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A competitive bidding process with landholder cooperation for landscape linkage

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Abstract

There has been growing interest in the use of market-like instruments to achieve cost effective environmental outcomes, and a range of new tools are being explored. While competitive processes such as BushTender have been successfully designed to establish conservation contracts on private land, it is much more difficult to design competitive tenders that also require cooperation between landholders. This paper reports on a series of experimental workshops held with landholders in central-western Queensland to design an auction process that would protect biodiversity in a vegetation corridor. The research focused on options to develop a corridor where landholders need to cooperate on location options within a competitive bidding process.

Keywords: Market-based incentive, auction, landholder cooperation, vegetation corridors, conservation contracts

1. Introduction

The government has a range of policy options to govern the use of environmental resources. There is a need to protect both the stock of environmental resources and the flow of services they provide. While some environmental stocks can be protected under public ownership, such as National Parks, other stocks are under private ownership and require a different set of policy tools. The conservation of environmental resources on private land is particularly important in Queensland where 88% of vegetation types listed as “endangered” (1.5 million ha) and 92% of those listed as “of concern” (9.5 million ha) are unprotected and occur on private land.

There is a general recognition that existing policies, directed towards reducing the environmental impacts of some land management practices, have failed to deliver the outcomes required. There is a belief that the decade of Landcare, while valuable in terms of awareness raising and capacity building, has under-performed in terms of delivering tangible environmental outcomes (van Bueren 2001). This has led to the consideration of a range of alternative policy options, and in particular to the use of market-based incentive approaches.

The BushTender project (Stoneham *et al.* 2003), a pilot initiated under the Victorian Department of Natural Resources and the Environment, was the pioneer auction for conservation contracts in Australia. The success of the project has encouraged further trials and development of the mechanism as an important policy tool that is able to maximize the efficient allocation of public funds to achieve environmental outcomes. In particular, it has led to the National Market-Based Instruments (MBI) Pilot program which was established in 2003 under the National Action Plan for Salinity and Water Quality. In this paper, some results from one of the ten pilots are presented.

The project was located in the southern Desert Uplands region of central western Queensland. Vegetation in the region, which is approximately the size of Tasmania, is becoming more fragmented from clearing and grazing activities. There are very limited areas of public land in the region, with 99% of “endangered” and 97% of “of concern” ecosystems occurring on private land. This means that landholders need to be engaged if the conservation of native ecosystems is to be improved.

The focus of the project was on biodiversity conservation, through the protection of vegetation in corridors linking across the region. Corridors have substantial benefits over scattered remnant protection because they allow wildlife to migrate when seasonal conditions change, and they help to ensure that critical mass is achieved. Key ecological benefits may be protected if east-west vegetation corridors could be established across the region. A corridor would be approximately 150 kilometers in length, and involve participation from 12 – 15 landholders. Competitive tender processes such as BushTender provides insights into how landholders may be encouraged to protect a vegetation corridor on their property, but it does not ensure that corridors are connected between properties and across the region. A new auction design was required that involved landholder cooperation.

There have been some trials in experimental economics that have provided some insights into the issue of landholder cooperation. Parkhurst *et al.* (2002) tested the use of an agglomeration bonus where an extra bonus was given for every acre retired that bordered on another retired acre. Laboratory results showed that a no-bonus mechanism always created a fragmented habitat, whereas with the bonus, players found the first – best habitat reserve. Parkhurst and Shogren (2004) move to a four player scenario and use the agglomeration bonus to create four different spatial conservation objectives – a core, a corridor, a cross, and a corner habitat configuration.

Both Pushkarskaya (2003) and Taylor *et al.* (2004) examine the use of group contracts for nonpoint source water pollution abatement. Pushkarskaya (2003) tests a bidding process to select the least cost team of abaters that avoids adverse selection by assigning individual abatement targets that are enforced within the team. Taylor *et al.* (2004) take a similar approach and explores the issue of moral hazard with the use of an “all or nothing” team contract. A first round bidding format is used to select the most cost effective team and then a second round of bidding is held where individuals place a bid to contribute to the group target. While the laboratory experiments found that positive outcomes could be achieved, the available data was limited. However, the experiment assumed that all participants would indeed cooperate in a group contract, and the problem of holdouts is not addressed. Both are issues explored in this paper. As Shogren (2004:1218) points out, the “question is what makes the mechanism work in practice for people who frequently fall short of the hyper-rational game theoretic ideal”.

In this paper, the results are reported from two experimental auction workshops conducted in Barcaldine and Jericho (518 kms and 434 kms west of Rockhampton respectively) in April 2004. The experimental workshop was a new hybrid model developed for this project to explore issues of auction design. 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.

Full details and results from the workshops are presented in Windle *et al.* (2004). The planning issues involved in planning the workshops and auction design are presented in Rolfe and McCosker (2003) and Rolfe *et al.* (2004). While simplistic metrics were used for the workshops, a process for assessing a biodiversity score and landscape linkage score has been outlined in detail in McCosker and Rolfe (2004).

