

What factors influence the effectiveness of financial incentives on long-term natural resource management practice change?

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doi: 10.4225/50/57C4E802072EC

Abstract

Financial incentives are used by natural resource management organisations to encourage landholders to adopt sustainable practices where the outcomes on a farm scale may be negative or marginal. There is a growing body of research aimed at understanding why landholders do or do not agree to participate in financial incentive programs, however research that considers when and how financial incentives work to bring about long-term behaviour change is relatively immature. The purpose of this review is to answer the question ‘What factors influence the effectiveness of financial incentives on long-term natural resource management practice change?’ In synthesising the evidence, it was found that there are numerous characteristics of the practice change itself, along with the program design and implementation, which are important to understand long-term behaviour change. These include whether inexpensive maintenance or long-term funding is available; whether the changes are relatively simple to sustain; whether the program involves structural changes; whether there is land use rigidity; and whether the changes have resulting environmental benefits that are highly observable. Additionally, it is advisable for programs that use financial incentives to include the following program features: ongoing extension support and a focus on building relationship and trust; flexibility in how the practice change is applied; active landholder involvement from planning to evaluation; and contract length that is appropriate for the complexity of the NRM practice. These characteristics can be used to guide policy makers in their natural resource management investment decisions. There is a clear need for greatly increased monitoring and evaluation of existing programs, both during the program and after its conclusion, in order to more fully understand its long-term impacts and ultimate effectiveness. Finally, landholders undertaking a practice change generally benefit from ongoing support from government natural resource management extension officers.

Despite a concerted effort and large sums of money dedicated towards improving environmental management on private land in Australia and New Zealand, there is a widespread view that efforts to date have not succeeded given that biodiversity, land and water quality continue to decline in many areas (Earl et al. 2010; Hone and Fraser 2004). Perhaps this is not surprising, given that a large cultural shift has been taking place in a relatively short time – only 50 years ago governments were paying landholders to clear native vegetation, but now landholders can be fined for clearing native vegetation and are obliged through regulations and industry codes to change previous management practices to enhance sustainability outcomes. For example, landholders are expected to reduce fertiliser and effluent run-off, improve soil quality and reduce salinity, use water and energy efficiently, reduce greenhouse gas emissions, and increase biodiversity through native vegetation retention (Dairy Electricity Advisory Program 2011; Dairy New Zealand et al. 2013)

Additionally, landholders are under pressure from the market to produce more in order to feed the world’s growing human population, while at the same time pushing

up against resource use constraints. Producing more food from fewer resources while maintaining or improving current resource standards is one of the great challenges of the 21st century (Sachs 2015).

Large sums of public and private funds have been invested in agricultural research and development in order to meet this challenge. With ever-improving technological advances and increased understanding of farming practices that reduce detrimental environmental impacts, government bodies generally have no shortage of suggestions for how landholders can reduce their impact. Convincing landholders to change their management behavior – some of which has been taking place for generations and may still be socially acceptable within the local farming community – has proved more difficult. Long-established and internalised social norms can be difficult to change, and can explain why some farmers persist with practices that are less and less socially acceptable to broader society (Minato et al. 2010). The ‘big stick’ regulatory approach has met with fierce resistance in some cases. For instance, the punitive measures set out in the *Native Vegetation Act 2003* in New South Wales have been perceived by some as an unfair state intrusion into private property rights and landholders’ ability to earn a living (Bartel 2013).

It is a reality that most landholders are under financial pressure to make an income from their land, and that some of the recommended practice changes do come at a financial cost. Some environmental practices are costly to farmers because they take land out of production (such as re-vegetation), or they are costly to implement with minimal or no return on investment (such as the materials and labour for fencing off riparian zones) (Aarons et al. 2013; Jeffrey et al. 2014). Sustainable practices that do bring about some production benefit or save landholders time and money are often adopted by landholders voluntarily. No-till farming and water efficient irrigation systems are examples of such practices (Kaine and Bewsell 2000).

How then to encourage landholders to voluntarily undertake practice changes on their private properties that might result in personal financial loss? Policymakers have used financial incentives as a sweetener in these circumstances, with a proliferation of government-run financial incentive programs in the agricultural sector across New Zealand, Australia, Europe, Canada, the USA and many parts of the developing world. Along with these programs has come a proliferation of research into human behaviour change and adoption theory from multiple disciplines, including economics, sociology, psychology, health promotion, marketing, agricultural extension, and anthropology (Kaine 2008; Pannell et al. 2006).

Review purpose

The current review was undertaken against this background. In particular, this review aims to address a gap in the research, which to date has focused on understanding why landholders do or do not participate in these programs and what could be done to increase participation numbers. In contrast, this review examines the effectiveness of financial incentives in bringing about *long-term* behaviour change – in short, what happens when the money stops? Or the program ends? If landholders revert back to their old practices, and the desired ecological outcomes of the program are not met, then the use of the public purse to fund these programs is questionable. Consequently, understanding when and how financial incentives work to bring about long-term behaviour change is an important policy question with practical implications for what types of programs are funded, and how they are designed and delivered.

This review addresses the key question: what factors influence the effectiveness of financial incentives on long-term natural resource management practice change? The review does not consider the characteristics of landholders that participate in financial incentive programs aimed at behaviour change, or their perceptions of the motivations and barriers to their involvement (Ernst and Wallace 2008; Greiner and Gregg 2011). Nor does it include models or simulations of how hypothetical market trading schemes may operate and how best to design them (Sinner et al. 2012).

How to define 'financial incentives'?

This review interprets 'financial incentives' in a broad sense. We consider evidence related to a variety of financial instruments, including competitive tenders and auctions, stewardship payments, subsidies, and grants. The evidence used in this review involves a variety of different financial incentives schemes internationally, some major schemes being Market Based Instruments (or MBIs, generally from Australia), cost sharing (generally from the USA), Agri-Environmental Schemes (or AES, generally from Europe) and Payment for Ecosystem Services (or PES, generally from the USA, Latin America and Africa).

How to define 'long-term'?

Only one study (Race and Curtis 2009) considers the definition of 'long-term' in the context of NRM practice change. The authors state that the recommended NRM practice needs to become largely a 'stand-alone' with no need for substantial external support, and be an integral component of the property's management. The study suggests that once the land-use practice has become established, 'long-term' could be defined as a period of 10 years, although this would depend on the particular practice implemented and the ecosystem in which it is taking place (Race and Curtis 2013).

Methodology

One of the key points of difference between a traditional narrative literature review and undertaking a systematic review is the reduction of potential bias in the conclusions that are drawn from the review. This is achieved through:

- the development of an *a priori* search protocol documenting the search terms and phrases, search sources, the inclusion and exclusion criteria, and any conflicts of interest;
- transparent documentation of how the relevance of information returned from the search process is assessed;
- an assessment of the quality of evidence items;
- transparent documentation of the extraction of the relevant evidence from studies using a data extraction table.

We have undertaken all of these processes in this review, with the search protocol, search terms and results, and an abbreviated and combined data extraction and quality assessment table included as appendices.

Evidence items were searched for from a wide variety of sources, including online databases containing peer reviewed journals, and databases containing grey literature. Databases searched were Science Direct, Wiley, JSTOR, DOAJ, TROVE and the search engines Google and Google Scholar.

