



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Contributed paper at the Salinity pre-conference workshop 8 February 2005  
of the 49<sup>th</sup> Annual Conference of the Australian Agricultural and Resource Economics Society,  
Coffs Harbour 9-11 February 2005

## **Market incentives for biodiversity conservation in a saline-affected landscape: farmer response and feedback<sup>1</sup>**

**Helena Clayton**

*Cooperative Research Centre for Plant-Based Management of Dryland Salinity and School of  
Agricultural and Resource Economics, University of Western Australia,  
clayth01@tartarus.uwa.edu.au*

### **Abstract**

There has been limited empirical research to investigate the way in which farmers respond to market-based instruments intended to encourage their participation in environmental management. This paper is based on a case study of an auction mechanism that is under trial to deliver market incentives to encourage farmers in a saline-affected landscape to contribute to regional biodiversity goals through on-ground works. The case study auction is the Auction for Landscape Recovery which is a pilot currently operating in the north eastern wheatbelt of Western Australia. It is a scheme that aims to create a flexible 'market' setting to encourage the participation of farmers to undertake on-farm projects to achieve the multiple benefits of biodiversity conservation, salinity control and water quality improvements. A substantial component of the pilot research is an investigation of the technical aspects of conserving biodiversity across a saline landscape, and how to select tenders to achieve an optimal allocation of the on-ground funding. This paper aims to complement this by investigating the socio-economic factors that influence farmers' responses to the market incentives delivered through the auction mechanism. Both qualitative and quantitative methods are presented in the paper to explore the socioeconomic factors that may explain farmers' decisions regarding participation in the auction. The analysis is based on data from some preliminary farmer interviews.

### **Key words**

*Auctions, perceptions, socio-economic dimensions*

<sup>1</sup> I would like to acknowledge the contribution of data for this paper from the Auction for Landscape Recovery (ALR) project funded by the National Action Plan for Salinity and Water Quality Management and managed by WWF Australia. Any errors of fact and interpretations regarding the ALR are the responsibility of the author.

## 1. Introduction

It is well recognised by policy makers and scientists that there is a significant role for farmers in regional biodiversity conservation. In fact, the pattern of native vegetation distribution on private land means that it is likely that the participation of farmers will determine the extent to which goals can be met. For example, the patches of bush that remain in the agricultural regions of Western Australia are primarily on private landholdings (Moore and Renton 2002). Despite the severe fragmentation of the existing bush, and the on-going salinity-related impacts, the remaining patches of native vegetation in the southwest of Australia represent significant biodiversity value (Wallace, Beecham and Bone 2002).

The motivation of farmers to invest money and effort into the protection of environmental assets of public value through a sense of concern, or obligation, however genuine, is often considered insufficient to encourage participation to achieve the level of protection of biodiversity demanded by the wider community. There are a complex combination of social and economic reasons why this might be the case. The insights from the adoption literature suggest that the factors include issues regarding uncertain or low economic gains from the investment, external benefits associated with biodiversity protection, and transactions costs of being involved, particularly if coordination is required (Marsh and Pannell 1997; Barr 1999; Pannell 1999). The practicality of the matter is summarised well by Pannell (2001a in Pannell, 2003) *“To a greater or lesser extent, almost all farmers are willing to make financial sacrifices for the good of their land or the environment, but they also must give priority to remaining in business and meeting other family and social objectives.”*(p.131)

The policy approach to address the concerns regarding nature and land conservation in rural landscapes has been, over the past decade or so, to focus on the ‘landcare approach’ facilitated through the National Landcare Program (started in 1989) and the first phase of the NHT program (1997-2002). While landcare has been acknowledged for increasing awareness and empowering communities, it has also received criticism for its apparent failing to provide cost-effective on-ground outcomes. The lack of prioritisation in fund delivery has, in particular, been criticised on economic efficiency grounds (Barr 1999; Pannell 2001b). The use of public funds for on-ground works is increasingly being aligned to strategic regional investment natural resource management frameworks established through the National Action Plan for Salinity and Water Quality and the second phase of the National Heritage Trust.

Along-side the re-evaluation of landcare is a substantial and growing interest from policy and research agencies in Australia in the role of market-based instruments (MBIs) for the management of biodiversity, salinity and other natural resource issues such as water

resources management. The exploration of such roles for market-based instruments is being facilitated through various programs and forums in Australia<sup>1</sup>.

Market-based instruments are designed to work through price mechanisms to deliver economic incentives that aim to influence resource management decisions of private decision-makers. These instruments focus on the ‘failure of the market’ to provide the correct price signals that adequately value environmental quality and ecosystem services to meet community expectations and values (Stoneham *et al.* 2000). The use of market (price) incentives is not new to the policy agenda. For example in agricultural contexts in Australia the common approach to addressing environmental degradation issues in agricultural contexts has been the delivery of market incentives (subsidies) based on the ‘beneficiary pays principle’ (Marshall 2003).

The piloting<sup>2</sup> of innovative approaches to market-based instruments is extending beyond the basic provision of economic incentives through subsidies (eg. through landcare grants) to that of increasing the scope of market mechanisms through the design of markets for environmental goods that would otherwise be missing. In the agricultural context this includes markets for biodiversity, carbon sequestration, and water resources. The piloting of MBIs involves an investigation of how to define environmental assets as a commodity in order to facilitate the development of a market in which specific environmental attributes can be bought and sold. Chaudhri (Acutt and Mason 1998; Chaudhri 2003) suggests that “...new developments in science, technology and economic theory allow us to shift the mix of policy instruments that define the boundary [between the marketed and non-marketed part of the economy] in ways that were not possible before.” (p.4).

This paper is interested in questions about how farmers respond to economic incentives delivered through new designs in market-based instruments. A case study MBI – The Auction for Landscape Recovery - is presented. The Auction for Landscape Recovery (ALR) is a pilot market-based instrument currently operating in the north eastern wheatbelt of Western Australia. It is a scheme that aims to trial a flexible ‘market’ setting to encourage the participation of farmers to undertake on-farm projects to achieve the multiple benefits of biodiversity conservation, salinity control and water quality improvements.

A substantial component of the evaluation of the pilot is to investigate the technical aspects of conserving biodiversity across a saline landscape, and methodology to select tenders to achieve an optimal allocation of the on-ground funding. This paper aims to complement this by investigating the following questions regarding farmer response and feedback to the auction: 1) What are the significant factors explain participation?, 2) what

---

<sup>1</sup> E.g. Roundtable discussion on the role of market-based instruments for achieving environment policy objectives in 1997, convened by the Environment Minister; The NAP Market-Based Instruments Pilot Program launched April 2003; National Symposium, *Market-based Tools for Environmental Management*, September 2<sup>nd</sup> -3<sup>rd</sup> 2003, Canberra, Australian Agricultural and Resource Economic Society

<sup>2</sup> There are a range of governmental initiatives in Australia that are facilitating the experimentation with market-based policy design, in particular the National MBI Pilots Program (NAPSWQ 2004a).

are the socio economic dimensions to farmers' response to key design features of the auction?, and 3) In what ways has the salinity context been a factor in determining conservation actions of farmers and participation in the auction?

The paper is based on data from the first phase of farmer interviews conducted in the study region. The investigation of participation in the auction in the paper draws upon both qualitative and quantitative methods. A quantitative analysis, based on an econometric model is developed to explore key socio-economic predictors of farmers' decisions about participation in the auction. The responses to open-ended questions included in the interviews provide the basis to explore direct feedback from farmers about specific design features of the auction. Only the first phase of the fieldwork for the overall study has been completed and therefore the results presented in the paper are preliminary. The results, however, do provide some useful insights for explaining participation, and the challenges that the salinity context raises for conservation auctions. It is hoped the preliminary results might stimulate some interesting discussion in the *Salinity Workshop* that will be of guidance for the future research directions.

The outline of the paper is as follows: in the next section a general discussion of factors of participation in agri-environmental schemes is presented. The literature reviewed has provided guidance for the design of the farmer interviews and development of the econometric model. In Section 3 the case study context is presented. This is followed by an overview of the design and implementation of the Auction for Landscape Recovery. In Section 5 an overview of the farmer survey is provided. In Section 6 the feedback from farmers who have participated in the ALR is discussed, and the challenges presented by the salinity setting are explored. The econometric model of participation is presented and discussed in Section 7, and in Section 8 a summary discussion is provided with some preliminary conclusions made. Throughout the paper biodiversity conservation and nature conservation are used interchangeably.

## **2. Factors of participation in agri-environmental schemes**

Apart from important considerations regarding the economic efficiency, a great deal of the success of voluntary agri-environmental schemes is based on the willingness of farmers to participate in them (Drake, Bergstrom and Henrik 1999; Vanslebrouck, Van Huylenbroeck and Verbeke 2002). In recognition of this, considerable attention is given in empirical studies of environmental policy to understanding factors that influence participation rates. A discussion is provided below of the most important factors raised in the literature.