The key focus of the workshops was to explore different auction design formats to elicit landholder cooperation. A discriminative price, sealed bid auction was used and two bidding formats to achieve landholder cooperation were tested. In the first, landholders were placed in groups of three or four and had to negotiate the location of a corridor across all properties, but then submitted individual bids for their participation. In the second, a two-stage individual bidding format was applied. After an initial bidding round

to locate a corridor across each property, landholders received feedback about the regional location of all bids, and were given the option of a second round bid, where they might readjust the location of their corridor to align with a neighbour, and increase their chance of submitting a successful bid. In both formats, participants were provided with small incentives to lodge the most cost-effective bids and form part of a winning corridor team.

The paper is organized as follows. The workshops are described in the next section and details and results of the two different bidding formats are outlined in the third section. The results are discussed in section four, and conclusions presented in the final section.

2. The experimental auction workshop and auction design

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 were 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 would help to identify this information better, and
- The involvement of landholders would 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.

Three critical issues were identified for the introduction of a vegetation corridor across the region. The first is the issue of participation, where relatively high levels would be required to achieve several alternative locations for a corridor and thus introduce a competitive framework. The second is the potential problem of holdout bids, where it is important to design a process that does not encourage holdouts to occur. The third is the

issue of bid formation and budget constraints, where it may be important to predict the total cost of achieving a corridor option in order to secure funding for implementation.

The workshops were designed around the use of an experimental ‘game’ developed specifically for this project. A series of dummy properties were developed that were realistic for landholders while minimizing the number of variables that could affect participants’ bid behaviour. Each participant was given a property map with the following details:

- 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 (that broadly reflected the distribution of the vegetation at the regional level),
- 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.

An example dummy property map is presented in Appendix 1. Twelve dummy properties were created that combined to form a grid of properties (see Appendix 2), which meant there was a maximum of 12 landholders in each workshop. While participants worked with dummy properties they were asked to make all decisions based on their knowledge and experience of their own properties.

The environmental focus of the game was biodiversity conservation, through landscape linkage. Participants were informed that the auction involved their nominating areas of their property that they were prepared to manage more conservatively, and that their bid price should reflect to cost to them of the required management changes. The baseline management conditions that applied were:

- *Commitment to retain a certain amount of pasture at the end of the dry season annually – about 1500kg/ha¹. (pasture photographs were provided)*
- *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.*

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*
 - *Box - second highest*
 - *Silver-leaf Ironbark - third*
 - *Yellow Jacket - fourth*
 - *Cleared - lowest*
- *Commitment of east-west linkage across the property.*
- *Make bid relevant to property viability.*

The relative bid values were assessed on the biodiversity score of each vegetation type; a corridor linkage score and the bid price. In addition, each property bid had an endowment score that adjusted for property size. Full details are provided in Windle *et al.* 2004. A spreadsheet had been created in ©Microsoft Excel and once the details of each bid were

¹ This is equivalent to approximately 40% ground cover. 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%.

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.

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. 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.

Three main bidding formats were trialed. 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 served as warm-up rounds, where participants became familiar with the experiment structure and were able to trial different approaches to bid formation. The aim of these early rounds was to avoid major learning effects being confounded with different auction designs in the latter part of the workshop.

The second part of the workshop focused on testing the two bidding formats that required cooperation between landholders to establish a continuous vegetation corridor across properties. The first involved landholders working together in a group and in the second, a two-stage bidding format was tested where individuals placed a bid and were then given the option of placing another readjusted bid in the second round, once the location of corridors in the first round had been established. The results of these cooperative bidding formats are the focus of discussion in this paper.

3. Bidding formats for cooperative outcomes

3.1 Group bidding process for corridor formation

Participants were organized into groups of three or four, 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. Each member of a group were given dummy properties that joined, so it was possible to establish corridors.

In this round, each group had to submit a vegetation corridor linked across all properties in the group. This required cooperation between group members to ensure each corridor linked at property boundaries. However, each individual property bid remained confidential, and was submitted after the corridor location had been decided.

Consequently, a corridor was formed across the properties but the relative value of the individual property bids varied. Bids for each corridor option lodged were assessed to determine which was the most cost-effective corridor, 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.

3.2 Individual two-stage bidding process for corridor formation

The second bidding format that was tested involved individual bids submitted in a two-stage process. It was explained to participants that the objective was to achieve a corridor linking across the set of dummy properties. The property maps had been designed so that north-south or east-west corridors could be designed. Landholders were asked to submit a bid for a corridor across their property, with the knowledge that a full corridor would need to be achieved before any individual bids could be successful. After the first round, bids were assessed and the location of each property corridor was drawn on a large map for all participants to view. As expected, the number of individual bids generated a series of discrete links that rarely happened to join at property boundaries. Participants could then see where potential corridors could be formed across the 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, giving clear incentives for participants to be part of one or more corridors linking across their dummy property. 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 one or more neighbours,
- provide an additional area to link to a different corridor option, or
- reduce their bid price.

