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The Australian experience in using tenders for conservation

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ABSTRACT

Over the past 15 years Australia has been trialling conservation tenders and other market based instrument approaches to generate environmental outcomes, particularly on private lands. The best known of these is the BushTender auction for vegetation protection in Victoria, begun in the early 2000s. Subsequently, nearly 100 other tenders for biodiversity protection have been run in Australia with substantial variations in application and methodology generated by a mix of both intended design and case study differences. The number of separate conservation tenders that have been performed, and the variations in environmental targets, state jurisdictions, case study circumstances, design and implementation, provides a rich data base of projects for analysis – unique at the international level.

The review section of the paper covers three broad areas. The first aim is to provide an overview of the various tenders and their history and design in different settings. The second is to review their application, particularly in relation to auction design, metric design and contract design aspects, while the third is to identify the extent to which tenders provided more cost-effective outcomes than alternatives such a fixed rate grants. An additional goal is to explain why, after so many trials, conservation tenders are not more widely used in Australia. Key conclusions are that the multiple trials show that tenders are robust, relatively simple to apply and deliver more cost-effective allocations of public funding than other grant mechanisms. The reasons for their limited use can be related more to political and bureaucratic forces and inertia rather than to economic and design limitations.

1. Introduction

Much biodiversity exists on private lands, and agricultural management practices can impact both positively and negatively on biodiversity stocks. While the public good outcomes of improved management provide a case for government involvement, the existence of private property rights, the difficulties of designing and enforcing regulatory mechanisms, and the political issues with imposing restrictions that generate private opportunity costs have led policy makers to consider voluntary approaches to generating improved environmental outcomes (Hanley et al., 2012). Five broad types of voluntary mechanisms are available to increase biodiversity conservation on private lands: mechanisms that change attitudes (e.g., education programs), mechanisms that improve landholder awareness of positive synergies between conservation and production (e.g., extension programs), mechanisms that improve technical efficiency (e.g., technology research programs), mechanisms that provide simple incentives to change behavior (e.g., flat-rate grants), and hybrids of voluntary and regulatory programs known as market based instruments (including mechanisms such as taxes, subsidies or payments for ecosystem services).

Using market mechanisms to encourage private landholders to produce public good environmental outcomes has become more common in the past three decades (Hanley et al., 2012; Schilizzi and Latacz-Lohmann, 2013), through schemes such as the Conservation Reserve Program (CRP) in the United States, the English Countryside Stewardship Scheme in the UK and the BushTender program in Australia. While the use of flat-rate grant schemes remain the norm in most conservation programs (Schilizzi and Latacz-Lohmann, 2007, 2013), mechanisms such as conservation tenders (also called reverse auctions or procurement auctions) have been trialled to increase both the amount of conservation outcomes per unit of expenditure (economic effectiveness) and the incentives to reveal information and search for more cost-effective options (economic efficiency) (e.g., Latacz Lohman and van der Hamsvoort, 1997; Stoneham, 2003; Ferraro, 2008; Hanley et al., 2012). Despite the inefficient allocation of funds through fixed-rate payment grant programs (e.g., Babcock et al., 1996; Pannell and

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Roberts, 2010), the use of alternative mechanisms such as conservation tenders has remained limited. Governments face information, capacity and strategic behavior challenges in designing and implementing efficient conservation tender schemes. Yet there have now been numerous examples of successful implementation around the world (Connor et al., 2008a,b; Jack et al., 2008; Claassen et al., 2008; Groth, 2011; Ajayi et al., 2012).

Australia has been a hotbed of trials and development for conservation tenders. Following the development in 2000–2001 of the BushTender program (Stoneham et al., 2003), which was a conservation tender designed to protect areas of native vegetation on private property in Victoria, there has been substantial public investment, research and interest in these types of reverse auctions to allocate public funding for environmental outcomes more efficiently (Hajkowicz, 2009). A number of trials have been held together with some longer running programs, with substantial involvement from researchers. The diversity of approaches provides a natural test environment to identify how conservation tenders can be designed and conducted efficiently. While the results of many individual projects and research inquiries have been reported and published, there has never been a systematic review of the use of conservation tenders in Australia and the learnings that have been generated. That is the focus of this paper.

This review is concentrated on the use of conservation tenders in Australia from 2001 to 2012. Other grant programs and market based instruments such as offsets are not covered to concentrate the research focus. The review is largely restricted to the application of conservation tenders for biodiversity protection, particularly vegetation. The evidence that is assembled in this paper shows that there has been a large number of conservation auctions held in Australia, with almost 100 separate tenders conducted across multiple programs in the period between 2001 and 2012, and many reporting cost-effective outcomes relative to other funding approaches. Despite this level of activity and the knowledge gains that have been generated, the use of conservation tenders has remained minimal in the allocation of public funds for environmental goals, and the number of new programs or organizations using conservation tenders has fallen from the late-2000s with no new initiatives at the national or state level emerging since 2009. Understanding why applied economics appears to have ‘won the battle but lost the war’ over funding mechanisms for environmental programs is a key challenge.

The paper is structured as follows. A brief review of the underlying theory is provided in the next section, followed by an overview of the use of conservation tenders to protect biodiversity in Australia. This is followed in section four with an assessment of their design and performance, together with an evaluation of the key learnings that have been generated. In Section 5, reasons are reviewed why conservation tenders are not more widely applied in Australia, despite such the breadth of field applications and successful outcomes. Conclusions and recommendations follow in the final section.