As a preliminary comment it is important to note that there is very limited empirical data on farmers' uptake of specific biodiversity management activities, such as the protection of individual species or ecological communities, or protection of an under-representative habitat type, the improvement of the connectivity or resilience of habitats. In some ways the uptake of such activities seems anathema to the core business of broad-acre traditional agriculture. However, these specific biodiversity "goods" are among those that are of most interest in the Auction for Landscape Recovery, and the basis upon which funding is allocated to participating farmers.

The participation in agri-environmental schemes, in general, is described not only as being influenced by the personal characteristics of farmers (and their business), but also by the design features - the economic and technical characteristics - of the instrument in question (Brotherton 1989; Vanslebrouck *et al.* 2002). This is consistent with the extension literature where both socio-economic characteristics of farmers, and the characteristics of the conservation technology in question are argued to be important determinants of adoption (see Marsh and Pannell 1997; Pannell 1999).

Personal characteristics are those that determine whether a farmer is favourably disposed, by preferences and circumstance, to the idea of a particular scheme and then it is the scheme design factors that determine whether participation will result in net economic benefits to the farmer (Brotherton 1989). It is the interaction between these two groups of factors - personal characteristics (such as age, enterprise and farm size, and environmental attitudes) and the specific features of a scheme (such as entry requirements, compensation payments, and support) – that determines the likelihood of a particular farmer participating in the scheme in question. For example, Lobley and Potter (1998) found the design of different environmental schemes in the U.K. to have an influence on the type of farmer joining and their motivation for doing so. They found that those farmers who were focused on the economic benefits of participation tended to join the Environmentally Sensitive Area Program, and the more steward-minded farmers tended to enter the Country-Side Stewardship Scheme.

The table below (Table 1) provides a summary of factors discussed in the literature as being important determinants of participation in agri-environmental schemes. These factors provided guidance for the development of questions for the farmer interviews conducted in the study area.

**Table 1: Factors of participation in agri-environmental schemes**

<b>Personal characteristics</b>	<b>Scheme features</b>
<i>Farm enterprise characteristics:</i>	- Target environmental outcomes
- Farm size	- Application process and private transactions costs for participating
- Farm enterprise mix	- Direct costs of activities
- Geographic location	- Compensation payments
- Economic status (debt ratio)	- Duration of contracts
- Sources of information	- Entry requirements
<i>Individual farmer characteristics:</i>	- Constraints imposed
- Farmer age	- Management institution
- Farmer education level	- Community support
- Previous experience in schemes	
- Attitudes, motivations and perceptions	
- Labour availability	
- Aesthetic preferences	

Findings regarding the influence of farmer characteristics are generally that the probability of participation increases for: younger farmers, farmers with higher education, larger farms, those with previous experience in agri-environmental schemes, close proximity to others (i.e. neighbours) participating, and positive attitudes toward the environment and the scheme in question, and schemes in general (Drake *et al.* 1999; Vanslebrouck *et al.* 2002).

Potter (Potter and Gasson 1988) found participation to be inversely related to the degree of constraints faced by a farmer, whether that be based on environmental, financial, economic or family circumstances. They argue that farm businesses subject to high resource constraints have the least capacity to adapt to the changes required from agri-environmental schemes. Findings from Vanslebrouck (2002) are consistent with this, where they found farmers with excess of labour or large farm size had a higher willingness to participate in agri-environmental schemes.

The theme of ‘motivations’ takes on reasonable importance in agri-environmental participation studies. The economic motivations is of obvious interest and importance, however the role of intrinsic motivations of farmers is also discussed in select studies. Ryan *et al.* (2003), for example, investigated farmers’ motivations for adopting conservation practices using hypothetical questioning about the likelihood of adoption of measures to protect riparian zones. The protection of these zones can have production benefits but it also results in significant public good benefits. Intrinsic motivations to participate in conservation schemes were found to be rated highly by farmers, well above the importance indicated for economic compensation. However, even though the importance of economic motivations was given a low rating relative to intrinsic motivations, it could still be the case that without payment farmers may not participate.

The role of motivations, apart from explaining participation, may also determine the success of schemes. It is pointed out by Potter and Gasson (1988) that “[t]o be effective in conservation ... schemes must produce changes in land use that would not otherwise take place” (p.367). They argue that motivations for participation may vary and affect farmers’ selection of on-ground works to the extent to which it is possible. In study of land diversion schemes operating in the U.S. they found that participants are often those who use payments to subsidise changes in land use or farming practices that were intended to be conducted anyway. A question was included in the farmer interviews for the research presented in this paper to try to explore this issue for the Auction for Landscape Recovery.

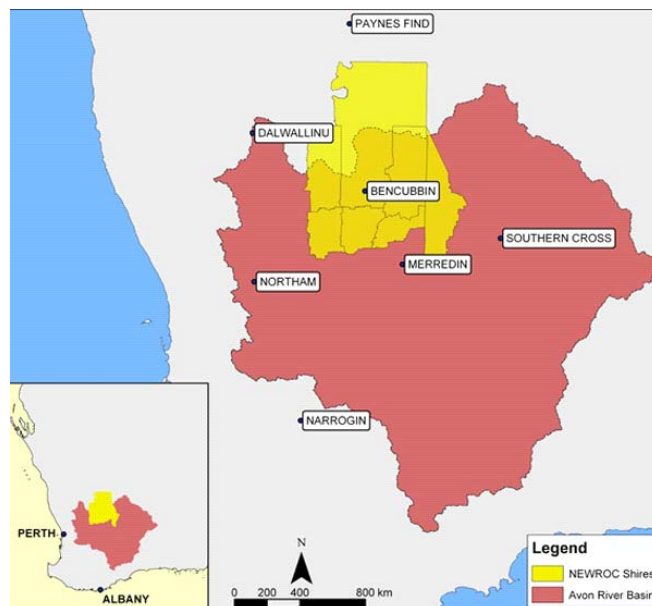
There appears to be consensus in the literature that participation is determined by both economic and non-economic factors, however (with some notable exceptions) the discussion of non-economic factors tends to be limited to the category of ‘attitudes’. This may in part be due to the gap that remains in our understanding of the social dimensions of natural resource management problems and the implications these have for the design of effective and appropriate environment policy instruments (Lambert and Elix 1993; Frost and Marsh 2000; Moore, Jennings and Tacey 2001; Fehr and Fishchbacher 2002; Ryan *et al.* 2003). Some of the social factors considered by these listed authors include:

- Social norms;
- Intrinsic motivations;
- Personal values and goals;
- Social capital;
- The uneven impacts from degradation across the social landscape;
- History of policy intervention; and
- Crowding out of social motivations from economic incentives.

The case study farmer interviews included some questions specifically addressing some of the social dimensions of participation. The general open-ended questions, although not targeted to solicit specific responses about the social dimensions of participation, have provided some interesting perspectives from farmers that are discussed in Section 6.

### 3. The case study context

The Auction for Landscape Recovery is being trialled in the northeast of the Avon River Basin. The trial area contains seven shires which are a collaborative administrative group called the North East Wheatbelt Regional Organisation of Councils (NEWROC) (Map 1)<sup>3</sup>. The trial area contains a high proportion of Target Landscapes identified as high priority for public investment to control salinity and protect biodiversity, according to the Salinity Investment Framework, also under trial in the Avon region. The NEWROC shires were selected for the trial to assist in the effectiveness of administration and communication within and between shires (WWF Australia, 2002).



**Figure 1: Trial area of the Auction for Landscape Recovery** (map produced by B. Parsons, CSIRO)

<sup>3</sup> NEWROC shires are: Koorda, Mt Marshall, Mukinbudin, Nungarin, Trayning, Westonia and Wyalkatchem



The Avon River Basin is a part of the south-west of Western Australia recognised as one of the world's mega-diverse regions. This region has the greatest native floral diversity in Australia (Hodgson, Hatton and Salama 2004). The native flora in the Avon alone includes 8000 species, of which 80 per cent are considered endemic (Avon Catchment Council 2004). The significance of the biodiversity in the area is despite the substantial clearing that has taken place for agricultural production, resulting in a highly fragmented vegetation cover. There is only 13 per cent of the Avon River Basin that has its original vegetation cover, 5.7 per cent of this is on private property (Avon Catchment Council 2004).

The large-scale clearing of native vegetation has resulted in the Avon being one of the regions in Australia most affected by dryland salinity. The region has been targeted for National Action Plan funding because of the extent of the salinity and water quality problems the communities in the area are facing. It was estimated in a recent Australian Bureau of Statistics survey of *Salinity on Farms* that 80 per cent of farms in the Avon are saline affected (Trewin 2002). The salinity in the Avon and the south west more broadly, presents one of the most significant threats to the remaining biological resources in the area. It is estimated that a substantial number of flora and fauna in salinising remnants of the south west are facing extinction (between 300 and 800 species of native plants and more than 200 species of fauna are showing signs of significant declining numbers) (Hodgson *et al.* 2004).

It is in this context that the Auction for Landscape Recovery is being trialled. The challenge of the trial is to investigate the key success factors and impediments of an auction mechanism to achieve landscape recovery outcomes in a highly-fragmented and salinising landscape.

#### **4. The auction for landscape recovery**

The Auction for Landscape Recovery is a trial scheme that involves farmers bidding competitively for funds to undertake on-farm environmental management activities. The trial involves a large research project team of 13 organisations, managed by WWF Australia.

