negative thing than the positive thing'.

Some survey respondents suggested reduced federal funding has increased their administration costs, decreased on-ground work and forced them to cooperate with federal policy. After attending a National Landcare conference one survey respondent stated he believed WA was not doing as well as other Australian states in dealing with these issues (male 26-40 yrs and male 56-66 yrs). Buchy and Race (2001) also argue that government approval processes retain the top-down approach which raises questions about the ability of regional NRM groups to devolve responsibility to communities. Some interviewees believed these groups remained part of the government with one interviewee suggesting they were developed as a separate 'entity' to the Agriculture Department, and as such remain a 'subsidiary' to the

department (male 41-55 yrs) or were 'sort of the remnant of Landcare and the government (male 56-66 yrs).

Negative survey comments also highlighted how some respondents felt about the regional delivery system with one female (26-40 yrs) echoing other participants, suggesting the Commonwealth government is shifting responsibility back to the local level and providing insufficient funding for local groups to carry out their work. The following respondent suggested that government policy was continuing the waste of public money on planting trees and those working in the NRM industry were not trying to solve the problems but simply ensuring their future employment.

The government feels if you throw enough money at an issue, it will go away. They support people who in my opinion are simply wanting the issues to remain unresolved to ensure their own future employment. The Direct Action Plan will follow this same template - lots of uncoordinated tree plantings instead of something that will really achieve results (male 66-75 yrs).

Other comments suggest that many landholders preferred the earlier Landcare and NHT1 programs. These programs allowed landholders greater control over works and funding; however some programs did not have strong sustainability actions or ethics (Griffin nrm P/L 2000). Reviewers argued these programs provided considerable funding with very little structure or accountability for funding and outcomes (Hajkowicz 2009; McVay et al. 2008). Other interviewees believed the current system is better suggesting 'the system now has less wastage of bureaucracy' (male 56-66 yrs). The following respondent clearly explained why he believed the current regional delivery program is an improvement on the previous Landcare program. Speaking as one who appears to have considerable understanding of the program's governance he suggests that while the Landcare program was successful in many respects, much of the government funding was wasted due to poor program design and this was greatly improved with the advent of the later regional delivery program. He suggests the latter program has been much more successful and is concerned about the current government's return to the previous Landcare model.

The Landcare movement, whilst it achieved an amazing amount of work, ultimately failed because of lack of governance structure and overreliance on volunteers. There are still farms in the Avon Valley who have piles of taxpayer funded fencing materials going rusty in a shed, long after the disbandment of the local Landcare group! The Regional NRM structure with its high levels of

accountability, governance, specialised experience in NRM and project management, and efficiency in managing financial resources, have achieved a far better result - and it's measureable, accountable and transparent. I am deeply concerned that the proposed return to the Landcare model will see a return to the 'bad ol' days (male 41-55 yrs).

Interviewee comments overall confirm landholders have very mixed attitudes toward government NRM programs and the role of NRM extension in their implementation.

## Chapter 6      Theme One: adoption stages and support methods

The first theme examines how the stages of NRM practices influence landholders' adoption. The first question asked respondents to rate the stage of their adoption for 13 NRM practices (Figure 6-1) and their attitude toward the benefits of the NRM practices in meeting their goals (Figure 6-2). Respondents were then asked which of four stages of change support, is most beneficial (Figure 6-3). They were also given a choice of 17 methods of support and asked to rate which of the four stages of change these methods would be most useful (Figure 6-4). The NRM practices were categorised into five agricultural practices similar to the ABARES studies. Respondents were then asked to rate the accessibility and relevance of the 17 methods of support for the five categories of NRM practice. Literature studies have been compared with survey findings, and survey respondent and interviewee comments.

### 6.1.1      Stage of adoption

The following question examined the stage of respondents' adoption of selected NRM practices using the Stages of Adoption model (Figure 3-2). As such it provides an overall picture of respondents' attitudes, behaviour and level of control over their NRM practices (Appendix A). All respondents were asked to rate their stage of adoption for 13 recommended NRM practices with a choice of six stages of change (3.2.1). The results provide evidence of the NRM practices where targeted NRM extension strategies might improve adoption.

The results of the first question of the survey based on the Stages of Adoption model in Figure 6-1 show:

- The practices with most respondents in the Contemplation (thinking about) or Preparation (trailing or planning) stages were, variable rate technology (VRT), planting or maintaining deep-rooted perennial pastures and controlled traffic farming. Less than 15% were contemplating or preparing to undertake further native vegetation planting or fencing. These respondents were developing or had developed a positive attitude toward adoption of these practices and their motivation had moved them to research, plan or trial for adoption.

- The practices with most respondents in the Interested stage (interested but currently unable to undertake) were, VRT, controlled traffic farming, planting or maintaining deep rooted perennial pastures. The stage indicates there are many perceived barriers to the adoption of these NRM practices.
- The practices currently being undertaken by most respondents in the Action stage (currently undertaking) were addressing soil acidity, undertaking no-till, including reduced stubble burning and managing WoNS (WoNS are weeds that have considerable public benefits, while managing crop weeds have mostly private benefits. Comparison with results from other studies suggests respondents included crop weeds in these responses). In this behaviour stage respondents may also have been reviewing and modifying a NRM practice.
- The practice with the highest number of respondents in the Dis-adoption stage (done but found not worthwhile) was for adopting periods of fallow. This occurred because trial or practice results discouraged adoption, farming or economic circumstances changed or no-tillage has reduced the need.
- A relatively even divide between those practices with respondents in some stage of adoption and those in the Pre-contemplation stage (not being considered in the next 5 years), suggesting there could be considerable opportunity for further adoption. Many respondents were not contemplating practicing single or multiple species agroforestry, cell or strip rotational grazing and controlled traffic farming in the near future. These respondents may not be aware of a problem, may believe they don't have the capacity to undertake adoption or do not understand the capacity of the practice to deliver required outcomes. They may also be respondents where the NRM practice is not beneficial for their environmental, economic or social situation.
- Practices with numerous respondents in the pre-adoption stages including; VRT, cell/rotational grazing, controlled traffic farming, setting minimum groundcover targets and planting perennial pastures, appear to have potential for adoption but suffer from considerable barriers (Appendix A). It is also an indication of likely final level of adoption for most of these practices (D. Pannell, personal communication October 2017).

- Consistent with the adoption literature, the results show that apart from native vegetation, overall the level of adoption appears to be influenced by the perceived private economic benefits of the practice.

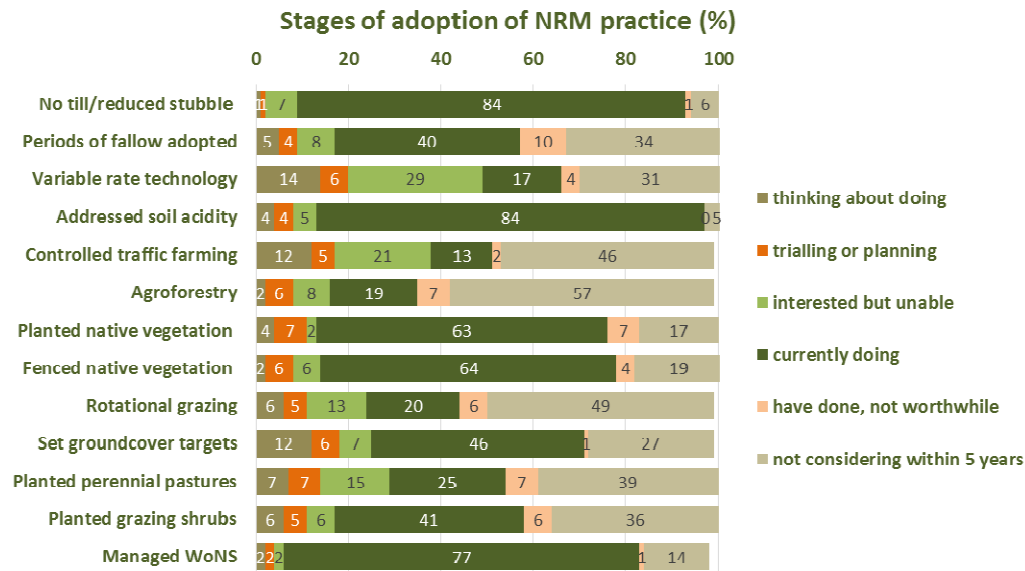


Figure 6-1: Stage of respondents’ adoption of NRM practices.

### 6.1.2 Assistance of NRM practice to meet goals

To better understand respondents’ stage of adoption it was considered important to understand their attitude toward the selected NRM practices themselves. Marshall (2008) found the perception that the NRM practice would contribute to landholders’ goals was positively related to most NRM practices while Ecker et al. (2012) found that aligning with their environmental goals was an important driver for both native vegetation and WoNS management. As such all respondents were asked how strongly implementing each practice on their farm assists their chances of achieving their main goals (3.2.2.1). Results (Figure 6-2) showed;

- Overall, respondents’ attitude toward the practice meeting their goals, reflected their stage of adoption. A significant number of respondents rated addressing soil acidity (91%), no-till and reduced stubble practices (89%) and managing weeds of national significance (71%), as a moderate or great help for achieving their goals.

- Other practices such as planting and fencing native vegetation, setting minimum groundcover targets, planting grazing shrubs and VRT were also believed to moderately or greatly assist respondents to achieve their goals.
- Practices that respondents rated the least likely to achieve their goals were agroforestry (84%), perennial pastures (35%), periods of fallow (25%) and controlled traffic farming (23%).
- Practices respondents were most unsure about the benefits assisting them to meet their goals were; cell or strip rotational grazing (39%), agroforestry (36%), controlled traffic farming (30%) and VRT (29%).

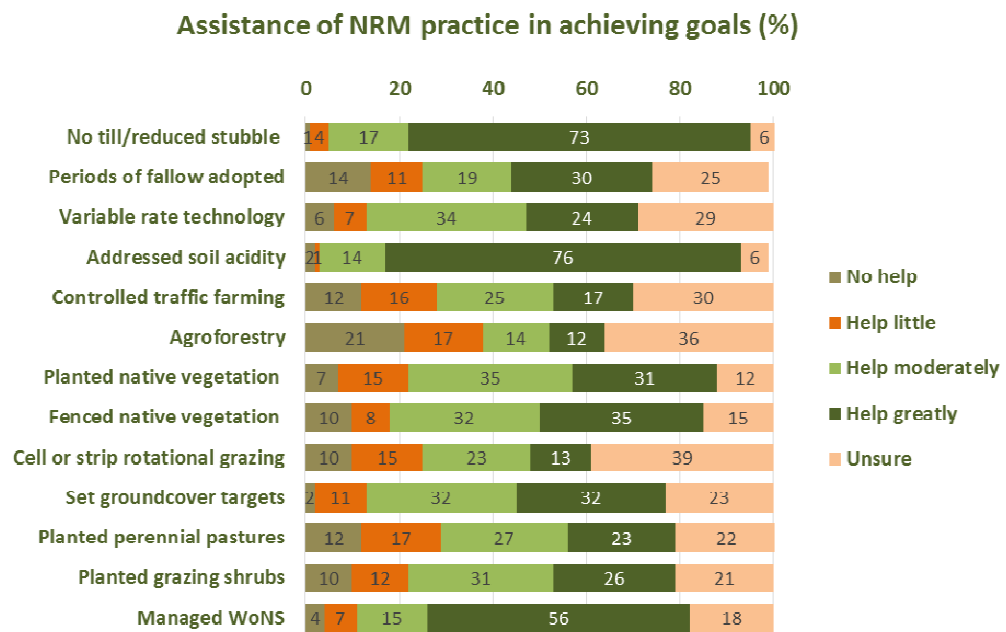


Figure 6-2: The assistance of selected NRM practices in achieving respondents' main goals.

### 6.1.2.1 *Significant Relationships*

#### 6.1.2.1.1 *Stage of adoption and ability of practice to meet goals*

Analysis was undertaken to determine how well the stage of respondent's NRM practice related to their attitude toward the practice achieving their goals (Table 6-1). Results showed a significant relationship between the stage of all practices, except VRT, and adoption of the practice achieving respondent's goals. This result may

reflect the high number of respondents in the pre-adoption stages of VRT (Table 6-1) and the barriers to adoption of this practice (Appendix A).

The results also highlighted that many landholders were unsure about the benefits of practices they were not undertaking meeting their goals; the percentage of those not considering the practice was almost identical to those who were unsure the practice will meet their goals with 29% of total respondents not considering undertaking the practices in the next five years and 26% unsure the practices would meet their goals. This result was confirmed by a Pearson’s correlation revealing that respondent’s stages of practice change and adoption of the practice achieving their goals had a moderate positive association ( $r = 0.619$ ), indicating that practices need to meet landholders’ goals before adoption occurs.

Table 6-1: Relationships between the stage of respondents' practices and adoption of the practice achieving their goals

Significant relationships between the stage of respondent’s practices and adoption of the practice achieving their goals	
Practice	Significant relationship
No-till, including reduced stubble burning	( $\chi^2$ 20, N= 84 = 98.23, $p < .00$ )
Periods of fallow adopted	( $\chi^2$ 20, N= 81 = 81.46, $p < .00$ ).
Addressing soil acidity	( $\chi^2$ 20, N= 85 = 43.85, $p < .00$ ).
Controlled traffic farming	( $\chi^2$ 20, N= 82 = 57.29, $p < .00$ ).
Single or multiple species agroforestry	( $\chi^2$ 20, N= 83 = 36.02, $p < .02$ ).
Planted native vegetation or encouraged regrowth	Planting ( $\chi^2$ 20, N= 83 = 66.28, $p < .00$ ), fencing ( $\chi^2$ 30, N= 84 = 44.30, $p < .00$ ).
Fenced native vegetation to control stock access	Fencing ( $\chi^2$ 20, N= 84 = 52.22, $p < .00$ ), planting ( $\chi^2$ 20, N= 83 = 36.09, $p < .02$ )
Cell or strip rotational grazing	( $\chi^2$ 20, N= 80 = 59.83, $p < .00$ )
Set minimum groundcover targets for long term	( $\chi^2$ 20, N= 83 = 35.16, $p < .02$ )
Planted or maintained deep rooted perennial pastures	( $\chi^2$ 20, N= 83 = 51.88, $p < .00$ ).
Planted grazing shrubs	( $\chi^2$ 20, N= 84 = 56.62, $p < .00$ ).
Managed WoNS	( $\chi^2$ 20, N= 82 = 55.62, $p < .00$ )

Of note was that significant relationships were also shown between planting perennial pastures and planting native vegetation ( $\chi^2$  20, N= 82 = 38.34,  $p < .01$ ), and fencing native vegetation ( $\chi^2$  20, N= 83 = 1.27,  $p < .05$ ), as well as between planting grazing shrubs, agroforestry ( $\chi^2$  20, N= 83 = 31.70,  $p < .05$ ), planting native vegetation ( $\chi^2$  20, N= 83 = 36.42,  $p < .01$ ) and fencing native vegetation ( $\chi^2$  20, N= 84 = 32.52,  $p < .04$ ). These results suggest positive attitudes toward planting and conserving vegetation meeting their goals may encourage respondents planting and conservation of native trees, agroforestry and planting perennial vegetation for grazing or biodiversity.



### 6.1.2.1.2 *Demographics, stage of NRM practice and ability of practice to meet goals*

A  $\chi^2$  test and Pearson's correlation were conducted to determine whether any personal and farm characteristics influenced the stage of respondents' NRM practice and their attitude toward the practice achieving their goals (Table 6-2). Results for the stage of landholders' adoption showed significant relationships with eight personal and farm characteristics, while there were 13 significant relationships between the personal and farm characteristics and the ability of the practice to meet their goals. Overall, the practice of no-till and stubble retention showed seven significant relationships, while the personal characteristic of age showed six significant relationships. The results of those NRM practices showing significant positive relationships both between the stage of adoption and the ability of the practice to meet their goals are shown below.

Table 6-2: Significant relationships between personal and farm characteristics, the stage of landholder adoption and the ability of the practice to achieve their goals.

Significant relationships between personal and farm characteristics, the stage of landholder adoption and the ability of the practice to achieve their goals			
Characteristic	NRM practice	Chi-square and Pearson's correlation	
Age	No-till and reduced stubble burning	Stage of change ( $\chi^2$ 25, N= 85 = 37.47, p<.05)	Practice meets goals ( $\chi^2$ 20, N= 84 = 35.40, p<.02)
Number of key decision-makers	No-till and reduced stubble burning	Stage of change ( $\chi^2$ 20, N= 85 = 36.32, p<.01)	Practice meets goals ( $\chi^2$ 16, N= 82 = 38.79, p<.00)
Farm size	Addressing soil acidity	Stage of change ( $\chi^2$ 20, N= 85 = 42.14, p<.00) (r = 0.402)	Practice meets goals ( $\chi^2$ 16, N= 82 = 33.64, p<.01) (r = 0.208)
		Controlled traffic farming	Stage of change ( $\chi^2$ 20, N= 85=31.58,p<.05) (r = 0.307)

Relationships between age and undertaking no-till and stubble retention showed cropping was mostly undertaken by WA Wheatbelt landholders in the mid 41-65 age range with a higher frequency of older respondents than younger ones believing it will greatly assist them achieve their goals. The significant relationship between the number of key decision-makers and the stage of undertaking no-till and stubble retention showed higher frequencies of respondents with two key decision-makers who were undertaking no-till. Almost half of the farms had two key decision-makers and 87% of these were cropping. Almost all of these respondents believed the practice greatly or moderately assisted them to achieve their main goals.

The results suggest farm size has a positive influence on the practice of addressing soil acidity. Many smaller farms were undertaking practices to reduce soil acidity less than the larger farms. This may be influenced by a range of factors such as location, type of production, economies of scale or past land management practices but may also be due to their access to information about this problem as literature highlights the difficulties for extension of engaging these landholders (section 2.4.4).

Farm size was also related to the stages of adoption of controlled traffic farming. More than expected large farms over 3000ha were found in the pre-adoption or adoption stages for controlled traffic farming and less than expected in all other farm sizes. This may be due to the capital cost requirements (such as need to modify machinery) and farm changes required that may make this practice unviable for smaller farms (Appendix A). Farm size was also significantly related to perceptions the practice would meet their goals. Respondents' with larger farms were shown to have greater belief that the practice will assist their goals than smaller farms. These relationships were also confirmed by positive Pearson's correlations. As such farm size was shown to influence practices of addressing soil acidity and controlled traffic farming.

### **6.1.2.2            *Discussion***

#### **6.1.2.2.1        *Comparison with other studies***

The current study was undertaken in 2014 and the results are shown alongside the WA and national results from the study undertaken in 2010 by Ecker et al. (2012) which included broadacre, dairy and horticulture, and the study by Kacans et al. (2014) which was undertaken in 2012 and shows Australian broadacre responses for all Australian states (Table 6-3). The results show overall similarities with the current study apart from managing WoNS. It is difficult to know why there is a significant difference between managing WoNS in the studies as the Wheatbelt survey contained a link to the official government page showing the WoNS. However de Hayr (2013) also found that 89% of Australian landholders had undertaken weed control practices in the last 12 months with 75% of this for controlling weeds to improve production. As such it appears respondents in the current study may have included controlling crop weeds in their response. Of note was that Kacans et al. (2014) found the drivers for managing WoNS were different from the other practices with respondents rating the influence of

social norms (‘desire to be recognised by neighbours and community’) as the second most important motivation for their WoNS management decisions.

The current Wheatbelt survey results for crop and native vegetation management practices are comparatively similar with the 2012 results (Kacans et al. 2014) with some differences likely due to sampling. However planting or maintaining native vegetation is difficult to measure. It could include respondents who are currently actively planting, or they have native vegetation present from earlier plantings. This however, would not indicate low adoption (D. Pannell, personal communication October 2017). Considerable time and effort goes into conserving native vegetation such as pest and weed control and maintaining fencing to control grazing stock and responses in the current survey are likely reflecting these activities. The large difference in grazing practices are likely due to ‘factors such as soil, climate and stocking rates’ across the states (Ecker et al. 2012, 56) and sampling differences (Kacans et al. 2014). Comparison is therefore difficult due to the difference in industry and state or national results shown.

Table 6-3: Comparison of ABARES 2010 and 2012 studies and Wheatbelt survey results.

Comparison of WA and average national results (Ecker et al 2012, 54), Australian broadacre results (Kacans et al. 2014, 11) and Wheatbelt survey results (%)					
	Practice	Ecker et al (2012) WA	National Average (2012)	Kacans et al. 2014 Broadacre	Wheatbelt survey (2014)
Crop management	No-till or reduced tillage	67	58	83	84 No-till & stubble retention
	Stubble retention	70	57	82	
	Fallow periods used	10	40	58	
Native vegetation management	Planting/management of native vegetation	31	38	41	63
	Fencing native vegetation	56	43	50	64
Grazing management	Cell or rotational grazing	26	50	60	20
	Minimum groundcover targets set	41	45	90	46
	Deep rooted perennials	15	38	53	15
WoNS management	WoNS management	17	49	46	77

Source: Ecker et al. 2012, 54; Kacans et al. 2014, 11.

Kacans et al. (2014, 2) found ‘a slight increase in adoption of most of the nominated sustainable practices between 2010 and 2012’. However other WA studies have found limited practice changes occurring in recent years. In their study of WA’s Northern Agricultural landholders in 2012, Hollamby et al. (2013) also found almost all

respondents had adopted minimum tillage, stubble retention and liming to address soil acidity. They also found there were few changes in these practices since their 2006 survey. The practice of VRT had increased by 22% over this period, however tramlining (controlled traffic farming) had declined. Many Queensland landholders have also been shown to be unconvinced of the value of controlled traffic farming (RocheCouste et al. 2015). GRDC surveys show that stubble retention is increasing but overall, the proportion of landholders making practice changes has steadily declined since 2004 for these particular practices (Watson and Watson 2015).

Jenkins (1998) study asked 145 landholders in the southern regions of the Wheatbelt a similar question to the current study (Table 6-4). Comparison shows some NRM practices have increased while others have stayed the same or decreased. Adoption of minimum tillage and stubble retention practices have increased by only around 12% over the last 20 years showing that this practice must almost be at saturation point as the literature suggests (Llewellyn, D'Emden, and Kuehne 2012). Although gypsum is not a treatment for soil acidity (McCord and Rix 2008), we can tentatively assume that lime application has significantly increased, demonstrating the growth in awareness and concern about this issue and potentially the increased soil acidity that has occurred over this period of time. A comprehensive report by DAFWA (2014) indicates that in 2013, 74% of landholders rated soil acidity as a moderate or major problem on their farm and only around half of the required lime was being applied to treat acidic soils in much of WA. Conversely, liming in the Northern Agricultural area is considerably higher than in other regions (Hollamby et al 2013), highlighting differences in practices across the Wheatbelt region.

Alley farming or agroforestry has also increased somewhat over this period which may be due to an increase in smallholdings undertaking agroforestry. Analysis of the current study showed 63% of farms under 500ha were in pre-adoption or action stages for agroforestry. As the Jenkins (1998) study was about native vegetation it is surmised the replanting and fencing of trees and shrubs applies to native vegetation. If this is so, the results show decreased planting and fencing of native vegetation together with an increase in those not considering it. Interviewee comments in the current study tend to support this result. Jenkins (1998) argued it was not the lack of awareness of ecological and land conservation values of bush on farms that was a barrier to native vegetation

conservation but the importance of species interconnectedness and ecosystems she found was not well understood. However, a general lack of concern about this issue is possibly a greater barrier. The overall difference in results may also be influenced by the wider sample area of the current Wheatbelt survey.

Table 6-4: Comparison of percentage of respondents in stages of NRM practice for Jenkins (1998, 25) and the current survey (in brackets) undertaken in 2014-15.

Comparison of percentage of respondents in stages of NRM practice for Jenkins (1998) and current (2014-15) surveys				
NRM practice	Stage of adoption of NRM practices			
	Completed	Started/ongoing (currently doing)	Planned (thinking/planning)	Not applicable (done or not considering)
Minimum till/no-till/stubble retention	5	72.5 (84)	5.5 (9)	17 (7)
Soil treatments eg. lime/gypsum	1.5	52 (84) ↑	24.5 (12) ↓	22 (5) ↓
Alley farming (Agroforestry)	1	5 (19) ↑	13 (17)	81 (64) ↓
Replanting trees or shrubs	1	81 (63) ↓	14.5 (13)	3.5 (24) ↑
Fencing of bushland/ replanted areas	6	72 (64)	16 (14)	6 (22) ↑

Note: Stages applicable to the current survey are in brackets.

Kacans et al. (2014) also investigated personal and farm characteristics and found six characteristics that influence adoption of similar NRM practices (Table 6-5). Neither addressing soil acidity nor controlled traffic farming were included in their study which the current study found were significantly related with farm size (Table 6-2). Instead their study showed adoption of no-till and stubble retention and planting perennial pastures were influenced by all six characteristics; higher on and off-farm income, return rate, larger farm size, younger age and higher education, however stubble retention was not related to higher rates of return. Planting and fencing native vegetation were positively influenced by both on and off-farm income, younger ages and higher education, while setting minimum groundcover targets was positively influenced by on-farm income, farm size and higher education. Fallowing and cell or rotational grazing were only encouraged by off-farm income while managing WoNS was positively influenced only by farm size.

Table 6-5: Personal and farm characteristics more likely amongst adopters than non-adopters of specified NRM practices.

Characteristics more likely amongst adopters than non-adopters of specified practices in Kacans et al (2014, 31),					
	Higher income/return rate	Higher off-farm income	Larger farm size	Younger	Higher Education
No-till and reduced stubble burning	yes and no	yes	yes	yes	yes
Following		yes			
Cell or rotational grazing		yes			
Minimum groundcover targets	yes		yes		yes
Perennial pasture	yes	yes	yes	yes	yes
Native vegetation	yes	yes		yes	yes
Fencing natives	yes	yes		yes	yes
WoNS management			yes		

Source: Kacans et al. 2014, 31.

The current study only found two significant relationships with similar demographics and practices, probably because of the small sample size. The stages of adoption of no-till and stubble retention were also positively related to age (Table 6-2) and following was also found to be positively related with percentage of income from the farm ( $\chi^2$  15, N= 85 = 46.58,  $p < .00$ ). Of note was that following was also negatively related to age ( $\chi^2$  25, N= 85 = 39.38,  $p < .03$ ) with a very weak correlation ( $r = -0.198$ ) and cross tabulations showing a definite trend toward younger respondents undertaking this practice. It must also be noted that following is not recommended as part of organic farming practices where the aim is to maintain cover as much as possible. Overall these results confirm literature reports on the different results found for the influence of personal and farm characteristics in adoption studies.

#### 6.1.2.2.2 Interview comments

The annual GRDC surveys provide a clearer picture of how grain growers are adapting their practices as a result of farming pressures. Their recent 2014 survey found overall sustainable farming practices are increasing with precision agriculture techniques (Appendix A) adopted on almost all farms. However chemical use, as part of these practices, is increasing and herbicide resistance remains a significant threat. This is also thought to be posing hazard to environmental and human health (Wheatbelt NRM 2014). Interviewees in the current survey raised concerns about chemical use with one female (26-40 yrs) suggesting no-till encouraged greater chemical use while an older female (56-66) had found out about research on chemical residue in American and Canadian grain and was concerned there was no residue testing done in Australia. She

was concerned about agribusiness agents' recommendations for chemical use saying 'They're all about results but what are you growing it for, you're growing it for somebody to eat'.

A young male organic grower (26-40 yrs) had switched to organic growing because he didn't like chemicals and suggested chemical use is increasing with landholders spending large amounts of money annually. He believed agribusiness agents were encouraging chemical use for their own financial benefit. Another male interviewee (41-55 yrs) was concerned about the future problems of chemical resistance by weeds suggesting chemical use is concerning both landholders and consumers alike. An interesting argument was raised by an interviewee in the study by McKenzie (2011, 117) who was worried about the emphasis of Catchment Management Authorities (CMAs) and regional NRM groups on encouraging adoption of no-till as she believed with the growing research on the detrimental effects of glyphosate they could 'soon be promoting an outdated system, when everyone else has already "moved on to something totally different"'.

The GRDC 2014 survey found grain growers are undertaking a range of practices to improve productivity and ensure longer-term sustainability for their farm. These include practices such as earlier seeding, reduced tillage and water conservation. Apart from upgrading machinery and technology the major changes grain growers have been undertaking in the last few years are crop rotation and soil improvement. They also found grain growers increasingly believe that climate change is presenting challenges for them and they therefore include climate change issues in their farm decision-making (Watson and Watson 2014).

However interviewees' responses for the current study suggest different practices are having different environmental impacts with one male (41-55 yrs) claiming that as a result of the change in recent decades to no-till practices 'There's a lot less wind and water erosion on farmland because of these practices and higher percentage of cropping'. However partial adoption of this practice still occurs; another male (41-55 yrs) survey respondent commented 'I still burn my stubble as a management tool'. A female (26-40 yrs) interviewee commenting on the loss of trees and ground cover also stated 'We're starting to loose so much topsoil through wind erosion. If we have a massive flood event we can pretty much kiss three quarters of our topsoil goodbye'. In

the 2014 GRDC survey, 90% of grain growers in the eastern regions of WA Wheatbelt rated seasonal conditions as the greatest influence on practice change, which was higher than all other regions in Australia. In 2015 the GRDC survey found that WA grain growers are continuing to change their practices in response to factors such as weather, R&D information and risks (Watson and Watson 2014; 2015).

### 6.1.3 Methods of support beneficial at stage of adoption

The methods of support provided to WA Wheatbelt landholders were investigated to determine the most appropriate methods to implement at each stage of practice change and the accessibility and relevance of each method for each category of NRM practice. These methods were taken from Ecker et al. (2012) and adapted with the help of Wheatbelt NRM staff. All respondents were first asked to rate the stage of adoption when support is most beneficial (Figure 6-3) and then the stage when each of the 17 methods of support are most beneficial (Figure 6-4). These questions included four stages from the Stages of Adoption model used at 6.1.1.

- Over 90% of respondents rated support as moderately or very beneficial when they are first thinking about the practice as well as when they are trialling and planning the practice.
- Support was rated beneficial to a slightly lesser degree when they were undertaking the practice (87%)
- Respondents had mixed attitudes toward the benefit of support when they are interested but currently unable to undertake a practice with 54% rating support as moderately or very beneficial and 45% rating it somewhat or not beneficial.



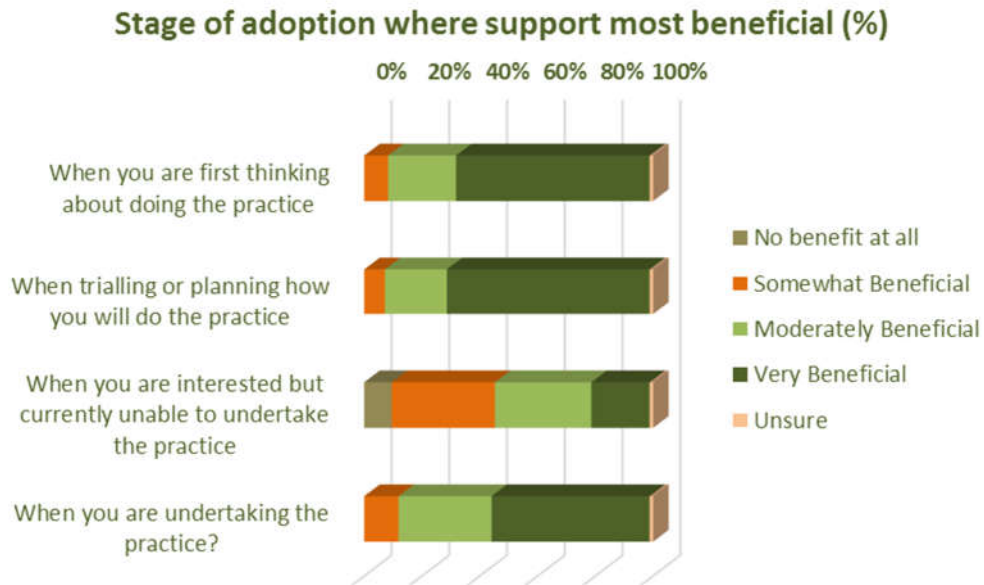


Figure 6-3: The stage of adoption where support is most beneficial.

Respondents were next asked which methods of support are most beneficial at the different stages of change (Figure 6-4). The telephone surveys revealed that some respondents were unsure about the definition of rapid appraisal processes and decision support tools, and social media was not used by many landholders, so many were unsure about these methods of support. The results indicate that the types of support rated most beneficial differ for each stage of adoption:

- As respondents progress through the stages of practice the methods of support they prefer changes:
  - When they are first thinking about a practice their most useful methods of support include: website and media information and practical demonstrations at field days and trials, group talks and case studies. At this stage they are mostly seeking information and evidence of the benefits and disadvantages of the practice for others and assurance that further research may provide benefits of adoption for them and their farm.
  - When they begin their planning or trialling, workshops and forums, trials and demonstrations and individual advice are most important. More local and individual support is required at this stage with further need to see the evidence of what other farmers are doing, to discuss the practice with other farmers and to get assistance to understand the practical applications of the

practice and how adoption of the practice fits with their own farming system.

- When they are undertaking a practice, financial assistance, support from peer networks, field guides and individual advice becomes most important. More practical assistance and support is required at this stage such as financial support, assurance from their peers that they are doing what they think they should be doing and individual advice from their peers and experts to enable them to adapt the practice to maximise the benefits.
- Respondents still rated support moderately or very beneficial when they were interested but currently unable to undertake the practice, when peer networks, web and media information, case studies and workshops and forums are most important. Here it shows that respondents still want to be part of the farming scene that undertake the practice, and kept up to date with current events and research even though they are currently unable or unwilling to undertake the practice themselves.
- The most useful methods of support overall included practical demonstrations, peer support, financial assistance, website and media information and individual advice.
- All landholders rated practical demonstrations of trials and demonstrations, and field days and tours as useful at some stage
- Only two respondents rated tax exemptions as not useful and one rated group talks and financial grants as not useful.
- The support rated as significantly the least beneficial was social media with 51% rating it not useful.
- Other support included:
  - Access to cheap hire equipment
  - Local government support for Landcare
  - Community groups, working together
  - Manpower.

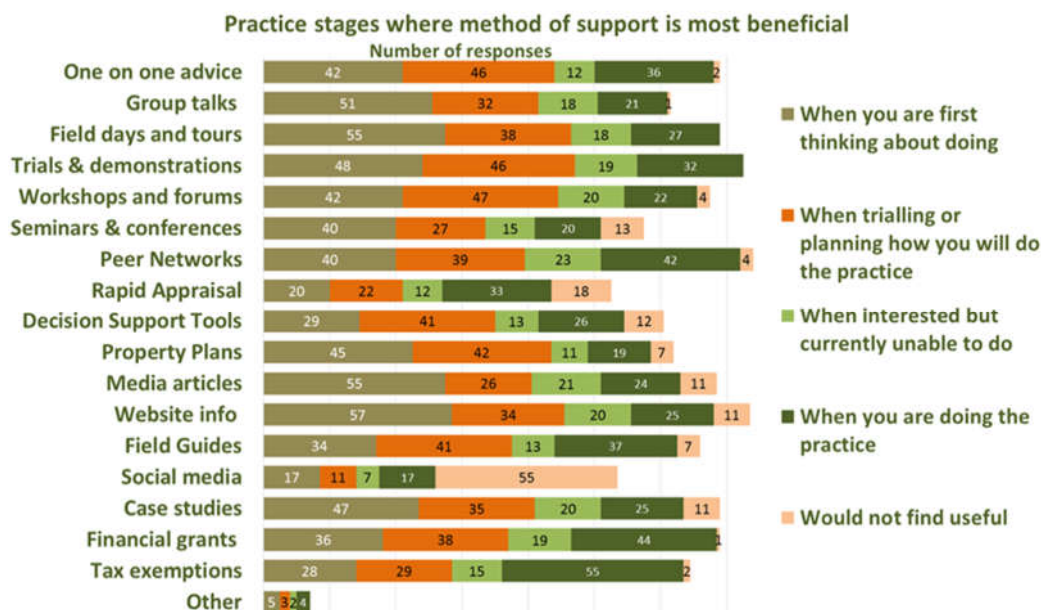


Figure 6-4: The methods of support most beneficial at each stage of adoption.

#### 6.1.4 Accessibility and relevance of methods of support

The next set of questions asked respondents to rate the accessibility and relevance of these methods of support for the NRM practices. Similar to the ABARES studies, the NRM practices were merged into five groups to simplify the questions, (conservation agriculture, sustainable grazing, agroforestry, managing native vegetation, and managing WoNS). Respondents were asked firstly how easy these methods of support were to access and then how relevant they are. The results were all moderately or strongly correlated suggesting that respondents' attitude toward the accessibility and relevance of the methods of support may be similar to that of other WA Wheatbelt landholders.

##### 6.1.4.1 Conservation agriculture

Conservation agriculture practices consisted of no-till including reduced stubble burning, adopting periods of fallow, VRT, addressing soil acidity and controlled traffic farming (Figure 6-5). Bivariate analysis revealed the accessibility and relevance of all methods of NRM extension for conservation agriculture had a significant association of  $p < .00$  except trials and demonstrations which was  $p < .01$ . Pearson's correlation showed a moderate positive relationship ( $r = 0.514$ ).

Accessibility of the methods of support for conservation agriculture practices:

- Overall, respondents rated most methods of support for conservation agriculture as easy to access except financial assistance.
- Information from media articles and websites is the easiest to access and financial assistance is the most difficult.
- Around half the respondents were unsure about social media.

Relevance of the methods of support for conservation agriculture practices:

- Overall, all methods of support were rated relevant except social media with many unsure of this support.
- Practical demonstrations (trials and demonstrations and field days and tours), individual advice and group talks, combined with financial assistance are considerably more relevant than other methods for these practices.
- Seminars and conferences and media articles and websites are the least relevant.

When the accessibility and relevance of conservation agriculture overall were analysed the results showed:

- Media and website information was very accessible but not so relevant, while financial assistance was very relevant but not very accessible.
- Individual and group advice and practical demonstrations were all accessible and very relevant.
- Many respondents were unsure about accessibility and relevance of social media.

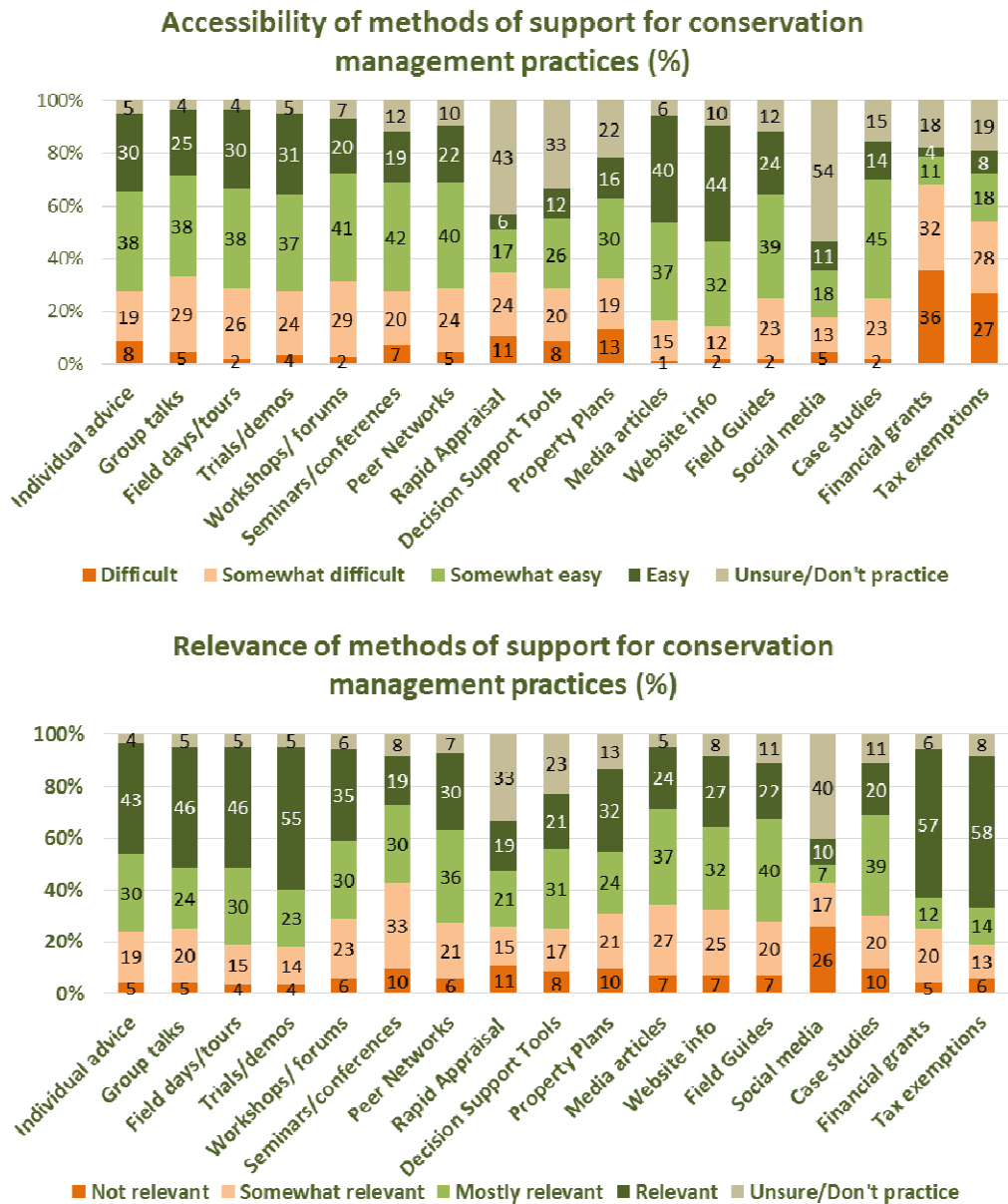


Figure 6-5: The accessibility and relevance of the methods of support for conservation agriculture.

#### 6.1.4.2 Sustainable grazing

Methods of support for sustainable grazing practices consisted of cell or strip rotational grazing, setting minimum, long-term groundcover targets, planting or maintaining deep rooted perennial pastures or planting grazing shrubs (Figure 6-6). Analysis of the accessibility and relevance of these methods of support showed there were significant relationships for all methods of support for sustainable grazing between their accessibility and relevance and a moderate positive Pearson's correlation ( $r = 0.623$ ).

Accessibility of the methods of support for sustainable grazing:

- Forty four percent of respondents were unsure about accessibility of support for sustainable grazing.
- Overall the accessibility of the methods of this support were somewhat easy to access.
- Media articles and websites were the easiest and financial assistance, individual advice and peer networks were the most difficult.

Relevance of the methods of support for sustainable grazing practices

- Overall respondents found this support moderately relevant.
- One-on-one advice and group talks combined with practical demonstrations and financial grants were the most relevant.
- Seminars and conferences, field guides and peer networks were the least relevant.

Further analysis of the overall accessibility and relevance of the methods of support for the results found:

- The accessibility and relevance of support was comparatively mixed with media articles, websites and case studies relatively equal.
- NRM extension for practical demonstrations and group talks were highly relevant but less easy to access.
- Financial grants, individual advice and peer networks were the most difficult but also relevant.
- Seminars and conferences and workshops and forums were the least relevant.

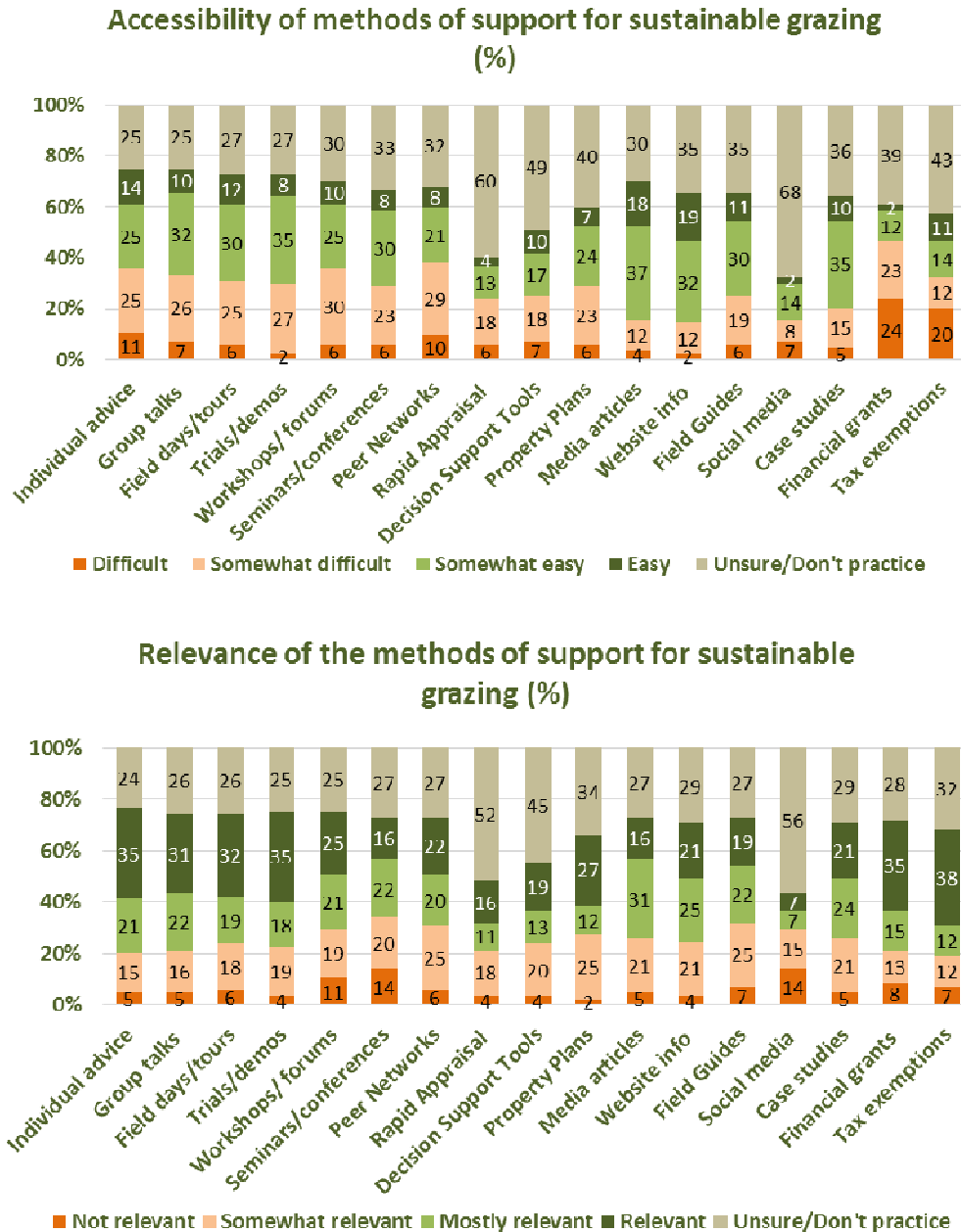


Figure 6-6: The accessibility and relevance of the methods of support provided for sustainable grazing practices.

