

# **Economics of Cost Sharing for Agri-Environmental Conservation**

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The problem of how to resource agri-environmental conservation is presently the focus of considerable attention from Australian policy-makers. Given the limited resources available, policy-makers are particularly anxious to design a framework for cost sharing which achieves desired environmental outcomes as efficiently as possible. The aim in this paper was to assist this process by analysing how the principles and practice of current arrangements for cost sharing are consistent with economic efficiency. It was found *inter alia* that economic efficiency does not provide an unambiguous basis for choosing among cost-sharing principles. The efficient rule depends on how property rights are defined. Only governments can reduce this ambiguity by better defining these rights.

Keywords: cost sharing, agriculture, agri-environmental policy, irrigation, conservation, Murray-Darling Basin, economics, economic instruments, property rights, transaction costs, duty of care, polluter pays principle, beneficiary pays principle, user pays principle, common property.

## **1. Introduction**

The problem of how to adequately resource agri-environmental conservation is presently attracting considerable attention from Australian policy-makers. The Murray-Darling Basin Commission (MDBC) (1996) prepared the discussion paper *Cost-Sharing for On-Ground Works* “to provide a basis for better-informed debate on whether paying for sustainable natural resource management is a public, private or shared responsibility among landholders, the community and governments.., More recently, the Standing Committee on Agriculture and Resource Management (SCARM) (1997) issued a draft resolution *Natural Heritage Trust: National Principles for Government/Community Cost Sharing*. Fargher (1997) and Industry Commission (1997) have also contributed to this discourse.

Large demands for resources to enable implementation of the strategies formulated by participatory approaches to agri-environmental conservation have highlighted the urgency of deciding who should pay (Woodhill 1997). Commencing in Victoria in the mid-1980s, irrigators and the state government made important progress in this respect through developing various Salinity Management Plans (SMPs). For each of the Plans, capital and other costs of on-ground works were shared according to a consistent set of guidelines based largely on the Beneficiary-Pays Principle, but to a lesser extent also on the Polluter-Pays Principle. This was a marked change from the previous norm of irrigators paying operating and maintenance costs of irrigation infrastructure investment and government paying the capital costs (Sappideen, Gross and Barr 1992).

More recently, Land and Water Management Plans (LWMPs) developed during the 1990s for irrigation areas in New South Wales (NSW) were strongly influenced by precedents set by SMPs.

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Based on the apparent success of these Victorian and NSW approaches to irrigated agriculture, at least in terms of governments and citizens agreeing to integrate their conservation efforts and share costs, there is now pressure to adapt these approaches for application to dryland agriculture.

Substantial funds were recently allocated by the Federal Government to the Natural Heritage Trust in recognition of the rapidly increasing demands for resourcing of participatory programs such as these. However, governments in the long run will be unable to address more than a small proportion of the costs of environmental problems associated with agricultural activity (Batie 1986). Thus there is a pressing need to maximise the conservation dividend from the limited government funds that are available. As significant as the advances in cost sharing made in SMPs and LWMPs have been, it is timely to consider whether further advances are required if the overall conservation task is to be afforded.

There appears to be a perception in some quarters that economic efficiency provides an unambiguous basis upon which to choose among the various cost-sharing principles being considered. Ambiguity is unattractive to policy-makers because it increases the potential for political arbitrariness or sectoral/regional loyalty to undermine the effectiveness of a program of cost sharing. Accordingly, the aims in this paper are to (a) assess whether economic efficiency provides an unambiguous basis for choosing among cost-sharing principles; and (b) review the extent to which the various cost-sharing principles currently being considered are consistent with economic efficiency.

## **2. What are on-ground works and why are they the focus of cost sharing?**

The first comment to be made about the MDBC's cost-sharing proposals is that they are restricted to on-ground works. The rationale for restricting cost sharing to on-ground works is clearly of interest. It is also important to be clear about what 'on-ground works' actually means. MDBC (p. v) defined on-ground works as "activities that require capital investment in establishment or construction. ... Examples include: establishment of pastures, shrubs and trees; fencing-off riparian zones, remnant vegetation and gullies and soil conservation earthworks. The cost-sharing framework does not apply to non-works activities such as income foregone from excluding livestock from protected areas, or the purchase of soil conservation equipment and machinery..,

On the basis of this definition and the examples provided, it appears that cost-sharing arrangements would apply only to conservation activities involving on-ground (read "on-site,") establishment/construction of reasonably durable assets. Even though exclusion of livestock from protected areas represents an opportunity cost to a grazier, it is apparently ruled out by this criterion because the 'ecological asset' created (biodiversity) remains less highly regarded than a 'productive asset' (eg, fencing or perennial pasture). Soil conservation equipment or machinery is constructed and its purchase clearly represents a capital investment, but it is apparently ruled out because in general it is not constructed on-site.