2. Theoretical background for conservation tenders

Conservation tenders are primarily used to address problems of asymmetric information and complexity involved in purchasing environmental improvements from private landholders (Latacz-Lohmann and Van der Hamsvoort, 1997; Ferraro, 2008). Asymmetric information arises because the managers of agricultural enterprises are the only actors with detailed knowledge about the opportunity costs of changing management practices to generate environmental improvements, while the government holds the knowledge about the public demands for conservation outcomes. Heterogeneity in both agricultural and conservation systems means that there are large variations in the private opportunity costs of making land management changes and the public benefits of those changes at the enterprise level (Hanley et al., 2012). As these private costs and public benefits are not (or only weakly) correlated, a decision maker faces a complex task of trying to select actions that will achieve the largest public benefits at lowest private costs, given that the decision maker has limited information about either.

Conservation tenders solve for these problems by replicating some aspects of a market discovery process. Under the programs, landholders are invited to submit tenders specifying their proposed actions and compensation (bid) levels, and a subsequent evaluation process identifies the biodiversity benefits involved and the most cost effective proposals. Typically those bids offering the highest environmental benefit per unit cost are selected to the point where the available funds are exhausted or some threshold rule is breached. The tender mechanism is essentially a one-sided auction with a single buyer and many sellers (hence the term procurement auction), so the standard theoretical basis for conservation tenders is in auction theory (Latacz-Lohmann and Van der Hamsvoort, 1997, 1998; Cason and Gangadharan, 2004; Latacz-Lohmann this issue).

Latacz-Lohmann and Van der Hamsvoort (1998) identify three major advantages of competitive tenders over fixed rate payment schemes (the latter are typical of grant mechanisms in agri-environmental schemes). These are that (a) issues of asymmetric information are addressed, (b) the auction prices are more likely to reflect the marginal value of the resources being used to produce the environmental outcome, and (c) the scope for rent seeking bids is reduced by competition between landholders. These advantages mean that there is scope for competitive tenders to improve the cost-effectiveness of public funding for conservation contracting on private land compared to grant schemes (Latacz-Lohmann and Van der Hamsvoort, 1997, 1998a,b; Connor et al., 2008a,b; Ferraro, 2008; Windle and Rolfe, 2008).

While the theoretical base for conservation tenders has been outlined by Latacz-Lohmann and Van der Hamsvoort (1997, 1998), a number of potential variations in the design, application and performance of conservation tenders make it difficult in practice to measure the relative cost-effectiveness of this policy instrument. The key areas where the design of a conservation tender can vary relate to auction design, metric design and contract design[1]. The first relates to the performance of the actual auction, the second to the evaluation of the bids, and the third to the operation and enforcement of the contracts, once the successful bids have been selected. These three stages are complicated by the varying interactions with human participants that are possible, where knowledge gaps, learning effects, strategic behavior, reactions to risk and uncertainty, varying levels of participation, perverse incentives and rent seeking are potential behavioral issues that have to be considered. This is only on the supply side (the landholders); there are also human interaction issues around knowledge gaps and perverse incentives (public choice theory) that can influence design on the demand (public sector) side.

Auction theory indicates that with risk adverse bidders, discriminatory, single round mechanisms may be the most efficient form of a competitive tender (Latacz-Lohmann and Van der Hamsvoort, 1997; Stoneham et al., 2003; Milgrom, 2004; Cason and Gangadharan, 2004). The selection of discriminatory rather than uniform price bids means that bidders would not receive any surplus on top of their bid amounts, while having only a single round means that bidders have incentives to reveal their true opportunity costs as they only have one bid opportunity. However, an

[1] Fixed-rate grants can also vary across similar dimensions.

assumption underpinning these theoretical predictions are that bidders have close to perfect knowledge about their opportunity costs, as identified in the 'independent private values model' suggested by Latacz-Lohmann and Van der Hamsvoort (1997) and Stoneham et al. (2003). Further it is clear that many of these conservation tenders are in fact repeated, albeit not always exactly in the same location or for the same biodiversity asset, allowing participants to become much better informed about the buyer (government) preferences. A consequence can be higher bids, with increased levels of bid shading (rents) included in bids in discriminatory price auctions (Shoemaker, 1989; Schlizzi and Latacz Lohman, 2007). A consequence is that expert design is required to tailor the tender mechanism to the situation of interest.

Conservation tenders represent very different challenges for design and implementation compared to other auction mechanisms. Typically the management issue of focus is on the periphery of landholder knowledge and interests, payments comprise a small proportion of enterprise budgets and landholders may have low levels of understanding about some aspects of costs, such as restoration costs. As well landholders have limited knowledge and experience about the tender process that will be followed and the type of competition they will face. This means that there are often issues for the designers to tailor the tender mechanism to the situation, for the agencies to generate participation, and for landholders to construct bids and understand the process (Whitten et al., 2013).

3. Overview of the use of conservation tenders in Australia

Australia governments have initiated a series of programs in response to community concerns over environmental issues over the past few decades. While earlier attention was focused on pollution and major environmental protection issues, more generic issues about biodiversity conservation became increasingly prominent in the 1980s. In 1989 the Decade of Landcare was launched, with a focus on establishing a network of community groups focused on addressing land degradation on farms, and an emphasis on communication and encouragement. Historically, the scale of farm support in Australia has been relatively limited with almost all production support phased out during the 1980s. The Decade of Landcare did however begin a recent trend of governments providing limited funding to landholders for environmental works, and for the first time directly from the Australian Government, with allocations focused on multiple small projects (Hajkowicz, 2009).

Over time, the emphasis of public sector involvement in environmental protection in agricultural areas has evolved in two key ways (Hajkowicz, 2009). First, there has been a move away

Table 1
Conservation tenders in Australia 2000–2012.