The following search phrases were used in these databases and search engines:

1. ('market based instruments' OR 'market based incentives') AND adoption AND ('long term' OR 'endurance of change' OR 'drop out') AND (agricult* OR 'natural')
2. ('financial incentives' OR 'economic incentives' OR 'incentive program' OR 'monetary incentives') AND (landholder OR farmer OR 'land manager' OR landowner OR 'primary producer') AND (adop* OR effectiveness) AND (biodiversity OR conservation)
3. ('cost share' OR 'fixed grant' OR 'financial grant' OR 'capital grant' OR 'financial payment') AND (evaluation OR program) AND (biodiversity OR conservation)
4. ('direct grant' OR 'fixed price grant') AND (biodiversity OR conservation)
5. ('agri-environmen* program' OR 'agri-environmen* payment' OR 'agri-environmen*scheme') AND ('behavi*r change' OR 'practice change' OR adopt*)

Given that only one evidence item from New Zealand was located in these initial searches, we undertook targeted searches to discover whether relevant New Zealand literature was available. This involved searching the publications sections of the websites of Department of Conservation and Motu Economic and Public Policy Research. Additionally, leading New Zealand researchers from the following organisations were personally contacted:

- AgResearch
- Cawthorn Institute
- Landcare Research
- Motu Economic and Public Policy Research
- Ministry of Primary Industries

As a result of this initial search, a total of 152 evidence items were deemed relevant based on their title and abstract. The full text of these evidence items was then assessed in accordance with the inclusion/exclusion criteria outlined in the search protocol (see Appendix 1). In summary, the inclusion criteria involved studies of landholders who had voluntarily participated in a government program that offered financial incentives and involved a practice change. The exclusion criteria applied to studies undertaken in locations and situations with very different economic and social circumstances to New Zealand and Australia. Other exclusion criteria applied to studies that assessed participation factors, sociodemographic characteristics, and attitudinal factors *without* assessing behaviour or future intentions at the cessation of program funding. Furthermore, expert opinion items that did not analyse actual landholder participation in a program were excluded, along with theoretical economic models and hypothetical preference surveys.

After removing duplicates and studies that did not meet the inclusion criteria ($n = 107$), a total of 42 studies were identified, and the relevant data and quality assessment information from these studies extracted into a literature matrix (see Appendix 2). These 42 studies were used as the evidence to answer the review question.

Review limitations

As discussed above, there is a substantial body of evidence on the demographics and characteristics of landholders who sign up to programs promoting sustainable practices

that include a financial incentive component. There is also a substantial body of evidence on what motivates landholders to be involved in these programs and any barriers to involvement.

There were surprisingly few studies of high quality that examined whether behaviour change had continued and environmental conditions had changed some years after the conclusion of a sustainability program involving financial incentives. Most studies discussed landholders' future intentions on the basis of interview or survey responses. While somewhat informative, an intention to do something in the future does not mean that it will necessarily happen. Often our review question was not the central focus of the studies included in the review, with study methods being limiting at times because they were not designed to examine long-term commitment to sustainable practices.

A further issue with the study methods was that the majority of the studies relied entirely on survey results from landholders who had participated in a sustainability program using financial incentives (Fisher and Pakula 2010; Gustafson and Hill 1993; Lichtenberg and Smith-Ramírez 2011; Mendham et al. 2007; Moon and Cocklin 2011; Page and Bellotti 2015; Race and Curtis 2009). While surveys are commonly used in social sciences and are appropriate for this topic, more rigour could have been applied to the studies using surveys in order to decrease the possibility of confounding variables. For example, replication and a control group were used in only one of the surveys (Crabb et al. 2000), while only two studies coupled their survey with site visits or satellite images to verify whether structural and environmental changes noted in surveys had in fact occurred (Duncan et al. 2014; Jackson-Smith et al. 2010). Given that landholders have been found to overestimate the success of their projects, on-site evaluations are a necessary element of a robust study design (Cotching and Sims 2000; Jacobson et al. 2003; Kammin et al. 2009).

Very few studies assessed various components within a financial incentive program or differences between financial incentive mechanisms using appropriate experimental design. The available evidence to answer this review question is immature, signaling that more research is required, along with monitoring and evaluation of programs.

Commonly reported factors that do not necessarily demonstrate long-term practice change

A small number of empirical studies examined the long-term adoption of NRM practices, or the long-term ecological impacts upon the cessation of a financial incentive program. Other factors (listed below) were more prominent in the literature, and could be easily mistaken for signals of long-term practice change. While such indicators may indeed assist the occurrence of long-term practice change, it would be unwise to assume that long-term change has occurred or will occur based on their presence. These factors are:

- *Landholder knowledge has increased.* Many surveys asked participating landholders whether their knowledge about a particular sustainability practice had increased as a result of the program. While increased awareness of NRM best practices is a vital component of behaviour change, it alone will not ensure that the change is long-term. Landholders lacking the financial resources or physical capability to undertake change may continue with their old practices (Tennent and Lockie 2013).

- *Landholders express an intention to continue the practice in the long-term.* It was common for studies to mention survey results such as ‘Eighty seven percent of participants expressed a long-term commitment to managing their areas after funding from the RLS Sustainable Agriculture Project ceased’ (Earl et al. 2005, 18). While positive that participants had such intentions, external forces can negate the best of landholder intentions to continue the practice in the long-term. For example, a landholder who committed to increasing biodiversity by participation in a tree-planting program may not be able to continue the required maintenance of these areas due to economic or physical constraints (Race and Curtis 2013). Relying purely on such statements in a survey without a follow up survey years later, ideally including a site visit, poses considerable risks for decision making.
- *A program has high participation rates.* This is a key traditional indicator of program success, but it does not necessarily illustrate the quality of achieved environmental benefits, or whether they resulted in long-term landholder behaviour change (Wilson and Hart 2001). While certainly helpful in ensuring that at least some landholders continue with the practice, it is no guarantee of this. For example, if landholders regard the payment as unfairly low for the work that they do, they will be unlikely to continue the practice when the contract, project or payments cease (Race and Curtis 2013).
- *A land use or practice has changed in the short-term.* A change does not necessarily reflect a commitment to the NRM practice. It could be a pragmatic business decision to access additional resources that may or may not continue to be implemented in the long-term (Race and Curtis 2013).

Features of the practice change that aid long-term behaviour change

There is a stronger likelihood that the NRM practice will be maintained over the long-term if the practice change that the financial incentive is targeting has the following features.

It is inexpensive to maintain or there is long-term funding available

Selecting practices that do not require significant ongoing funding (or selecting program participants with appropriate financial resources and interest) is important if there is an expectation that landholders continue with the practice once the program and government funded financial incentive ends. Ferraro and Burnside (2000) discuss this in their evaluation of the WEST 2000 Rural Partnership Program, in the context of rabbit and woody weed control in NSW. There is little environmental benefit in providing one-off or short-term payments to landholders to undertake pest control if they do not have the personal financial resources to continue undertaking the control in the long-term (Ferraro and Burnside 2001). This was also an issue in Colombia for small-holder farmers who could not afford to buy fertilisers to maintain the silvopastoral system once the payments for ecosystem services ceased (Hayes 2012).

With programs where landholders are expected to fund a portion of the structural or ongoing management costs, it is important that government agencies use the most efficient and effective ways to implement the practice change, and that they do not underestimate the implementation costs. Getting this wrong can cause much distress among landholders, as well as damage program reputation and trust (Storz 2008).

Certain practices may require ongoing financial incentives if they are to continue to be undertaken in the long-term. This was the case in a study of landholders involved in Agri-Environmental Schemes in Switzerland. Those undertaking organic farming were generally reliant on direct payments to subsidise the cost of the numerous controls and income loss arising from the restrictions it entailed, and many indicated that they would abandon organic farming if subsidies ceased (Karali et al. 2014).

