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**DESIGNING AUCTIONS WITH LANDHOLDER
COOPERATION: RESULTS FROM
EXPERIMENTAL WORKSHOPS**

RESEARCH REPORT No. 4

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**ESTABLISHING EAST-WEST LANDSCAPE LINKAGE
IN THE SOUTHERN DESERT UPLANDS RESEARCH
REPORTS**

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Any comments will be gratefully received and should be directed to Juliana McCosker

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Abstract

This report is the fourth of a series of reports detailing the outcomes of a research project based in the Desert Uplands region of central-western Queensland. The aim of the project is to demonstrate to government that public and/or private funds can be efficiently allocated for vegetation corridor protection through voluntary engagement with landholders. The mechanism to demonstrate is a type of auction (competitive tendering) system where competing proposals for corridor locations are evaluated for potential funding. The focus of the research project is to evaluate different auction mechanisms that encourage cooperative outcomes in a competitive tendering environment.

A series of experimental workshops were held with landholders in the Desert Uplands region, to test the design of a suitable auction format. The results from these workshops are presented in this report. The workshops were divided into two sessions. The first focused on multiple individual bidding rounds. The main aim in these rounds was to familiarize landholders with the process, identify the monetary tradeoffs associated with setting aside conservation blocks, examine the strategies used between bidding rounds and to determine if competitive pressure would drive down the relative bid values. In the second session of the workshops two different bidding formats were tested to develop a suitable auction design when collaboration between participants is required to achieve a particular outcome – in this case, the formation of a vegetation corridor. First, a format of group bids was tested and second, a two stage (bid/rebid) individual bidding system was tried.

An experimental workshop design (with landholders as participants), was favoured over the more common use of laboratory experiments (usually with students as participants) as the method of testing auction design. It was important to gather information (that only local landholders would have), about the costs of management changes, and about their attitudes to, and behaviour in, a competitive tender process. Some useful insights into the relative advantages of an experimental workshop over a laboratory experiment are presented in the report, as well as some of the tradeoffs.

1. Introduction

This report is the fourth of a series of reports detailing the outcomes of a research project based in the Desert Uplands region of central-western Queensland. The aim of the project is to demonstrate to government that public and/or private funds can be efficiently allocated for vegetation corridor protection through voluntary engagement with landholders. The mechanism to demonstrate is a type of auction (competitive tendering) system where competing proposals for corridor locations are evaluated for potential funding. The focus of the research project is to evaluate different auction mechanisms that encourage cooperative outcomes in a competitive tendering environment.

A key mechanism used in the research project to explore corridor development and auction design issues is workshop experiments that involve landholders. In previous reports various planning (Rolfe and McCosker 2003) and design (Rolfe *et al.* 2004) issues in the development of an auction system have been explored. In the first half of 2004, experimental workshops were conducted to test the design of different auction formats. Full details and results from these experimental workshops are presented in this report.

In designing market-like mechanisms, it is normal to start from a theoretical base and then move to some form of experimentation or field pilot to test the design. A common process for testing auction design is to apply experimental economics in a controlled laboratory environment with paid volunteers as participants. Students are commonly used as participants, as most laboratories are located in universities. However, in this research project, experimental workshops were held with landholders in the region of interest. There are several reasons why landholders were selected as participants in the workshops:

- The attitudes and experiences of landholders are expected to be very important for the design and support of an auction process and so the selection of the most efficient mechanism should be done with landholders,
- There is asymmetrical information about opportunity costs and relevant attributes and the involvement of landholders may help to identify this information better, and
- The involvement of landholders will help to familiarise and promote the use of biodiversity tender mechanisms within the region.

The design of the biodiversity tender process has to be sensitive to the characteristics of the regional area and the landholders there. The southern Desert Uplands region is dominated by low-intensity beef cattle operations. Properties cover large areas, and most operations are run as family units with limited use of employed labour. Typical of many pastoral operations in northern rangelands areas, profits are relatively low. Many landholders are long term residents of the region. Innovations are typically adopted with caution, and people are often wary of government support or involvement. Typical of many regions in northern Australia, most landholders have not had much involvement with conservation processes such as Landcare, although the Desert Uplands Buildup and

Development Group has successfully provided NRM services in the region over the past decade.

These factors mean that while the use of tender mechanisms has great potential to provide landholders with better incentives to manage for biodiversity outcomes, it may be difficult to generate broad enthusiasm for new programs. Key aims of the experimental workshops therefore included:

- Identification of a suitable process to introduce biodiversity auctions to landholders,
- Identification of an appropriate process to design a corridor across a region,
- Assessments of the ability of landholders to engage in biodiversity tender mechanisms,
- Identification of a standard set of engagement and contractual rules to use in the experimental workshops, and
- Identification of the appropriate levels of support that landholders might need to participate in auction processes.

The workshops were designed around the use of an experimental ‘game’ developed specifically for this project. A series of dummy properties were developed that combined to form a grid of 12 properties. The workshops involved up to 12 landholders, and lasted for approximately 3 – 4 hours. Each participant in the game was randomly allocated one of the 12 properties available. Property sizes, vegetation types and development levels were typical of the range of important characteristics in the Desert Uplands region. In a session round, each participant was asked to nominate an area of their dummy property that they might manage more conservatively. They also had to nominate the annual payment that they would require over a five year period before they would enter into a voluntary agreement. Participants providing the most cost-effective bids were rewarded.

The structure of the game meant that it was possible to ask for individual bids from participants (modeling a BushTender type of system), as well as testing different ways of receiving bids for corridor formation. Many of the design issues in developing the game have been reported in Rolfe *et al.* (2004). The approach is a form of synthesis between experimental economics and a field pilot without being easily classified into either group. It is like experimental economics in that it utilizes a simulated environment to test how people would form bids, but is not as tightly controlled as a normal experimental procedure. It is also like a field pilot in that it is focused on a real world application with actual landholders, but does not go beyond hypothetical scenarios in a half-day workshop.

In this report, the outcomes of the main experiments for the research project are outlined.

2. Experimental workshop and auction design

Three workshops were conducted with local landholders in central Queensland between February and April 2004. The first workshop (Gindie) was conducted in February 2004 just outside the Desert Uplands region to trial the workshop format. Only multiple individual bidding rounds were conducted. The format worked well and the results are included in the analysis below.

The second and third workshops (Barcaldine and Jericho) were held in two areas within the Desert Uplands region in April 2004. These were the main workshops for the research project. In both these workshops, the first part of the workshop focused on multiple individual bidding rounds, and then the second part concentrated on bidding formats where cooperation between landholders was required to select vegetation corridors. Although the two towns are only 84 kms apart (Barcaldine is 518 kms, and Jericho is 434 kms west of Rockhampton), there were some differences between landholders attending the workshops (Table 2.1). The most notable difference appeared to be in the size of cattle enterprise, with farms being smaller in Barcaldine than Jericho. Participants in Barcaldine self-reported a higher level of balance between production and environmental outcomes, with more participants in Jericho reporting a focus on production outcomes. There was a low percentage of property development or clearing in both areas, but more notably in Barcaldine.

Table 2.1 Socio economic and attitudinal characteristics of workshop participants

Participant characteristics	Barcaldine	Jericho
Gender – Males	42%	57%
Average age	45 years	52 years
Experience in the area	20	27
Cattle enterprise - less than 1000 head	83%	43%
Ownership – Leasehold	83%	86%
Off farm income – have some	58%	57%
Average % of total income	18%	15%
Average % of property cleared or developed	9%	24%
Focus equally on production and environment	92%	57%
Interested in being paid by government	58%	71%

There were seven key features in the design of the workshops, and each is discussed in more detail below.

- Background information
- Baseline conditions
- Grazing property maps
- Developing the first bid
- Biodiversity corridor metric; bid assessment and winner rewards
- Bidding formats
- Workshop feedback and follow up questions

2.1 Background information

The workshop sessions began by the researchers providing background information about the project and the context of the workshop. It was explained that the key goal of the project was to determine how landholders may be voluntarily engaged to develop vegetation corridors across the southern Desert Uplands. The project would establish the preferred options for developing agreements with landholders so that if funding was made available from other sources, the process of installing a linkage zone could begin. In the longer term it is possible that up to three linkage zones may be established.

A linkage zone would be different to a dedicated environmental reserve. It would involve areas of native vegetation on the cattle properties in the region being jointly managed for both cattle production and biodiversity outcomes. Landholders would receive some payment to reward them for managing part of their property in this fashion. Where possible, the vegetation zones would link up between properties so that an effective corridor (of varying widths) could be established across the region.

2.2 Baseline conditions

Once participants had been presented with background information, they understood that they were going to identify areas on their dummy properties that they were prepared to management more conservatively, for a nominated cost. They were then provided with specific details relating to the management of the nominated areas, as follows:

- *Commitment to retain a certain amount of pasture at the end of the dry season annually – about 1500kg/ha¹. See pasture photographs. (Appendix 1)*
- *Fire is allowed but the area must be destocked until minimum biomass is reached.*
- *No additional exotic plant species can be introduced deliberately.*

While minimum conditions were specified to ensure particular environmental outcomes, they still allowed landholders flexibility over their production outcomes, and they could still graze cattle in designated areas. In addition, landholders were advised that any agreements would:

- *be for a 5 year period with annual payments,*
- *be in the form of a contract, and*
- *include a monitoring process based on an annual visit, with two weeks notice.*

¹ This is equivalent to approximately 40% of available biomass. Participants at the Barcaldine and Jericho workshops indicated that an average of 66% of their property would have 40% of biomass at the end of a dry season in a **normal** year. This ranged from a minimum of 30% of the property to 100%. However, in the in the last couple of years which have been drought affected, an average of 33% was reported; ranging from a minimum of zero to a maximum of 50%.

In terms of the auction process and the development of their individual bids, participants were provided with the following information:

- *Changes to water points and fencing associated with a bid will be funded separately.*
- *Regrowth commitment possible especially for the purposes of attaining linkage.*
- *Commitment to volunteer as much land as possible that will not unduly impact on the property viability.*
- *Commitment to give as much variety of vegetation types as possible.*
Biodiversity values are rated as:
 - *Brigalow/ Gidgee - highest (score = 10)*
 - *Box - second highest (score = 5)*
 - *Silver-leaf Ironbark - third (score = 2.5)*
 - *Yellow Jacket - fourth (score = 1.5)*
 - *Cleared - lowest (score = 0.5)*
- *Commitment of east-west linkage across the property.*
- *Make bid relevant to property viability.*

2.3 Grazing property maps

The experimental workshops were focused on achieving landscape corridors in an area used for cattle grazing. Participants at the workshops were asked to make decisions about where they might locate a vegetation block or corridor on a property and how much they would need to be paid, to manage the block in a more conservative way.