The auction has operated in two rounds. The first round opened on 30 November 2003 and was finalised in January 2004 and the second round opened on the 30 November 2004 and the results will be finalised in February 2005.

Individuals or groups were able to participate by submitting an initial Expression of Interest with basic information about their proposed on-ground works. A Community Support Officer then arranged an on-farm meeting to discuss the project with the farmer and conduct a site assessment. The site assessment provided the primary data on which to evaluate the environmental value of the project proposed by the farmer. A tender (or bid) then had to be submitted where the farmer provided specific details of the farm management actions and the amount of financial compensation they would require in

order to undertake the work they proposed. Farmers were allowed to submit multiple tenders for different sites or different levels of work on the same site.

At the end of each round the tenders are collectively evaluated against the target environmental outcomes of the auction. Tenders are compared on a value-for-money basis and only the most competitive are successful. An amount of \$200,000 (\$100,000 for each round) was available to allocate to the farmers with the most competitive tenders. The successful landholders in the auction are required to enter into a legally binding agreement with the Avon Catchment Council. The agreements outline the on-ground activities farmers have a commitment to complete.

The target environmental outcomes of the ALR are aligned to the goals of the Avon Regional NRM Strategy. The target outcomes focused on achieving biodiversity conservation benefits at the landscape scale, however the auction has been conducted as a multiple benefits auction and therefore any complementary benefits from the on-ground works in terms of salinity and water quality improvement were also taken into account in the tender evaluation. For example, "...revegetation to create wildlife corridors may also have a local impact on water tables, soil erosion and salinity risk.." (WWF Australia 2004 p.3). Salinity therefore had two potential impacts on the tender evaluation: salinity mitigation would increase the *benefits* value of the tender, while salinity risk to biodiversity that is not mitigated by management would actually reduce the *benefits* value of the tender, or deem the project "infeasible" in achieving the biodiversity conservation outcomes proposed.

The number of farmers across the NEWROC shires who participated in auction is outlined in the table below (Table 2). In the first Round 38 farmers submitted 55 bids, and a total of \$93,000 was allocated across the nine successful tenders. In Round 2 an amount of \$107,000 is available for on-ground works. There are 24 farmers who have participated in Round 2 - 10 of whom had also participated in Round 1 - submitting 33 bids. Tender selection for Round 2 will be finalised on in February 2005. A discussion of the some of the possible reasons for the reduced participation rates across the two rounds is provided in Section 6.

**Table 2: Farmer participation in the Auction for Landscape Recovery**

Shire	Round 1			Round 2		
	EOIs submitted	People submitting tenders	Tenders submitted <sup>1</sup>	EOIs submitted <sup>2</sup>	People submitting tenders	Tenders submitted
Koorda	7	6	8 (0)	3 (2)	2	5
Mt Marshall	13	8	10 (5)	8 (2)	7	9
Mukinbudin	4	6	12 (1)	4 (2)	2	3
Nungarin	4	4	7 (2)	4 (1)	4	5
Trayning	7	3	3 (1)	0	0	0
Westonia	4	3	4 (0)	2 (1)	2	7
Wyalkatchem	9	8	11 (0)	4 (2)	4	4
<b>Total</b>	<b>48</b>	<b>38</b>	<b>55 (9)</b>	<b>25 (10)</b>	<b>21</b>	<b>33</b>

<sup>1</sup>Numbers in parenthesis for column are the number of successful tenders

<sup>2</sup>Numbers in parenthesis for column are people who also participated in Round 1

## 5. Farmer interviews

### 5.1 The questionnaire

Data presented in this paper has been collection through face-to-face interviews with farmers in the case study area. This includes interviews with both participants in the ALR and non-participants. Interviews were conducted by a team of four people: the author, two landcare coordinators working in the study area, and a NRM student living in close proximity to the study area. A structured questionnaire form was used in the interviews.

As a lead up to the face-to-face interviews a selection of 20 farmers who participated in Round 1 of the ALR were asked to participate in a brief telephone interview (15-20 minutes). These telephone interviews were conducted by the author and took the form of a discussion guided by some open-ended questions focused on issues thought too be important to landholders' participation decisions and experience of the auction. The questions included: reasons for their participation; feedback on the role of the Community Support Officer, the bidding process, and the competitive approach of the auction. There was also some discussion on their priorities, concerns and opinions regarding NRM, landcare and the role of financial compensation to assist on-farm environmental management.

The feedback from the telephone interviews provided the basis upon which to develop the structured questionnaire. There are several existing questionnaires that also assisted in the development of the questionnaire including Vanclay (1986), Jenkins (1998), and Sweeny Research (2001). The questionnaire contained a combination of closed-ended and open-ended questions depending on the nature of the topic in question. A summary of the topics covered in the questionnaire is provided in Appendix C.

### 5.2 Interviews

There have been a total of 62 interviews conducted with 31 participants and 31 non-participants. The number of completed interviews constitutes a little less than half of the total of 150 interviews that are planned. The plan is to interview 100 per cent of participants and a stratified random selection of non-participants to make up a total of 150. A summary of the completed and planned interviews across the seven shires is provided in the table below (Table 3).

**Table 3: Interviews: completed and planned**

Shire	Participants			Non-participants		
	Completed interviews	Aim	Remaining	Completed interviews	Aim	Remaining
Wyalkatchem	9	12	2*	0	15	15
Koorda	3	6	2*	6	20	14
Trayning	3	4	1	3	6	3
Nungarin	4	9	5	0	5	5
Westonia	2	3	1	5	11	6
Mukinbudin	1	6	5	5	18	13
Mt Marshall	9	15	4*	12	22	10
	<b>31</b>	<b>55</b>	<b>20</b>	<b>31</b>	<b>97</b>	<b>67</b>

\*some ALR participants in this shire are either not willing or not able to take part in an interview

## **6. Feedback from farmers about the auction**

In this section some discussion is provided on the responses from the participants in the auction to some of the open-ended interview questions that asked for feedback from farmers on their experience participating in the auction. A discussion of feedback from farmers on the scheme design is thought relevant as suggested by the literature reviewed in Section 2, to explore way in scheme design features might influence participation. Overall it seems that most participants view the auction favourably. The feedback indicates that the economic incentives were a significant attraction, but there are also other features of the design that attracted participation, such as the Community Support Officers, and the flexibility of the scheme. It also appears that there are some elements of the design - mainly related to the target outcomes - that were a disincentive to participation. This emerged more so in the second round, for farmers who had participated already in Round 1, perhaps on the basis of a misunderstanding about what the target outcomes of the auction were. The discussion of all these issues is provided below.

### *Reasons for participating*

The one reason mentioned by the majority of respondents for participating, not surprisingly, was the fact that funding was available for on-farm activities. The comments on this ranged from the help this would provide to improve the sustainability of their farm, address salinity, and assist nature conservation works on the farm.

A few people said that a reason for participating was because it was an auction – they liked that it was a new approach to funding but felt familiar with the process of tendering, and actually liked the competitive dimension of the auction because they felt that the best use of money would be achieved on the ground. Admittedly it was only a small group of the participants interviewed who expressed these sentiments, however it is interesting that these were comments made by people who's Round 1 tenders were not successful.

A common theme in the feedback about the reasons for participating in the auction was the flexibility afforded by the auction design. Respondents returned very positive comments related to their ability to have flexibility to specify projects based on their personal priorities, biophysical and farm-business constraints. For example, one farmer indicated that they had participated because the ALR was the first scheme that had seen that allowed them to include labour costs. The fact that flexibility of the project extended to include the possibility of salinity mitigation was also a significant draw-card. The comments regarding flexibility also related to positive aspects of having 'ownership' over the process of project development.

At the other end of the spectrum, one landholder disliked the open-ended, flexibility of the bidding process and indicated a preference to work within a structured scheme with guidelines about favorable activities and how much they should charge. This respondent is very new to the area and to farming which may be part of the reason why they found the flexibility difficult to work with. Although there were also a few long-time farmers who echoed this same frustration with the openness of the auction guidelines. On this point, one farmer commented that he was planning to put in a similar project to his

neighbour but decided not to spend the time submitting a tender into the first round until he saw the outcome of this neighbours' application.

#### *Satisfaction with the application process*

A farmer-friendly process: this response was elicited in almost all interviews, and was related to short forms and a simple process, the fact that there were local Community Support Officers (CSOs) to assist the application process, and the emphasis in the application form on getting the project right rather than the buzz words right (this is how the landholders framed it). These were seen as positive incentives to participate.

There were very positive comments about the role and assistance of the CSOs and the local Community Landcare Coordinators (CLCs) in providing inspiration, support and information. The enthusiasm of other WWF officers based in the area for inspiring their conservation activity through revealing to them the biodiversity value of their remnant was also mentioned by some of the respondents. It was interesting too, that the *site assessment* conducted by the CSOs for data collection purposes for tender evaluation was seen by many respondents as a very positive component of the project. People felt that it was refreshing to have personal contact with the project team, making it less of a bureaucratic process. It was also the fact that their CSO had seen what they were trying to achieve through their project that was viewed very positively. However on the negative side there were some landholders who were concerned that the ALR-employed CSOs duplicated the role of CLCs and networks that already exist.