It is evident from the experience with SMPs and LWMPs that the such approaches have considerable potential to exploit cost-savings available from substituting other conservation options for engineering-type works and from better integrating engineering-type works with other options so as to harness synergies among them. Even though the MDBC has broadened its definition of works to include 'non-engineering' works such as establishment of trees and perennial pastures, this definition nevertheless continues to exclude a wide range of potentially important options. This may

distort the incentives local communities face when deciding among alternative ways of tackling an environmental problem.

In the Liverpool Plains, for instance, problems associated with groundwater recharge and surface runoff can be ameliorated by introducing farming practices which leave the soil profile drier than would otherwise be the case. Two such practices are planting perennial pastures and intensifying rotations to reduce areas of land left fallowed. Subject to the MDBC definition of on-ground works, the costs of the first practice could be shared with polluters or beneficiaries but the costs of the second practice may not; since each extra annual crop that would be established under the latter option may be insufficiently durable to be counted as a capital investment. It would not be surprising therefore if the local community showed greater interest in the former option compared to the latter.

Other potentially-valuable options fall more clearly outside the MDBC definition of on-ground works. Considerable conservation benefits can sometimes be obtained by low-cost changes in day-to-day behaviour (either by farmers or government employees). In the irrigation context, for instance, more careful irrigation scheduling can minimise surface run-off and thereby greatly reduce the need for works such as recirculation systems or public drains. A consequence of excluding such options from cost-sharing arrangements is that local communities may neglect them when choosing options to meet their conservation targets.

One reason for restricting arrangements for cost sharing to on-ground works as defined may be the high transaction costs of monitoring and enforcing farmer adoption of other kinds of options. Another reason may be that adequate incentives to adopt some of these other options are provided under alternative arrangements (eg, taxation concessions). These reasons need to be made explicit, however, so they can be debated and so policy makers are better prepared to respond in the future if circumstances change (eg, taxation concessions are removed, or advances in remote sensing technology reduce transaction costs of monitoring day-to-day farmer behaviour).

Any argument based on transaction costs to the effect that cost-sharing arrangements should be restricted to works-type options should in any case be regarded with caution. Future environmental benefits from on-ground works are invariably sensitive to various factors including the ways in which they are operated and maintained. For instance, benefits from planting and fencing tubestock depend on how reliably farmers perform their watering, weed-control and fence-maintenance responsibilities. Watertable-lowering benefits from farmers installing groundwater pumps strongly depend on how much they are used and how well they are maintained.

It is not unusual for private and public interests to differ significantly with respect to how works are installed, operated and maintained. Unless cost sharing or other incentives are introduced to bridge this difference, farmers' efforts in this regard may be considerably less than hoped for. For instance, governments in the past heavily subsidised construction of on-farm soil conservation works in the expectation that farmers would not require further subsidisation to maintain those works. However, such works have often lacked a sustained impact due to this expectation being overly optimistic (Barr and Carey 1992). Furthermore, transaction costs of ensuring that works are installed, operated and maintained according to the public interest will often be substantial. These costs should be accounted for before passing judgement that transaction costs for works-type options are generally much lower than non-works options.

Where ongoing cost sharing by government is required to provide sufficient incentive for farmers to operate and maintain works in the public interest, the investment in works is exposed to the risk that subsequent governments will decide to terminate such arrangements. Any comparison of the attractiveness of works against other conservation options needs to account for this risk. Of course this risk can be lessened if government agrees to provide all the funds for ongoing cost sharing at the outset and allow these funds to be ‘quarantined’.

### **3. Why is cost sharing needed?**

The question of why administered cost sharing is needed for agri-environmental conservation is addressed in this section. In Australia, after all, it is commonplace to entrust the responsibility for allocating costs of producing or maintaining many goods to markets. Why are ‘conservation goods’ any different?

The main reason is that (i) markets can only arise if those paying for a good can exclude others from the benefits of the transaction, that is, if the good is private; and (ii) it is often not possible to provide conservation as a private good. Private goods are rival and excludable. A good is rival if consumption by one person reduces the amount of the good available for consumption by others, and excludable if the cost of excluding non-payers from enjoying the good is affordable (Wills 1997).

