Estimating the cost of protecting biodiversity on privately managed properties in the Australian Rangelands

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Abstract

A significant quantity of native vegetation and biodiversity exists on privately managed rangeland properties. However, landholders do not always conserve these resources at a level that society desires, due to a lack of appropriate market signals. Policies involving regulation can impose substantial costs to landholders. Market Based Instruments (MBI) have therefore been introduced to provide market incentives for conservation. In a case study of an MBI scheme, we estimate the costs of protecting biodiversity on privately managed properties in Western NSW. The cost of this on different conservation areas varied widely.

Introduction

Native vegetation and its associated biodiversity are becoming scarce and therefore a valued resource to society in Australia. A significant quantity of native vegetation exists on privately managed farmlands, and so landholders can play an important role in conservation. The lack of appropriate market signals, however, means that they tend to conserve less biodiversity than society would prefer.

Regulations and other policy measures to protect native vegetation on farms have been introduced in all Australian jurisdictions. But these policies can impose substantial costs to

landholders, and may be ineffective in achieving biodiversity and environmental outcomes. Recently, Market Based Instruments (MBIs) have received considerable attention as an alternative to regulation. They are used to create a market that provides signals to farmers to increase their production of environmental goods and services.

This paper describes a way of measuring the private and social costs of increasing the production of biodiversity by landholders in the Australian rangelands. This research focuses on a particular MBI scheme, the West 2000 Plus Enterprise Based Conservation (EBC) project. The scheme has operated in the Western Division of New South Wales from 2003 and will continue until 2012.

The Western Division of New South Wales has primarily been used for grazing sheep on native pasture, on large properties and in conditions of low and unreliable rainfall. Environmental issues in the region include soil erosion, encroachment of woody weeds and the decline of the pasture and groundcover conditions. Currently, less than eight per cent of the Division is formally managed for conservation, but the Western Catchment Management Authority aims to raise this to 25 per cent by 2035. This aim, amongst other factors, has led to an interest in MBIs as a method of increasing conservation outcomes in this region.

The EBC scheme created a market for biodiversity by providing landholders with an annual payment in exchange for the provision of specified environmental services. Potential participants submitted bids, for the amounts they were willing to accept for providing those services, through a closed bid auction. Two methods of providing services were available to landholders. The *de-stock* approach involves removing all domestic stock and controlling feral animals, in exchange for a negotiated annual payment. The *groundcover* approach provides an annual incentive payment if groundcover levels are maintained above a given threshold, regardless of stocking or management practices, except that landholders must control feral animals. Several participants also received a fifty per cent subsidy for required infrastructure improvements, such as fences, to comply with the requirements of scheme. Ten landholders were selected for participation in the EBC scheme.

Methods

Any policy that restricts production on agricultural land involves opportunity costs to the landholder, in the form of forgone income from the best alternative use of the resources. This analysis determines the costs of supplying biodiversity from each of the farms, both from the perspective of the private landholder and the broader society. These private and social costs are defined by equations 1 and 2 respectively.

$$PC = \left(\sum_t \left(TR_{at} - TC_{at} - w_{at} \right) \left(1 + \delta_s \right) \right) - \left(\sum_t \left(TR_{et} - TC_{et} - w_{et} \right) \left(1 + \delta_s \right) \right) \quad [1]$$

$$SC = PC + \sum_t G_t \cdot \left(1 + \delta_s \right) \quad [2]$$

Where *PC* is the private opportunity cost, *SC* is the social opportunity cost, TR_{at} and TR_{et} are the total private revenue from the best alternative enterprise and the EBC enterprise in time period *t*, respectively. The terms TC_{at} and TC_{et} are the total expenses from the best alternative enterprise and the EBC enterprise in time period *t*, respectively. The symbol *w* represents the value of the owner-operator's labour, G is the government costs of the project including the administration, establishment and monitoring costs, contributions to infrastructure costs, and annual incentive payments, and δ_s is the discount rate, which was 5 per cent and 7 per cent for *PC* and *SC* respectively. Maintenance of capital items was included in *TC* as a real depreciation cost. Change in land value was also accounted for in the determination of *PC*.

The private and social costs for each property were calculated on the basis of data obtained from participating landholders, under the market and climatic conditions prevailing at the time. This was a deterministic analysis. Given the variability of both market and climatic conditions, a stochastic analysis was also conducted to examine the implications of these sources of uncertainty. This analysis required refinement of an existing pasture growth model (GRASP) to allow climatic variables to be treated probabilistically. A simulation system was developed to model the EBC policies over the range of climatic and market

conditions. This comprised a pasture growth model, a grazing flock dynamics model, an animal consumption model and economic models. This simulation system also allowed for the simulation of and determination of the costs in biophysical changes that can be expected as a result of the EBC project.

This paper focuses on the deterministic analysis. Moss (2008), provides the full model description and findings of the stochastic analysis.

Results

A summary of results is provided in Table 1. The private costs, which represent the landholders cost of participating in the EBC scheme, are presented both exclusive and inclusive of the annual incentive payment.

Deterministic analysis

When the annual incentive payment is included, participants benefit by $2.36 per hectare, on average, with a range of costs from -$13.04 to $30.51 per hectare. A negative cost is of course a benefit. The range shows that:

- Some participants benefited from the scheme with these payments; and
- Others bore net costs.

Thus, with the government's subsidy for infrastructure works:

- Some participants would have benefited by undertaking the activities required in the EBC project without annual incentive payment; and
- Other participants incur a net cost, even with these payments.