Such dependence on ongoing financial incentives may be more appropriate in some countries than in others. In an Australian context, landholders involved in a tendering system for native biodiversity protection were concerned about the permanence of government funding for purchasing biodiversity services, given short funding cycles and inevitable changes in policy and budget priorities due to political cycles (Race and Curtis 2009). A major limitation of programs based on market instruments such as competitive tenders or auctions are that payments received for work done are wholly reliant on government funding, which is unlikely to continue in the long-term. The nature of the conservation work being done often means that landholders cannot pass on these management costs to consumers. Tennent and Lockie (2013) argue that there is little advantage in funding biodiversity conservation in the short-term – it is a long-term commitment. Hence they question the logic in funding short-term schemes that won't continue when government funding ceases.

New Zealand has a history of experimentation with innovative market based schemes for conservation purposes, which aim to address the problem of relying on short-term government funding for long-term behaviour change. For example, an individual transferable quota on fisheries has been in operation since 1986, and has managed to keep fish stock numbers at sustainable levels since their crisis in the early 1980s (Sinner et al. 2005). In 2008 New Zealand was the first country to implement an emissions trading scheme that includes forestry as part of its commitment to its Kyoto Protocol obligations. While deforestation rates have decreased since the scheme's implementation, the market is still fledgling and new plantings haven't yet occurred at a large scale. The main barrier to overcome is uncertainty around domestic and international emissions trading schemes – while uncertainty still permeates the system, forest owners are hesitant to make large scale, long-term investments in carbon forestry (Karpas and Kerr 2011).

More recently, the Lake Taupo nitrogen cap and trade scheme was introduced in 2011 in New Zealand, aimed at improving water quality. The first of its kind worldwide, the scheme operates by capping the total nitrogen emissions from agriculture into the lake, and creating tradeable 'nitrogen discharge allowances' (NDA). Landholders in the catchment are given some flexibility to make business decisions, by being able to trade their NDAs to other landholders or sell them to a public fund. While the market is still in its infancy, landholders are engaging with it and many elements of its design appear to be working, although again, initial uncertainty over its long-term viability has resulted in a cautious approach to involvement by some landholders (Duhon et al. 2015; Kerr et al. 2015).

The environmental benefits of the practice are highly observable

High observability of the benefits resulting from a practice that is linked to an incentive program has been reported as a powerful stimulus for behaviour change, as landholders feel that their efforts really do make a difference (Burmeister et al. 2006; Moon and Cocklin 2011) For landholders participating in a conservation farming program in Indiana, the multiple benefits of implementing and maintaining grassed waterways were highly observable, and worked to increase enthusiasm and

commitment to the practice. Observable benefits included reduced soil erosion, increased presence of wildlife, and enhanced aesthetic quality of the waterway (Reimer et al. 2012). The high observability of practices that reduced soil erosion has been mentioned as a motivating factor in other studies also (Van Herzele et al. 2011).

In contrast, environmental benefits of practices aimed at reducing salinity are often not highly observable, because improvements require long time-scales, and observable landscape changes are minimal. Given that landholders often can't determine whether their ongoing actions are making a difference, short-term funding for practice change in this area might have limited success (Pannell 2001).

The practice is relatively simple to sustain

The more complex an innovation or practice is, the greater the risk that the behaviour change will not be sustained in the long-term (Läpple 2010; Morris et al. 2000; Oja 2008). For example, landholders in the CS Scheme found that the field margins option was difficult to understand, introduce and maintain, and as a result this was one of the least successful options in terms of uptake, implementation and continuation of practice (Morris et al. 2000). It is important that appropriate levels of support are provided with financial incentive activities to build the capacity and confidence of landholders, particularly in the first year of the program when learning curves associated with the new practice are high (Läpple 2010; Cattaneo 2003).

The practice involves structural changes and land use rigidity

A number of studies found that land use rigidity, resulting from fixed and irreversible conversion or transaction costs, has an effect on whether land is reverted to pre-financial incentive management (Crabb et al. 2000; Hayes 2012; Johnson et al. 1997; Roberts and Lubowski 2007; Sullivan et al. 2004). For example, some investments such as fencing or tree planting are not easily reversible – removing them requires an input of time and money. In contrast, practice changes involving daily management practices are more easily reversed.

This was highlighted in a study that evaluated ongoing landholder use of best management practices after government funded projects in the USA. They found that over 80 per cent of structural and planting practices were still in the field, while less than half of the management practices were still actively being used by project respondents (Jackson-Smith et al. 2010).

Features of the project design and delivery that aid long-term behaviour change

There is a stronger likelihood that the NRM practice will be maintained over the long-term if the project design and delivery of the program with the financial incentive has the following characteristics:

Ongoing extension support, relationship building, and trust

Many studies found that landholders placed high value on ongoing support from NRM organisations (Boyer and Heath 2009; Burmeister et al. 2006; Mendham et al. 2007; Morris et al. 2000; Schenk et al. 2007; Wilson and Hart 2001). On-farm visits and follow-up from knowledgeable individuals aid in assisting landholders to meet the program's ecological aims, particularly because discussions and information transfer have relevance to the landholders' actual circumstances (Kammin et al. 2009; Schenk

et al. 2007). Given the importance of extension support in assisting with long-term change, NRM organisations should resist the temptation to cut extension funding or set work targets that are too high for program staff to achieve. Such actions can result in poor quality or non-existent long-term support for landholders, make dis-adoption of the practice more likely, and negate the years of effort and large sums of money put into sustainable agriculture programs (Mendham et al. 2007).

Additionally, a strong relationship of trust between landholders and NRM bodies has been found to be crucial in order to achieve large scale involvement and behaviour change (Emtage and Herbohn 2012). This relationship can help landholders move past the initial ‘honeymoon’ period of enthusiasm and commit to the long-term input that the practice change involves (Race and Curtis 2013). Extension support brings with it important ongoing advisory, information and support services, which can provide a much needed boost to waning landholder motivation, especially with regard to long-term expensive land-use change (Hayes 2012; Mendham et al. 2007; Race and Curtis 2013; Zammit 2013).

There is flexibility in how the practice change is applied

A common finding in the literature was the necessity for flexibility in how landholders can apply the desired NRM practice to their property. Three key reasons were provided for its importance: firstly, flexibility enables adaptive management. If a financial incentive mechanism is too rigid (e.g. some Payment for Ecosystem Services contracts), this can impinge on landholders’ capacity to adaptively manage the natural resource in the face of changing ecological, social and economic conditions (Hayes et al. 2014; Storz 2008). For example, with some conservation auctions, landholders have underestimated the work required in actions such as pest control. Fixed and binding agreements were difficult to meet as the level of pests was higher than originally anticipated. Without flexibility, landholders in such circumstances felt that they were being underpaid for their efforts and had little desire to continue with the practice at the conclusion of the agreement (Race and Curtis 2013).

Flexibility in implementation also increases ownership of conservation works, and encourages the formation of partnerships (Coggan and Whitten 2008; Moon and Cocklin 2011; Posthumus and Morris 2010) This increased involvement and ownership has, in some cases, led to a greater amount of conservation work being undertaken than originally planned, and a willingness to continue with the conservation work at the conclusion of the agreement (Coggan and Whitten 2008).