ID	Program	State	Scope/outputs	# Tenders	Year/s	Funding ($M Aus)	# Of bids allocated	Area (ha)
Research focused tenders								
1	Auction for landscape recovery (MBI_1)	WA	Multiple	1	2004	0.2	21	
	EcoTender (MBI_1)	VIC	Multiple	1	2005	0.4	31	259
2	Catchment care (MBI_1)	SA	Multiple	1	2004	0.14		
3	Catchment care (MBI_2)	SA	Multiple	2	2007	0.20		
4	Nest egg (MB1_2)	NSW	Habitat	1	2007		20	80,000
5	Burdekin Tender (MBI_2)	QLD	Water quality	1	2007	0.61	33	
Federal level tenders								
6	Env. Stew. Prog	VIC	Targeted sps	3	2007/10	5.51	>55 (n = 2)	4,322
7	Env. Stew. Prog	NSW (4) QLD (1)	Targeted ecosystem	5	2009	70.50		26,475
8	Env. Stew. Prog	SA	Targeted sps	2	2010/11	1.00		
9	Env. Stew. Prog	NSW (1) SA (2)	Multi ecosystem	3	2010/12			
10	Biodiversity Hotspots Program	TAS (1) SA (2)	Targeted biodiversity	3	2006–7	6.73	>39 (n = 2)	6,456
11	Forest Conservation Fund	TAS	Forests	2	2006/8	17.78	88	13,779
State level tenders								
12	NSW Environmental Services Scheme	NSW	Multiple	1	2003	2.00	24	10,983
13	Veg. Incentives Program	QLD	Native veg.	3	2005–6	2.86	37	18,880
14	Nature Assist	QLD	Native veg.	4	2007/13	10	93	2,200,000
State/regional tenders								
15	BushTender	VIC	Native veg.	10	2001/11	16.27	538	33,339
16	EcoTender trials	VIC	Multiple	3	2008/10	4.6	152	1684
17	Murrumbidgee CMA: EcoTender II	NSW	Multiple	1	2009			
18	WildEyre	SA	Biodiversity	1	2010			940
19	R. Murray forest tender	SA	Native veg.	3	2007/8	5.70	15	2,442
Regional level tenders								
20	Liverpool Plains	NSW	Multiple	3	2001/5	1.44	71	15,052
21	Hunter Central Rivers CMA	NSW	Native veg.	4	2005/?			
22	Northern Rivers CMA	NSW	Native veg.	2	2007	0.70		
23	Southern Rivers CMA	NSW	Native veg.	4	2005/?	0.75 (n = 2)	46 (n = 2)	3347 (n = 2)
24	Lachlan CMA	NSW			2011			
25	Goulburn-Broken: CMA	VIC	Multiple	2	2004–5	0.65	17	517
26	North East CMA	VIC	Native veg.	3	2004–7	0.85	61	1,315
27	Gippsland/Corrangamite	VIC	Salinity	2	2005–6	0.70		994
28	Wimmera CMA	VIC	Multiple	14	2006/11	5.95	237	7,414
29	Glenelg-Hopkins CMA	VIC	Wetlands	3	2010/11	17	492	
30	Coorangamite CMA	VIC	Multiple	4	2010/12	4.29	>32 (n = 3)	>2180 (n = 3)
31	SA Murray Darling NRM	SA	Specific sps	2	2009/10	0.66	23	5,337
32	Desert Uplands NRM	QLD	Veg. corridor	1	2006	0.35	15	84,882
33	Fitzroy basin NRM	QLD	Biodiversity	1	2006	0.18	9	13,647
34	Burnett Mary NRM	QLD	Water quality	2	2006/7	0.27	28	
	Total			94		>178.2	>2177	>2.5 million

MBI = market based instruments pilots program; CMA = catchment management authority; NRM = regional natural resource management group; WA = Western Australia; SA = South Australia; NSW = New South Wales; VIC = Victoria; QLD = Queensland; n = number of tenders.

from cooperation and encouragement strategies towards more direct incentive measures. These have largely focused on positive financial incentives, although in some cases negative regulatory incentives have also been introduced. Second, there has been a move away from the local, atomized approach of landcare groups toward a more systematic regional or river catchment approach and the formation of Natural Resource Management (NRM) groups to facilitate programs and funding. The Australian Government has identified 56 regions across the country, and has established a group of regional Natural Resource Management (NRM) bodies to oversee environmental programs.

These changes towards stronger direct incentives and regional coordination have been integrated with major joint funding initiatives between the Australian and state governments from the late 1990s and some stand-alone initiatives of the Australian government. These initiatives, such as the National Heritage Trust program and the National Action Plan for Salinity and Water Quality, were similar to landcare in the sense that it provided grants through community groups; however, they had a focus on environmental outcomes and funded projects at the regional, state and national level. Hajkowicz (2009) reports that by 2006/07, general environmental expenditure by the Australian Government had increased to $4 billion (Australian $) per annum[2].

It was in this period of rapid development and funding for voluntary incentives to improve environmental protection that conservation tenders began to be applied, in part because of recognition that previous grant programs were ineffectual or expensive (Stoneham et al., 2003; Pannell and Roberts, 2010), or poorly scoped and targeted (Hajkowicz, 2009). Key reasons for trialling tenders have included a desire to improve the efficiency of funding (Stoneham et al., 2003; Miles, 2008), to improve participation and attract different groups of landholders, to provide incentives to search for efficiencies and to identify the opportunity costs for landholders to make management changes (Rolfe et al., 2011).

