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# **Using Incentives to Buy Land-Use Change in Agriculture for Environmental Benefits**

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# Using incentives to buy land-use change in agriculture for environmental benefits

David J. Pannell

## Abstract

In general, the use of incentive payments to landholders in environmental programs is poorly thought through. This article discusses situations where environmental incentive payments are more likely to be a cost-effective response by environmental funders. It is proposed that incentives can be used in two broad ways: to encourage trialling of new practices by landholders, or to compensate landholders for losses resulting from land-use changes. It appears that environmental funders often do not pay sufficient attention to the differences between these two approaches. The first approach only makes sense if the new practices are ‘adoptable’, and so are expected to remain attractive to landholders beyond the trialling phase. The importance of adoptability and the factors likely to influence the adoptability of an innovation are discussed. The question of who should pay is relevant to whether incentives are appropriate, but is largely political, rather than economic. The concept of market failure is of little practical relevance to environmental funders wishing to target and prioritise their investments. A set of key questions is proposed for environmental funders to address when considering the potential role of incentives.

*JEL classifications:* Q24, Q28, Q57, Q58, H23, H4

*Key words:* environmental subsidies, incentives, externalities, adoption of innovations, environmental policy

## **1. Introduction**

Incentive payments are used in many countries to encourage people to change their behaviour in ways that would benefit the environment, or the management of natural resources.

However, the use of incentives is usually not very discerning, and often the money involved could be spent more effectively.

The money involved is large. In Australia, for example, the two main national programs for improved environmental management in rural areas are the National Action Plan for Salinity and Water Quality (NAP, a \$1.4 billion program over eight years) and the Natural Heritage Trust (NHT, a \$1 billion program over five years). Sizable shares of their budgets are planned to be spent on incentive payments to landholders, mainly farmers, to change their land use practices.

In the Australian context, one of the main changes being purchased through incentive payments is replacement of traditional, short-lived or ‘annual’ agricultural species, with longer lived ‘perennial’ species, to address problems of dryland salinity (Pannell, 2001), biodiversity loss (Keighery et al., 2004), soil erosion and eutrophication. It is intended that these perennials will help to keep saline groundwater tables at bay, will add to or protect existing habitat, and will help to stabilise soils and reduce nutrient loss into waterways.

This paper is a discussion of key issues around the use of incentives for these purposes, with the aim of providing guidance to environmental funders on circumstances where incentives are most likely to be appropriate and where they are likely to be inappropriate. The context of

the work is a broader study on the selection of policy tools for the management of dryland salinity (Ridley and Pannell, 2005).

## **2. Broad roles for incentive payments for environmental management**

Incentive payments are used in two broad ways:

(a) to encourage people to trial, and (it is hoped) subsequently adopt, new practices that are believed to be in their best interest already, and that happen to also benefit the environment, and hence benefit the broader community.

(b) to compensate people for adopting practices that result in net costs to the adopters, but which benefit the environment and the broader community.

This is a crucial distinction, but one that, in my experience, many environmental funders do not sufficiently recognise. It is essential to think through these two cases if incentives are to be used well.

In case (a), the incentive payments can be small and temporary. They need only to be big enough to be effective bait, rather than long-term sustenance, because once hooked, landholders will realise that they like being hooked, and will be happy to stay hooked in the long-term. This is the same sort of situation where one could successfully use education and communication programs to encourage behaviour change.

The incentive payments would mainly accelerate the change, rather than raise its final level. The final actual level of change would depend on how attractive the new land-use practices were to landholders after incentive payments ceased. So, a key question for a funder who is considering offering small, temporary incentive payments is, to what extent are the changes likely to be maintained after the payments cease? In other words, how adoptable are the practices without incentives. If they are not adoptable on a sufficient scale to achieve the desired environmental benefits, it doesn't make sense to offer small, temporary incentives to encourage trialling.

In case (b), the incentives need to be large enough to provide both bait and sustenance (i.e., to compensate for losses relative to traditional practices). The incentives could either be ongoing regular payments or a larger up-front payment, but in either case they would need to be larger than case (a), probably substantially larger. Case (b) is like throwing fish food off a jetty to attract fish. The fish would hang around the jetty, enjoying the free feed for as long as it was provided, but would quickly drift away if the feeding stopped. That is, because the new practices are not sufficiently attractive in themselves, landholders would dis-adopt them once incentive payments stopped, unless the system forced them to continue through a contractual agreement, backed by monitoring and enforcement (a further expense).

Another analogy of the two cases would be that in case (a), offering incentives is like an advertising campaign, to let people know that an attractive product is available, whereas in case (b) advertising is not sufficient – the product is not sufficiently attractive – and we need to subsidise the price of the product in order for people to buy it.

There is a situation that is probably somewhere between cases (a) and (b). If environmental benefits can be generated by small, relatively low-cost changes, it may be possible to convince landholders to bear those costs for the good of the broader community. In other words, because of their personal commitment to the environment, they would adopt them for the long term as a result of small, temporary incentives, so in this way it is similar to case (a). But if the changes required are large and expensive, we should not expect them to happen so easily.