Dummy property maps were created for use at the workshop that were realistic for landholders while minimising the number of variables that could affect conservation area choices and bid formation. The following details were provided on each property map:

- A property name
- Property area
- Vegetation types
- Cleared areas
- Fences
- House location
- Water points
- Road access
- Watercourse

The maps were made more realistic by varying the property sizes and showing the vegetation areas in different patterns on each property. However, substantial consistency between the ‘dummy’ properties was generated by having:

- the same vegetation types on each property,
- the same proportion of each vegetation type on each property,
- the houses and most fences in the cleared areas,
- similar numbers of paddocks and watering points on each property, and
- a similar mixture of cleared blocks, vegetation blocks and vegetation strips on each property.

The percentage distribution of the different vegetation types was the same on each dummy property map and broadly reflected the distribution of the vegetation at the regional level. For example, each map had 30% of the area covered by Yellowjacket which represented the approximate area of low production country in the region. Details of the property sizes and vegetation areas are presented in Table 2.1.

Table 2.1 Property sizes (in hectares)

Property	Property Size	Yellow jacket	Cleared	Broadleaf Ironbark	Box	Gidgee/Brigalow
% of area		30%	30%	20%	15%	5%
A - "Allawah"	16000	4800	4800	3200	2400	800
B - "Banyulah"	24000	7200	7200	4800	3600	1200
C - "Claydon"	33000	9900	9900	6600	4950	1650
D - "Dunaird"	32000	9600	9600	6400	4800	1600
E - "Elgin"	14000	4200	4200	2800	2100	700
F - "Furnlea"	9000	2700	2700	1800	1350	450
G - "Glenmyre"	8000	2400	2400	1600	1200	400
H - "Hopetoun"	45000	13500	13500	9000	6750	2250
I - "Iona"	15000	4500	4500	3000	2250	750
J - "Jilliby"	21000	6300	6300	4200	3150	1050
K - "Kildare"	18000	5400	5400	3600	2700	900
L - "Landrossy"	21000	6300	6300	4200	3150	1050

The overall layout of the properties is shown in Appendix 2 and an example of an individual property is shown in Appendix 3.

2.4 Developing the first bid

Landholders were being asked to manage their country more conservatively, and while grazing was still permitted, it was likely that some destocking would be required. It was expected that the cost involved in these management changes would be based on the costs of lost production and any other costs incurred, minus the reduced operating cost and other associated benefits. The bid price was formulated on an assessment of these costs and reflected the landholders' opportunity cost of management change. While the participants had dummy properties to work with, they were asked to assess the cost of these management changes based on their experience on their own property.

To help participants make these calculations and formulate their bids the following assistance was provided:

- A practice worksheet (Appendix 4),
- Examples of stocking rates that might apply for the different vegetation types in the area (Appendix 5),
- On the reverse side of each bidding sheet (Appendix 6), was a property map with gridlines to help calculate the size of a particular area, and
- Workshop facilitators were on hand to assist if required. Advice was only given on the calculation process and not on the specific values to include.

Considerable time was taken to ensure all participants were comfortable with the way in which they formulated their bids. Once they had made the initial bid, the formulation of bids for subsequent bidding rounds proceeded more rapidly (see Section 3 for details).

To make a bid, participants were provided with a bidding sheet (Appendix 6), which had the property map on the reverse side. They were required to:

- Indicate the location of the conservation block on the map provided,
- Provide details of the area of each vegetation type, and
- Indicate the amount of the bid.

2.5 Biodiversity corridor metric, bid assessment and winner rewards

A process for assessing a biodiversity score and landscape linkage score has been outlined in detail in McCosker and Rolfe (2004). However, that assessment procedure relies on detailed background information, supported by on-site assessment. In order to be able to make a rapid assessment of bids in the experimental workshop, a more simplified metric was utilised. There were three principal components of the biodiversity corridor metric; the biodiversity score; the corridor score and the endowment score.

Biodiversity score

Each property had five main vegetation types or classifications, and details of the area of each type being offered in a conservation block were provided on the bidding form (Appendix 6). Weights were assigned to each vegetation type, based on relative scarcity in the region (Table 2.2). First, general estimates were made of the percentage of each broad vegetation type that remain in the Desert Uplands area. The inverse of this value was then taken and rounded up or down to make it easier to explain to participants in the workshops. For example, a rating of 10 for Brigalow/Gidgee means that there is about 90% cleared in the region (the real figure is in the high 80% range), while a figure of 5 for Box means that about 80% has been cleared (the real figure is probably slightly lower). A weighting of 0.5 was adopted for cleared country to identify that while it has some value for conservation purposes (perhaps to allow regrowth in connecting strips), it has a much lower benefit than the vegetated areas.

Table 2.2 Weightings for different vegetation types in the biodiversity index

Vegetation type	% cleared	% remaining	Weight (Inverse of % remaining)
Brigalow/ Gidgee	90	10	10
Box	80	20	5
Silver-leaf ironbark	60	40	2.5
Yellowjacket	30	70	1.5
Cleared land			0.5

The biodiversity score was assessed by adding the relative contribution of each vegetation type.

$$\text{Biodiversity Score (BS)} = \text{Brigalow area} * 10 + \text{Box area} * 5 + \text{Ironbark area} * 2.5 + \text{Yellowjacket area} * 1.5 + \text{cleared area} * 0.5$$

Corridor score

Two separate weightings for a corridor score were applied; one for the individual bidding rounds (Section 3) and one for the cooperative or group bidding rounds (Section 4). In the individual bidding rounds, the corridor score related to the percentage of east-west linkage in the offered bid area (on the property). In effect, relative bid values were not altered if the offered bid area formed a corridor across the property, but were reduced if the bid area did not form a corridor. For example, if a submitted bid only represented 80% of a corridor linkage, the relative bid value was reduced accordingly.

In the cooperative bidding rounds, the desired outcome was the linkage of property level vegetation corridors across property boundaries. Two different formats were trialed (see Section 4), but as one format required participants to work in groups of three to ensure linkages were made across property boundaries, there was no need to include an extra weight for corridor linkage. Instead, a corridor score was applied based on the width of the corridor offered at the property level. Corridors that were at least one kilometre wide were assigned the full weighting of 100%, and those with less were given a proportionally lower weight.

$$\text{Corridor score (CS)} = \text{percentage of corridor across property greater than 1kilometre wide}$$

Endowment effect

In order to reflect ‘real’ variations and to make the landscape maps appear more realistic, there was substantial variation between properties in terms of size (Table 2.3). However, it is often recognised that endowment effects can influence bid values in experimental economics, and participants in the Gindie workshop suggested that people with the larger properties had more scope to submit more cost-effective bids. Because participants in the workshops were competing for rewards, it was identified that bids should be weighted

according to property size. Results reported in Rolfe *et al.* (2004) confirmed that endowment effects were present and bids were subsequently adjusted to take account of those effects.

The endowment score was calculated by:

1. determining the proportional difference in property size from the mean,
2. limiting the maximum change to 20%, and
3. adding 1 to ensure all changes were positive.

Details are presented in Table 2.3 (smaller properties get cheaper rating).

Table 2.3 Property sizes (in hectares)

Property	Property Size	Proportional change from average	Limit max change to 20%	Endowment factor
	<i>PS</i>	<i>(PS-21333)/PS</i>	<i>*0.12</i>	<i>Add 1</i>
A - "Allawah"	16000	-0.333	-0.040	0.960
B - "Banyulah"	24000	0.111	0.013	1.013
C - "Claydon"	33000	0.354	0.042	1.042
D - "Dunaird"	32000	0.333	0.040	1.040
E - "Elgin"	14000	-0.524	-0.063	0.937
F - "Furnlea"	9000	-1.370	-0.164	0.836
G - "Glenmyre"	8000	-1.667	-0.200	0.800
H - "Hopetoun"	45000	0.526	0.063	1.063
I - "Iona"	15000	-0.422	-0.051	0.949
J - "Jilliby"	21000	-0.016	-0.002	0.998
K - "Kildare"	18000	-0.185	-0.022	0.978
L - "Landrossy"	21000	-0.016	-0.002	0.998
Average	21333			

Bid assessment and winner rewards

The relative value of the bids were assessed in the following stages:

1. Assess the biodiversity score (BS),
2. Include the corridor score adjustment (BS*CS),
3. Assess relative bid value ([BS*CS]/\$ bid offer), and
4. Adjust for the endowment effect.

A spreadsheet had been created in ©Microsoft Excel and once the details of each bid were entered, bids could be assessed immediately, and the results of the bidding rounds were available within minutes. The winners were announced and small financial prizes were given to the first, second and third best bids. No further details of the bids were revealed. This provided bidders with a competitive incentive to try and improve their bids in subsequent rounds.

2.6 Bidding formats

Three main bidding formats were trialed in the workshops. The first part of workshop concentrated on individual bidding rounds, where participants were encouraged to put in a bid for a corridor across their property, but there was no need to link a corridor with a neighbouring property. These individual rounds were used to:

- familiarise participants with the process of formulating their bids,
- familiarise them with the actual bidding process, and
- provide them with information to help improve their chances of winning.

These rounds were also used to allow some more simple tests to be conducted before the more complex cooperation rounds were run. For example:

- test whether there was a higher cost involved in managing a corridor across their property rather than a vegetation block,
- understand the strategies bidders might employ,
- test whether competitive gains could be made with multiple bidding rounds, and
- understand what tradeoffs might occur between different vegetation types and possibly other factors.

Details and results are presented in the next section.

The second part of the workshop focused on the two bidding formats that required cooperation between landholders to ensure a continuous vegetation corridor across properties could be achieved. The first involved landholders working together in a group and in the second, individual bids were made with multiple rounds once the location of corridors in the first round had been established. Details and results from these two bidding formats are presented in Section 4.

2.7 Workshop feedback and follow up questions

Once all the bidding rounds had been completed, a brief discussion was held to obtain feedback about specific issues in the design of the different bidding formats and the information provided. These opinions are incorporated in Sections 3 and 4 below.

Participants were also asked to complete a short questionnaire designed to provide some socio-economic details, some details of their attitudes to the potential live implementation of the trialed scheme, and some feedback about the workshop. To ensure anonymity, these details were recorded against the participants' bidding number which had been assigned at the start of the workshop. The results are discussed in Section 5 below.

3. Multiple individual bidding rounds

In this bidding format landholders were asked to formulate an individual bid for their property. Although considerable time was taken in the formulation of the initial bid (approximately one hour), subsequent bidding rounds were completed more rapidly (approximately 15 minutes). At the end of each round, the first, second and third best bids were announced and small monetary prizes were awarded. This created a competitive environment. The round was then repeated. However, landholders had little patience for repetitive processes, and there was a clear tradeoff between extending the number of rounds to obtain the most information and participant boredom. Four rounds were held in the Gindie and Barcaldine workshops and only three rounds in Jericho workshop as participants were becoming distracted.

The main aim in these rounds was to familiarize landholders with the process, identify the monetary tradeoffs associated with setting aside conservation blocks, examine the strategies used between bidding rounds and to determine if competitive pressure would drive down the relative bid values.