The BushTender program was implemented in Victoria in 2000, and involved landholders in two regional areas being invited to submit proposals and bids to protect areas of native vegetation on their property. The cost-effectiveness of this program, the existence of similar schemes internationally, and a major program of competition reforms across the government sector, created substantial interest in the use of conservation tenders and market based instruments more generally in Australia. The subsequent applications and trials of conservation tenders in Australia can be classified in different ways according to scale, purpose and funding source. They are summarized in Table 1 into five broad categories:

- Major research programs.
- National level tenders or initiatives.
- State level tenders or initiatives.
- State and regional partnerships.
- Regional level tenders.

4. Review of the performance of conservation tenders

4.1. Trends in performance and expenditure

The performance of conservation tenders can be assessed in a number of ways. An approximate summary of the location and year of conduct for the tenders identified in Section 3 is provided in Table 2, where data is available for 89 tenders out of 94 identified programs. This identifies significant differences across states and over time. Victoria has run the most number of conservation tenders, accounting for more than half of the tenders held nationally. It has also been the most consistent, with the only state identified as holding a tender in 2012.

The summary also shows that activity in conservation tenders appears to have peaked in 2009 and 2010, with a rapid decline by 2012. There is typically a long lead time in establishing support and funding and design for conservation tenders, and the majority of the tenders in 2009 and 2010 were existing schemes. If a lead time of two years is assumed, it suggests that support and interest in conservation tenders peaked in about 2007 and 2008, coinciding with change in the Federal Government in Australia from the conservative Liberal-National coalition to the more left-leaning Labor government. The decline in activity by 2012 is supported by little evidence of new programs being established, and the reduction in other support. For example the Designer Carrots website, which provided support to regional NRM groups across Australia to design and run conservation tenders, was mothballed in 2012.

Conservation tenders have also only accounted for a very small share of environmental funding in Australia. Data on the amount of funding committed for different conservation tenders is difficult to source because of gaps and differences in reporting. For 80 tenders reported in Section 3 where data on funding commitments was available, the average expenditure per auction was $1.94 million Aus. Extrapolating across the full set of conservation tenders indicates that up to $192 million Aus has been allocated with tenders in the twelve years from 2001 to 2012, although Doole et al. (2014) suggests that the total expenditure could be more than $200 million Aus. Given that total public expenditure on agri-environmental schemes is likely to be more than $1 billion Aus per annum (Hajkowicz, 2009), this indicates that allocations through tender mechanisms is less than 2% of total funding – hardly a major funding tool despite the apparent activity!

4.2. Auction design

The majority of conservation tenders have used a discriminatory, sealed, single round bidding format. There has been substantial support provided to landholders in most projects to provide information and help to scope and develop project proposals. Most projects have involved an expression of interest stage followed by submission of a more detailed bid, although some tenders (e.g., Corangamite Coast) appears to have only involved an expression of interest stage, followed by direct offers to landholders.

Four important variations on auction design can be identified from the case studies: multiple bidding rounds, outcome auctions, two-part bid structures and multiple benefit auctions. In relation to the first, Rolfe et al. (2009) report for the Desert Uplands

Table 2
Number of conservation tenders by state and year (approximate).

	NSW	QLD	SA	TAS	VIC	WA	Total
2001	1				1		2
2002							
2003	2				1		3
2004			1		2	1	4
2005	3	2			4		9
2006	1	4	1	2	4		12
2007	2	2	4		5		13
2008			2	1	3		6
2009	5	1	1		7		14
2010	1		4		8		13
2011	1		2		9		12
2012					1		1
Total	16	9	15	3	45	1	89

[2] Government expenditure to 2013–2014 has remained at a high level. See http://www.nrm.gov.au/funding/approved/2013-14/index.html for the details on just one program, Caring for Country.

vegetation corridor project that (a) multiple bidding rounds (three rounds) were held within the one auction and (b) participants were given some information about the location of other bids between bidding rounds to help encourage better coordination and linkages between projects. Results showed that participants substantially reduced their asking bids between rounds, perhaps as better information increased their confidence and reduced the risk premiums or bid shading being asked. Successive rounds also help to refine and coordinate the conservation proposal offered by landholders, a case similarly made by Reeson et al. (2011).

Tenders based on environmental outcomes (e.g., change in threatened species numbers) have been suggested instead of the more standard approaches of focusing on inputs (e.g., fencing supplies) or outputs (e.g., area fenced off from predators). In one MBI that focused on protecting habitat for ground nesting birds in Murray River catchments, researchers tested whether tenders could be run by the outcomes that could be generated (e.g., targeted birds present in breeding season) rather than the input actions (e.g., removal of grazing stock) (Whitten et al., 2008).

There has been some use of two-part bid structures, with an involvement fee and an outcome bonus used in the Murray projects (Whitten et al., 2008), and management plans and convenant rewards used in the Vegetation Incentive Program (VIP) in Queensland (Comerford and Binney, 2006; Comerford, 2013). These provide an initial payment to participants irrespective of success, and hence provide incentives to lodge full bids, helping to avoid thin market problems.

The fourth area of development in auction design involves multiple benefit tenders. Some studies (e.g., Lowell et al., 2007; Rolfe et al., 2011) have identified the advantages of including multiple environmental benefits in a single auction, where bids that target multiple objectives are shown to be more cost effective on average than bids that focus on single objectives. The EcoTender trials in Victoria involved assessing bids for contributions to terrestrial biodiversity, aquatic function, saline land area and carbon sequestration (Eigenraam et al., 2007).