### 6.1.4.3 Agroforestry

Bivariate analysis revealed the accessibility and relevance of all methods of support for single or multiple species agroforestry (Figure 6-7) had a significant association of  $<p.00$  and a high positive Pearson's correlation ( $r = 0.722$ ).

- As only 19% of respondents are currently undertaking agroforestry and nearly 60% of respondents were unsure about the accessibility and relevance of this practice, there were fewer responses for analysis.

- Overall respondents were mixed in their attitude toward accessibility with websites and media articles the easiest to access and financial grants and seminars and conferences most difficult.
- Seventy seven percent were unsure about social media.

#### Relevance of the methods of support for single or multiple species agroforestry

- Overall respondents were relatively evenly mixed in their consideration of whether support was relevant or not apart from financial support.
- Trials and demonstrations, one-on-one advice, and financial assistance were most relevant and apart from social media, media articles and seminars and conferences were least relevant.



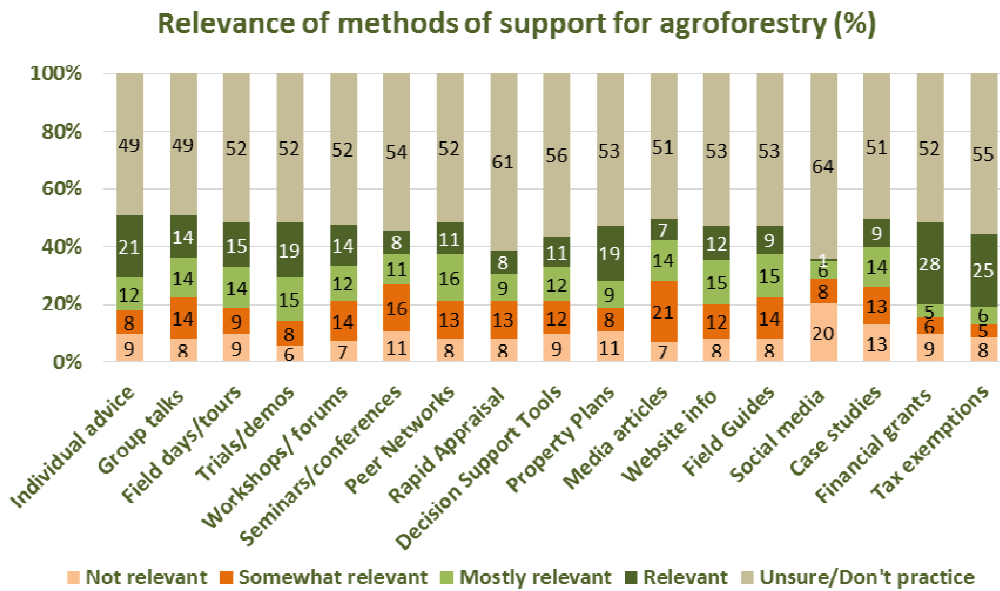
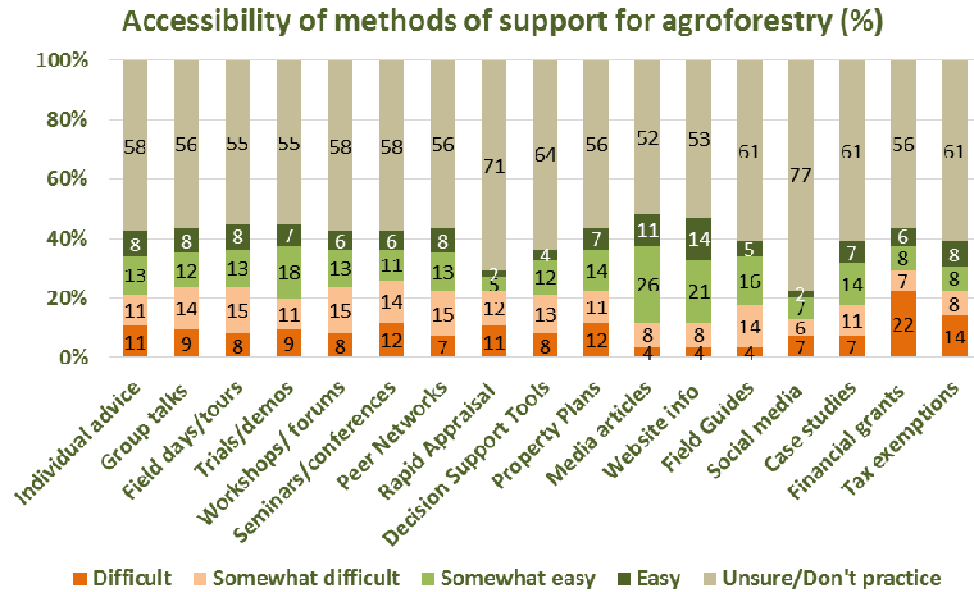


Figure 6-7: The accessibility and relevance of the methods of support for agroforestry.

When the overall accessibility and relevance of the methods of support for agroforestry were analysed:

- Websites and media articles again had higher accessibility than relevance and financial assistance was highly relevant but difficult to access.
- Trials and demonstrations, individual advice, field days and property plans all had higher relevance than accessibility and seminars and conferences were difficult to access but not relevant.

#### **6.1.4.4            *Native vegetation management***

Analysis of the accessibility and relevance of the methods of support for planting and fencing native vegetation and managing regrowth showed a significant relationship between all methods of support (Figure 6-8) with a moderate positive Pearson's correlation ( $r = 0.528$ ).

Accessibility of the methods of support for native vegetation management.

- Overall, around 65% of respondents were currently managing native vegetation and most found it easy or somewhat easy to access support although they were relatively unsure about tax exemptions for these practices.
- Media articles and websites were somewhat easy to access with one-on-one advice considered easy or somewhat easy.
- Financial assistance and workshops and forums were most difficult.

Relevance of the methods of support for native vegetation management

- Respondents rated all methods of support for native vegetation management relevant except social media moderately relevant and financial support highly relevant.
- Apart from financial assistance, one-on-one advice, group talks and practical demonstrations were rated most relevant, and seminars and conferences and workshops and forums the least relevant

Further analysis of the accessibility and relevance of the methods of support for native vegetation management found:

- Media articles and websites were more accessible than relevant while individual advice and trials and demonstrations more relevant than accessible and financial assistance again highly relevant but the most difficult to access
- Workshops and seminars were only somewhat easy to access and somewhat relevant

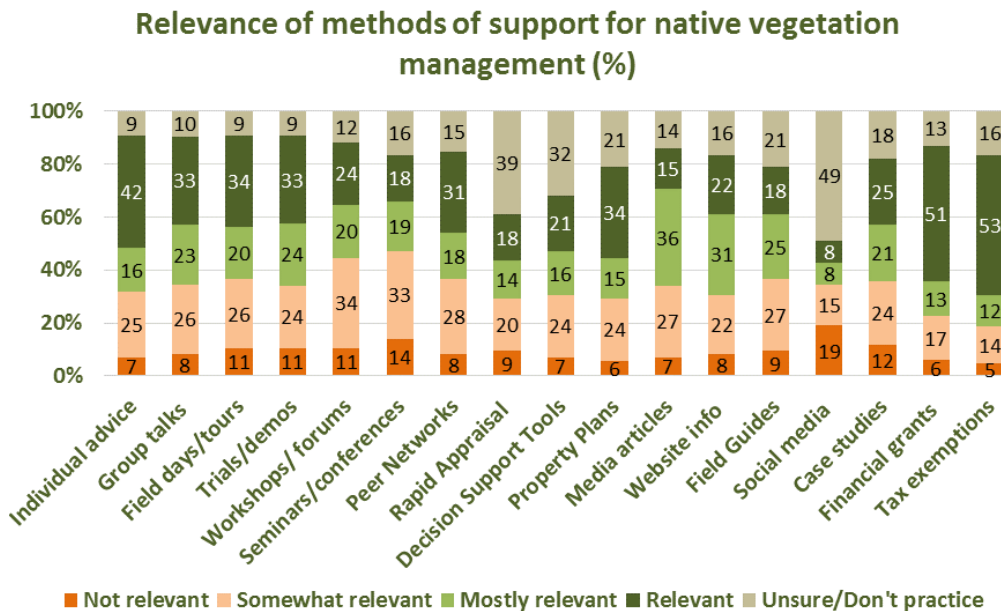
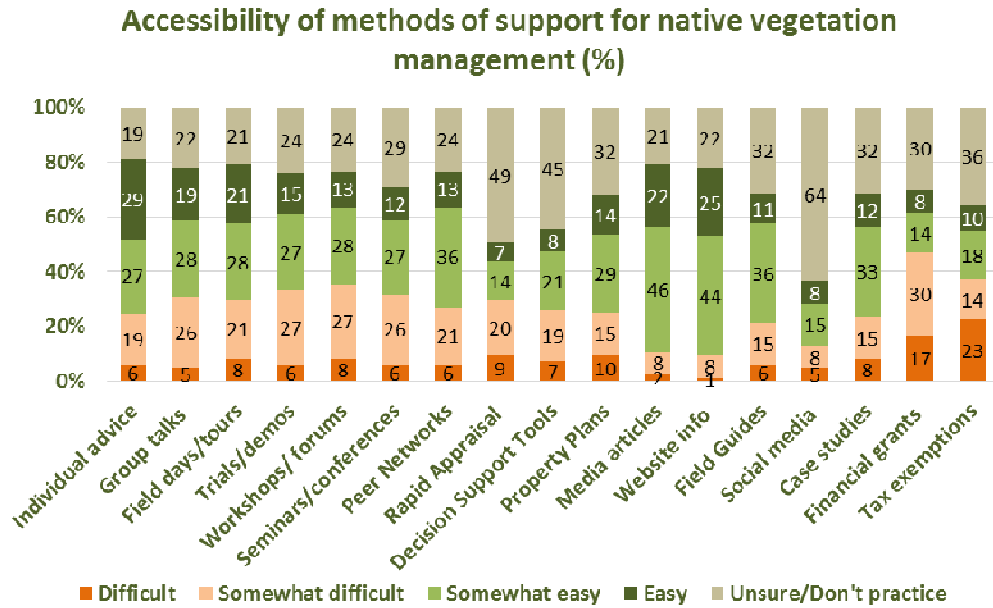


Figure 6-8: The accessibility and relevance of the methods of support provided for native vegetation management.

#### 6.1.4.5 *Managing weeds of national significance*

Analysis showed that all methods of support for managing WoNS had significant relationships between their accessibility and relevance of support and a moderate Pearson’s correlation  $r = 0.644$  (Figure 6-9). This question was again problematic as it likely included both crop and WoNS which brings the results into question, particularly as some may have included crop weeds while others did not.

Accessibility of the methods of support for managing WoNS:

- With 77% of respondents reporting they undertake crop weed and/or WoNS management, apart from financial assistance this support was rated moderately easy to access.
- Websites and media articles and one-on-one advice were easiest and practical demonstrations and financial support the most difficult to access, with around a third rating financial assistance difficult to access and another third unsure
- Respondents were unsure about financial and property plan support.

Relevance of the methods of support for managing weeds of national significance:

- Overall respondents considered support for managing weeds moderately relevant.
- Individual advice and group talks combined with websites and media articles were the most relevant.
- Field days and tours, workshops and forums and seminars and conferences were the least relevant.

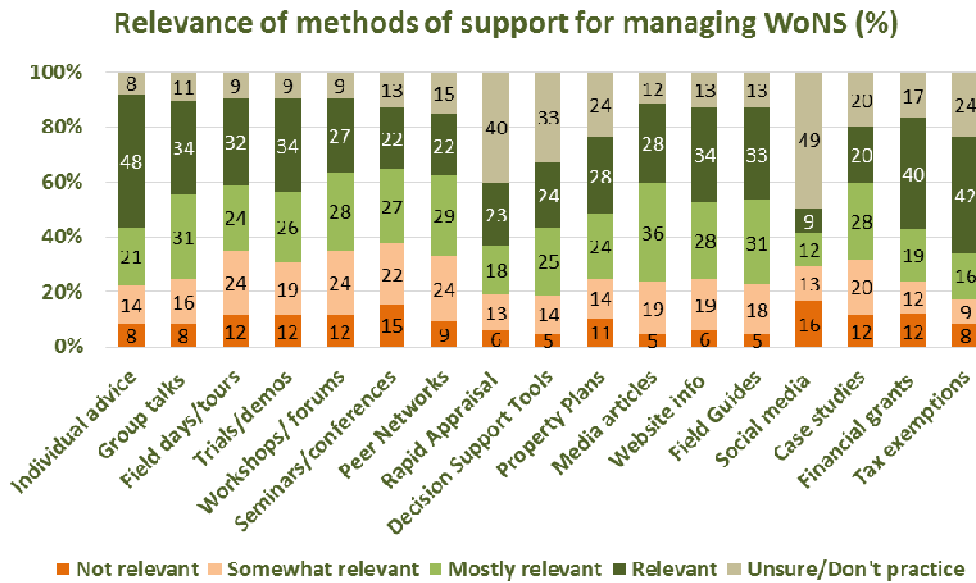
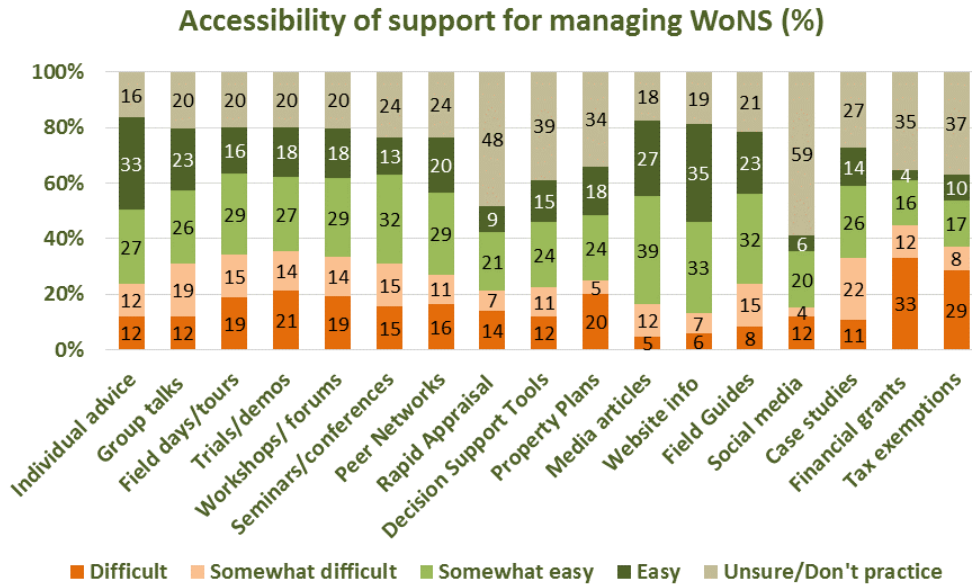


Figure 6-9: The accessibility and relevance of the methods of support provided for managing Weeds of National Significance.

The differences between the accessibility and relevance showed:

- Websites, media articles and individual advice were most accessible and also relevant.
- Practical demonstrations and group talks were more relevant than accessible.
- Financial assistance was rated difficult but relevant.

#### 6.1.4.5.1 *Combined results*

##### 6.1.4.5.1.1 Accessibility and relevance

To compare the accessibility and relevance of the methods of support provided for the categories of NRM practices analysis was undertaken by merging responses into four groups of easy, difficult, relevant and not relevant (Figure 6-10).

These results show:

- Overall, a greater percentage of respondents rated the methods of support for all NRM practices relevant than not relevant and more accessible than difficult to access.
- Nearly half of the respondents were currently undertaking all of the five practices for conservation agriculture (Figure 6-1) which had the lowest rating for unsure.
- Along with managing native vegetation and WoNS, conservation agriculture also had the greatest difference between the relevance and the difficulty of accessing the methods provided for support suggesting this support is relevant but not so readily accessible.
- Sustainable grazing showed the greatest mix of responses with many unsure about the provision of these methods. Between 20%-46% of respondents were currently undertaking sustainable grazing practices.
- Respondents' stage of adoption (Figure 6-1) showed 64% of respondents have either done agroforestry and found it not worthwhile, or are not considering it, and this is reflected in the high number of respondents who were unsure about the methods of support for agroforestry.

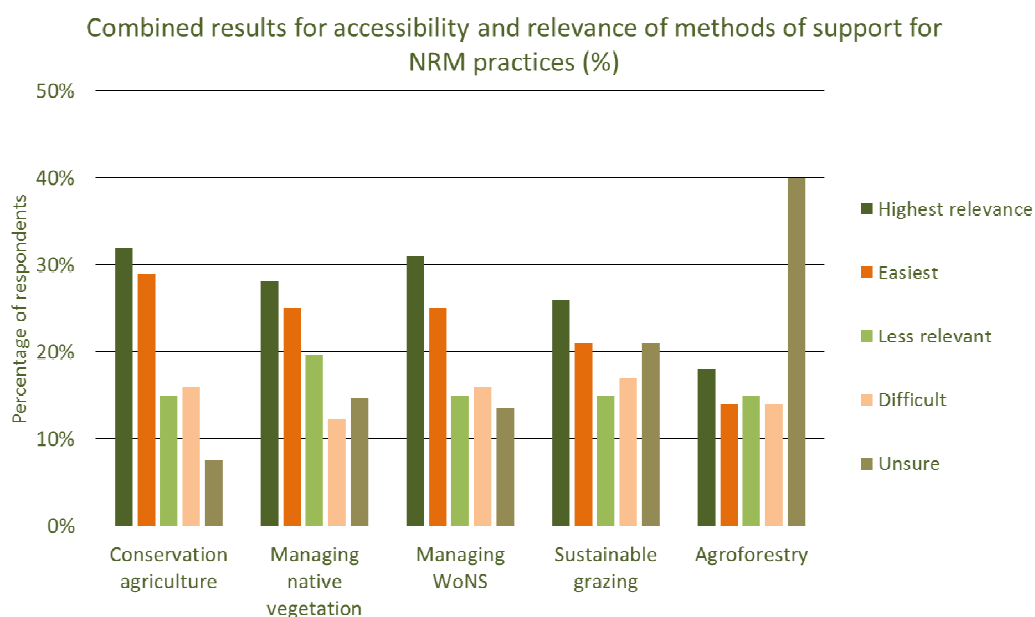


Figure 6-10: Combined results for accessibility and relevance of methods of support for NRM practices.

When this combined graph is compared with the graphs showing the stage adoption (Figure 6-1) and the ability of these NRM practices to meet respondents' goals (Figure 6-2) it is clearly shown that adoption and importance of these practices aligns with their ratings for the accessibility and relevance of the methods of support used to promote the different categories of NRM practices.

#### 6.1.4.5.1.2 Theme one

A table was constructed of theme one results; the stage of adoption of the selected categories of NRM practices, combined with evidence of landholder attitudes toward the methods of support and the stage of adoption when the methods are most beneficial (Table 6-6). As can be seen from section 6.1.2, respondents' attitude toward the practice meeting their goals, reflected their stage of adoption so these results were not included. To construct the table, in the first column of the stages of adoption of NRM practices responses for those respondents who were in the pre-adoption stages (thinking about, planning or trialling or interested but currently unable) were combined, with respondents in the action stage in the second column. In the responses for accessibility and relevance of the methods of support for adoption NRM practices, those respondents who rated the methods of support 'difficult or somewhat difficult'

and ‘relevant or somewhat relevant’ were also combined. The three highest responses in each section have been highlighted to show general trends in the results.

The table shows many respondents in the pre-adoption or action stages of conservation agriculture practices and most respondents managing crop weeds and/or WoNS. Overall, the same methods are rated most beneficial, most relevant and least accessible. Eight types of methods were shown to be highly important in the pre-adoption stages: individual advice, practical demonstrations, workshops and forums, peer networks, electronic and media information and case studies, while only two, peer networks and financial support, were highly important in the action stage. The method of group talks was the only one not included shown to be highly difficult to access and highly relevant for some practices. As such respondents rated these eleven methods most important overall.

Of note was that one-on-one advice was highly relevant for all five NRM practices, highlighting the importance for extension to provide good quality information. Incentives, in the form of financial assistance had the highest relevance for all practices except managing weeds, which likely illustrates the extent that respondents included crop weeds in their responses. This type of assistance was rated the most relevant when respondents are undertaking the practice. One-on-one advice and practical demonstrations were all rated highly beneficial in pre-adoption stages, highly relevant for most practices and practical demonstrations were very difficult to access for both agroforestry and managing weeds. Workshops and forums were also highly beneficial in pre-adoption stages and very difficult to access but not as relevant. Group talks were rated highly difficult and highly relevant but not rated in the top three as beneficial at any stage of adoption, while workshops and forums, peer networks and website information were rated highly beneficial at some stage of adoption but were not rated in the three highest for relevance for any NRM practice.

Media articles were also highly beneficial in pre-adoption stages but highly relevant only for managing weeds while case studies were highly relevant during the interested stage but not highly difficult or relevant for any stages. Of note was that website information was readily accessible but not rated highly relevant, suggesting this form of information access is not yet providing the individual type of information landholders require. As shown by Kacans et al. (2014) the methods to support



managing native vegetation were different from other practices with only individual advice and financial assistance very relevant.

Overall the trends show that one-on-one advice and support from individual landholders or landholder groups combined with government financial assistance are highly relevant for adoption of these NRM practices. They also show that individual advice, practical evidence and self-learning methods for accessing information are most relevant and beneficial at all stages of change. These methods are likely key methods used by private consultants, grower groups and other local landholders, fostering the high use and motivation to use their support shown in theme two.

Table 6-6: Combined table for stages of adoption, stages when methods of support are beneficial, and lowest accessibility and highest relevance of methods of support for adoption of NRM practices.

Combined table for stages of adoption of NRM practices, stages when methods of support beneficial and accessibility and relevance or methods of support for adoption of NRM practices (%) (n=85)																		
Stages of adoption of NRM practices				Stages when methods of support beneficial				Accessibility and relevance of methods of support for adoption of NRM practices										
		Thinking/trialling/ interested Doing						Conservation Ag.		Agroforestry		Native vegetation		Grazing Mngmt		Managing WoNS		
				Thinking	Trialling	Interest	Doing	Difficult	Relevance	Difficult	Relevance	Difficult	Relevance	Difficult	Relevance	Difficult	Relevance	
				One on one advice	49	54	14	42	27	73	21	33	25	59	36	56	24	69
				Group talks	60	38	21	25	33	70	24	28	31	56	33	53	31	65
Conservation agriculture				Field days and tours	65	45	21	32	29	76	24	29	29	54	31	51	34	55
		9	84	No till/reduced stubble burnt														
		17	40	Periods of fallow	56	54	22	38	27	77	20	34	33	56	30	53	35	60
		49	17	Variable rate technology	50	56	24	26	31	65	24	26	35	44	36	46	33	55
		12	84	Addressed soil acidity	48	32	18	24	27	49	26	19	32	36	29	39	31	49
		38	13	Controlled traffic farming	48	46	27	50	29	65	22	27	27	48	38	42	27	52
	17	19	Agroforestry	24	26	14	39	35	40	22	18	29	32	24	27	21	40	
	13	63	Planted native vegetation	35	49	15	31	29	52	21	22	26	38	25	32	22	48	
	14	64	Fenced native vegetation	53	49	13	22	33	56	22	28	25	49	29	39	25	52	
Grazing management		24	20	Cell/rotational grazing	65	31	25	29	17	61	12	21	11	52	15	47	16	65
		25	46	Minimum groundcover targets	68	40	24	30	14	60	12	27	10	53	14	46	13	62
		29	25	Planted perennial pastures	40	49	15	44	25	61	18	25	21	42	25	41	24	64
		16	41	Planted grazing shrubs	20	13	8	20	18	17	13	7	13	17	15	14	15	21
	7	77	Managed WoNS	55	41	24	29	25	59	18	24	24	46	20	45	33	48	
				Financial grants	42	45	22	52	68	69	29	33	47	64	46	51	45	60
				Tax exemptions	33	34	18	65	54	73	22	31	37	65	32	49	37	59
				Other	6	4	2	5										

## **6.1.4.6 Discussion**

### **6.1.4.6.1 Comparison with other literature**

The ABARES studies asked respondents about their participation in learning activities during the previous two years. Consistent with the relevance of methods in the current study Kacans et al. (2014) found high participation for broadacre respondents were field days (53%), training courses or workshops (34%) and trials (24%). Wright et al. (2015), Musawi (2013) and the GRDC (2012) surveys mixed both providers and methods together and offered a useful perspective on the importance WA landholders placed on both providers and methods of support (Table 6-7). Wright et al (2015) sourced her respondents through Grower Group e-newsletters and Crop Update meetings, Musawi (2013) used the Grower Group Alliance for distribution, while GRDC surveyed 107 grain growers in WA. As such these surveys are focussed mostly on production, and include grain growers sowing more than 120 hectares of grain (Watson and Watson 2015), and are unlikely to include the percentage of smaller farms and organic or other types of production captured in the current study. However overall trends are likely applicable to the current study.

In order of importance respondents in the study by Wright et al. (2015) rated methods of support for general farming information as; Internet, field days, crop updates, books, mobile apps, free workshops, newspapers, fee paying technical workshops and radio, while GRDC rated the influences on practice change as: publications, field days, grower updates, radio, newspapers, conferences/workshops and Internet in order of importance (Watson and Watson 2012). However learning from private consultants was rated highest, in both studies therefore individual support was higher than other methods, as in the current study. These results also show that, consistent with the current study, practical demonstrations at field days and self-learning methods for accessing information are highly important. Musawi (2013) rated the most important providers and methods for accessing information as; Internet, publications, mobile phone, brochures, newspapers and library.

Of note was the high rating for the Internet in the Wright et al. (2015) and Musawi (2013) studies but the lowest rating in the GRDC 2012 survey. It is difficult to know why this occurred but may be due to different phrasing of the question with the first two asking about the importance of the information to their decision-making and the

other asking about the influence on their practice change. The current study found information on the Internet was very accessible but only moderately relevant which may contribute to this disparity. Also of interest is that WA government officer support was rated higher than workshops in the study by Wright et al. (2015). On the other hand workshops and forums were rated highly beneficial in the pre-adoption stages in the current study while WA government support was rated relatively low (section 6.1.3).

Publications are rated relatively highly in all three surveys (books are likely to be considered publications in the Wright (2014) survey) while newspapers are rated considerably lower. In the current study respondents were asked to rate the benefits of media articles. These were rated relatively beneficial in the pre-adoption stages. Therefore taking the Wright et al. (2015), Musawi (2013) and the GRDC (2012) findings into account, it appears that respondents in the current survey may have referred to books and other publications rather than newspapers when they responded to this question. Also of interest is the moderate influence of the radio in the GRDC 2012 survey but very low importance in the Wright et al. (2015) survey, and the moderate importance of mobile phones. These two methods of support were not included in the current study but may be worth investigating in future studies, particularly as researchers predict that improvements in mobile phone coverage in rural areas will improve communication and change the relationship between landholders and extension in the future (Keogh and Clementine 2014).

Table 6-7: Providers and sources of information used by WA landholders for general farm information and as influences for practice change, listed in order of importance.

Providers and methods used for accessing information by WA landholders for general farm information and as influences for practice change listed in order of importance		
(Wright et al. 2016, 2)	(Musawi 2013, 56)	GRDC 2012, 144
Private consultant	Farmer groups	Private consultant
Internet	Other farmers	Grower groups
Grower groups	Internet/web	Publications
Field days	Publications	Field days
Neighbours	Private companies	Leading growers
Crop updates (industry forum)	Personal knowledge	Grower updates (industry forum)
Books	Extension worker	Radio
Local community	Mobile phone	GRDC information
Mobile apps	Government officer	Newspapers
Family members	Brochures	Retail agronomist
State Ag Department	Local newspaper	Conferences/workshops
Free workshops	Local library	Government department
Local papers		Internet
Fee paying technical workshops		
Radio		
Agribusiness reseller		

Source: Wright et al. 2016, 2; Musawi 2013, 110, Watson and Watson 2012, 144.

Of interest was that when Musawi (2013) asked respondents to rate where they expect to find the most accurate agricultural information, private companies were ranked fifth. This result is probably due to respondents including agribusiness support. The bias of this support is discussed by interviewees in the current study. Musawi also asked respondents to rate the importance of the same providers and methods of support 10 years previously. This result showed a rise of 964% in mobile phone use and a 537% rise in Internet use. It also showed the use of printed material use had increased by 83% while newspaper use had decreased by 72%; reflecting trends occurring in society in general. He found their preferred providers and methods of support may change over time; however the importance they attached to the information they provided was driven mostly by their familiarity with their use.

Wright et al. (2015) also asked respondents to rate the most important method for finding information to solve production-oriented pest and disease issues finding that field days were highest and Internet use near last. This result is interesting when compared to the GRDC 2014 survey which found grain growers in WA have high use of the Internet for commercial purposes with over 80% of growers selling their grain over the Internet in 2014 (Watson and Watson 2014). This suggests WA grain growers use the Internet for marketing grain, but not other crop-related issues. Consistent with

the current study, the Wright et al. (2015) survey also showed social media were not used frequently. Her study found that Facebook and YouTube were used by less than 10% of respondents on a daily basis with 60% of respondents using 'other' media sources most often on a daily basis. However these sources are not explained by Wright (2015).

Vergot, Israel, and Mayo (2005) also asked cattle producers in Florida their preferred channels (methods) of information from their county extension agents. The study also showed that field days and demonstrations were less relevant than media articles, other landholders and consultants' advice for livestock production. It also highlights a difference in use of electronic sources of information between the period of their study and the current study.

Farm forestry support services may be slightly different as there are fewer landholders doing farm forestry to share information, and fewer options for learning. An assessment of information requirements for Australian landholders undertaking farm forestry in 2008 found most landholders were influenced in their decision-making by publications or newsletters, including research information, and personal advice from a consultant or provider of extension. Fewer received information from field days, other landholders or trade/forestry magazines (Roth and Molony 2008). Results of the accessibility and relevance of methods of support for agroforestry in the current study also show individual advice and practical demonstrations are relevant but field days may be difficult to access.

#### **6.1.4.6.1.1 Methods of support**

Individual advice used to be the main form of extension undertaken by the public sector. With the introduction of group-based extension, government NRM programs developed a strong emphasis on group-based participatory processes, particularly as they reduced government costs (Vanclay and Lawrence 1995). However researchers began to call attention to its limitations, including different environmental conditions and social circumstances (Robertson et al. 2009; Vanclay 2004) and problems with many landholder personalities (Shrapnel and Davie 2001), suggesting there was an overemphasis on group-based extension to the detriment of developing individual relationships built on trust and credibility (Pannell et al. 2006). It therefore appears

logical that survey respondents in the current survey placed high relevance on individual advice.

Suggesting the focus should be on practical on-ground changes and not just raising awareness, Toric (2005) recommended greater use of individual advice and financial incentives to encourage adoption of public-good practices. However group-based extension remains particularly important for NRM as many environmental issues require community commitment to catchment-based approaches and often involve understanding complex science and technology. In their recent study of large-scale Victorian farms Wilkinson and Rowbottom (2013) found these landholders are willing to travel great distances to acquire their information and individual advice through networking with other landholders, scientists and industry leaders. Studies of smallholders has also found individual advice to be critical to their participation in NRM programs (Meadows, Emtage, and Herbohn 2014).

The high relevance of field days, tours, trials and demonstrations noted in the current study concurs with results in the literature, indicating the relevance of practical demonstrations. The trialability of a practice refers not just to the physical ease of trialling but the ability of the landholder to learn from it, which is influenced by the complexity of the NRM issue and observability of the practice (Cary, Webb, and Barr 2001; Pannell et al 2011). As such studies have found learning from their own trials and individual advice and information, particularly from other landholders, rated as the most important methods for influencing adoption (Wright et al. 2015; Tarnoczi and Berkes 2009; Toric 2005; Moore and Renton 2002). These type of methods of support are also aligned more with practices with greater private than public benefits.

According to Tarnoczi and Berkes (2009), programs based on these methods ‘allow for the co-production of knowledge that can lead to learning’ and adoption. Kacans et al. (2014) found that information was used more by respondents attending trials (93%) than by those attending training courses or workshops (91%) or field days (79%). Similar to the current study, other WA Wheatbelt studies found field days were mentioned as important information sources (Toric 2005; Moore and Renton 2002), while Llewellyn, D’Emden, and Gobbett (2009) found that participation in relevant seminars, field days and workshops was positively correlated with uptake of minimum till practices. However McKenzie (2011) found that landholders seeking information

for innovation tended to rely on one-on-one advice from people in their networks rather than attending trials and demonstrations or field days. They commented on a lack of time to attend these events and a feeling of being overloaded by them all.

Investigation of financial incentives motivating adoption by Ecker et al. (2012) found that government grants and tax incentives were rated very low compared to factors such as profit, reduced costs and improved land values as motivations for adoption of NRM practices. Their study also found financial grants were rated moderately important for native vegetation management but 'tax incentives were the least influential of the financial motives listed'. Their findings likely reflect the limitations and variability of grants and tax incentives as well as overall attitudes toward independence and neoliberal ideals.

The 1996 study of native vegetation in the WA Wheatbelt by Jenkins (1998) also found a difference between financial grants with contracts attached and tax incentives as nearly one third of respondents preferred a particular grant compared to 6% wanting a 150–200% tax deduction. However the focus and question construction for these studies was very different from the current study making them difficult to accurately compare. The current study showed financial grants and tax incentives were rated equally relevant for all practices, but the results may have been affected by straight-lining. They do however show a trend toward respondents' belief that financial support for adoption of NRM practices is very important. The results also highlight that financial assistance is highly important for practices with higher public benefits ie managing native vegetation.

The results in section 7.2 show respondents are highly motivated to use the support of other local landholders reflecting the importance of methods such as group talks, workshops and forums and peer networks both in the pre-adoption and adoption stages of change. Respondents rated access to these methods of support very difficult for both agroforestry and grazing management. Studies have found peers from a similar background have a key role in providing information and support for change (Foskey and Avery 2003) and emphasise the role peer expectations play in encouraging commitment to change (Barr and Cary 2000). For instance, studies have found peer group pressure to conform to social norm acceptance are an important influence on adoption for no-tillage (Llewellyn, D'Emden, and Kuehne 2012) and planting



perennial pastures (Crossley, Turnbridge, and McDonald 2009). The success of projects has also been seen to rest on the use of experienced peers (O’Kane 2009). The use of peers is also important to improve awareness and participation amongst smallholders (Meadows, Emtage, and Herbohn 2014). However, studies show that older landholders with little formal education may not receive this support as they are less likely to participate in formal and non-formal learning activities (Foskey and Avery 2003) highlighting literature recommendations for the use of diverse methods to support adoption (Pannell et al. 2011; Marshall 2011).

The current study shows property plans moderately important during the pre-adoption stages, moderately relevant for conservation agriculture and managing weeds and comparatively difficult to access support for their development in all practices. Ecker et al. (2012) found only 37% of WA respondents were using them and only half the Australian respondents included NRM activities in their plan. Although most (80%) of these respondents referred to them when making decisions they were only referred to sometimes. The GRDC 2014 survey also showed that only 23% of 103 WA grain growers had a formal business plan with 16% believing the plan resulted in improved profitability (Watson and Watson 2014).

In comparison, Jenkins (1998) found that in 1996, 60% of the 145 survey respondents had a farm plan; however, this varied considerably with the shire. Although this service is not generally provided by regional NRM groups, Keogh and Clementine (2014) found whole of farm planning rated of medium importance to grain growers, and property planning is shown to be significant in capacity building (Curtis and Mendham 2011). Ngathou, Bukonya, and Chembezi (2006) also found landholders with property plans were nearly 11% more likely to rate risk management information they receive as useful, and suggested this was possibly because these landholders understood how useful and applicable property plans were because they allowed them to recognise specifically what the farm required to operate efficiently.

Media articles and electronic media were both beneficial in the pre-adoption stages but only highly relevant for managing weeds. However they were moderately relevant and the most accessible method of support for all practices. Both Australian and American studies have found that younger, large-scale landholders are reducing their use of traditional electronic media – television and radio – and relying more on smartphone

and tablet apps for their information and communication (Wilkinson and Rowbottom 2013; Rejesus et al. 2008) and younger landholders are using the Internet more than older landholders who are influenced more by people they have developed relationships with (King and Nettle 2013). ABS (2009) data also showed that in 2007–08 larger, more remote farms in Australia were using the Internet more than smaller farms located nearer urban areas.

In his study of WA landholders IT requirements Musawai (2013) found landholders require highly specific information that is relevant to the task at hand. He suggests landholders generally perceive the amount of information available as advantageous as it provides them with independence to make their own decisions and the information itself is also generally seen as relevant. Yet landholders' perception of their ability to find the relevant information often leads to loss of interest in accessing this information. As such information overload and the time it takes to sieve through information showed the relevance of information was critical to whether they decided to use information or not.

This finding highlights the importance for extension to sieve through information and provide them with relevant and concise information. However Musawai (2013) also found that poor connectivity and the lack of ICT infrastructure were key barriers to accessing electronic information and few respondents believed the Internet would replace existing methods of support. Nonetheless Dhakal (2014) suggests the rapid growth in Internet use over the last few years has made this resource important for learning and adaptive capacity, while Fell (2000) argued the use of the Internet for networking rather than gathering information will assist landholders to overcome the barriers to effective communication and learn to appreciate sharing of information and experiences 'over the farm fence' as their forbears did.

#### **6.1.4.6.2            *Interviewee comments***

##### **6.1.4.6.2.1        Internet use**

Comments from survey respondents and interviewees in the current survey support these findings. Although many survey respondents found information they had accessed beneficial, many also wanted more freely available, independent, timely, relevant, localised information that is easier to understand and synthesised for easy

access (section 7.7). Interviewees mentioned the ready availability of information but the lack of time to read it all. One interviewee argued the need was for landholders to use the information available suggesting there is 'a huge network of support in information. There's so much stuff available to us, what we need to focus on is getting it into practice...' (male 41-55 yrs). Others commented that research results needed to be better publicised and better communicated to improve understanding, the information was 'fragmented' which made it difficult to find local, specific information, or that the overload of information was creating a barrier to using the information. Survey respondents therefore wanted more 'sieved' and simplified information providing 'short and precise snippets as to what is happening and what is available' (male 41-55 yrs) or in 'dot points, graphs etc that are straight to the point' (female 41-55 yrs). Another respondent believed the answer was 'to build better and more inclusive data bases to reach all local farmers' rather than supplying too much information (female 41-55 yrs).

Interviewees were asked their opinion about extensions use of the Internet (section 4.4.1.2). The following interviewee explains how her son does not have time to read all the emails he receives and the feeling of being overloaded by information prevents him from engaging with the information.

I help reconcile the books so I get into his computer from time to time and I can see that he's got hundreds of emails there. You know they're industry stuff, they'll be mostly farmer orientated stuff and he won't have read them. And then of course tomorrow there'll be another 20 or 30 come in. Everyone keeps on saying 'Well that's the medium to get to them', but then it gets to overload. As soon as you get to overload you just freeze. You're not doing any of it (female 56-66 yrs).

Discussing the benefits of receiving sieved information the same interviewee commented on a newsletter they used to receive from a local Landcare officer saying the reason it was good was because 'It wasn't too long and she'd have links to the stuff and she had a bit of visual stuff and she had quite a bit of local stuff' (female 56-66 yrs). Another interviewee supported the findings of Musawi (2013) on the independence the increased availability of information on the Internet has provided to landholders. He discussed the ease of using information in emails he gets from an industry group and the benefits it provides in accessibility to other group or event information.

I'd get an email from GRDC probably weekly I think. You can just delete it, it's easy to do. But if you actually want to click on it and have a look that will give you a lot of the up-to-date information. Then if you then want to go and look at the Facey group results or look at the Mingenew-Irwin and Liebe group results or attend their field days you get that information as well of course (male 56-66 yrs).

While another male landholder (66-75 yrs) highlighted the problems for older landholders in the change to Internet use by extension; explaining the divide between older and younger landholders that occurs with Internet use. He explained how older landholders such as himself 'struggle with it because we've never been taught. What we have been we've only done self-taught and that's not very satisfactory'. He commented on how some older landholders overcome this problem by getting their children to manage the book-keeping side of the business but still maintain control of the business themselves, but commented 'There is a divide between those that have been trained and brought up with it and the older ones that struggle with it'.

#### **6.1.4.6.2.2 Accessibility and relevance**

Interviewees were also asked about the changes to support in recent decades and many had mixed attitudes about the accessibility of information. Some believed there was ample information for landholders. One male interviewee (41-55 yrs) believed it was readily accessible but suggested financial capacities were probably 'the limiting factors'. Similar to findings by Musawi (2013) he also emphasised the importance of specific, local information by commenting that even though the information he gets from retail companies is biased, the 'good thing about it is it is usually quite localised to your area, it's quite specific information usually'. Others believed information was more difficult to access. Similar to comments by other interviewees the following male believed there was ample information available during the period of Landcare that is not available now.

There's less availability, there's no doubt about it. Since it's gone and they've taken it out of government and done more private, the information is not as available. It's harder to access. Fifteen years ago we had the Landcare movements going. There was an abundance of information and meetings...All that's gone now (male 41-55 yrs).

Yet another believed the problems with information accessibility and use lay with the landholders themselves. He believed many landholders are not pro-active in obtaining information through group participation and even though they are shown where to go

for information, their 'modesty' prevents them from obtaining it. He believed the problem was not the accessibility of information but the approach of some landholders to applying it, suggesting they need to do more than just take the advice they are given and take responsibility for using the information effectively to manage their business.

You've got to be part of a group and you've got to avail yourself of the information. You can't be blinkered. That's the trouble most farmers, they're very modest...and they don't avail themselves of the information. You can lead a horse to water but you can't make it drink...A lot of farmers too expect to be spoon-fed. They sit back and say I was told or whatever, but they forget that it is up to them. They are running a business and they do need to do a little bit more (male 41-55 yrs).

Small landholders also spoke of their problems with accessing some methods of support. They discussed how working in Perth during the week restricted their attendance at events and field days as most of these were held on week days and they were required to take time off work to attend. One female interviewee (41-55 yrs) was also concerned about the inequity of funding and support suggesting that 'farmers take all these funds and handouts and other people that are small landholders...really struggle to do the things that we would like to improve this environment'.

One survey respondent believed that 'All the information you get is important because it helps you make decisions' (male 75+ yrs). Of concern was that information about NRM was thought to be more difficult to find by some interviewees who commented that 'information specifically relating to Landcare issues is very hard to find and probably...I don't know where you go to find any (male 41-55 yrs) while another stated 'you've got to know who to ask. If it wasn't for the next door neighbour I wouldn't have known about NRM' (female 26-40 yrs).

# Chapter 7 Theme two: The influence of NRM extension

## 7.1 ABARES studies

The second theme examined the influence of the providers of support on landholder decision-making for adoption of NRM practices (Table 4-5). The Ecker et al (2012) study indicated financial, environmental and personal factors had significantly higher importance than the availability of support in motivating landholders to adopt the selected NRM practices (Table 7-1). As such, they suggest the availability of support was important once they had made their decision to adopt, but was considerably less important for motivating decision-making for adoption. As can be seen from the table below when considering the importance of the availability of support to their land management practices, respondents were not greatly influenced with only around 20-30% rating it important to some extent. As such the results of this Wheatbelt survey need to be viewed within this framework.

Table 7-1: Motivations driving broadacre and dairy landholders’ adoption of land management practices and the importance of the availability of support in consideration of land management practices.

	Motivations for adoption of management practices for broadacre and dairy industries (%)					Importance of availability of support in consideration of management practices (%)			
	Crop practices	Native vegetation practices	Grazing practices	Weed practices		Crop practices	Native veg practices	Grazing practices	Weed practices
Financial	40	17	45	42	To a great extent	6	9	6	6
Environmental	33	32	24	23	To some extent	29	29	20	23
Personal	12	9	9	18	Not at all	65	62	74	71
Support	7	9	7	5					

Source: Ecker et al 2012, 12, 29.