Flexibility in the incentive mechanism (perhaps through providing multiple mechanisms) enables NRM bodies to cater for different landholder needs. For instance, some landholders would prefer money to support the cost of materials, while others with less farming experience and high off-farm income may need ‘know-how’ or technical support. Financial incentives need to be flexible enough so they can be tailored to meet these different needs. A fixed grant offering a single payment rate to all participating landholders may ‘under-invest’ in some landholders by being insufficient to sustain their commitment over the long-term, and ‘over invest’ in other landholders by exceeding the level of support needed to ensure their long-term commitment (Race and Curtis 2013).

Overall, a flexible program can help to make the promoted conservation change more palatable to those implementing it on the ground. This has been the experience of the Lake Taupo Nitrogen cap and trade scheme in New Zealand. There has not been large scale, sustained landholder backlash against the scheme because its flexibility allows for intensification of land use (which ensures that those on undeveloped land

are not disadvantaged), and the trading mechanisms allow landholders to sell credits and a trust fund to be established (Kerr et al. 2015).

However, there is a risk that increased flexibility can lead to low additionality (i.e. a small effect when the intervention is compared to a baseline) and some recommended practice changes not being adopted, particularly if they do not provide obvious private benefits (Posthumus and Morris 2010; Moon and Cocklin 2011)

Active landholder involvement from planning to evaluation

Actively engaging landholders in the planning and implementation of the NRM practice has been shown to improve their knowledge, skills, confidence, and commitment to sustainable farming practices (Boyer and Heath 2009; Burton et al. 2008; Wilson and Hart 2001). Often landholder commitment to the project is stronger because they have an increased sense of ownership as a result of their involvement (Posthumus and Morris 2010). Programs that do not require a lot of active landholder involvement, such as zoning off land for conservation, are less likely to result in long-term behaviour change (Burton et al. 2008).

Active involvement in monitoring and evaluation is also important, as landholders are required to observe and record the application and impacts of the practice. This step in the process is highly influential on whether the landholder perceives any benefit of the practice and therefore whether they will continue to undertake it in the long-term (Morris et al. 2000). Indeed, a landholder's belief that a practice change is of both financial and ecological value can certainly assist in that change being implemented in the long term.

Informal monitoring and the reporting of observations by landholders have also been found to be useful in increasing landholder awareness and enthusiasm. For example, under a BushTender management agreement, landholders were required to submit an annual report, reporting against the progress of management actions outlined in their agreement. While being a requirement to trigger the next payment, this annual reporting also increased landholder awareness of changes that had occurred on their site and created an opportunity for landholders to be aware of their achievements and share them with others (Burmeister et al. 2006).

Contract length appropriate for the complexity of the NRM practice

Compliance with incentive conditions has been found to increase over time, and it has been suggested that this is related to improvements in landholder understanding and capacity as they go through the 'learning curve.' (Burmeister et al. 2006; Cattaneo 2003). Programs and support therefore need to be of a duration appropriate to the complexity of the practices. If they are too short, there is a higher likelihood that the practice change will not continue in the long-term.

Possible undesired outcomes from programs using financial incentives

A number of possible unintended outcomes may arise from the use of financial incentives, according to the evidence base.

Crowding out

'Crowding out', a relatively recent theory, suggests that providing financial incentives to landholders to undertake a practice for the public good (such as protection of native vegetation for increased biodiversity) can 'crowd out' their intrinsic motivation for

undertaking that practice. The financial incentive changes their belief that they have a duty to undertake that practice and they start to demand payment for it.

In a literature review of studies assessing the crowding out phenomenon, Rode et al. (2013) found several studies that suggested the existence of a motivation crowding out effect with financial incentives for biodiversity protection (Rode et al. 2013). They claim that small positive incentives can lead to an overall adverse effect, and recommend NRM bodies to 'pay enough or don't pay at all' (Andrews et al. 2013; Rode et al. 2013). It is important to assess existing intrinsic motivations of program participants prior to large scale implementation of a program. Doing so can assist in determining whether crowding out has occurred at a later date due to the program (Andrews et al. 2013; Rode et al. 2014).

It is worth noting that Rode et al. (2013) warned that the evidence in support of crowding out is inconclusive. They found methodological limitations for the empirical studies in their literature review that demonstrated a crowding out effect. These included a lack of adequate baseline information regarding pre-existing intrinsic motivations, and weak comparability of results of case studies due to inconsistent terminology and methods.

There is evidence of financial incentives not producing a crowding out effect. In their study of 71 landholders in south eastern Australia, Duncan et al. (2014) found that landholders who had recently been subsidised for a project were more likely to have later completed unsubsidised work. This indicates that, at least in terms of medium-term economic impact, the large increase in public subsidies did not diminish privately funded activity, as might be expected according to the theory of crowding out (Duncan et al. 2014).

With 'crowding out' being a recent theory with few high quality studies supporting it, it is more a possibility to be aware of than a solid reason not to pursue financial incentive programs.

Low additionality

A frequently cited problem with financial incentive programs is that they can provide low additionality, or only marginal benefits. Low additionality can also occur when participants may have already been undertaking a similar practice before enrolling in the program, or would have undertaken it irrespective of funding. Evaluation surveys have often determined that a significant proportion of landholders that receive financial incentives were already undertaking the same or similar practices (Crabb et al. 2000; Earl et al. 2005; Gustafson and Hill 1993; Kaljonen 2006; Posthumus and Morris 2010; Storz 2008; Windle et al. 2007).

In situations where the practice would have been implemented without a financial incentive, the financial incentive may represent some additionality in that it can reduce timescales for the work to occur and enable landholders to receive guidance (Earl et al. 2005; Fisher and Pakula 2010; Moon and Cocklin 2011). If the practice is already occurring then it may enable landholders to increase the amount of land that is subject to practice change or investment, or it can result in work being undertaken to a higher standard (Earl et al. 2005). It can also bring about less measurable but equally worthwhile benefits, such as increasing the reputation of the NRM organisation and building relationships with landholders that can serve as a springboard into future NRM activities and programs. In an evaluation of a financial incentives program for machinery upgrades run by a Catchment Management Authority (CMA) in New South Wales, it was found that while 73 per cent of the applicants would have converted their machinery within the next five years regardless of the financial incentive, nearly half

of the participants have moved on to take part in other programs run by the CMA (Fisher and Pakula 2010).

Slippage

Slippage (i.e. a reduction in the overall resource quality compared to a baseline after the intervention) has been documented in numerous studies (Fleming 2010; Leathers and Harrington 2000; Lichtenberg and Smith-Ramírez 2011; Posthumas and Morris 2010; Smith-Ramirez 2005; Wu 2000). It can occur in financial incentive programs, for example when landholders' farmland not subject to the program is farmed more intensively, or previously unfarmed land is bought into production. It generally occurs to offset perceived or actual production losses of land subject to a financial incentive. For example, it was found that farmers involved in a cost share program were more likely to reallocate areas of their land that were under vegetation into crop production, which would likely have some negative environmental impacts (Lichtenberg and Smith-Ramírez 2011). While the effect of slippage on long-term practice change has not been assessed, improvements attributed to financial incentives may be offset by slippage to some degree and it therefore needs to be considered.

The need for increased monitoring and evaluation

Given the identified research gap, it is vital that monitoring and evaluation of financial incentive programs takes place. To begin with, a number of baseline measurements need to be recorded at the commencement of projects (Earl et al. 2005). Jackson-Smith et al. (2010) claim that there are many potential benefits to developing better tracking systems for post-contract implementation and long-term maintenance of best management practices. They found that there were many instances of practice non-implementation and non-maintenance amongst landholders in Utah, as well as instances of non-contracted conservation behaviour that took place on participating farms.