An additional variation relates more to program design where there are three main differences in the use of delivery agents. The first, typical of many regional initiatives, are tenders fully designed and implemented by a single proponent, even if that proponent has applied for that funding elsewhere. The second is where tenders are fully devolved to regional or other agencies, but the design and purchase priorities (usually but not always including the metric) are specified by a more centralized agency. The third are tenders implemented through delivery agents where the agent supplies some functions and the principal others. The Environmental Stewardship program is an example of this approach where the Lachlan and Central West catchment management authorities were delivery agents for several rounds but the Australian government agencies performed some operational roles as well.

The VIP in Queensland is one of the conservation tenders that has been independently assessed where issues with implementation were identified (Comerford and Binney, 2006). Key problems were a small number of bidders, particularly in the first two rounds, and very high bid levels. Comerford and Binney (2006) noted that key lessons from the auction were to be careful with mechanism design, particularly covenants, to allow sufficient time to plan and conduct an auction, to provide adequate support to landholders, to be able to evaluate the biodiversity benefits of proposals accurately and consistently, and to be able to set and use a reserve price.

4.3. Scope and metric design

The largest variation between conservation tenders in Australia relates to the associated metrics used to evaluate the bids, where there has been substantial experimentation around different bid structures and elements. Hajkowicz (2009) suggests that it is the use of metrics to quantify benefits that is one of the most clearly distinguishing features of conservation tenders compared to the more common fixed price grant schemes. Conservation tenders require that the outputs that will be generated need to be clearly targeted and defined, and the outcomes can be assessed and measured. In contrast, fixed price grants focus on the measurement of inputs rather than benefits, so any assessment metrics are much simpler.

Reasons for variations are complicated by heterogeneity in landscapes and the biodiversity or other objective of the tenders, but three broad reasons for differences can be identified. First, many tenders have included very different environmental outcomes as part of the targets; for example, the MBI EcoTender trials assessed carbon sequestration and water quality outcomes alongside biodiversity benefits (Eigenraam et al., 2007). This means that metrics vary by the type and number of targets that are being assessed, with some specialized metrics designed for combinatorial auctions and multiple benefit auctions. Second, metrics vary according to whether inputs, outputs or outcomes are being assessed. Almost all conservation tenders assess benefits in terms of modelled outputs that will be generated (e.g., hectares of vegetation that will be protected), while some (e.g., the MBI nest egg project) assess benefits in terms of the outcomes that the outputs will generate (e.g., the number of successful nesting outcomes). Estimating outputs and outcomes requires some predictive function to be generated based on the existing condition and the inputs (management actions) to be added. Third, some metrics take account of the risks and uncertainties involved, allowing for the possibilities that outputs may not occur, and that outcomes may not be generated from the outputs. Essentially this involves weighting the benefits in some manner with information that allows some assessment of the probabilities that the desired results will occur.

The scope of the environmental goods being considered and requirements for predictive functions have generated very different approaches to the functional form of metrics that can be categorized into two groups, following Whitten et al. (2012). The first are based on condition indexes, where the base score is given by an assessment of the existing condition of the vegetation of interest, sometimes including spatial context drivers, which is then modified to account for the impact of management actions through additive or multiplicative processes. The Habitat Hectares score reported in Stoneham et al. (2003) provides an example of the multiplicative approach with a Biodiversity Benefits index (BBI) calculated for each bid i as follows:

$$\mathrm{BBI}_i = \frac{\mathrm{BSS}_i \times \mathrm{HSS}_i}{b_i}$$

where BSS_i represents the biodiversity value of the area, HSS_i represents the change in quality of habitat expected, and b_i represents the landholder bid. By contrast, Gole et al. (2005) used an additive metric to assess landscape recovery bids in Western Australia, where a net Biodiversity Benefits Index (BBI) was calculated and then added to an other environmental benefits Other Environmental Benefits Index (OEBI) score, where OEBI was estimated as follows:

$$\mathrm{OEBI} = \frac{\text{salinity benefits} + \text{water management benefits} + \text{soil management benefits} + \text{other enviromental benefits or management activities (grazing, fire, pest, plants and feral animals)}}{2}$$

The second approach to assessing a metric involves multi-criteria based indexes, where different elements are scored and then combined with weightings to generate a summary measure (e.g., Hajkowicz et al., 2008). These are typically used to assess bids with multiple objectives. A variation of this approach involves expected values, where there is more explicit focus on assessing the likelihood of future outcomes. These are more appropriate for taking account of uncertainty about the responses to different management actions.

We note that there has been little sensitivity testing around the impact of metrics on project selection, although it appears that most metrics are only sensitive to a small number of factors, particularly for conservation tenders with a limited number of bidders. Two of the only studies to report this were Rolfe and Windle (2011b) and Whitten et al. (2009), where they noted that some elements of their metric had very limited impact on project selection. Whitten et al., 2009, 2011, 2012 provide more detailed reviews of metrics used in several conservation tenders, while Pannell (2013) provides a more general overview of the key principles required to rank environmental projects.

A number of challenges in metric design remain. Site visits are one of the most expensive components of tender implementation and a recent focus has been on minimizing collection costs while ensuring data accuracy and discriminatory power (Whitten et al., 2011). There is no agreement about whether it is better to have dedicated specific metrics with associated costs for design and assessment compared to simple and generic metrics. The treatment of effects in slow response systems with long lag effects is not always consistent, and the calibration of metrics across different ecosystems and biodiversity assets and the treatment of uncertainty about outcomes remains challenging. Furthermore the underlying ecological knowledge of likely responses to management changes remains limited or contested in many settings.