### Instrument limitations

How the providers of support are defined in studies by both the researcher and respondents affects the results. Providers were defined and categorised differently in the all studies found in the literature, including the ABARES studies and GRDC surveys. Those used in the current study were taken from the Ecker et al. (2012) and Wheatbelt NRM staff assisted with redefining them for the WA Wheatbelt. An attempt was made to balance the need to be explicit, with the need to contain the number of

providers, however anomalies still arose that likely affected the outcome of the survey, particularly as respondents themselves appeared not to be sure.

Grower groups and industry associations were problematic as interviewees discussed membership of Australian industry associations when asked about grower group membership. Wright et al. (2015) and the GRDC surveys found significant differences between private consultant support and agribusiness agent support (Watson and Watson 2014; 2015). The interview comments concerning the use of private consultants or agribusiness agents also suggest it would have been better to separate these two providers of support, particularly as less than half the interviewees (46%) use a private consultant regularly. Combining WA government officers and local government may also have made this choice difficult for respondents as Wauters and Mathijs (2013) found landholders rated local government the greatest influence on their conservation decisions.

Within the boundaries of the map used in this study the other two regional groups with responsibility for NRM in the southern and northern areas of the WA Wheatbelt are the South West Catchment Council and Northern Agricultural Catchment Council. As such identifying both Catchment Councils and regional NRM groups would have improved respondents' understanding. These anomalies bring into question the ratings for awareness, use and motivation to use these providers of support and their attitude toward these providers understanding the adoption risks for landholders. This research has therefore highlighted the need for further research to better define landholder perceptions of the different 'categories' for providers of support to benefit future studies.

## 7.2 Awareness, use, motivation to use and attitudes toward providers of support

All respondents were asked to rate their awareness of the providers of support available for land management. These providers are explained in section 4.2. Results revealed that overall respondents were mostly aware of the support available to them for land management (Table 7-1). Respondents rated the highest awareness of support for grower groups, other local farmers, private or agribusiness consultants and Landcare, and they were moderately aware of support provided by research organisations,

regional NRM groups, WA government officers and industry groups (i.e. Meat and Livestock Australia). Fifty-eight percent of the 85 respondents were not sure of the support provided by non-government organisations (i.e. World Wildlife Fund or Men of the Trees). The moderate and low awareness for some providers of support suggest there are behavioural controls to increased use of these providers.

Respondents who were mostly or fully aware of the providers of support were then asked which ones they had received support from in the last five years (Table 7-2). Results showed that overall respondents had received support from all providers, with most of the support from the providers they were most aware of; other local landholders, private/agribusiness and grower groups. Fewer respondents received support from government-funded providers and very few received support from non-government groups. There were four respondents who had received other support; private agronomist, share cropper, Greening Australia and WISALTs Inc. Respondents who had used the support in the last five years were also asked how motivated they were to use them (Figure 7-1).

This result shows the same pattern with many respondents strongly or moderately motivated by grower groups, other local landholders and private/agribusiness consultants, with fewer motivated by Landcare and regional NRM groups. Respondents who were not or only slightly motivated to use the providers of support were asked to explain why they gave these ratings. Different value systems, costs, relevance, availability, lack of awareness, and insufficient or unhelpful support reduced their motivation. All respondents were aware of the services of at least one provider of support; one was only aware of the services of grower groups.



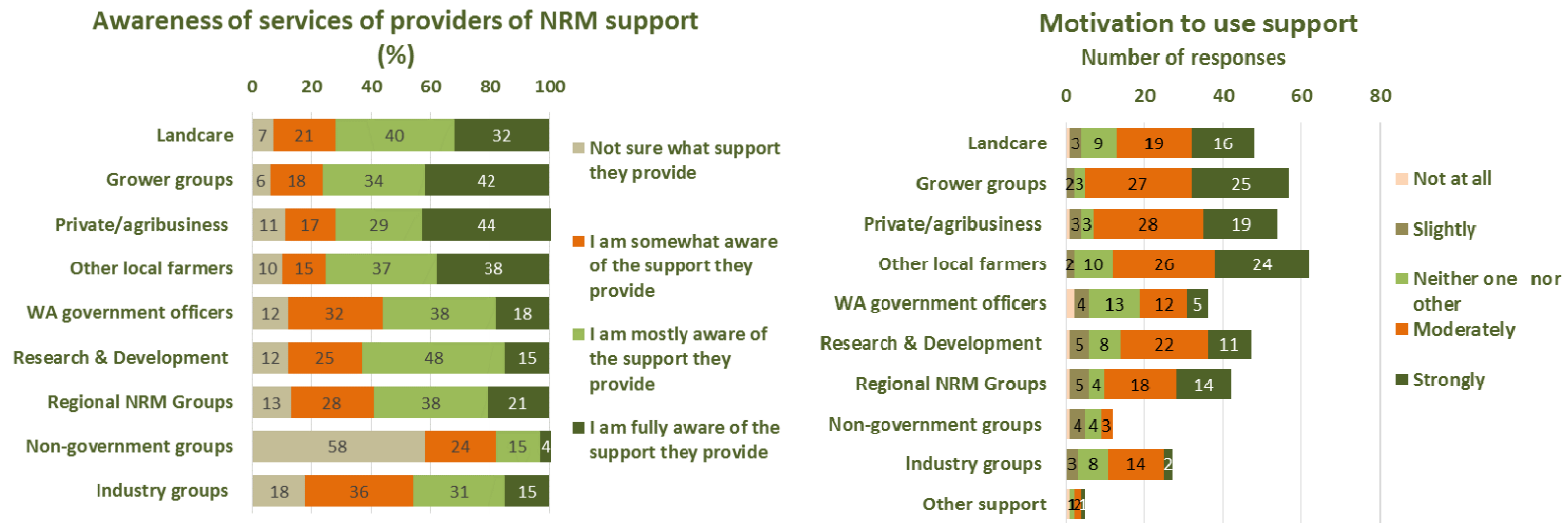


Figure 7-1: Respondents' awareness of providers of support for NRM practices and Motivation to use the providers of support

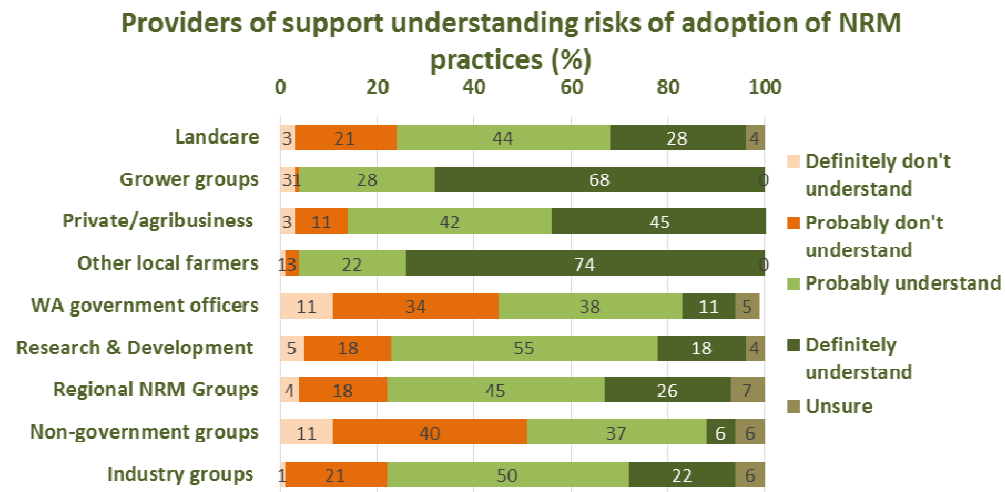


Figure 7-2: Respondents' belief the providers of support understand the risks for them in adopting NRM practices

### 7.3 Risks involved in undertaking practices

To determine attitudes toward the providers of support, most respondents were then asked to rate how well they considered the providers of support understood the risks involved for them in undertaking NRM practices. Similar to previous patterns, Figure 7-2 above shows that all respondents who answered these questions believed grower groups, other local landholders and private/agribusiness understood the risks involved for them in undertaking NRM practices. There were no respondents who were unsure about these providers of support. Forty five percent (n=73) who answered the question for WA government officers and 51% (n=35) who answered for non-government organisations believe they probably or definitely don't understand the risks. Regional NRM groups had the highest number of respondents unsure (7%) about these providers understanding the risks of adoption for them. However respondents who believed they probably or definitely understand, were almost equal in number with Landcare.

Table 7-2: Respondent perceptions of the awareness of, use of and motivation to use providers of support for land management, and of their understanding of the risks involved for landholder adoption of NRM practices.

Respondent perceptions of awareness, use and motivation to use providers of support for land management and of their understanding of the risks involved for landholder adoption of NRM practices (%)				
Providers of support	Moderate/strong awareness (n=85)	Used support	Moderately/strongly motivated	Probably/ definitely understand risks
Grower groups	76	89 (n=65)	91 (n=57)	96 (n=78)
Other local farmers	75	98 (n=63)	81 (n=62)	96 (n=76)
Private/agribusiness	73	89 (n=61)	87 (n=54)	86 (n=74)
Landcare	72	79 (n=61)	73 (n=48)	73 (n=78)
R&D	64	87 (n=54)	70 (n=47)	73 (n=74)
Regional NRM Groups	59	84 (n=50)	76 (n=42)	71 (n=73)
WA government officers	56	77 (n=47)	47 (n=36)	49 (n=73)
Industry associations	46	69 (n=39)	59 (n=27)	72 (n=68)
Non-government groups	19	75 (n=16)	25 (n=12)	43 (n=35)

Further analysis (Table 7-2) shows, overall there was a considerable difference between respondent's awareness of, use of, and motivation to use the providers of support for the adoption of NRM practices and their attitudes toward support understanding of adoption risks. The results show four different levels of support.

1. *Grower groups, other local farmers, and private or agribusiness consultants:* respondents were moderately or strongly motivated to use these three providers of

support they were most aware of, had used most often, and were considered to best understand the risks involved for them in undertaking these NRM practices. Of note was their use of other local landholders was the highest, yet nearly 20% were ambivalent about their motivation to use them again.

2. *Landcare, regional NRM groups and R&D*: these providers of support were very similar with 48 respondents using Landcare and 42 using regional NRM groups and a similar percentage motivated to use them again. They both had moderate use and respondents were moderately motivated to use them and considered they probably understand the risks involved for adoption. Forty seven respondents had used R&D organisation support. The greatest difference overall between respondent's awareness and their use of support was for Landcare with 72% of the total respondents mostly or fully aware and 56% of total respondents using their support.
3. *WA government officers and industry associations*: awareness of these providers showed around half the respondents were fully or mostly aware of their support, yet between 21-31% of respondents did not use them. The difference between their use, and motivation to use these two providers of support was also less with only 59% of respondents who had used industry support and 47% of respondents who had used WA government officers, moderately or strongly motivated to use them again. Also of note was that only half the respondents (n=73) considered WA government officers probably or definitely understand the risks.
4. *Non-government organisations*: few respondents were aware of these providers and only three respondents were moderately or strongly motivated to use their support. These organisations were also considered significantly less likely to understand the risks involved for adoption of these NRM practices.

Overall the results of the current Wheatbelt survey showed that respondents have high awareness and motivation to use private sector support and other landholders who they believe understand the risks for them in adoption of NRM practices. Their moderate use of government and industry-supported organisations, Landcare, regional NRM groups and R&D, is also in line with their moderate motivation and attitude toward them understanding adoption risks for them. Of note was the similar percentage of the total respondents who were aware of WA government support (56%) and regional NRM group support (59%) and the lower rating for the use and motivation to use WA

government support again. There appears little support provided by non-government groups.

### 7.3.1 Significant relationships

#### 7.3.1.1 *Awareness, motivation and adoption risks*

Chi square analysis was also undertaken to determine the relationships between the awareness of the services of the providers of support and motivation to use them, as well as the motivation to use them and their attitude toward providers understanding of adoption risks. These results are displayed in Table 7-3. The results of both analysis were confirmed by Pearson’s correlations which showed weak positive relationships. There were 31 significant relationships altogether for these three questions, however only those significant relationships that were the same for both analysis are shown below.

Table 7-3: Analysis between awareness of providers of support and motivation to use them, as well as motivation to use the providers and their understanding of adoption risks.

<b>Similar relationships between respondents' awareness of and motivation to use providers of support, and their motivation to use providers of support and attitude toward support understanding of adoption risks.</b>		
	Awareness and motivation	Motivation and risk attitudes
Private/agribusiness consultants	( $\chi^2$ 12, N= 48 = 26.42, p<.01)	( $\chi^2$ 16, N= 51 = 39.16, p<.00)
WA Government officers	( $\chi^2$ 12, N= 36 = 22.21, p<.04)	( $\chi^2$ 16, N= 35 = 34.45, p<.00)
R&D organisations	( $\chi^2$ 12, N= 47 = 37.67, p<.00)	( $\chi^2$ 16, N= 44 = 43.38, p<.00)
	Awareness and motivation	Motivation and risk attitudes
Landcare and grower groups	( $\chi^2$ 12, N= 75 = 20.75, p<.05)	( $\chi^2$ 16, N= 48 = 31.12, p<.01)
Grower groups and R&D	( $\chi^2$ 12, N= 75 = 20.74, p<.05)	( $\chi^2$ 16, N= 48 = 28.68, p<.03)
R&D and grower groups	( $\chi^2$ 12, N= 48 =28.10, p<.01)	( $\chi^2$ 16, N= 48 = 39.19, p<.00)
	(r = 0.353)	(r=0.434)

Relationships were found between the awareness, motivation to use and risk perceptions of private consultants and agribusiness agents, WA government officers and R&D organisations suggesting respondents’ awareness and attitude toward these respondents may influence their motivation to use them. Similarly the results showed respondents’ may have a similar awareness, motivation and attitude toward Landcare groups as grower groups, and a similar awareness, motivation and attitude toward grower groups as R&D organisations. The results reinforce the notion that an awareness of the services provided by the different providers of support and their attitude toward them, may influence the motivation of survey respondents to use them.

### 7.3.1.2 *Personal and farm characteristics*

Further analysis was conducted to determine relationships between the personal and farm characteristics and respondents' awareness, motivation to use the providers of support and perceptions about this support understanding the risks involved for them in adopting NRM practices (Table 7-4). Several relationships were found; however results were mostly mixed with the number of responses often too small to provide any meaningful finding. The key relationships overall were farm size and Landcare support.

Farm size:

- Awareness of support showed respondents on larger farms had greater awareness about grower groups than those on smaller farms.
- A negative relationship for motivation to use Landcare support showed decreasing motivation to use their support as the farm size increased.
- Most respondents believed other local landholders understand the adoption risks, but smaller-scale farms were less positive.

Landcare support:

- There were no relationships between respondent awareness and Landcare; however motivation to use Landcare support showed a tendency for households with two key decision-makers to be moderately motivated.
- As above, farm size and respondents' motivation to use Landcare support showed decreasing motivation to use their support as the farm size increases.
- Most respondents believe Landcare support probably understand adoption risks.
- Slight tendency for younger families and empty nesters to be more positive about Landcare understanding adoption risks.

Only one significant relationship was found for regional NRM groups and this also showed mixed results for age, however a small number of older respondents believed they definitely do not understand adoption risks.

Results suggest households with two key decision-makers are motivated to use Landcare support and landholders on smaller farms and in young family and empty nest households having a more positive attitude toward Landcare support understanding of adoption risks. Of note was that age was significantly related to both Landcare and regional NRM groups but no other providers. Results also showed a positive relationship between households with empty nesters who believe other local landholders ( $\chi^2 24, N= 76 = 38.37, p>.03$ ) are less likely to understand adoptions risks. As the demographics showed a tendency for older respondents to own the smaller farms, these results suggest a tendency for older landholders, particularly those on smaller farms to be more positive about Landcare, and less positive about grower groups, other local landholders and regional NRM group support while respondents with larger-scale farms support grower groups more.

Table 7-4: Key relationships between personal and farm characteristics and awareness and motivation to use support providers and their understanding of adoption risks for landholders.

Relationships between personal and farm characteristics and awareness and motivation to use support providers and their understanding of adoption risks.			
Personal/farm characteristic and provider of support	Chi square	Frequencies	Pearson's correlation
		<b>Farm size</b>	
Farm size and awareness of grower group support	( $\chi^2$ 12, N = 85 = 38.59, $p < .00$ )	Respondents on larger farms had greater awareness about grower groups than those on smaller farms.	( $r = 0.406$ )
Farm size and motivation to use Landcare support	( $\chi^2$ 16, N = 48 = 26.06, $p < .05$ )	This negative relationship showed farms under 2000 ha tended to be more motivated to receive Landcare support than farms over 3000 ha.	( $r = -0.450$ )
Farm size and local landholders understanding of adoption risks	( $\chi^2$ 16, N = 73 = 30.58, $p > .02$ )	Although most respondents believe other local farmers definitely understand the risks for them in undertaking an NRM practice, there were less than expected in the smaller 1-499ha range	
		<b>Landcare</b>	
Key decision-makers and motivation to use Landcare support	( $\chi^2$ 16, N = 48 = 27.90, $p < .03$ )	Very mixed responses however there were many more than expected households with two key decision-makers who were moderately motivated.	
Age and Landcare understanding of adoption risks	( $\chi^2$ 20, N = 78 = 40.09, $p > .00$ )	Very mixed attitudes with many believing they probably understand	
Household structure and Landcare understanding of adoption risks	( $\chi^2$ 24, N = 78 = 51.92, $p > .00$ )	Results were mixed, however young families and empty nesters were more positive about Landcare understanding the risks	( $r = 0.210$ )
		<b>Regional groups</b>	
Age and regional NRM groups	( $\chi^2$ 20, N = 73 = 36.15, $p > .01$ )	Mixed responses, however a small number aged 66-75 yrs believed these groups definitely did not understand the adoption risks.	

## 7.4 Influence of regional NRM groups

It was also thought important to explore the influence that regional NRM groups in particular have on the adoption of NRM practices (Figure 7-3). As such respondents were asked in the first question their stage of adoption of the selected NRM practices and secondly they were asked whether their consideration or adoption of the practice was in any way a result of information, activities or supported projects specifically provided by regional NRM group staff. Many respondents (62%) were influenced by regional NRM group extension for these practices.

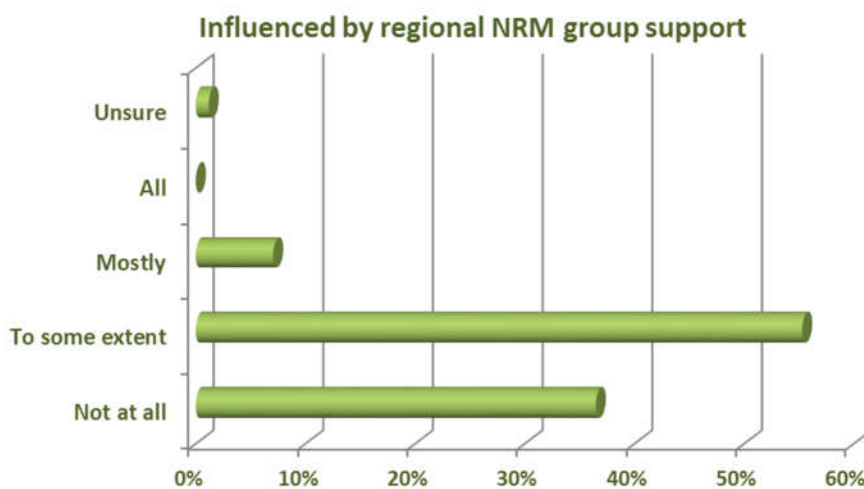


Figure 7-3: Adoption of NRM practices influenced by regional NRM group extension.

Price and Leviston (2014) found trust and influence measure the same latent concept, suggesting the results of this measure also include respondents' trust in the regional NRM groups. Analysis showed a moderate correlation between the influence of regional NRM groups in adoption of these practices and respondent trust in the care that regional NRM groups have for their community (section 5.2.2.2). There was also a weak positive Pearson's correlation between motivation to use regional NRM group support and respondent trust in the care that regional NRM groups have for their community ( $r = 0.246$ ). These relationships show a moderate level of trust in these groups has a moderate influence on adoption of NRM practices, suggesting further investigation may be worthwhile.



## 7.5 Government funding

Government funding to incentivise landholders to participate in the practices promoted by regional NRM groups is a key part of most projects. Funding, in relation to this survey, is mostly provided for materials such as fencing materials or seedlings. The purpose for the following two questions was to find out the level of influence funding from regional NRM group and Landcare programs has on respondents' adoption and as such there was no time limit for the questions (Table 4-5). All respondents were firstly asked which NRM practices they had received government funded 'Landcare grants' for in the past (Figure 7-4). The results showed that:

- Funding was mostly accessed for native or other vegetation planting or management.
- Around 69% (59) of respondents received government funding, mostly for fencing native vegetation to control stock access (43%), planting native vegetation or encouraging regrowth (40%), planting grazing shrubs (23%) and single or multiple species agroforestry (14%).
- Funding was received for all practices except VRT and controlled traffic farming.
- Nearly one third of respondents did not receive any funding.

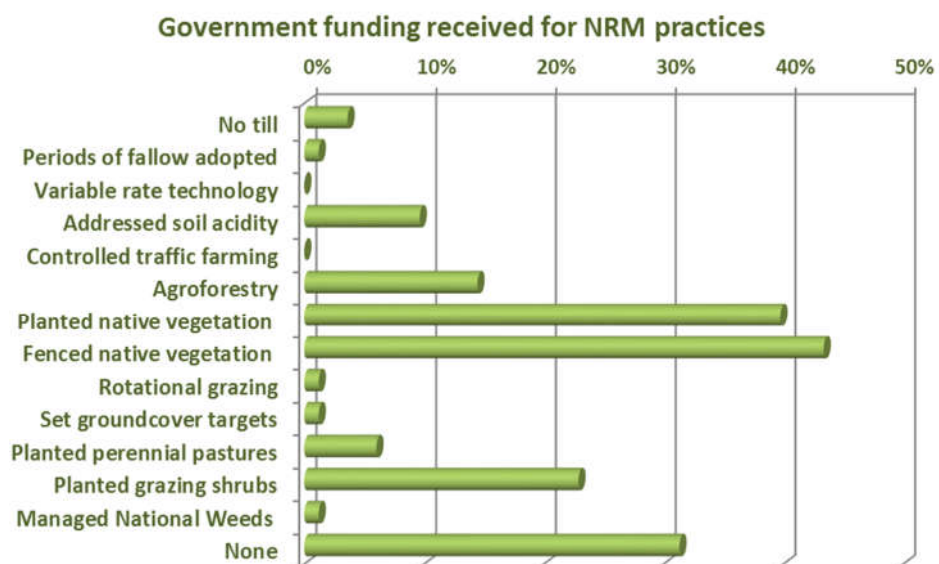


Figure 7-4: Government funding respondents received for adoption of NRM practices.

Of note was that only 8% of respondents who received government funding were not influenced at all by extension from regional NRM groups. Analysis conducted to determine whether there was a relationship between receiving regional NRM group extension and government funding found a marginally significant relationship of  $p < .07$ . However this suggests strong potential for a relationship in further research. Cross tabulation results also showed that over one third (35%) of respondents who did not receive government funding were influenced to some extent by extension services from regional NRM groups, suggesting that regional groups don't necessarily need to use funding to influence adoption.

Bivariate analysis showed farming experience influenced access to government funding ( $\chi^2 15, N = 83 = 93.15, p < .01$ ). Almost half (49%) of respondents had over 30 years' experience, and of these 71% had received government funds, mostly for planting and fencing natives and planting grazing shrubs. However age had no significant relationship with a fairly even spread of access to funding across all age groups. The result suggests that many who received government funding, are likely to have accessed it in previous NRM programs.

### 7.5.1 Likelihood of adoption without funding

To determine the influence of government funding to encourage adoption of NRM practices, respondents who had received government funds were then asked their likelihood of undertaking the different practices without this financial assistance (Figure 7-5). The results show that 43% of respondents received funds for fencing native vegetation and 40% received funds for planting native vegetation and that nearly half of this work was somewhat unlikely or unlikely to be undertaken without government funding. Ecker et al. (2012) suggests the greater use of government funding for planting and fencing native vegetation may be due to the ease of access to these funds because of the higher public benefits than other NRM practices. The high percentage of respondents who were likely to have undertaken practices to address soil acidity without funds (71%) probably reflects the relative advantages of adopting this practice (Appendix A).

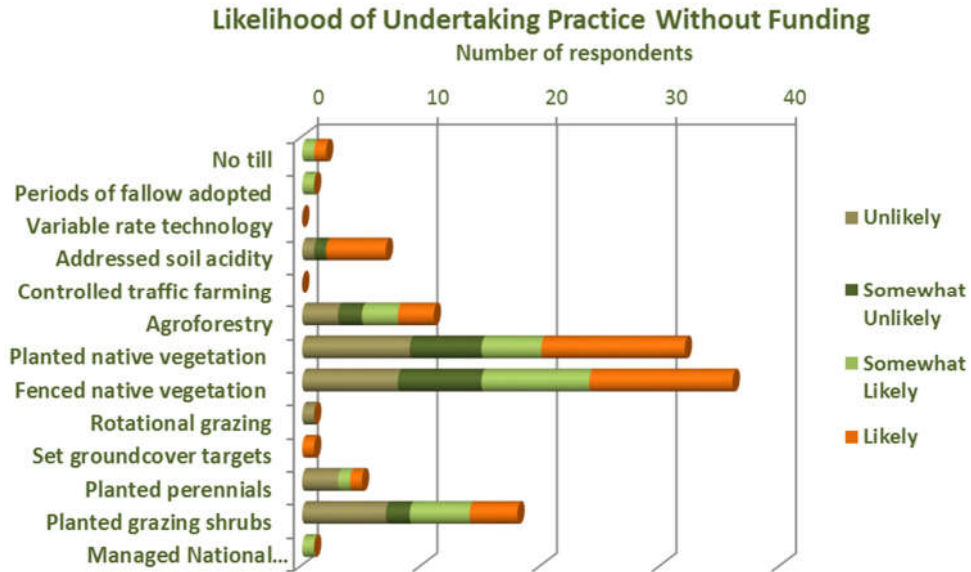


Figure 7-5: The likelihood of a respondent undertaking a NRM practice without government funding.

No significant relationships were found between the questions relating to government funding and respondents' motivation to use the providers of support so it was not possible to answer the question in Ecker et al (2012) regarding relationships between the motivation to use the providers of support and access to government funding (Table 4-5).

## 7.6 Discussion

### 7.6.1 Comparison with literature

#### 7.6.1.1 *Providers of support*

##### 7.6.1.1.1 *Other landholders and grower groups*

Both other landholders and grower groups were used for support by most respondents who were moderately or strongly motivated to use their support again and these providers were believed to probably or definitely understand the risks in undertaking NRM practices. Landholder preference to learn from other landholders is reported by other researchers (Pannell et al. 2006). American studies have also found around 40% of respondents always or usually prefer information from other landholders (Vergot, Israel, and Mayo 2005) and the connection with local landholder groups has a significant influence on adoption (Baumgart-Getz, Prokopy, and Floress 2012).

Wright et al. (2012) also found over 70% of WA respondents rated other landholders and grower groups very or extremely important for general farm information. This was confirmed by GRDC research showing respondents in WA were significantly more likely to rate grower groups as a major influence on practice change than other regions of Australia (Watson and Watson 2014). The importance attached to the support provided by other local landholders and grower groups suggests a relatively high normative influence amongst WA Wheatbelt landholders.

However, Kacans et al. (2014) found that other landholders were rated highest for cropping practices. Around one third of broadacre and dairy respondents were motivated by support for crop management, and around one third of those rated peers or neighbours the most important provider of support for crop management decisions, while their influence on grazing management was less (Table 7-5). They also showed grower groups provide the greatest number of extension activities for landholders (Table 7-6). However, the demographic analysis for the current study shows that respondents with smaller farms may have less awareness about grower group support than those on larger farms and that older respondents on smaller farms may be less positive about support from grower groups and other landholders than younger respondents (Table 7-4); suggesting these groups have limited influence on this sector of landholders.

#### **7.6.1.1.2      *Private/agribusiness***

Survey results highlighted extensive use of private or agribusiness consultants in the last five years with only 36% of respondents not using them. Analysis of relationships also showed respondent awareness and attitude toward these providers influences their motivation to use them. The high use of private or agribusiness consultants is consistent with recent results from Hollamby et al. (2013) who studied adoption trends in the Northern Agricultural Region of WA from 2006-2012 and found that most (72%) used private consultants on an ongoing basis. They also found this practice had not changed within this time period.

The 2014 and 2015 GRDC surveys provide more in-depth evidence of WA grain growers' use of paid consultants. Their 2015 survey showed nearly two thirds of growers in the central Wheatbelt paid for a private consultant, which is more than any other Australian state. However their survey also showed the use of private consultants

varies with 61% using them in the WA central region (highest in Australia) 58% in the WA southern sandplain region, 48% in northern regions and 40% in eastern regions. It also shows the use of private consultants varies from year to year. Of note was that use of private advisors was not tied to profitability as profit over the preceding 5 years in the central region was 51% while the eastern region had 60% profit. As such the difference may be influenced by other factors including remoteness. However the survey did warn of the small sample for the eastern region (Watson and Watson 2014; 2015). Recent research on seed purchase suggests that price has a strong influence on the use of private consultants, with greater potential for those landholders driven by price to be influenced by agribusiness agents than private consultants, sometimes to the detriment of their productivity. This study also highlighted a difference in the advice provided; private consultants provide farm system level advice compared to product level advice from agribusiness agents (King and Nettle 2013).

Llewellyn, D'Emden, and Kuehne (2012) also found no-tillage adoption was significantly related with the use of private consultants, while the GRDC survey (Watson and Watson 2015) showed that respondents paying for consultants were younger and had substantially larger areas of land in cropping than respondents who did not use them (3,574ha users in WA vs 2,489ha non-users in WA). This is consistent with Wilkinson, Barr, and Hollier (2011) who found production-oriented consultants are seen as value for money for large-scale farms. Kacans et al. (2014) also found private/agribusiness consultants were highly active in providing extension services (Table 7-6) mostly for production-oriented activities (Table 7-5). Analysis in the current study showed no significant relationship between farm size and private/agribusiness consultants, however interviewees mentioned how they were not seen as value for money for smaller-scale farms (section 7.8.1.2).

Current Australian research also shows that private sector advisory services are less prevalent in the broadacre livestock industries than cropping (Keogh and Clementine 2014). Stone (2005, 22) also found that private consultant services declined as the percentage of livestock to cropping ratio increased. Farms producing only grain had high consultant input while those with equal emphasis on grain and livestock production showed 'minimal outside advice and input'. His respondents' also commented that the cost of advice for wool production was too high. The study showed

withdrawal of Australian government livestock services was not being replaced by the use of private consultants and there were few other providers for these services. Consistent with recent research (Wilkinson, Barr, and Hollier 2011) the author identified a growing information gap between progressive and traditional livestock producers, with traditional producers turning to the Internet for information. The lower accessibility and relevance of the methods of support for grazing management found in the current study supports these findings.

#### **7.6.1.1.3            *Landcare/regional NRM groups***

The disparity in the current study between respondents' awareness of Landcare groups and their use of Landcare groups for support is likely due to the national branding of the program over the last few decades and the decrease in Landcare groups in recent years (Love 2013). However this difference also highlights that awareness of a provider does not necessarily lead to use. Landcare was used more often than regional NRM groups with 56% using Landcare in the current study and 49% using regional NRM groups. Kacans et al. (2014) study also showed that Landcare groups provided a greater number of activities (Table 6-7) and their support was used by a considerably greater number of respondents for all four categories of NRM practices than regional NRM groups (Table 7-5). However the current study found regional groups were shown to have considerable influence on landholder adoption and analysis showed significant relationships for trust in regional NRM groups. Of note was that Kacans et al. (2014) found support from both these groups was sought mostly for public-good practices such as native vegetation and WoNS management.

The awareness and participation in Australian government programs also has a bearing on attitudes and behaviour toward these two groups. This was measured by the ABARES studies and demonstrated that participation rates were significantly lower than awareness of these programs. For instance 33% of broadacre respondents were aware of Caring for our Country in 2012 and only 15% participated (Kacans et al. 2014, 56). Participation in these programs did however improve skills and knowledge, and positively influenced adoption of all NRM practices except periods of fallow and managing WoNS. Other studies have found significant positive relationships between government support and adoption of NRM practices (Curtis and Mendham 2011). However researchers point out the difficulty for landholders to attribute any practice

change to a particular program or extension activity ‘due to the multitude of social and informational processes’ that landholders are exposed to (Mallawaarachchi and Green 2013; Marsh and Pannell 2000, 616). Private and public organisations have recognised this problem and in recent years considerable effort has gone into branding research findings and services and measuring the level that other providers of support identify where particular research originates from, for accountability purposes (Watson and Watson 2014).

Analysis in the current study shows respondents aware of Landcare services who have a positive attitude toward them and are motivated to use them, may also have the same awareness, attitude and motivation to use grower group support (Table 7-3). Attitudes toward Landcare group support was also significantly influenced by a range of personal and farm characteristics (Table 7-4). Age was found significantly related to both Landcare and regional NRM groups and literature highlights how age can affect NRM extension. Vanclay and Lawrence (1995) suggest the difference in ages between landholders and NRM extension, as well as landholder’s past negative experiences with extension personnel, often makes them sceptical of their advice. Rogers et al. (2013) confirms that experience and extension expertise is essential for influencing adoption. As such, the relatively high turnover rates and young NRM extension personnel working for government programs makes age a particular issue for adoption of NRM practices. The results overall highlight that Landcare and regional NRM group support is likely influenced by different values and attitudes from those of other providers and a wide range of personal and farm characteristics.

The current study did not ask respondents about group membership and how this might affect their use or motivation to use providers of support. Kacans et al. (2012) found that group membership was positively related to adoption of all practices except period of fallow and managing WoNS. However GRDCs annual surveys ask WA respondents about membership of a formal group which reveal relatively low levels of group membership amongst grain growers. These surveys have shown a downward trend in recent years with only 34% of respondents belonging to a formal discussion group in 2015 (down from 40% in 2014).

Sixteen per cent were members of a farming systems group (grower group), 9% were members of a Landcare group and 11% were members of a state farming association

(which may be categorised in the current study as a grower group such as WANTFA). As such the results suggest respondents in the current study may have included support they used previous to the five years stipulated in the survey and/or, as commented on by interviewees, they receive information, advice or support from these groups in ways other than membership. This is not consistent with Toric (2005) who suggested information from groups was mostly restricted to group members, but the rise in Internet use since this time may have changed access to this information.

Additionally, Marshall (2008) investigated how trust influences motivation to use groups and found that only around half the respondents trusted their regional NRM group compared to their subregional group. However the similar responses in the current study for the use of, motivation to use and understanding of adoption risks for Landcare and regional NRM groups, the significant relationships shown for these groups in Table 7-4, and the significant relationship found for trust in regional NRM group support (section 7.4) suggest that respondents have similar relationships of trust with both these providers of support. The differences may be due to changes in Landcare and Catchment Management and regional NRM group activity since this time. However further research investigating the difference Internet use in the last decade has made to the way landholders use these providers may also be beneficial.

#### **7.6.1.1.4 R&D**

Support for R&D organisations was almost as high as for Landcare indicating the importance respondents attach to the support provided by these organisations. However, GRDC is an industry funded organisation with the key focus on improving production for grain growers and as such including this organisation in R&D support providers likely increased respondents support in the current study. Alternatively, Kacans et al. (2014) found R&D support was the least used provider for each of the four practice categories. However their survey did not include non-government groups and industry organisations. The difference in survey results likely highlights the different interpretations placed on what NRM research and development consists of.

There were few questions that directly related to NRM and longer-term land management issues in the GRDC surveys. However, as was suggested by one interviewee (male 41-55 yrs) in the current study, their practices are ‘all tied in together because obviously we want to grow the most profitable, sustainable crop which goes



hand in hand with managing the resource'. This makes a direct comparison of the GRDC survey results with the current study problematic as it is not possible to effectively separate responses in relation to production from those that include NRM and long-term land management activities. The GRDC surveys include an investigation of grain growers' satisfaction with GRDC themselves. Their results show an upward trend since the commencement of these surveys in 1992 in grain growers' satisfaction with the support provided by this industry organisation. However their 2015 survey shows satisfaction with their performance varies significantly in WA, with one region rating their performance highest of all Australian states while the other regions rated them lower than almost all the other states. This was shown to be due to the relevance of their research to WA, particularly in the eastern and central zones.

Their 2014 survey included questions about addressing longer-term sustainability. The results revealed only 35% of respondents in the central and northern regions of WA rated satisfaction with GRDC fairly to very high for investing in activities for public good compared to 66% for the highest Australian region suggesting GRDC may not be supporting NRM very well in these regions. The GRDC 2014 survey also highlighted the need for improvement with many WA respondents believing R&D organisations were not addressing long term sustainability as well as most other states. It also showed 90% of the 319 grain growers in WA rated R&D as critical for their business (Watson and Watson 2014; 2015).

Kacans et al. (2014) also found that along with policy, climate change and resource availability, R&D is a key influence on adoption of NRM practices. The strong relationship found in the current study suggests the awareness and attitude toward R&D organisations influences respondents' motivation to use them. The relationship found with grower groups also reflects the close connection between these two providers with many of these groups supported by funding and other services such as information provided by the research undertaken by these large industry R&D organisations (Table 7-4).

#### **7.6.1.1.5 WA government**

The level of motivation for WA government support in the current study is similar to GRDC survey results (Table 7-7) with lower motivation to use these providers than most others. The current study also showed attitudes toward these groups is linked to

their motivation to use them with less than half those respondents who had used their support motivated to use them again and the second highest percentage of respondents believing they do not understand the risks involved in NRM adoption after non-government groups. However Kacans et al. (2014) found government support slightly more influential overall, with respondents moderate use of their support for conservation agriculture and grazing and native vegetation management, and highest use for managing WoNS (Table 7-6).

These results may be due to a difference in state agency support in other Australian states and perhaps reflects the difficulty of providing government support to landholders over the vast area of WA. Interviewees in the current study also commented that all support in the eastern regions of WA is limited. Previous WA Wheatbelt studies also show higher importance for government extension. Toric (2005) found the WA Department of Agriculture was the most important provider of support for improving soil erosion and Jenkins (1998) showed 71% of respondents would use them in the future for support for remnant vegetation. The differences in the current study clearly indicate the decline in WA government NRM extension within the last decade and this is supported by interviewee comments.

#### **7.6.1.1.6            *Industry and Non-government***

These two providers of support were not included in the ABARES studies. The results reflect the different type of support provided by these providers. Industry associations provide R&D and funding support for research, but their support also consists of providing information, business training, quality control mechanisms, commodity market assistance and government lobbying support for the industries they represent. The size and profitability of the industry they represent appears to reflect their size and services they provide. Non-government organisations only provide support for conservation. The low awareness, use and motivation to use these providers suggests support from these groups may have greatly reduced since the early Landcare and NHT years. The large area of land involved also likely makes it difficult for non-government groups to assist Wheatbelt landholders. Advice and support for planting trees is still done by local nurseries in a few areas however much of the extension is provided by biodiversity officers working for regional NRM groups or is provided through

specialised grower groups such as the Oil Mallee Association, and WA Sandalwood Plantations or Avongro.

### 7.6.1.2 *ABARES studies*

The current Wheatbelt survey did not investigate the motivation for use of the providers of support for each of the five categories of NRM practice, as the ABARES studies had done this. Their studies found that different providers of support influenced different practices (Table 7-5) (Kacans et al. 2014) with less than a third of broadacre respondents seeking support in 2012. Broadacre and dairy respondents used private consultants and agribusiness agents most for managing crops, livestock grazing and WoNS, other landholders were used most for crop and grazing management, while Landcare and regional NRM groups and government extension officers were mostly used for native vegetation and weed management. As such these authors suggest ‘service providers have speciality areas in terms of which practices they support best’. (Kacans et al. 2014, 87).

Table 7-5: Broadacre support sought and the highest three providers for each NRM practice area for broadacre and dairy landholders.

Broadacre support sought and the highest three providers for each NRM practice area for broadacre and dairy landholders (Kacans et al. 2014, 63,25-26)		
Practice area	Sought broadacre support (%)	Highest three providers of support for broadacre and dairy
Crop management	31	Private consultants/agribusinesses (41%), other landholders (31%) and farmer production groups (21%)
Grazing Management	18	Private consultants/agribusinesses (38%), government extension (21%) and peers or neighbours (21%)
Native vegetation management	27	Landcare (58%) and NRM groups (20%) and government extension officers (12%)
WoNS management	10	Government extension officers (27%), private consultants/agribusinesses (26%) and Landcare groups (25%).

Source: Kacans et al. 2014 24-26.

Other studies concur with the ABARES studies’ findings that landholders use a range of different providers and methods of support for different practices (Tarnoczi and Berkes 2009; Toric 2005; Jenkins 1998). Studies have also shown that provider support is used for different purposes. For instance McKenzie (2011, 112) found other local landholders were important for independent, practical and unbiased advice, grower groups were important for ‘enthusiasm, support and lesson sharing’, and private consultants were important as a provider of expertise and a tool for decision-making. Her research is consistent with adoption literature by Cary, Webb, and Barr (2001, 20) who observed that ‘other farmers were often sought out for background

information and for information on practical issues related to farming’, while extension officers and consultants were sourced ‘for detailed technical advice’.

The ABARES studies also provided information that links both providers of support and the some of the methods they use (Table 7-6). Respondents were asked who the delivery agents were who provided the learning activities they participated in during the previous two years. Grower groups and private consultants and agribusiness provided a similar number of field days, grower groups provide most of the trials and all these providers provide a similar number of training courses and workshops. Landcare groups provide around the same number of trials as private consultants and agribusiness while Regional NRM provide more training courses than Landcare groups.

These results demonstrate that those providers of support rated highest in the current study were also those that delivered most of these activities for broadacre and dairy respondents in the ABARES studies and that regional NRM and Landcare groups rated moderately in the current study and also provided a moderate number of the activities. This finding provides evidence that the use and motivation to use the providers of support equates with the number of activities and events provided by these providers. They also show however, that state government officers provide very few field days or trials but a moderate number of training courses and workshops. Musawi (2013) also found DAFWA was used more often by WA landholders for learning resources than GRDC or grower groups, even though WA respondents in the current study suggest there is relatively low use and motivation to use WA government officers.

Table 7-6: Provider of support for methods of NRM extension for broadacre and dairy industries in Australia.

Provider of support for methods of NRM extension (Kacans et al. 2014, 30)			
Delivery agent	Training course		
	Field days (%)	or workshop (%)	Trials (%)
Private consultant or agribusiness agent	32	26	16
Local farmer network	37	24	37
Regional NRM group/CMA	3	9	10
Landcare group	5	6	18
State government agency	4	17	3

Source: Kacans et al. 2014, 30.

Kacans et al. (2014) also investigated the production and/or NRM focus of these activities which showed considerably more activities had a production focus particularly for trials with 85% focused on production and only 11% of the trials with a combined production and NRM focus. They also showed 48% of the field days and 34% of training and workshops had a combined focus. Very few had a sole focus on NRM or environmental issues. Overall the results showed a low to moderate number of providers of support were combining NRM in the activities they provide to landholders.

### **7.6.1.3                    *Other studies***

Survey respondents' awareness, use of and motivations for those providing support for adoption of NRM practices in the current study were also consistent with similar studies undertaken in WA. For instance, in a recent study of WA landholders, Wright et al. (2015) Musawi (2013) and the GRDC 2012 survey (Watson and Watson 2012) all found that private consultants, grower groups and other local landholders were the most important providers of support for general farming information to change a practice, solve a problem or influence practice change. WA government officers were less important than other community members and family while agribusiness agents were the least important (Table 6-7). Investigating providers of information Musawi (2013) found that WA landholder groups and individual landholders were more important than private companies, but private companies remained more important than extension workers or government officers.

However the studies also highlight how the phrasing of these providers make a significant difference to the ratings, ie private consultant and agribusiness resellers in Wright et al. (2015) were first and last respectively, the GRDC survey below (Table 7-7) shows them second and second too last, while private companies in Musawi (2013) were in the middle. When this is compared with the current study where private and agribusiness providers were combined, it suggests these two providers of support may have very different levels of importance for landholder support and respondents may have had difficulty responding to this variable. The studies support literature's call for a clearer definition for the providers of support and their role.

Although it was not possible to accurately compare many findings between the ABARES studies and the current one, the GRDC surveys provide evidence for

comparing motivation for some providers. These surveys asked WA respondents whether any of the providers of support had motivated them to make changes to their grain enterprises in the last two years, and what the longer term influence on sustainable agriculture of each provider of support was. When the results of the GRDC 2014 and 2015 surveys are combined with the results from the current study for this question (Table 7-7) the surveys show similar percentages of grower groups, private consultants and other local farmers motivating practice change, with less influence by government departments. Their results therefore show similar percentages of respondents overall are motivated by these providers and the priority given to the motivation to use them is the same as the current study.

Table 7-7: Providers of support with a major or minor influence on practice change and motivation for their use.