How to undertake such monitoring and evaluation is not without challenges. Race and Curtis (2013) argue that in most Australian catchment regions several instruments can be operating simultaneously, which makes it difficult to determine which individual instrument is responsible for influencing different landholder practice change over the long-term. They claim that the impact of one policy instrument can dilute or mask the contribution of another, and that study designs (such as in-depth qualitative research) need to be carefully developed to address this issue (Race and Curtis 2013).

Strategically targeted programs for highest ecological impact

Ultimately, the reason NRM organisations spend time and money on running behaviour change programs is to improve the condition and sustainability of our natural resources. However, with the complexity involved in engaging landholders and understanding how to best use financial incentives as a policy tool, it is easy to lose sight of this ultimate goal. Recent research into European Agricultural Environmental Schemes (AESs) found that few studies have examined whether AES projects have in fact made headway in enhancing biodiversity in the wider farm landscape, with lack of baseline data, monitoring and evaluation being common (Michael et al. 2014). While not the focus of this review (see Swann 2015 for a more detailed discussion), some researchers have suggested that financial incentive programs should ideally target landholders whose properties contain the most threatened ecosystems, or whose

properties are well placed strategically to deliver the biggest ecological ‘bang for bucks’ spent (Cooke and Moon 2015; Green and Clarkson 2006). The NSW government’s recent program ‘Saving Our Species’ has considered some of these issues, particularly through allocating threatened species to certain management streams based on their distribution, ecology and security.

Conclusion

Financial incentives are a widely accepted policy tool for use by NRM organisations, particularly when the sustainability practice that they are encouraging has few benefits to landholders at a farm scale level, or is expensive to implement or maintain. Government funding is vital in order for new technological advances and ecological understanding to be disseminated and implemented by landholders and for large scale ecological benefits to be realised. However, this funding can quite easily miss its mark and have little impact on long-term landholder behaviour change if invested in a poorly designed program or an inappropriate practice.

The body of evidence is maturing with regard to the characteristics of landholders who sign up to government sustainability programs that offer a financial incentive, and their motivations and barriers for doing so. There is, however, a research gap with regard to the factors that influence the effectiveness of financial incentives on long-term practice change. Very few studies assessed elements of a financial incentive program, or differences between financial incentive mechanisms, using appropriate experimental design. It was uncommon for studies to assess the impact of a program on long-term landholder behaviour change, or its long-term ecological impact. Given the considerable amount of public money being invested in these programs, it is imperative that these long-term impacts are studied and understood, and then used to guide future programs. In order for this to occur, baseline data must be gathered for current programs, and appropriately designed monitoring and evaluation needs to be undertaken during the program and after its conclusion.

Despite this research gap, this review did find evidence that shed light on some influential factors that increase the likelihood of programs bringing about long-term landholder behaviour change. These factors can be used to guide policy decisions around investment and risk management. On the basis of this evidence, practice changes with the following features were more conducive to long-term behaviour change:

- Inexpensive maintenance or long-term funding is available;
- Changes are relatively simple to sustain and not complex;
- Program involves structural changes and land use rigidity;
- Changes have resulting environmental benefits that are highly observable.

Additionally, it is advisable that programs that use financial incentives include the following program features:

- Ongoing extension support and a focus on building relationship and trust;
- Flexibility in how the practice change is applied;
- Active landholder involvement from planning to evaluation;
- Contract length that is appropriate for the complexity of the NRM practice.

Numerous evidence items stressed the importance of ongoing extension support and strong relationships between government bodies and landholders in assisting with long-term behaviour change. Policy makers are advised to ensure that extension services are adequately funded and resourced. Cutting back on funding for extension services can result in work targets that are too challenging to meet, and high staff turnovers leading to an absence of quality relationship-building with landholders, or long-term assistance. Without this relationship, feedback and support, landholders are more likely to discontinue use of the practice, negating the years of effort and large sums of money invested into sustainable agriculture programs.

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Appendix 1: Search Protocol

A set of inclusion and exclusion criteria was applied to each search to determine if each result should be added to the ‘admissible pool of evidence’. Each piece of evidence was required to pass each criterion to be included. The assessment was prepared using at least the abstract and sometimes, such as in the case of study type, using the full text. When uncertainty existed, the reviewers tended towards inclusion.

The inclusion criteria applied to this search were that studies should:

- assess the effectiveness of financial incentives in achieving the continued use of sustainable practices on farmland after a final payment was made to the landholder or after a contract to deliver environmental benefits had ended;
- undertake an assessment of landholder intentions at the end of a contracted period that related to the delivery of a financial incentive;
- involve voluntary landholder participation;
- assess participation slippage or moral hazard in relation to financial incentives; and
- assess motivations for entering into multiple or one-off payment schemes if they directly related to endurance of change.

The exclusion criteria applied to studies that:

- were undertaken in locations and situations where very different economic and social circumstances were present;
- involved landholder participation that was not voluntary;
- assessed participation factors without assessing behaviours/actions during and after cessation of funding;
- assessed the effect that agri-environmental programs had on biophysical indicators at a landscape scale without assessing landholder actions;
- solely addressed the cost effectiveness of agri-environment programs or cost-analysis of different incentive options;
- assessed socio-demographic characteristics, attitudinal factors (relating to targeting participants) but did not assess future intentions or practices during and/or after a program related to a financial incentive; or
- assessed adoption factors relating to initial landholder participation only.

In addition, the criteria excluded:

- expert opinion items that did not analyse actual landholder participation;
- hypothetical landholder choice/preference surveys;
- quantity or market friction based market based instruments (MBIs);
- theoretical models of moral hazard relating to economics.

Some systematic reviews and literature reviews were included where these were highly relevant to the topic and provided important contextual information, and where the relevant primary source could not be located.

A number of search strategies were used to identify relevant material. Searches were not restricted to any specific date range.

Strategy 1: Search the Collaboration for Environmental Evidence (CEE) library

The online CEE systematic review library was searched to identify if there were any existing systematic reviews that would answer the search question.

Strategy 2: Systematic search of online databases

A systematic search of scientific databases was conducted. These searches were undertaken using a set of pre-defined search phrases. The databases used included the following types of evidence:

1. Peer-reviewed scientific journal articles;
2. Grey literature, including consultancy reports, government reports and theses.

Strategy 3: Search for New Zealand based literature

New Zealand researchers and Natural Resource Management organisations were contacted to find relevant research conducted in New Zealand.

Strategy 4: Sourcing of evidence that is cited

In cases where conclusions were drawn within the evidence that was found, and that cited evidence had not been found via other search strategies, attempts were made to source that primary evidence as opposed to relying solely on the authors' conclusions.