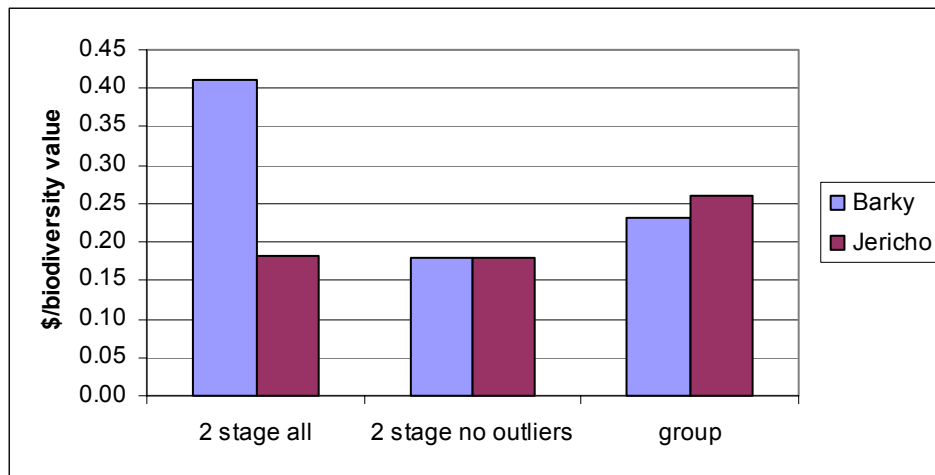
The layout of the corridor areas in Round 1, Round 2 and combined rounds are presented in Appendix 3a, b and c respectively. While the diagrams are not very clear, the behaviour of the landholder with Property C (top right hand corner) is clearly depicted. In the first round bid the corridor follows the watercourse; it runs north to south and then veers to the south west. After the first round results have been displayed, it is clear that the corridor location of Property C does not connect with the neighbouring Property B, but if the corridor is readjusted to veer off to the south east, it would connect with Property F. In Round 2 Property C puts in another bid and creates a new corridor opportunity. However, Property B also offers a new location in Round 2 and creates the opportunity of linking with the Round 1 bid from Property C as all Round 1 bids remain live.

This bidding format was very successful. Many landholders bid for multiple corridor locations across their property, with the result that many options for different corridor linkages were identified (a total of 18 in Barcaldine). 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.

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

The average relative bid prices for the different corridor bidding formats at the two workshops are presented in Figure 1. The lowest relative bid values represented the best value for money. The influence of two individual bidders at Barcaldine was strong, and once removed the results from Barcaldine appeared similar to those at Jericho. The relative values of the group bids were higher than those for the two-stage bidding process, implying that additional transaction costs might be incurred in dealing with a neighbour. However, T-tests were conducted between the different formats and workshops, indicating that there was no significant difference in the results.

Figure 1. Average relative bid values for corridor formation at Barcaldine and Jericho



It is interesting to note that there were no outlying bids in the group bidding format at Barcaldine, which was held after the two-stage bidding round. The two individuals with the outlying bids in the two-stage bidding round were both in the same group, and both placed bids in the group bidding round that were close to the average. This suggests that group dynamics may reduce the tendency for strategic behaviour.

When all bids are considered, the influence of individual bids can be strong, but the more expensive bids are unlikely to be part of a successful combination in a live situation. A more useful examination is to compare the “winning” bids across the different bidding formats.

Details from Barcaldine of the three group (combination of four individuals working together) bids and the top three two-stage (combination of four individuals bidding independently) corridor bids, are presented in Table 1.

Table 1. A comparison of successful corridor formation bids at Barcaldine

Bidding format	Bid amount (\$/year)	\$/acre	Biodiversity score*	Area of Corridor (acres)	Biodiversity and corridor score* (BS*CS)	Relative bid value \$/(BS*CS)
Group 1	23682	0.43	117697	55150	110340	0.215
Group 2	17977	0.70	96050	25625	80442	0.223
Group 3	24032	0.86	104355	27950	104355	0.230
2 stage	13306	0.41	119193	32450	108763	0.122
2 stage	12887	0.41	115728	31250	105601	0.122
2 stage	37954	0.82	179726	46200	146027	0.260

* details of how the biodiversity and corridor scores were assessed are presented in Windle *et al.* (2004)

There is little different in the average relative bid values in the group bidding format, whereas in the two-stage format the first two combinations had a significantly lower relative bid values than the third. If the winning bid combination from each group is compared, the relative value of the group bid is significantly higher than the two-stage combination (T statistic:-2.791; d o f = 6). The value of the group bid was nearly double that of the winning two-stage combination.

3.4 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 2, 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 2.² 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 = <i>very interested</i> to 5 = <i>not interested at all</i>	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,
- The area of 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,
- 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.

The results show that the area of the different vegetation types to be conserved was a relatively lower influence on bid value than a combination of attitudinal and demographic variables. This indicates that a key factor in developing a viable bidding mechanism is to engage participants in ways that develop confidence in the auction mechanism and the bid formation process.