4.4. Contract design

Conservation tenders typically require some form of formal agreement to ensure that all actions and payments occur; the need to specify the actions and outputs in a contractual form often distinguishes conservation tenders from more general fixed-rate grants programs (Hajkowicz, 2009). While the latter also can involve contracts and agreements, these tend to less-specific than for tenders which are focused achieving outputs or outcomes rather than simply assigning inputs. Contracts also specify the payment arrangements, which are typically tied to outputs. A key challenge in contract design is to formalize arrangements with landholders in ways that do not inhibit participation and involvement. Many conservation tenders involve up-front payments to encourage involvement and cover transaction costs. Behavioral evidence in at least one setting (the Wimmera CMA) suggests that landholder reservations toward longer contracts and covenants tend to relax with experience with tender instruments and contractual requirements.

Issues around contract design have largely focused around the regulatory and institutional arrangements needed to support longer term agreements. While many of the earlier and smaller tenders have involved short-term and relatively simple contracts, other tenders have been associated with mechanisms such as covenants to guarantee that actions occur into the future. Griener et al. (2009), Moon and Cocklin (2011) and Comerford (2013) all report that landholders involved in agricultural production prefer short term conservation contracts over covenants or other restrictions on title. However, Miles (2008) and Blackmore and Doole (2013) reported that landholders preferred medium term contracts over short term contracts. Both Moon and Cocklin (2011) and Comerford (2013) report that non-producing landholders preferred the use of covenants and longer term mechanisms.

4.5. Efficiency gains

The major justification for holding conservation tenders in Australia has been the improvements in cost-effectiveness and efficiency in the allocation of public funds; this is the core reason identified in most reports and technical papers. Three streams of evidence point to the potential efficiency gains from using tender mechanisms.

The first stream of evidence relates to the heterogeneity in bid values that are generated in the tenders. Most tenders (e.g., Stoneham et al., 2003; Connor et al., 2008a,b; MJA, 2010a,b; Rolfe et al., 2011; Rolfe and Windle, 2011a) exhibit bid curves that have an inverse 'L' shape, with a low cost section (several bids that are very good value), a middle cost section (benefits come at increasing cost), and then a very high cost section where the curve becomes almost vertical (additional bids have high costs and/or no benefits). The information revealed in the tenders is that there are very large variations in opportunity costs to produce environmental services, noting that some bid shading (profit seeking) is expected in asking prices (Latacz-Lohmann and Van der Hamsvoort, 1998). Rolfe et al. (2011) reported that the 10 highest-ranked projects in the Burdekin tender were more than 100 times more cost-effective than the 10 lowest-ranked projects, demonstrating that there are large economic benefits from selecting projects on the basis of cost-effectiveness.

The second stream of evidence relates to the potential variation in project selection between competitive tenders and other mechanisms. Rolfe and Windle (2011b) compared the selection of bids for the Burdekin tender under two approaches: the tender metric and an alternative Best practice Management Practice (BMP) scorecard that is the more standard approach in grant schemes. They found a significant difference between the approaches; the BMP approach would have only selected 24% of the most cost effective bids that the metric identified.

The third stream of evidence is focused on comparing the cost effectiveness of different approaches. One approach has been to assess the benefits by comparing the discriminatory pricing results to a counterfactual situation where all bids were priced at a uniform bid price, set at the cut-off point in the discriminatory price auction. For example, Stoneham et al. (2003) used this approach to argue that applying a fixed price scheme to the first BushTender project would have cost nearly seven times as much as was achieved with the tender mechanism. However, this form of assessment of cost-effectiveness is likely to be overstated, for several reasons. Bid shading or profit seeking is likely to be present in both uniform and discriminatory price schemes (White and Burton, 2010), narrowing bid differences and disguising real opportunity costs. It is difficult to get a clear counterfactual for assessing the performance of conservation tenders (Schilizzi and Latacz-Lohmann, 2007), as variations between schemes may attract different bids from landholders. As well, the difference is very sensitive to the shape of the bid curve in the discriminatory auction and the selection of the final bid (Gole et al., 2005; White and Burton, 2010).

Other attempts to assess the cost effectiveness of auction performance have been made, with White and Burton (2005), Gole et al. (2005) and Connor et al. (2008a,b) testing different options for the counterfactual. White and Burton (2005) reported gains of between 200% and 315% from using auctions in the Auctions for Landscape Recovery MBI project in Western Australia, comparing actual bids against the input costs of doing the on-ground works (further details are provided in Gole et al., 2005). Connor et al. (2008a,b) estimated that a uniform payment scheme would only achieve 56% of the benefits gained from a tender process. Windle and Rolfe (2008) reported a 30% efficiency gain with a tender scheme for vegetation protection in part of the Fitzroy basin in Central Queensland compared to a fixed price scheme that was being run concurrently by the Natural Resource Management group in another part of the basin. MJA (2010b) report that the Tasmanian forest tender was 52% more efficient than selecting projects on a first-come, first-serve basis, consistent with the approach taken by many fixed-price grant schemes. Rolfe and Windle (2011b) reported that the use of tenders in the water quality auction in the Burdekin purchased 255% more biodiversity improvements than if a BMP scorecard had been used to select projects. Lowell et al. (2007) noted that although the conservation tenders applied in the Gippsland and Corangamite catchments had higher assessment and administration costs, the overall cost-effectiveness compared well to grant-based schemes.

Despite the efficiency gains, many researchers have noted that conservation tenders typically have much higher design, assessment and administration costs because of the scientific assessment process (Lowell et al., 2007). This means that the costs and performance of conservation tenders is linked to the scale of operations, with the overhead costs lower for larger tenders and multiple rounds.