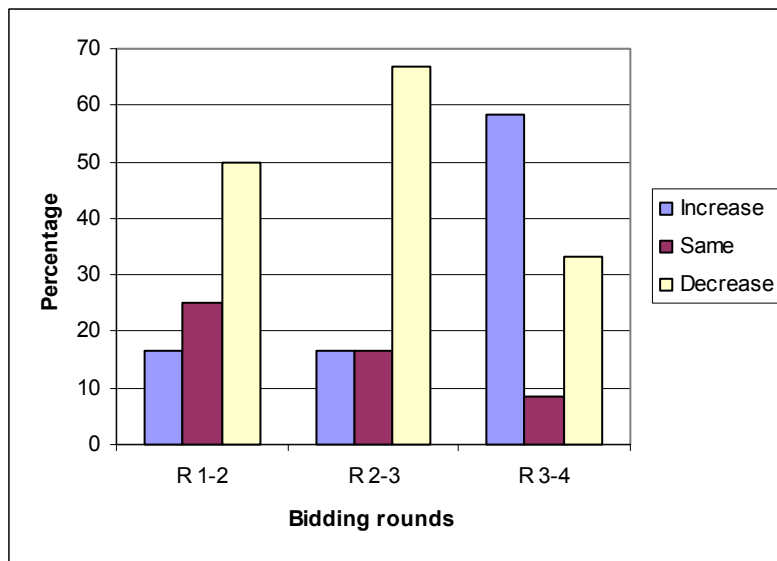
3.1 Vegetation blocks Vs corridors

In the first workshop at Gindie, landholders were only requested to submit a bid for a block of land on their property. In the first three rounds these could be in any shape or location, but in the fourth round they asked to make a bid on a corridor across their property. A number of people increased the relative value of their bids between rounds 3 and 4 (Figure 3.1) indicating that the cost associated with a corridor were higher than for a block of vegetation within their property. This is to be expected because a corridor is likely to cut across several paddocks and vegetation types. Landholders may find that there are higher opportunity costs and management costs associated with a corridor than with a discrete block (eg the back paddock).

A comparison of average relative values between rounds 3 and 4 at the Gindie workshop revealed no significant differences (T-statistic = .467 with 22 d of f). However, anecdotal evidence from a feedback questionnaire completed by participants at the Barcaldine and Jericho workshops, where landholders were asked how much more money they would require for a corridor compared to a block of vegetation, indicated there would be an extra cost for some people. Seven out of the eighteen people who completed this survey provided an answer, giving a mean estimate of a 23% premium for a corridor over discrete blocks of vegetation.

Landholders at Gindie were asked about several design issues and were probed about the difference between submitting a bid for a corridor rather than a block of their property. There was general agreement among landholders that there was no real difficulty in their offering a corridor bid if that was required.

Figure 3.1 Changes in relative bid values in multiple bidding rounds at Gindie



In subsequent workshops, attention was focused on the need for a corridor in the beginning and it was made clear that a corridor bid was preferred, although not essential. In Barcaldine, only one landholder did not offer a corridor from the beginning and everyone in Jericho started with a corridor bid.

Result 1: There is no immediate barrier to landholders managing a conservation contract on a vegetation corridor across their property.

Result 2: Managing a corridor rather than a block of vegetation would incur an additional cost to some landholders.

3.2 Bidding strategies

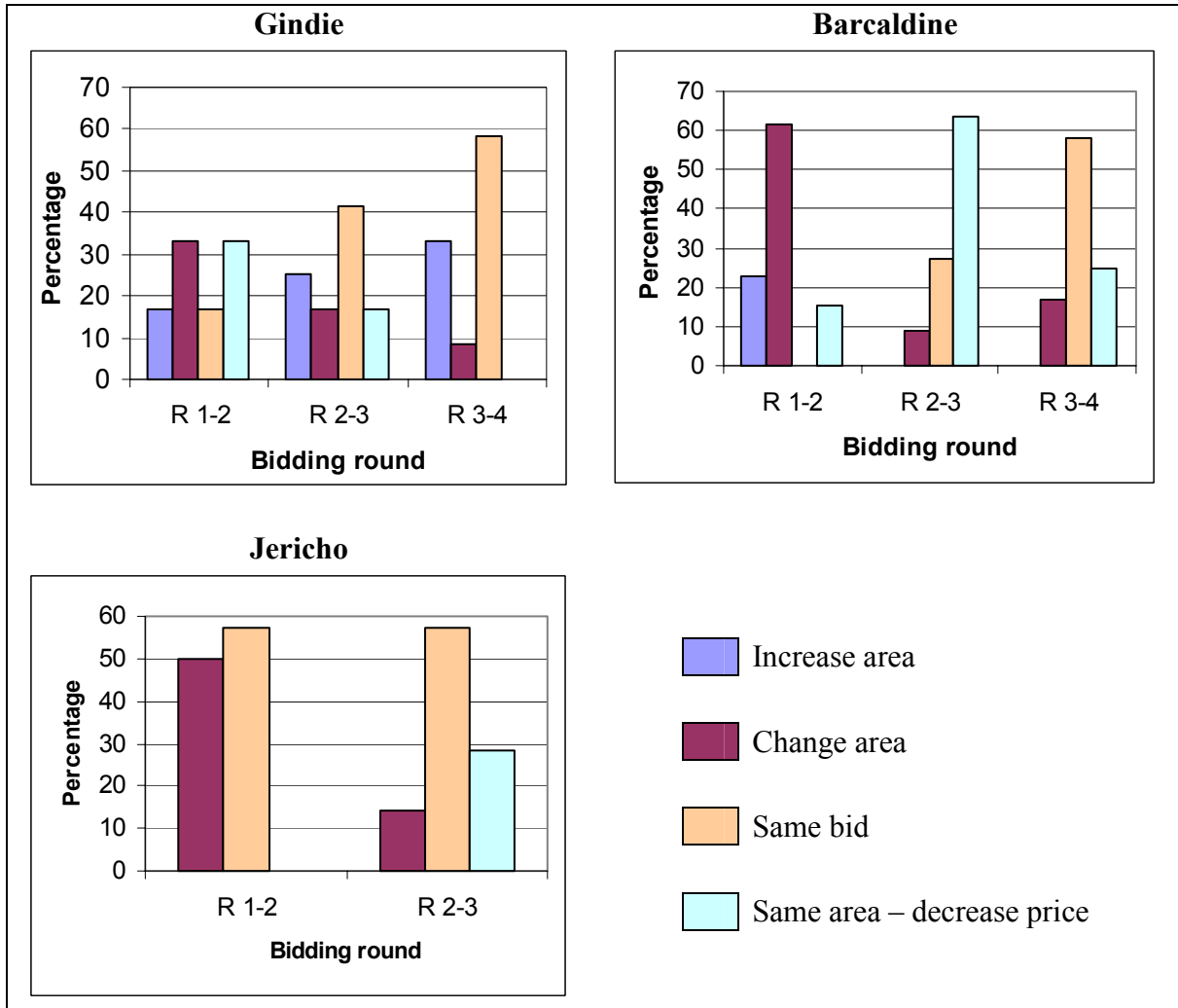
The bidding strategies at the workshops were examined in two ways, both providing useful insights into the effects of multiple rounds on bid formation. First, the bids were categorized in terms of the bid areas.

In Gindie, no instructions were given about the bid areas being submitted, only that a corridor was required in the fourth round. Participants continued to increase the area of their bids in all rounds (Figure 3.2), but the number of bids that were the same also increased.

In both Barcaldine and Jericho, participants were advised that they could change their bids completely in the second round if they wished, but were requested to keep the same area in rounds 3 and 4. In Barcaldine, the percentage of bids that were the same increased, while the percentage that had the same area, but reduced the price dropped off in the final round. In Jericho, the percentage of same bids was constant and only in the

third round did some landholders start reducing their price (Figure 3.2). These results indicate that landholders were willing to be flexible about corridor location, but may only be willing to engage for a limited number of rounds.

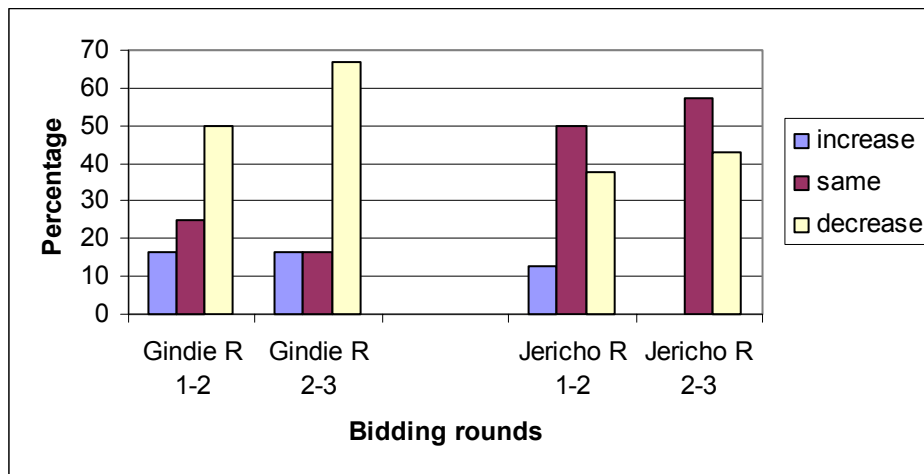
Figure 3.2 Changes in bid areas in individual bidding rounds



The second way of looking at bidding strategy is to examine the changes in relative bid price over the different rounds. Gindie was the first workshop that was conducted and in the first three rounds participants were only asked to put in a bid for a block on their property, before being asked to consider a corridor across the property in the fourth round. It would appear that there was a more extended learning effect in Gindie as prices continued to decline quite sharply between rounds 2 and 3 (Figure 3.3).

In Gindie, the relative value of bids continued to decrease in all three rounds, whereas in Jericho, the number of same bids increased and the number that decreased appeared to be leveling off (Figure 3.3).

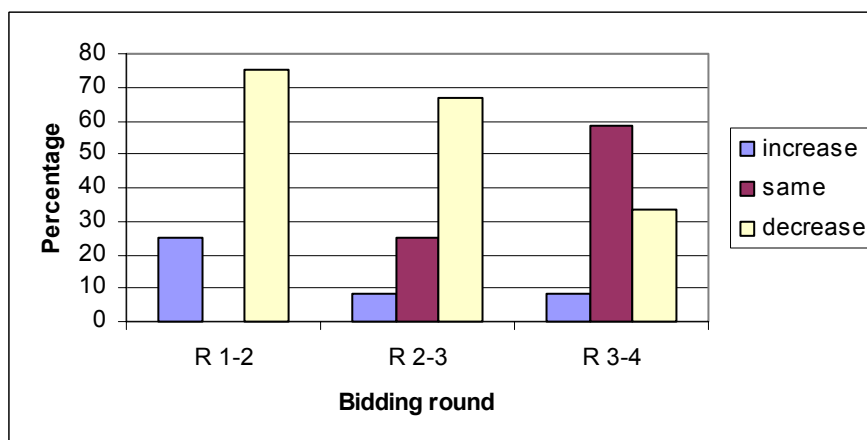
Figure 3.3 Changes in relative bid values for individual rounds in Gindie and Jericho



In Jericho, the workshop was held on the same day that the *Vegetation Management and Other Legislation Amendment Act 2004* was passed which phased out broad scale tree clearing of remnant vegetation by 2006, and the workshop was slow to proceed as landholders aired their views about the government and vegetation management. Once the bidding rounds started, some participants lacked the patience for multiple bidding rounds and only three rounds were held. It appears that they were less willing to take time to consider reducing their bids in order to win a prize. There was a high proportion that kept the same bid and although the proportion of decreased bids increased in third round, the increase was not as distinct as in Gindie (Figure 3.3).