Providers of support (2015)	GRDC Surveys Western Region 2014, 114 & 2015, 50 (%)			Wheatbelt Survey (%)	
	Providers motivating change (n=319)	Major	Minor	Providers influencing longer-term sustainability (2014) (n=319)	Moderately/ strongly motivated
Grower group/forum	80	38	42	20	91 (n=57)
Paid advisor	76	46	30	32	Private/agribusiness 87 (n=54)
Local leading growers	70	25	45	25	Other landholders 81 (n=62)
GRDC information	66	14	51	43	R&D 70 (n=47)
Retail agronomist	50	18	33	17	
Government department	44	8	36	14	WA Government 47 (n=36)

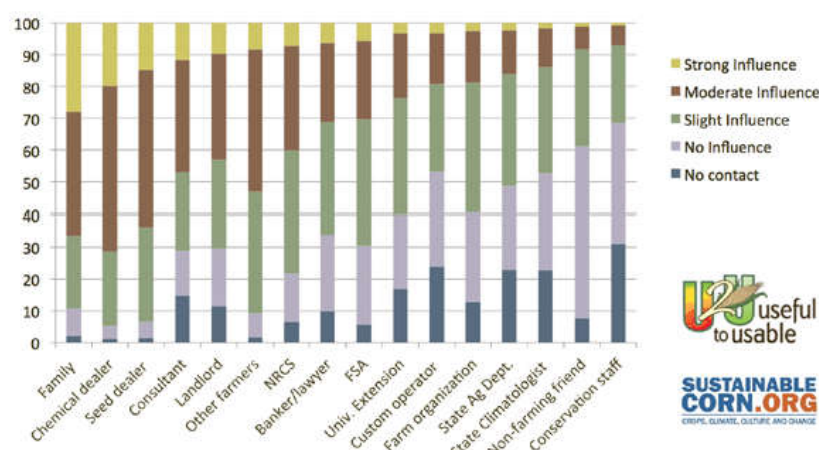
Source: Watson and Watson 2014; 2015, 114, 100 & 50.

However the GRDC surveys show that apart from private consultants, the influence of these providers was predominantly minor, yet the current study showed most respondents who had used the providers were highly or moderately motivated to use the services of the first four providers. As such the level of motivation appeared to be higher in the current study. Their study also highlights the strong influence of private consultants on landholder attitudes and behaviour for grain production. Additionally 92% of WA respondents were shown to have undertaken practices for long-term farm sustainability, but the providers of support have significantly less influence over the adoption of these practices. Of importance for this study was that respondents believed the influence of private consultants and agribusiness advisors on adoption of sustainable activities had increased between 2012 and 2014 to 32% (Watson and Watson 2014). However it is not clear what practices they are rating.

The authors point out the GRDC's influence on practice change in 2015 was significantly higher than the previous year (66% compared to 56%) and suggest respondents may have used their survey responses 'to send a message of support for their R&D Corporation while it is in the political spotlight' (Watson and Watson 2015, 45). Their results therefore appear to be affected by selection bias, however comparison with the current survey suggests that R&D are a relatively important influence on decision-making for those respondents that use their services. The difference in the size and range of the samples may also have affected the results.

A recent American study by (Prokopy, Towery, and Babin 2014) asked a similar question about the influence of groups and individual extension agents providing support to corn producers. The following graph (Figure 7-6) shows responses with similarities to WA studies with private consultants and other local landholders rated highly and state government agencies rated considerably lower. The Natural Resources Conservation Service and university extension staff also have a moderate influence; similar to Landcare and regional NRM groups in the current study, while conservation groups are also rated last. However the high level of influence of retail suppliers is of note, particularly compared to the study by Wright et al (2015) where respondents rated this provider of support last as a source of general farming information but second for pest and disease information. Farm organisation may apply to groups such as grower groups but it is difficult to know the number and purpose of these organisations. Overall the graph highlights similar changes in private and public sector support occurring in Australia in recent decades.

Q: Please indicate how influential the following groups and individuals are when you make decisions about agricultural practices and strategies



Influence of groups and individuals on farmer decision making about agricultural practices and strategies. Results from a 2012 survey of Midwestern corn producers conducted by Useful to Usable (U2U) and SustainableCorn.org

Figure 7-6: Influence of providers of support on landholder decision-making about agricultural practices and strategies.

Source: Prokopy, Towery, and Babin 2014, 3.

Note: NRCS is the Natural Resources Conservation Service and FSA is the Food Services of America.

Wilkinson, Barr, and Hollier (2011) also asked respondents to list the services they had used and who the provider of those services was. Their study asked about government, private consultants or agribusiness agents and found around one third of respondents did not use any of these providers. Of these, 61% found all the information they required by undertaking their own research and only 28% of these respondents used other landholders or grower groups as their main source of information. Alternatively, the current study found there were no respondents who did not use a provider of support selected for this study, however eight respondents (9%) only used one provider; three only used Landcare services, while grower groups, private/agribusiness consultants, other local farmers, WA Government officers and non-government groups were the only providers used by the other five.

#### 7.6.1.4 Risk

Correlations between the awareness, motivation and attitudes toward support understanding of adoption risks for NRM practices confirms that risk perceptions influenced respondents' attitudes toward the use of the providers of support (Table 7-2). Nicholson (2015) argues that landholders have traditionally developed their own risk strategies with little understanding or assistance from those working in extension, however apart from WA Government officers and non-government groups,



respondents show they believe most providers of support have a moderate or high understanding of the risks of adoption. The low confidence in WA government officers understanding of the risks involved is probably influenced by greater emphasis of current state government focus on regulatory control, and negative social norms toward government. Interviewees also confirmed a lack of similar values for non-government organisations; suggesting these two providers lack the trust essential for developing supporting relationships for extension (section 7.8.2.4).

Literature points out that risk and uncertainty are perceived differently by different landholders and are one of the key factors that affect landholders achieving their goals and aspirations (Pannell et al 2011; Greiner and Gregg 2011). For instance risk perceptions influence identity with the farm such as whether it is a business asset for production purposes or a family farm with inheritance value, which in turn influences decision-making and the choices made (O’Kane 2009). These factors likely contributed to the results, and therefore how and why perceptions of risk influence use and motivations toward the use of providers of support are worth investigating further.

#### **7.6.1.5                    *Personal and farm characteristics***

The ABARES studies did not analyse personal and farm characteristics with the providers of support. Other studies have used a range of explanatory variables to determine the influence of personal and farm characteristics on diverse topics such as climate change practices (Donnelly et al. 2009) the regional delivery system (Marshall 2008) landholder NRM attitudes and behaviour (Toric 2005) drivers and constraints to adoption of NRM practices (Cary, Webb, and Barr 2001) and native vegetation attitudes (Jenkins 1998). However, the problem with the selection of variables used to measure the influence of personal and farm characteristics on practice change is highlighted by Pannell et al. (2011, 17) who commented ‘It seems that in the empirical literature every measurable characteristic of farms and farmers has been found to be statistically related to some measure of adoption of some innovation’. These authors suggested a range of characteristics shape the relative advantage of the practice. Hence the motivation and use of those that promote the adoption of an NRM practice must also be influenced by these characteristics. Relationships found in the current study suggest further studies that enable generalisations to be made may be worthwhile.

### **7.6.1.6                      *Funding***

Government incentives have been part of NRM programs since the beginning and reports clearly outline the problems of effectively targeting investment and providing accountability for public investment (section 2.4.2). In 1996, Jenkins investigated the effectiveness of funding schemes in prompting native vegetation replanting and fencing in the southern regions of the Wheatbelt. Similar to this study, they also found that around 60% of respondents who had received funding would have completed the work without the funding. It therefore appears that WA Wheatbelt studies, including the current study, support findings by Ecker et al. (2012) that financial assistance is of relatively low importance in landholder motivation for adoption of native vegetation practices but very low importance to other NRM practices. Similarly, other studies have found that ‘only part of the implementation of NRM by landholders can be directly attributed to investment by NRM programs’ (Curtis and Mendham 2011, 153), and for practices with lower private good, community recognition and NRM extension support are often more important than financial assistance (Januchowski-Hartley et al. 2012). However, as Ecker et al. (2012) point out, this may also be influenced by policy funding of public-good practices.

Authors also inform us that when incentives are provided to improve adoption of practices with public benefits, the practices may not be implemented in ways that are consistent with the desired outcome. As such the policy may not achieve its desired outcome (Kaine et al. 2011). Klerkx and Jansen (2010) also found that incentive vouchers were not effective in encouraging landholders to demand NRM support and tended to reward those who were already motivated to undertake NRM practices; thereby undermining the basic philosophy behind NRM initiatives. Other authors highlight that non-financial motivations, such as stewardship ethics, that influence landholders’ decision making are often excluded from policies. They point toward the important role of regional NRM groups in developing effective strategies with a local context that harness landholders’ intrinsic motivations for conservation (Greiner and Greg 2011). Pannell et al (2011) recommend those providing NRM extension ensure they understand when funding is appropriate, suggesting that sometimes it is better to do nothing as in some instances the environmental benefits are insufficient to warrant investment.

## 7.7 Attitudes and behaviour toward providers of support

### 7.7.1 Benefits of NRM extension

In order to understand the motivations of landholders to use the different providers of support, survey respondents were asked what they considered were the benefits apart from financial, they received from support. Their comments related to six key themes suggesting the benefits of support benefited:

1. *Decision-making*: by providing; information, more variables, diverse opinions from other people, on-farm analysis and assistance with planning, independent advice, new ideas that reduced the stress of decision-making, knowledge for more balanced decisions and a sounding board.
2. *Knowledge building*: by providing; access to useful, timely, new and novel research information, opportunities to attend trials, field days, workshops and seminars that provided the latest opportunities. Support also provided productivity and NRM information about; new machinery/technology and up-to-date production techniques, grain marketing, crop varieties for better yield, technical information about land use issues, information on fertiliser options and dryland crop management, ideas to increase returns while reducing costs, options for increasing profit by improving soil health and how to get the most out of the land and look after the soil and bush on a limited budget.
3. *Personal support*: by providing; valuable backup and assurance that provided, encouragement, confidence, motivation and moral support to implement plans that made the farm more sustainable going forward, shared information of the successes and failures, increased social networks of support, particularly with peers.
4. *Practice change support*: by assisting respondents with; how to implement farm system changes, how to combat changing weather conditions, improving farm resilience, reducing salinity levels, managing stock numbers on certain paddocks and improving soil health and drought security that enabled livestock numbers to be retained.

5. *Implementing on-ground work*: by setting up of ground works and trials in the local environment, and providing plants, machinery and labour to revegetate areas.
6. *Improving natural resources/social*: by providing support and information on; funding grants and plant species that grow in the area, protection of wildlife habitat and increasing biodiversity by building corridors without too much interference on productivity, improving the beauty, integrity and aesthetics of the farm and country, and improving social inclusion and awareness of the plight of farmers.

One survey respondent commented that the provision of support ‘Provided community events and forums which also help inclusion and expression for locals. It is good to see knowledge and experience shared and available to the local farmers’ (female 41-55 yrs). Ecker et al (2012) also found 13% of respondents rated government programs and NRM extension as improving community interaction. Similar to the current study the main benefits in their study were from gaining skills and knowledge (43%), implementing on-ground works (30%) and changing management practices (16%).

Analysis of their 2012 survey showed a 14% increase since 2010 in benefits from participation in Caring for our Country and also that ‘adopters were more likely to have participated in an Australian Government program than non-adopters’. They suggest this is likely due to landholders with land degradation problems seeking information through these programs and as such participation improves their capacity to effectively manage their problem or prevent further problems (Kacans et al. 2014, 82).

Authors highlight the important role of skill development, particularly from trials. A study by Ghadim and Pannell (1999) showed that improving the landholder’s technical and management skills through trialling had a positive influence on adoption. They suggest the initial size and rate of skill development may be enhanced and the interpretation of trial information may be more accurate and hence improve decision-making. The result is the potential for higher crop profits. Skill development that improves environmental and social outcomes is also crucial for sustainable agriculture. However as highlighted by Mallawaarachchi and Green (2012), a major problem for many individuals and organisations providing NRM extension is that, the complex information supply chain, which includes funding agencies, research providers and knowledge brokers, limits landholder’s ability to associate information or advice with

any particular provider. One interviewee in the current study clearly expressed this problem.

I have difficulty explaining where I get any specific information. It's like when you go to a field day and people say "Did you learn anything today?" and I always say "I don't know". I tend to absorb little bits of information all the time and you don't specifically realise where it's coming from (male 41-55).

Interviewees were also asked to comment on how they used the advice, information or assistance they received from the different providers of extension to explore how the benefits they receive might motivate them to adopt changes to their farming practices. Their comments reveal a range of different benefits and experiences. One female interviewee (26-40 yrs) observed how she benefited from receiving information 'really, really' quickly from her regional NRM group. After attending a talk on 'alternative fodder crops for guarding against wind erosion and soil erosion' she went home and attempted to get information on a particular type of ground cover but could not find anything. Two days after contacting her regional NRM group she received a report in the mail with the information she required.

Discussing how he had learnt from the successful plantings on bare salt land by an environmental consultant another interviewee describes how the mounding and planting of the right species had allowed vegetation to grow on an area of land he had subsequently believed no vegetation would grow.

I did learn from Bill because I saw what he did and it's turned out to be very successful. We've had bare salt land where Bill, through mounding and planting the right species there, we've now got trees growing there or saltbushes growing there that I never ever thought we could ever retrieve that land (male 66-75 yrs).

Consistent with literature on the observability and risk involved in adoption (Pannell et al. 2011), one male interviewee (41-55 yrs) highlighted how consultant-run field days were beneficial as 'it's always good to be able to go and visually see the research. I think you can hear about it and read about it and talk about it but there's nothing like seeing the information'. Explaining how he uses the advice provided by retail companies he also discussed how he weighs up the risks of achieving the expected outcome from adopting advice, and suggests that if the risk of not taking advice is too great he will accept the advice. He also discussed how he may disagree with the advice or choose to vary the trial to measure the best outcome.

I usually look at the outcome, what if he's right and what if he's wrong. If the outcome is him being right and me not taking his advice is quite serious, I'll probably take his advice. But I can often say "Oh I don't know if I agree with you there Dick, I might put half on and see what happens", you know. Or like I said before you do a little bit or you do half his way and half my way (male 41-55 yrs).

The remark illustrated the point made by Wilkinson (2011) on the incomplete or partial, gradual or stepwise adoption of practices to best suit environmental or other conditions. Discussing how he believed landholders should get the most benefit from private consultants' advice, the following astute interviewee suggests they should be used wisely, for short periods of time to provide general or specialist advice. He also emphasises the need for landholder's to use their own judgement based on their knowledge of their property and suggests landholders thoroughly research the issue themselves before the consultation. This was a recurring message amongst interviewees when asked about the bias in information they receive.

They've got specialist knowledge in a particular area. You only need them for a limited amount of time...but you need to use them wisely. They can give you general advice and even specialist advice in certain things. But you probably know your property better than anybody else so you need to be able to weigh up what you know. Sometimes before you go to a consultant it pays to do a bit of research and find out things for yourself as well so you have as much knowledge as you can gather (male 41-55 yrs).

Overall survey responses on the benefits from support built on the information provided by the ABARES studies by expanding on the benefits shown in these studies and explaining landholders' thought processes in how they weigh up the benefits and use the providers of support to obtain the most benefit.

### 7.7.2 Barriers for NRM extension

The data from several questions help us determine the barriers to greater use of the different providers of support. These questions asked respondents to explain why they were not motivated to use the providers of support, how they believed the support they had received could have been improved and whether they had received the support they preferred and if not, what type of support was preferable and why this was not available.

### **7.7.2.1                    *Lack of motivation to use providers of support***

Only 18% of respondents were unsatisfied with their use of the providers of support and over half of these suggested their lack of motivation was due to the lack of relevance of the support provided. These comments included: ‘Don't provide practical solutions’ (male 41-55 yrs), ‘They don’t really understand about my farming situation’ (male 41-55 yrs), ‘Because in the past their advice has been shown to be wrong’ (male 56-66 yrs) or the support has ‘generally been very time consuming and ended up me providing more information than receiving’ (female 26-40 yrs). Others suggested the cost of engaging a provider was not worthwhile commenting; ‘We don’t like paying someone to tell us what to do’ (male 41-55 yrs).

Some were not aware of the services provided, while for others the availability of support was the problem, for instance; ‘The CSIRO don’t do much anymore/I used to do more research with the CSIRO’(male 41-55 yrs). Three respondents suggested it was the different values of support that presented barriers to their use with comments such as ‘WWF and specialist groups have a different aim than commercial farming so their advice can be taken on board only to a certain extent’ (female 26-40 yrs) while for one respondent there were other barriers such as ‘Lack of time, lack of money, already done it, I don't agree, etc.’ (male 66-75 yrs).

### **7.7.2.2                    *Improvements to support***

Respondents who had used the providers of support were asked what the benefits of the support they had received were (section 7.7.1) and then asked how they considered the information, advice or assistance they had received could have been improved. These were open-ended questions that 75% of respondents commented on. Their issues were:

1. *Accessibility and relevance of information:* Many respondents commented that improving information was important by providing them with; more freely available, independent, timely, relevant, localised information that is easier to understand and synthesised for easy access, with a few wanting greater use of different mediums such as radio, hard copy, local newspapers or social media. One respondent was concerned about the high costs of accessing information while another was concerned about the loss of access due to publicly-funded information

going into private hands. Another believed landholders need to share information more freely.

2. *Funding and support*: Several respondents wanted increased research funding and more providers of support while others wanted more funding for resources and on-ground works. Some wanted better targeting of funding while others wanted funding available for a greater range of practices. Some were concerned about the lack of awareness of and accessibility to funding support; with excessive paperwork and delays also a problem.
3. *Ongoing and more practical support*: Others believed there was a need to maintain ongoing support with timelier follow-up, and more local field days and demonstrations.
4. *Awareness*: Some were not aware of the services provided by the Department of Agriculture and wanted better understanding of the services of the different providers of support.
5. *Value systems*: Others believed that government and NRM groups were not concerned about landholders' issues, and were not open-minded enough to support new ideas. Concern about the different values of landholders was also raised.
6. *Duplication and integration*: Some believed that projects were duplicated and not integrated while others considered there were too many providers of support and these needed to be merged with specialisation provided within larger groups.
7. *NRM education*: Some believed there was a need to improve community knowledge and understanding about NRM and environmental issues.
8. *Succession planning*: One respondent also wanted more information on succession planning.

### **7.7.2.3            *Preference for support***

To determine the extent the availability of the support they had received was a barrier for NRM extension, respondents were asked whether the support they had received was generally their preference or were there other types of support they would have preferred to use (Figure 7-7). The results show that overall respondents were happy with the support they had received with 65% either preferring or generally preferring the support they received. Only 12% were unhappy with the support they received and 23% had no preference either way.



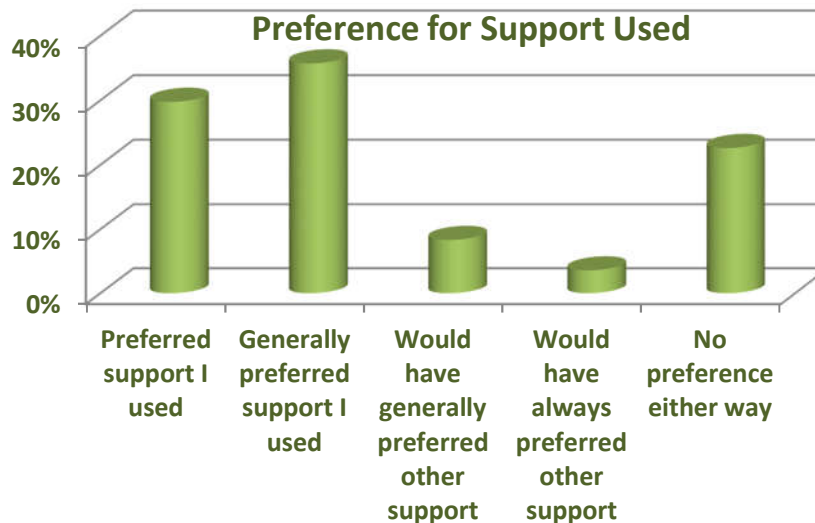


Figure 7-7: Respondents' preferences for the support they had used in the past.

However 6% of respondents would have preferred other support. To find out what type of support was not being provided, these respondents were asked to explain the type/s of support they would have preferred to use and why they thought this was not available.

Other support preferred included:

- More one-on-one advice
- More traditional Landcare-based support
- Providers of support with same farming values
- More grant application assistance.
- Independent assistance particularly from Department of Agriculture
- Support with succession
- More flexible, non-traditional approach to assistance

NRM extension was not available due to:

- Funding for Landcare officer no longer available.
- Policy to reduce Department of Agriculture extension services.

The result that respondents generally preferred the support they received concurs with industry results (Watson and Watson 2014). Literature showed mixed results toward the importance of the providers of support as barriers to adoption. Ecker et al. (2012,

35) found that only 6% rated lack of support, advice or training as a barrier. However, in his 2005 study of Wheatbelt landholders Toric found that for four out of six NRM issues respondents rated the availability of good advice as the second most important barrier, after financial capacity, to implementing strategies to reduce the impact of these issues. Other studies found the provision of support was critical to successful project outcomes describing it as ‘an engine’ driving innovation and solutions to NRM issues (Botha and Coutts 2011).

Toric (2005) also found that accessing adequate written information on the strategy options was rated almost last for most NRM issues. However, the current survey found accessing *relevant* information for better understanding was a key issue raised by respondents. According to (Gartmann 2014, n.p.), ‘the “sieves” for landholders are increasingly “the consultant” and the local discussion group, Landcare group or farm system group’. In this way, landholders are now using private providers or organising their own group-based learning support systems to overcome the barriers to adoption of NRM practices. When asked his opinion on the availability of information the following Wheatbelt interviewee explained why information needs to be relevant. He argues that it is not the availability of information that is the problem, but using the information and technology effectively through trialling on the farm. He provides an example of why he needs to do this.

We have a huge network of support in information. There’s so much stuff available to us, what we need to focus on is getting it into practice and working out for ourselves and the soils on our own farm. Like on my farm I have about 8 different soil types in one paddock so I can’t just have one fix does it all. I have to be continually working with stuff and change and different technologies and different things made available to use to make things better (male 41-55 yrs).

Wright et al. (2015) also found that although most respondents preferred the support they received, a small percentage suggested ways their support could have been improved, many of which were similar to the improvements suggested above. These findings are explored more fully in the following section of interviewees’ comments.

## 7.8 Interviewee comments

Much of the qualitative research focused on exploring in greater depth the aspects relating to the providers of support. The following comments explain respondents’

attitudes toward this support and provide their thoughts on the questions put to them in the qualitative interviews (Appendix B.5). Their comments as expected, incorporate both production and NRM issues. Those comments in relation to private consultants and agribusiness agents have a particularly strong focus on productivity with limited application to support for NRM.

## 7.8.1 Individual support

### 7.8.1.1 *Other local landholders*

The literature reviewed in this study emphasises the strong influence that other landholders have on social norms and decision-making which was reflected in survey results, with individual landholders and groups of local landholders both providing high motivation for adoption of NRM practices. McKenzie (2011) found a range of reasons why other landholder's advice is important such as, their advice was often alternative advice to that which an agronomist would provide due to liability constraints, their advice is independent, and their advice arises from their experience with the practice, including the mistakes they've made. This was also mentioned as beneficial by survey respondents in the current study with comments such as being 'able to find out the mistakes that other farms have made which is very valuable' (male 41-55 yrs) or benefits of 'Shared information. What works and doesn't work. Pitfalls and mistakes' (female 41-55 yrs). These comments are consistent with literature revealing that the advantages of providing landholders with the strengths and weaknesses of a practice will 'encourage positive attitudes', 'strengthen self-efficacy' and 'increase perceived behavioural control and self-identity' (Parminter 2011, 4).

Consistent with literature on the 'good farmer' identity (Burton and Wilson 2006), when asked about how he believes other landholders' land management attitudes might influence him, the following interviewee explained how the failure of his neighbours to undertake certain practices resulted in their failure to succeed in farming, which gave him the confidence to believe in his own success. Conversely their practices that appeared 'interesting' would be investigated by him. In this way he identified with the type of practices that would make him a successful farmer.

...so in a way perhaps because of what my neighbours are doing I think I'm doing the right thing... There's a lot of reasons, but I've watched some of my neighbours just slowly collapse and I'm thinking, 'Well you didn't put your crop in on time,

you don't spread lime', so that gives me confidence I'm doing the right thing...And yet if they were doing something interesting I would chase that up (male 56-66 yrs).

Due to survey respondents' comments on sharing of information, interview respondents were asked their opinion on how well information is shared between landholders. One male interviewee (26-40 yrs) explained why he believed landholders like to share information. He argued that other landholders are a key provider of information because, rather than having just theoretical ideas, it is important to understand what other landholders 'in the real world' are doing. Pannell et al. (2011) also emphasises how observability of the results of an innovation are important for adoption.

Some interviewees believed landholders share information well, with one older male (56-66 yrs) commenting he thought the landholders he mixed with were not really competitive, believing this was 'an Australian thing'. He had been to Mexico and found landholders there did not share information freely. The following interviewee believed sharing farm experiences allowed landholders to bond together. Consistent with literature on landholder personality and working in groups (Shrapnel and Davie 2001), he believed they are happy to share their opinions and experiences but will not work together. He revealed that other landholders were a key influence on his farm decision-making.

I think farmers, it's the one thing where they might bond and unite a little bit on is sharing their experiences on what works and they're quite happy to do that. Try to get them to work together and they won't. But ask them their point of view and what their experiences are, they're usually quite happy to tell you that. So I'd say a very, very big influence on what I do on my farm comes from other farmers and I think they share quite well (male 41-55 yrs).

While others believed landholders' sharing of information was mixed. One interviewee suggested age made a difference to the level of sharing with younger generations sharing much more than older generations. To confirm this she explained how a young neighbour had recently purchased his property and told her he cannot get information from older landholders as they expect him to learn from experience as they had. She suggested this was not helpful for him as he is a young landholder working on his own who will need a lot of assistance in the future.

Older generation, no. But our generation down I think, yes. Our next door neighbour has just bought the place next door and he's only 22...the older blokes he says he can't talk to any of them. Cause they say 'Oh well you just learn like we did'. And we went 'Yeah that's not helpful'. He's a young guy that's struck out on his own. He's going to need a lot of help (female 26-40 yrs).

The second young male interviewee (26-40 yrs) also believed some landholders are willing to share information while others are not. He stated that many landholders were unwilling to share information on seeding rates or fertiliser use and he didn't know why as he believed they were all trying to achieve the same aim.

Some are good and some are tight as a fish. I don't know why some people are like that. You know we're in it together. A lot of people won't tell you what they're doing or what their seeding rates are or what their fertiliser is they're using. They just keep it to themselves, hush hush (male 26-40 yrs).

The following interviewees provided their thoughts on the difficulties of sharing information. The responses support research suggesting landholders' introverted personalities reduce their ability to communicate effectively with others and participate in sharing environments (Strachan 2011). One interviewee argued landholders' lack of sharing is due to their modesty and while willing to reveal their failures they are not keen to discuss their successes. He also suggests they are not willing to access the information that is available and argues for landholders to be open to accessing information by joining groups, which according to literature is something many landholders are reluctant to do.

...you've got to remember farmers are very modest if you ask me...We all talk up our failures...But as a rule farmers don't talk up their successes...and they don't avail themselves of the information. You can lead a horse to water but you can't make it drink...You've got to be part of a group and you've got to avail yourself of the information. You can't be blinkered (male 41-55 yrs).

The second interviewee explains why he is reluctant to advise other landholders. He suggests that other landholders would need to ask for his advice before he would provide it, inferring that by proffering advice without being asked for it is bragging and would make them feel deficient.

I've never told them that 'You should be doing this', because they've got to ask, it's not for me to say. You don't want to go rubbing it in (male 56-66 yrs).

One interviewee suggested there was a difference between crop and livestock producers in sharing information so this question was asked of others. Crop producers were rated more inclined to share information than livestock producers. One male (41-55 yrs) perceived that ‘Livestock producers keep information to themselves’ suggesting this may be due to greater competition in this field, while he believed grain producers were more willing to share their mistakes, problems or information. Another interviewee who had experience in both fields also agreed that crop producers are more willing to share information. He argued that from his experience as a Merino stud breeder the competition involved with selling their product, as well as their pride in being a stud breeder, made these producers ruthless and unwilling to share knowledge, even between friends. He suggested this was because crop producers sell their produce to the same market and are therefore subject to the same price for their produce, whereas stud breeders’ sell to individuals and price is therefore competitive.

...cropping is fairly shared. We actually had a Merino stud...The stud breeding game is ruthless...if your rams at sale are looking better than someone else’s, you’re not giving any information away. That’s where they are competitive, because you’re trying to get clients. And there’s a bit of pride. You can be reasonably good friends but you don’t share knowledge there. It’s not like in the grain industry where we’re all selling to the same market and taking the same price...But the stud games a bit different (male 66-75 yrs).

Another interviewee commenting on why he believed sharing differed suggested it was due to spatial farming factors as a result of varying environmental and climate conditions.

...cropping tends to be very local and I think that’s because the conditions and the environment and the weather is unique to your local area. Whereas the livestock is quite spread far and wide and the agroforestry is spread far and wide (male 41-55 yrs).

Other interviewees commented on the decline in sharing of information by landholders in recent decades. The following two interviewees provide three different reasons why they believe the decline has occurred. The first interviewee comments that in his experience the sharing between landholders has declined in the last two to three decades due to increasing competition between landholders, particularly in regards to large-scale landholders’ land acquisition or information they have purchased. His perception is that in the past, because information through government departments

was freely available it was shared, but as it is now paid for the information is retained by the landholder who purchased it. The second interviewee argues that sharing information has declined due to changes in the locality of local meetings to zone meetings, as the time spent driving to attend the meeting has increased and reduced the regularity of these meetings. She also suggests the increase in farm size and reduction in population has reduced the opportunity to observe and discuss things with your neighbour.

I think compared to 20 or 30 years ago, farmers now, well its been my experience that farmers are not as open as they used to be about what theyre doing on their farm because theres more of a sense of competition between farmers, especially the big farmers who are always looking for a bit of extra land and they want an advantage so they'll keep that information to themselves. Especially when theyve actually bought that information, theyve paid for it. Its not freely available like it used to be through the Ag. Department or whatever. So they tend to keep it to themselves. Thats my impression anyway that the neighbours are not as open as they used to be (male 56-66 yrs)..

Years ago too they probably used to meet more regularly...They used to meet in each town, each town used to have its own branch. Whereas now we only have zones so there's probably an hour or so to drive to wherever the meeting is and they don't even have them very often now. So in a way we've lost that sharing...as the farms are larger you don't see your neighbour fencing or you don't see your neighbour out and about. Because there's so much more land and less people living there (female 56-66).

Comments on the support provided by other local landholders provide a variety of explanations about how and why they share information, the barriers to sharing and how agricultural changes in recent decades have made the sharing of information more difficult. Interviewee comments are also consistent with theories provided in existing literature about how the characteristics of landholders affect their willingness and ability to communicate.

### **7.8.1.2                    *Private consultants***

The following comments from interviewees help to explain landholder attitudes toward using private consultants for support. One interviewee suggested private consultants are used by some landholders because they 'are more comfortable having decision-making shared with a consultant' (male 41-55 yrs) and were used as a sounding board or confirmation for their decision-making. Another landholder on a

large property with better than average performance informs us that although he does use private consultants as a sounding board, his main reasons for employing them are to secure advice about new innovations and practices that he has not yet learnt about. As such, he suggests he demands substantial assistance from them.

...we do use him as a sounding board but we're really relying on him now to be a step ahead of us as far as chemicals and the like goes, so we'll take their advice. If we've got an idea we would run it past them. So we're using them pretty hard (male 56-66, +3000ha).

In their study of Victorian landholders on large-scale farms Wilkinson and Rowbottom (2013, i) also found specialist advisers were used for 'support, confirmation, second opinions and as sounding boards as well as for primary information' and that trust in these advisers was very important. These authors also emphasise, these landholders gather the information they require and always make the final decision themselves. A key problem in relying on private sector advice is the propensity for the private consultant to have greater influence on behaviour due to being paid. This issue was discussed by one of their interviewees who stated ... 'one of the real problems though is when you do pay for advice you tend to follow it. It doesn't always mean that it's correct (16H)' (Wilkinson and Rowbottom 2013, 12).

Interviewees in the current study also commented on the need to understand the issues themselves as they are 'employing them for advice but it's my business that's on the line if I implement bad advice' (male 41-55 yrs +3000ha). The following interviewee in the current study relayed an interesting conversation he had with another landholder on the subject. He discusses how he explained to the landholder he needed to understand the issue himself to make his own decisions, rather than rely on a consultant to tell him what he should do. Highlighting the notion that farms are operated as businesses, he argued advice needs to be weighed up to determine its value to the enterprise. Other interviewees made similar comments.

Its an interesting one actually because I had this discussion some time ago with another person and it was all about "My consultant told me to do this" and I said well "Why", and he goes "Well I don't really know why". I said "Did you ask him?". "Oh no" but he said "I need to do it". I said to him "Well you really need to know where you're at with it and what your margins are with what you're doing". If you go and do whatever your agronomist or consultant tells you then yes, it's a problem. But in our game now it's a business and we have to operate now as



business people so we have to work out whether what we're being instructed to do adds value to it. We have to have our own understanding (male 41-55 yrs).

One older male interviewee (56-66 yrs, 3000ha) with a large-scale farm explained how he uses both other local landholders and private consultants for support stating; 'I guess I've got several peers that, we just bounce things off each other continually and then we pay an agronomist for advice'. This comment is consistent with studies showing older landholders rely on their social networks for information and support (King and Nettle 2013) and that fee-paying services are often used for confirmation or a second opinion (Wilkinson and Rowbottom 2013).

Combining private and agribusiness consultants in the current study may have proved problematic particularly as many landholders with smaller farms may use free agribusiness information and advice but cannot afford to use a private consultant, or their farming systems do not fit the consultant's model for support as the following interviewee explained. He asked a private consultant for assistance but was told he was unable to help him because he did not conform to the model of farming the consultant was trained to assist.

I used to in the past but being a small farmer...they basically told me that they can't really fit me into their idea of agriculture because I was too small in their opinion, and they don't just think the way a small farmer is forced to think. They don't have a good model for me to use (male, 41-55 yrs, 1-2000ha).

The following interviewees with small-scale farms inform us they use private consultants to provide confidence when making a major investment, but they are not value for money on a more permanent basis. Interviewees using more organic methods also agreed with these comments. The first interviewee was willing to pay for advice about planting host trees for Sandalwood to confirm the decision her and her husband had already made and provide them with the confidence to undertake the work. She comments that although they had attended field days to find out what they needed to know, it was important to obtain expert confirmation of their decision due to the size of their investment. As such the provision of support enabled them to overcome their risk aversion to investing in Sandalwood.

I paid an expert in the field ...to come and have a look and see if what we'd worked out was correct. He gave us the go ahead and also recommended what host trees were suitable in the area. So that gave us a kick start and gave us the confidence,

you know. It was our choice to pay for it. It's all really well going to field days, but because it's our life savings going into this you just want to be sure that the stuff you learn at field days is correct. Like, to have someone come to the site and go 'yep, yep, that's right', that's exactly right, then that gives you more confidence (female 41-44 yrs, 1-499ha).

Another interviewee commented that paying for information is not viable for him, particularly as he is able to get all the information he requires freely.

One interviewee practising regenerative methods of farming suggested getting support was more difficult. She described how she and her husband had been encouraged to change to regenerative farming by two agronomists with expertise in this way of farming. She suggested they were lucky to have been able to access their advice and information when they did as these agronomists have since left the region.

Well we actually had a couple of agronomists, really really good agronomists, they've unfortunately moved on now. They were independent ones...they were the ones that put us on to composting, mulching, putting microbes round your seed and things like that...But it was just like all the stars were aligned at this time and we were lucky enough to get these two blokes with completely different ideas and that's what started us on that track (female 26-40 yrs).

Of interest was that McKenzie (2011) also found some interviewees had stopped using private consultants due to the standard farming approach they took because of litigation problems. They also believed that both private and public sector extension were not very innovative or flexible in their approaches and that it was landholders themselves that were developing new approaches to problems. This issue was also raised in the current study. One male survey respondent (66-75 yrs) had been successfully innovating with forestry methods for 13 years and was unable to get funding 'because I will not follow "best practice". He called for providers to have an 'open mind' and 'look at what has been achieved before making negative decisions'.

One interviewee was also frustrated with attending events where the research had been undertaken by innovative landholders and the presenter was providing information that was already known by attendees 'claiming it's a significant breakthrough'. He argued that all private consultants do is obtain information from one landholder and pass it on to the next.

Most times the leading farmers are in front of...some of the professional agronomists or the professional consultants. Because all the consultants are doing

is finding a very good idea that works on one of their client's farm and then telling all their other clients. But where does the good idea originally come from; from the farmer (male 41-55 yrs)

These comments are consistent with literature reports on extension changes to a landholder-driven approach (Table 2-3).

A key message arising from the literature was the influence that financial capacity has on adoption of NRM practices (Ecker et al. 2012; Sutherland et al. 2012; Pannell et al. 2011; Toric 2005; Vanclay 2004) and the influence this has on the use of those providing support (King and Nettle 2013; Wilkinson and Rowbottom 2013). The following interviewee with better than average farm performance, outlines how the type of advice provided by private or agribusiness consultants differs with the financial capacity of the landholder to undertake the recommended practice. He suggests that an agronomist may advise him to implement practices such as liming, which is expensive but has long-term benefits for the soil, because he knows he can afford to do this. However the agronomist is less likely to advise a client who he knows cannot afford to do it.

I know that agronomists have some clients in a good financial position and therefore they can make suggestions for the future. But they can't to some clients because they know they can't afford it. It all has to be economic. But some of these long-term things such as liming, which is the simplest example, is a long term investment that we should all be doing as hard as we can, but it all costs money. I know our agronomist has got clients that he would discuss it with, but he's more or less telling us, "You put this lime on" and we're doing it because we know it's right for the soil long term. But he wouldn't tell some so confidently because he knows the budget wouldn't allow it (male 56-66 yrs, 3000+ha).

Three key issues of concern about private or agribusiness consultants raised in the literature: 1) the costs of paying for private consultants, 2) the control of information (section 2.5.2) and 3) whether advisors need accreditation due to the limited NRM information in their advice (section 4.4.2), were included in interviewees' questions to ascertain their attitudes. Interviewees were divided on the subject of paying for private consultants. Some believed private consultants were too expensive and not value for money, particularly for smaller farms as a previous interviewee commented, while another on a slightly larger farm suggested growing costs were currently viable but may not be the future. As such she believed consultants were still encouraging

landholders to increase their farm size to gain economies of scale; inferring this would allow landholders to continue to pay for their services.

Our own consultant that does this agronomy stuff, yes it is getting expensive...I guess at the moment it's do-able, and that's another reason why they actually keep on pushing you to buy more land; to actually make it more cost effective...I know years ago they sort of had the 'Get big or get out'. Well its just a lot more subtle now I think (female 56-66 yrs, 2-3000ha).

Interviewees with larger-scale farms also mostly agreed the costs were high but also believed that some were value for money while others were not and that you needed to pay to get the quality advice required. One male interviewee (56-66 yrs on 3000ha) commented 'if you're not using a lot of that information with confidence there's no point in employing them'. These comments are similar to an interviewee in Stone (2005, 25) who stated "Using them might be dearer than finding the information out for myself but I trust their advice". They reflect literature discussions on the significant role that credibility and trust plays in landholders' relationships with those who provide support (Price and Leviston 2014; Pannell et al. 2011).

The following interviewee discussed the costs of employing a private 'tree plantation and Landcare consultant'. He had paid him considerable sums of money and found his advice had been value for money as he has successfully established grazing shrubs where he previously thought they would not grow. When asked about the problems of employing private consultants for NRM he suggested funding was often used for government reports rather than on-ground works; reflecting critiques of NRM program reviews on the problem of accountability for public investment versus achieving on-ground outcomes (Clayton, Dovers, and Harris 2011). As an example of the costs of employing consultants he explained that a local group he is involved with had received quotes to undertake a remnant vegetation assessment. He believed the quotes were excessive as they were greater than the value of the land.

They're very learned people but their reports and their writing and so on might give comfort to a government department sitting in judgment on an application, but it doesn't put a seedling in the ground... [a local group] did speak to a lady who I do know has done work on this farm for the Wheatbelt NRM in assessing our remnant vegetation here, and she wanted just under \$12,000 which equates to \$417 a hectare which is more than the land is worth. Just to do a flora and fauna study (male 66-75 yrs).

He argued that payment of private consultants is problematic as 'You've got to have people with the right knowledge and the right ability and the ability to get things done'. He then suggested that government funding should be used to support someone like the consultant he used as he gets the on-ground work done and employs backpackers, who are cheaper, and therefore charges less than other consultants.

When asked their opinion on the control of information by private consultants interviewees' comments were mixed, with some disagreeing, suggesting this was a comment made by landholders who were not actively involved in getting information for themselves, while others agreed. The following interviewee describes how a private consultant may react negatively when information they have provided is exchanged informally with others. She explains that this reaction is why they no longer use the services of their last private consultant.

They really don't like it when, say you're having your neighbours over for tea and you start talking about cropping, which everyone does. If your agronomist or your consultant finds out that you've been discussing his information with your neighbours, they normally say 'Well we need to charge you for that because it's not free information'. And basically unless your neighbours subscribe to them coming over and having a look around their place they can get really cranky. That's basically the reason we got rid of the last one (female 26-40).

Another interviewee (male 41-55 yrs) explained that he saw the issue as a problem due to the growing number of consultants working in an increasingly competitive environment. One survey respondent was concerned that information from government funded research was 'difficult to locate in succeeding years' because it was now controlled 'by a single private business' (female 41-55 yrs). However others were more pragmatic suggesting it is a 'commercial reality' (male 41-55 yrs), or they pointed out that conditions of industry-funded research required information to be placed in the public domain, which allows them to freely obtain the information anyway (male 41-55 yrs).

When asked about the need for advisors to have accreditation systems to ensure farms are appropriately managed for the future some interviewees were negative suggesting 'it's probably up to you to check the qualifications and credibility of the bloke you employ' (male 41-55 yrs). One interviewee highlighted the potential bias in this type of system because of different values underlying the scheme.

...depends who is going to accredit them. It's only as good as the accreditation facility that's managing it so that can be an open-ended thing. That would get back to one particular body saying this is the right way of doing and this is not the right way of doing it (male 41-55 yrs).

However some interviewees were concerned about the responsibility of those providing the advice, suggesting there may be a need for systems of accountability. They suggest it is the lack of responsibility for the impacts of their advice on landholders that is a problem. One male (41-55 yrs) argued a consultant is used on the assumption their advice is beneficial, yet their lack of responsibility for the outcome raises scepticism amongst many landholders.

Interviewee comments overall suggest there is mixed use and attitudes toward private consultants with most experience and positive attitudes toward their services arising from landholders with larger-scale farms who also appear to be driving the extension and research agenda. Interviewees suggest they are used as a sounding board, to support their decision-making for adoption of a practice and to obtain current, relevant information, but are not value for money for smaller-scale landholders. Their comments are also consistent with issues raised in the literature about the costs and control of information and the importance of trust and credibility in their relationships, and highlight the barriers to accessibility of knowledge held by private consultants. They also reflect the differing relationships providers of support have with business-oriented and traditional farms (Wilkinson, Barr, and Hollier 2011).

### **7.8.1.3                    *Agribusiness agents***

Consistent with literature, survey respondents raised concerns about the bias in information provided to them by agribusiness agents (section 2.5.2) wanting 'Better availability of unbiased advice/most advice is aligned with companies selling products' (male 41-55 yrs). As such interviewees were asked about their thoughts on the bias of information and advice provided by retail companies. After stating he gets half his information from other local landholders one 41-55 year old male interviewee on 1000-2000ha of land commented 'Probably 35-40% of the rest of my information I would glean from the free client provider...' This is consistent with literature suggesting that advice from agribusiness representatives is used extensively by many landholders with smaller-scale farms (Wilkinson, Barr, and Hollier 2011).

Interviewees mostly agreed that agribusiness agents' information and advice was biased but highlighted the fact the landholder needs to understand they are a commercial business and therefore the advice they provide 'is tied to maximising the returns to that corporate, not necessarily to the individual' (male 66-75 yrs). Researchers also suggest that market forces are driving decreases in seed prices which discourages the provision of information and advice due to the reduction in profit. They argue this may result in lost knowledge and experience from the industry (King and Nettle 2013) which will of course affect landholders; particularly those with smaller-scale farms.

Interviewees were also asked about the availability of agribusiness advisors to determine whether this had any influence on their decision-making. While most believed they were readily available one male interviewee (56-66 yrs) argued they were not, due to the lack of 'skilled experienced, agronomists'. He submitted he had difficulty replacing his current agronomist due to the lack of enthusiasm for agronomy as a career a decade ago and implied this is changing due to the greater importance of agriculture to the economy with the declining mining boom and the influence this has on social norms.

Another interviewee explained how the evolution of the industry in WA has influenced landholders' advice today. He discusses the competition that occurred between the large mainstream companies and smaller alternative advisors in the past and suggests that competition has reduced the large companies which allows more independent advisors to compete in this field. As such he believes control of the advice provided has improved.

What have been here in the past is alternative advisors which a lot of the mainstream companies tried to talk down because the mainstream companies, the Elders and Landmark, they market particular products which are provided by the bigger companies. These other advisers came in and go "You dont need to use all that stuff. You could be using this or you could be using that", and of course the big companies dont like that. Well now that the main retail ones have been whittled down there's not as many of them, there are more independents who think differently. They provide a different structure now of advice. Its a lot better adjudicated (male 41-55 yrs).