² The limited data set means that the model is ‘overfitted’ to some extent, as shown by the adjusted r-square and significance levels.

4. Discussion

The preliminary evidence from the workshops suggested that the group bidding format was preferred by participants. This is consistent with a 'Landcare' approach to natural resource management, where group participation is often a key element in management strategies. Results demonstrate that group bidding processes are viable, particularly when small numbers of landholders are involved.

There are three key potential disadvantages of applying the full group bidding process at a corridor level. The first is that transaction costs can be expected to rise as groups get larger and landholders have to negotiate outside of their circle of immediate neighbours. Because a corridor across the region may have to cross 12 – 15 properties, it may not be a simple matter to form a group and have it effectively negotiate a position. These transaction costs may be reduced with the aid of a coordinator, but would still remain substantial.

The second potential disadvantage of the group bidding process is that it involves a prior selection of participants. Where there are a number of properties in a region, there is normally a large combination of properties that can be selected to form a corridor, and a single property may be part of many different options. If a single group is formed, it typically represents a single path. A group approach to bid formation would tend to reduce the potential for landholders to be part of different bid options. This can be demonstrated from the workshop example, where three group bids were designed for the 12 dummy properties, and 18 separate corridor combinations emerged from the independent 2-stage auction. This means that the use of group processes to form bids may not generate enough separate bids to have a genuinely competitive process.

The third key disadvantage of group bidding processes is that average bids would be expected to be higher. This is because there could be expected to be some 'norming' behaviour where participants not only decide the location of a corridor, but what the bid costs for different land types might be. It is much more likely that those with lower marginal costs will raise their bid prices to 'norm' with others in the group, thereby raising overall bid levels.

The potential for this 'norming' of bid price was minimized in the workshops by asking participants to design the corridor as a group and then submit individual bids. However the results (as shown in Figure 1) indicate that some factor has pushed up bid prices from the group process. The lower average bids from the independent two-stage process are likely to be the result of the increased competitive pressure that emerged. Participants were aware that if they had individually high bids, they might miss out on being part of a team because a corridor might be designed around them. In the group process, they were assured of being part of a bid, and did not face the same level of competitive pressure.

Despite these disadvantages, there may be several benefits associated with group negotiation processes, including improved participation rates and higher levels of compliance. 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).

Other advantages of a group bidding format are:

- It avoids a second bidding round,
- More likely to get an outcome than individual bidding,
- Most people are comfortable with dealing with their neighbours,
- As landholders undertake their own negotiations, they are more likely to comply and outcomes will be achieved, and
- It deals with holdouts better than individual bidding.

Other disadvantages of a group bidding format are:

- It will be more expensive,
- High incentives may be required to encourage participation,
- A facilitator may be required to encourage groups to form, and
- Some landholders might not like dealing with neighbours on environmental issues, which marks a change from the normal basis of the relationship.

Overall, a group bidding process is possible, but increased costs may make it less attractive than a two-stage bidding process in many situations. The group bidding process appears to be more suited to situations where:

- (a) group size does not have to be large,
- (b) there are a number of groups that can be formed, ensuring that competition is maintained,
- (c) use of groups can encourage higher participation rates, and
- (d) use of groups can encourage better compliance.

The two-stage bidding process also worked well in the experimental workshops. The process and results demonstrated several key advantages. The first is that it optimizes the selection of corridor paths across a region, because corridor options are not restricted to membership of a group or to a single option from a group. The second is that it increased competitive pressure on participants, ensuring that more cost-efficient corridor options were generated.

Other key advantages of a two-stage bidding format are that:

- Bidders do not have to deal with their neighbours,
- It caters for people who prefer to be independent,
- Participants have a better understanding of the regional outcomes,
- It suits the development of a web based bidding tool which is likely to be the most efficient tool, (although web-based design may adversely affect participation), and
- A facilitator is not required.

The main disadvantages of a two-stage bidding format appear to be:

- The bidding process may be complex for many participants,
- Low participation rates may be a problem,
- Neighbours may need to negotiate in the second round,
- It clearly identifies the potential for holdouts,
- Some bidders may need to be encouraged to readjust their bids in the second round,
- Two rounds may not be enough to allow all adjustments to occur, and
- The timing of the site assessment may be difficult if bids are changed in the second round.

One of the main issues arising from this format is that it clearly identified the opportunity for holdouts. The problem of holdouts arises because after the first bidding round, the location of all individual bids is outlined in a regional overview. All bidders can then clearly see if the location of their corridor aligns with that of a neighbour. This is the very point of the format, so that bidders can readjust their second round bids if necessary, and increase their chances of selection. However, if a bidder finds they are located in the middle of an obvious corridor, they have the incentive to either holdout completely in the expectation that they might be given further incentives to participate, or to act strategically and increase their bid price. The importance of holdouts will be reduced if there are plenty of participants and in situations where multiple corridor options are available. To some extent, strategic behaviour can be averted by keeping all Round 1 bids live, so that landholders can not simply increase bid price. Other design features that can help to reduce the impact of holdouts are:

- no new entrants in the second bidding round,
- a joint bid bonus is paid to encourage cooperation,
- the environmental outcome of a corridor at all cost be relaxed to the acceptance of “stepping stones” if necessary (bidders should be made aware of this), and
- possibly include multiple outcomes in the auction to encourage a range of bidders.