In Barcaldine, four individual bidding rounds were held. Bid prices continued to decrease across rounds (at a diminishing rate), but the proportion of bids that remained the same increased (Figure 3.4). This may indicate some level of resistance to participation if multiple rounds are conducted.

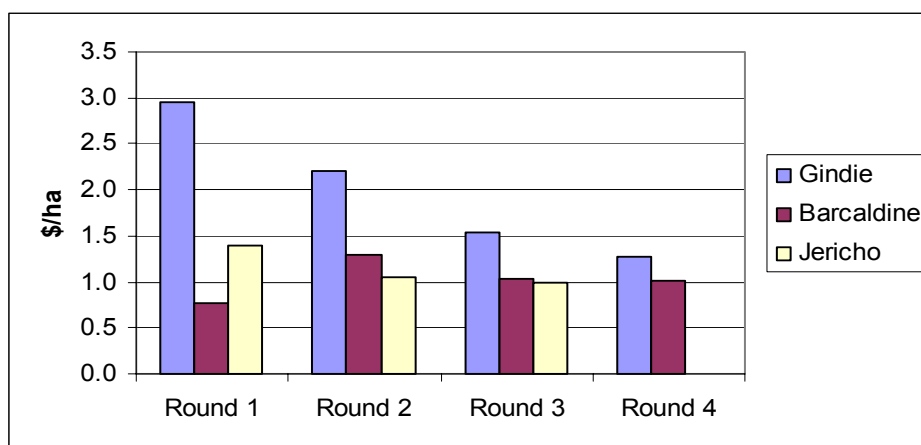
Figure 3.4 Changes in relative bid values for individual rounds in Barcaldine



3.3 Changes in relative bid prices

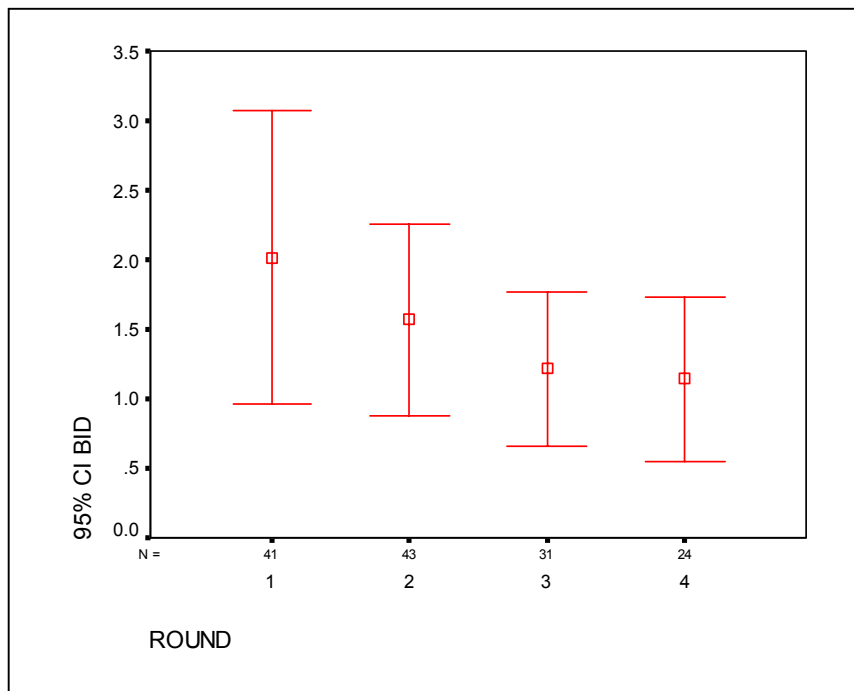
An examination of the average relative bid values in the different rounds is illustrated in Figure 3.5. In all three workshops, the average relative bid values decreased over multiple rounds. This was true even in Gindie where several individuals increased their relative bid value in the fourth round when asked to place a bid on a corridor rather than a block (see Figure 3.1 above). In Barcaldine, 75% of landholders reduced their bid price over the bidding rounds. The decrease in values ranged from 5% to 48% and averaged 29%.

Figure 3.5 Average relative bid values for individual rounds



Another way to examine the trend in relative bid values over the four rounds is to combine the bids for all the workshops and calculate the error bars. Figure 3.6 illustrates that not only is there a drop in the mean bid value in the first three rounds, but the variance in bid values also declines as the error bars (95% confidence interval) become more compact and converge in the fourth round, along with mean bid price. This indicates that participants were becoming more expert at forming bids over successive rounds.

Figure 3.6 Mean bid price (\$/ha) for all workshops with error bars (95% CI)



The results presented above suggest that competitive pressures (from the offering of prizes) were able to drive prices down over multiple rounds, but that most of the gains from competition were realized in the first two or three rounds. To test the statistical robustness of this assertion, the data from the different workshops² was combined and two-way ANOVAs were conducted with the workshop location identified as an extra fixed factor. It was expected that there would be a difference in relative bid values at the workshops as bio-physical conditions varied between districts. In particular, there were better soils in the Gindie area than at the other locations; grazing was more productive and so the opportunity costs of reduced stocking rates were higher. The use of two-way ANOVAs allowed for these variations to be controlled when searching for significant variations in bids between rounds.

When the bid levels for rounds 1 and 2 were examined there was a statistical difference between the rounds (at the 10% level of significance), but there was no statistical difference between bids from rounds 2 and 3 (see Table 3.1). In both cases the workshop location was also a significant factor. The implication of this result is that the competitive efficiencies are almost all gained by just adding one extra bidding round to a competitive tendering system.

² To keep the workshops manageable participation was limited which meant that any statistical analysis of individual workshops would also be limited because of the small data set.

Table 3.1. Relative bid values between rounds 1-2 and rounds 2-3 in all workshops**A. Dependent Variable: Relative bid value – rounds 1-2**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	29.406(a)	7	4.201	3.650	.002
Intercept	92.741	1	92.741	80.582	.000
ROUND	3.839	1	3.839	3.336	.072
WORKSHOP	25.066	3	8.355	7.260	.000
ROUND * WORKSHOP	.798	3	.266	.231	.874
Error	79.411	69	1.151		
Total	210.990	77			
Corrected Total	108.816	76			

a R Squared = .270 (Adjusted R Squared = .196)

B. Dependent Variable: Relative bid value – rounds 2-3

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	15.555(a)	6	2.592	2.355	.041
Intercept	51.969	1	51.969	47.216	.000
ROUND	.000	1	.000	.000	.987
WORKSHOP	14.861	3	4.954	4.501	.006
ROUND * WORKSHOP	.427	2	.213	.194	.824
Error	67.141	61	1.101		
Total	148.825	68			
Corrected Total	82.696	67			

a R Squared = .188 (Adjusted R Squared = .108)

Result 3: Competitive pressure does appear to drive prices down over bidding rounds but competitive gains are soon exhausted.

3.4 Factors influencing bid prices

Some indication of the importance of different factors that influence bid formation was assessed by the use of regression analysis. Multiple regression was used, where a series of independent variables, including areas of vegetation and participant characteristics, was used to predict the bid price that was lodged. The results of a regression model from the combined Barcaldine and Jericho data sets are shown in Table 3.2. The data was drawn only from the first four and three rounds in each workshop respectively, representing the individual bidding rounds.

The model is very significant (Adjusted r-square = .973) but there is a very large constant, indicating that other variables not in the model may also be important. The model shows that the areas of the three most productive country types (cleared, Gidgee

and Box) are very important, but areas of Ironbark and Yellowjack were not. The coefficients for country type show that respondents wanted on average: \$11.62 for each acre of Gidgee, \$2.77 for each acre of Box, and \$5.31 for each acre of cleared country that was involved.

The model results also indicate that:

- bids are strongly influenced by factors apart from the areas of vegetation involved,
- bids are positively linked with enterprise size (participants from smaller properties tended to make more competitive bids)
- bids are negatively linked to development level (indicating that landholders on more developed properties have less to offer – and perhaps don't need the money as much)
- bids are linked to interested in being paid by government for ecosystem services (those not interested would need to be paid more money)
- Bids are negatively linked to the workshop round (bid values are lower for successive rounds).

Table 3.2 Predictors of bid value in individual rounds at main workshops

Coefficients	Coefficient	Std. Error	Significance
Constant	-17793.26	3657.38	.000
Gidgee scrub (acres)	11.62	2.21	.000
Box (acres)	2.77	.86	.005
Broadleaf Ironbark (acres)	-.06	.67	.931
Yellowjacket (acres)	-.11	.31	.727
Cleared (acres)	5.31	.52	.000
Enterprise size (dummy)	3549.27	1091.21	.004
% of property developed (%)	-331.48	116.88	.011
Interested in being paid by govt (dummy)	8355.42	1684.95	.000
ROUND	-2814.92	427.07	.000

Dependent Variable: Bid amount
Model fit: Adjusted R square = .973

4. Bidding formats for cooperative outcomes

Two bidding formats were tested at the Barcaldine and Jericho workshops to develop a suitable auction design when collaboration between participants is required to achieve a particular outcome – in this case, the formation of a vegetation corridor. First, a format of group bids was tested and second, a bid/rebid individual bidding system was tried. Results of each are outlined below.

These rounds were conducted after the individual bidding rounds, by which time participants were familiar with the bidding process and how they might adjust their bids.

4.1 Group bidding process for corridor formation

Participants were organized into groups of three, and were placed with people they had not initially selected to sit with, and where possible, with people who might have had different views on conservation.

In Barcaldine, it was clear from the discussion between participants that there were opposing opinions about grazing management. Some landholders already had relatively conservative stocking rates and were submitting low bids as they felt there was little opportunity cost involved in meeting the ground cover requirement. Other landholders in the group were more focused on production outcomes and these landholders thought the more conservation oriented people were being unrealistic in bid formation. People with opposing viewpoints were placed in the same group.

In this round, each group had to submit a vegetation corridor linked across three properties. This required cooperation between group members. However, each individual property bid remained confidential, and was submitted after the corridor location had been decided. Consequently, a corridor was formed across three properties but the relative value of the individual property bids varied. Bids were assessed to determine which were the most cost effective corridors, with the successful group being awarded an incentive prize.