Appendix 2: Literature matrix

Table 1 Literature matrix of evidence in the review

Study	Context	Key Findings	Study Design	Potential biases
<i>More robust study designs</i>				
Burton et al. 2008	Case study from Hessen, Germany and Aberdeenshire, Scotland. Use of a conceptual framework based on Bourdieu's notions of capital we explore how farming activities are able to generate symbolic capital, and compare this with the symbolic value of conservation work. This examines why voluntary agri-environmental programs often engender minimal attitude change towards productivity agriculture among conventional farming communities	We find that voluntary agri-environmental work returns little symbolic capital to farmers. By prescribing management practices and designating specific areas for agri-environmental work, farmers are not allowed to develop or demonstrate skilled role performance – thus inhibiting the development of embodied cultural capital. We conclude by suggesting that entrepreneurial production-target based agri-environmental schemes may be ultimately more effective in changing long-term behaviour.	Replication - 2 geographically distinct sites (Germany and Scotland) Surveys - respondents selected by snowball methodology. Respondents total (n= 25) 13 Scotland, 12 Germany. Structured interview using cards with images. Control - approx. half involved in AES, half not (involved in AES - Scotland n =8, Germany n=5)	Small sample size. No before after. Only considers social capital. The suggestion that entrepreneurial production target based on AES may be more effective in the long term is more a suggestion than being a finding of the study.
Crabb et al. 2000	This study was an economic evaluation of a grant scheme aimed at making conservation part of normal farming and land management practice.	The evaluation found that nearly two thirds of agreement holders definitely intend to re-apply at the end of their ten-year agreements and only 3% will definitely not re-apply; the remainder are undecided. Those definitely intending not to re-apply are older and have smaller agreements. The ten-year length of agreements is a major deterrent to renewal for the undecided.	Replication - 5 distinct case study areas. Control and surveys - postal survey sent to 3000 non-participating landholders in the case study areas, a national survey sent to 3000 agreement holders and survey of 1500 unsuccessful applicants to the scheme. Interviews (telephone and face to face) n=148.	There is no independent verification of whether future intentions to re-enrol are actually implemented.

Duncan et al. 2014	This study (undertaken in south-eastern Australia) attempts to determine the validity of an assumption often used in government reports regarding revegetation and fencing off native vegetation. The assumption is that wholly privately funded sites match publicly subsidised sites on a hectare for hectare basis (a so-called 'x2' assumption).	The study found that contrary to the 'x2' reporting assumption, about 75% of the total area of the 412 sites studied was from subsidised sites, and that proportion was far higher for the period after 1997. However, rather than displacing unsubsidised activity, the studies modelling showed that landholders who had recently been subsidised for a project were more likely to have subsequently completed unsubsidised work. This indicates that, at least in terms of medium-term economic impact, the large increase in public subsidies did not diminish privately funded activity.	<p>Independent site verification: Aerial photography was used to map the extent of revegetation, native vegetation fencing and restoration on 71 representative landholdings in rural south-eastern Australia.</p> <p>Interviews: Landholders were interviewed and the age and funding model of each site was recorded.</p>
Fisher and Pakula 2010	This study examined the adoption of machinery incentives in the central west region of New South Wales.	Project participant responses showed that while the majority accelerated their practice change as a result of the incentive, 73% would have adopted these practices within five years regardless of the incentive. In contrast, 13% of respondents noted that they would never have adopted these practices without the incentives.	<p>Interviews: Structured telephone interviews with 24 key stakeholders, 319 recipients of incentives and 21 unsuccessful applicants were undertaken. Additionally focus groups, a desktop review and feedback from a workshop presenting project findings were also used.</p>

Jackson-Smith et al. 2010	This paper examines the strengths and weaknesses of using formal USDA Natural Resources Conservation Service records of conservation program participation as an indicator of spatial and temporal patterns of Best Management Practice Implementation and maintenance.	While over 80% of structural and planting BMPs were still in the field, less than one-half of the management BMPs were still actively being used by project respondents.	Official contract files for each of the 90 landowners who participated in the program between 1992 and 2006 were reviewed. Interviews: Fifty-five of the original 90 participants were interviewed. Field verification: We shared a list of the best management practices encouraged in the program along with aerial photographs of their property and reviewed each practice to discover whether or not they were still using the practice.	While aerial photographs were helpful, particularly to verify structural works, management practices could not be independently verified using this method.
Kammin et al. 2009	This study was conducted in 1998 in Illinois. It involved an evaluation of the Private Land Wildlife Habitat Management Program as it functioned from 1986 to 1996.	This evaluation found that landholders valued site visits from state officers or other experts who had experience with the practice. It also found that landholders generally thought that their practice change had resulted in a more profound ecological change than in fact had occurred.	Survey: Self-administered mail questionnaire of 34 biologists involved in program from 1986 – 1996. Of the 4,548 participants, 75% were mailed a survey and 1,431 responded. Site verification: A random sample of 101 properties managed by program participants were selected for on-site evaluations.	There was a lower than expected landholder response rate to the survey. It is unclear whether the site verifications used any data to compare site condition before the intervention to its condition afterwards.

Systematic Reviews

Rode et al. 2013	This paper reviewed the theoretical insights and empirical findings on motivation crowding effects with economic instruments for biodiversity protection.	The most important finding from our review is that several empirical studies suggest the existence of motivation crowding effects with economic incentives for biodiversity protection, supporting the hypothesis that economic instruments can have important impacts on relevant motivations and conservation logics.		
Rode et al. 2014	The paper seeks to advance our understanding of the extent to which the use of economic incentives can undermine ('crowd out') or reinforce ('crowd in') people's intrinsic motivations to engage in biodiversity and ecosystem conservation.	This review found that while economic instruments for conservation are increasingly being used worldwide, it is crucial to assess existing intrinsic motivations and expected changes in people's motivational structures prior to large-scale implementation.		

Surveys

Andrews et al. 2013	This paper investigated framing effects in the context of farmer decision making about conservation tillage practices.	The results suggest the possibility of modest financial payments ‘crowding out’ intrinsic motivations for contributions to public goods such as soil conservation. From a policy perspective, these findings also suggest the relative inefficacy of offers of modest conservation payments in promoting no-till farming, especially among non-adopters.	3 hypotheses were tested using a survey-based experiment administered to a national sample of row-crop farmers.
Burnside 2005	This study evaluated the WEST 2000 Plus program, undertaken in NSW.	The evaluation found that there is a declining need for investment in NRM works that have economic and environmental benefits. Further investments in NRM should be the responsibility of landholders only unless it can be demonstrated that there are substantial off-site benefits and impacts. It is evident from the responses to this evaluation that considerable investment has occurred on properties without WEST 2000 Plus funding and that many landholders will make further investments.	149 pastoralists responded to a telephone questionnaire. Discussions with other stakeholders were also undertaken and secondary data and information used.
Emtage and Herbohn 2012	This study investigated the factors that influence landholders to adopt recommended practices and use this to provide insights into how to encourage greater adoption of these practices	A strong relationship of trust between landholders and NRM bodies has been found to be crucial in order to achieve large scale involvement and behaviour change	
Ferraro and Burnside 2001	This paper presents selected outcomes of an evaluation of the \$17.5 million WEST 2000 Rural Partnership Program.	One-off payments are unlikely to be effective if repeated interventions are required over time and money is a barrier to implementation. This has been documented to be the case in western New South Wales for rabbit control and woody weed control	Primary data from: A telephone survey of randomly selected landholders (n = 173), detailed discussions with (landholder) grant recipients (n = 37), focus group meetings involving non-landholder stakeholders (n = 40). Secondary data i.e. funding applications and evaluation sheets and interviews with WEST 2000 Staff and Management Board