4.6. Participation

There has been substantial research effort into understanding factors that influence participation in conservation tenders (e.g., Greiner et al., 2009; Greiner and Gregg, 2011; Moon and Cocklin, 2011; Rolfe et al., 2011; Whitten et al., 2011; Morrison et al., 2012; Comerford, 2013, 2014; Moon et al., 2012; Zammitt, 2013). Participation is important to ensure that tenders are successful, but also to demonstrate that landholders understand the process, are able to construct bids, and can engage. High levels of participation also drive competitive pressures and limit rent-seeking behavior (Rolfe et al., 2009; Hanley et al., 2012). The failure of the VIP in Queensland to attract enough participation is the key reason why no bids were allocated in the first round, and only 24% of the $12 M budget was ultimately allocated across all rounds (Comerford and Binney, 2006).

A number of studies have reported on both the efforts undertaken to support landholders and the experience of landholders in the tender process. For example, MJA (2010a) report interviews with landholders involved with the Environmental Stewardship Program where landholders were positive about their experiences and would participate again. Coggan et al. (2013) report an extensive survey of participants confirming the earlier MJA study and indicating relatively low transaction costs of participation and high levels of satisfaction with the tender process.

Most studies have focused on identifying the factors that appear to encourage or hinder landholder participation. Among the most important that have been identified are administrative load and transaction costs (e.g., Connor et al., 2008a,b; Windle and Rolfe, 2008), landholder characteristics and attitudes (Whitten et al., 2007; MJA, 2010b; Moon et al., 2012; Comerford, 2013; Zammitt, 2013), program characteristics (Gore et al., 2008; MJA, 2010a; Comerford, 2013), and relationships between landholders and agencies (Blackmore and Doole, 2013). For example, Gole et al. (2005) identified that key limitations on landholder participation in conservation activities and tenders were time and financial resources, while engagement with landholders requires specialized skills; MJA (2010a) identified that employing appropriate delivery agencies, avoiding oversubscription, appropriate lead times and good communication processes helped with participation; and Comerford (2013) identified that fixed covenants, onerous management conditions and poor program design were all major disincentives to participation. Lack of awareness remains a general limitation; despite extensive communication of major schemes such as the Environmental Stewardship program a lack of awareness remains an important limitation on participation (Coggan et al., 2013).

4.7. Crowding out, perverse incentives and transaction costs

A number of researchers have identified some issues with the implementation of conservation tenders. Here the most important are noted.

One issue identified with tender mechanisms is the potential for crowding-out effects, where the process of paying for environmental improvements could reduce incentives for landholders to provide the services voluntarily (Hajkowicz, 2009). Critics have argued that the free market or competitive forces in a tender process are more likely to stimulate crowding-out behavior than flat-rate grants (Reeson and Tisdell, 2008; Yang et al., 2010). However, it is difficult to distinguish why incentive mechanisms allocated through an auction process will generate different crowding out effects to those allocated through a grants program, or to measure changes in additionality. The limited evidence that is available suggests that landholders are using payments to undertake actions that they had identified for future implementation sooner than they could otherwise do, but are not seeking to only profit from tenders (Coggan et al., 2013). Despite the lack of evidence of crowding out effects occurring, the risk of crowding out or discouragement effects appears to be a key reason why NRM groups prefer fixed-rate grants over tenders.

A second issue is the potential for strategic behavior and rent capture, particularly as landholders become familiar with conservation tenders. Many tenders are designed in ways that limit these risks, for example, by using reserve prices and avoiding repeats in the same area. The BushTender program in Victoria is notable in that it has been run in different regions each year. There are some examples of bid prices increasing over time; MJA (2010b) reported that average bid prices in the Tasmanian Forest Conservation Fund tender rose from $925/ha to $1,623/ha through the course of the program, but noted that this may have been because the most cost-effective bids were captured in early tenders and the community became more aware of higher prices being offered. It may have also been because the last bid round was run concurrently with a fixed price offer program, which had the effect of placing a floor price on bids in the competitive tender program.

A third problem relates to the high costs of designing and running conservation tenders, including the need for specialist administration staff and the transaction costs that are generated onto landholders. Gole et al. (2005) noted that establishment costs were higher with an initial tender because of the new tasks to perform, but that there was no reason in the longer term to expect much difference in administration costs compared with fixed-price grant schemes. MJA (2010a) estimated that the design, administration and program delivery costs were 10.3% of the program budget in the environmental stewardship program, and 11.3% of budget in the Tasmanian Forest Conservation Fund. However, MJA (2010a) noted that many smaller tenders had much higher relative administration costs. This matches the findings of Connor et al. (2008a,b) who reported that the administration costs of running a tender mechanism were 24% higher than a fixed-rate grants program.

5. Discussion

Given the number and diversity of conservation tenders that have been held in Australia, the small and declining role that these have in allocating expenditure for environmental issues is puzzling, particularly as their use in the high profile BushTender and Environmental Stewardship Programs appear to have been highly cost-effective. We note that a reduction in environmental funding does not appear to be a contributing factor, with government expenditure on programs such as Caring for Country[3] remaining at a high level. Here we canvass three broad groups of reasons why government and NRM agencies are avoiding the use of competitive tenders.

The first are doubts about using competitive processes. Some concerns are pragmatic, relating to the potential for thin markets, administration and transaction costs, and limited opportunities when there is little heterogeneity in opportunity costs or small environmental benefits. In some situations competitive tenders are not as suitable as other approaches such as direct negotiation (Windle and Rolfe, 2008; MJA, 2010b), although this is unlikely to be true for larger scale programs with adequate lead times for design. Other concerns are driven by opposition to the use of market processes, viewing engagement in environmental protection measures as higher level goals that should not be confounded with economic forces (Yang et al., 2010) – although we note these concerns and many of the same administration limitations should also impede the use of any substantive fixed price or grants program.