The other concern that will influence the successful implementation of a two-stage bidding process, and competitive tenders generally, is that low participation is likely to be an issue in many parts of Australia, and certainly in Queensland. In recent years in Queensland, there has been an erosion of private property rights, particularly on freehold land (the reduction having occurred much earlier in some other states). Many landholders do not trust the government, and think that any voluntary agreements are the first step in a process that will further erode their property rights.

Landholder attitudes will have a primary influence on the response rate to an auction, such as attitudes to:

- government funded incentive schemes,
- legally binding management agreements,

- property rights, particularly on freehold land,
- uncertainty about an auction process,
- uncertainty about all the costs involved and the potential for hidden costs, and
- the costs of developing a bid and the likelihood of success.

Ensuring participation rates are high enough will be a major challenge in some areas and will result in higher budget requirements. There is no clear guidance in the literature on minimum participation rates, though van Bueren (2002) quotes the US EPA (2001) finding that simulations have demonstrated that at least 8 participants are required for a market to operate efficiently. If cooperation is required between landholders, certainly the number will have to be higher.

To encourage participation, not only will an extensive promotional campaign and program of information sessions need to be planned (the trial auction workshops outlined in this paper are an excellent educational tool), but consideration will need to be given to providing bid entry incentives (not necessarily financial). Participation may also be encouraged by using local groups for administering a program, and through the appointment of suitable coordinators.

Low participation might also mean that some of the restrictions in the auction design may need to be relaxed. For example, the no new entrant rule might be relaxed. It is likely that in the pioneer auctions, some landholders will be reluctant to get involved immediately. However, once the auction is underway, some landholder may want to join the bidding process. This is most likely to occur after the first round results have been announced and the regional location of all corridor bids has been released, which will spark much discussion amongst landholders and in the community.

Where there is a gap in corridor linkage there will also be a strong incentive to allow a gap bidder to enter a second round bid. However, if new entrants are allowed at this stage their potential for strategic bidding will be large. On the other hand, if participation is low, there would be benefits of having a gap bidder enter a second round bid, particularly if their reluctance to join in the first place was more about uncertainty than strategic behaviour, and if it was clear their bid could not exceed the reserve price.

The participation issue means that for the Desert Uplands, some combination of a group bid approach and the two-stage bidding design might be considered. This might work by allowing small groups of landholders (2 – 4 landholders) to enter bids as well as single bidders. This may achieve the participation and compliance benefits of group behaviour while maintaining the key economic advantages of the two-stage bidding process.

5. Summary

The experimental workshop format designed for this project demonstrated how a bidding game can be used with landholders. For landholders, the key benefits of using the

experimental workshop are that it demonstrates how a competitive tender system might work and encourages 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.

The workshop allowed two potential auction systems to be compared and tested. The first was a group bid process, while the second was an independent two-stage bidding process. The results demonstrated both options were viable, and allowed potential weaknesses and strengths of each to be identified.

The key strengths of the independent bid approach appear to be that it reveals a wide variety of potential corridor options, allows many different combinations of landholders to be formed and assessed, provides automatic incentives for bids to be adjusted, and places competitive pressures on participants to submit cost-effective bids. In contrast, the group bidding approach is much more rigid in the number of options that can be formed and submitted, is likely to be less cost-efficient, and to have high transaction costs where larger groups involved.

The group bidding approaches do have some key advantages that may make them more efficient in some situations. These include advantages in terms of encouraging participation and compliance, and in reducing participation costs (at least for some members). The use of a coordinator to form and operate groups may help to strengthen these advantages and minimise the weaknesses.

The workshop results provide some insights into how vegetation corridors might be established across the Desert Uplands region. The independent two-stage process appeared to be more efficient in generating outcomes than the group bidding process. This was because the two-stage auction format generated substantially more corridor options, provided more flexibility to participants and placed more competitive pressure on bid formation. There was some weak statistical evidence to suggest that there was more bid efficiency in the two-stage bidding process compared with the group process.

However, the workshops also demonstrated that it would be difficult to ensure high rates of participation from landholders in the region, and that attitudes and other factors would drive bid formation. These issues indicate that there may be real advantages in a group bid process, where 'norming' behaviour tends to lift participation and compliance rates. The difficulties with applying the group bid process to the case study region is that the transaction costs of running a group might be very high, and there may not be enough group bids developed to ensure a competitive process.

These results suggest that a viable approach may be to use the independent two-stage auction design, but with particular attention to strategies that address participation rates, and complexity and learning issues. The use of the workshop approach to familiarize

landholders with the process prior to a bidding round is recommended. Some of the strategies that might be considered to encourage participation and ‘norming’ behaviour include the use of local groups for administration, and the appointment of an experienced coordinator.