#### *Reasons for not-participating in Round 2*

There were 10 farmers who did re-enter, but the majority of the 38 farmers who submitted a tender in Round 1 decided not to participate again. The participants from R1 who have been interviewed and who did not enter round 2 were asked an open-ended question of "why not?". The respondents expressed a general sense of disappointment and, for some, a sense of despondency at not being successful, and hence not willing to participate again. Others were more matter-of-fact about their decision not to participate in round 2 as they had feedback that their project was not closely aligned to the ALR objectives, yet they expressed that they were not interested in changing it to fit the target outcomes more closely.

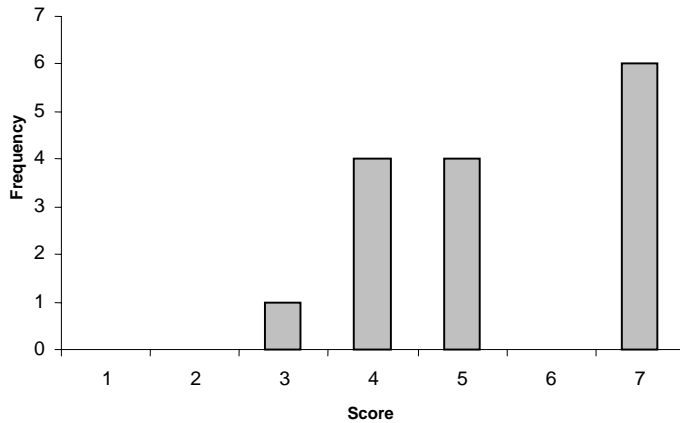
#### *Relevance of the target environmental outcomes of the auction*

In general the respondents' feedback was that the target outcomes of the ALR were consistent with landholders' priorities, however salinity management was raised by most of the landholders as their highest priority. However, there was also some fairly strong dissatisfaction expressed toward the target outcomes by some of the unsuccessful participants from round 1. A few felt they had not realised that the main objective was nature conservation and were not prepared to alter their project to be more suitable to these objectives of the scheme.

#### *Likelihood of implementing project without funding*

The respondents who had participated in round 1 that were unsuccessful were asked "how likely are you to implement your project anyway?" They were asked to rank the

likelihood of implementation on a scale from 1 to 7 where 1 = definitely will not implement my project and 7 = definitely will implement my project. The number of responses across the scale is shown in Figure 2.



**Figure 2: frequency of scores for likelihood of project implementation**

A fair proportion (two thirds) of the respondents have indicated that they are likely to implement their project even though it was not successfully selected for ALR funding. Some of the farmers' comments recorded for this question were:

*“We have done part of it already and were just hoping for assistance”*

*“We are implementing our project at the moment”*

*“It is something we need to do as we have to fence off to protect the bush from sheep”*

*“The works are something I want to get done, but it is a lower priority than other activities and expenditure on my property”*

The responses raise some concerns about the success of the auction to effect land use change beyond that which would occur anyway. On the positive side the responses generally indicate willingness from the failed bidders to contribute to land conservation, and in some cases nature conservation, outcomes. There are some limitations to interpreting the responses to this particular question because of the inherent inaccuracies with hypothetical questioning, and the fact that many of the unsuccessful projects may have been unsuccessful because of high private benefits associated with them, and therefore these would be more likely to be implemented anyway.

## **6.2 Feedback regarding salinity and nature conservation**

This section continues the discussion of feedback from respondents to open-ended interview questions, however it is a discussion focused on specific issues relating to the salinity setting in which the auction is placed. The issues relate primarily to the landholders' perspectives about the target outcomes of the project and how multiple benefits would be considered in the tender evaluation.

There has been a clear message from the interviews that the primary land management concern of farmers (across both the ALR participant and non-participant groups) is salinity. It is perhaps then not surprising that a large proportion (almost 30 per cent) of the tenders proposed engineering interventions (drainage or groundwater pumping) largely for salinity mitigation purposes. Many of these projects “had largely on-farm benefits with few or difficult to confirm biodiversity benefits, despite the fact that the documentation emphasised that the projects would be evaluated on the basis of public benefits rather than private benefits.” (WWF Australia 2004b p.37).

The ALR was designed as a multiple-benefits auction because of the known salinity, water logging and water quality concerns in the study area, and the known links of these processes to the degradation of biodiversity assets. Apart from the technical challenges of accounting for the multiple benefits in the tender evaluation process, the project team was also aware of the challenges of communicating the multiple benefits to avoid misunderstandings about the projects’ overarching objective of landscape scale biodiversity benefits (WWF Australia 2004b). It seemed obvious from the tenders submitted in round 1 that there was some misunderstanding from farmers and as a result the ALR team did consider changing the stated outcomes of the auction in Round 2 to a single outcome target of biodiversity conservation. However, for reasons of consistency, it was decided that this change would not be made (WWF Australia 2004b).

Although it was decided to keep the multiple benefits focus for round 2, the unsuccessful landholders in Round 1 were given specific feedback about the sorts of projects that were successful and reasons of why their tender was not competitive enough to be selected. In the second round the CSOs also emphasis in their communication to landholders that biodiversity conservation benefits were the main focus of the ALR. As a result the projects submitted by farmers in Round 2 contrasts substantially to those in Round 1. In the second round there is only one project addressing salinity through engineering solutions and the rest propose fencing, regeneration, re-vegetation, or feral animal control.

A substantial amount of the farmer directed discussion in interviews the author has conducted - both over the phone and in face-to-face – was concerned with engineering solutions to salinity mitigation, concerns about the lack of alternatives for salinity mitigation and the politics of the debate. The farmers also discussed issues about how to approach biodiversity conservation in a saline landscape. A quote from one of the farmers interviewed captures these issues well:

*We were given suggestions [by the CSO] on how to change our application for round 2 to be more likely to be successful but it doesn't work in the long-term [referring to trees], we know that, and it is frustrating to see funds going in that direction. We have learnt what not to do. Priorities are: start with land and deal with salinity. By fixing the soil [saline soil] then the environment will in turn be protected. Planting of trees needs to be targeted across the landscape i.e on hillside and in recharge areas. There is a need for trees on the valley floor, but it is not a priority...”*

Another comment I like for its honesty:

*“Are we on different planets? ...there are many more things [referring to salinity] than stock affecting our remnants...”*

The feedback from farmers briefly outlined here, as well as the bidding behaviour across the two rounds provides some insights into the challenges of achieving biodiversity conservation in a saline landscape. The important question, in relation to this paper is whether participation is affected? It does appear that the re-focusing of the strategy for communicating the multiple benefits intent is an explanation for the reduction in participation in round 2, and the low level of re-entry from round 1 participants. A related question which is important to raise is: Does this reduced participation mean that opportunities have been missed for achieving the target outcome of biodiversity conservation outcomes? While this is a pertinent question, it is one that can not be answered based on the existing information available for the paper. It is a question that is placed in the ‘for future research’ category!

In the next section the quantitative investigation of participation is presented.

## **7. Quantitative evaluation of participation**

### **7.1 Specification of regression model**

The quantitative analysis involved the estimation of a multiple regression model of participation. The purpose of the regression analysis is to identify key factors that influence, or explain, the variation in participation in the ALR. This will assist in exploring the questions: What are the economic and social factors that influence the participation decision? Are these factors what we would expect? Has participation been extended beyond the ‘usual suspects’ that would normally participate in conventional grant processes?

The independent variable has a qualitative form – the choice to participate in the ALR or not participate – given a value of one for participants and zero for non-participants and therefore the binary logit model was selected (Greene 2000)<sup>4</sup>.

$$p(y=1| X_i) = \frac{\exp(X_i\beta)}{1 + \exp(X_i\beta)}$$

Participation is observed as a discrete choice and the logit estimation is based on the notion that the propensity for participation varies, based on the influence of explanatory variables (Long 1997). The relationship between the independent variables ( $X_i$ ) and the dependent variable ( $y$ ) is expressed in terms of a probability - the probability of a farmer making the choice to participate in the scheme (Aldrich and Nelson 1984). Hence, the expected value of  $y$  is restricted to the values of between zero and one. The parameters ( $\beta$ ) that are estimated are used to interpret the change in the probability that  $y = 1$  for a

---

<sup>4</sup> Given the “great similarity between the logit and probit models” (Long 1997), the selection of the logit over the probit model was arbitrary.



one unit change in the value of the explanatory variable (everything else remaining constant).

The questionnaire presented in this paper was designed, in part, to explore factors thought to affect willingness to participate in the ALR. The variables measured in the questionnaire have been used to construct the regression analysis. The full set of variables thought to be relevant is outlined in table 4. Only a subset of these variables was used in the regression estimation, as indicated in the table by the asterix.