Garbach et al. 2012	This study evaluated adoption of silvopastoral conservation practices (reintroducing trees and shrubs into permanent pastures).	PES payments (Payment for Ecosystem Services) increased adoption of practices that provide primarily public goods. Practices providing primarily private benefits were adopted in the absence of PES. Farmer-to-farmer information sharing further supported use of conservation practices.	101 farmers were interviewed after the RISEMP pilot had closed – 66 who had received payments and/or technical assistance, and 35 who had not participated in the program.
Gustafson and Hill 1993	The objective of this study was to identify factors that influence North Dakota CRP participants' decisions about future land use.	It was found that a majority (52 percent) of CRP land would be returned to crop production if the CRP program was not renewed in 1995. Twenty-one percent of CRP land would be rented out or leased and 18 percent used as pastureland.	Cross-sectional data from a mail survey were used to identify factors that are most likely to influence CRP land use decisions and to investigate relations between land use decisions and socioeconomic characteristics. A response rate of 39 percent or 351 participants was obtained from the sample size of 900.
Hayes 2012	The study examined the sustainability of a PES silvopastoral programme in Colombia from peasant farmers' perspectives.	Participants needed ongoing extension support with information and motivation, and couldn't maintain practices that required constant funding. When funds for fertiliser ran out, they stopped applying it.	Two surveys were used – one of pilot project participants (n=21, total 23) and new participants (n=54, total 60).
Hayes et al. 2014	This study examined how PES institutions fit with the tenets of adaptive decision-making for sustainable resource management.	PES programs are not inherently decentralized, flexible management tools, as PES contracts tend to restrict decision-making rights and offer minimal flexibility mechanisms to change resource-use practices over the duration of the contract period.	Surveys and replication: Interviews with program participants, program direction and extension agents of a PES carbon offsets program in Ecuador, and a silvopastoral program in Colombia.
Hoye and Bently 2008	This study looked at landholder adoption of native vegetation management in the Bega Valley Shire Area.	It was found that contract landholders rated administration requirements and flexibility in the lower bracket, indicating a need for future program design to explore landholders' needs and expectations.	Telephone survey – 250 landholders with 5+ Ha, (56 held a native vegetation management contract). This was 8% of the 2988 landholders in region on 5+ Ha.

Johnson et al. 1997	This study aimed to examine the effects of factors that influence landowners' post-contract use of CRP lands in the Texas High Plains.	The financial value of the commodity base will be a significant factor in the post-contract land use decision. The probability of acres returning to crop production increased with contract size. 69% of CRP acres would be returned to crop production in the absence of an extension of current contracts.	A mail survey was conducted among 740 CRP contract holders, who represented a stratified sample (by location) comprised of approximately 5% of total contract holders in the Texas High Plains	
Kaljonen 2006	This article analyses how implementation practices produce conditions for agri-environmental management.	The paper discusses poor program designs (including the importance of flexibility and of recognising local conditions and farmer' knowledge).It also discusses additionality.	Farmers from 31 farms located in Finland and enrolled in the general protection scheme were interviewed. The farms were selected to represent different production modes, size, age and environmental.	
Lambert et al. 2006	This report examines the business, operator, and household characteristics of farms that have adopted certain conservation-compatible practices, with and without financial assistance from government conservation programs.	The report discusses farmer characteristics of involvement in voluntary programs and some features of successful programs.	Authors used crop-specific data from the Agricultural Resource Management Surveys to examine the characteristics of farms that adopt conservation management practices. A section of the 2001 ARMS survey of all farms was used to examine the adoption of different practices.	The data and survey are not included in the paper so it is difficult to assess their quality.
Läpple 2010	This article investigates the determinants that affect both adoption and abandonment of organic drystock farming over time in Ireland.	Risk-averse farmers are less likely to adopt, whereas farmers who express environmental concern are more likely to adopt. Farmers are most likely to adopt in their first year of farming and are most likely to exit after the first five-year contract expires, suggesting that farmers encounter problems with organic farming.	341 organic, 41 ex-organic and 164 conventional farmers were surveyed.	Surveys not included. Different surveys used for organic farmers and conventional farmers.
Lichtenberg and Smith-Ramírez, 2011	This paper examines the extensive margin effects of conservation cost sharing using farm-level data from Maryland.	It was found that cost sharing provides incentives for farmers to use conservation methods they would find unattractive without the financial help of cost sharing. With regard to slippage, farmers who received cost sharing allocated 50 percentage points less total farmland to vegetative cover than they would have in the absence of cost sharing.	Survey of 487 Maryland farm operators. Stratified random sampling was used to ensure a sufficient number of responses from commercial operations	

Moon and Cocklin 2011	This study aimed to understand landholders' motivations and barriers to conserve biodiversity, by interviewing 45 landholders involved in such programs in Queensland.	Results showed that changes to land management practices specified in the program should be developed with landholders to ensure that they are achievable and will provide the desired ecological outcomes. Observable improvements in land condition can be a powerful stimulus for behaviour change. Flexible programs carry the attendant risk of achieving low additionality.	Invitations were sent to program participants and 45 respondents (a response rate of 78%) was achieved. Interviews were conducted face to face or via telephone.	Given the small, selective sample of landholders interviewed in this research, it is likely that additional barriers to participation exist.
Morris et al. 2000	This study aimed to understand farmers' attitudes towards and willingness to participate in the Arable Field Margins option of the Countryside Stewardship Scheme.	Landholders in the CS Scheme found that the field margins option was difficult to understand, introduce and maintain, and as a result this was one of the least successful options in terms of uptake, implementation and continuation of practice. Landholders placed high value on ongoing support from the CS Scheme organisers.	Survey and replication: Telephone Questionnaire designed. Farmers were randomly selected from the Yellow Pages telephone directory to provide coverage from the predominantly arable parts of England as defined by MAFF agricultural statistics. 212 farmers interviewed from a range of farming types, farm sizes and soil types	Yellow pages as sampling tool - criticism that it misses lifestyle/organic farmers. This wasn't the target audience so authors claim using the yellow pages was a valid tool.
Page and Bellotti 2015	In this research farmers' values towards on-farm ecosystem services, motivations and perceived impediments to participation in conservation programs were identified in two local land services regions in Australia using surveys.	The study examines mainly participation, not ongoing NRM practice change, but it does discuss the impacts of legislative uncertainty regarding a carbon price.	91 surveys of landholders used in final sample. Sample strategy: A voluntary online survey. Email invitations containing the link to the survey were sent to approximately 800 farmers through Central West Farming Systems (CWFS) and EverGraze@.	
Race and Curtis 2013	This paper examined how best to deliver payments for environmental services, and considered whether market-based instruments (MBI) deliver better outcomes than traditional approaches.	If the change toward 'best practice' NRM is relatively easy to sustain, of low cost, perceived to be successful, and adds value to the property's management, then there is a strong likelihood that the commitment can be maintained over the long term. Support and grants should be tailored to suit different landholder's needs. Ongoing support is important. Programs need flexibility.	In-depth semi-structured interviews with 31 landholders. Purposefully stratified sample included farmers and non-farmers, from 3 catchments in central northern Victoria, where there was a diversity of land uses.	Selection bias - those who participated were known to/associated with the NRM's.