Another possibility is to design some combination of the two approaches, where landholders may be encouraged to submit bids as small groups as well as individually, with the understanding that they could be part of several different corridor strategies. This would achieve some benefits of group behaviour without the requirement that only whole group bids be submitted for corridor options. A combined approach would require particular attention to the various incentives that participants might face, as well as to metric design, auction design and other design issues. These remain an important topic for further research.

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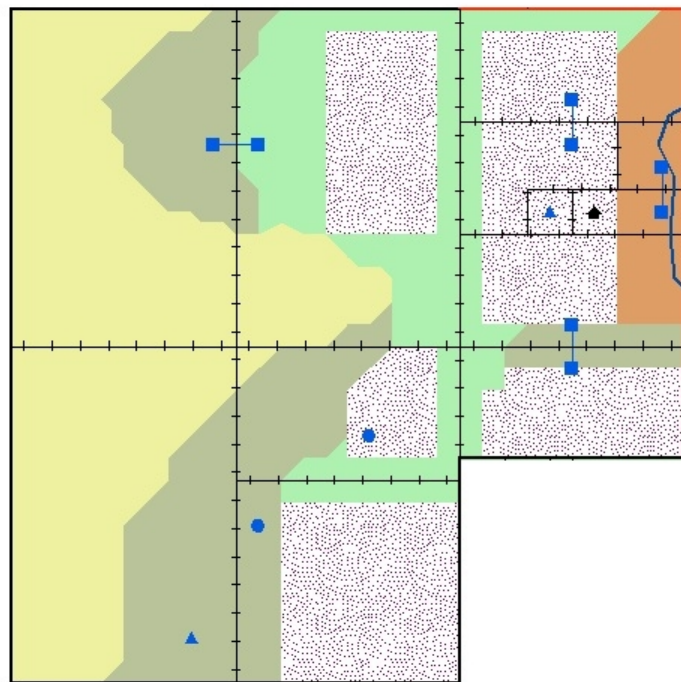
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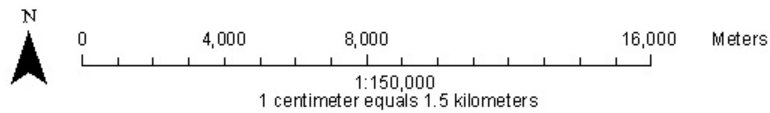
Appendix 1 Individual property map