**Table 4: Variables measured in the farmer interviews, hypothesised as significant for explaining the participation decision**

Category	Survey Item
<i>Economic factors</i>	<ul style="list-style-type: none"> <li>◆ Farm size*</li> <li>◆ Farm ownership</li> <li>◆ Cropping yields*</li> <li>◆ Off-farm income</li> <li>◆ Farm enterprises</li> <li>◆ Resource constraints regarding nature conservation*</li> </ul>
<i>Basic demographics</i>	<ul style="list-style-type: none"> <li>◆ Age</li> <li>◆ Education level</li> </ul>
<i>Attitudes and perceptions</i>	<ul style="list-style-type: none"> <li>◆ Role of nature conservation activity as part of land management activities</li> <li>◆ Responsibility for protecting the natural environment</li> <li>◆ Financial assistance for nature conservation*</li> <li>◆ Objectives of nature conservation schemes</li> <li>◆ Motivations regarding nature conservation</li> </ul>
<i>Landcare, experience and environmental factors</i>	<ul style="list-style-type: none"> <li>◆ Experience and success in conservation schemes*</li> <li>◆ Membership in landcare or catchment group*</li> <li>◆ Role of a landcare officer on the farm*</li> <li>◆ Area of on-farm native vegetation</li> <li>◆ On-farm salinity impacts</li> <li>◆ Farm geographic location</li> </ul>

\*Item included as variables in preliminary logit regression model

Tables showing some descriptive statistics (mean and standard deviation) for the majority of the variables shown in Table 4 are provided in Appendix A. The descriptive statistics for certain survey items are presented as proportion of observations with a ‘yes’ answer. The basic descriptive statistics for the set of survey items included in the final regression estimation are also provided in Table 6 in the main body of this paper.

The process of elimination of variables from a larger set to those included in the final estimation was based on the common, albeit rudimentary, iterative estimation process, working from a general-to-specific specification. The set of survey items included as explanatory variables in the model are outlined in Table 5.

**Table 5: Survey items by which explanatory variables are defined**

Variable name	Survey item	Response range
Time limiting Costs limiting	What are the important constraints for you regarding on-farm nature conservation... <i>i. lack of time</i> <i>ii. financial costs involved</i>	not a factor low importance high importance
Yield <sub>w</sub>	Relative wheat yield (long-run average)	tonnes/ha
Farm Size	Farm area	Hectares
Willingness	The willingness of farmers to undertake nature conservation would increased if the full costs were covered by the government (including payment for farmers' time)	7 point scale: 1= "disagree strongly" 7 = "agree strongly"
Landcare (PC)	First principal component based on the three original variables:	"yes" or "no" response to original variables
Success	1. Have you been successful in any nature conservation or environmental schemes (both grant and non-grant based)?	
Role	2. In the past 2 years has a Landcare coordinator (or other environmental officer) had a role in assisting your land management activities?	
Member	3. Are you a member of a landcare or catchment related group?	

Some descriptive statistics (means and standard deviation) are shown in Table 6. The statistics are split across non-participants and participants. The graphical presentation of the distributions for the data is presented in Appendix B.

**Table 6: Descriptive statistics of variables in the regression**

	Non-participants		Participants	
	Means		Means	
Time limiting	1.29	(0.81)	1.72	(0.53)
Costs limiting	1.46	(0.74)	1.71	(0.59)
Willingness	5.75	(1.88)	6.69	(0.71)
Farm size ('000 ha)	4.62	(1.98)	3.86	(2.91)
Wheat yield actual (tonnes/ha)	1.38	(0.25)	1.57	(0.31)
Wheat yield relative (to maximum yield)	0.58	(0.1)	0.66	(0.13)
Role	0.54		0.79	
Member	0.39		0.69	
Success	0.54		0.72	

## 7.2 Regression results

The results of the estimation are presented below (Table 7).

**Table 7a: Regression results**

<b>Explanatory variables</b>	<b>Coefficient</b>	<b>z-score</b>	<b>P&gt; z </b>	<b>Sig.</b>
Costs limiting	1.38	1.78	0.075	*
Time limiting	0.93	1.65	0.098	*
Yield <sub>w</sub>	9.58	2.47	0.014	**
Log of area	-0.91	-1.61	0.106	
Willingness	0.73	1.88	0.061	*
Landcare (PC)	0.71	2.41	0.016	**
Intercept	-6.70	-1.06	0.289	
Observations	57 <sup>c</sup>			
ALR participants	29			
Non-participants	28			
Log-Likelihood	-23.732			
LR chi2(5)	31.54			
P-value	0.000			
Pseudo R <sup>2</sup>	0.399			

\* indicates significance at the 10% confidence level and \*\* at the 5% level

<sup>c</sup> Five observations not used due to missing data points

**Table 7b: prediction accuracy of the model specified (goodness-of-fit indicator)**

<b>Participation (observed)</b>	<b>Predict 'No'</b>	<b>% correct</b>	<b>Predict 'Yes'</b>	<b>% correct</b>	<b>Total (observed)</b>
<b>No</b>	21	0.75	7		28
<b>Yes</b>	5		24	0.83	29
<b>Total (predict)</b>	26		31		57

A general caveat is appropriate before a discussion of the results is provided. This is that the estimation of participation in a “once-off” scheme such as the ALR may have some limitations. This is because the scheme is not well established in the study area and may not be well known across the area. Therefore it could be the case that a farmer has not participated because they did not hear about the scheme. However having said this, the scheme was widely marketed in all forms of print and radio media and the implementation has been managed by an organisation that has well established networks in the study area. There is also some indication from the interviews with non-participants that the ALR was perhaps well known among farmers in the region – 19 of the 31 non-participants interviewed had heard about the scheme prior to the interview.

The goodness-of-fit of the estimated model is reasonable with a pseudo  $R^2$  of 0.399 and correct prediction for 75 per cent of non-participants and 83 per cent of the participants.

The score for the importance the constraints from costs involved in undertaking on-farm nature conservation activity ('Cost limiting') is estimated to have a positive effect on participation (sig. at 10% level). This would be expected from participants in a scheme providing grant assistance to off-set some of the costs of undertaking on-ground nature conservation projects. It is also supported by the qualitative data where the majority of the participants in the scheme stated that the availability of funds was a key factor prompting their interest in participating in the scheme. Also embedded in the score could be an indication of interest in nature conservation activity as the respondents were instructed to answer this question only if they would like to undertake more nature conservation but are constrained by the factor. The degree to which time is a limitation to on-farm nature conservation (sig at 10%) also has a positive effect on the probability of participation, justified on the similar grounds. The financial support from funding can provide assistance for labour, or at least justify the contribution of limited labour resources to the on-ground activity.<sup>5</sup>

A positive effect on the probability of participation is also estimated for wheat yield. This is a reasonably logical outcome if yields are accepted as a proxy for income (albeit a basic one). The higher levels of income would increase the economic capacity for farmers to undertake nature conservation.

The land area is not quite significant (at the 10% level) but it is worth mention of the negative sign, not necessarily expected. There is empirical evidence elsewhere (e.g. Drake *et al.* 1999) that has found that farmers with larger farms are more likely to participate in agri-environmental schemes because of increased capacity to adapt to changed land use practices. There is some counter evidence to this from Vanselmbourk *et al.* (2002) who found that in schemes with higher opportunity cost the larger farmers were more likely to participate but in schemes with minimal impact of farm profit it was the smaller farmer who was more likely to participate.

The estimated coefficient for Willingness is positive – an increase in the degree of agreement to the statement that 'financial compensation will increase the willingness of farmers to undertake nature conservation' is predicted to have positive effect on the probability of participation. An expected result.

The final variable included in the regression is a new variable 'Landcare' based on the correlation between landcare membership (Member), the role of the Landcare officer on

---

<sup>5</sup> Although it is argued that the positive coefficient for the two constraint variables is an expected result, this argument does differ from that proposed by Potter and Gasson (1998) and Vanslembrouck (2002) who found participation to be inversely related to the degree of constraints faced by a farmer, whether that is based on environmental, financial, economic or family circumstances. In the case of the ALR, a definitive conclusion can not really be made either way at this stage because of the small number of observations that the estimation is based upon.

the farm (Role) and whether there has been success in environmental schemes (Success). The three variables are all likely to have important explanatory value for participation however they also have a reasonable degree of correlation which was suspected to be causing problems with multicollinearity. As a way of reducing the dimensionality of the variable set, and overcome the problem with multicollinearity Principal Components Analysis (PCA) was conducted as suggested by Dunteman (1989). Only the first principal component was included in the regression as it was the only component to have an eigenvalue of greater than one. The results of the PCA are included in Appendix B. The positive coefficient estimated indicates the probability of participation, as would be expected, increases for increasing scores for first principal component. This is when the value of the original variables all increase, indicating that participation is more likely for those to whom a landcare officer has provided assistance, there has been some success in other schemes in the past five years, and there is membership of a landcare group.

## **9. Conclusions**

This paper focused on an investigation of the participation response from farmers in the NEWROC region of the Avon to the Auction for landscape Recovery – a pilot biodiversity conservation scheme being run in the area. The participation response was of particular interest firstly because of the unique design of the funding allocation mechanism of the auction compared to conventional grant-based schemes, and secondly because of the interest in investigating how farmers may respond to economic incentives for biodiversity conservation in the context of substantial salinity impact and risk.