Interviewee comments correspond with literature about the bias of agribusiness support and highlight the need for landholders to learn about the issue themselves and

question the advice of these agents. They also suggest that the availability of these providers of support and the information they provide may have improved.

## 7.8.2 Group Support

### 7.8.2.1 *Grower Groups*

Although grower groups were rated very highly in the survey, when interviewees were asked about their use and the benefits of grower groups their comments showed attitudes are very mixed. These groups are important for some respondents as the following comments suggest. Similar to private consultants, many of the comments about grower groups focussed on productivity more than NRM. However as the first comment indicates, many of these groups have both a production and NRM focus. The first male was a member of a small local group conducting activities such as on-farm trials. He points out that although the group is mostly focussed on production, NRM is also an integral part of the process of cropping for the long-term. He suggests the benefits of group membership for him is that he is able to learn about the benefits and disadvantages of farming practices. The ability to learn from both the successes and failures of other landholders was also raised as important by several survey respondents.

...most of our support comes through our own localised networks now. Like in this area we've got a local grower group...so we do a lot of on-farm trials...the local grower groups are more of an agronomy thing. It's all tied in together because obviously we want to grow the most profitable, sustainable crop which goes hand in hand with managing the resource. I see more, because I make sure I'm part of these local groups and we see these results. So I see the successes and I see the failures also of course (male 41-55 yrs).

When asked about the benefits of belonging to a grower group the second male describes how the flow of information from one group benefits other groups. He describes how the information gained from employment of private consultants by the larger groups is distributed to smaller groups through their members where adoption may follow, and how the reverse occurs with local knowledge from smaller groups discussed at meetings of the larger groups and taken to trials. As such both expert and local knowledge is passed on to members of both small and large groups.

There's a lot of information comes directly through from the grower groups and there's also a flow-on effect, that if we employ an agronomist at our Facey



group...stuff that we pick up at the Facey group might get discussed at the other group I was talking about and that might get implemented or taken up by other farmers. And that also works back the other way that a member of our agronomy group might start doing something outside the square or a bit different and we might discuss that at the Facey group and that could lead to some trials or something being done there. So it's definitely a two-way flow of stuff that goes round and round in circles (male 41-55 yrs).

The following interviewee outlined how he believed funding systems provided to the larger groups ensured that information was accessible to non-members. He suggests the larger groups are the drivers for farming practices and that the conditions of industry funding they receive stipulates they publish their results, which makes it available to people such as himself who are not members of the group.

I think you'll find that most of these practices are being driven out of those big groups. The South East Premium Wheat Growers, Mingenew-Irwin, Liebe group, Facey group, they will drive a lot of the ideas. Then of course when they have GRDC funding they have to publicise all their results and that's where someone like me, that isn't a member of these groups, can access this information (male 41-55 yrs).

Other interviewees discussed the barriers and limitations of grower groups. These included the costs, timing, environmental conditions and travel distance to attend the meetings which made attendance unviable. One female (26-40 yrs) interviewee believed the expense and travel were not worth the effort of attending their meetings commenting '...it's like 'Oh we've got to go up there again'. It's just a bit pushed for time. It's not really value for effort'. While another interviewee declared the timing of the meetings often did not work in well with their other farming tasks, and even though some landholders considered them worthwhile, for him the different farming environment where the meetings were held also made them impractical due to the different soil types. He had attempted to organise trials on his own farm as an alternative.

...we do a lot of hay and chaff deliveries into Perth and if the time doesn't suit us we can't go, and it's just a waste of money...I know people that go and they tell me how good they are. But, where they have them it's totally different soil type and farming to where we are. I try and get trial plots and everything that happens on our farm. Because to me, our farm's unique with the amount of heavy soil we've got compared to anyone else in the area (male 26-40 yrs).

The problems of power relationships (section 2.5.3) and how this plays out both within and outside groups were commented on. One male (41-55 yrs) survey respondent stated that conflict within grower groups discouraged him from participating, while an interviewee suggested these groups are not inclusive and require an invitation. He argued they are elitist and do not share knowledge with non-members of the group; thus supporting results from Toric (2005).

In these production groups that are now set up across the state they are becoming very selective about who they will have in those groups and they are sharing their information within the group...you've got to be invited and they say "No, we're the champion farmers in the area because we're the best. We share our knowledge and we're not allowed to share the knowledge outside the group" (male 66-75).

As such they highlight how power dynamics in relation to short-term productivity issues can be divisive for farming communities. However this attitude may not affect farming practices in the long term due to the ubiquitous nature of information available on the internet today. Interviewees did not reveal whether this attitude is also present in groups with a dominant NRM focus.

Interviewee comments support literature studies on the role that grower groups now play in extension in the WA Wheatbelt and reveal respondents' attitudes toward the advantages and disadvantages of membership as well as the accessibility and effectiveness of the groups themselves. They reveal that some landholders find them beneficial while others find a range of barriers to membership and access to their information.

### **7.8.2.2            *Landcare***

Of note was that 'Landcare' was often used to describe anything to do with activities in relation to NRM as well as environmental issues. Other researchers also point out that within Australian farming circles the term Landcare is used in relation to land conservation in general (Kington and Pannell 2003). Survey respondents found benefits from NRM extension such as; 'New ideas, of working the Landcare side' and 'I used Landcare information for decisions', and factors requiring improvement such as; 'Better understanding of current Landcare related issues in our community' and 'funding is tight so Landcare is put at the bottom of the budget'. These comments highlight the impact this movement had on landholders' perceptions of land management and the importance of local level support (Marshall 2008). For instance,

when asked the type of support they would prefer, some survey respondents wanted ‘the type of support we got from Landcare 15 years ago’ as this ‘encouraged other farmers to do things on their land as well’ (male 66-75 yrs) while another (female 26-40 yrs) complained about the loss of access to funding due to the decline in Landcare groups.

Almost all interviewees in the current study commented on the significant decline or lack of Landcare groups in their area. The following interviewees proffered four different reasons for this decline. The first interviewee describes the poor state of many local Landcare groups, suggesting that the withdrawal of funding greatly affected activity; thus supporting literature indicating the reliance of these groups on government funding (Simpson and Clifton 2010).

It’s still there but it is a hollow shell of its previous self. I think they still provide support to some people...Once the money trail dried up it all fell apart very quickly. It’s like everything, you know, when there’s money there there’s lots of activity (male 41-55 yrs).

The second interviewee also confirms literature reporting on problems with burn-out of group members contributing to the decline in the Landcare movement (Love 2013; Frost and Dymond 2000). She suggests that up until five years ago, they were actively involved in their local Landcare group, but the loss of leadership through burn-out has considerably reduced the activity of their group.

As far as Landcare goes, only 5 years ago it was the flavour of the month for probably a decade prior to that and personally we were involved in a very active local Landcare group, and so there were a lot of things on our plate with that, through grants and through other people wanting to hop on board. We don’t have any of that now...and some of that would be due to...I guess our group got a bit burnt out and it takes a few enthusiastic leaders to follow up any leads, that a lot of that has dried up anyway (male 56-66 yrs).

The third interviewee provides two reasons. He explains how their Landcare group has been replaced by a private business who also utilise the knowledge and services of regional NRM group staff. As such the private sector has been able to replace public sector NRM extension in a particular area where market forces are sufficient (Botha, Coutts, and Roth 2008). He also argues the Internet has replaced the role of Landcare groups in providing access to expertise and disseminating information.

...no we don't have a Landcare group... Basically we use our tree nursery now as our resource management rather than a Landcare group... So we feed off them and they'll organise field days and different things...and they can go to the next level which is a Landcare facilitator, say like you're with Wheatbelt NRM or NACC or someone like that. So that's how we utilise it now...And like I said now you can access Internet and phones and people at any time you like for whatever information you want (male 41-55 yrs).

Responding to a question on the changes in support, the following interviewee explained why she believed many landholders do not get involved in Landcare groups and how she believes farm-scale changes have altered group membership. She upholds literature concerning the introverted personality of most landholders and the problems of working with groups (Strachan 2011; Shrapnel and Davie 2001) with suggestions that landholders are unlikely to work in a group unless it is really necessary or they are no longer farming and are driven by a passion to change a specific natural resource factor. She also points out that many large-scale farms now encompass the whole catchment area and the landholder is responsible for managing the natural resources over the entire catchment. As such the problem is no longer a group problem.

In general you'd have to have a group working on a catchment level but most farmers are very individualistic and they're not going to work in a group unless there's a real need or they're retired and they really want to do something about a particular thing. Now that you've got bigger farms a lot of the farmers do actually own the whole catchment I suppose so they're not reliant on somebody else...if they had to work on a catchment and as I said if you own the whole catchment it's your problem, it's not a group problem anymore (female 56-66 yrs).

Commenting in reference to regional NRM group extension she also explained how their extension has been required to change back from group to individual extension. This was consistent with another interviewee who clearly describes why he believes group-based NRM extension with Landcare groups was not effective for most landholders. He suggests it was the regional NRM group change back to individual extension as well as landholders' lack of interest and enthusiasm for group-based work that resulted in the decline of Landcare groups. He believes individual support through the regional NRM groups is an improvement.

...they really actually have gone right back to dealing one to one. And I guess that's why Landcare groups have fallen apart. Their policy was at one stage, they didn't work with individuals they work with groups because they wanted to give more service so we'd get in a group. But the thing was there were only 2 people interested

and the group ran out of enthusiasm and fell apart so I think it's a bit better to do the sort of Landcare aspect by the natural resource management body (male 41-55 yrs).

Interviewees' comments were consistent with literature on the decline of Landcare groups (Hunt et al. 2012; Pannell et al 2011). Factors contributing to the decline included; funding withdrawal, burn-out of group members, replacement by the private sector and increased use of information technology. Others highlighted the individualistic nature of landholders, large-scale farming and the waning of interest in group-based extension as reasons for the decline in Landcare groups and the change to individual support through NRM regional groups.

### **7.8.2.3                      *Regional NRM groups***

Responses toward regional NRM groups in the current survey were mixed. One female respondent (26-40 yrs) commented 'I actually don't have any idea as to what NRM do in the community' or 'what their goals and objectives are'. Another female (41-55 yrs) respondent suggested the culture of some regional NRM groups had shifted away from agricultural concerns to coastal and aboriginal issues and they were no longer concerned about assisting inland agricultural regions. However, many respondents were pleased with the assistance they have received from their regional NRM group finding them 'very helpful caring and obliging' (male 41-55 yrs), others thought their regional NRM group 'does a great job but need to advertise more to encourage more community involvement!' (male 26-40 yrs). This sentiment was also echoed by a female interviewee (56-66 yrs), although she did believe their advertising had improved recently.

They also showed there may be confusion for some about the difference between Landcare and regional NRM groups. For instance, interviewees referred to Landcare group extension when commenting on regional NRM group extension. When asked about extension received from Landcare groups, one male (41-55 yrs) interviewee, referring to the Wheatbelt NRM e-newsletter, explained how he gets emails every month from a Landcare group in Northam. While discussing the work of Wheatbelt NRM another male (56-66 yrs) commented they were focused on 'the aboriginal side of Landcare'. As such it appears some participants may have found Landcare and regional NRM group extension difficult to separate. The following interviewee

explained how he understands the situation. He comments how Wheatbelt NRM are now doing the work that Landcare groups used to do and that because they now work on a one-on-one basis instead of working with groups, Landcare groups have disappeared.

...and as I say the NRM which is the Wheatbelt Natural Resource Management and that's really your Landcare people. I think they've changed the name and that's why there's no more Landcare groups around because we all sort of work one to one with our natural resource area manager. So if I've got a project I don't do it through my Landcare group. I contact my Northam regional resource management office and out comes one of their people (male 41-55 yrs).

Howard and Larson (2009) also found only 73% of respondents correctly understood the definition of NACC's role. One older respondent revealed a similar lack of understanding of Wheatbelt NRM's role. He wrote that he wanted the independent type of support previously provided by the Department of Agriculture suggesting regional NRM groups 'could offer land care support in Department of Agriculture's place'(male 66-75 yrs). The comment is of note as literature discusses how regional NRM groups had virtually replaced agriculture extension by the end of NHT1 (Millar 2007), and highlights the problems of accessibility for regional NRM groups.

Ecker et al. (2012) argued that group-based approaches remain an important method for NRM extension, but point to the difficulty for many living in remote areas in travelling to attend meetings; an important factor for many Wheatbelt landholders. Some respondents in the current study mentioned they found access to NRM extension difficult. For example survey respondents living in the more remote eastern regions of the Wheatbelt commented that most providers of support were 'not interested in supporting the far eastern Wheatbelt' (male 41-55 yrs) while another respondent (male 66-75 yrs) didn't have much contact with Wheatbelt NRM as their head office was too far away. He believes they need to be more centrally located. Smallholders also highlighted the problems they have with attending events and demonstrations because of their work commitments in Perth or elsewhere. The following interviewee with a smallholding explained how this differed with the regional NRM group. One group organised their events during the week to suit the larger-scale farms, so she had to take time off work to attend. The other group with more smallholders, organised events during the weekend.

In some cases they were really good at running field days on weekends so that everybody could attend, and other ones, they would run their field days during the week because that suited them personally and it suited their farmers, because their farmers would probably have footy or cricket on the weekend...We had to take time off work. Like the South West they're always on the weekends because they have a lot of small landholders. Whereas in the Wheatbelt they have all their field days during the week. So its just too bad if you're a small landholder and you can't take time off work to go out to those field days.

Barr (2010) highlights the difficulties experienced by many NRM extension staff in developing trusting relationships required to influence adoption of NRM practices. Diverging values or agendas of productivism and conservationism create conflict, particularly when NRM contract funding is tied to inappropriate or sometimes impractical practice change. Survey and interview comments highlighted the depth of concern that some landholders have with this issue and the difficulties faced by NRM extension in promoting practice change. Survey respondents believed that 'NRMOs are generally poorly educated about agriculture...some don't relate well to farmers as they're from a different background' (female 41-55 yrs) or that 'there is a disconnect between State and Federal programs and the farming communities. I think those working in these programs come from a different angle than farmers'. He believed NRM regional group staff had an environmental bias suggesting that 'NRM is too 'politically green in outlook' (male 66-75 yrs). Interviewee comments also provide some important contributions to our understanding of landholder concerns about this issue. However their responses on this question were also very mixed.

When asked about an environmental bias (section 2.5.1), one male interviewee (41-55 yrs) who had used the services of his regional NRM group did not believe they were biased toward environmentalism, but had worked with him to achieve his goals. While the following interviewee was also very satisfied with the support he has received from his regional NRM group, but suggests the reason for this was due to their farming background. As such he suggests they were influential because they shared similar experiences and values as himself.

All I can say is that my experience with NACC or any of the regional management staff is fantastic. I've had really good dealings with them...The ones that I've been dealing with have actually come off farming experience. So they're either married to a farmer or they've been a farmer or farmer's daughter or son. So they've had

that involvement in the industry. So I think that probably played a part with the ones that I've been dealing with (male 41-55 yrs).

Other interviewees were concerned about the focus of NRM staff and their programs. The following interviewee discusses the tension between the productive and environmental focus of NRM programs, also highlighting the problems of defining NRM extension discussed above. He argues that the focus of regional NRM group staff should be on wildlife protection and human welfare issues, and 'the other stuff' should be the responsibility of the state's agriculture department. He believes their work is not worthwhile and has been developed by staff for their own employment. As such he is sceptical about the expertise and activities of the staff and the transparency of regional NRM groups.

...they're worrying about some wildlife and they're respecting the indigenous, but some of the other stuff just leave that to the other bodies that are doing it and give us the money, give it back to the Ag. Department or something. I think it's just a fuzzy thing that they've all created jobs for themselves. I'm very sceptical about who's running that and who's auditing that and what the hell they're doing (male 56-66 yrs)

The limited relative advantage of many NRM practices led researchers to recommend NRM extension staff ensure the practices they are promoting are adoptable before proceeding with extension to promote its uptake (Pannell et al. 2011: Cary, Webb and Barr 2001). The following interviewee clearly explains how the promotion of NRM practices incorrectly endorsed as beneficial, impact on the credibility of those providing support. He argues that planting vegetation to prevent wind erosion has extensive impacts on his crop due to increased pests, destruction of infrastructure and competition with available water. He also maintains the practice is not effective in adverse conditions and the environmental benefits are generally limited to feelings of altruism.

The NRM officer said to me the other day "Oh you know you should have tree belts for the wind protection". I said "You've got to be careful saying that because I put in a row of trees and I fence it, I actually harbour rabbits, they eat my crop, the parrots eat my crop, the trees fall on my fence and bust my fence, the trees suck out into my paddock and I lose another hectare along the edge where the trees grow, and in actual fact you go on about wind management, but when I get a windy day it doesn't actually stop my paddock blowing away, and it might be warm and fuzzy but there's actually not much benefit in environmental Landcare (male 41-55 yrs).



His comments highlight previous literature discussions on the problems of developing experience and extension expertise when government funding cycles create high staff turnover rates and young NRM extension personnel.

In recent years government NRM programs have had a particular focus on increasing indigenous participation in NRM (Australian Government Land and Coasts 2012b). However two older male interviewees were concerned about the extent of this activity. One argued the focus is good for Indigenous people but is misplaced as it is the 'regular farmers' who are mostly active and responsible for 'Landcare' (male 56-66 yrs) while another stated 'they're overdoing it. Why they're doing it I'm not sure. They need to work in part of it, but the Wheatbelt NRM are very, very pro-indigenous'. But he also believed 'the indigenous people have a role to play, and they could play a better role and a bigger role than they do' (male 66-75 yrs).

He continued to explain that funding was provided to improve Indigenous participation in business enterprises but there was not enough training and accountability provided to ensure they succeeded. He suggested the Indigenous people involved were able to do the physical work but failed to do the administrative and financial aspects of the business. He expressed regret as he believed they worked well on community projects such as this one and the failure of the business resulted in unemployment for many. However, the indigenous aspect of NRM was not included in the scope of this thesis.

As such comments overall suggest there is a mixture of concerns about the different values of many working in regional NRM groups as well as their role, performance and accessibility, while others showed an appreciation for the assistance they provide to many in the region.

#### **7.8.2.3.1            *Regional NRM group funding***

The literature debate about private versus public investment for conserving remnant vegetation was raised as a concern by survey respondents with comments emphasising the importance and availability of funding grants (Gill 2011; Marsh and Pannell 2000; Toyne and Farley 2000). One survey respondent commented on the need to provide financial incentives to landholders due to the high cost of rehabilitation stating, 'Farmers need financial incentives to encourage them to do some of this type of work as the cost of rehabilitating is great' (male 41-55 yrs). Another interviewee explained

the importance of government incentives for him to undertake NRM on his property. He describes how he has undertaken fencing and tree planting because he has received government grants. He also suggests as he cannot afford to pay for this work himself, taxes he and others pay needs to continue to be invested in programs funding this type of work for him.

The only reason I get involved in natural resource management is because I can get grants for it. I'll put in fencing and I'll put in trees and that sort of stuff, and I can afford to do that because it's being paid for. But I can't afford to do it for myself. So I need these systems in place so funding becomes available through our taxes obviously, to make this work for me; and so we do (male 41-55 yrs).

Alternatively the following interviewee believed the government was providing the assistance required as there was ample government funding available to landholders. He argued the fault lay with landholders who were too apathetic to take advantage of the funding available.

I reckon there's plenty of options available to farmers but there seems to be a fair bit of apathy in farmer uptake...I got an email the other day, and on the email, it came from the government NRM, and on their email to me they said 'Funding, funding, funding'. There's so much of it available. So I think the government is doing what it can, but there seems to be a deal of apathy there by the growers (male 41-55 yrs).

One male (66-75 yrs) survey respondent provided some insight into why this may be so by suggesting that even though incentives are provided to rehabilitate or conserve native vegetation, landholders are obliged to pay similar council rates and taxes on the land irrespective of whether the land is used for production or conservation. As such he argued the opportunity costs are too high. The comment is consistent with Jenkins (1998) research that found 13.5% rated contracts a disincentive to obtaining incentives due to factors that included the payment of rates for the land. The comment highlights the importance of understanding opportunity costs of conservation for landholders to identify whether conservation is likely to occur (Conradie et al. 2013).

Overall comments by interviewees support arguments for increased government funding for work with a high public benefit, and better design of policy mechanisms that include both private benefits and costs, and non-financial motivations (Curtis and Mendham 2011; Greiner and Gregg 2011).

#### 7.8.2.4 *Non-government groups*

Respondents raised the issue of different values with non-government groups and therefore the lack of relevance for landholders. One female survey respondent (26-40 yrs) commented, 'WWF and specialist groups have a different aim than commercial farming so their advice can be taken on board only to a certain extent'. When asked about the support from these groups, interviewees commented on support they had received from Greening Australia, WWF and Men of the Trees in the past; when they were in primary school, in 1987 or in the mid-2000s. However their attitude toward these groups was mixed. One female interviewee (26-40 yrs) commented on how knowledgeable Men of the Trees were when planting roadside vegetation as they were able to tell them the right species to plant for each level of vegetation cover, while a second female (41-55 yrs) planting Sandalwood host trees on their land had decided not to enlist the assistance of non-government groups due to the negative feedback they had received about their planting expertise.

Jenkins (1998) found 59% of respondents obtained advice and information about native vegetation from local nurseries and contract planters. The following interviewee also commented how he uses his local nursery because they are localised support; consistent with studies indicating that local-level support is better positioned to engage landholders effectively (Marshall 2008). He also argues that administrative procedures restrict conservation groups to the Perth region and prevents them traveling further afield. Other interviewees also confirmed this opinion.

The tree nursery is close...you need somebody to be able to go to locally, not 200ks away...That's why we utilise them because they are our local identity... As soon as they urbanise things, getting up over those hills over Perth becomes a real difficulty for a lot of them. They become office bound because of the paperwork that's involved and everything else (male 41-55 yrs).

Besides reduced government funding, the rise of the Internet has likely had an impact on demand for non-government services. One interviewee with a smaller-sized farm who receives around half of his income off-farm discusses his Internet use. Commenting on the trees he is intending to plant, he informs us that he accesses most of this information from the Internet, and although much of this originates in America, he is usually able to find the Australian equivalent. However when he is ready to

undertake the planting he will also need to obtain further information from somebody in person.

But there's quite a lot of area we'd like to plant in trees. I get the information mainly off the Internet. I usually just google and type in the question and that comes up with a whole raft of different sites. Quite often the information you get is generally in America but if you try and localise it to Australia you can usually find something. I don't find I can get enough information purely like that. If now was the time I would go and find the information probably from a person (male 41-55 yrs).

This interviewee has been farming less than 10 years and his comment is consistent with literature suggesting newer owners are less likely to use established rural networks and more likely to use contemporary sources of information such as the Internet (Curtis and Mendham 2011). Some interviewees believed all the conservation groups should amalgamate with regional NRM groups, commenting 'what about we concentrate all that effort through the NRM and we integrate the tree growing with the fauna protection...why have four, when one will do? A one stop shop' (male 41-55 yrs), or they should '...link in together, like to the Landcare and have many arms because it would carry more weight...' (female 56-66 yrs). However another believed that the younger landholders know nothing about these groups suggesting the ideology they represented was outdated and these groups should disappear. He argued the focus should now be on providing information and innovation to improve production.

My son in law and daughter have been on the farm for five years now and if you asked them who's Men of The Trees or Greening Australia or WWF they wouldn't have a clue. They would not know the point of them or what they did or did not do. That's five years, so they could all just be rubbed out...it's just that we've stopped using horses, we've stopped using those sort of things. But we're still desperate for information, desperate for innovation, but it's all about production.

Highlighting a problem for both government and urban-based conservation groups is the difficulty of maintaining conservation areas in remote regions and the relationship that entails with local landholders. The following interviewee commented on a bushfire that occurred in a large conservation area in the WA Wheatbelt. He argues that conservation groups lobby the government because they want to conserve bushland. However landholders had to undertake the firefighting to protect the bushland because the fire was threatening their farms, and no conservation group members were there to assist. He is annoyed by the way he perceives the government and the media support these groups, yet they do not have any responsibility to protect

these areas. As such his view of conservation groups is poor and the likelihood of him developing a positive relationship with these groups is further diminished

...in the light of the bushfire that we'd had, it's alright for these groups to come and hound the government and lobby the government to have this Great Western Woodland out here...But when the fires start out at Forestania with lightning like they did this last harvest, none of those people from the Wilderness Society were out there fighting them. It was farmers got off their headers and went out there because we were fearful that a few days of north-west winds, even though they were 100 kms away, would have brought them right into our farms here... But this is what annoys the hell out of me. So many of these...lobbyists...that want everything their way and governments tend to bend their way and the media get behind them, but when there's a job to be done you never see them (male 66-75 yrs).

Overall there was limited support and mixed attitudes toward these groups with many examples of support provided in past decades. The tensions between public benefits and private costs are also revealed. Today, conservation information and support is often accessed through alternative sources such as local nurseries, the Internet or regional NRM or grower groups. Interviewees suggestions that these groups should amalgamate is likely driven by other issues they discussed such as knowing where to go and the time involved in accessing the information required. Conservation groups such as WWF have had officers successfully working with regional NRM groups for many years, providing mutual support for both organisations. As suggested, further development of this type of partnership may improve the presence of these organisations.

### 7.8.3 Institutional support

#### 7.8.3.1 *WA government officers*

Some survey respondents' comments in this study concerning the support provided by the Department of Agriculture were positive with benefits received from their support and trials assisting them 'in making better decisions' (male 41-55 yrs). One interviewee explained how he uses WA government advice and information in conjunction with using support from other local landholders for confirmation.

The last 10% of my information I'm just as likely to ring up the Ag Department and talk to one of their soil scientists or somebody and say "I've been given all this information, what's your slant on that?" and he'll give me an opinion on the

telephone, and he's got no reason to give me biased information, so you can always go and get a second opinion if you like. You can talk to your fellow neighbour and he might say "Yeah well he told me that and it's all wrong" or whatever (male 41-55 yrs).

Yet many interviewees and survey respondents reflected on the loss of state government support in recent decades with comments such as, 'I'm very disappointed that a lot of agriculture department staff cannot continue in their projects because of funding cuts' (male 26-40 yrs), and when asked about the decline in their services they replied 'The Ag. Department definitely provided the service' (male 41-55 yrs). Others suggested they were too distant from them (male 41-55 yrs), their advice is not always practical or relevant to the issues (male 41-55 yrs), or they did not know what support they provide (male 41-55 yrs). An older male interviewee (56-66 yrs) believed the reduction in state government funding of the Agriculture Department has been excessive, forcing landholders to pay through their industry levies for the work formerly undertaken by the Department of Agriculture. Palmer, Fozdar and Sully (2009) also found more than half of their WA respondents were concerned about the decrease or disappearance of government extension services.

Some interviewees in the current study commented how the withdrawal of government services had impacted on their access to information and advice with one male interviewee (56-66 yrs) commenting; 'Well it's made getting advice a lot more complicated and time consuming and individually costly'. The following young female believed the withdrawal of support by the Department of Agriculture has made finding support more complex as the specialisation of those providing support has made it difficult to find out the appropriate service provider to contact for a particular problem.

I think it's too fractured. Everyone's off doing their own thing. Whereas when the Ag. Department was running the show sort of, it was like, if you had any questions or had any worries everyone went to the Ag. Department and it wasn't an issue. But now you've got to go "OK is this animal health, is this cropping health, is this an NRM thing?" and you've got to think "OK now who do I ring about this?" And you've got to think through your list of contacts and work out who you've got to ring about stuff and if you're going to get support from them (female 26-40).

One survey respondent clearly outlined that he believed the loss of unbiased support by the Department of Agriculture has threatened the agricultural industry, and was

saddened by the loss of credibility this caused to landholders in the last decade. He argued the problem was made worse by senior employees remaining with the department which prevented younger people developing a career with the department, resulting in the subsequent employment of overseas experts who understand the technical aspects but are unable to communicate this to the landholders. As such he believes their assistance is inadequate and funding of the department is not worthwhile.

I would prefer to have the Department of Agriculture support that we used to have a couple of decades ago, especially as this was unbiased. The greatest threat to agriculture has been the breakdown in the support they provided. Their credibility in the eyes of farmers has taken a severe battering in the last 10-15 years. This is sad. The problem is that the older people stayed in the department and wouldn't shift, making it difficult for younger people to find a career path in the industry. Now many of the experts are from overseas and even though they may know about the science, they don't relate to the Australian farmer and are not able to adequately communicate their knowledge to them. So I am very disappointed with the quality of help provided by the Department of Agriculture now and I think it is a waste of public money (male 41-55 yrs).

This decline is shown by Jenkins (1998) who found that Agriculture Western Australia and the (then) Department of Conservation and Land Management (CALM) were rated relatively highly for advice about managing bushland. Many of the responsibilities for conservation and land management of private land are now undertaken by the Commonwealth-funded regional NRM groups. State funding is now focused on conserving public lands under the Department of Parks and Wildlife (formerly CALM) with biosecurity, regulation and assisting landholders to improve productivity the responsibility of DAFWA. One interviewee believed government departments have a key role in biosecurity including identification of rare diseases, and crop services not generally provided by the private sector (male 56-66 yrs). As such personal contact with landholders is mostly limited to technical support and regulatory control. Similar to Palmer, Fozdar, and Sully (2009), one survey respondent believed that DAFWA had not kept pace with the sophisticated needs of landholders and as they were now focussed more on biosecurity and regulation, suggested landholders 'are often reluctant to provide them with information in case they get prosecuted' (male 41-55 yrs). Toric (2005) also found that many of his interviewees had little contact with the WA agriculture department.

One interviewee suggested he only uses their website for accessing information such as pasture and livestock management and weed identification (male 26-40 yrs). However, consistent with other WA studies (Musawi 2013; Parsons 2009), interviewees had difficulty with accessing information on their website and found their website unstructured, difficult to use and ‘atrocious’ (male 41-55 yrs). Of note however were the comments from an interviewee with an organic farm who had found information provided by DAFWA was useful commenting; ‘The Ag. Department does actually have an information package on organic farming and it wasn’t too bad’ (male 26-40 yrs).

A key issue about the provision of support in general was raised by interviewees in the McKenzie (2011) study who complained about the lack of follow-up from farm trials undertaken by providers of support resulting in duplication of research rather than a systematic approach to learning from government-funded trials. They believed this was due to government policy cycles that interfere with ongoing project funding and cause high staff turnover. Both survey respondents and interviewees in the current study commented on this problem with survey respondents suggesting ‘More timely follow up or/and man power.’ (female 56-66 yrs) is required, while another female (41-55 yrs) commented ‘It is unfortunate successive governments keep rearranging DAFWA, CALM etc because people who instigate projects are difficult to locate in succeeding years to glean follow up information and the results of research from’. One female interviewee (56-66 yrs) commented how her son had become very enthusiastic about doing some NRM work after attending a group talk but because there was no follow-up he did not ‘go the next step’ and do anything about it.

As with other literature, many survey respondents and interviewees in this study were concerned about the loss of unbiased and accessible information and support previously provided by the Department of Agriculture and apart from biosecurity, they believed their services had mostly now become difficult to access or irrelevant, although this varied with the participant. The impacts of government policy funding on ongoing support was raised by several participants as an issue of concern.

### **7.8.3.2                    *Research and development organisations***

Comments on the services provided by GRDC showed mixed results with some wanting ‘Better communication/more relevant GRDC research’ (male 41-55 yrs)



while others found their support was ‘not bad’ but ‘a bit fragmented to go find out what they’re doing...because GRDC are not centred in WA and the information you want might be coming from other states and they’re not really suited for here (male 56-66 yrs). They suggested ‘It would have been good if they had moved to WA’ (male 26-40 yrs).

Yet many interview comments were positive suggesting they; ‘do a tremendous job’ (male 41-55 yrs), ‘play a very, very important part’ and ‘the majority of farmers are happy with GRDC as it is now’ (male 66-75 yrs). One female interviewee (56-66 yrs) believed that GRDC was a respected organisation. She suggested they provide a lot of information, however the problem of information overload (Marsh and Pannell 1998) reduces landholders’ time and motivation to access it. The following interviewee believed there was a problem with the levy funding of the organisation. He was concerned with the lack of control landholders have with the compulsory levy system as, although it may be viable when cropping was profitable, in the years when landholders received little or no profit they had to pay their levy using credit and as such the levies were funded by their debts.

...the trouble with GRDC we’ve got no control over what percentage of our profit goes to R&D. Because it’s a compulsory levied statutory, 1.05% of farm gate value. So in a very good year it might only be 10% of your profit or even 5% of your profit. But in a bad year it could be all of your profit. Or in a worst case scenario which a lot of the eastern Wheatbelt farmers have faced in the last 5 years, it’s negative profit. They’ve actually had to debt fund it (male 41-55 yrs).

When asked about the benefits from attending GRDC forums one male (41-55 yrs) believed the information he receives reinforces his decision-making, commenting ‘There’s not a lot new. So a lot of it is a reinforcement or fine tuning of what you’re already doing’. Llewellyn, D’Emden, and Kuehne (2012, 206) also point out that landholders will often access information ‘to support and reinforce an existing decision to adopt’. One male interviewee (56-66 yrs) also found the information provided by Meat and Livestock Australia (MLA), another levy-funded industry organisation, useful.

Discussing the CSIRO, one male (66-75 yrs) interviewee recounted some recent work improving Canola the organisation is pursuing together with GRDC, and believed their work was essential, while another male (41-55 yrs) was concerned about recent

funding reductions to the CSIRO. Others suggested they used to have more contact with them in the past but they have little knowledge about their current work. The following male suggested their research focus was on national and global agriculture. He proposed they must be successful because their work was not being criticised.

...they conduct the really, really expensive research, especially in diseases and animal health and these types of things...so I think they're looking more at agriculture in Australia as international. So I think that when there's no trouble they don't get any praise but there's probably only no trouble because they're doing their job and nobody notices that, you know what I mean (male 41-55 yrs).

An interviewee in the McKenzie (2011) study highlighted the change to landholder-driven research discussed in the literature. He believed scientists were often studying things landholders had been doing a decade before and it was the scientists who were learning from the landholders and not the other way around. This issue was also raised by interviewees in the current study with one male (41-55 yrs) who discussed his frustration with researchers informing him of information he was already aware of stating 'that's what all the better farmers have been doing for years. And you'd be amazed at how much of that research is driven like that'. Another interviewee suggested the feeling amongst landholders is that scientists working for the Department of Agriculture are similar commenting that 'farmers are finding their own way and the Ag. Department will research something farmers have already found is working. That's just the feeling' (male 26-40 yrs). These comments suggest the change to landholder-driven research has created some confusion about the role of scientists in agriculture.

In relation to university research the following male discussed how their valuable research, supported by industry partnerships, is often presented at an organised event but generally not credited to the university. He suggests, although landholders do not applaud a university's contribution to this research partnership, he believes it is invaluable.

I know UWA weed research on resistance is invaluable. But that's supported by GRDC, but it's at the university so we get some synergies from the facilities and their students of the university...we get the same with Curtin and that's a bilateral partnership with GRDC. That sort of work bubbles along and we probably never think to give the university the credit for it. It comes from a researcher at a field day or presentation and they'll say they're from a university. But I think I'm

speaking for the general farmer, you don't say 'Oh we'd be lost without UWA'. You don't do that, but that's basically a fact with some of these things, in partnerships (male 56-66 yrs).

Nevertheless, while discussing funding provided by research organisations for projects his grower group has been involved with, one male (41-55 yrs) highlighted the difficulty of determining the organisation involved commenting 'So where that comes from is hard to tell at the end'. This issue was also discussed by Mallawaarachchi and Green (2012).

Overall attitudes were mixed toward GRDC with the benefits of their wealth of research used to reinforce decision-making. However paying compulsory levies to support this organisation is difficult for some landholders. Most know little about the current work of the CSIRO but concern was raised about current funding cuts to their research. University and industry partnership research was often not credited to the universities that undertake the research, highlighting the difficulty described in the literature of determining the organisation that produced the research information. They also reveal interviewees attitude toward the change to landholder-driven research agendas as discussed in the literature.

### **7.8.3.3                    *Industry groups and associations***

Less than half the survey respondents were aware of the services provided by industry bodies and interviewees had less to say about these bodies. Responses were mixed with one suggesting 'they offer quite a bit of support but I think it's timeliness at the moment...it sometimes depends on what staff they've got. They might be really right up with the stuff you might need or they might not' (female 56-66 yrs) while another believed they 'squabble and in-fight and I don't have a great deal of faith in those two particular groups' [WAFF and PGA] (male 41-55 yrs). The following interviewee voiced the same problem suggesting the large number of industry bodies reduced their capacity to influence government on behalf of farmers. He also believed the differences between the two key bodies, WA Federated Farmers (WAFF) and Pastoralists and Graziers Association (PGA), preventing them from uniting was disadvantaging WA farmers by providing government with an excuse for not supporting farmers, and his dream of them uniting was not going to occur.

There's so many other smaller bodies trying to save the grain industry. A group of farmers start and I think they need a good shake out so that we're all one voice. And it's unfortunate that WAFF and PGA can't be one voice. It's not good for the state's farmers. But they're very different. It does give the government a way out "Well you want it but they don't so why should we bother to do anything". But it's been a dream for a long time...that we could be one voice, but it would appear that it's not going to happen (male 55-66 yrs).

An interviewee with an organic farm also told of the industry that supports his type of farming the National Association of Sustainable Agriculture, Australia (NASSA). He explained that as an organic farmer he required certification from his industry body who also provide manuals and guidelines for land management. His comments suggest he has a pragmatic approach to their support.

...we're certified with a certain body like NASAA, we're a member...and you get information sent to you... they do have manuals and recommendations on how to manage properties... I don't feel dissatisfied that they provide enough support for me so they must do.

As such those interviewees aware were mostly supportive of industry associations. However they believed the timeliness of their information sometimes needs improving and their conflict and fragmentation reduces both their appeal to landholders and reduces their lobbying power.

## 7.9 Summary of survey results

The previous three chapters provided the results and interpretation of the study and compared this with existing literature to show how it builds on current knowledge. The findings have been interpreted to support the research objectives. They reveal most respondents undertaking the survey were males aged between 26-55 years, with over 1000 ha of mixed crop and sheep farms. Most had been farming more than 20 years, had young families, or were empty nesters (children all left home) and were first, second or third generational owners of their farm. They had mostly completed secondary education or received higher degree qualifications. Their households mostly consisted of two or three key decision-makers, they received more than 75% of their income from the farm, and considered their farm financial performance was average or above average compared to other local farms. Significant relationships found

between these characteristics show links between the variables and help to build the profile of respondents.

Overall, survey respondents showed social norms in relation to NRM are generally positive with attitudes that all or some aspects of NRM are important. Interviewees' comments supported many of the issues raised by literature. They revealed concerns over the dominance of productivism and apparent decrease in conservationism creating a major decline in motivation and potential knowledge lock-in, highlighting the attitudinal issues faced by NRM extension. They also reflect literature findings on the confusion of what NRM consists of and the response of some landholders to their NRM issues. They explained why many landholders are not doing more to manage their natural resources with some highlighting the dichotomy of productivism and conservationism, the dominance of neoliberalist ideology and issues with responsibility for NRM. However they also reveal the problems faced by landholders in adopting practices that do not have relative advantages and for extension in promoting practices not aligned with landholder goals.

The results suggest most respondents believe regional NRM groups are genuinely concerned about their community but are equally undecided or disagree they are a rubber stamp for the Commonwealth government. Many believe that the regional approach is a way to hand over responsibilities for difficult issues but are mixed in their view that the approach is a way to transfer NRM costs. Most respondents either agree or are unsure about the Commonwealth government's commitment to community empowerment. Participant comments reveal why some respondents believe regional NRM groups no longer care about their community and why they suffer from bureaucratisation. They explain why they consider the regional delivery approach is not effective and that responsibility for difficult issues is being shifted back to local groups without the funding to support them. They also highlight the governance improvements made to later regional delivery programs and raise concerns about current trends in government's regional delivery approach to NRM.

Most respondents were addressing soil acidity, undertaking no-till, including stubble retention and managing weeds, many were in the pre-adoption stages of, or interested but currently unable to undertake VRT, planting deep-rooted perennials and controlled traffic farming, some had tried and dis-adopted periods of fallow while around half the

respondents were not contemplating undertaking agroforestry, cell or strip rotational grazing and controlled traffic farming in the near future. The stage of NRM practice was significantly related to landholder's belief in the capacity of the practice to achieve their goals for all practices except VRT and many were unsure about the benefits of practices they were not undertaking meeting their goals. Significant relationships also showed attitudes toward vegetation are reflected in all practices relating to planting and conserving vegetation.

While there were a range of personal and farm characteristics shown to influence attitudes and behaviour toward adoption of NRM practices only three characteristics (age, the number of key decision-makers and farm size) were shown to influence three NRM practices (no-till, addressing soil acidity and controlled traffic farming) for both the stage of adoption and the ability of the practice to meet respondents' goals. Comparison with the other studies of WA landholders show overall results are similar with current studies and changes that have occurred with past studies. Other studies also inform us of changes in landholder practice due to climate change, and concerns about chemical use that are also discussed by interviewees.

Overall respondents showed almost all believe support is most beneficial in the pre-adoption stage of their NRM practice, most believe it is beneficial when they are in the active stage of adoption and equal numbers of respondents believe it is beneficial or not very beneficial when they are in the interested stage of adoption. The importance of the methods of support also differed with the stage of practice change with information, practical demonstrations, most important in the contemplation stage, practical demonstrations, workshops and individual advice in the preparation stage, financial assistance and peer support in the action stage and peer support and information remaining important in the interest stage. Practical demonstrations and individual advice were rated most important and financial assistance and group support were almost equally important. Social media was the least important of all methods. Ratings for the providers of support in the current study were also consistent with the ratings for those that delivered the participatory activities in the Kacans et al. (2014) study.

Methods of support for conservation agriculture were easy to access except financial assistance and all were rated relevant except social media with many unsure of this

support. Many were unsure about accessibility of support for sustainable grazing with accessibility of these methods somewhat easy to access and moderately relevant. Although there was a high percentage of respondents unsure about support for agroforestry the remaining respondents were mixed in both their attitude toward accessibility and relevance of these methods of support apart from financial support which was rated highly relevant. Methods of support for native vegetation management was easy or somewhat easy to access and all relevant except social media, and support for managing weeds were moderately easy to access apart from financial assistance and moderately relevant.

Managing native vegetation and weeds and conservation agriculture had the greatest difference between the accessibility and relevance suggesting some respondents would like more assistance for these practices. The high number of respondents unsure about agroforestry and sustainable grazing underscores the importance of intensive cropping in the Wheatbelt. The gap between the accessibility and relevance of support for all NRM practices suggests respondents have mixed access to these methods of support. The high correlations for all categories of NRM practices indicate the results may be similar to that of other WA Wheatbelt farmers. Combining results show as landholders progress through the stages of practice change the methods of support they prefer changes, with the same methods rated most beneficial with the stage of adoption, as those rated most relevant but least accessible. They show the high relevance of individual and financial support and practical demonstrations. Other WA studies reveal the importance of both methods and providers of support and the rising use of both Internet and mobile phones. Overall results concur with other WA studies and interviewees' comments provide further evidence of their need for assistance in sieving out relevant information.

In view of the extent that Ecker et al. (2012) found the availability of support motivated respondents the current results need to be interpreted with their results in mind. Overall respondents were mostly aware of the providers of support with the highest awareness for grower groups, other local farmers, private or agribusiness consultants and Landcare, moderate awareness of support for research organisations, regional NRM groups, WA government officers and industry groups and many not sure of the support provided by non-government organisations. Those respondents aware of the providers

had received support from all providers, with most of the support from other local landholders, private/agribusiness and grower groups. The greatest difference between respondent's awareness and their use of support was for Landcare probably due to their branding. Their motivation to use these providers of support and their belief that the providers of support understand the risks involved in their adoption of the NRM practices, corresponded with their level of awareness and use. The results showed little support or motivation for use of non-government groups and only half the respondents who responded to the question about support understanding adoption risks rated WA government officers as probably or definitely understanding the risks. Regional NRM groups were shown to have influenced adoption of NRM practices and funding assisted native vegetation management.

Analysis found significant relationships between awareness, motivation and attitudes toward adoption risks for three providers and between Landcare, grower groups and R&D organisations. Relationships for personal and farm characteristics found older respondents on smaller farms mostly influenced Landcare support. The results were mostly consistent with current literature. The key areas respondents believed they benefited from the support they received were assisting them with decision-making, improving their knowledge and networking, practice change support, implementing on-ground work and assisting them to improve the natural resources of their farm and social benefits. Consistent with literature, respondents were mostly happy with the support they received with the greatest barriers being accessibility and relevance of information combined with funding and on-ground support.

Interviewee comments showed landholder concerns and attitudes toward the providers of support are very mixed and their attitudes toward the issues arising in the literature were mostly consistent with these reports. They discussed the importance of grower group and other landholder support, the impacts of changes to private sector support, the decline in Landcare groups, mixed awareness and attitudes toward regional NRM groups with support for increased government NRM funding, and highlighted the limited support for non-government groups. They revealed regret at the loss of WA government agency support, emphasised the importance of R&D and revealed their frustration and difficulties supporting industry organisations. Overall these comments



highlighted the many challenges faced both by landholders and NRM extension in improving both production and conservation in the region.