The second group involve concerns about the technical skills needed to perform tenders. These can relate to the difficulties of assessing the biophysical outcomes of proposals and incorporating them into assessment metrics, the lack of skills in governments and agencies to implement tenders, and the burden on landholders constructing bids. A number of researchers (e.g., Gole et al., 2005; MJA, 2010a) have highlighted the importance of sourcing appropriate skills for different aspects of design and implementation.

The third group of reasons revolve around public choice theory issues, where public agencies do not face the appropriate incentives to improve the efficiency of public funds. Agencies tend to be only evaluated on input measures (e.g., budget allocations, engagement with landholders), and may prefer not to predict the outputs and outcomes that may be generated from investments into environmental issues, given the risks that those outputs and outcomes may not occur. As a result, they favor grant mechanisms (and sometimes regulation) over competitive tender processes. A related concern is the loss of control of budget or outcome, which may make it more difficult to apply for funding in devolved funding settings or argue for budgetary allocations in agencies or ministries. Grant based approaches specify a budget and a nominated outcome for that budget; whereas, the focus on the asymmetric information problem in a tender tends to reduce confidence in similar estimates for conservation tenders. The risk averse decision settings in governments thus tend to select for the less efficient mechanism with the appearance of greater control and lower risk.

The number of completed tenders in Australia confirms that, with careful design, concerns over the technical and operational implementation of competitive tenders can be addressed; while competitive tenders are not appropriate in all situations, well scoped and well designed tenders have been implemented successfully across a very wide range of organizations. The 'natural experiment' in tenders that has played out in Australia, with large variations in the use of expertise and design, has largely been successful, with the tendering approach performing robustly across different settings. The results demonstrate significant efficiencies in public funding, indicating that tenders should be more widely applied if governments intend to maximize the environmental benefits from investment, at least in the short run. With adequate investment to provide key technical skills, it appears that tender mechanisms can improve the returns on public funds.

This analysis shows that the slowdown in the use of competitive tenders are not caused by economic and design limitations, but are more likely to be related political and bureaucratic forces and inertia, including short planning cycles, focuses on engagement rather than efficiency outcomes and pressures to minimize administration costs. Overcoming such barriers may require a combination of a greater focus on cost-effectiveness together with an acceptance that despite the uncertainties of tender performance, when appropriately designed and applied they should outperform other grant or fixed payment approaches in heterogeneous settings.

6. Conclusions

This review has shown that since 2000 a large number of conservation tenders have been trialled and performed across all the major states in Australia. Almost all tenders have been run as single round discriminatory auctions, with some multiple round and multiple good auctions included. The variety of tenders that have been held demonstrate that it is possible to run conservation tenders in different settings, and with varying design features. Although most have been run as small scale pilots in restricted areas with landholders very unfamiliar with these types of instruments, they have attracted sufficient bids to allow the auction process to operate. There have been some testing of different auction processes, a variety of metrics to assess the environmental benefits of proposals, and different conditions and contract requirements on successful bidders. These results confirm that conservation tenders are a robust policy instrument.

There has also been substantial attention on evaluating the economic benefits of using conservation tenders over fixed-price grants and other simpler mechanisms. Here it is more difficult to evaluate success because no clear counterfactuals exist; it is not possible to trial tenders and fixed rate grants on the same action with each farmer. Different approaches to evaluation have been undertaken with Australian projects, with almost all identifying that competitive tenders achieve more biodiversity outcomes per unit of funding than with fixed-rate grants. The extent of cost-effectiveness varies with factors such as the distribution of bids, the bid selection method, and the approach used to calculate the comparable costs using a fixed-price grant, but the relative increase in effectiveness has been reported from 30% more (Windle and Rolfe, 2008) to 700% more (Stoneham et al., 2003).

However, the variety of conservation tenders in Australia has provided a natural experiment that has also revealed areas where knowledge remains limited. First, the variety of metrics employed, without any systematic framework identifying the most suitable for any particular application, indicates the lack of consensus in what attributes metrics should encompass and how these should be combined into a single score. Given the diversity of approaches to biodiversity assessment and project evaluation this is not surprising, but it makes it difficult to benchmark and compare the results of different tenders. Second, the use of discriminatory price tenders has worked well in the settings in which it has been employed to date. Nevertheless, theory and experiments clearly suggest that uniform prices are likely to be more efficient in large scale, repeat tender settings. There is a need to identify what constitutes appropriate triggers for switching pricing rules given other attributes of conservation tenders such as time between repeated tenders, changes in purchase prioritization, and asymmetric information in assessing biodiversity value. Furthermore, the limited experimentation with different payment structures illustrates the need for further research into what might be the most incentive compatible payment strategy. Finally, while there has been sufficient participation for competition in the tenders performed to date, these have been relatively small scale and there has been limited potential for landholders to behave strategically. Hence, it remains unknown whether tenders would be as effective in settings which require substantive change by a large proportion of landholders.

[3] See http://www.nrm.gov.au/funding/approved/2013-14/index.html for the funding details on Caring for Country.

To advance the use of competitive tenders in Australia, we make four key recommendations. First, there should be a general principle established that the provision of public funds for private conservation should be allocated on a competitive basis to maximize cost-effectiveness. Second, there should be more review and benchmarking of all environmental funding programs; this will allow better evaluation of different mechanisms and reveal the effectiveness of efforts to meet different environmental targets. Third, there should be support and expertise provided to Natural Resource Management groups and other administration bodies to reduce the administration costs and barriers to the use of competitive tenders. Fourth, further research and design effort is required to address remaining knowledge gaps.

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