One question proposed was what are the social and economic factors that might explain participation? Results from the econometric estimation indicate that significant factors that increase the likelihood of participation are: Positive attitude toward the role of financial compensation for nature conservation activities, the importance of costs and time as constraining factors for on-farm nature conservation activity, higher yields of the primary crop (wheat), and the effect of previous experience in other schemes, input from a landcare officer on the farm, and membership in a landcare group.

There is a question about whether the flexibility in the design of the auction mechanism to allow the landholder to determine the price would have the possible benefit of extending participation beyond a typical group who would usually participate in grant-based schemes. The preliminary regression results provide an indication that some of the standard explanatory variables are relevant in explaining participation, expect perhaps for the indication that resource constraints have a positive, rather than inverse, relationship to the likelihood of participation. At this stage there seems to be inadequate information to provide a conclusion to such a question about the extension of participation. As the dataset is expanded it will be interesting to see what other variables may also be significant in explaining participation, and in which direction the influence is predicted to be. An expanded dataset would allow for more robust conclusions from the regression estimations.

The positive feedback from farmers on the key design features of flexibility and the personal contact with a Community Support Officer provides useful insight into the design features that might encourage and extend participation in the future.

The response by some farmers to the multiple benefits intent of the ALR by submitting projects with a high salinity and low nature conservation focus, although not entirely unexpected given the salinity mitigation priorities in the study area, had the problem of being misaligned to target outcomes of the ALR. Hence, some of the tenders that were submitted in round 1, in particular, were essentially a response to an incorrect price signal and were not at all likely to be successful. Once the biodiversity conservation target was more clearly communicated to farmers in round 2, some of those who had participated in Round 1 realised that the ALR objectives had limited relevance to the project they were prepared to enter as a tender. The important question is: does the reduced participation mean that opportunities have been missed for achieving the overall target outcome of biodiversity conservation?

The non-participation decision of farmers was perhaps on the valid basis of their high opportunity costs for nature conservation given the existing strain of salinity on farm resources. In this case the non-participation is expected and is perhaps not a missed opportunity. However, why these particular high opportunity cost farmers would not be prepared to submit a bid for biodiversity conservation that would cover their opportunity costs is an empirical question that remains unanswered. In some ways the challenge might be for them to see the auction as providing an opportunity to be paid to deliver environmental goods as a “product”, albeit one that is distinct from the traditional farm production output. On this note, research in other areas of public policy suggests that there can be a diversity of responses, sometimes unexpected and unwanted, when market incentives are provided to encourage peoples’ provision of “goods” that are socially unaccepted as commodities. This may apply in the case of the environment.

Overall, it is argued that there is a continuing need for studies of participation and non-participation in agri-environmental schemes to investigate ways to increase the willing engagement of farmers in environmental management. This is especially needed as new approaches to environmental policy instrument design are being experimented with to shift the boundary between the marketed and non-marketed part of the economy and (in the specific case of the ALR) of the natural environment.

In the immediate future the direction of further research will be focused on the completion of the fieldwork to expand the available dataset which will allow for more robust analysis of the participation response to the ALR, and the challenges presented by the salinity context. In the longer-term there is interest in focusing research on the social dimensions of participation in agri-environmental schemes in more depth and in particular to explore the interactions between socially-based motivations and economic incentives delivered through market-based instruments for environmental management.

## References

- Acutt, M. and Mason, P. (Eds.) (1998) *Environmental valuation, economic policy and sustainability: Recent advances in environmental economics*, Elgar, Williston.
- Aldrich, J. H. and Nelson, F. D. (1984) *Linear Probability, Logit, and Probit Models*, Sage Publications, Newbury Park.
- Avon Catchment Council (2004) *The Avon NRM Strategy: First Draft (version 10)*, Avon Catchment Council, Northam
- Barr, N. (1999) 'Social Aspects of Rural Natural Resource Management', Vol.1 *Commodity Markets and Resource Management Outlook 99: National Agricultural and Resources Outlook Conference*, ABARE, Canberra, pp. 133-140
- Brook, A.; Zint, M. and de Young, R. (2003) 'Landowners' responses to an endangered species Act listing and implications for encouraging conservation' *Conservation Biology*, 17 (6): 1638-1649.
- Brotherton, I. (1989) 'Farmer participation in voluntary land diversion schemes: some observations from theory' *Journal of Rural Studies*, 5 (3): 299-304.
- Chaudhri, V. (2003) 'Market-Like Policy Options', *Land Stewardship Series*, Department of Sustainability and Environment, Victoria
- Commonwealth of Australia (2004), *NRM Managing Our Natural Resources: Can Markets Help? List of some MBI projects in Australia*, Retrieved 12 Dec 2004 from the Natural Resource Management website:  
<http://www.nrm.gov.au/publications/nrm-mbi/projects.html>
- Drake, L.; Bergstrom, P. and Henrik, S. (1999), 'Farmers' attitudes and uptake', In *Countryside Stewardship: Farmers, Policies and Markets*, Vol. Chaper 5 (Ed, Van Huylenbroeck, G. W., Martin) Pergamon, Oxford.
- Dunteman, G. (1989), *Principal Components Analysis*, Sage University Paper series on Quantitative Applications in the Social Sciences: no. 9, Sage Publications, Beverly Hills,
- Fehr, E. and Fishchbacher, U. (2002) 'Why social preferences matter - the impact of non-selfish motives on competition, cooperation and incentives' *The Economic Journal*, 112: C1 - C33.
- Frost, F. and Marsh, S. (2000) 'Salinity: A Major Challenge for Western Australian Communities', *10th World Congress on Rural Sociology: Sustainable Rural Livelihoods - building communities, protecting resources and fostering human development*, Rio

- Greene, W. (2000) *Econometric Analysis*, Prentice-Hall International, New Jersey.
- Hodgson, G.; Hatton, T. and Salama, R. (2004) 'Modelling rising groundwater and the impacts of salinisation on terrestrial remnant vegetation in the Blackwood River Basin' *Ecological Management and Restoration*, 5 (1): 52-60.
- Jenkins, S. (1998) *Native Vegetation on Farms Survey 1996: a survey of farmers' attitudes to native vegetation and landcare in the wheatbelt of Western Australia*, Research Report 3/98: Environment Australia, Perth
- Lambert, J. and Elix, J. (1993) *Remnant Vegetation in the Rural Landscape*, Occasional Paper No. 04/93 Land and Water Resources Research and Development Corporation
- Lobley, M. and Potter, C. (1998) 'Environmental stewardship in UK agriculture: A comparison of the Environmentally Sensitive Area Programme and the Countryside Stewardship Scheme in south east England' *Geoforum*, 29 (4): 413-432.
- Long, J. S. (1997) *Regression Models for Categorical and Limited Dependent Variables*, Sage publications, Thousand Oaks.
- Marsh, S. and Pannell, D. (1997) 'What we think we know about extension, and why its not enough for landcare', *Paper presented at Western Australian Landcare Conference*, Geraldton
- Marshall, G. (2003). 'From words to deeds: enforcing farmers' conservation cost-sharing commitments, *Journal of Rural Studies*, 20(2): 157-167
- Moore, S.; Jennings, S. and Tacey, W. (2001) 'Achieving sustainable natural resource management outcomes on the ground: the key elements of stakeholder involvement' *Australian Journal of Environmental Management*, 8: 91-98.
- Moore, S. and Renton, S. (2002) 'Remnant vegetation, landholders' values and information needs: an exploratory study in the West Australian wheatbelt' *Ecological Management and Restoration*, 3 (3): 179-187.
- NAPSWQ (2004a), *National Market-Based Instruments Pilot Program*, Retrieved 12 Dec 2004 from the National Action Plan for Salinity and Water Quality website: <http://www.napswq.gov.au/mbi/index.html>
- NAPSWQ (2004b), *National Market-based Instruments Program Projects*, Retrieved 12 Dec 2004 from the National Action Plan for Salinity and Water Quality website: <http://www.napswq.gov.au/mbi/projects.html>



- Pannell, D. (1999) 'Economics, extension and the adoption of land conservation innovations in agriculture' *International Journal of Social Economics*, 26 (7/8/9): 999-1008.
- Pannell, D., (2001a), Economic Dimensions of Landcare, *State Landcare Conference 2001, 11-14 September 2001*, Mandurah Western Australia, pp. 131-144
- Pannell, D. (2001b) 'Harry Potter and the Pendulums of Perpetual Motion: Economic Policy Instruments for Environmental Management' *Connections - Farm, Food and Resource Issues*, 1: 3-8.
- Pannell, D. (2003) 'Heathens in the chapel? economics and the conservation of native biodiversity' *Pacific Conservation Biology*.
- Potter, C. and Gasson, R. (1988) 'Farmer participation in voluntary land diversion schemes: some predictions from a survey' *Journal of Rural Studies*, 4 (4): 365-375.
- Ryan, R.; Erikson, D. and Young, R. (2003) 'Farmers' motivations in adopting conservation practices along riparian zones in a mid-western agricultural watershed' *Journal of Environmental Planning and Management*, 46 (1): 19-37.
- Stoneham, G.; Crowe, M.; Platt, S.; Chaudhri, V.; Soligo, J. and Strappazon, L. (2000) *Mechanisms for Biodiversity Conservation on Private Land*, Natural Resources and Environment, Victoria
- Sweeney Research (2001) *BushTender Trial Final Questionnaire (unpublished)*, Sweeney Research, Albert Park
- Trewin, D. (2002) *Salinity on Australian Farms*, Australian Bureau of Statistics, Canberra
- Vanclay, F. M. (1986) University of Queensland, Brisbane, pp. 249.
- Vanslembrouck, I.; Van Huylenbroeck, G. and Verbeke, W. (2002) 'Determinants of the willingness of Belgian farmers to participate in agri-environmental measures' *Journal of Agricultural Economics*, 53 (3): 489-511.
- Wallace, K.; Beecham, B. and Bone, B. (2002) *Managing Natural Biodiversity in the Wheatbelt: a Framework*, Department of Conservation and Land Management, Western Australia, Perth
- WWF Australia (2002), *Auction for Landscape Recovery proposal to the National MBI Pilots Program*, internal project document