Sullivan et al. 2004	This report examined whether the impacts of CRP enrolment on rural employment and businesses, rural population and beginning farmers.	One factor that clearly influences the choice of post-CRP land use is the type of cover used when the land was in the program. CRP land planted to trees was far less likely to be converted to crop production upon the contract's expiration than was CRP land planted in grasses and legumes.	Trends in the geographic distribution of CRP land and the characteristics of farm operators participating in the CRP were analyzed using CRP contract data and survey data on farm enterprises. A literature review detailed some of the known environmental and recreation impacts of the CRP.
Wilson and Hart 2001	This paper focuses on the importance of possible changes to attitudes of farmers participating in the UK's Environmentally Sensitive Area (ESA) scheme and the Countryside Stewardship (CS) scheme.	Key findings are the importance of flexibility, extension, monitoring and education.	200 farms from 2 different districts were surveyed in the UK in 1997 using structured questionnaire followed by in-depth interviews. The sampling strategy in the two districts was similar, with a random survey of participants and non-participants and in-depth interviews.
<i>Interviews</i>			
Bowyer and Heath 2009	This study aimed to understand the role that a financial grant and technical support played in the 'Profitable perennials' project undertaken in Western Australia had on participants' adoption of perennial pastures.	The grant played a key role in involving farmers in the project and quickly leading them to trialling perennial pastures. It reduced the risk of implementing perennial pastures by reducing the capital outlay required for establishment. The technical support provided farmers access to a broad information network that allowed them to learn quickly about perennial pastures. The impact of the project on long-term adoption was difficult to assess because most participants had only just established pastures.	Semi structured interviews with 17 landholders were undertaken. Interview guide used and included in Appendix 'Purposeful sampling' technique used – landholders selected from 3 different areas in a geographic spread across the region. Because 100 per cent of the project participants were not interviewed, it is possible that not all viewpoints or ideas have been captured through this study.
Karali et al. 2014	This paper identifies the factors that either constrain or facilitate farmer decisions to participate in environmental management practices in Switzerland.	Seventeen factors were found to influence farmer decisions to participate in environmental management practices, demonstrating that their decisions were not solely driven by economic incentives.	The study is based on a qualitative, thematic analysis of in-depth, semi-structured interviews of 24 respondents. Respondents were selected using a theoretical sampling method from a purposeful sample.

Posthumus and Morris 2010	This paper examined farmers' opinions about CAP-reform, from successful interventions that aimed to reduce soil erosion and diffuse pollution, and also from failures.	This article is more on factors that influence adoption rather than long term practice change, but some useful findings, including the need for flexible rules to enable farmers to adapt practices on their farm, the possibilities of slippage and additionality, and actively involving landholders with trials.	Semi-structured interviews were held with 36 farmers. Replication: By selecting sub-catchments with a geographical spread, a variety of land management situations were accounted for. A stakeholder workshop was attended by 23 stakeholders	The sample of farmer interviewees was small, locally focussed and thus not representative for the entire farming population in the UK.
Reimer et al. 2012	A qualitative analysis of in-depth interviews with farmers was conducted to determine which characteristics make four common BMPs more or less acceptable to agricultural producers.	The four practices include two management/operational practices (cover crops and conservation tillage) and two structural practices (grassed waterways and filter strips).The multiple benefits of implementing and maintaining grassed waterways were highly observable and worked to increase enthusiasm and commitment to the practice. Observable benefits included reduced soil erosion, increased presence of wildlife and enhanced aesthetic quality of the waterway	Interviews were conducted with forty-five producers in two watersheds in Indiana, USA.	The sample was primarily production-focused farms producing cash grains and soybeans. Smaller hobby farms and farms growing non-commodity crops may have very different views of practice characteristics.
Schenk et al. 2007	The objective of the study was to determine which conditions and factors influence acceptance positively or negatively.	It was found that those affected should be given the possibility to participate in an early phase of the planning process. Those affected should be informed about planned measures as early as possible. Information should not be seen as a troublesome duty, but as a cornerstone.	Replication: two different conservation measures were studied. Interviews: 22 people representing the following groups were interviewed in an iterative procedure: land owner (3), farmer (16), nature conservationist (1), local politician (2) and representative of the tourist industry (2). Sampling: The interviewees were theoretically sampled so that those selected included people have a representative sample.	In a qualitative approach the aim is not to obtain a representative sample, but rather to gain insights into the subject. Therefore only a small number of individuals were interviewed.
Storz 2008	The study examined the Farm Bill Conservation Program using an informal interview process.	It was found that participants need low cost programs with flexibility, uncomplicated practices. Additionality was discussed.	Landholder interviews using a modified sondeo methodology.	

Tennent and Lockie 2013	This article reviews the outcomes of three projects that targeted biodiversity conservation on agricultural land in Central Queensland.	This study suggests that while short-term and targeted environmental goals were achieved, arguably the most important outcomes of these projects were their capacity to build support networks, foster communication between natural resource management agency staff and landholders, and promote a greater appreciation for the relationships between biodiversity and productivity	Semi-structured, qualitative interviews with 13 land managers, 12 project officers and 3 community stakeholders was undertaken. Interviewees were selected on the basis of their involvement with one of the three projects and their willingness to participate in the study conducted on published academic and industry research.
Van Herzele et al. 2011	The paper sets out to examine the mechanisms by which mobilisation for agri-environmental management develops.	The study follows AEM along the various trajectories of implementation (design, distribution, application).	During March/June and November 2008, semi-structured interviews were conducted with 13 experts involved in AEM implementation, as well as 37 farmers who have practical experience with AEM.
<i>No methods section</i>			
Burmeister et al. 2006	This report presents the opinions of landholders who took part in a trial program.	This study demonstrated the value of the annual reporting process and the importance of observing improvements in vegetation condition. The majority of landholders indicated that they would voluntarily continue to apply the management actions or at least continue to forego existing land uses such as grazing by stock, beyond their contract period	Surveys with a control were used, along with landholder annual reports and some site visits. But these were undertaken by consultants and not available in the report. It was difficult to assess the study design given the lack of detail in the report. The study did not look at long term results and landholders only reported on changes during program while receiving payments, not after payments ceased.

Curtis et al. 2009	This study was an evaluation of Southern Rivers Bush Incentives Program.	Site visits by Project Officers were strongly welcomed by landholders and were considered to be one of the most beneficial aspects of the program. Time for basic extension was limited, a constraint of the program. Project Officers got around this by encouraging landholders to accompany them while they did a site assessment and even to help the in data collection on plots.	No methods section.	Authors appear to have been the staff who were project officers on the program using data collected during the program. Not an independent evaluation, could give rise to some conflict of interest.
Earl et al. 2005	The authors were contracted to provide an evaluation of the RLS Sustainable Agriculture Project in its initial phase. This report contains information gathered from the evaluation.	In our view the familiarity of project staff with landholders was beneficial to the process, with negotiations proceeding from a firm basis of trust. It is recommended that in the future a range of baseline measurements be recorded at the commencement of projects.	This report contains information and findings from an evaluation of the RLS Sustainable Agriculture Project in its initial phase from January 2005 to June 2005.	It was difficult to assess the methods given that the evaluation was not available.
Windle et al. 2007	This study examined details of a Queensland conservation auction, including its design and outcomes.	The study discussed problems with having a short term contract for long term goals, along with additionality.	No methods section in the paper.	The paper lists the survey as an appendix but this not attached to the main report. A link to the appendix online no longer active.
Zammit 2013	This study examines two Tasmanian programs that have engaged with over 1400 landowners.	Landowner appreciation that their land had both production and commercial conservation values grew. The flow of information to build capacity through improved awareness, knowledge transfers and skills development. Participation encouraged many landholders to redesign their properties into production and conservation zones that supported improved management for both productive and conservation outcomes.	No methods section in the paper.	The researchers reported on their experiences in engaging private landholders in 2 large market based conservation projects in Tasmania.

Other

Roberts and Lubowski 2007	The study examined the persistence of cropland retirements induced by the Conservation Reserve Program (CRP), the largest U.S. conservation program.	It found the likelihood of a parcel returning to crop production is associated with the profitability of cropping activities and of alternative land uses, land cover contracted under CRP, land attributes, and location.	Researchers analysed micro data on land use for the 48 states during periods before and after the expiration of the first set of CRP contracts. The data reflect choices made by landowners who opted out of the CRP early, or who chose not to renew their contract.
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