## 7.10 Chapter summary

These chapters presented the results and analysis for both the quantitative and qualitative data collection. Explanatory variables included respondents' profiles, which were explained in terms of their demographical context followed by NRM identity and attitudes toward institutional trust. Further results were then presented based on the two themes. Firstly The Stage of Adoption model showed the stage of respondents' NRM practice, the stage when support is most beneficial as well as the stages when the methods used are most beneficial. The accessibility and relevance of these methods of support were also examined. The second theme used the TPB concepts and explored respondents' awareness, use, motivation and attitudes toward the providers of support. Results were presented first followed by discussion comparing results with literature, then interview comments. A general discussion of these chapters follows.

# Chapter 8            General Discussion

## 8.1            Introduction

The previous three chapters integrated and interpreted the study's data and compared it with previous literature to incorporate existing knowledge with the results. In this way the findings build on previous knowledge and provide a more comprehensive picture of the providers of support and methods they use for encouraging adoption of NRM practices. This chapter discusses these findings, interpretations and literature comparisons in relation to the research objectives, the framework and the themes which emerged during the research.

## 8.2            General discussion

### 8.2.1            Explanatory variables

#### **8.2.1.1            *Respondent profiles***

Results show that middle-aged males continue to dominate agricultural decision-making in the WA Wheatbelt; however analysis shows there may be a trend for younger females with higher formal education to take a greater role. Comparison with past studies also show the ongoing aging of landholders in the region. The importance of this factor to NRM is highlighted by an overseas study which found 'older farmers are less likely to change their behaviors and adopt new practices' This is because they are less likely to want to invest in expensive equipment or skill development as they near retirement age (Prokopy, Towery, and Babin 2014, 2). The findings also likely reflect the role of rural women in agriculture in the WA Wheatbelt.

Ecker et al. (2012) found that older age was the third greatest factor limiting change in management practices for broadacre farmers and age was also a significant influencing factor in the current study. Other studies suggest older landholders may have reduced incentives for adoption, particularly when family succession is not an option. They also suggest that health may be negatively correlated with adoption of conservation practices and that older aged, more experienced landholders with lower formal education may be less inclined to take part in NRM activities. The increasing age of

farmers since the 1980's and the declining rate of younger people entering farming (Allison and Hobbs 2006) therefore raises implications for NRM.

When compared with other studies, respondents' farm sizes appear typical of the multifunctional land use in the region. Examination of farm size and type of production highlights the amalgamation of farming for crop production, and this is confirmed by a generational shift shown in farms. The extensive farming experience of most respondents, the high percentage of second, third and fourth generational ownership and the high reliance on the farm for income reflect the fact that farming is not just an occupation, but is a life-style choice requiring long-term commitment and support. These findings suggest the region has a relatively stable population for larger-sized farms. Of note was nearly half the respondents were in the middle age group – 41-55 years – and these respondents owned or managed a range of farm sizes suggesting many farms overall are owned by this age group.

Generational ownership of farms was also shown to influence respondent profiles with first and second generational ownership of many smaller-scale farms, highlighting literature reports on the growth of multifunctional land use. The high percentage of younger couples and older, less experienced respondents on first and second generation farms, with many of these being potentially higher educated and on small-scale farms, points to this demographic owning the smaller farms. This suggests much of the alternative production and land-use may also be undertaken by these landholders. It also suggests that these landholders may require more assistance using alternative extension methods, particularly as many of these landholders appear to be first generation owners. However further analysis is required to ascertain how education levels may influence this situation.

On the other hand consistent with other studies, respondents aged under 56 years were shown to own many of the large-scale farms with adequate economies of scale to earn them a higher income. Studies show these farms are continuing to expand and increase profits. Landholders on larger property sizes have been shown to adopt NRM practices due to their greater financial capacity to implement them. However, studies also show that motivation for profit may not always be the most important factor in NRM decision-making. On the other hand interviewee comments in the current study suggested many younger landholders have a strong focus on productivity and are less

inclined toward conservationism. The dominance of productivist identities within social norms may also have a significant influence on NRM decision-making.

The significant increase in formal education in recent decades, shown in the current study through the use of a previous WA study, highlights the increasing sophistication of farming and the need for knowledge and extension in a wide range of disciplines. It also points to challenges for NRM extension, particularly in regard to self-learning methods. Informal training appears to show positive influences in some studies but was not included in the current study; which may have influenced the lack of significant relationships for education. However the complexity of many NRM problems suggests formal education may be a greater advantage for understanding and dealing with some of these issues. Evidence of the catalysing effects of any form of education suggests that in general both formal education and training are important for adoption of NRM practices.

As might be expected older, more experienced households showed higher incomes. Combined with analysis of generational relationships and households, these results also tend to highlight the growing number of younger and older couples with off-farm income buying smallholdings in the region and the ongoing succession of larger farms by families. Literature highlights the importance of household structure to adoption of NRM practices. Children are shown to make a significant difference to lifestyle choices and income during the family cycle, and farm labour and the potential for succession has been found to significantly influence adoption of NRM practices.

Women as secondary decision-makers has also been shown to influence NRM decisions as well as the number of decision-makers suggesting benefits for extension aimed at including these factors into their strategies, particularly as women are often the decision-maker with university qualifications. Nearly half the households had two key decision makers and analysis highlighted the ongoing succession occurring on many of these farms. Although other studies have found this variable influenced decision-making, the current study found other variables may be more relevant.

Income showed the highest number of relationships and therefore the greatest influence on respondent profiles. Most respondents earned more than 75% of their income from the farm and relied on cropping as part of their farm income, while those

earning less had smaller lifestyle farms. This result is consistent with other WA research showing most landholders derive most of their income from the farm. As expected income increased with greater age, farming experience, generational farm ownership and older households. However like other studies there was a decline in the financial scale of the farm as respondents' reach older ages, and greater profit for larger farms due to economies of scale. Relationships with farm size in the current study therefore emphasise the links between farm expansion and income production and the advantages of increasing farm size to capture economies of scale. Privacy issues restricted more questions on income, however household income percentages found in other WA studies are likely similar to the current study.

Researchers suggest low income households may have less disposable income to undertake NRM practices, even though their asset wealth is higher than the average Australian. Alternatively households reliant on the farm for income have been shown to increase adoption of some NRM practices, while the third of households in the current study earning off-farm income are likely to have mixed attitudes and behaviour toward adoption. However research also shows that expectations for future profits has a greater influence on adoption than current financial status. Most respondents in the current study who rely on their farm for income believe their farm performance is mostly better or the same as their neighbours. However the number of respondents with smaller-scale farms who are unsure about this factor suggests sharing of information is more difficult for this sector. The study was unable to confirm other studies suggesting that belief in future farm performance may influence adoption practices.

Research has found that overall, studies show mixed relationships for these variables. However this analysis of the personal and farm characteristics provides a useful profile of the respondents suggesting research on a larger scale would be worthwhile to ascertain whether this profile is representative of landholders in this region.

### **8.2.1.2**                    *NRM identity*

Respondents identified relatively strongly with their perceptions that most other local landholders believe NRM or some NRM issues are important. Although these questions could not be further analysed, the findings do point to further research into the influence of NRM on social norms as being worthwhile, particularly into those

who disagree with the social norms about NRM. This may help us better understand the influence of providers of support on attitudes and behaviour. The results also emphasised the complexity of attitudes that influences NRM highlighted in literature, and interview comments reflected this. Their comments suggested the factors influencing NRM attitudes today included a move away from Landcare ideology and concern for the environment, toward productivism, and the conundrum of responsibility for public-good investment.

Other reasons given for the change in attitude and behaviour included large scale farming demands on time and money and the change to pull-driven NRM extension services focussed mostly on increasing productivity. They commented on the difficulties of engaging with those who have different values; an issue for both landholders and those providing support, and the need for NRM practices to be profitable; as discussed in the literature. They also discussed issues relating to the tragedy of the commons; revealing difficulties in understanding how their own actions contribute to land degradation and ecosystem decline.

Confusion with the definition of NRM shown in other studies was also reflected in survey respondent and interviewee comments. Fields, Luloff, and Krannich (2013, 226) inform us the sociologies of natural resources and environmentalism evolved separately with environmental sociology emerging much later in response to growing public concerns about environmental impacts. Natural resource sociology focusses on how local natural resource conditions affect local communities while environmental sociology has a broader orientation toward state, national and global conditions with a more economic perspective. They argue these two fields of enquiry remain 'distinct but complimentary', with limited overlap.

However NRM programs attempt to fuse these two social ideologies and implement the processes for attitude and behaviour change they demand. The joining of conservation and farmer industry organisations to develop the Landcare movement legitimised environmental ideologies for agriculture; encouraging awareness and understanding of the benefits of conservation of native vegetation. This study's comments reveal many landholders retain a belief that NRM is about conservation. Whereas as NRM staff highlight, NRM encompasses much more than just 'trees' (Boggs 2016). This issue is a key problem for NRM extension to improve their

influence on the adoption of NRM practices. The responses and comments provided in the current study highlight the myriad of challenges involved in successfully achieving this aim.

### **8.2.1.3                    *Institutional trust***

The significant relationship found between institutional trust and the influence of regional NRM groups on adoption of NRM practices suggests respondents may have developed reciprocity strategies of trust with these regional groups, perhaps due to the growing absence of Landholder groups. However many believed regional NRM groups are still controlled to a large extent by government policy. Consistent with Marshall (2008), many respondents were also unsure or had negative attitudes toward the regional delivery system and Commonwealth government commitment to community empowerment, with some suggesting recent policy changes may be detrimental to the future success of the NRM system and themselves.

It is unfortunate that these two explanatory variables (NRM identity and institutional trust) could not be used in further analysis to explore how these attitudes might affect adoption of NRM practices or motivation for use of the providers of support. The results do however indicate that these attitudes may influence attitudes and behaviour toward NRM practices and are therefore worth exploring in further research.

## **8.3            Theme one**

### **8.3.1            Stage of adoption**

The findings clearly indicate that the adaptation of the Stages of Change model developed by Prochaska and DiClemente (1983) provides a useful model to investigate landholder adoption and the stages when both support and the methods used by providers are most beneficial. Consistent with literature they show the NRM practices with higher private benefits have the highest adoption rates. The high rates of these practices also reflect the long and extensive work undertaken by NRM extension in past decades.

Practices such as native vegetation management practices that have higher public benefits have been moderately adopted, while those practices with a greater mix of private and public benefits and/or greater complexity and difficulty with

implementation, have the lowest adoption levels. Some of these more complex practices show respondents in the pre-adoption stages and appear to have potential for adoption, but involve considerable barriers, see Appendix A. The stage of Interest suggests barriers may include perceived behavioural controls such as limited skills and knowledge which could be assisted by NRM extension. Few practices have been tried and dis-adopted, indicating these NRM practices have been well proven before adoption by respondents. However many are not being considered within the next five years. In fact, the graph appears to be fairly evenly split between those practices in the pre-adoption or adopted stages and those dis-adopted or not being considered within the next five years. Overall, the results reflect the complexity of adoption explained in the literature as well as the limited, private financial benefits and relative advantage of many NRM practices to achieving individual landholder's goals.

### **8.3.1.1                    *Goals***

Significant relationships indicate the concept that respondents' attitudes toward the practice meeting their goals was a reliable measure of attitudes and behaviour toward adoption (section 3.2.2.1). Respondents' attitude toward the practice meeting their goals reflected their stage of adoption with significant relationships found between the stage of adoption and the practice assisting respondents to meet their goals for all practices, except VRT. However they also showed most respondents who were not undertaking a practice were also unsure about the ability of the practice to meet their goals, suggesting there may be potential for NRM extension to promote further adoption. Many respondents were thinking about adopting VRT but many were also unsure about it meeting their goals which may be why it was not related. The significant relationships shown between the stage of adoption and those respondents who believe planting and conserving vegetation meets their goals suggest these respondents may be more inclined to adopt these type of practices.

### **8.3.1.2                    *Personal and farm characteristics***

Analysis of the personal and farm characteristics between both the stage of respondents' practice and their attitude toward the practice meeting their goals shows particularly strong relationships between respondents' age, the number of key decision-makers and farm size. This result shows younger respondents were less likely to believe no-till and stubble retention would meet their goals, and most households



with two key decision-makers were undertaking these practices and strongly believed they would assist them to meet their goals. Relationships with farm size showed smaller farms were less likely to address soil acidity or practice controlled traffic farming; possibly due to a lack of access to information and support about these issues or the relevance of the practice. Comparison of personal and farm characteristics and adoption of NRM practices with Kacans et al. (2014) showed several personal and farm characteristics that positively influence the adoption of most NRM practices, however very few were similar to those found in the current study; likely due to the small sample in the current study. The results highlight literature comments on the variability of these characteristics found in studies.

### **8.3.1.3**                    *Other studies*

The overall similarities with the ABARES report, except for managing weeds, suggests results of the current study are likely representative of WA Wheatbelt landholders. However the significant difference in the results for managing WoNS between the ABARES studies and the current study suggests there may have been confusion about what constitutes a WoNS in the current study. Findings from other studies suggests respondents may have included practices to control crop weeds in their response. Interviewees also reveal the extensive chemical costs and time they spend on managing crop weeds.

Other WA studies show little or no increase in the proportion of WA grain growers making practice change in the last decade and suggest the focus of adoption has changed to increasing technology use and soil improvement. This change is consistent with literature and interview comments in the current study highlighting an increased focus on productivity. Comparison with past WA studies show interesting results with a small increase in minimum tillage and stubble retention in the last 20 years, which is consistent with literature suggesting this practice has reached saturation point, while the significant increase in liming is consistent with DAFWA reports on the increased soil acidity during this period.

An increase in agroforestry implies a similar increase in smallholdings, particularly when compared with the percentage of small farms in the current study in the pre-adoption or action stages for agroforestry. Comparison also suggests a decline in native

vegetation management and attitudes toward this practice, which was supported by interviewee comments in the current study.

#### **8.3.1.4**                    *Interviewee comments*

Interviewees were not specifically asked about attitudes or behaviour toward NRM practices however some interesting points were raised within their general discussion. Some of their concerns were shown in GRDC survey results, such as the high adoption of precision agriculture techniques which have increased chemical use and raised concerns about herbicide resistance as well as environmental and human health issues. This concern had encouraged the change to organic farming for one interviewee who was particularly concerned about the role of agribusiness agents in increasing the use of chemicals in the region. Interviewees in other studies had even suggested the role of regional NRM groups in promoting these practices may eventually make them vulnerable to promoting outdated practices. Interviewees in the current study suggest practice changes being made may be partial or not sufficient to provide effective benefits to the environment. Nonetheless, recent GRDC surveys suggest landholders are continually changing practices in response to climate change and other factors.

Overall, the results revealed respondents' stages of adoption for the specified NRM practices and confirmed literature outlining the need for the practice to meet landholder goals before adoption. They are also consistent with the TPB concept that our attitude toward the outcomes of performing the behaviour and our evaluation of how much we value those outcomes influences the likelihood of us performing the behaviour. The findings for these questions therefore met the study's first objective of determining the stage of WA Wheatbelt landholders' adoption of specified NRM practices and their attitude toward the effectiveness of these practices in meeting their goals.

#### **8.3.2**                    **Methods of support**

The following discussion is about two key recommendations in the Ecker et al. (2012) report (Table 4-5); to improve understanding about the influence of the providers of support and the methods they use to promote adoption of NRM practices. The Stage of Adoption model developed for the study was used to explore the stages of adoption when support is most beneficial and when the selected methods used by the providers

of support to assist landholders in the WA Wheatbelt are most beneficial. These methods were confirmed with the help of Wheatbelt NRM staff.

Findings show that support for adoption of NRM practices is highly beneficial in both the pre-adoption and action stages of adoption but respondents were mixed in their attitudes toward the benefit of support when they are in the interest stage. However for over half the respondents support remained important in this stage. Results from questions to determine respondent attitudes toward the methods of support providers use, show their preferred methods change as they progress through the stages of practice change. During the early contemplation stage respondents wanted information from Internet and media sources as well as being able to learn from other landholders and observe the practice in action. When in the preparation stages they also wanted to observe the practice in action, but also to learn together with other landholders in workshops and forums and get individual advice and assistance with planning as to how the practice might work for their particular property. These results confirm literature suggestions there are two learning processes: firstly at the precontemplation and contemplation stages where information is collected, integrated and evaluated to assist decision-making and secondly during the preparation or trialling stage where 'learning by doing' and skill development occurs (Prochaska, Norcross, and DiClemente 2013; Pannell et al. (2011, 13). Intervention stages include engagement, issue identification, providing options, developing an action plan (Table 3-2).

More practical support was preferred when they are in the action stage of the practice in the form of financial assistance, continued individual advice and guides about how the practice works in the field. Support from their peers was also very important at this stage. Interventions are also recommended for the action stage in the practice change stage of extension interventions (Table 3-2). When respondents are interested but currently unable to undertake the practice support remained moderately relevant with support from their peers again very important at this stage as well as information, and working with other landholders at workshops and forums. In general, practical demonstrations, peer support, financial assistance, information and individual advice were the methods of support preferred by respondents. Similar to Wright et al. (2015) the responses highlighted that social media is not used very much by respondents.

Consistent with other research, respondents showed that as they move through the stages of change, they require different extension methods to effectively support behaviour change.

### 8.3.3 Accessibility and relevance

The current study investigated the second Ecker et al. (2012) recommendation to determine the type of methods used by the providers of support and the accessibility and relevance of these methods for landholders. Findings showed that overall the methods of support were rated higher for relevance than accessibility; suggesting that respondents believe support in general is highly relevant. They rated the selected methods of support most accessible and most relevant for conservation agriculture, followed by managing weeds then native vegetation. Fewer respondents rated sustainable grazing management and agroforestry support as many were unsure about this support and/or this practice is not one they are considering. Findings also show the ranking for the accessibility and relevance of each method of support was similar across the different categories of NRM practice; however this may have been influenced by straight-lining.

Website and media information was the most accessible and financial support the most difficult overall, although individual advice for managing native vegetation and weeds was also easy to access and highly relevant. The findings show the abundance of information now available on the Internet and from media sources. They also reflect interviewees' comments on the ready availability of private consultant or agribusiness agent advice as well as the decline in government funding support in recent decades.

Apart from financial support, individual advice, group talks and practical demonstrations were all highly relevant for all practices, however practical demonstrations were particularly relevant for conservation agriculture. This result is consistent with the findings of the following questions regarding the providers of support with private consultants and other landholders the most important and trusted overall. Kacans et al. (2014) showed that these are the key providers and organisers for practical demonstrations and workshops, and studies emphasise the importance of individual advice from private consultants and other landholders. Overall, financial assistance for native vegetation had the highest relevance which may reveal a call by respondents for greater government funding assistance for these practices. It also

reflects other results of the study showing the highest respondent access to government funding was for planting and fencing native vegetation and a moderately high percentage would be unlikely to undertake these practices without it.

### **8.3.3.1**                    *Combined results*

#### **8.3.3.1.1**                *Combined accessibility and relevance*

Combined results for accessibility and relevance show that some respondents find NRM extension for conservation agriculture, managing native vegetation and weeds relevant, but difficult to access, suggesting some respondents would like more assistance for these practices. The high number of respondents who were unsure about agroforestry and sustainable grazing or did not practice it, reflects the greater focus on intensive cropping in the Wheatbelt, and is supported by interviewee comments indicating there is less support for livestock production and agroforestry. Results therefore suggest respondents have mixed access to these methods of support, with some of the reason likely due to the lack of support in general for certain types of production, and remoteness.

Lack of accessibility to support due to remoteness was commented on by survey respondents, although an examination of postcodes with this question failed to find any pattern between those rating access difficult and location, but appeared to be related to the NRM practice and the person themselves, i.e. one respondent found many methods difficult and relevant for sustainable grazing practices but no other practices, while another found support only for native vegetation and managing weeds was difficult and relevant for most methods.

The significant relationships and moderate to high positive correlations for all categories of NRM practices indicate the results may be similar to that of other WA Wheatbelt landholders. They also support comments by Ecker et al (2012) of the need for further research into support provided for the different industries such as livestock production, forestry, sandalwood and others. Comparison of this combined graph with those from the stages of respondents' adoption and the ability of the practice to meet respondents' goals, shows a similar pattern for respondent's attitude and behaviour toward these different categories of NRM practices; indicating the relevance and

demand for these methods of support are directly related to the level of adoption and importance of these categories of NRM practices.

#### **8.3.3.1.2            *Combined results for theme one***

Combined results for theme one demonstrate that different methods of support are beneficial for each stage of adoption and the same methods are rated both beneficial and highly relevant. There are also differences between accessibility and relevance of the methods of support provided for the different categories of NRM practices. As such different levels of support are being provided for the different categories of NRM practices and the relevance of these methods also differs for the different practice categories. The accessibility and relevance of these methods are also consistent with respondents' level of adoption for the different categories of NRM practices.

Most respondents are undertaking conservation agricultural practices and managing weeds. They also show that methods for managing both native vegetation and weeds are different from the other practices. This finding is consistent with the ABARES studies which highlight the different motivational drivers for these practices. The current study demonstrates attending field days and learning about the practice is important in the thinking stage, respondents then seek individual advice and attend practical demonstrations in the planning and trialling stage. When they move to the action stage, peer support and financial assistance becomes most important. If respondents find they are unable to undertake the practice in their current circumstances, they still benefit from support from other landholders and learning about their possible adoption of the practice. Clear evidence is therefore provided of the importance for NRM extension strategies to be based on these methods at each particular stage of adoption.

The combined findings highlight the importance respondents attach to both individual and financial support. Literature discussion on individual support has emphasised its importance with the cyclical changes that have occurred in government policy and extension in past decades - from individual to group support and then back to individual support - as well as the importance of this method of support in regards to landholder personality type. The high relevance of financial assistance also shown in the current study points to the importance respondents attach to this method of support. As such the importance of both individual advice and financial support to improving

adoption of NRM practices, notwithstanding other factors, suggests greater focus by both policy and NRM extension on these methods may benefit future adoption of all NRM practices, and in particular native vegetation management. Other studies have asked respondents about the importance of financial support for adoption of NRM practices but comparison was not possible as their focus and question construction are very different to the current study.

High ratings for the relevance of practical demonstrations in the form of field days, tours, trials and demonstrations for practices relating to cropping, livestock production and agroforestry also suggests respondents find these methods important for learning about these types of production. This is consistent with other studies showing the importance of practical demonstrations to learning and leading researchers' advice about the importance of observability of a practice to adoption. Of note however, is that attention has been drawn to a problem of overload due to the lack of time to attend the increasing number of trials and field days being organised. Nonetheless, the fact that respondents also believe these practices are difficult to access for agroforestry and managing weeds suggests there may be some demand for greater access to methods providing observable outcomes for some NRM practices. They also suggest the difficulty of accessing these methods is likely to influence their adoption of these practices.

The high relevance of media sources for accessing weeds information also suggests providing electronic and media articles is an important NRM extension strategy for improving management of weeds; particularly in pre-adoption stages. However the lower relevance of this information shown for other practices points to barriers explained by both the literature and interviewee comments such as; finding relevant information for specific requirements, particularly at a local scale, information overload and confusion, poor connectivity and infrastructure, and age. It also points to the importance of providing other extension methods to support adoption of NRM practices such as accessing information and advice through social networks and observing the practice outcomes for themselves.

The necessity for group-based support such as group talks, workshops and forums and peer networks for complex NRM issues has also been emphasised in literature reports and the current study findings show respondents also believe support is very difficult

to access for some practices and highly relevant for others; confirming the importance of support from other landholders. The benefits of using peer pressure to increase adoption of NRM practices is shown in other studies. Methods such as these, based on harnessing support are recommended as an important extension tool for all landholders; except possibly those who are older and less educated who may require alternative methods of support. Property planning is not generally supported by regional NRM group staff but is shown to be moderately important in other studies. However studies also show few WA landholders have property plans and is likely why it was not rated highly in the current study. The low relevance of social media may point to a growing gap between some landholders and their mostly younger, more technically proficient support providers; highlighting literature recommendations for a range of methods to be used by NRM extension to improve adoption of NRM practices.

### **8.3.3.2            *Other studies***

Other recent WA studies (Wright et al. 2015; Musawi 2013; Watson and Watson 2012) showed the importance and influence of both the providers of support and the methods they use, which were mostly consistent with the current study. They found that individual advice from private consultants and other landholders, practical demonstrations and self-learning methods such as publications and the Internet were most important. They also show that methods for self-learning are equally important with the services provided by those individuals and organisations delivering the support.

Unfortunately none specifically included Landcare and regional NRM groups as variables so it is not known where these groups fit with the methods of support. These studies also showed the information supplied in person by the providers of support was generally rated more accurate than website or media information; apart from agribusiness agents; underlining the substantial problem of bias in their support. Internet access was also rated moderately accurate although the importance of this method varied substantially with the different studies. They also suggest electronic sources are used extensively for some commercial purposes, while information about other issues may be sourced using different methods or providers.



Musawi (2013) provides evidence of the significant change in the last decade where landholders source their information, with electronic sources showing dramatic increases in the last ten years and a large reduction in the use of traditional newspapers and libraries. This of course has also had extensive impacts on how NRM extension is undertaken. This study also found some WA landholders believe the large amounts of information available through electronic sources is beneficial as it provides them with independence. However the study also showed the specificity and relevance of the information required and poor infrastructure in some regional areas, often leads to information overload and reduces interest in Internet use. Nevertheless the study highlights the importance of the Internet for learning and improving adaptive capacity as well as helping to overcome the barriers to effective communication in rural regions.

Interviewee comments were mostly consistent with these studies and other literature highlighted in the discussion above with many finding the availability of information beneficial but also finding the amount of information daunting. Some believed there was ample information that just required putting it into practice, while others highlighted the problem of information overload and the loss of interest in using the Internet as a result. Many asked for sieved information that presents concise, localised information to be used for specific purposes, while older interviewees commented on their lack of skills and motivation to use the Internet for accessing information; highlighting a growing divide between younger and older landholders.

When asked about accessibility of support interviewees showed mixed attitudes with some believing support is more difficult to access since the withdrawal of state agency extension. Some also believed landholders need to be more pro-active in joining groups to obtain their information. Access to NRM information and support from regional groups was a particular problem for interviewees with smallholdings who want more events held during weekends when they are not working in urban areas. Of particular concern for NRM is that some respondents even suggested they were often unsure where to go for NRM information.

Overall the findings suggest the concept of accessibility used as a measure of controlled behaviour, showed access to support services can be a barrier for some landholders, particularly those that are not inclined to join groups or are unwilling or have difficulty using the Internet. They highlight the complexity and ‘fragmentation’

of services combined with an overload of information that makes accessibility of specific information challenging. The results therefore fulfilled the three objectives for theme one to determine; the stage of WA Wheatbelt landholders' adoption of specified NRM practices and the attitude toward the ability of these practices to meet their goals; the stage of adoption where the methods used to support adoption of the NRM practices are most beneficial; and their attitude toward the accessibility and relevance of these methods of support. The qualitative data also expanded on the meaning of support and particular issues and helped to fulfil the aim for these objectives.

### 8.3.4 Implications for the use of these findings

The profile of these respondents highlights the importance for NRM extension of developing extension strategies that include the increasing growth of younger females with formal education and older males who own many of the smaller-scale farms. These are often the landholders using alternative farming methods and types of production who literature suggests require alternative methods of NRM extension. The trend in generational ownership by young families and dependence on farm income are also worthy of note for NRM extension as studies highlight the potential for farm succession and adoption of NRM practices to be linked. They also emphasise the importance of financial capacity to this adoption.

The specific stages of adoption survey respondents were in was clearly identified with most respondents contemplating, preparing or undertaking conservation agricultural practices and managing WoNS. However, the likely inclusion of crop weeds in responses for WoNS raises doubts about the accuracy of the results for this practice. Nevertheless, when combined with interviewees' comments, the finding may also highlight the extensive costs and time spent on controlling these weeds. It also brings attention to comments made in other studies about the implications for NRM extension in promoting NRM methods that rely on control methods that may become unacceptable in the future.

The limited number of respondents in the pre-adoption stages of many practices suggests the barriers highlighted in literature may limit further adoption of these practices. Alternatively, the high number of respondents unsure about the benefits to achieving their goals for the practices they have not adopted suggests possibilities for future NRM extension opportunities. These findings highlight the complexity of

adoption discussed in literature and emphasise the importance for NRM extension to understand the barriers to adoption of each NRM practice for individual landholders. The study also shows that NRM practices need to meet respondents' main goals before they are judged suitable for trial or adopted. As literature recommends, it is therefore essential that NRM extension understand the relative advantage or level of private versus public benefits of a practice to landholders' lifestyle or business goals before any activities to support them are attempted.

Overall the findings show that multiple methods for delivery of respondents' information and advice is preferred and that as they progress through the stages of adoption their preferences for the method of support they receive for adoption of NRM practices changes. Similar methods were also found to be both highly beneficial and highly relevant overall.

When we compare the results we see that when respondents are thinking about the practice, their needs are quite broad. They are mostly seeking information and evidence of the benefits and disadvantages of the practice for others and assurance that further research may provide benefits of adoption for them and their farm. During the planning and trialling stages we see the need for more local and individual support with the need to see the evidence of what other landholders are doing, to discuss the practice with other landholders and to get assistance to understand the practical applications of the practice and how adoption of the practice fits with their own farming system. More practical assistance and support is required at the stage of adoption such as financial support, assurance from their peers that they are doing what they think they should be doing and individual advice from experts to enable them to adapt the practice to maximise the benefits. Assistance from other landholders on maintaining or adapting the practice to suit their farming conditions is also important during the adoption stage. When respondents are interested but currently unable to undertake the practice, their responses show they still want to be part of the farming scene that undertake the practice, and kept up to date with current events and research even though they are currently unable or unwilling to undertake the practice themselves

The results confirm the importance of NRM extension understanding the value respondents place on these methods of support at the different stages of adoption and

the benefits of using the most beneficial methods at the most appropriate stages of support. As Sutherland et al. (2012) suggest, the recognition of distinct stages of adoption where NRM extension methods are relevant and beneficial has important implications for NRM extension services and programs. For instance, the findings show that providing practical demonstrations or website information in the pre-adoption stage may be very influential but is likely to be of little use when a problem has not been recognised or when the practice has been adopted. However landholders' knowing where they may obtain the information may still be beneficial, particularly in the stage where respondents are interested but currently unable to undertake the practice; when peer support is highly important. The importance of this method is highlighted in similar studies (Prokopy, Towery, and Babin 2014).

Peer support was also shown to be beneficial to respondents during their action stage but less important when they are first thinking about or preparing to undertake the practice, and individual advice was shown to be most important when respondents are planning or trialling a practice and only moderately important at other stages. According to Sutherland et al. (2012) it is likely that landholders in the pre-adoption stages will be more motivated to change and are therefore more likely to be persuaded by NRM messages that lead to adoption.

The findings of the current study build on evidence to support literature recommendations. They indicate that providing information during the pre-adoption stages is important to influence decisions to proceed to trial (Pannell et al. 2011) and financial resources and support during the action stages will assist to reduce the risks and stress of adoption and facilitate change (Sutherland et al. 2012). Parminter (2011, 7) also found different types of support are required as landholders move through the stages of change and suggested extension encourage innovation by organising groups for landholders and 'providing them with opportunities and information to reflect upon their own production systems and their decision making and learning processes'. In this way landholders in the planning, trialling or interested stages of change could be invited to group workshops to develop innovative ways to implement NRM practices while bus tours for those in the thinking, planning or trialling stages could be used to attend field days or trials and demonstrations to learn about and discuss their perceptions of the practice.

Ensuring those landholders in the action stage have access to peer networks or financial incentives would also prove beneficial. However to effectively implement the extension requirements at each stage of adoption, NRM extension personnel need to have the appropriate capacities and tools to support landholder change. In this way extension capacities need to be matched with their ability to implement the most appropriate methods for each stage of adoption.

Prochaska, Norcross, and DiClemente (2013, 12) point out that many interventions are inappropriately targeted at the action stage and warn that interventions planned to progress adoption need to be applied at the appropriate stage to be effective. The stage of landholders' adoption of NRM practices therefore needs to be identified during initial stages of planned interventions to provide a clearer picture of their readiness for change. Combining this with evidence of landholder attitudes toward the accessibility and relevance of the methods of support and the stage of adoption when the methods are most beneficial, has provided a strong indication of the strategies required to improve landholder adoption, and ensure the most relevant methods of NRM extension are adequately implemented at the most beneficial stage of adoption. Use of this data will improve the prospects for support to be used as an effective tool to improve adoption of NRM practices.

## Chapter 9      Theme two

### 9.1      Awareness, motivation and attitudes toward adoption risks

The following section discusses a key recommendation proposed by Ecker et al. (2012) (Table 4-5) and the fourth objective of the study, to ascertain the providers of NRM extension available to WA Wheatbelt landholders and to explore their influence on adoption of NRM practices and how that relates to other studies. Pannell et al. (2011) also made a similar recommendation;

In an environment where there is an excess of information for farmer managers to consider in relation to on-farm management decisions, it is important to be able to distinguish which information and learning networks farm managers consider are credible and reliable (Pannell et al. 2011)

It is also important the results of the current study are framed within the drivers of adoption shown in the ABARES studies. These findings show the availability of support plays a small, secondary role to the financial, environmental and personal motivations that drive adoption. The difference in ratings between these studies and the current one is likely because of the wider focus of the ABARES studies; ratings respondents applied to questions about the providers of support in the current study were not considered within the wider focus of the drivers of adoption in the ABARES studies and as a result, their responses are higher.

Overall results of the current study showed all respondents had used at least one provider of support in the last five years. These were rated in four levels. Private consultant/agribusiness, other landholder and grower group support showed the highest respondent awareness, use and motivation to use, of all the selected providers of support. It also showed relatively high trust in the belief that these providers best understand the risks they face in adopting these NRM practices, with no respondents unsure about their understanding. This was consistent with literature which highlighted the preference for information and support from other landholders, and the pressures of market forces on trust in private sector support. Interviewee comments also suggest market forces have encouraged ample supply of private and agribusiness support. This is supported by Hollamby et al. (2013) who found the use of private consultants had

not changed between 2006 and 2012. The lack of motivation by a significant proportion of respondents to use the support of other landholders again, likely highlights the varying attitudes toward productionism and conservationism. This was reflected in relationships suggesting a tendency for older respondents owning smaller farms to be less positive about grower groups and other local landholders.

The second level consisted of Landcare groups, regional NRM groups and R&D organisations. These groups and organisations have now become institutionalised and are supported with funding from both government and industry, or landholder levies. Although there appears greater awareness of Landcare support, both Landcare and regional NRM groups were rated very similar in their use and motivation to use their services, and their belief in their understanding of adoption risks. As Ecker et al. (2012) suggested, the branding of Landcare likely explains the gap between the awareness and use of these groups. Some confusion between these groups and the support they provide may also have contributed to their similar ratings.

The third lowest rated were WA government extension and industry bodies. WA government extension had the highest response for the neither/nor rating for motivation which suggests they find there is variability in their service, or respondents were unsure about this provider. Many respondents were also significantly less motivated to use their services and believed they do not understand the risks involved in practice adoption. Literature suggests the withdrawal of government agency services and a greater focus on regulation has created feelings of loss and antagonism toward government agencies. Industry groups provide a different type of service from most other providers and their support is generally reliant on the size and profitability of the industry they support. Interviewees' attitudes toward these bodies suggest some landholders feel they have an obligation to support the organisation or association that supports them. However, they are also concerned about paying compulsory levies when seasonal conditions make this difficult. These factors probably play a part in the ratings given to these providers of support.

Non-government groups such as Greening Australia, Men of the Trees, GAWA, Birds Australia and the WWF, were rated lowest overall. Government policies that have reduced funding and focussed on targeted environmental priorities in recent years has also reduced non-government support in farming areas that was prominent during the

early Landcare and NHT programs. Changes in attitudes toward productivism and conservationism in recent decades may also limit the use of these groups. This was reflected in survey comments about the different values of these groups to landholders. The low awareness of around one third of respondents also suggest there may be barriers to their use. The results overall highlight the difference in shared values amongst providers of support and landholders, with higher use and motivation to use other landholders and private sector extension providers who are more likely to share the same values and promote practices with private benefits than government funded groups that necessarily include public-good benefits.

### 9.1.1 Comparison with other studies

Consistent with Ecker et al (2012) the findings show that respondents want a range of providers to deliver their information and advice. Their study showed that landholders access different providers for different practices, suggesting that service providers have practices they specialise in. This finding is also supported by other studies and is important for the current study as it helps to explain the importance respondents attach to production and land management and why they have different levels of use and motivation to use the different providers of support. For instance they show that private sector support is used most for production information and advice and land management and conservation information and advice is accessed more from public-funded providers of support. Other studies also inform us that landholders seek different types of support from different types of providers ie independent advice is more likely sought from other local landholders, decision-making support may be sought from landholder-driven groups while production expertise is often sought from private sector providers.

The ABARES studies also supplied evidence of the providers of support that deliver some of the methods used by landholders for information and advice. These findings are also important for the current study as they link both the providers and the methods they use for support. They show that most of the activities attended by landholders are delivered by two of the most important providers in the current study and those of moderate importance in the current study deliver a moderate number of activities. This finding provides evidence that the use and motivation to use the providers of support equates with the number of activities and events provided by these providers. Of note



however is that WA studies show state government officers deliver considerably more learning opportunities than other providers, even though they were rated relatively low in the current study. The ABARES studies also showed a moderate to low inclusion of NRM information in the practical demonstrations and training delivered overall by these providers confirming the dominance of productivism discussed in the literature. Unfortunately this did not provide a breakdown on the percentage of these provided by private sector support.

The priority for survey respondents' ratings for the providers of support in the current study were also consistent with similar studies recently undertaken in WA suggesting this finding may be representative of WA Wheatbelt landholders. However comparison of other WA studies clearly highlights how the phrasing of these providers make a significant difference to the ratings. They emphasise the complexity of extension discussed in the literature and the urgent need to provide a clearer definition for the providers of support and their role in the field of extension.

The GRDC surveys offer evidence of motivation for the use of some providers. They show similar percentages as the current study, and the priority given to the motivation to use them is the same; however the level of motivation appeared to be rated higher in the current study ie whether they were a low or high motivation. This difference may be due to the different sample and the small number of respondents answering this question in the current study, but suggests the trends in the current study may be representative of WA Wheatbelt landholders. Of note was GRDC results for the influence of these providers on the long-term sustainability of their farm are similar with the results in the ABARES studies. However it is difficult to understand how respondents in the GRDC surveys interpreted this question and what the results mean for the current study in relation to NRM practices.

Overall the GRDC studies highlight the strong influence of private consultants on landholder attitudes and behaviour for practices with private benefits that improve grain production. They also demonstrate that further research separating private consultants and agribusiness agents may benefit our understanding of landholder attitudes and behaviour toward these providers, particularly in relation to NRM practices and Landcare and regional NRM groups. It is of interest to find an American study undertaken around the same time as the current study which asked a similar

question; particularly as it shows that overall, the providers of support have similar influence. The study not only highlights similar changes in private and public sector support occurring in Australia in recent decades but also the similar need to investigate the influence of these providers in their extension system.

### 9.1.2 Risk and trust

Significant relationships were found to exist between respondents' attitude toward the providers understanding of adoption risks and their awareness and motivation to use them. The results therefore suggest that respondents' attitude toward the providers understanding of adoption risks does influence their awareness and motivation to use them; confirming the use of this concept as a suitable measure of attitude. Respondents were shown to believe most providers of support have a moderate or high understanding of the risks of adopting NRM practices; suggesting these providers have developed moderate or high levels of trust amongst respondents.

Those they believe have a lower understanding are either responsible for regulatory enforcement or are believed to have different values and as such lack the trust involved with the use of these providers of support. This was supported by both survey respondent and interviewee comments. As such we can see the concepts of motivation, perceptions of risk and trust are interlinked; as well as the extent to which each provider is trusted. Of note was the significant relationship pointing to trust in regional NRM groups. Differences in the way risk and institutional trust are perceived by different landholders suggest further investigation into why and how these perceptions influence the motivation and use of providers of support is worthwhile.

Overall these findings showed how respondents' awareness, use and motivation to use these providers, as well as their belief the providers understand the risks associated with the adoption of the NRM practices are all related and that the stronger their awareness, motivation to use and trust in the provider, the more likely they are to use their services. They are therefore consistent with the TPB theory that the higher the intention to undertake a behaviour, the more likely the person is to perform the behaviour.

### 9.1.3 Significant relationships

Analysis undertaken to determine the significant relationships between respondents' awareness of the services of the providers of support, their motivation to use them, and their attitude toward these providers' understanding of adoption risks, suggest an awareness of the services of these three providers and their attitude toward them, may influence motivation to use them. The results also suggest a similar awareness and attitude toward one provider may influence their motivation to use another. For instance the results show that respondents who are aware of Landcare group services, have a positive attitude toward them and are motivated to use them, may also feel the same way about using grower group support. This result was also found for motivation toward grower groups and R&D support. Many grower groups evolved from Landcare groups and are also focused on sustainable farming practices, and funding and support from R&D organisations are essential for the existence of many grower groups today. As such these factors are likely to influence the attitudes toward these groups and organisations. However further research is required to confirm these relationships.

The limited number of responses made it difficult to obtain much meaning from analysis between the personal and farm characteristics and respondent's awareness, motivation to use the providers of support and perceptions about this support understanding adoption risks for NRM practices. However farm size did show significant relationships for all three questions, and several significant relationships were found for Landcare group support suggesting some personal and farm characteristics may influence attitudes and use of some providers.

These relationships also suggest there may be a tendency for older landholders, particularly those on smaller farms to be more positive about Landcare, and less positive about grower groups, other local landholders and regional NRM group support. Of interest was the results suggest age may influence both Landcare and regional NRM groups but no other providers. Other studies highlight the diverse range of personal and farm characteristics that influence landholder attitudes and behaviours. Leading authors inform us that relative advantages of a practice are shaped by a range of these characteristics, which therefore suggests attitudes and behaviours toward those promoting these practices must also be influenced by these characteristics.

Further research with a larger sample to confirm these relationships may therefore be worthwhile.

## 9.2 Benefits and barriers to extension

### 9.2.1 Benefits

The benefits arising from the support provided to respondents were organised in six key themes. Many respondents suggested support benefited them by providing options for more balanced decisions and a sounding board to provide confidence in proceeding. Many also benefited by increased knowledge in a range of different factors relating to both increased productivity and land management. Others suggested the benefits came from personal support that improved their motivation and allowed them to share others knowledge and experience. Some suggested support aided them to make practice changes to assist with a range of different issues while others found support was beneficial for implementing their on-ground work. Several believed support had benefited them with funding and expert advice on conservation issues that allowed them to improve the biodiversity of their farm as well as the social sustainability of their community. Overall, respondents benefited from support that assisted them to improve the sustainability of land use in the region.

These comments built on findings in the ABARES studies that found similar benefits arising from respondents' participation in government programs. These authors suggested the benefits of participating in these programs was likely due to improved capacity to manage environmental problems or prevent further problems occurring. However literature highlights the limitations for landholders' ability to associate information or advice with any particular program or provider. One interviewee in the current study agreed with this, expressing difficulty with understanding where the information he receives originates from. Nevertheless, some interviewees were able to explain how they had benefited from particular providers. This included timely information provided by a regional NRM group, and assistance from an environmental consultant who was able to assist the respondent to revegetate land he had otherwise believed was not possible.

When asked how they use the support delivered by providers, interviewees emphasised the importance of trialling and being able to see the outcomes of the practice. They

explained how their perceptions of risk are used to assess their decision-making for adoption, and consistent with literature, they told how the practice or innovation is adapted to suit the farming situation. Commenting on private consultants' advice they argued they are best used at short, irregular intervals and again emphasised the issue of landholders researching the issue themselves and making their own judgement that best suits them and their farm. Overall these comments further explained the information provided by the ABARES studies.

### 9.2.2 Barriers

The survey findings show a range of factors contributed to the lack of motivation to use the services of those providing support including relevance, costs, availability, different values, awareness of their services and value for money. Most respondents contributed to comments about how they believed support could be improved with many suggestions for improving the accessibility and relevance of information made available to them.

Studies show that reliance on private sector and other landholder support for assistance is growing; however survey respondents' comments in the current study suggest this demand is not always being adequately met. A key problem is accessing local, contextually relevant information. This was illustrated by interviewees who described the problem with attending meetings where soil conditions were different from their farm and the difficulties of finding relevant information on the Internet. Similar to literature recommendations, several respondents wanted funding increased for research, manpower, on-ground outcomes and a greater range of practices. Others were concerned about the lack of awareness and accessibility of funding grants. As in many reviews of government NRM programs interviewees also commented that current funding needs to be better targeted. Lack of funding was also rated by ABARES study respondents as a significant barrier to adoption of NRM practices.

The need to maintain ongoing support and timelier follow-up were raised as issues. Along with the interviewees, respondents highlighted the confusion about services now available with some survey respondents wanting a better understanding of the services delivered by the different providers of support. Others suggested there was an oversupply of providers resulting in projects that were duplicated or not adequately integrated; calling for providers to be merged and specialised. Some respondents also

believed there is a need for greater education about NRM as well as other environmental and social issues affecting the agricultural community.

Other studies show mixed findings for the availability of support as a barrier for practice change. The current study results are consistent with Ecker et al (2012) in finding the support respondents had received was generally their preference; suggesting the availability of support is not a major barrier to adoption of NRM practices. The small percentage of respondents not satisfied generally wanted what they saw as unbiased support such as that provided in the past by Landcare and the Department of Agriculture which was no longer available due to government withdrawal of services.

Literature reports and respondent comments on: the costs and lack of access to information from private consultants, landholders need to share information more freely, and the different values of landholders and NRM extension personnel, pointed to the need to explore these issues further. They were therefore included in the interviews.