### **3. Problems with existing incentive programs**

A major problem with existing incentives currently being paid under the NAP and NHT is that the funders often confound the two cases. They are offering small, temporary incentives, as if they were dealing with an example of case (a), in situations that would actually require large, permanent incentives to be effective in the long term – case (b). They have not evaluated the land-use changes to see whether they are adoptable on a sufficient scale to achieve the desired benefits before designing the incentive system.

The result is that much of the money is being spent in ways that will not generate environmental benefits in the long term, because the changes will be undone once the payments cease, or once markets shift to favour other land uses.

A second problem with current incentive systems is that, in many cases, they are not well linked to environmental outcomes. Even if the land-use changes they buy were maintained in the long term, they may be in locations or at scales that mean that the resulting environmental benefits are small in relation to the payments being made. Environmental funders need to pay

close attention to the cause-and-effect relationship between land-use change and environmental benefits if they are to avoid spending money on land-use changes that would not actually benefit the environment. Currently in Australia, there is not sufficient onus on the regional bodies that channel the funds to landholders to do this – that is, to seriously consider whether the changes they are buying will actually achieve environmental outcomes.

For salinity management, in particular, situations where case (a) is appropriate are actually not as common as we would like, because there is currently an insufficient range of perennial plant options that are economically attractive (Kingwell et al., 2003; Pannell and Ewing, 2006), although there are exceptions, of course. In particular, funders often appear to fail to recognise the high opportunity cost of land-use change on a large scale. The scale of conversion of annuals to perennials needs to be large in order to contain water tables (National Land and Water Resources Audit, 2001), and the result is that planting perennials at the high levels indicated as being necessary to achieve environmental targets may result in large economic losses to the landholder (e.g., Bathgate and Pannell, 2002).

More generally, a sceptic looking at funding allocated to a supposed example of case (a) could reasonably ask, if the proposed new land use practices are actually in the best interests of the landholders, why have they not been adopted already. I suggest that the practices would need to be new and poorly known to landholders for the argument that it is actually an example relevant to case (a) to be convincing.

Identifying examples of case (b) that are worth funding also poses a number of challenges.

The payments to landholders need to be large enough to cover:



- the financial shortfall between new and traditional land-use options
- a premium to cover the loss of option value if landholders are to be contracted to maintain the changes in the longer-term (which they need to be if the payments are to be assured of achieving outcomes) (Isik and Yang, 2004)
- perhaps a premium for risk or uncertainty
- a further incentive to prompt them into action ('bait')

In addition there would be costs of monitoring and enforcing agreements. Because the costs involved in this case need to be large for the system to be effective, this type of incentive payment should be targeted to particularly high-priority cases. These will be cases where the values of the assets under threat are outstandingly high, and the planned land-use changes can be effective in preserving or enhancing them. Not surprisingly, Ridley and Pannell (2005) concluded that case (b) style incentive payments are justified only in special cases in the management of dryland salinity.

#### **4. What makes a new land-use adoptable?**

The adoptability of a practice is a key issue in determining whether payment of small, temporary incentives can be an effective strategy. Pannell et al. (2006) reviewed the factors that influence the adoptability of a new technology. They grouped the factors into two broad categories: relative advantage (the extent to which the new technology is more attractive than the old) and trialability (the ease with which potential adopters can trial and learn about the technology).

The factors that determine relative advantage include:

- the short-term input costs, yields and output prices of the innovation or of all farming activities that it effects;
- the innovation's impact on profits in the medium-to-long term;
- the innovation's impacts on other parts of the whole-farm system within which it will be imbedded;
- adjustment costs involved in adoption of the innovation;
- the innovation's impacts on the riskiness of production;
- the innovation's compatibility with a landholder's existing set of technologies and resources;
- the innovation's complexity;
- government policies;
- the opportunity cost or profitability of the traditional practice which the innovation would replace;
- the compatibility of a technology with existing beliefs and values; and
- the impact of the innovation upon the family lifestyle.

The determinants of an innovation's trialability include:

- the divisibility of an innovation, meaning its ability to be used on a small scale, or the ability to test only a sub-component of an innovation package;
- the observability of results from an innovation;
- the time lag between establishing a trial and observing its results;
- the complexity of an innovation, which can reduce the capacity of landholders to have confidence about the consequences of adopting it;
- the cost of undertaking a trial;

- risks of trial failure; and
- quality of implementation of the trial.

Overall, the issue of adoption of environmental practices is complex and multifaceted. The issue needs to be carefully and thoroughly considered by environmental funders and planners before selecting the magnitude and type of incentives offered.

## **5. Who should pay?**

The "beneficiary-pays principle", closely related to the "user-pays principle", says that the beneficiary of a good or service should bear the costs of its provision. The "polluter-pays principle" moves the financial burden onto those who are creating the environmental problem. Proponents of the "cost-sharing principle" recognise that there can be multiple winners from some environmental works, potentially including some benefits to the polluters. Perhaps it is fair that the costs are shared out according to those benefits.