WWF Australia (2004a), *Farmer Guidelines to the Auction for Landscape Recovery  
Second*, produced by Michael Burton, UWA

WWF Australia (2004b), *ALR Fourth Quarterly Activity Report to the Commonwealth*,  
submitted by WWF Australia on behalf of the project partners

## Appendix A: Descriptive statistics for survey results

**Table A1a: Motivations and constraints regarding nature conservation<sup>1</sup>**

	Non-participants		Participants	
Motivating factors	Mean score <sup>2</sup>		Mean score <sup>2</sup>	
Aesthetics	1.36	(0.78)	1.50	(0.68)
Natural environment	1.57	(0.62)	1.83	(0.45)
Economic incentives	1.04	(0.78)	0.98	(0.85)
Farm sustainability	1.96	(0.19)	1.93	(0.26)
Personal satisfaction	1.75	(0.50)	1.84	(0.36)
Community Involvement	0.68	(0.72)	1.09	(0.77)
Constraining factors				
Time	1.29	(0.81)	1.72	(0.53)
Costs	1.46	(0.74)	1.71	(0.59)
Information	0.64	(0.78)	0.45	(0.49)
Salinity impacts	0.93	(0.86)	0.59	(0.82)
Lack of support	0.57	(0.84)	0.55	(0.63)

<sup>1</sup> Respondents were asked to rate the extent to which the listed factors were relevant to their decisions about nature conservation, or whether listed constraints were a factor in limiting the nature conservation activities on their farm. 0 = not a factor, 1 = low importance, 2 = high importance.

<sup>2</sup> Figures in parenthesis are standard deviations

**Table A2a: Agreement to statements<sup>1</sup>**

	Non-participants		Participants	
Attitudes	Mean score		Mean score	
i. Expectations	4.70	(1.77)	4.81	(1.70)
ii. Willingness	5.75	(1.88)	6.69	(0.71)
iii. Importance.	5.73	(1.36)	5.81	(1.17)
iv. Management fee	3.96	(2.10)	4.72	(1.96)
v. Positive message	5.68	(1.28)	6.14	(1.22)
vi. Objectives	4.71	(2.00)	4.83	(1.71)

<sup>1</sup> The statements are shown in Table A2b.

**Table A2b:**

**Please indicate the extent to which you disagree or agree with the following statements**  
(On the scale 1 represents 'disagree strongly' and 7 'agree strongly'. DK is Don't Know)

- 
- i. Too much is expected of farmers as far as the protection of the natural environment is concerned
  - ii. The willingness of farmers to undertake nature conservation would increase if the full costs were covered by the government (including payment for farmer's time).
  - iii. Looking after the natural environment is an important consideration among farmers in my area
  - iv. Farmers should be paid an annual management fee if they are expected to contribute to the nature conservation on their farm
  - v. Financial assistance for nature conservation sends out the message to farmers that native vegetation is a valuable environmental asset to think about
  - vi. The objectives of nature conservation schemes seem to be based on what people outside my area value
- 

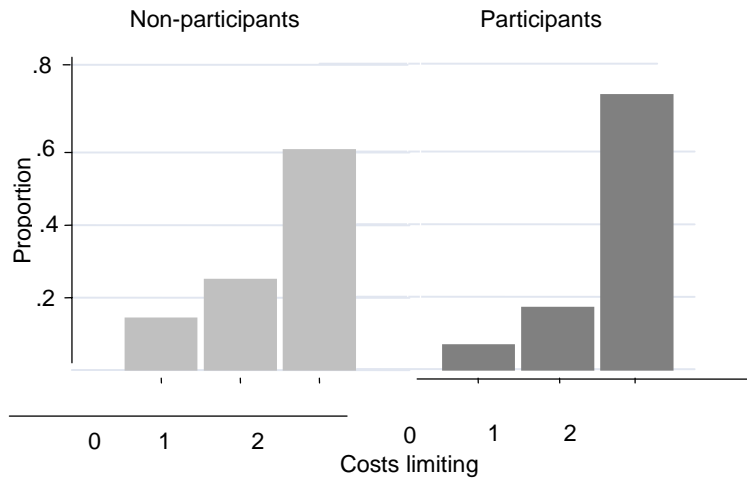
**Table A3: Farm characteristics**

	<b>Non-participants</b>		<b>Participants</b>	
	<b>means</b>		<b>Means</b>	
Farm size ('000 ha)	4.62	(1.9)	3.86	(2.91)
Land ownership (% owned)	88.5	(16.5)	87.8	(28.2)
Land use (% of total area)				
Cropping	62.7	(15.8)	63.9	(20.0)
Grazing	22.0	(14.8)	21.2	(15.6)
Native vegetation	15.1	(10.6)	14.1	(10.2)
Wheat yield actual (tonnes/ha)	1.38	(0.25)	1.57	(0.31)
Wheat yield relative (proportion to max)	0.58	(0.1)	0.66	(0.13)

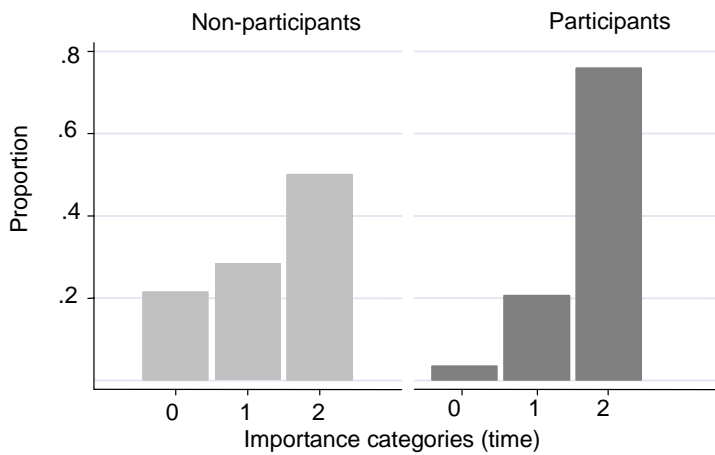
**Table A4: Landcare, previous experience, farm enterprises, off-farm income, age and education**

	<b>Non- participants</b>	<b>Participants</b>
	<b>Proportion of obs. = yes</b>	
<b>Landcare/schemes</b>		
Role	0.54	0.79
Member	0.39	0.69
Applications	0.61	0.79
Success	0.54	0.72
Salinity	0.39	0.41
<b>Farm enterprise</b>		
Wheat	1.00	1.00
Oil seeds	0.11	0.03
Legumes	0.39	0.28
Sheep	0.71	0.59
<b>Off-farm Income</b>		
Zero	0.54	0.43
<25%	0.39	0.43
25-50%	0.07	0.04
50-75%	0.00	0.07
>75%	0.00	0.04
<b>Age</b>		
<30	0.04	0.03
30-39	0.11	0.14
40-49	0.46	0.24
50-59	0.25	0.34
60-69	0.14	0.17
>69	0.00	0.07
<b>Education level</b>		
High school	0.64	0.72
Trade qual.	0.07	0.07
Agricultural College	0.11	0.10
Tertiary	0.18	0.10
Post graduate	0.00	0.00

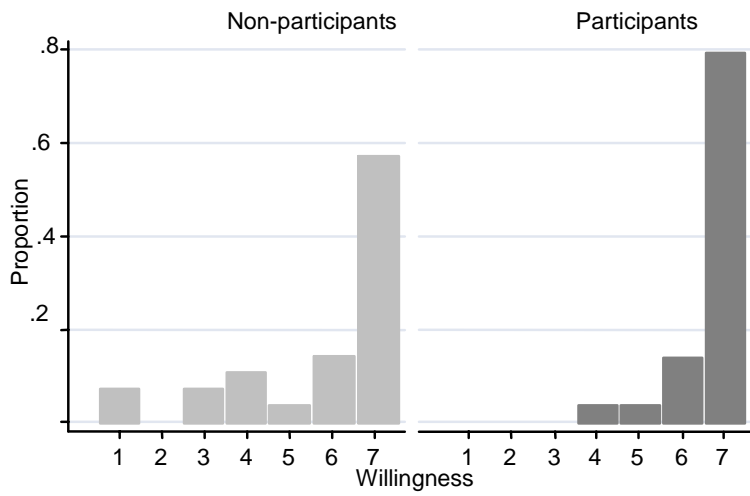
## Appendix B: Distribution of variables included in the logit regression