Landholders appeared quite willing to negotiate with their neighbours about the location of a corridor and spatial linkage did not appear to be a problem. Many landholders enjoyed the social interaction of negotiating corridor locations, and preferred this mechanism. This was confirmed in discussions after the round. However, it was also clear that the bid price of individuals would need to remain confidential.

Result 4: Landholders were willing to negotiate corridor location with their neighbours, but were not prepared to share bid information.

4.2. Individual two stage (bid/rebid) bidding process for corridor formation

The second bidding format that was tested involved a two stage process (bid/rebid). It was explained to participants that a north-south corridor was required and initially, landholders were asked to submit a bid for a corridor across their property. These bids were recorded and the location of each property corridor was drawn on a large map for all to see.

Participants could then see where potential corridors could be formed across the whole area covered by the 12 properties. It was also apparent that a number of options existed to form a corridor, and it was not clear from a bidder perspective (seller) where the buyer might choose to locate the corridor and if their bid would be successful.

Participants were then informed that their first bid would remain “live” but they could put in another bid if they wished. They would only win an incentive prize if they were part of the most cost-efficient corridor bid. There are several potential strategies landholders might adopt in the second round to increase their chance of success. For example they could:

- relocate their first bid to link with their neighbour and fill a gap,
- provide an additional area, or
- reduce their bid price.

The corridor layout for the two rounds of the Barcaldine workshop over the 12 properties is presented in Appendix 7 (a) and (b). The combination of the two bidding rounds (Appendix 7c) resulted in 18 possible combinations for a corridor in this workshop. Similar results were achieved in the Jericho workshop.

This bidding format was very successful. Many landholders bid for multiple corridor locations across their property, with the result that many different groups were bidding for the corridor option. Some landholders preferred this approach to that of working in a group (particularly those who had been placed in a group with people who had contrasting viewpoints). However, some of them did consult and negotiate with their neighbour in developing a second bid.

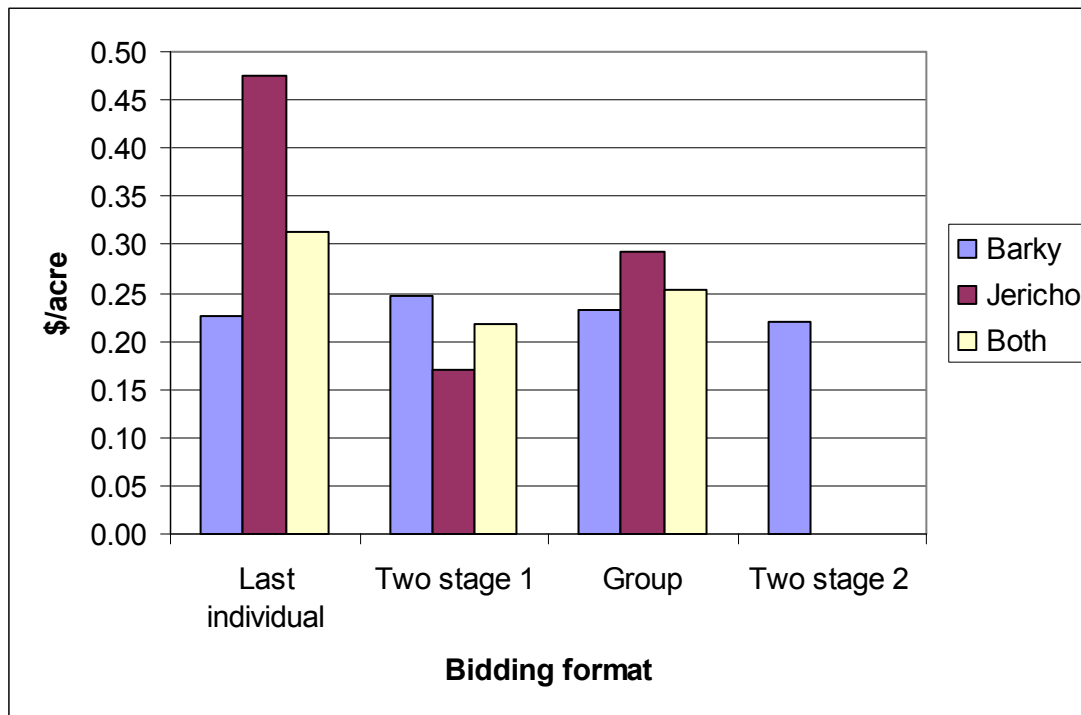
Result 5: The bid-rebid process was very efficient at developing multiple corridor options across a number of landholder combinations, and generating a competitive process.

4.3. Relative bid values for corridor formation at Barcaldine and Jericho

The average bid prices for the different corridor bidding formats are presented in Figure 4.1. In both Barcaldine and Jericho, a two-stage bidding round was completed before the group bidding round. In addition, a second two-stage round was completed in the Barcaldine workshop after the group bidding round. It is expected that there would be some confounding effects between a premium for corridor bids (discussed in section 3.1) and price reductions from successive rounds in the workshop (discussed in section 3.3).

In Barcaldine, there was little variation in the mean bid values across the different bidding formats. In Jericho (which influences the combined bid), it appears that the mean bid value was higher in the group format, implying that additional transaction costs might be incurred in dealing with a neighbour. However, T Tests were conducted between the different formats and workshops and there was no significant difference in the results. There do not appear to be any efficiency advantages between the bidding formats.

Figure 4.1 Relative bid values for corridor formation at Barcaldine and Jericho



In a live situation where a group format was applied, it is likely that some landholders would have to negotiate with several neighbours in order for a corridor to be linked across the region (rather than just the two or three used in the workshop). Some landholders may also need to negotiate with different groups of neighbours if they are in key linkage areas. These factors mean that the group negotiation process may involve large transaction costs in a real life situation. However, there may be other benefits associated with group negotiation processes, including improved participation rates and higher levels of compliance.

In the workshops, the two stage process worked well, and some participants preferred working on their own. The results in terms of identifying possible corridor linkages were very successful. In situations where multiple corridor locations are possible across a region, the multiple bidding process may be the most efficient way of identifying effective options. However, displaying the bid areas after the first stage provides information for strategic bidders and may increase the potential for holdouts.

Result 6: *No difference in bid efficiency could be found between the two bidding formats. In a real trial the group bid format may involve high transaction costs if negotiations involve several neighbours.*

Result 7: *A two stage (bid/rebid) bidding format resulted in more corridor options being available across the region, but is vulnerable to possible holdouts.*

4.4 Factors influencing bid prices

A multiple regression analysis was run on the data available from the corridor bidding rounds from both the Barcaldine and Jericho bidding rounds. Results of the model are shown in Table 4.1³, and show that a number of factors were significant in predicting bid values. It is noticeable that *Round* is not a significant variable in these regression results. It appears that after the individual bidding rounds participants were not adjusting their bids any further to reflect this factor.

Table 4.1 Predictors of bid value in corridor rounds at main workshops

		Unstandardized Coefficients		Significance
		B	Std. Error	
(Constant)		-1209.595	.000	.000
2 stage Corridor	Dummy coded 1 for 2-stage	853.435	.000	.000
Box	Area in acres	1.097	.000	.000
Broadleaf Ironbark	Area in acres	.530	.000	.000
Cleared	Area in acres	3.079	.000	.000
Gender	Dummy coded 1 = Male	535.368	.000	.000
Age	Age in years	172.581	.000	.000
Off-farm income	Dummy coded 1 if it exists	-4545.874	.000	.000
Interested in being paid by govt	Ranges for 1 = very interested to 5 = not interested at all	2267.428	.000	.000

a Dependent Variable: Bid amount
Model fit: Adjusted R square = 1

A number of predictors did emerge as significant in the regression. Their impact is summarized as follows:

- There was a premium for bids in the 2-stage corridor process relative to the bids in the group corridor process,
- Box, ironbark and cleared country were important explanators. The relative size of the coefficients is roughly in line with productivity variations between the country types,
- Male participants nominated higher bids than females,

³ The limited data set means that the model is ‘overfitted’ to some extent, as shown by the adjusted r-square and significance levels.

- Older participants nominated higher bids than younger participants,
- Participants with off-farm income nominated lower bids,
- Participants who were not interested in being paid by the government nominated higher bids,
- Some of the demographic and attitudinal variables had potentially offsetting impacts,
- The impact of the vegetation coefficients was likely to be small in relation to the impact of the demographic and attitudinal variables.

5. Other key information gained from the workshops

Feedback questionnaires were distributed at all the workshops and highlighted some important issues, but the most notable aspect of the workshops was that they provided a practical and valuable learning experience.

5.1 Workshops were enjoyable and provided an important learning experience

In general it appeared that most participants enjoyed the workshop process, although some had more difficulty with the calculations than others. However, once the initial calculations had been made and the costs of production had been determined, participants generally appear comfortable with the process. There were several key aspects that participants liked about the process including the following:

- *The process was fun, and enjoyable (mentioned by many)*
- *Gave insight into how a vegetation corridor might be conserved*
- *Gave insights into different opinions on grazing management and conservation*
- *Very informative*
- *Sharing private and public costs and benefits is an interesting and proactive concept*
- *Provides a positive approach and shows that grazing management and land conservation can coexist*
- *Constructive consultation*
- *It was easy to follow and fairly self-explanatory. Once the initial round had been completed the process ran smoothly.*
- *As fair to each participant as possible*
- *I liked the fact that it has the input of producers and it would allow people who look after their land to be rewarded*

When asked about what they didn't like about the process, participants focused on the following:

- *It was too long*
- *It was too difficult*
- *Needed more information*
- *Concerned about property viability*
- *Should focus on management, not corridors*

One of the best indications of the learning value of these workshops was at Jericho. The workshop was unfortunately held on the same day that new tree clearing legislation came into force in Queensland. The session began with some participants voicing their anger and hostility towards any concept of vegetation management and their skepticism about any government policy that be of benefit to them. However, by the end of the workshop participants understood how a competitive bidding process might work and how the outcome, a vegetation corridor, could have both private and public benefits. Some were clearly turned from skeptics to ambassadors of the process.

While the workshop appeared to be a positive learning experience for landholders, participants at Barcaldine and Jericho were specifically asked if it had any influence on their attitude to a competitive tender for conservation contracts. Nearly half (47%) said that it did (Table 5.1).

Table 5.1 Influence of the workshop on participants view of the scheme

	% of responses
Yes, the workshop changed my opinion a lot and I am much more interested	47%
Yes the workshop changed my opinion a lot and I am a bit more interested	29%
The workshop has not changed my opinion very much	12%
After learning about it in the workshop I am not very interested	12%
After learning about it in the workshop I am not interested at all	12%
I already thought positively about the concept	12%

5.2 Attitude of participants to a competitive bidding process for conservation contracts

Some members of the public believe there is a conflict between the idea of paying landholders for good management and the notion of “duty of care”. Participants were asked for their views on the subject. The majority (72%) thought that they should be paid for providing ecosystem services above a duty of care, but nearly a third (28%) thought that it was just good management, or they were not sure.

