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Original research article

The money or the trees: What drives landholders' participation in biodiverse carbon plantings?

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HIGHLIGHTS

- A BBN model was constructed based on a literature review, interviews and expert elicitation.
- Program characteristics are more influential at driving participation than financial incentives.
- Biodiversity co-benefits is another important factor.
- Combining biodiversity incentives with flexible permanence options increases program adoption.

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ABSTRACT

Carbon farming programs typically aim to maximise landholder participation rates to achieve desired environmental outcomes. This is critical for programs aiming to tackle both climate change and biodiversity loss simultaneously, as landholder participation in those schemes directly determines the level of carbon sequestered and the potential biodiversity gains. Biodiverse carbon planting is a key private land conservation practice that needs active stakeholder involvement to deliver successful policy design and implementation. In this study we developed a Bayesian Belief Network (BBN) of landholder participation in biodiverse carbon planting schemes to determine factors most likely to influence program participation. An initial conceptual model was developed based on a review of the literature. The model was refined through interviews with participating landholders and other key stakeholders and, finally, parameterised using expert-elicited information. Our results indicate that participation rates are most influenced by program attractiveness and the identified values of co-benefits (such as biodiversity conservation) rather than financial incentives. Scenario evaluation revealed that providing a combination of biodiversity incentives with more flexible permanence options could increase the program adoption rate. Stacking or bundling credits combined with contract agreements is also likely to increase the participation rate. These findings can assist policy development by focusing on the aspects of policy design most likely to increase participation.

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1. Introduction

Biodiversity loss is among the most important ecological issues facing Australia (Hatton et al., 2011; Vanclay and Lawrence, 1995). The State of Environment Report 2011 concluded that human activities such as land clearance and population growth are the primary factors responsible for the situation (Hatton et al., 2011). Currently, public conservation areas encompass one-third of Australia but are not considered adequate to conserve biodiversity given their size and the ecological communities they represent (Cowell and Williams, 2006). Therefore, programs for conserving and increasing biodiversity on private land require greater attention and the participation of landholders in these programs is essential (Stephens, 2001).

Biodiverse carbon planting is a key private land conservation practice that has the potential to stimulate investment in biodiversity conservation alongside carbon sequestration. In addition to storing carbon, tree planting has the potential to preserve vital ecological processes and provide suitable habitat for wildlife (Bauhus et al., 2010; Campos et al., 2005; Carswell and Burrows, 2006). Biodiverse plantations will potentially increase the availability of resources for native animals, function as seed banks and enhance the resilience of the ecosystem against climate change and pest invasion (Crossman et al., 2011; Pearce, 2005). Such plantations can be incorporated into existing farming systems through wind breaks, riparian zones and native woodland plantations (Sabto and Porteous, 2011).

1.1. Participation rates of landholders in biodiverse carbon programs

Policy-makers in natural resource management are concerned about participation rates in environmental programs (Mettepenningen et al., 2013). In many cases the number of participants has a direct impact on the expected environmental outcomes of the program. In particular, the number of landholders participating in carbon and biodiversity related programs directly influences the objectives of carbon abatement and improvements to biodiversity. Thus, if favourable to landholders, biodiverse carbon planting schemes have great potential to lead to large scale landscape restoration and carbon sequestration (Lin et al., 2013). Like many carbon planting schemes (and other market-based instruments), biodiverse carbon planting schemes rely on financial incentives to achieve higher participation rates among landholders (Hecken and Bastiaensen, 2010; Rode et al., 2015). However, the conservation outcomes of these schemes may also provide an incentive to landholders (Pascual and Perrings, 2007).

The Carbon Farming Initiative (CFI) was introduced in Australia in 2011 to assist in the achievement of a five percent greenhouse gas abatement target by 2020 (Besley et al., 2014) and offers landholders an opportunity to sell sequestered carbon (Australian Government, 2013). Bio-sequestration (e.g. biodiverse carbon planting) is one of the approved methodologies within the initiative (Australian Government, 2014a,b). The CFI is currently in a transitional period (Australian Government, 2014a,b). Hence, it is timely to review carbon farming programs with a view to identifying approaches that could better achieve objectives for carbon abatement, biodiversity conservation and landholder engagement.

Landholder participation rates depend on many social and environmental drivers (Bacon et al., 2002), some of which are independent of scheme design. Examples include the compatibility of programs with the primary land management practices of landholders (Pannell et al., 2006) and the awareness and values of the environmental and productivity benefits of the scheme (Balderas Torres et al., 2015; Jellinek et al., 2013). Existing social networks and the presence of trusted peers within a scheme could also increase participation rates (Sharp et al., 2013; Bodin et al., 2006; Torabi et al., 2016). This is because landholders can observe what is involved in the adoption phase and participation outcomes experienced by their peers (Kueper et al., 2013). Active engagement in local "Landcare" groups also provides social learning opportunities that appear to increase participation in agri-environmental schemes (Sobels et al., 2001). In addition, participation in other conservation programs develops skills and knowledge (Pannell and Wilkinson, 2009) and progresses emergent stewardship values (Gill, 2013) that assist landholders to engage in biodiverse carbon planting schemes.

Specific characteristics of biodiverse carbon sequestration schemes can also affect participation rates and implementation success. Of these, transaction costs are particularly influential (Coggan et al., 2013); a complicated administration process typically reduces landholders' willingness to become involved. Understanding those processes is resource-consuming for participants, in terms of both time and money (Cocklin et al., 2007). The management requirements of a scheme are another important factor, as high management requirements could negatively impact participation rates (Coggan et al., 2013). In addition, the legal obligation of carbon planting schemes that requires the trees to stay on properties for 100 years (Bradshaw et al., 2013) may reduce landholder willingness to join a scheme, especially in traditional farming landscapes, where landholders might be concerned about the financial implications of revegetation, including impacts on property values (Lokocz et al., 2011).

Financial incentives could assist landholders with establishment and ongoing management costs. Such incentives can be introduced in a range of ways to compensate for the loss of income associated with land use change and thus increase the program uptake rate (Pannell et al., 2006; Pannell and Wilkinson, 2009). Different methods to financially incentivise landholders' participation in biodiverse carbon plantings exist. These include bundling or stacking carbon and biodiversity credits (Deal et al., 2012; Turner et al., 2014). Bundling entails selling the credits resulting from the carbon plantings in the carbon market, but with the possibility of charging a greater price, as they could be sold as "premium carbon credits" due to the biodiversity co-benefits; therefore, the bundled credits cannot be sold separately in the relative markets. This also