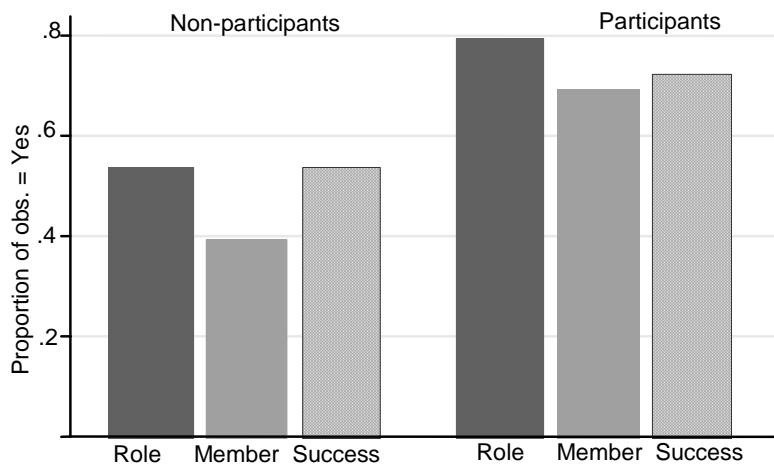
**Figure B1:** Distribution of observations across categories for **Costs a limiting factor** (0 = not a factor, 1 = low importance, 2 = high importance)



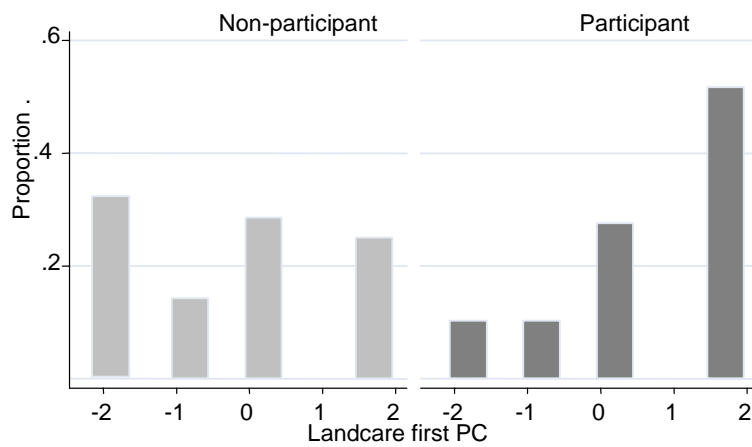
**Figure B2:** Distribution of observations across categories for *time* as a limiting factor (0 = not a factor, 1 = low importance, 2 = high importance)



**Figure B3: Distribution of observations across scores for Willingness**



**Figure B4a: Distribution of observations with value of 1 (yes) for Role, Member, and Success**



**Figure B4b: Distribution of Principle Component scores**

**Table B1: Correlation coefficients for Member, Role, and Success**

	Member	Role	Success
Member	1		
Role	0.47	1	
Success	0.40	0.46	1

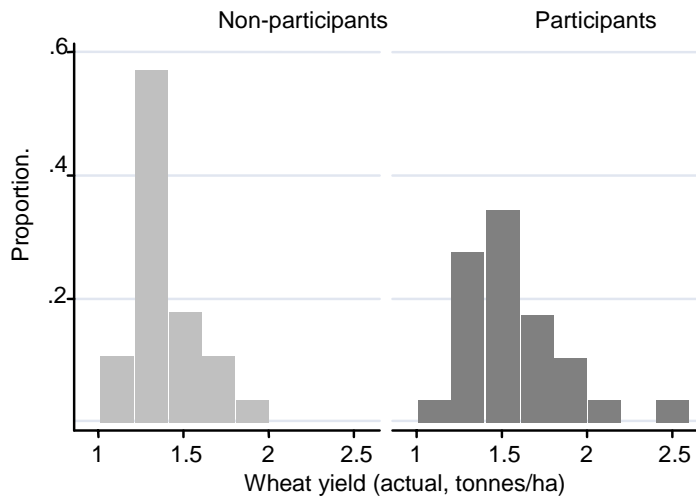
**Table B2a: Principal components results**

Component	Eigenvalue	Proportion of variance
1	1.88	0.63
2	0.61	0.20
3	0.52	0.17

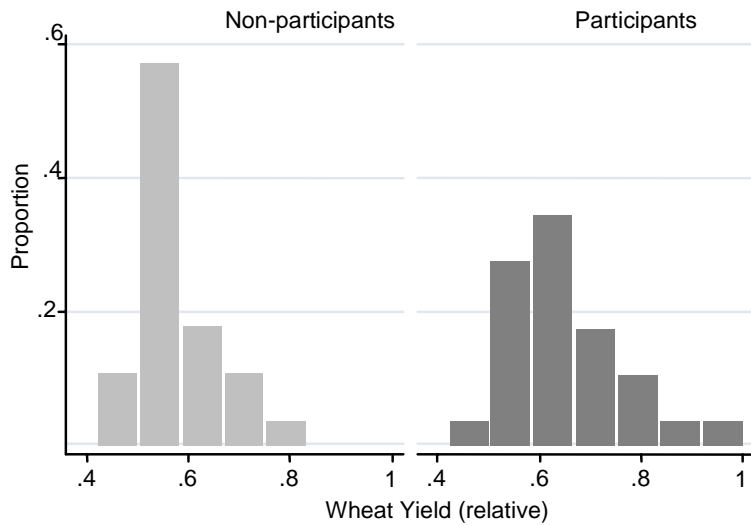
**Table B2b: Eigenvector scores for Component 1**

Original variable	Value
Role	0.60
Success	0.56
Member	0.57

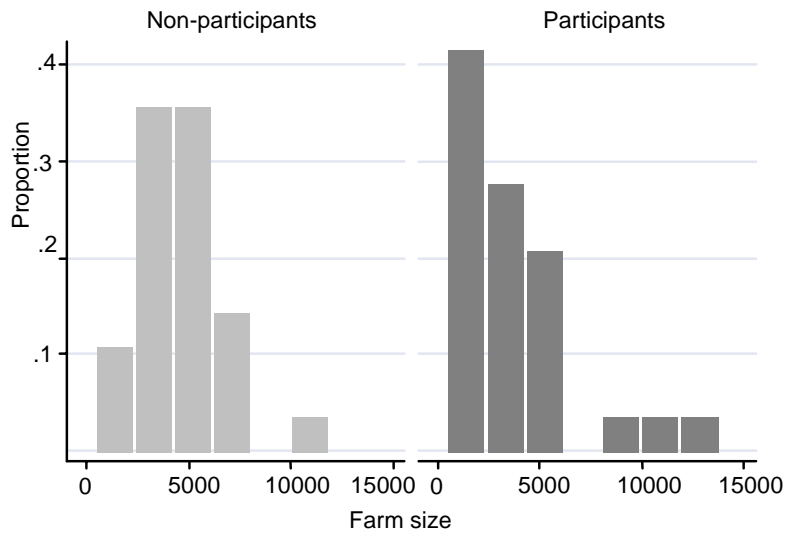




**Figure B5a: Distribution of observation for long-run wheat yield**



**Figure B5b: Distribution of observations for *relative* long-run wheat yield**



**Figure B6: Distribution of observations for farm area (ha)**

## **Appendix C: Summary of the sections of the farmer questionnaire**

The questionnaire has six sections. Section one is different for the participant and non-participant groups and Section 2 is only relevant to participants. Sections 3 to 6 are identical across the two groups.

The first section for participants consists of some straight forward questions about where the farmer had heard about the ALR, and 7-point rating scales were used to elicit a measure of satisfaction with the tender submission process, importance of the environmental targets of the auction and fairness of the tender selection process. An open-ended question was included to stimulate discussion the main things that prompted interest in participating in the auction. In section 2 questions focus on the tender development process, things important in pricing the tender, with mostly open-ended questions about their particular project, if there have other sites appropriate to the auction, and reasons for their choice of which round/s they participated in.

The first section for non-participants includes questions about whether the farmer had heard about the ALR before taking part in the interview, and if they had, what their level of interest was regarding participating and some of the reasons why they did not participate. Each respondent was also asked to indicate their level of interest (on a 7-point scale) in participation in the ALR if it was operating in the area in the future.

The third Section consists of four questions about nature conservation, farming and financial assistance. The first three questions ask about nature conservation activity on the farm, motivations and constraints regarding nature conservation. The fourth question contains seven statements and respondents are to indicate the extent to which they agree or disagree using a 7-point scale.

Section 5 asks about participation in environmental schemes in general (a list of all schemes operating in the Avon is provided), group membership, if there was a landcare officer in the area, and if he/she had a role assisting land management activities.

Section 6 includes questions on salinity impacts and salinity management.

The final section asks some basic questions about the farmer and the farm business eg. age, education, farm area, farm type, yield.