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

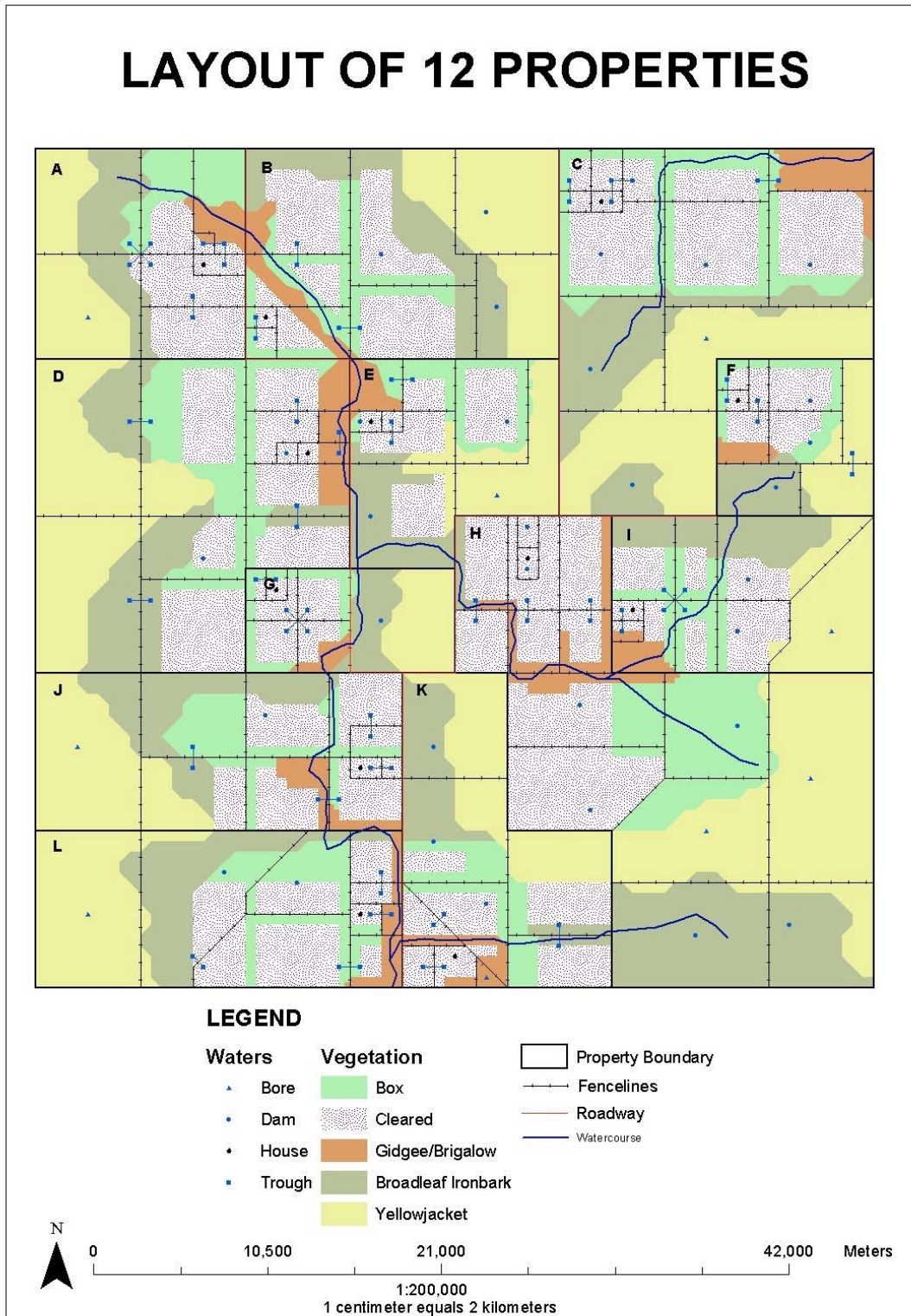


LEGEND

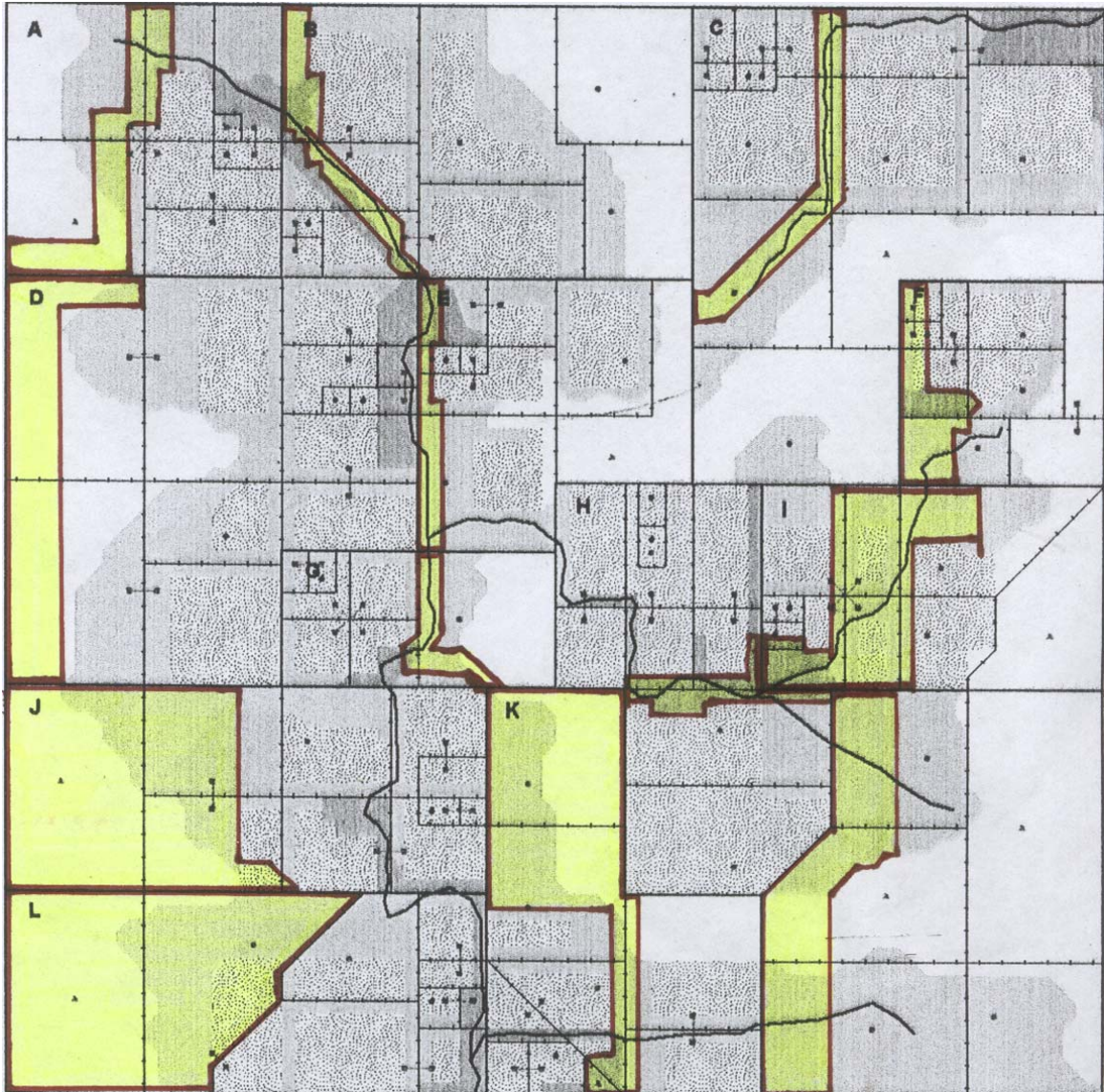
Waters	Vegetation		
▲ Bore	Box (4,800ha / 11,860.8acres)	▭ Property Boundary	—+—+— Fencelines
● Dam	Cleared (9,600ha / 23,721.6acres)	— Roadway	— Watercourse
▲ House	Gidgee/Brigalow (1,600ha / 3,953.6acres)		
■ Trough	Silver-leaved Ironbark (6,400ha / 15,841.4acres)		
	Yellowjacket (9,600ha / 23,721.6acres)		