Participants who received a benefit from joining the EBC, exclusive of the EBC annual payment, did so for several reasons. For example, they received funding for infrastructure works that improved their land value, or their adoption of the EBC project and its associated activities required less labour than what would have been required otherwise.

Table 1: Private and social costs of the EBC under the actual market and climatic conditions.

	Private Cost[1] Inclusive of EBC Payment ($ per ha)	**Private Cost**[1] Exclusive of EBC Payment ($ per ha)	**Social Cost** ($ per ha)
Minimum	-13.04	-8.46	3.00
Mean	-2.36	0.90	11.02
Maximum	30.51	32.10	161.81

[1]*Both the private cost inclusive and exclusive of the EBC payment includes the payment for any infrastructure from the government. This was necessary as this infrastructure was deemed essential to fulfil the requirements of the scheme.*

The financial impact, exclusive of EBC incentive payments, ranged up to a benefit of $8.46 per hectare (Table 1). This may be the result of the initial establishment contributions by the government for infrastructure works. It is important to note that, due to an expected operational life greater than the nine years of the project, contributions to on-ground works may continue to provide benefits to the landholders after the completion of the project.

The average social cost of the EBC project was $11.02 per hectare, with a range from $3.00 to $161.81 per hectare. The social costs were:

- always positive; and
- highly variable across the properties.

Cumulative Cost Curves

The private cumulative cost curve (Fig.1) represents the manner in which the private costs to farmers increase as the total quantity of area conserved increases.

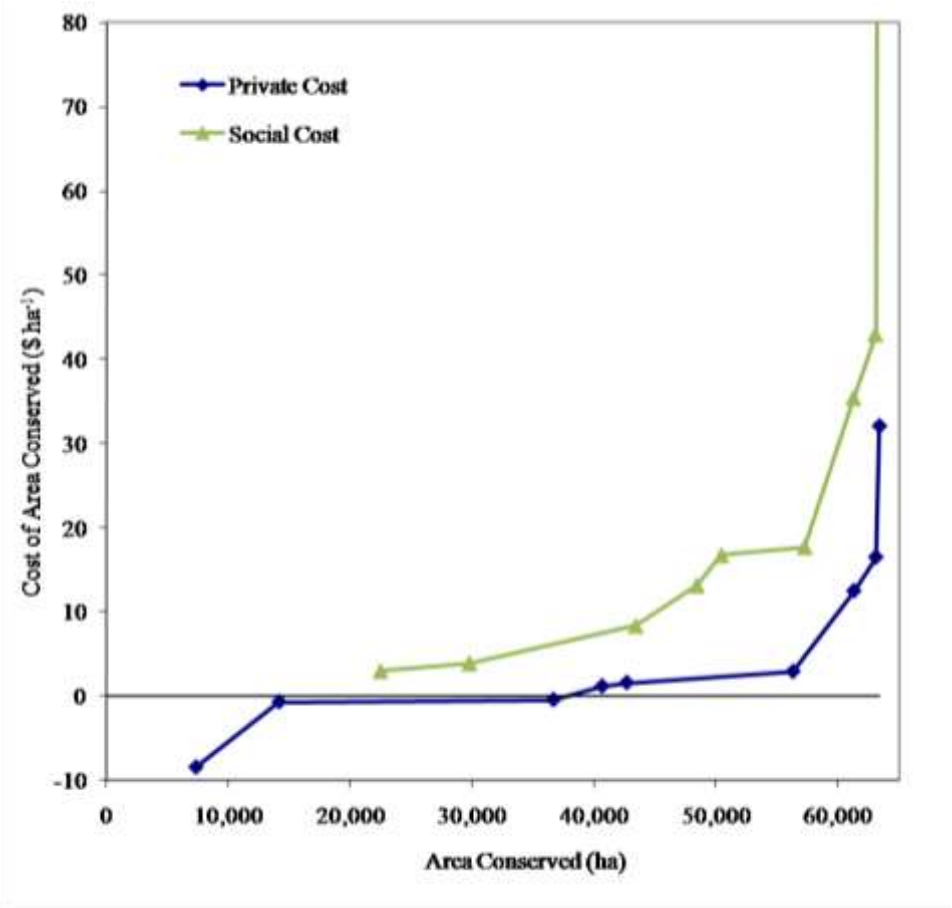

Fig.1. Private and social cumulative cost curves.

Private costs include any lost income from reduced stocking, as well as the costs of any additional labour and material needed to undertake the required EBC management activities. The figure shows that over 35,000 hectares can be conserved while conferring a benefit (a negative cost) on the participants, and that there is an increasing cost of conserving areas from additional participants.

The shape of the private cost curve suggests that an efficient strategy will require a mixture of different policies depending on the position of the cost curve. For example, for landholders that incur a benefit (negative cost), an education and training policy might be the most efficient strategy. For landholders that incur a small private cost, MBI policies may be employed. For landholders who bear a high private cost, the most efficient policy may be to avoid conserving additional biodiversity, unless of course, the benefits of the additional conservation outweigh this cost.

The social cost of conserving increasing areas of land, where these areas are ranked from lowest to highest cost, is also presented in Fig.1.

Conclusion

This research has shown that:

- Different conservation sites incur a wide range of private and social costs;
- Private costs ranged from negative to positive;
- Social costs were always positive;
- An efficient strategy will require a mixture of different policies depending on the position of the cumulative cost curve.

A market-based instrument such as the EBC program can be an important part of the policy mix for conserving biodiversity on privately managed properties in the rangelands.

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