Another issue that was raised by several participants was the potential problem of holdouts. This is a very real problem in a situation where cooperation is required to achieve an outcome, i.e. a vegetation corridor. Careful attention will need to be paid to auction design to address this problem.

Some participants mentioned issues that related to concerns about equity. Some thought that everyone should use the same set of figures when calculating their bids. Others were not sure that the right people would be rewarded in a competitive bidding system, i.e. those managing their property in an environmentally responsible way. These concerns generally reflect a lack of understanding about the way a competitive bidding process might work – i.e. those managing their property well would have lower opportunity costs and therefore be able to offer low and competitive bids.

There appeared to be general support for a scheme where landholders could bid competitively for conservation contracts and the large majority of participants from all workshops (70%) indicated that if a scheme ran in their area, that they would put in a bid. However, the majority of these (80%) would like some form of assistance in developing a bid. The main form of assistance required would be in terms of understanding the full costs associated with a management change and in developing a bid. The majority of participants (60%) used the figures provided in the workshop to assist them in their bid calculations (see Appendix 4 and 5) and a further 25% used the figures in conjunction with their own experience.

Result 8: There would be local support for a competitive bidding scheme, but some assistance would be required in developing bids.

Result 9: To ensure a sufficient number of bidders it might be necessary to provide some compensation for the cost involved in developing and entering a bid.

6. Discussion and summary

The use of experimental workshops, run in the field with landholders rather than in the laboratory with students, had several trade-offs. Some of the advantages were associated with information that could be collected from landholders that would not have been possible with students. For example, information was collected about:

- landholder behaviour in the different auction formats, which including both individual and cooperative arrangements. Such information could not have been collected from students in a laboratory,
- the costs landholders associated with management changes required to form biodiversity corridors, and how these varied amongst landholders,
- the tradeoffs landholders made between different vegetation types on their properties,
- landholder attitudes to a competitive bidding scheme for incentive payments to achieve a biodiversity corridor in their area, and
- the total costs of running a live scheme.

On the other hand, there were some other tradeoffs and more statistically robust data could have been collected in a laboratory with students. For example, using landholder workshops:

- there was limited opportunity for repetition,
- the number of participants was limited,
- the variables influencing participant behaviour were not as “scientifically” controlled, and
- remuneration for attendance was more costly with landholders and limited the number of workshops.

One of the main aims of the workshops was to explore the way landholders behaved under different bidding formats and how in turn this might influence their bidding strategies and relative bid values. There are two opposing theories about how landholders might formulate the value of their bids for conservation contracts that will determine whether a single round or multiple round bidding design is the most appropriate. The “independent private values model” assumes that the opportunity cost of a contract is the basis of price formulation and as this is a fixed cost, a single round auction is sufficient (Latacz-Lohmann and van der Hamsvoort 1997). On the other hand, the “common values model” assumes that bids are formulated on bidders’ perceptions about the public value of their conservation contract. As such a value is based on perceptions the bid price is not fixed and may change in a multiple round system (Latacz-Lohmann and van der Hamsvoort 1997).

Landholders were keen to know what was wanted and how the relative bid values were calculated indicating they were using information about public values in their bid formation. It is possible that after establishing the opportunity cost of their bid, an additional component was added which accounted for public values and that landholders were appropriating some information rents (Cason *et al.* 2003).

However, there are two other components; learning and uncertainty, that might have translated into a premium added onto the bid price, and which was the margin for reduction in the multiple rounds. The multiple bidding rounds allowed landholders to learn about two important components of the bidding process; how to formulate their bids and how to adjust their bids to become a winning bid. This learning process differed between landholders and between workshops. Clearly, there was a considerable learning process for participants and it was unclear as to the extent this might have affected the bid amounts. If the bid component being reduced was purely a learning effect, then in a live situation, this learning process could be completed before the auction and a single round auction (bids represent a fixed opportunity cost) would be appropriate.

The issue of uncertainty is more complex. Participants were unfamiliar with the bidding process; were unsure of how to maximise their chances of winning, and were generally uncertain about the expected outcomes. Most graziers are familiar with an open, ascending bid process at cattle sales. In such a process they can gain information about the relative market price during the bidding process, and allowing bidders to learn about others' valuations during the auction can make them more comfortable with their own assessments and less cautious (Klemperer 2002). In these workshops, participants made sealed bids and were only provided information about who were the winners, and not about the winning bid values. To account for their uncertainty and to protect themselves against a form of "winners curse"⁴, it is reasonable to assume that some people would have included an "uncertainty" premium onto their bid price. It is possible that this might be another component of the bid that was reduced in subsequent bidding rounds. If uncertainty was a component of bid price, it is an effect that could possibly be reduced before a live auction, but is likely to remain an issue. In this case, a multiple round auction would be the appropriate format.

The results from the multiple bidding rounds indicate that competitive gains were to be made, but most gains were realized after only a few rounds. It is likely that initial bids were compiled based on the following considerations:

1. opportunity cost of management change
2. possibly some information rent,
3. possibly an additional cost of learning, and
4. possibly another premium to cover the cost of uncertainty.

It is also likely that considerations 2-4 were the components that were reduced in the competitive process and that given careful auction design, the learning cost could be completely removed (the learning process would need to be completed before the bidding process began). Given the current situation in Australia, where competitive incentive schemes for conservation contracts are not well developed or widespread, then it is likely that minimum bid prices will include an extra uncertainty cost. This uncertainty will only be removed once these schemes become more common.

⁴ The danger that in an ascending auction the winner has focused too much on winning and overestimated the value of the good. In this case it would refer to landholders who underestimate the true cost of their management changes.

In many procurement auctions bidding is costly (Colombo 2003) and bidders can incur costs of learning their costs of production (McAfee and McMillan 1987) or costs of preparing a bid (Menezes and Monteiro 2000). When these costs are taken into account some people may choose not to bid, and to ensure a sufficient number of bidders enter the competitive process, it may be necessary to subsidize the bidders that do not win the auction (Colombo 2003).

In the individual multiple bidding rounds, the use of five different bid components (vegetation types) and five different weightings for each one, meant that it was hard for participants to act strategically⁵. However, the potential for strategic behaviour increased in the cooperative bidding rounds.

There appeared to be a good opportunity for groups of landholders to work together in the formulation of a corridor bid, and there was some evidence this produced the lower cost outcome. It was clear that individual bids within the group would need to remain private and could lead to adverse selection or a free rider effect. It is also likely that there would be additional transaction costs involved in the negotiation process, particularly if one person had to engage with a number of neighbours. However, evidence from the USA suggests that once the extra transaction cost of a group bid has been incurred, there is less change of contract withdrawal at a later date (Cattaneo 2003).

The two stage (bid/rebid) bidding format was very successful in the workshop setting as the outcome was multiple corridor options from a two stage bidding process. However, the process clearly identified the opportunity for holdouts. This means that the bid/rebid format may only be suitable in situations where multiple corridor options are available.

The other key result of the workshop format was that it demonstrated how a bidding game can be used with landholders to demonstrate how a competitive tender system might work and encourage participation. The results of the workshop showed that substantial learning effects occurred as participants moved through the bidding rounds, implying that in a real application, participants need to be familiar with the issues and the auction design to generate efficient bids. The use of this type of workshop may be a very efficient process to familiarise landholders with the issues involved in competitive tenders and bid formation before a 'live' auction is conducted.

Acknowledgements

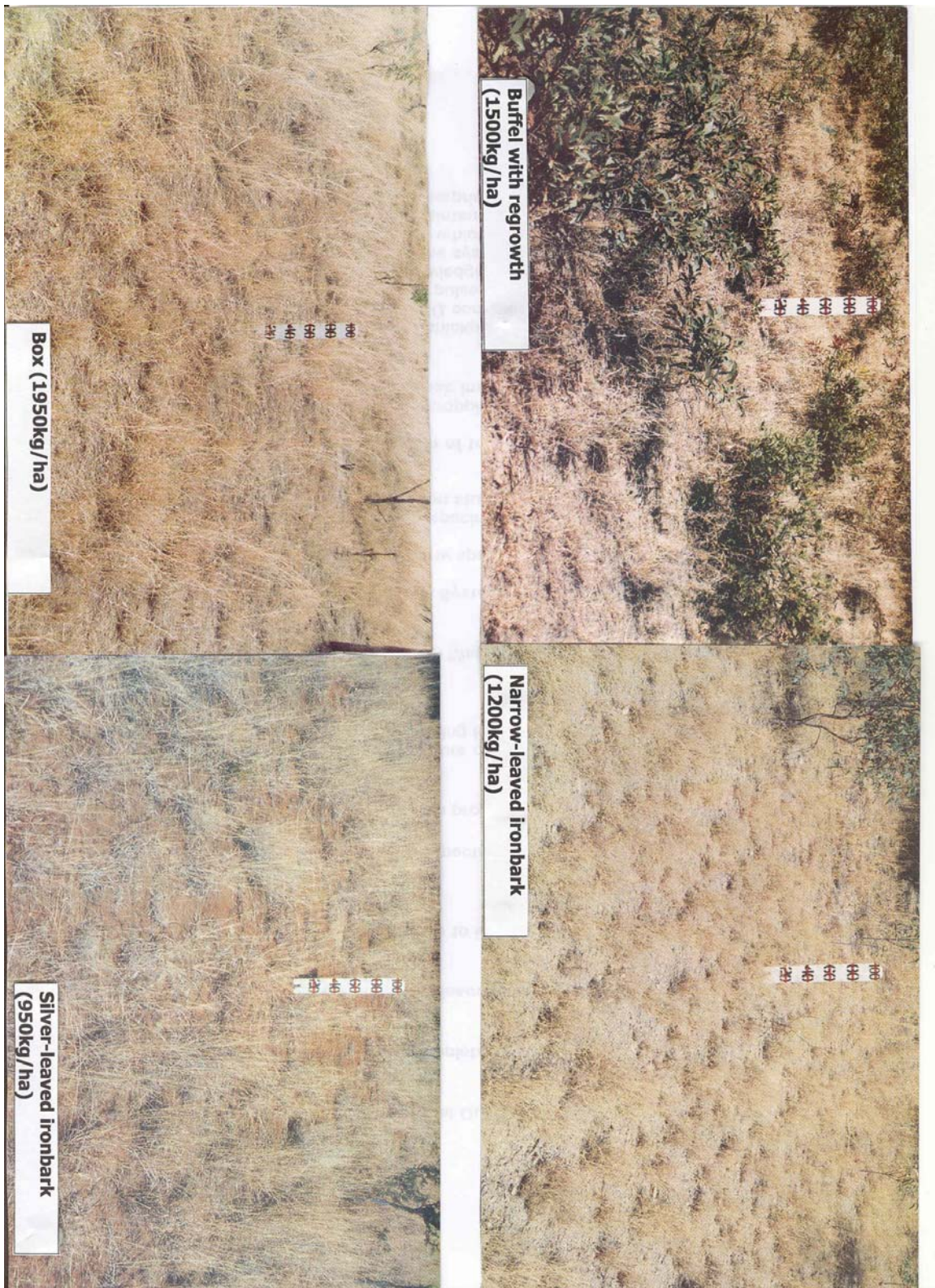
The design of this project and implementation of this project has involved contributions from members of the Desert Uplands Buildup and Development Committee. Their assistance in the organization and administration of the experimental workshops is gratefully acknowledged.