I believe that the choice among these options is primarily political, rather than economic. Payment of incentives is consistent with beneficiary-pays or cost-sharing, but not with polluter-pays. In my observation, an approach that is commonly judged to be politically feasible is to give precedence to the status quo. This means that polluter pays would be applied to prevent a change to a more polluting activity, while beneficiary pays (or an approximation of it in the form of government funding) would be used to encourage a change to a more environmentally beneficial outcome. A group with particularly high political power can over-ride this system, but apart from that it often seems to work out this way. Economists could not say they have anything against this system from a distributional perspective.

Depending on the issue and how it is addressed, they may have concerns about efficiency. For example, the proposed solution may create high transaction costs or perverse incentives, or do-nothing might be a better option.

## **6. Market failure**

So far I have not emphasised market failure as a criterion for payment of incentives. In principle, in order for an incentive payment to be justified, one needs to be able to identify a factor that is causing the free market to fail to deliver the maximum possible benefits. A classic example of such a cause is an ‘externality’, which is a benefit or a cost that accrues to someone other than the decision maker. The implication for environmental funders would be that the changes funded would need to generate benefits for people other than the landholder (often loosely referred to as ‘public benefits’). A second cause of market failure is poor information, as in case (a) where landholders apparently do not realise what is good for them.

In fact, the existence of externalities or information failure is not a sufficient condition for market failure to exist. It is also necessary to check that the benefits of addressing the problems outweigh the costs. “If with government intervention, the losses exceed the gains, the spillovers should remain” (Pasour, 1993, p.3)

In practice, the concept of market failure is not very helpful to environmental funders to prioritise or target their investments because causes of market failure can be identified in every environmental problem. In cases (a) and (b), both refer to benefits ‘to the broader community’ (i.e., externalities) and both suffer from serious information limitations.

More generally, there has been criticism of the very concept of market failure on the basis that real markets *always* fail to measure up to the idealised markets of perfect competition (Pasour, 1993). This means that “market failure” alone provides us with no useful criterion for assessing options for government intervention. Further, if transaction costs are recognised, it cannot be proven that government action is warranted simply because a traditional cause of market failure exists (Dahlman, 1979). “When transaction costs are taken into account, economic analysis has yet to develop a reliable system for identifying ... examples of market failure that have relevance for public policy” (Pasour, 1993, p.2).

## **7. Payments for actions or outcomes?**

The discussion so far has been based on an assumption that environmental funders will pay incentives on the basis of land-use change, rather than for environmental outcomes achieved. In the first case, all costs due to risk and uncertainty are borne by the environmental funder, while in the second case, they are borne by the landholder. Given the high levels of environmental information required, payment on the basis of outcomes would probably require large additional premiums to cover the transaction costs of information collection, and the risks associated with inaccurate information or environmental shocks. There are likely to be considerable economies of scale, as well as lower risk premiums, if the responsibility for information is concentrated in the hands of the environmental funders and planners. In other words, notwithstanding economic theories that emphasise the efficiency benefits of regulating for outputs rather than inputs, payments for actions is likely to be the more efficient option. Nevertheless, this is an empirical question, about which further research would be helpful.

## **8. Key questions for environmental planners and funders**

In view of the foregoing discussion, the key questions that planning bodies need to address to design sensible and effective environmental incentive schemes include the following.

1. What is the relationship between the scale of change (e.g., in land use) and the level of environmental benefits?
2. What is the relationship between the scale of change and the level of incentive payments that would be needed to achieve that scale of change?

Without answers to both of those questions, one cannot hope to adequately determine what level of incentive payments should be offered, if any, and for which purposes?

To address question 2, a number of subsidiary questions are needed:

- 2.1 Are the new land-use options readily 'adoptable' (i.e., sufficiently attractive without extra incentives)?
- 2.2 If so, on what scale?
- 2.3 If so, will small, temporary incentives help to accelerate that adoption?
- 2.4 Where they are not already adoptable, what scale of incentives will be needed to achieve the desired changes (opportunity cost plus option value plus risk premium plus 'bait')?

2.5 If those larger incentives are paid, what system of monitoring and enforcement will be needed, and what will it cost?

If it were possible to answer the above key questions 1 and 2 quantitatively and in dollar terms, it would be possible for funders to determine the optimal scale of land-use change and what rate of incentive would need to be paid to achieve it. One could use the two relationships from questions 1 and 2 to look at a range of scales of land-use change (corresponding to different incentive rates via question 2) and see which scale generates the greatest net benefits. It would correspond to the rate at which the marginal benefits (the additional environmental benefits from an extra hectare of land-use change) are equal to the marginal costs (the additional incentive payments required to cause land use to change on that extra hectare).

In practice this is extremely difficult to apply strictly. Neither of the two questions can be answered with much precision or certainty, and answers to question 1 will probably be difficult to convert into dollar terms, especially if the benefits include non-market values from improvements in the natural environment (e.g., Smith, 1996; Bennett and Blamey, 2001). Nevertheless, it should be possible to specify the approximate outcomes that are expected to result from payment of incentives: what level of additional adoption would occur, and what environmental benefits would follow (in biological, physical or economic terms)? If these cannot be specified, basic accountability requirements would say that the funders should not be spending public money on the incentives in question.

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