Overall respondents revealed a range of benefits as well as barriers that limit landholder adoption of NRM practices including access to relevant information, increased knowledge and personal support, funding assistance and ongoing support. They highlighted the confusion about the services of providers and suggested greater understanding and awareness of NRM in general would help to decrease barriers to adoption. Their comments suggest there are a range of aspects of support and social norms that create barriers for respondents' control over the use of services of some providers of support. This finding is consistent with the TPB concept that our perceived behavioural control, which consists of our perception of how easy or difficult it is to perform a particular behaviour, influences the likelihood of us performing that behaviour. These findings are explored more fully by interviewees in the following section.

## 9.3 Providers of support

### 9.3.1 Individual support

#### **9.3.1.1 *Other landholders***

The overall importance of support from other landholders was consistent with other studies and highlights the importance of landholders sharing their experience and knowledge, and extension use of peer support as an effective strategy for practice change. However the literature also indicates the dominant focus on production in agrarian culture may present limitations for using peer support for encouraging NRM. Current survey findings of perceptions of other local landholders understanding the adoption risks, showed those on smaller-scale farms were less positive. Interviewees confirmed this with comments about how these respondents do not mix much with other landholders due to their work in urban centres or mining. This suggests a divide between small and larger-scale farming and the conflicts raised in literature about multifunctional land use. Further research using a larger sample may substantiate this result.

Overall, interviewee comments suggest respondents are mixed in their attitudes toward the support of other landholders. Their comments were consistent with literature highlighting the strong influence of other landholders because of the independent information they provide and understanding the benefits and downfalls of other landholders' 'real world', practical experience that is most important. As such they emphasised the importance of the observability of a practice discussed in the literature. Interviewees also revealed how the 'good farmer' identity influenced landholders by allowing them to see how the adoption of certain practises contributed to their success as a farmer and the lack of adoption resulted in the failure of their neighbours.

When answering questions about landholders sharing of information interviewees revealed mixed attitudes. They believe it is something Australian landholders do well compared to some other countries, and as landholders find it difficult to work together, sharing opinions and experiences is a way for landholders to bond. They also believed some landholders are willing to share information more than others, and age made a difference with younger generations sharing more than older generations. One young

interviewee found it difficult to understand why other landholders were not willing to share as he believed they were all trying to achieve the same aim. Other comments were consistent with literature about landholders' personalities and abilities to communicate, suggesting they are sometimes reluctant to join groups to improve their understanding, and are willing to reveal their failures but not keen to discuss their successes or proffer advice as this is seen as bragging.

Interviewees also believed there was a difference between the sharing of information by crop and livestock producers. They believed crop producers are more inclined to share information than livestock producers as crops are sold to the same markets at the same prices while livestock is sold to individual buyers and therefore there is more competition in livestock prices. However there were no studies found to support this argument. They also argued that sharing information was more relevant for crop producers as it was more reliant on local environmental and weather conditions than livestock or agroforestry. Some believed there has been a decline in sharing of information by landholders in recent decades due to the change to larger sized farms. They suggested this change had created competition amongst landholders due to the need for greater secrecy around land values, and the subsequent reduction in population had reduced opportunities to share information with neighbours.

Another believed this change has resulted in local groups expanding the area of land they cover, which has increased travel times and reduced the regularity of meetings. As a result their membership has declined and their information is shared amongst fewer landholders. They also commented on how information previously available free through government departments had encouraged information sharing, but the change to fee-paying support has resulted in the information being retained by the purchaser. Overall their comments provide a variety of explanations about how and why landholders share information and support literature about how the characteristics of the landholder affects their willingness and ability to communicate and share their information.

### **9.3.1.2            *Private/agribusiness***

The relationship between the awareness, motivation and attitude toward private consultants and agribusiness agents reinforces the high importance attached to private consultant and agribusiness support shown in the current study. This importance is



also shown in other WA studies. These studies also revealed the high use of private consultants in WA compared to other Australian states. However they also show the use of consultants varies annually, as well as within the WA Wheatbelt with different regions using them to varying degrees. This did not appear to be linked to farm profit but may be influenced by accessibility or relevance. However the survey did warn of sample issues. Studies also show these providers deliver the greatest number of activities attended by landholders. Other studies also showed that private consultants are mostly used by younger landholders on larger-scale farms, mostly for production purposes. This was not confirmed by analysis in the current study, however interviewees also discussed this issue.

Findings in the current study suggests landholders may not consider support for livestock production is worth paying for while cropping information is. However, it also suggests that more support is provided for cropping than livestock production and this was supported by interviewees. Literature suggests that private sector services may not have adequately replaced the withdrawal of government services for this industry sector and argue that traditional livestock producers are therefore disadvantaged. Interviewees' use of private consultants was similar to that discussed in the literature with use including; a sounding board, confirmation for their decision-making, and allowing them to keep up to date with new innovations and practices. They also suggested older landholders tend to use their advice for confirmation after discussions with other landholders within their social networks.

Other studies underlined the importance of trust in landholders' relationships with their advisors. They found that landholders with large-scale farms tended to gather the information and then make the final decision themselves. However these landholders also highlighted the propensity for private consultants to have greater influence on behaviour due to being paid. This issue was also discussed by an interviewee in the current study who emphasised the need for landholders to understand the issue or practice themselves to make their own decisions, rather than relying on a consultant to tell them what they should do. Reflecting literature discussion on the change in farming focus to a business enterprise, he believed that, as business owners, landholders need to determine whether the practice is value for money before being adopted.

Interviewee comments indicate there are problems with private sector support for landholders with smaller farms that do not fit the traditional model, or farms that are managed differently from standard farming approaches. As a result interviewees complained about the lack of information available from these providers or the lack of innovation and flexibility in their services. They also believed they are unnecessary as all relevant information is freely available anyway. Others suggested the use of a private consultant to provide confidence when making a major investment may be worthwhile in helping them overcome their risk aversion, but they are not value for money on a more permanent basis. Their comments also revealed the influence the landholders' financial capacity has on the advice provided by consultants, with different advice provided to those who have the financial capacity to undertake the recommended practice than those who do not, highlighting the potential impacts this has on the long term sustainability of their land.

These comments underlined the barriers and limitations of private sector support. They also reinforced literature suggesting education systems continue to focus on training traditional agricultural methods, and other literature emphasising the need for more adaptive extension to cope with the growth in multifunctional production systems and land use; particularly in relation to new owners. Their comments also revealed that combining private and agribusiness consultants in the current study may have made it difficult for some survey respondents to answer these questions.

Overall interviewees were divided on whether the costs of paying for private consultants was too high but their comments clearly showed a relationship between farm size and value for money. Interviewees with small-scale farms discussed the lack of value for money in engaging private consultants while those on slightly bigger farms believed the costs may be currently viable but may not be the future. Comments from those on large-scale farms highlighted the role that credibility and trust plays in landholder relationships with providers of support, reported in the literature. These interviewees mostly agreed that costs were high but argued they were aligned with the quality of advice; suggesting the need to pay more for better quality advice.

However their comments pointed to the mixed expertise of these providers suggesting some were value for money while others were not. This discussion then led to their comments about landholders need to research and understand the problem themselves

as discussed above. Their comments also suggest that respondents with larger-scale farms may be driving the RD&E agenda as literature advocates, while many with smaller-scale farms are not. An issue was also raised about consultants encouraging landholders to increase their farm size and gain economies of scale to provide income for their future employment. This issue was not found in the literature but suggests these providers may have contributed to the rapid growth in farm size in recent decades.

The costs of employing a private expert for planting and conserving trees and grazing shrubs was also estimated to be high and the benefits subject to obtaining information and advice from someone with the 'right' expertise. Throughout the NRM programs reviewers reported on funding tensions between the need for investment accountability and achieving on-ground work. Both respondents and interviewees in the current study made similar comments; also suggesting the need for government to employ people with the expertise to achieve on-ground outcomes.

Interviewees were also mixed in their attitudes toward the control of information by private consultants with comments on the negative reactions of private consultants toward landholders sharing the information they received from them. They were also concerned about the loss of government funded research information into private sector control. Other interviewees thought it was not a problem as they believed funding conditions allowed them to access the information; or they were more pragmatic believing it is all part of the competitive environment these providers work in.

When asked whether advisors need accreditation due to the limited NRM information in their advice most interviewees did not see this as beneficial commenting that the responsibility lies with the landholder to ensure they employ someone who is qualified. Problems with the effectiveness of this type of scheme were highlighted such as the potential bias because of different values; those charged with the responsibility for designing and implementing the scheme may have different values from landholders. Nevertheless, they revealed a lack of trust and credibility in the advice and information provided by some providers; signifying there may be some need for an accreditation system.

As survey respondents commented on the difficulty of getting unbiased information from agribusiness agents, interviewees were asked about this subject. Although most agreed this was a problem, they emphasised the need for landholders to understand the competitive aspect of these businesses and not to rely on the information, but to learn about the benefits and disadvantages of the product or practice themselves. This is particularly important in relation to environmental impacts. For example, past advice from both private consultants and agribusiness agents in relation to fertiliser use has since proved to have created extensive problems for soil quality and the environment. Landholders are now having to spend considerable sums of money in addressing soil acidity in the region (DAFWA 2014).

Most interviewees also believed agribusiness agents were readily available although one interviewee explained they have not been in the past but the increased significance of agriculture to the economy in recent years was improving the situation. It was also suggested that past competition had reduced the number of large companies which allowed more independent advisors to compete and improved the quality of advice provided.

Overall the study findings supported literature reports on the high importance of private consultant advice and information for the larger-scale farms with a key focus on cropping. They also suggested the costs and benefits were not viable for smaller-scale farms and accessibility of support for other types of production and non-traditional farming approaches is more difficult. They highlighted the need for landholders to learn about the issue or product themselves and question the advice of these providers. The findings mostly highlight the benefits of private sector support for large-scale farms and the barriers for those with smaller farms. They also reflect the impacts of changes from public to private sector support reported in the literature.

## 9.3.2 Group support

### 9.3.2.1 *Grower groups*

The importance attached to grower group support reflects their growth in WA in recent years and the normative influence of these groups. The success of these groups and their alliance network has institutionalised this form of support in WA, with research emphasising their extensive support and importance to practice change, particularly

compared to other regions of Australia. Findings that a lack of awareness and less positive attitudes toward support from grower groups by those on smaller-sized farms in the current study, suggests support from these providers may not be accessible, or may have limited relevance for this sector of landholders. Interview comments from smallholders also confirm this result, with comments that the timing and focus of grower group meetings and members exclusive attitudes discouraged their attendance. The significant relationships shown between awareness, motivation and attitude of these groups and Landcare R&D suggest there may be a link between respondents' attitude toward these groups and organisations ie those with positive attitudes toward grower group support may also be positive about Landcare and R&D support and vice versus.

Interviewee comments also reveal how some believe the benefits of grower group membership is the ability to learn from both the successes and failures of other landholders' practices. They also indicate how knowledge is shared amongst group members and the wider farming community. They inform us that information is circulated between members of both large and smaller groups. Larger groups also have the capacity to pay for expert knowledge which is then passed on to local groups, while local knowledge is discussed at local group meetings and in turn passed on to members of both small and large groups. Some non-members also believed information from grower groups was readily available as the large grower groups have the capacity to get funding for important research projects. Funding conditions ensure the findings they make are made freely available to all landholders.

However interviewees who were not members also provided evidence of the barriers and limitations of grower groups. Some believed the expense of travel to meetings was not value for money, for others the timing of the meetings was impractical, while others were not members because the different farming environment of the area where the group was based meant membership was not worthwhile. For some the power relationships amongst group members, discussed in the literature, discouraged their participation. Conflict within grower groups and the lack of information sharing with non-members, discouraged them from attending the meetings, revealing how power dynamics can be divisive for farming communities. Overall their comments explain some of the advantages and disadvantages of grower group membership. They also

support literature and results of the current study indicating the importance of these groups and other local landholders in supporting landholder decision-making and driving landholder practice change.

### **9.3.2.2            *Landcare***

Consistent with the ABARES studies, Landcare was shown to have greater awareness and be used more often than regional NRM groups though the difference was considerably less in the current study. Awareness and participation in government NRM programs has also been shown to improve attitudes and behaviour toward NRM. However, as other studies highlight, the results may be problematic due to the difficulty for respondents in determining which of the large number of information sources they have been exposed to, they obtained the information from. This was also reflected in interviewee comments suggesting confusion between these two providers of support. The word ‘Landcare’ was often used synonymously with anything to do with environmental issues or NRM highlighting some confusion over the roles of Landcare and regional NRM groups. Analysis also highlighted the close interconnections between Landcare and grower groups.

The decline in Landcare has been amply discussed in the literature and the survey and interviewee comments provided WA Wheatbelt perspectives on this issue. Commenting on the significant decline of Landcare groups in their area they provided several reasons why they believed this decline was occurring. These included; withdrawal of funding which reduced activities, burn-out of group members, and replacement by a private business or the Internet. The amalgamation of farms to encompass the whole catchment area was also thought to be responsible for the decline in Landcare groups; a sole landholder managing the natural resources over the entire catchment makes the problem no longer a group problem. Consistent with literature they observed how landholder personalities made them reluctant to work in groups; suggesting this contributed to the decline in group membership. They also discussed the change from group to individual extension with some suggesting the decline in groups may have encouraged a move by regional NRM groups back to individual support while others believed the opposite occurred with the move to individual support affecting Landcare membership.

The significant relationships found between Landcare and grower groups suggest respondents' have similar attitudes toward these groups while the relationship with age to both Landcare and regional NRM groups may reflect changing environmental values. The result may also arise from differences between the predominantly young staff working in regional NRM groups and the aging farming workforce. Comparison of the findings with previous studies suggests the attitude and behaviour toward support from all groups might be changing and may be due to the rise in Internet availability and use. These factors may be worth investigating further to determine how changing environmental values and technology use may be affecting group membership and how all support groups are changing their extension to adapt to these changes. For instance Boggs (2016) outlines how staff at Wheatbelt NRM are improving their digital communication activity.

The high awareness and comments about Landcare underscored the positive impact the Landcare movement had on landholders' perceptions of land management and the importance of local level support. They highlight the extensive loss of Landcare groups from the region and the complex reasons why this has occurred. They also show that further investigation into changes in group membership overall and how groups are responding to these changes may be worthwhile.

### **9.3.2.3                      *Regional NRM group support and funding***

When viewed in light of the findings of the ABARES studies, respondents' ratings for the influence they believe regional NRM groups had on their stage of adoption for the selected NRM practices may reflect some NRM bias in the sample or selection bias amongst respondents. However the significant relationship between both, the influence of these groups on adoption, and respondent motivation to use their support with respondents' attitude toward regional NRM group's community care, suggests these respondents may have developed considerable trust in regional NRM group staff. This may be worth investigating further using a statistically accurate sample to determine how these groups influence landholders' adoption of NRM practices.

Survey respondents' and interviewees' comments about regional NRM groups were very mixed with some unaware of their services, others dissatisfied with their lack of support for agriculture, but many pleased with the assistance they have received from these groups. The problem of promoting their services was also raised with suggestions

they have not advertised their services adequately. They also showed there is some confusion about the difference between Landcare and regional NRM groups which may have affected survey ratings for these groups. Explaining the changes in the use of these groups they stated that regional NRM groups have now replaced the work of Landcare groups and discussed how they no longer work with their Landcare group but access individual support from their regional NRM group. However other comments suggest there are some landholders that know very little about these groups and their purpose emphasising the problems with accessibility and funding for those working in these groups.

Literature also stresses the importance of group-based approaches for NRM but highlights there may be difficulties for landholders such as those living in remote regions to participate. This problem was raised by survey respondents living in the eastern Wheatbelt regions in the current study. Due to the large area of the Wheatbelt and limited funds this problem appears difficult for regional NRM groups to effectively address. It is also difficult to get competent staff to work in more remote areas. Similarly complaints were made about their support not being available for smallholders in the Wheatbelt area where the regional NRM group was believed to focus on support to respondents with larger-scale farms. Literature highlights the growing importance of smaller-scale farms (Paül and Haslam-McKenzie 2010) and respondents' concerns about the lack of NRM extension access suggests greater emphasis by NRM extension is required for this sector.

Another issue for NRM extension discussed in the literature is the problem of developing trusting relationships to influence adoption of NRM practices. Conflict created by different values and contract funding conditions were reflected in survey and interview comments revealing deep concerns by some landholders with this issue. When asked about an environmental bias by regional NRM groups interviewees were mixed. Some believed they were not biased; however sometimes this was because those providing the support had come from a farming background so shared the same values. Other comments revealed a lack of trust and credibility and scepticism of the transparency of these groups with suggestions that funding would be better spent by government agencies. They also explain how lack of expertise can be a problem; suggesting that government funding cycles can create barriers to developing expertise



and highlighting the difficulties faced by NRM extension in promoting practice change.

Another criticism of regional NRM groups was the focus on increasing Indigenous participation in NRM. They believed their support for Indigenous participation was misplaced as farmers are the people most active and responsible for NRM. Others showed mixed attitudes toward this issue, believing they are focussing too much on supporting Indigenous NRM participation while at the same time supportive of their assistance with business enterprises to provide employment for local Indigenous people.

### **Funding**

Investigation of the government funding provided to landholders showed most respondents had received funding, mostly for native or grazing shrub seedlings or fencing, although respondents had accessed some funding for almost all the NRM practices. However, the significant relationship between respondents who received government funding and farming experience suggests much of the funding may have been accessed in previous NRM programs. As suggested by previous studies, the results showed that government funding has limited influence on adoption of NRM practices. However they also show the ease of access to government funding for planting or conserving trees and shrubs has encouraged a considerable number of respondents to undertake this type of work.

Results also showed only a small percentage of respondents who received funding were not influenced at all by extension from regional NRM groups; however this relationship was very weak. Alternatively over a third of respondents who did *not* receive government funding were influenced to some extent by extension services from regional NRM groups. Unfortunately these questions were not able to answer the question regarding the influence of funding and the motivation to use support raised by Ecker et al. (2012) (Table 4-5). Nevertheless, analysis does suggest further investigation is very likely to reveal a link between regional NRM group support and the government funding provided for their projects. It must be noted though, that literature points to problems for NRM policy and extension in providing funding that promotes effective outcomes. They emphasise the importance for those involved to

cultivate non-financial factors that influence adoption and to clearly understand the social, economic and environmental outcomes before funding is provided.

Comments about government funding showed positive attitudes toward the importance and availability of funding support, with some stressing the need for financial incentives for conservation and explaining how they would not have the financial capacity to undertake this type of work without it. Others believed the government was providing ample funding support but argued that landholders were not taking sufficient advantage of the funding because of their apathy. Comments on the high opportunity costs such as paying rates for unproductive land suggest a reason for this apparent apathy.

This comment is consistent with similar WA studies and highlights literature recommendations on the importance of extension understanding opportunity costs of conservation to identify whether conservation is likely to occur or not. It also supports literature arguments for better design of policy mechanisms that include both private benefits and costs, and non-financial motivations. As literature explains this needs to be done with care to ensure altruistic motivations are not reduced (Hajkowicz 2009). Their comments also highlighted the literature debate about private versus public investment for conserving remnant vegetation, which was also raised as a concern in the current Wheatbelt NRM strategy.

In general there appears a mixture of concerns and understanding about the different values of many working in regional NRM groups as well as their role, performance and accessibility, while others showed trust and an appreciation for the assistance they provide to many in the region. Their comments highlight the importance for many landholders of providing government funding for managing native vegetation, yet also reveal the limitations of incentives for increasing adoption of NRM practices. Overall they point to the benefit of further investigation into the relationship between these groups and their funding on the adoption of NRM practices.

#### **9.3.2.4            *Non-government***

Government funding cuts have drastically reduced the level of activity of non-government groups since the decades of the early NRM programs and this was reflected in the current survey results for their support. Today this work is being

undertaken mostly by commercial businesses, Landcare, regional NRM groups and specialist grower groups. Their comments clearly indicate the growth of productivism and the challenges faced both by landholders in their goal to increase production and by those working to increase conservation in this region.

### 9.3.3 Institutional support

#### **9.3.3.1 R&D**

The moderately high ratings for R&D organisations reflects the importance survey respondents attach to research to assist them to improve their productivity and land management. This result was confirmed by the significant relationship found between awareness, motivation and attitude toward these organisations. GRDC surveys show how this R&D organisation has increased in prominence due to the phasing down of government R&D, and has taken over much of the responsibility for assisting R&D for grain production in Australia. Grain growers pay a compulsory levy to this organisation and as such they are driving the direction of R&D for their industry. GRDC research shows that grain growers attach high importance to R&D for their industry and while many growers are satisfied with the performance of GRDC in the rest of Australia, many growers in WA are not. This is because many WA growers believe they are not providing R&D that is relevant to WA conditions, particularly in relation to long-term sustainable grain production. Interviewees in the current study also suggested this is due to GRDC's decision to have their head office in Eastern states rather than WA. The relationships found in the current survey also support moderate motivation by respondents for R&D organisation support and close connections between grower groups and these organisations. However these results were not consistent with the ABARES studies that found respondents attached very little importance to the support provided by R&D organisations; most likely as a result of different interpretations of R&D organisations in these surveys.

Interviewees expressed mixed attitudes toward GRDC; some expressed disappointment with the relevance of the research for WA conditions while others were positive, highlighting the important role and respect for this organisation. GRDC provides a lot of information and again the problem of information overload was raised. A problem with compulsory levies for this organisation was also raised with suggestions that in years with limited or no profit, landholders were using debt funding

to pay these levies. Literature has pointed out the extent of landholder debt in the past, however studies also show WA landholders have made considerable profits in recent years, suggesting this may not be a problem for many at present. Their comments about the benefits of attending GRDC events were consistent with literature indicating the use of these events to reinforce decision-making.

While most interviewees no longer have contact and know little about the current work of the CSIRO, it was considered essential by some, with concern raised about the recent government funding cuts to this organisation. Some also believe universities undertake valuable research with industry partnerships that is often not credited to them; reinforcing literature pointing out the difficulty of determining the organisation that produced the research information. However similar to other studies, some interviewees believe most research is being driven and undertaken by leading landholders and not scientists. These comments suggest the change to landholder-driven research has created some confusion about the role of scientists in agriculture.

Overall, interviewee comments highlight the importance landholders place on R&D. They suggest that GRDC is a respected organisation providing a wealth of information that is accessible and relevant for many but could be improved by providing more varied research that is relevant to WA environmental conditions. They also raised concerns that financial responsibilities to support this organisation was too much for some landholders. Many no longer knew much about the work of the CSIRO while others believed their research was important and were concerned about their recent funding cuts. Similarly few mentioned university research, but those that did believed their research conducted in partnership with industry organisations was highly valued. They raised the issue about recognition of where research information originates. However they also reveal a landholder perspective on the change to landholder-driven research that again highlights the problem of defining the role for providers of RD&E.

### **9.3.3.2                    *WA Government***

The awareness and motivation to use WA government officers in comparison to other providers was also different to the ABARES studies who found them moderately important for three categories of practices and most important overall for managing weeds. The differences are likely due to state support differences across Australia and the barriers to providing landholder support across remote regions in WA. The current

study results are also likely to reflect a general distrust due to their responsibility for biosecurity and regulation enforcement, highlighted in literature. Interviewees showed mixed attitudes toward their current focus on biosecurity and regulation. Some believed this role was important as private sectors do not provide this support, while others believed it has caused a loss of relevance and trust amongst landholders.

Results also showed respondents' attitude toward WA government officers is significantly related to their motivation to use them with a large decrease in motivation to use them again and high percentage believing they do not understand the risks involved in NRM adoption. However WA studies show these providers supply a significant percentage of the training courses and workshops attended by landholders. Their lack of support in remote regions was raised by survey comments suggesting the eastern regions do not get the support provided to other regions. Comparison of the current study with previous WA Wheatbelt studies illustrates the withdrawal WA government support discussed in the literature, and is supported by interviewee comments.

Overall interviewees had mixed attitudes toward the use of WA government officer support with a few detailing the benefits they received from undertaking trials supported by them or their contact with scientist working for the Department of Agriculture who provided them with unbiased information and advice. However consistent with other studies, many mourned the loss of state government support in recent decades and their comments suggested they are now providing little support for many landholders. Some appeared betrayed by their withdrawal; forcing landholders to pay for the assistance they had previously provided free. They also believed withdrawal of their services made access to information more complicated, time consuming and costly. The specialisation of services now makes it difficult to know who to contact to access support for a particular issue. To add to this problem, interviewees found accessing information on the DAFWA website was difficult.

They suggested the aging DAFWA workforce had prevented younger people from gaining employment. As the older staff left they were then replaced by overseas experts with good technical skills but poor understanding of how to communicate with Australian landholders. Hence they believed funding the department is no longer

worthwhile. It was also argued the loss of their support reduced their credibility amongst landholders and threatened the agricultural industry.

Comments about both public and private support providers in general highlighted frustrations with the lack of follow-up. Concerns were also raised about extension activities that motivate practice change but fail to follow up with further assistance. Their reasons for this occurring included; government policy cycles causing funding interference, government agency reorganisation and high staff turnover; limited ongoing research and restricted access to former research findings. Extension literature highlights the importance of following up to maximise learning and overcome barriers to changes in attitude and behaviour (Coutts et al. 2005).

Overall the study's findings and comments support literature detailing the decline of state services in recent decades. Interviewee comments expand on survey findings by highlighting their attitudes toward the loss of readily available information that is free and unbiased, their change in focus to biosecurity and regulation and staff changes that now result in little contact and support provided by WA Government officers. They also expressed frustrations with the lack of follow-up resulting from government policy cycles.

### **9.3.3.3            *Industry***

The lower awareness, use and motivation for industry bodies perhaps reflects why these providers were not included in the ABARES studies. Industry bodies provide a range of services, some of which are not generally provided by other providers, and this also makes them difficult to categorise and compare their services with those that provide 'traditional' extension services. The range of services provided is reflected in the scale of the industry they represent with a wide range of services provided for the grain industry, less services available for the livestock industry and fewer services provided for forestry or organic farming.

Interviewees also had less to say about these providers and suggested their support often depends on the availability of staff. They also believed there were too many of these bodies and too much conflict within them which reduced their capacity to influence government on behalf of landholders; thereby providing government with an excuse for not supporting them. They also emphasised the benefits of lower-level

regional connections, outlined in the literature, which they believe gives them better representation in government. However they pointed to the need for these bodies to be actively lobbying to achieve results and for financial support from landholders; also highlighting the issues of supporting them during poor seasons. As such interviewees were mostly supportive of these organisations that in turn are designed to support them.

## 9.4 Implications for the use of these findings

The findings of the current study build on evidence to support other literature recommendations. Studies, including Ecker et al, (2012, 3) and Prokopy et al. (2015, 269) suggest NRM extension would benefit from using landholder support networks and ‘preferred or common interaction methods’ using a ‘train the trainer’ approach to provide a more targeted approach to increase adoption of NRM practice. Kilpatrick and Johns (2003, 162) argue that using the providers landholders use most to deliver NRM information will reach a greater cross section of landholders. They also suggest these providers be used to identify the type of information and training that landholders require so that strategies can be developed to target landholders’ perceptions of their needs. They argue these strategies could ‘improve participation while allowing some scope to introduce other concepts or skills that do not have the initial drawing power’ and recommend research such as that included in the current study, to find the best methods for these providers to undertake this process.

Researchers also suggest this approach will help to ‘reduce transaction costs and pool resources across the chain with other advisors’ while still providing ‘relevant information that influences farmer decisions through intermediaries’ (Prokopy 2015, 269). Therefore using the networks developed by private consultants, grower groups and other local landholders ‘to implement extension efforts and disseminate information presents a logical way to combine and extend the reach of factors found to have a significant effect on [NRM] adoption’ (Baumgart-Getz, Prokopy, and Floress 2012, 23). Ensuring these providers are also aware of the stage of landholders’ adoption they are supporting, the most beneficial methods to use at these different stages to support NRM adoption and the most relevant methods to use for each category of NRM practice, would allow these providers to more effectively undertake this process. It may also be useful to coordinate the delivery of this information to the key providers with other NRM groups.

Researchers do however point to problems with these strategies. Firstly they would distance NRM extension from the end delivery of the information which would therefore reduce the likelihood of landholders recognising their contribution to the support being provided. As such NRM extension needs to ensure they advertise their services and use their nationwide network of regional and Catchment Management groups as well as overseas NRM organisations to capitalise on their branding. As many landholders with large-scale farms are often the innovators of new information, there is also a need to distribute information emerging from them. NRM extension therefore needs to collaborate closely with grower groups and R&D organisations and continue to build relationships with landholders built on trust and credibility (Wilkinson and Rowbottom 2013). Ecker et al (2012) also caution the need for NRM extension to be aware that the group-based approach, agrarian values and the focus on outcomes inherent in agribusiness and many grower groups, may not always be suitable for NRM engagement or landholder's needs.

Other studies found agribusiness agents rated considerably lower for importance than private consultants (Wright et al. 2014) and their support is used more by landholders with traditional farms with lower income. They point to problems of using these providers as intermediaries for providing NRM information as the technology or information may not always be suitable for delivery by these providers. Their comments suggest NRM extension could use 'a facilitatory role that would seek to extend the resources' of both NRM extension and agribusiness providers to deliver NRM information (Wilkinson, Barr, and Hollier 2011, vii).

Current study findings also support literature on the problems of providing NRM extension to the growing number of landholders with small-scale farms. They show a significant percentage of respondents would be likely to undertake natural vegetation management without funding. As researchers suggest, investment in training programs may therefore be better value for money than funding on-ground work that is likely to be undertaken by these landholders without government funding. Other suggestions include identifying new landholders' needs 'perhaps at the time of a property sale' and providing them 'with ways to engage local networks and wider information sources'(Curtis and Mendham 2011, 173).



However smallholder interviewees' comments on the problem of accessing other local landholder support because of the different values emphasises the need to ensure these local networks involve landholders with similar values. Methods of support such as 'follow-up field-days on participating properties, free one-on-one on-property advice, and NRM guides that include detailed case-study accounts of landowner experiences' (Meadows, Emtage, and Herbohn 2014, 618) were also recommended as important for engaging smallholders in NRM. Comments from the current study also highlight that ensuring methods such as field days, demonstrations and group talks for these landholders is organised at appropriate times to suit their participation.

Findings of the current study also suggest the attitude of many respondents toward the importance of NRM and their trust in Catchment Management and regional NRM groups can assist these groups to develop relationships of support that result in increased adoption of NRM practices in the region. However they also show there are a smaller percentage of respondents who believe NRM practices are not very important. Authors therefore warn of the need to define a clear connection between environmental awareness and NRM attitudes as well as the levels of private and public net benefits of the NRM practices before intervention. This will provide a guide for the type of intervention that is most appropriate i.e. 'Depending on their relative levels, it may be appropriate to use positive incentives, negative incentives, extension, technology development, or no action' (Baumgart-Getz, Prokopy, and Floress 2012 Pannell 2008, 239).

Many respondents were shown to be sceptical of the benefits of the regional delivery system and Commonwealth government commitment to empower their community. Evidence from other studies suggests the barriers to improving adoption of NRM practices amongst these respondents will significantly increase as levels of trust decline (Marshall 2008). In this way findings from the current study highlight benefits for NRM extension in clearly understanding the attitudes of the landholders' they are supporting, both toward the importance of NRM for them, and their attitude toward the Commonwealth government and their NRM regional delivery program, before developing strategies for change. The findings also show low awareness of some providers by several respondents and difficulty with accessing some of their methods

of support; suggesting this may present barriers to further adoption and indicate possible benefits from further extension.

Researchers also argue that extension strategies that support individual change processes by addressing psychological motivations as landholders move through the stages of change will prove most effective (Parminter 2011). It is therefore clear that taking into account the financial, environmental and personal motivations highlighted in the ABARES studies, together with the motivations for the use of support revealed in the current study, will significantly assist NRM policymakers and extension to develop appropriate strategies that increase the influence of NRM extension on the adoption of NRM practice.

## 9.5 Summary

The following is a summary of chapters eight and nine. The key questions asked respondents their stage of adoption of selected NRM practices, their attitude toward these practices achieving their goals, their stage of adoption when selected methods of support are most beneficial and the accessibility and relevance of these methods of support. Attitudes toward NRM and institutional trust were also gathered. Respondents were also asked for their awareness, use and motivation to use selected providers of support and their attitude toward the providers understanding of the adoption risks involved for them. Bivariate analysis showed relationships in the data and interviewees' narrative expanded on the data.

Overall the findings highlight the dominance of middle-aged males producing crops in the region and the related dominance and use of the providers of support for this industry. They also show most farms include sheep production to improve their income spread. Respondent profiles highlight factors that may help to understand characteristics that influence adoption and the use of the providers of support and the methods they use. The findings support literature showing the high use of private sector and other landholder support, including grower groups, and the more moderate use of groups funded by government NRM programs. They showed these respondents are in a range of different stages and the level of their adoption is matched by their perception of the benefits of these practices meeting their goals.

Further evidence showed respondents prefer a range of different methods for delivery of information and advice about land management and that as they progress through the stages of adoption their preferences for these methods of support changes. Written information and observation is most important in the contemplation stage, while individual advice and observation is most important in the trialling and early adoption stages when information is evaluated with trusted contacts. During the action stage financial support and support from other landholders is most important. It also highlights the relative importance of support when landholders are waiting to undertake a practice, particularly support from other landholders.

Respondents showed that the methods most preferred at each stage of adoption were the same methods rated both beneficial and highly relevant. Also highlighted were that different levels of support are being provided for the different categories of NRM practices and the relevance of these methods also differs for the different practice categories. The accessibility and relevance of these methods are also consistent with respondents' level of adoption for the different categories of NRM practices with the highest ratings for adoption of conservation agriculture practices and the methods to support this production. The decline in government funding support in recent decades and the abundance and relevance of information now available on the Internet and from media sources signals changes in extension methods and the type of information and support being provided. Although not suitable for analysis, findings also point to the potential for social norms about NRM and institutional trust to influence decision-making.

The findings also showed how respondents' awareness, use and motivation to use the providers of support, as well as their belief the providers understand the risks associated with the adoption of the NRM practices are all related, and the stronger these factors are, the more likely they are to use their services. They also indicate the extent to which each provider is trusted. According to previous studies and interviewees, it is also highly likely the preferred methods of support are services delivered by the most preferred providers and that much of the research and extension being undertaken is driven by landholders with larger-scale farms. Interviewee comments also provided further insight into their attitudes and behaviour toward these

providers that helped to explain these results as well as certain issues raised in the literature.

Importantly, findings show that landholders are in different stages of adoption and that the benefits of support and landholders' preferences for the methods of support they receive, change as they move through the stages of adoption. This is important evidence for NRM extension as it confirms other theoretical research indicating different interventions are more effective at different stages of adoption. Interventions to improve adoption of NRM practices such as those recommended by researchers, can then be applied. The study also showed that most respondents prefer to use private consultants and other landholders' support. When this evidence is combined it is clear that providing NRM information to these providers and using their networks to pass this information on to landholders will increase the reach of NRM information to landholders. Targeting this approach by using the most beneficial and relevant methods at the appropriate stages of adoption will therefore increase the potential to influence the adoption of NRM practices.

Overall the information gathered by the study was consistent with previous literature and built on the information provided by these studies. It fulfilled the study's objectives to improve understanding of the influence of NRM extension and the methods they use in motivating adoption of NRM practices and helped to further explain some of the issues arising in the literature. It also showed the availability of support has an important role in enabling land management activities as well as how NRM extension can be used as an effective tool to better support landholders in their adoption of NRM practices to improve the management of their land.

# Chapter 10      Conclusions and Future Directions

## 10.1      Introduction

The final chapter of this thesis summarises the study's research phases and results. The contributions the thesis has made to literature, the providers of support and policy-makers are also specified. This is followed by limitations of the study and ideas for further research. The thesis ends by providing some overall thoughts and conclusions about governments' role, the difficulty of developing effective NRM policy and ends with recommendations for action arising from evidence of the study.

### 10.1.1      Summary of research phases

The study was undertaken in four phases. Firstly the key research questions were gathered from the first ABARES study (Ecker et al. 2012) and a thorough literature research was undertaken on a range of industry studies and reports, theories and research methods to determine the best way to approach the task of answering these questions. A model for the stages of adoption was then developed and included in a framework with conceptual variables relating to the Theory of Planned Behaviour and contextual factors, based on this knowledge. A sequential mixed methodology design was chosen to explore the stages of landholder adoption and the benefits and relevance of the methods support providers use to support adoption of NRM practices. This method was also used to build on understanding of landholders' perceptions of the influence of support providers on their decision-making.

The second phase involved the implementation of online methods including a survey and interviews. These methods were chosen to reduce the costs and time associated with gathering data from people living in large, often remote regions. Telephone surveys were also included to reduce sample bias. Survey distribution was undertaken using Wheatbelt NRM, NRMOs, grower group and private consultant networks. Survey data were then statistically analysed by Qualtrics software using Chi-square analysis and Pearson's correlations using Excel.

The third phase consisted of online interviews undertaken to explain the relationships found in analysis, and expand on respondents' comments and issues arising in the

literature. This was followed by thematic analysis of all qualitative data using NVivo software. In the fourth phase, quantitative findings were presented in chapter five using tables and graphs and respondents' narrative was used to present the qualitative findings. This chapter also included interpretations of the findings, how the findings compare with other studies and how they explain and build on existing literature. The following chapter discussed the findings and interpretations from both phases of the research in relation to the research objectives, the framework and the themes which emerged during the research.

### 10.1.2 Summary of results

The findings suggest most of the framework provided a practicable model to investigate landholder adoption and the providers who support this adoption and the methods they use. The Stages of Adoption model developed for the study revealed important new information about WA Wheatbelt respondents' stages of adoption, when support is most beneficial and when the methods provided by support are most beneficial. The findings therefore showed the effectiveness of the Stage of Adoption model. TPB attitudinal concepts used in the framework - goals, motivation and risk perceptions - showed a significant influence on adoption of the selected NRM practices and use of the providers of support. However the social norm concepts – attitudes toward NRM and institutional trust – require further adjustment and research to substantiate their validity.

The findings also suggest the contextual factors used in the study showed a range of personal and farm characteristics do influence the respondents' attitudes and behaviour toward the topics of this study. They also revealed the multifunctionalism of land use in the region. The benefits of using a mixed method research design were supported by the results showing broad trends in the quantitative data and the deeper more comprehensive accounts of individual issues provided by the qualitative data.

Respondents' highest adoption rates were for crop-based NRM practices and the providers of support rated highest were private sector support and other landholders. The most beneficial and relevant methods of support were those likely provided mostly by these same providers of support; reflecting a dominance of support services focussed on improving crop productivity and maintaining traditional agrarian activities and values. They also suggest that support is mostly landholder-driven, with the

relevance and demand for these methods of support directly related to the level of adoption of the categories of NRM practices. As such the type of support that is sought and received may limit learning about NRM practices.

This data were consistent with literature reporting on the importance of broadacre crops to the gross value of agricultural production for the region and the neoliberal-driven changes to private sector support in the last few decades. However most respondents were also undertaking practices to improve or conserve the native vegetation on their land or contemplating it in the next five years. These activities were reinforced by evidence showing moderate ratings for the providers of support for these type of practices. However interviewee comments suggest an overall decline in environmental concerns and Landcare membership, while other WA studies show limited increase in NRM practices in recent years.

The lower adoption rates and relevance of methods to support grazing management practices reflects the lower contribution of livestock to farm production and level of support for this industry, discussed by interviewees. Past studies suggest agroforestry may have increased in the last two decades but the adoption rates and relevance of the methods to support this practice still remain relatively low. The difficulty shown for accessing some methods of support, particularly agroforestry and managing weeds, may therefore be influencing adoption of these practices. Evidence showing adoption levels were the same as attitudes toward the benefits of the selected NRM practices, underscores the importance of the need for the practice to meet landholder goals, emphasised in literature.

The moderate to high importance shown in social norms relating to NRM in general by many respondents was also consistent with NRM activities and highlights the impacts of shifts in environmental and NRM awareness and activity, encouraged by government NRM programs in recent decades. Nevertheless many believe NRM, or aspects of it are not very important, and further exploration with interviewees suggests a strong division exists between productivist and conservationist ideologies that challenges NRM extension efforts to encourage adoption of NRM practices. Additionally, evidence showing moderate to low trust in the Commonwealth government's commitment to community empowerment and their NRM programs

show barriers exist that may further limit participation. However there was also evidence of a moderate level of trust and influence by regional NRM groups.

Reduced government funding in recent decades has produced a sense of loss amongst some landholders for previous extension services, and limited activity undertaken by NRM and conservation groups. The complex extension services now in place are often confusing and difficult to access for many landholders. However the high relevance and benefits overall of the methods of support, particularly during the contemplation and preparation stages of adoption, provides evidence of the importance respondents attach to the provision of support. The findings also indicate how respondents' motivations to use the services of the providers of support fit within the ABARES studies' framework of their financial, environmental and personal motives for adoption of NRM practices.

Importantly the findings show that educating private consultants and key landholders about NRM practices and using their networks will improve the reach to all landholders. They also show that landholders are in different stages of adoption and the benefits of support and landholders' preferences for the methods of support they receive, change as they move through the stages of adoption. These findings correspond with NRM extension interventions recommended by other researchers that can be applied at different adoption stages to improve NRM practices. The findings therefore fulfil the key objective of this study: how to make NRM extension an effective tool that can influence decision-making.

### 10.1.3 Contributions

#### ***10.1.3.1 Literature***

The major contributions of this research have been to confirm much of what has been found in previous studies and the issues written in previous literature, and to fill some of the existing gaps. The study enriches and builds on current understanding by providing new and valuable insights into WA Wheatbelt landholders' adoption of selected NRM practices, and the influence of the providers of support and the methods they use to promote adoption of these practices. Very few studies have investigated the providers of support or the methods they use and no studies could be found that



investigated these aspects of adoption in relation to a similar range of NRM practices. The study therefore also contributed new knowledge and understanding of these topics.

The Stage of Change model traditionally used in the health industries was adapted for the current study to measure landholders' stage of adoption. The study also confirmed the effectiveness of this model. The findings from the use of this model provided a unique insight into respondents' stage of adoption of selected NRM practices, the stages of adoption when support is most beneficial and the stages of adoption when the methods of support are most beneficial. Confirmation of the effectiveness of this model by Botha and Coutts (2011) highlights the model's contribution to theoretical literature and suggests it is a worthwhile tool for further research. This study also confirmed there are some important constructs that account for influences on the attitude and behaviour of respondents. Many of these constructs were validated by empirical evidence from relevant studies.

Overall, the findings illustrate the important role the availability of support has in enabling land management activities and how it can be used as an effective tool to better support landholders in their adoption of NRM practices to improve the management of their land (Ecker et al. 2012). It has found relationships that may exist between adoption behaviours and attitudes toward the NRM practices, as well as between the attitudes and behaviour of respondents toward the providers of support. Relationships were also found between the accessibility and relevance of the methods they use to promote adoption. The study also showed that relationships may exist between NRM social norms, institutional trust and personal and farm characteristics that may influence respondents' adoption attitudes and behaviour as well as their intentions toward use of the services of those providing support. Findings also suggest there may be some barriers to the use of the providers of support and the methods they use.

In the main they indicate the benefits of further research to determine their validity. This research also raised many questions in relation to how further research might improve understanding of landholder attitudes and behaviour toward adoption of NRM practices, and the providers of support and methods they use to promote this adoption.

### **10.1.3.2            *Providers of support***

The study has made a significant contribution to the work of those providing support for adoption of NRM practices by providing unique evidence of the attitudes and behaviour of some landholders in the WA Wheatbelt, and outlining strategies that the findings suggest will provide practical options for improving NRM practices. Specifically the findings highlight for NRM extension that respondents' stage of adoption of the selected NRM practice reflects their attitude toward the ability of the practice to achieve their main goals, and that as they move through these stages of change the methods of support they prefer changes. They also highlight the importance of understanding the relative advantage of a practice to its adoption. The study showed similar methods of support are highly beneficial and highly relevant overall, confirming the importance of NRM extension understanding the value landholders place on these methods at the different stages of adoption. Therefore as previously stated, they highlight where, and how greater NRM extension effort may influence increased adoption of NRM practices.

Firstly they show the need for NRM extension to understand the stage of adoption of NRM practices for those landholders they are working with and the most beneficial and relevant methods to apply at each stage of their adoption and category of NRM practice, to provide a more targeted approach to increasing adoption of NRM practice. Secondly, these findings confirm there are specific providers and methods of support that these respondents and other landholders may prefer to use to assist them with their decision-making for these NRM activities. The value of this finding for NRM extension is that these influential providers can be used to channel NRM information to reach a greater cross section of landholders. By developing a 'train the trainer' approach and use of the networks developed by private consultants, grower groups and other local landholders, together with advising these providers on the most beneficial and relevant methods to use at each stage of adoption, will provide both a more targeted approach to encouraging adoption of NRM practice and increase the number of landholders with the skills and knowledge to implement these practices.

### **10.1.3.3            *Policy***

The findings of this study are important for policy because they build on recent findings from research undertaken by a key Commonwealth government research

organisation within an Australian government department. The aim of their research was to improve the development of policy and programs by finding out why landholders adopt selected NRM practices and how best to support adoption of these practices. Many of their suggestions and recommendations for further research into the influence of the availability of support on landholder adoption of NRM practices have been answered by the findings within the current study. The study will therefore help to improve policy-makers understanding of WA Wheatbelt landholders' diversity and decision-making for the adoption of selected NRM practices, as well as their attitudes and behaviour toward the providers of support and the methods they use to promote adoption of NRM practices. For these reasons it will help to guide the development of policy initiatives that support landholders in their adoption of NRM practices.