⁵ In Barcaldine, there were three husband and wife couples who worked together on their bids and might be assumed to have the same opportunity costs. There was a significant difference in the relative bid values of the husband and wife in two out of three couples.

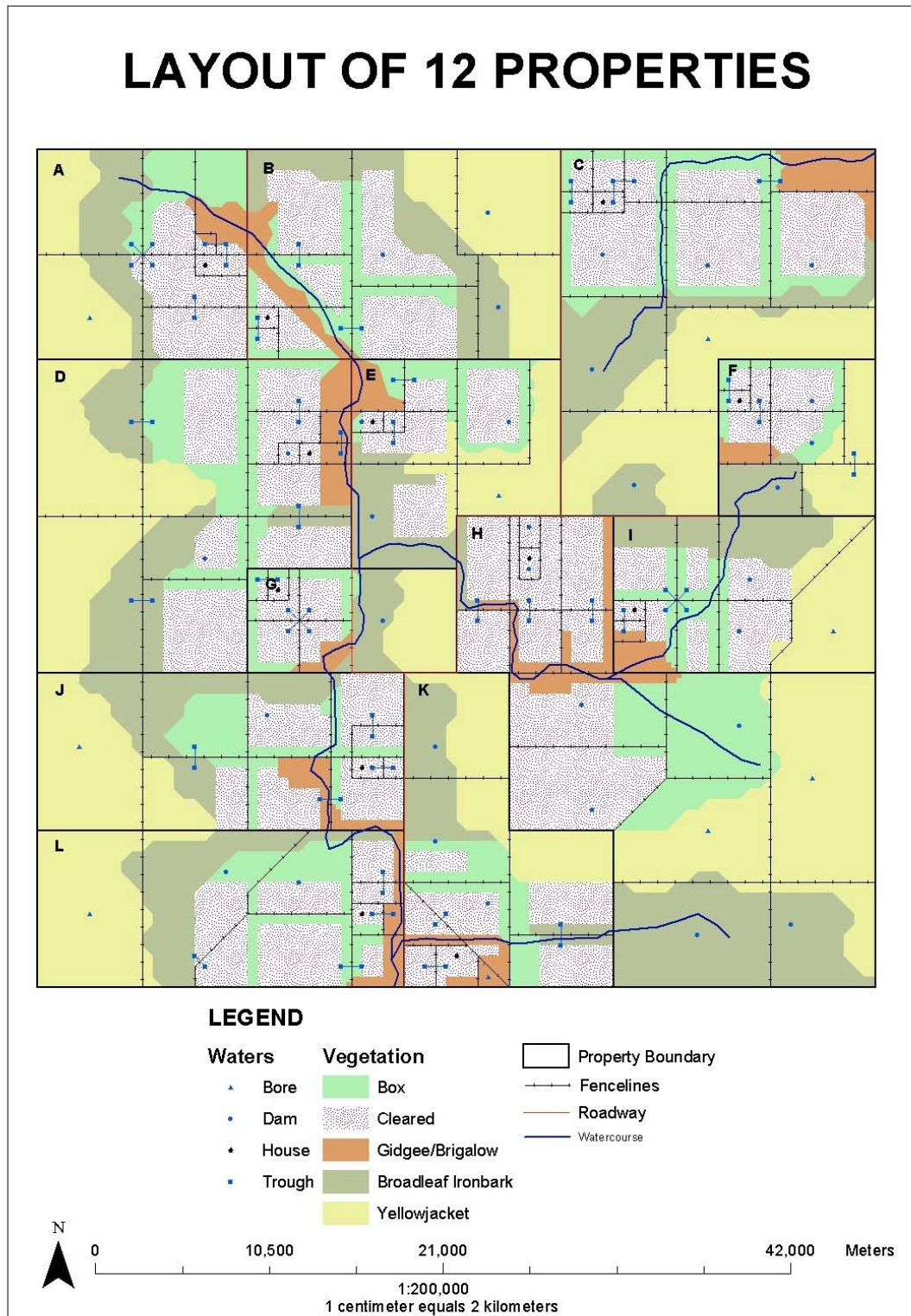
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Appendix 1. Pasture biomass photos

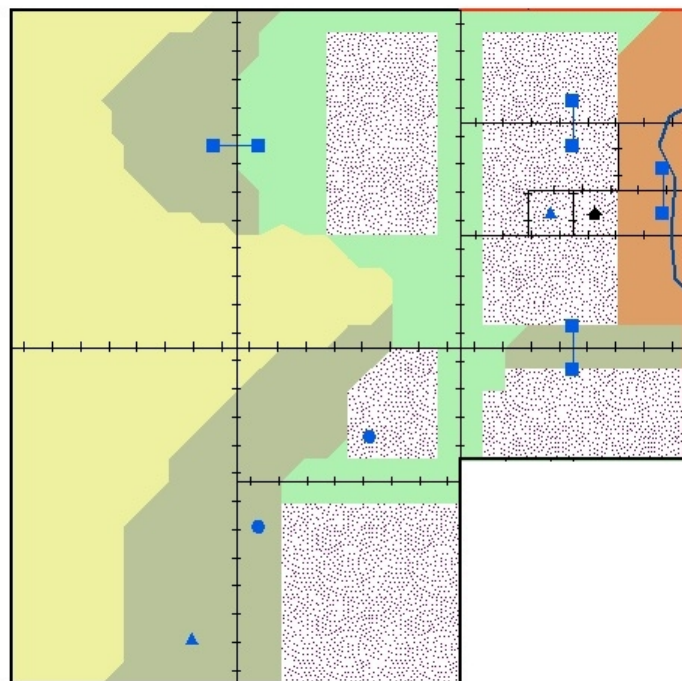


Appendix 2. Landscape map of 12 ‘dummy’ properties



Appendix 3. Individual property map

PROPERTY D "DUNAIRD" (32,000ha / 79,072acres)



LEGEND

Waters

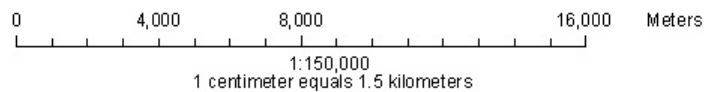
- ▲ Bore
- Dam
- ▲ House
- Trough

Vegetation

- Box (4,800ha / 11,860.8acres)
- Cleared (9,600ha / 23,721.6acres)
- Gidgee/Brigalow (1,600ha / 3,953.6acres)
- Silver-leaved Ironbark (6,400ha / 15,841.4acres)
- Yellowjacket (9,600ha / 23,721.6acres)

Property Boundary

- Fencelines
- Roadway
- Watercourse



Appendix 4. Practice worksheet

One approach to working out the change in production values for reducing stocking rates is based on the following for each country type:

Acres of vegetation set aside (A), multiplied by, the current stocking rate (B), multiplied by, the value per beast (C) = **Current revenue**
 Current revenue (D), multiplied by, the required reduction in stocking rate (E) = **Reduced income**

The total cost of changing management practice = Reduced income + other costs – any benefits (eg reduced operating costs)

	A	B	C	D	E	F	
Vegetation type	Acres set aside	Current stocking rate (Acres per beast)	Value of production per beast	Current revenue (A/B x C))	Reduction in stocking rate (%)	Reduced income (D xE)	
Example	50	25	\$225	\$450 (50/25 x 225)	20%	\$90 (20/100 x \$450)	
Gidgee / Brigalow							1
Box							2
Broadleaf ironbark							3
Yellowjack							4
Developed country							5
Add all costs	Total change in cattle income over one year				Total 1 to 5		6
	Add on any other costs						7
					Total cost (6+7)		8
Remove all benefits	Reduced operating costs						9
	Any other cost reduction or savings						10
				Total benefit (9+10)			11
Total cost of change					TOTAL COST (8-11)		

Appendix 5. Example of stocking rates for the Desert Uplands area

Vegetation type	Normal stocking rate	Change in stocking rate (cattle/acre)	Value of production per beast	Value per acre per annum
Gidgee/Brigalow	1 beast to 50 acres	20%	\$225 per annum	20% of \$225 ÷ 50 acres = \$0.90/acre
Box	1 beast to 40 - 50 acres	10%	\$225 per annum	10% of \$225 ÷ 40 acres = \$0.50/acre
Broadleaf Ironbark	1 beast to 45 - 55 acres	5%	\$200 per annum	5% of \$200 ÷ 50 acres = \$0.40/acre
Yellowjack	1 beast to 65 - 75 acres	5%	\$200 per annum	5% of \$200 ÷ 70 acres = \$0.29/acre
Cleared country	1 beast to 15 - 30 acres	10%	\$250 per annum	10% of \$250 ÷ 20 acres = \$1.25/acre