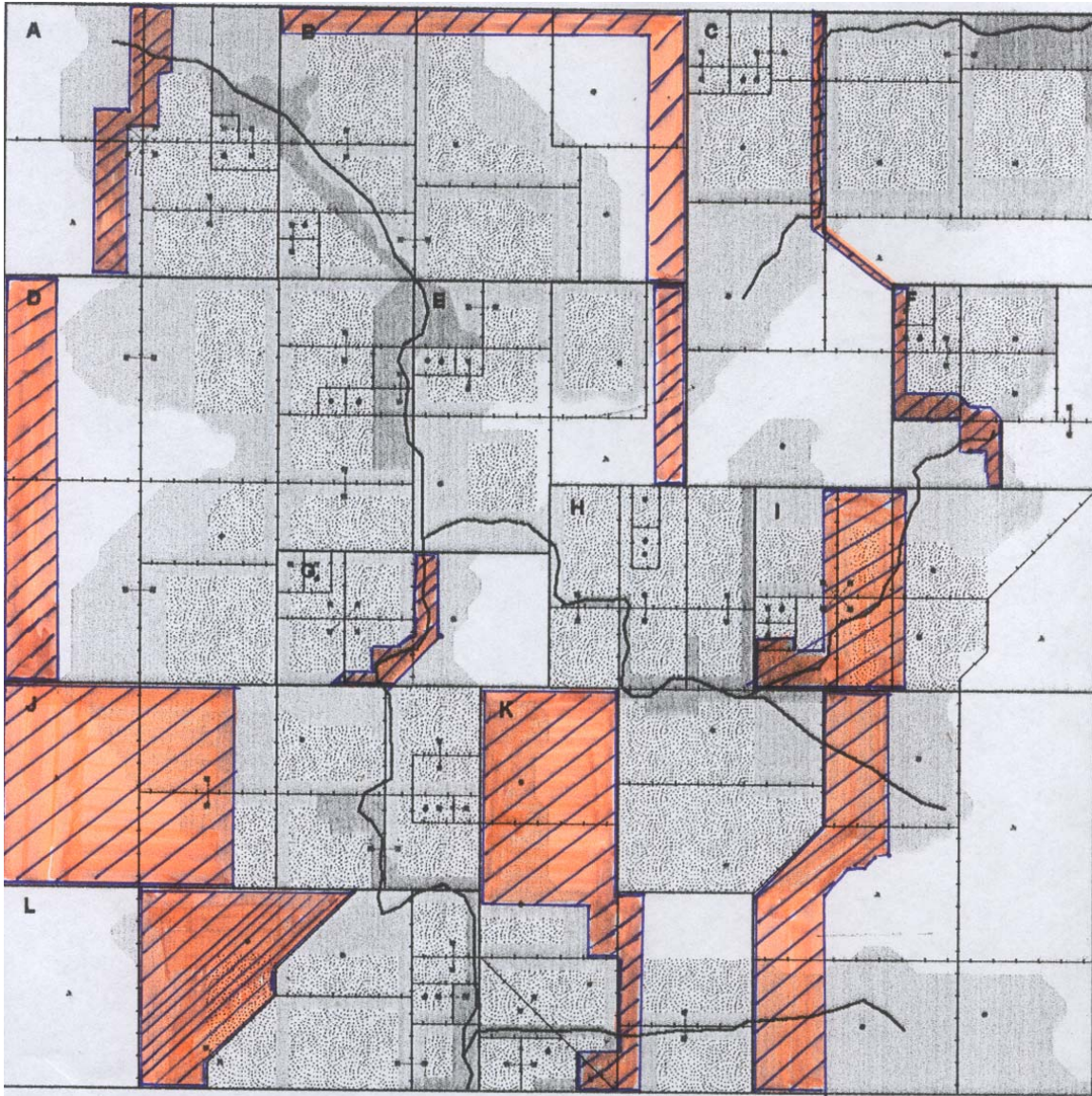
Appendix 2 Landscape map of 12 dummy properties (A- L)



Appendix 3a Bid areas in Round 1 of two-stage format



Appendix 3a Bid areas in Round 2 of two-stage format



Appendix 3a Combined bid areas in Round 1 and 2 of two-stage format