The close association with Wheatbelt NRM links the research to both regional and national levels. In this way policy and improved regional and local interventions, that incorporate landholder perspectives, can be developed and implemented to better meet the goals of both landholders and the government. While the findings of this study arise from a limited number of landholders in the WA Wheatbelt, the insights offered by this study should encourage further research into a range of different aspects of the study and appeal to all stakeholders involved in supporting a more sustainable agricultural industry.

#### 10.1.4 Study limitations and further research

Potential limitations of any research include validity and reliability and these factors have been addressed in Chapter 4. Other limitations have been explained in section 7.1. The study covered a broad range of factors influencing the provision of support to encourage adoption of NRM practices and the resultant survey was extensive and may have produced some respondent fatigue and straight-lining. The study also lacked statistical significance due to the limited sample size. In hindsight it may have been more effective to omit some questions and reduce the size of the questionnaire to try and increase the sample size. In this way it may have been possible to provide findings that were representative of all landholders in the WA Wheatbelt. The study did nevertheless, provide a broad understanding of overall trends in the provision of support for these respondents and reveal several gaps where future research may benefit understanding.

The inability to gain access to emails or other contact details to WA Wheatbelt landholders resulted in the use of NRM networks as a key source for online survey distribution and obtaining potential contacts. This method made it difficult to keep reminding landholders to respond to the survey, likely increased the time it took to fulfil the quota and probably provided a bias in respondent attitudes toward NRM. Similar research undertaken using personal emails and reminders should encourage greater participation and provide more valid findings.

There is a fine balance between defining the NRM practice, the providers of support or the methods they use to enable representation and validity, and omitting or combining these choices to prevent survey fatigue. The current study showed this was particularly true for defining those providing NRM support which may have made it difficult for respondents to provide responses, and reduced the accuracy of their responses. This included combining private consultants and agribusiness agents, WA government officers and local government support and not including CMAs with regional NRM groups.

It also highlighted the need for further research to better define landholder perceptions of 'categories' for providers of support to benefit future studies such as; differences between grower groups and other landholder-driven groups such as WANTFA, the Oil Mallee Association and the WA Sandalwood Plantations and how they define industry groups and R&D organisations such as GRDC and MLA or NASSA. The difference shown between attitudes toward private consultants' and agribusiness agents' support in other studies also suggests further research into the different use and motivation for these providers, particularly in relation to Landcare and regional NRM groups, may be worthwhile.

A key shortfall of this study was investigating the link between the providers of support and the methods they use. The ABARES studies linked the providers of support to a limited range of methods and these were used in the study to show which providers of support deliver the different methods. The current study showed which methods of support are most beneficial at the different stages of adoption. Further research to determine which providers of support are most important at the different stages of adoption would therefore improve understanding of which providers of support to

target that best deliver each method of support, and whether there were methods that are best provided by either public or private services.

The key study this research was based on (Ecker et al 2012) also determined the motivation for use of the providers of support for each of the five categories of NRM practices. Therefore further research to measure attitudes toward provider support and behavioural control using quantitative methods based on the TPB model and qualitative research would build on this knowledge and improve understanding about the overall influence of the availability of NRM extension on landholders' attitude and behaviour. These questions were too complex to include in the current study but could include measures of the perceptions to which the different providers of support think they should adopt each of the NRM practices, their tendency to comply with what each provider of support thought they should comply with, and the extent the ease or difficulty of accessing the services of each provider of support is likely to influence their adoption of each NRM practice.

Some factors investigated in this study indicate some relationships that may exist. Further studies would show whether these relationships are statistically accurate and provide a better understanding for policy, researchers and providers of support. Strategies could therefore be better targeted to improve the adoption of NRM practices. These included:

- relationships between personal and farm characteristics that provide an understanding of the profile of landholders in the WA Wheatbelt and how these characteristics influence the use of different providers and their methods of support
- relationships between landholder adoption and the ability of the practice to meet their goals.
- relationships between how landholders perceive the understanding of those providing support about the risks involved for them in adopting NRM practices and their motivation to use these providers
- relationships between government funding and how this influences the motivation and use of regional NRM groups
- relationships between the accessibility and relevance of the methods of support.

Further research into other factors arising from the findings would also improve understanding and extension strategies such as;

- how attitudes toward NRM and institutional trust influences the motivation and use of providers of support
- how landholders evaluate each provider of support and how this affects their decision-making
- how changes in technology use are affecting attitudes toward adoption of NRM practices and how NRM extension are responding to this
- how changing environmental values are affecting group membership and how groups are responding to these changes
- how government and industry funding influences landholders' use of Landcare and grower groups

Similar research recently undertaken with American landholders suggests the need to examine how private consultants convey the information they receive, for instance do they provide the information directly to landholders or do they 'first repackage it and add their own spin?' They also suggest there may be landholders who are not receiving the information they require or there may be gaps in topics that these providers do not value (Prokopy et al. 2015, 270). Few Australian studies have investigated the information supplied by these providers of support and those that have, show these providers see limited value in NRM and provide limited NRM information in the activities they organise or their advice.

The current study showed there appears to be some landholders who are not receiving the information they require. Strategies have been discussed that could assist NRM extension to improve the reach and gaps in NRM knowledge provided by these providers and shown the most beneficial methods to use for delivery. However further research and monitoring into how private sector providers convey these NRM messages would ensure they effectively inform landholders about practices that will improve their land management. A better understanding of the key requisites for future extension personnel would also greatly benefit the field. Research to determine the match between what senior agricultural extension personnel, senior agricultural university lecturers and private agronomists believe are key skills and knowledge

required for future extension staff would provide a worthwhile contribution to this understanding.

Other attitudinal measures often applied in current questionnaires use the typology of the landholder or the focus of their aspirations for their farm. The inclusion of a measurement for farming aspirations i.e. Byron et al. (2006, 29) would have improved the study's respondent profile and understanding of the study results. Studies exploring gender issues in agriculture have found 'the majority of extension and training is still unconsciously directed at the men in the business, in particular, older men' (Howard, Stelling, and Mahoney 2015, 103). The current study did not investigate gender issues and how this influences attitudes and behaviour toward those providing NRM extension. However further investigation into this aspect of support would be worthwhile.

While these results have some relevance, particularly for those working in NRM extension, the quantitative findings were drawn from a limited sample with uncertain representativeness, and thus should be interpreted carefully. Nevertheless, future researchers can draw on this mixed methods approach using a larger sample to verify and build on these findings, just as this study has built on others.

### 10.1.5 Final Conclusions

Although government NRM programs and the regional scale NRM delivery approach have been widely accepted, the concerns about its ability to address the significant issues of sustainable land management are central to this research. Growing awareness of the need to take responsibility for the environment is driving institutional efforts for communities' to take ownership and accept responsibility for these issues and NRM extension plays an essential role in these processes. However this often places an unfair and impossible burden on these caretakers of the land and significant barriers for NRM extension. Adoption of NRM practices is often risky, complex and long-term, and potentially made more difficult by a decreasing and aging landholder population. The findings of this study showed the separation of government-funded NRM extension and the increasingly dominant production-focussed private sector, combined with a complex and often conflicting role for NRM extension, often limits the ability of those working in extension to bring about meaningful change and is leading to questioning

of their role and capacity to succeed. Hopefully, the strategies outlined in this research will go some way to improving this situation.

Researchers also question the potential for governments to develop appropriate NRM policy interventions and ‘sustainable financing mechanisms’ with the capacity to respond to the diversity of landholders and their future agricultural challenges (Mallawaarachchi and Green 2013; Faure, Desjeux, and Gasselin 2012); which will continue to place barriers to adoption of NRM practices. When asked how he sees the future role for government the following interviewee voiced frustrations likely shared by many landholders in the WA Wheatbelt. He suggests there is a lack of government support for the comparatively small number of people in both agriculture and rangeland industries as well as those people that work in NRM extension to support these industries. He argues that no one has fully taken on this responsibility.

That’s the role of government to do those things that private enterprise are not going to do. In other words to watch our back for us so that we don’t get ripped off and hammered into the ground and basically stuff up our natural resources trying to flog it to death to make the most money for the suppliers of machinery or chemicals or something. I think the demands of the city and the numbers of the people in the city means that people in agriculture and NRM and the rangelands of course, there’s no votes in it so they just don’t get a look in really. Unfortunately there’s no political clout. The chair isn’t taken! (male 56-66 yrs).

Broadly, the findings of this thesis suggest that landholders in the WA Wheatbelt believe the availability of support has an important role to play in assisting them with their production and sustainable land management. They also show the complexity and challenges involved in improving adoption of NRM practices for those working in NRM extension. They help make sense of landholders’ attitudes toward NRM and those who provide support for both production and sustainable land management, as well as the methods they use to promote adoption of NRM practices. In addition the findings build on evidence to support literature recommendations for activities to improve NRM extension. The thesis also shows the need for government, industry and civil society to ‘take the chair’ and have an ongoing debate about how they see the future of their agricultural industry and the people who work to support the sustainable development of both the production and land management of the landholders involved.



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## Appendix A NRM Practices

NRM practices, their definition, use, advantages and disadvantages			
Practice	Definition and Use	Advantages	Disadvantages/barriers
No-till/reduced tillage	Refers to any 'sowing system aimed at retaining crop residues and minimising soil disturbance'. Includes Reduced Tillage, Direct Drill, No-Till, Zero-Till (Victorian No-Till Farmers Association Inc 2015). Often referred to as conservation tillage. Multiple-till - prepare the vast majority of crop using one or more cultivations prior to sowing (McRobert & Rickard 2010, 45).	Environmental benefits: improved soil conservation, reduction in soil erosion and soil compaction, increases water use efficiency.  Landholder benefits: improves timeliness of sowing, reduction in time, labour and fuel use and increased productivity, improved nutrient and input-use efficiency, socially accepted practice.	High cost of machinery and herbicides.  Increases reliance on herbicides and insecticides and encourages more applications resulting in increased resistance and environmental and human safety threats (McRobert & Rickard 2010; Toric 2005; Wheatbelt NRM 2013a).
	Most "no-till" adopters continue some strategic tillage (~30% cropped area) for a range of sound agronomic reasons' but the appropriate level of soil disturbance remains contentious (Kirkegaard et al. 2014, 133) Benefits to productivity and profitability of reduced tillage has decreased the need for government intervention (Pannell and Roberts 2015).	Reduces environmental and human health risks from smoke pollution  Advantages for climate change mitigation: limited soil carbon sequestration and reduced carbon emissions (Lemerle 2015; Pannell et al 2006; McRobert and Rickards 2010)	Results from the GRDC (2014) survey showed 31% of 108 WA landholders producing grain were experiencing herbicide resistance as a problem during 2013 and 2014.  Increased plant selection pressure, difficulties in sowing into high stubble loads, increased machinery costs, and more complex management decisions (Lemerle et al. 2015, 1)
	In 2008, 88% of WA Wheatbelt landholders were using no-till practices and 78% were sowing their entire crop using no tillage practices (Llewellyn, D'Emden, and Gobbett 2009, 16)	'intensive no-till cropping can generate disease suppression' in crops, (Kirkegaard et al 2014, 140)	'Amelioration of sub-surface acidity by surface-applied lime can take 2-4 years longer in no-till than disturbed systems'. (Kirkegaard et al 2014, 139)
Stubble retention	Straw and stubble from crop is retained in the ground and on ground surface. Undertaken with reduced tillage practices. Recent research shows growers partially adopt stubble retention and combine this with selective burning for 'flexible' stubble management (Lemerle et al 2008)	Prevents wind and water erosion, conserves water for crop production and improves soil health. In wetter areas provides on-farm livestock grazing or can be sold for livestock fodder or compost. (Kirkegaard et al. 2014).	Cost of new technology/machinery for not-till (Toric 2005).  Need for pest, weed and disease management
	In 2008 between 23-55% of WA Wheatbelt landholders were still burning some of their stubble, depending on the region (Llewellyn, D'Emden, and	'Cereal crop stubble after harvest represents a significant carbon pool' (Rochecouste et al. 2015, 21).	Machines have difficulty seeding into thick and/or tall stubble. Needs to be managed to optimise benefits of soil health improvement.

Variable rate technology	<p>Component of precision agriculture technology. Farm machinery used to apply variable rates of agricultural chemicals, especially fertiliser based on soil type to improve crop yield. Uses GPS positioning, yield monitors, and variable-rate applicators. Growing use of VRT (Robertson et al. 2011)</p>	<p>More cost-effective use of inputs (chemicals, fuel, labour, and machinery), Increased yields, Increasing product value through selective harvesting (Robertson 2011, 182).</p>	<p>Technical issues with equipment ie matching technology with farm system, software access to service provision and incompatibility of equipment with existing farm operations. A high level of data management, interpretation, and judgement is required (Robertson 2011, 182).</p>
Addressing soil acidity	<p>Soil acidity is due to nitrate leaching from fertiliser and organic matter and export of agricultural products. Natural process is accelerated by agriculture. Measured by soil pH. Low pH (high acidity) in surface soil decreases nutrient availability and biological activity. Low pH in subsurface soil causes increase in aluminium, toxic to plant roots. Liming neutralises acidity, however adoption is slow and WA agricultural soils remain undertreated overall (DAFWA 2014, 10). ABS (2014a) reports an increase in area of application in WA of soil enhancers in 2012-13.</p>	<p>Liming has shown on-farm economic benefits and increased yield and has been shown to cover cultivation costs with payback period estimated around four years. Improves soil health, water repellence, erosion, and helps decrease phosphorus export. Benefits conditional on seasonal conditions, severity of acidity, soil and production type (DAFWA 2014).</p>	<p>'Amelioration of sub-surface acidity by surface-applied lime can take 2-4 years longer in no-till than disturbed systems'. Nutrient stratification and root disease can also be a problem (Kirkegaard et al 2014, 139) Barriers are upfront costs, time lag for returns, financial and environmental impacts of soil acidity not factored into planning, mixed messages about application, uncertainty about effectiveness (DAFWA 2014). Particularly conditional on the expertise of the landholder in implementing the practice and the costs of transporting lime (GRDC 2015).</p>
Controlled traffic farming	<p>Adjusting cropping machinery to run on permanent traffic lanes to reduce the percentage of paddock compacted by wheel tracks. Also known as tramline farming (Hagan, et al. 2015).</p> <p>Uses satellite Global Positioning System (GPS) and reference stations to auto steer tractors (Rochecouste et al. 2015). Compaction restricts plant access to subsoil moisture. Calculated to cost WA agriculture around \$333m annually. Is increasing and becoming more difficult to resolve (Hagan, et al. 2015). Controlled traffic farming has increased in recent years (ABS 2014a)</p>	<p>Less compacted soils increase soil organisms which assist organic recycling. Reduces fossil fuel consumption per hectare by about 50% of conventional systems (Rochecouste et al. 2015, 22).</p> <p>Improves plant use of stored subsoil moisture, reduces cost of deep ripping programs where compaction is moving deeper through the soil profile, protects farm investment in costly soil amelioration techniques such as spading or mould board ploughing to remove compaction (Hagan, et al. 2015). Improves profit due to higher yield and grain quality and less fertiliser and fuel consumption. Improves environment with less nutrient leaching, less water erosion, better infiltration and less greenhouse gas emission (<a href="http://www.agric.wa.gov.au">www.agric.wa.gov.au</a>).</p>	<p>Capital cost (such as need to modify machinery), requirements, and farm changes required such as reorganizing fencing or changing the direction of the planting row, and the deep ruts from wheels using the same tracks. Less cost and effort if all machinery is at complementary widths with necessity to only change wheel spacing modifications to create a fully matching system. Otherwise it may require replacement of all current machinery to create a system that works effectively (Hagan, et al. 2015).</p>

	Tree cropping provides economic, environmental and social benefits ( <a href="http://www.avongro.com.au">www.avongro.com.au</a> )	Provide environmental values, wind breaks, soil protection, local groundwater management aesthetics and potential land values. Also provide grazing, carbon sequestration shade and shelter for stock and bushfood (Wheatbelt NRM 2013c, 16).	Loss of arable land. Time, costs and difficulty of establishment. Long wait and unsure economic returns. Hard to establish. Short lived (Toric 2005).
Single or multiple species agroforestry	Range of species suitable is increasing. Oil Mallees and Sandalwood most popular. Uncertainty with oil mallee industry. Integrating agroforestry with grazing options can provide multiple benefits (Wheatbelt NRM 2013c).	Oil Mallees: Don't need fencing; sheep don't graze; aesthetic benefits; ameliorate rising watertables and salinity; carbon credits; native to region and grow in low rainfall. (Toric 2005). Sandalwood: grows well on soils unsuitable for cropping and can provide significant profit. Brushwood grows on less productive soils, provide economic returns from fencing panels (Wheatbelt NRM	Most timber species only suitable in higher rainfall areas. Can have high ongoing management requirements such as pruning and thinning (Wheatbelt NRM 2013). Presents both economic and social risk to the landholder so generally placed on marginal land where it is less productive and more difficult to monitor for carbon sequestration (Schirmer 2013).
Planted native vegetation or encouraged regrowth	Biodiversity plantings need variety of groundcover, trees and shrubs, and particularly local species. Local native species knowledge is increasing and recognised as important for biodiversity (Wheatbelt NRM 2013c).	Provide environmental values, wind breaks, soil protection, local groundwater management, aesthetics and potential land values. Native species, particularly local, improve the environment (Wheatbelt NRM 2013c). Biodiversity benefits in additional habitat, but often lower in value than remnant protection (Cary and Roberts 2011)	Additional fencing costs, direct loss of farm land to conservation (Cary and Roberts 2011) Trees may reduce flexibility to switch annual crop production in response to weather (Pannel et al 2006)
Fenced native vegetation to control stock access	Native vegetation in the WA Wheatbelt has been reduced to around 30% (ranges from 6% to 99%) of its original cover causing fragmented ecosystems, and extensive degradation of soil, biodiversity and water systems (Allison and Hobbs 2006)	Provides corridors and habitat for native animals, protects rare plants and provides recreational areas and aesthetic values. Improves property's value. Important to control salinity and erosion. Shelterbelts can increase crop yields to a distance approximately 10 times the height of vegetation. Animal production benefits from the shelter as it decreases exposure of stock to wind and rain, and provides shade. Other benefits are; sustainable yield of fenceposts, firewood, honey, cut flowers, seed for sale to nurseries, or trees for sale or revegetation of farm (Jenkins 1998).	Additional fencing, maintenance and pest control costs, reduces stock shelter, shelters feral animals and harbours weeds, fire hazard, reduces access to arable land (Jenkins 1998).
Cell or strip rotational grazing	Rotational grazing involves rotating livestock through paddocks to allow paddocks to rest and grow sufficient pasture for further grazing. Cell grazing is more intensive and involves smaller paddocks or 'cells'. 'Minimum level of soil cover (usually 50% to 70%) to avoid significant soil erosion' (Kirkegaard et al 2014, 136).	Reduces potential for overgrazing causing land erosion and reduced production. Usually allows higher overall stocking rates and helps to manage plant species composition by targeting undesired species and supporting growth of palatable perennial pasture species. Helps prevent stock infections.	May require more infrastructure and greater labour than set stocking. May not be practical when plants are not growing. Reduced opportunity to selectively graze may result in lost production ( <a href="http://www.mla.com.au">www.mla.com.au</a> ).



Set minimum groundcover targets for long term	In 2012-13, 'farmers that monitor their ground cover in paddocks still predominantly do so by visual estimates, but actually counting the number of plants in an area has increased as a monitoring method' (ABS 2014b)	Reduces structural collapse and hard-setting of soil following heavy rainfall (Kirkegaard et al 2014, 136)	Difficult on 'annual pasture systems during summer and autumn, particularly during drought years' without alternative grazing options (Wheatbelt NRM 2013c).
Planted or maintained deep rooted perennial pastures	It is recognised that perennial plants: extract soil water and nitrogen from below the root-zone of annual plants, convert rainfall falling outside the annual growing season to green feed, and provide more stable groundcover (Robertson and Revell 2014). Perennial pastures such as native grasses, Lucerne and Puccinellia can improve production, protect natural resources and build farm resilience (www.agric.wa.gov.au).	Increased water use, reduced soil loss. Increased stocking rates mean increased profit but increased management required as well (Cary and Roberts 2011).  Can be planted using seeds which reduce costs. Combined legume-based species and grasses can be tailored to suit environment (Wheatbelt NRM 2013c). Pastures can be cropped directly over perennial pastures, crops sown between established rows of summer-active perennial pasture provide more flexible livestock management, greater income stability and whole farm profit (www.agric.wa.gov.au).	High up-front costs and often not economically favourable (Wheatbelt NRM 2013c). Scarcity of seed of suitable varieties, inadequate access to pertinent technical information or credible advisors, perceived riskiness, poor and patchy establishment, fear of failure, tacit disapproval of unconventional practices and the need to alter grazing management (Crossley, Turnbridge, and McDonald 2009, 1)  In the eastern Wheatbelt, introducing large-scale perennial pastures into a cropping system may threaten traditional summer holidays allowing temporary escape of harsh summer environments (Pannell et al 2006)
Planted grazing shrubs	Range of species suitable for grazing is increasing, including for saline soils. Local native species knowledge is increasing and recognised as important for biodiversity (Wheatbelt NRM 2013c).	Helps manage salinity and maintain groundcover (Robertson and Revell 2014) Good option on unproductive land, windbreak and stock feed in dry seasons and shade during summer. Saltbush provides grazing on saline land. Acacia: good feed value; works well mixed with legumes. Tagasaste: don't need fencing; grows on unproductive sandy soils; propagates by itself; good feed value; stops erosion (Toric 2005). Valuable green feed for livestock during summer/autumn feed gap. 10-20% of unproductive farm areas planted in forage shrubs can increase profitability (Wheatbelt NRM 2013c).	Need to be planted using seedlings which increases costs. Reduces arable land area (although cropping can be done between the rows of shrubs), Acacia saligna short lifespan. Lucerne difficult and costly to establish. Saltbush needs hay and water to establish. More complex stock management (Toric 2005)
Managed Weeds of National Significance	Australia currently has 32 Weeds of National Significance (WoNS). Practices to control weeds include biological control, suppression of weed growth, physical removal, chemical control and integrated weed management <a href="http://www.environment.gov.au">http://www.environment.gov.au</a> The Australian Weeds Strategy guides weed management activities under the National Landcare Program <a href="http://www.nrm.gov.au">www.nrm.gov.au</a> Weed identification tools are provided by DAFWA to assist Wheatbelt landholders to identify and eradicate weeds <a href="http://www.agric.wa.gov.au">www.agric.wa.gov.au</a>	Weed control restores native species, prevents or ameliorates land degradation, improves farm and forest productivity and reduces threats to biodiversity by maintaining the natural diversity and balance of ecological communities <a href="http://www.environment.gov.au">http://www.environment.gov.au</a>	Material and labour costs incurred by landholders to eradicate. Estimated costs around \$1.5 billion a year in weed control activities and \$2.5 billion in lost agricultural production. Environmental costs may be greater. WoNS invade crops, smother pastures and sometimes harm livestock. They aggressively compete for water, nutrients and sunlight, resulting in reduced crop yield and poor crop quality. They can also cause human health problems <a href="http://www.environment.gov.au">http://www.environment.gov.au</a>

# Appendix B Survey documents

## B.1 Information sheet



Hi, my name is Lynda Braddick and I am a mature-aged student doing research for a PhD at Curtin University with farmers in the West Australian Wheatbelt.

**Purpose:** There are a lot of people working in government policy and within the Wheatbelt region, to assist farmers with the management of their land. The purpose of my research is to improve their understanding of the influence they have on farmer's motivation and decisions to undertake natural resource management (NRM) practices. Support providers include people involved in:

- Landcare and grower groups,
- private consultants and agribusiness agents,
- other farmers,
- government extension officers,
- research and development, non-government and industry organisations.
- Regional NRM groups

This information will be useful not only to government, but also to other people and organisations providing land management advice and support to farmers in the Wheatbelt. By understanding more about what you think about their current methods, it will allow them to improve the type of support they provide, and how and when they provide it to yourself and other farmers in the future.

**Survey Request:** Therefore, if you are a farmer in the Wheatbelt, we would like you to provide us with your views. The survey is complex in places but there are a wide range of methods being undertaken to try and help farmers manage their land and those undertaking the work would appreciate your feedback on their efforts. The overall results will be made available to everyone who provides land management advice or support. The survey may take around 20-30 minutes to complete. A \$20 email voucher from Bunnings will be provided as a thank you to those farmers who complete the survey and choose to provide their email address. Your survey responses will only be accessed by me, I will delete your email address prior to any analysis of the information and you will not be sent any other correspondence once the survey is completed. The survey will be closed when a quota of 82 has been reached.

Federal privacy laws protect the confidentiality of any comments you make in relation to the survey and your information will be used solely for research purposes. There are

no right or wrong answers and while I prefer you to answer all questions in the survey, you do not have to.

**Results:** Aggregated results of the survey will be made available through the Regional NRM Group e-newsletters at a later date for those who are interested or you can email me for a copy on [lynda.braddick@student.curtin.edu.au](mailto:lynda.braddick@student.curtin.edu.au). When I have finished with the information it will be stored at the State's General Disposal Authorities but I will remove any details that may identify individual farmers with the information.

**Regulations:** This study has been approved under Curtin University's process for lower-risk Studies (Approval Number RD-44-13). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21). For further information on this study contact the researchers Lynda Braddick, [REDACTED], Associate Professor Laura Stocker, (08) 9266 9034, the Curtin University Human Research Ethics Committee c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au).

## B.2 Interview permission slip



Farmers Perceptions of the Influence of Natural Resource Management NRM support Providers on Their Decision-Making in the Wheatbelt Region of WA

### Interview Consent Form

Federal privacy laws protect the confidentiality of any comments you make in relation to the survey and your information will be used solely for my research purposes. There are no right or wrong answers and while I prefer you to answer all questions in the survey or interview, you do not have to.

- I agree to participate in this interview and:
- I have read the information and understand the purposes of the study.
- I have been given an opportunity to ask questions.
- I understand I can withdraw at any time without consequences.
- I understand that any information which might potentially identify me will not be used in any writing published in this study.
- I agree to participate in the study as outlined to me.

Participant's  
signature.....

Name.....

Date .....

## B.3 Terms and conditions of Bunnings Voucher



### **Survey of NRM Support Influence**

#### **Terms and Conditions for receiving the Bunnings voucher**

Instructions on receiving a \$20 emailed gift card from Bunnings are contained within promotional material for this survey and form part of the conditions of receipt.

By providing your email address, survey respondents agree to abide by these Terms and Conditions.

The Terms and Conditions of the use of this gift card are governed by Bunnings.

The survey is being conducted by a PhD student at Curtin University of Technology, GPO Box U1987, Perth, Western Australia, 6845 ("Curtin").

The survey titled NRM Support Influence commences on 13<sup>th</sup> March 2014 and will be closed when a quota of 85 has been reached.

Receipt of a \$20 emailed gift card is limited to respondents who complete the survey and include their contact details.

To receive a \$20 emailed gift card, the entrant must complete the survey accessed through a link in Wheatbelt NRM e-newsletters and submit the survey before the closing time.

Respondents will be responsible for all costs associated with participating in the survey and receipt of a gift card, which may include costs associated with accessing the Internet.

Respondents may only participate in the survey once.

There will be one \$20 gift card emailed to each respondent who completes the survey before the closing time.

The survey respondent will be emailed the gift card within seven (7) days of the survey closure by the email address supplied by the respondent on the completed survey form.

If the respondent does not receive the gift card within 14 days of the survey closure they are to contact the researcher, Lynda, [REDACTED] or Associate Professor Laura Stocker, (08) 9266 9034, the Curtin University Human Research Ethics Committee. c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning 9266 9223 or by emailing hrec@curtin.edu.au.

The survey respondent will be responsible for all costs associated with receiving and using the prize.

1. Bunnings gift cards can only be used towards any purchase of goods at any Bunnings location in Australia.
2. The gift card is not a credit or debit card and not redeemable for cash.
3. When redeemed the gift card must be relinquished to the cashier. Maximum change given is \$9.95.

The gift card is not transferrable.

Bunnings and Curtin University are not responsible for lost, stolen or damaged cards.

Bunnings and Curtin University are not responsible in any manner whatsoever for any problems or any financial costs incurred, or any combination thereof, including any injury or damage to participants or any other persons related to or resulting from receipt and use of the gift card.

Curtin University accepts no responsibility and shall not be held legally liable or responsible for any accident, loss, injury or damage to any individual or property whether direct or indirect, whether in contract, tort, negligence or otherwise arising out of or in connection with the survey completion and receipt and use of the gift card, either during or after the survey.

Supply of an email address signifies acceptance of all conditions. Survey respondents are required to abide by the Terms and Conditions as presented.

Curtin University's decision will be final and no correspondence will be entered into.

Personal information provided by a survey respondent to Curtin University for the purpose of receiving a gift card will be collected, used and disclosed in accordance with Curtin's Privacy Statement. A copy of the privacy statement is available at <http://global.curtin.edu.au/legal/privacy.cfm>. Personal information collected will be kept strictly confidential and will not be sold, reused, rented, loaned or otherwise disclosed to any third party otherwise than in accordance with the Curtin privacy statement and these Terms and Conditions.

## B.4 Survey instrument

### Influence of NRM Support

To find out more about this survey [Information form](#)

QA1 For respondents who are 18 years of age or older: I have read the gift card [Terms & conditions](#) for the \$20 'Thank You' emailed gift card from Bunnings and provide my consent to be bound by them.

**Federal privacy laws protect the confidentiality of any comments you make in relation to the survey and your information will be used solely for research purposes. There are no right or wrong answers and while I prefer you to answer all questions in the survey, you do not have to.**

- Yes I would like to receive the gift card and accept the terms and conditions
- No I don't wish to receive a gift card

QA2: PLEASE SUPPLY YOUR EMAIL ADDRESS FOR THE GIFT CARD

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QB1: Firstly are you:

- Male
- Female

QB2: Which of the following best describes your role in the farming industry

- I don't work in farming in the WA Wheatbelt
- I work extensively in farming in the WA Wheatbelt and am the main decision-maker in that business
- I am a joint decision-maker on a farm in the WA Wheatbelt
- I work extensively on a WA Wheatbelt farm but am not the main decision-maker
- I am the partner of primary decision-maker who owns/manages a WA Wheatbelt farm
- I am the parent of a primary decision-maker who owns/manages a WA Wheatbelt farm.

Q1: Which of the following applies to you?

	I am thinking about doing	I am trialling or planning how I will do	I am interested but currently unable to do	I am currently doing	I have done and found not worthwhile	I am not considering doing within the next 5 years
No till, including reduced stubble burning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Periods of fallow adopted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Variable rate technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Addressed soil acidity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Controlled traffic farming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Single or multiple species agroforestry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted native vegetation or encouraged regrowth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fenced native vegetation to control stock access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cell or strip rotational grazing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Set minimum groundcover targets for long term	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted or maintained deep rooted perennial pastures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted grazing shrubs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Managed Weeds of National Significance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Q2: Was your consideration or adoption of the practice in any way a result of information, activities or supported projects specifically provided by staff at a Regional NRM group?

- Not at all
- To some extent
- Mostly
- All
- Unsure

Q3: Which, if any, of these practices have you received government funding or a 'landcare grant' for in the past?

- No till, including reduced stubble burning
- Periods of fallow adopted
- Variable rate technology
- Addressed soil acidity
- Controlled traffic farming
- Single or multiple species agroforestry
- Planted native vegetation or encouraged regrowth
- Fenced native vegetation to control stock access
- Cell or strip rotational grazing
- Set minimum groundcover targets for long term
- Planted or maintained deep rooted perennial pastures
- Planted grazing shrubs
- Managed Weeds of National Significance
- None

Q4: How likely would you have been to undertake these practices without this financial assistance?

	Unlikely	Somewhat Unlikely	Somewhat Likely	Likely
No till, including reduced stubble burning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Periods of fallow adopted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Variable rate technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Addressed soil acidity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Controlled traffic farming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Single or multiple species agroforestry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted native vegetation or encouraged regrowth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fenced native vegetation to control stock access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cell or strip rotational grazing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Set minimum groundcover targets for long term	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted or maintained deep rooted perennial pastures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted grazing shrubs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Managed Weeds of National Significance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5: How strongly would/does implementing each practice on your farm help your chances of achieving your main goals?

	No help	Help little	Help moderately	Help greatly	Unsure
No till, including reduced stubble burning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Periods of fallow adopted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Variable rate technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Addressed soil acidity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Controlled traffic farming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Single or multiple species agroforestry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted native vegetation or encouraged regrowth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fenced native vegetation to control stock access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cell or strip rotational grazing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Set minimum groundcover targets for long term	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted or maintained deep rooted perennial pastures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planted grazing shrubs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Managed Weeds of National Significance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6: How important do you believe natural resource management is to other farmers in your local community?

- Not important
- Not very important
- Some things important some not
- Important
- Very Important

Q7: How much do you consider your attitudes toward natural resource management are similar to other farmers in your local community? Are you:

- Exactly the same as other local farmers
- Similar to other local farmers
- Somewhat the same as other local farmers
- Somewhat different to other local farmers
- Different from other local farmers
- Very different from other local farmers

Q8: Please rate the extent you are aware of this support.

	Not sure what support they provide	I am somewhat aware of the support they provide	I am mostly aware of the support they provide	I am fully aware of the support they provide
Landcare/NRMOs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grower groups ie Liebe Group, WA No Till Farmers Association, Oil Mallee Association, Avongro	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private/agribusiness consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other local farmers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WA government officers ie; DAFWA, including local government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Research & Development organisations ie; CSIRO, Universities, GRDC	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regional NRM Groups ie; Wheatbelt NRM or NACC	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-government groups ie; WWF, Men of the Trees, Birds Australia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry groups and associations ie; GIWA, MLA National Farmers Federation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9: Which of the following support providers have you received information, advice or assistance about land management from in the last 5 years?

- Landcare
- Grower groups
- Private/agribusiness
- Other local farmers
- WA government officers
- Research & Development organisations
- Regional NRM Groups
- Non-government groups
- Industry groups
- Other (please specify) \_\_\_\_\_

Q10: Apart from the financial benefits, what are some of the ways this support was beneficial to you?

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Q11: How could this information, advice or assistance have been improved?

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Q12: In general, how motivated are you to use information, advice or assistance from these sources of support?

	<b>Not at all</b>	<b>Slightly</b>	<b>Neither one nor other</b>	<b>Moderately</b>	<b>Strongly</b>
Landcare	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grower groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private/agribusiness consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other local farmers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WA government officers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Research & Development organisations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regional NRM Groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-government groups ie WWF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry groups and associations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13: You have stated that you are not, or only slightly, motivated to use these sources of support. Why do you say that?

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Q14: In general, how well do you think these people providing support understand the risks involved for you in undertaking land management practices?

	<b>Definitely don't understand</b>	<b>Probably don't understand</b>	<b>Probably understand</b>	<b>Definitely understand</b>	<b>Unsure</b>
Landcare	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grower groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private/agribusiness consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other local farmers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WA government officers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Research & Development organisations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regional NRM Groups	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-government groups ie WWF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Industry groups and associations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15: At what stage in your change in land management practices would support be of greatest benefit?

	<b>No benefit at all</b>	<b>Somewhat Beneficial</b>	<b>Moderately Beneficial</b>	<b>Very Beneficial</b>	<b>Unsure</b>
When you are first thinking about doing the practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When trialling or planning how you will do the practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When you are interested but currently unable to undertake the practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When you are undertaking the practice?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q16: In general, what type/s of support would you find most useful at each of these stages of undertaking change in land management practices?

	When you are first thinking about doing	When trialling or planning how you will do the practice	When interested but currently unable to do	When you are doing the practice	Would not find useful
One on one advice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Group talks and assistance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Field days and tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trials and demonstrations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Workshops and forums	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Seminars and conferences	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peer Networks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rapid Appraisal Processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Decision Support Tools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Property Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Media articles, leaflets & Flyers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Website info & E-News Bulletins	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Field Guides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social media ie Facebook & Twitter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Case studies/Champions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Financial grants & paid assistance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tax exemptions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Q17: We would like to know how easy it is for you to access support for land management and how relevant the support is. So, thinking about conservation agriculture practices of no till, including reduced stubble burning, adopting periods of fallow, variable rate technology, addressing soil acidity and controlled traffic farming:(a) how easy is it for you to get the following types of support?

	<b>Difficult</b>	<b>Somewhat difficult</b>	<b>Somewhat easy</b>	<b>Easy</b>	<b>Unsure/Don't practice</b>
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18: Thinking about conservation agriculture practices of no till, including reduced stubble burning, adopting periods of fallow, variable rate technology, addressing soil acidity and controlled traffic farming: (b) how relevant is this help to your land management strategies?

	<b>Not relevant</b>	<b>Somewhat relevant</b>	<b>Mostly relevant</b>	<b>Relevant</b>	<b>Unsure/Don't practice</b>
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19: How easy is it for you to get the following support for Agroforestry practices of Single or multiple species agroforestry?

	<b>Difficult</b>	<b>Somewhat difficult</b>	<b>Somewhat easy</b>	<b>Easy</b>	<b>Unsure/Don't practice</b>
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q20: How relevant is the following support for Agroforestry practices of Single or multiple species agroforestry?

	Not relevant	Somewhat relevant	Mostly relevant	Relevant	Unsure/Don't practice
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q21: How easy is it for you to get the following support for native vegetation management practices of planting or encouraging native vegetation or fencing native vegetation to control stock?

	<b>Difficult</b>	<b>Somewhat difficult</b>	<b>Somewhat easy</b>	<b>Easy</b>	<b>Unsure/Don't practice</b>
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q22: How relevant is the following support for native vegetation management practices of planting or encouraging native vegetation or fencing native vegetation to control stock?

	Not relevant	Somewhat relevant	Mostly relevant	Relevant	Unsure/Don't practice
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q23: How easy is it for you to get the following support for sustainable grazing practices of cell or strip rotation grazing, setting minimum long-term groundcover targets, planting or maintaining deep rooted perennial pastures or planting grazing shrubs?

	<b>Difficult</b>	<b>Somewhat difficult</b>	<b>Somewhat easy</b>	<b>Easy</b>	<b>Unsure/Don't practice</b>
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Q24: How relevant is the following support for sustainable grazing practices of cell or strip rotation grazing, setting minimum long-term groundcover targets, planting or maintaining deep rooted perennial pastures or planting grazing shrubs?

	Not relevant	Somewhat relevant	Mostly relevant	Relevant	Unsure/Don't practice
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Q25: How easy is it for you to get the following support for managing Weeds of National Significance?

	<b>Difficult</b>	<b>Somewhat difficult</b>	<b>Somewhat easy</b>	<b>Easy</b>	<b>Unsure/Don't practice</b>
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q26: Lastly, how relevant is the following support for managing Weeds of National Significance?

	Not relevant	Somewhat relevant	Mostly relevant	Relevant	Unsure/Don't practice
One on one advice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Group talks and assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field days and tours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trials and demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workshops and forums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seminars and conferences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Peer Networks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Appraisal Processes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decision Support Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Property Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Media articles, leaflets & Flyers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Website info & E-News Bulletins	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Field Guides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media ie Facebook & Twitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Case studies/Champions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial grants & paid assistance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax exemptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q27: Thinking about the types of support you have used in the past, was this generally your preference or were there other types of support you would have preferred to use?

- Preferred support I used
- Generally preferred support I used
- No preference either way
- Would have generally preferred other support
- Would have always preferred other support

Q28: What type/s of land management support would you have preferred to use and why do you think this was not available?

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Q29: How much do you agree or disagree with the following statements:

	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neither Agree nor Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
Regional NRM Group staff members generally care about our community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regional NRM Groups are just a 'rubber stamp' for decisions made by the Commonwealth Government	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The regional approach is a way for governments to hand over responsibilities for difficult issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The regional approach is a way to transfer NRM costs onto volunteers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Commonwealth government is committed to community empowerment to solve their own land management problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q30 Do you have any further comments you would like to make?

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QB3: What age group are you in?

- 18-25 yrs
- 26-40 yrs
- 41-55 yrs
- 56-65 yrs
- 66-75 yrs
- 75+ yrs

QB4: What type of farmer are you?

- Beef & cattle
- Cropping
- Sheep for wool
- Sheep for meat
- Other (please specify) \_\_\_\_\_

QB5: Size of farm in hectares

- 1-499 hectares
- 500-999 hectares
- 1000-1999 hectares
- 2000-2999 hectares
- 3000+ hectares

QB6: How many years have you been a farmer?

- 1-3 yrs
- 4-8 yrs
- 9-15 yrs
- 15-20 yrs
- 21-30 yrs
- 30+ yrs

QB7: How many generations of your family have owned your farm including yourself?

- 1
- 2
- 3
- 4
- 5 or more

QB8: What is your highest level of education you have completed?

- Primary
- Some secondary
- Completed secondary
- Trade or technical qualification
- University degree or diploma
- Prefer not to answer

QB9: Which of these best describes your household?

- Single
- Share accommodation
- Couple without children
- Family most under 16 yrs
- Family most over 16 yrs
- Empty nesters (children left home)
- Other (please specify) \_\_\_\_\_

QB: 10 How many people, including yourself, are key decision-makers for the farm?

- Only myself
- Myself and one other
- Myself and two others
- Myself and three others
- More than four of us

QB11: Approximately what percentage of your total income comes from your farm production?

- up to 25%
- 25%-50%
- 50%-75%
- 75%-100%

QB12: Thinking back over the last 10 years, how would you rate your farm's financial performance compared to other farmers like you in your area?

- Better than average
- Average
- Below average
- Don't know/Prefer not answer

QB13: What is your postcode?

\_\_\_\_\_

Thank You. Please click the next button to submit your survey

[NEXT](#)

## B.5 Interview guide

Interview Guide	
<b>1. Attitudes toward changes in support</b>	What have been the main benefits and disadvantages of the change from government to private assistance for you as a Wheatbelt farmer?
<b>2. How support is used</b>	Firstly, in the last 5 years, have you received support from [source]? What type of information, advice or assistance have you received from them and how did you use that to help you with your decision-making?
<b>2B. Attitude toward sources of support (ask at same time as Q2).</b>	
<b>Other local farmers</b>	<ul style="list-style-type: none"> <li>• What are your thoughts about farmers sharing information and experience they've had with land management? How well do you think farmers do this and how could this be improved?</li> <li>• What ways do you think other farmers' attitudes toward NRM might influence your attitudes and decisions?</li> </ul>
<b>Grower groups ie Facey Group, Liebe Group, WANTFA, Avongro</b>	<ul style="list-style-type: none"> <li>• Do you belong to a local grower group? How well do you think the group helps you and other farmers with managing their land and how could this be improved?</li> <li>• Some farmers mentioned that the costs of employing private consultants is too high. What are your thoughts on this?</li> <li>• What do you think about the problem that some farmers talked about of private consultants controlling knowledge and information by making farmers pay for it? Has this ever been a problem for you? YES-In what way? NO-Do you think this is a problem for farmers?</li> <li>• Some people say that those working for private organisations should have training and/or accreditation systems to ensure farms are appropriately managed for the future. What are your thoughts on this idea?</li> <li>• In WA, most retail advisors work for the large companies such as Elders or Landmark whereas in the eastern states there are more small companies providing advisors. What are your thoughts on the availability of advisors working for retail companies in your area?</li> <li>• Some farmers said the information they got from companies was biased because the company was trying to sell their product. What are your thoughts on this?</li> </ul>
<b>Private Consultants</b>	
<b>Agribusiness advisors</b>	

<b>Landcare</b>	<ul style="list-style-type: none"> <li>• Do you belong to a Landcare group? What are your thoughts on the benefits and disadvantages of Landcare groups in WA?</li> <li>• What do you think about the support farmers get from the WA state government for managing the land?</li> </ul>
<b>State Government</b>	<ul style="list-style-type: none"> <li>• Do you think state governments still have a role in supporting Wheatbelt farmers with land management and if so, what do you think they should be doing?</li> </ul>
<b>Research &amp; Development organisations ie GRDC, CSIRO, Universities</b>	<ul style="list-style-type: none"> <li>• What are your thoughts on the information provided to farmers about land management by research organisations like GRDC, CSIRO, universities?</li> </ul>
<b>Regional NRM groups ie Wheatbelt NRM or Northern Agricultural Catchment Council (NACC).</b>	<ul style="list-style-type: none"> <li>• One problem mentioned by several farmers was that the government and people working in NRM don't have the same objectives as farmers. They focus more on environmental aspects of farming and don't include the financial aspects enough in their activities. What's your opinion on this?</li> </ul>
<b>Non-government organisations ie Greening Australia, WWF, Men of the Trees</b>	<ul style="list-style-type: none"> <li>• What are your thoughts on the work that environmental groups like WWF, Men of the Trees and Greening Australia do in your area?</li> </ul>
<b>Industry associations ie MLA, Federated farmers, Grains WA</b>	<ul style="list-style-type: none"> <li>• What do you think is the role of this type of support and are there any ways you think these types of organisations could improve their help to farmers?</li> <li>• Many people working in extension believe they should use the internet or smartphones more to do things like blogging, Facebook, YouTube, twitter. What are your thoughts on this?</li> </ul>
<b>3. Future role of support</b>	<ul style="list-style-type: none"> <li>• What do you think is the role of state and federal government in supporting Wheatbelt farmers with management of their land?</li> </ul>

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