Appendix 6. Bidding sheet

Date _____

Session _____

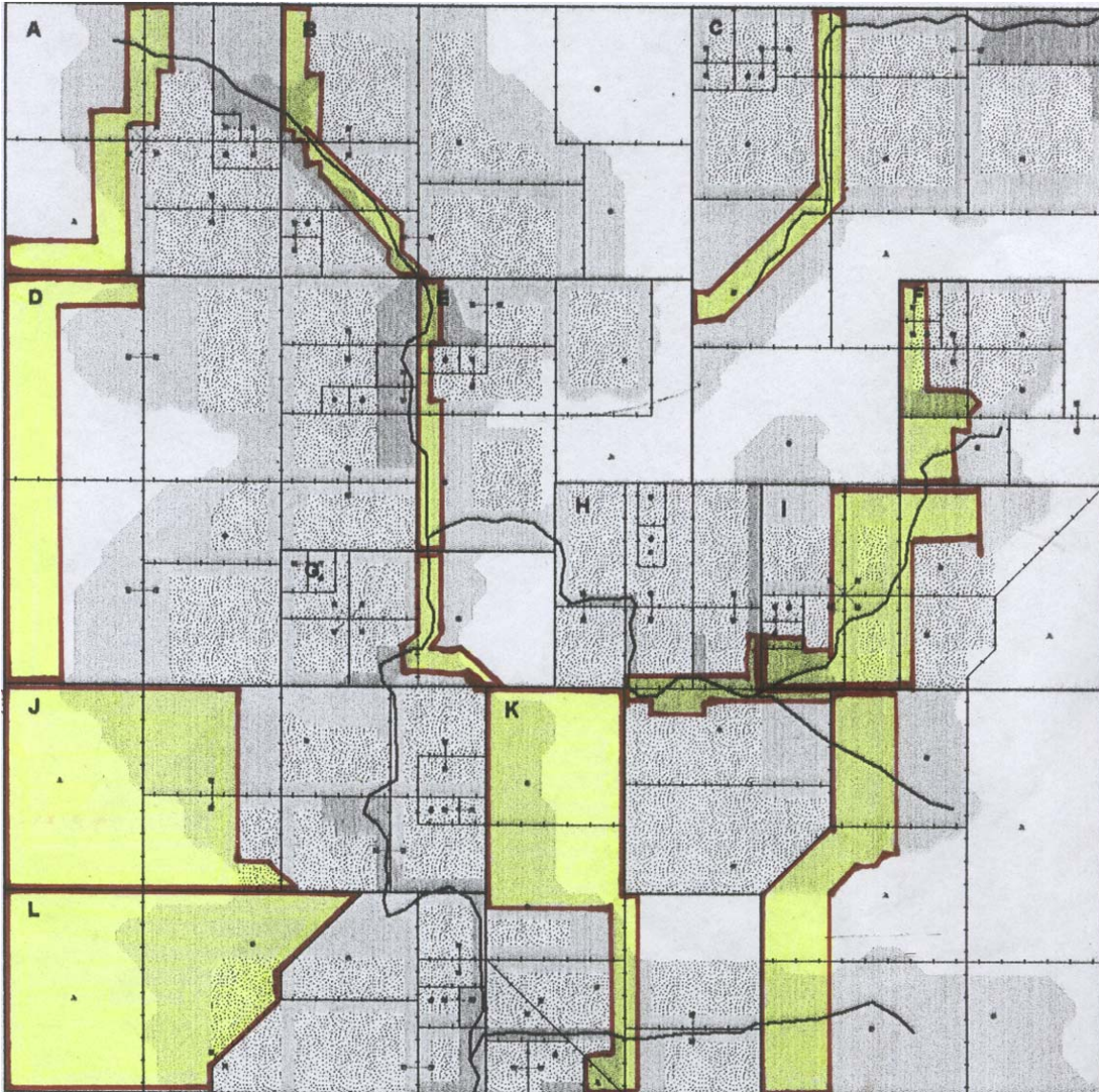
Round _____

Property _____

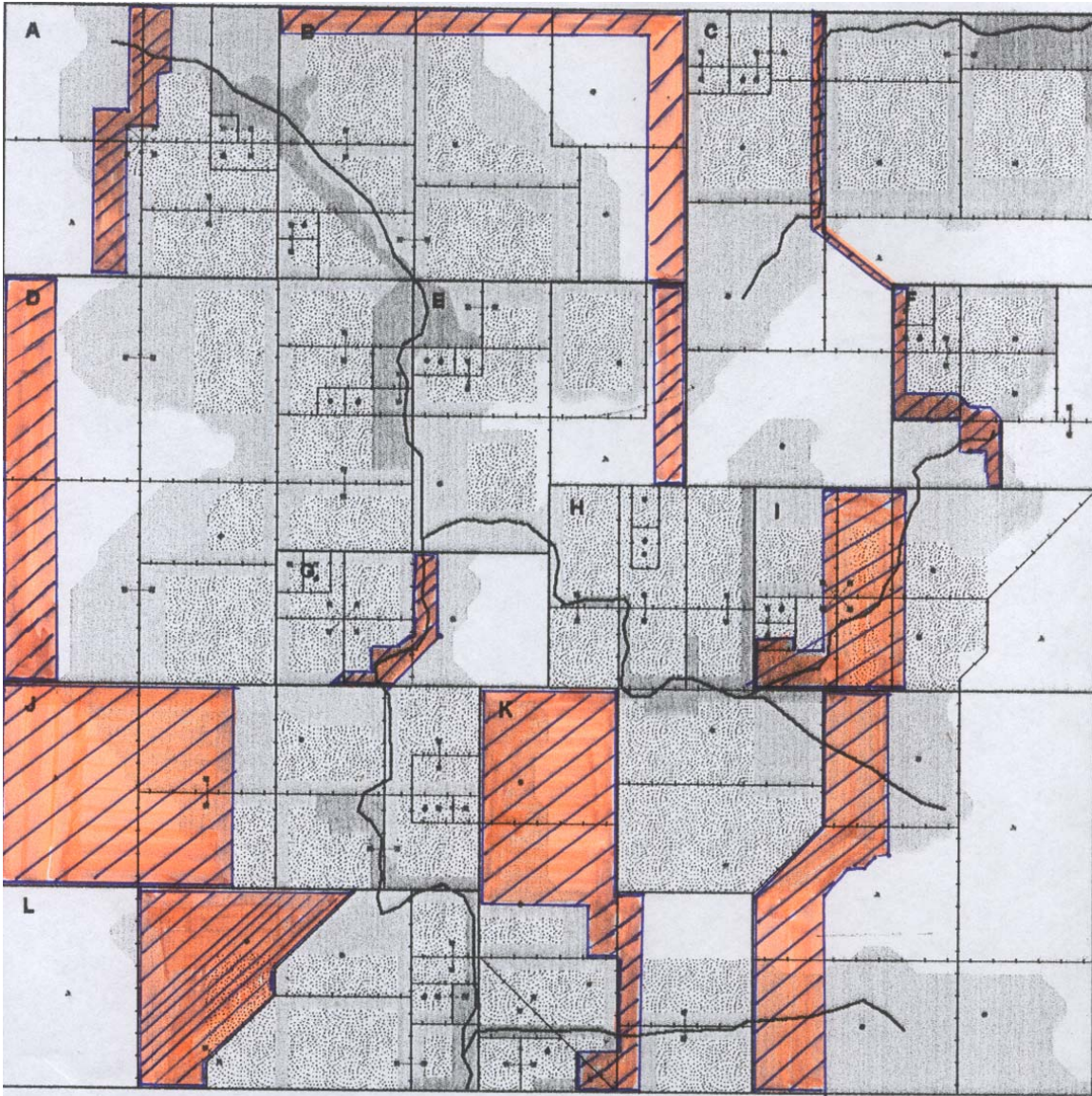
Vegetation type	Acres to be set aside
Existing Brigalow scrub	
Box country	
Broadleaf Ironbark	
Yellowjack	
Cleared country	

Amount of money needed
(each year for 5 years) \$ _____

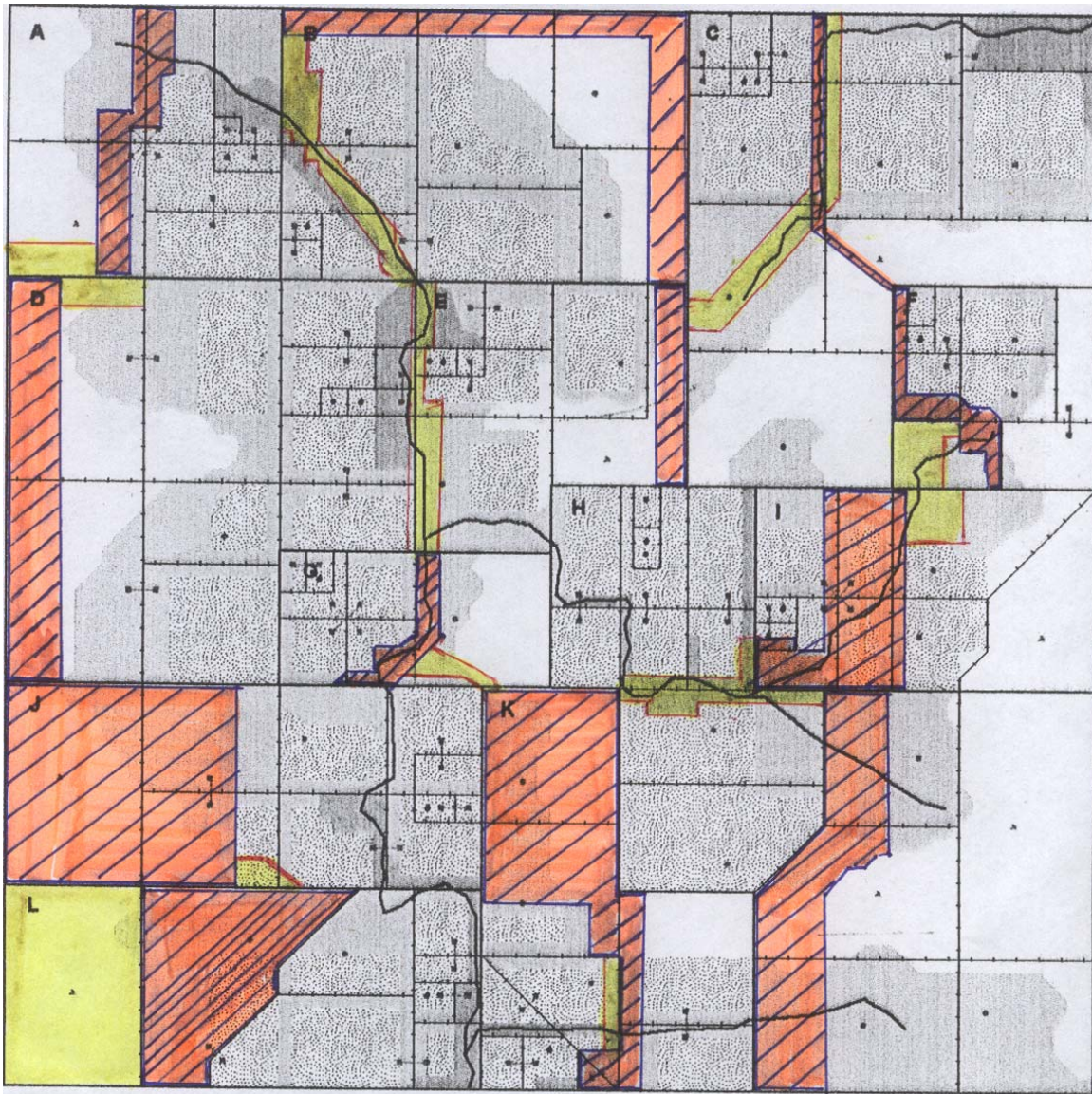
Appendix 7a Bid areas in round 1 of bid/rebid format



Appendix 7b. Bid areas in round 2 of bid/rebid format



Appendix 7c. Combined bid areas in round 1 and 2 of bid/rebid format



Other research reports in this series

Rolfe, J.C. and McCosker, J.C., (2003). *Overview of the issues in planning a corridor tender process*, Establishing East-West Corridors in the Southern Desert Uplands Research Report No.1, Environmental Protection Agency and Central Queensland University, Emerald.

Rolfe, J.C., McCosker, J.C., Windle, J., and Whitten, S. (2004). *Designing Experiments to Test Auction Procedures*, Establishing East-West Corridors in the Southern Desert Uplands Research Report No.2, Environmental Protection Agency and Central Queensland University, Emerald.

McCosker, J.C., and Rolfe, J.C., (2004). *Designing A Biodiversity Index To Assess East-West Landscape Linkage*, Establishing East-West Corridors in the Southern Desert Uplands Research Report No.3, Environmental Protection Agency and Central Queensland University, Emerald.