Lack of technological or institutional means to overcome non-rivalry and/or non-excludability often means that there is no alternative but for conservation goods to be consumed as public goods. However, this raises the problem of determining who is to supply such goods. The supply problem arises because the scope that exists for individuals to free-ride on others’ efforts to supply a public good might result in minimal supply (Wills 1997). Although free-riding can sometimes be managed if circumstances favourable for collective action exist or can be created (Lichbach 1996), the solution to date has generally been for such goods to be supplied as a result of government intervention. Unless government is willing to incur the full cost of such provision, there is a need to determine how to share the cost among other parties.

The first cost-sharing principle to be considered is the Polluter-Pays Principle (PPP).

## **4. The Polluter-Pays Principle**

### **4.1 What does it mean?**

The PPP involves full recovery of the costs of treating or preventing environmental degradation from those who cause the degradation. All OECD member governments agreed in 1973 that: “The principle to be used for allocating costs of pollution prevention and control measures to encourage rational use of scarce environmental resources and to avoid distortions in international trade and investment is the so-called ‘Polluter Pays Principle’ „ (OECD 1975). This commitment was reiterated in a wider arena in Principle 16 of the 1992 Rio Declaration.

The name of this rule is unnecessarily restrictive if taken literally. Pollution (harm associated with emission of wastes into environmental sinks) is only one of many forms of environmental degradation to which the rule has been applied. In this paper pollution therefore refers loosely to harm associated with any form of environmental degradation.

The rule is also unspecific about who is the polluter. According to Pearce (1988), a polluter is a party emitting damaging wastes to the environment. This has often been broadened to any party who degrades the natural environment. Bromley (1996) argues, however, that emissions only constitute pollution when a victim is within the realm of the emission. In some circumstances the victim may be seen as causing pollution by ‘coming to the nuisance’ and should therefore, by Bromley’s reasoning, be regarded as the polluter.

Bromley used the example of a factory emitting smoke and launderers drying clothes outdoors. The factory is the polluter if it arrives after launderers are already established within the prospective realm of the emissions. However, the launderers may be regarded as polluters if they establish within this realm after the factory is already established.

It not uncommon, however, for ‘coming to the nuisance’ to be regarded with sympathy by the wider population where it is consistent with society moving toward its long-term goals. Bromley illustrated this with the example of an established feedlot emitting flies and odour being considered the polluter even though a residential developer seeks to establish a new estate in its vicinity. Despite the usefulness of Bromley’s perspective, most people’s understanding of a polluter accords with Pearce’s. Hence Pearce’s definition is used in this paper to avoid confusion.

## **4.2 Consistency with economic efficiency**

Tilton (1995) suggested that the popularity of the PPP with the general public and policy-makers is explained more by equity considerations than by an economic efficiency motive: it simply seems fair to charge the costs resulting from pollution to those who cause and benefit from it. Nevertheless this rule does further economic efficiency by requiring polluters to ‘internalise’ costs to society of their environment-degrading activities which they could previously ignore. By effecting this internalisation through taxing polluters, moreover, the PPP results in greater long-run economic efficiency than if polluters were instead subsidised.

Although in the short run the effect of taxing firms a certain amount per unit of their pollution is equivalent to paying a subsidy of the same amount for each unit of pollution that they forego, the long-run effects of the two options are quite different. A polluter-pays tax reduces short-run profitability, induces long-run exit of firms from an industry and thereby reduces the industry’s capacity to pollute. This is more consistent with economic efficiency than paying polluters subsidies which increase short-run profits, induce long-run expansion of the industry and thereby increase the industry’s capacity to pollute (Baumol and Oates 1988; Pearce and Turner 1990).

Thus the PPP is consistent with economic efficiency insofar as supports taxing polluters rather than subsidising them. Maximisation of economic efficiency, however, requires that polluters be taxed according to marginal cost pricing (Young 1992). The reason is that economic efficiency requires that each input to production be priced at its marginal cost to society. Where conservation activities involve significant fixed costs, however, marginal cost pricing may result in a revenue shortfall (Atkinson and Stiglitz 1980). The MDBC’s (p. 55) version of the PPP avoids this problem and is simpler to apply: “... individuals who cause degradation of land and water resources pay to alleviate and manage the problem in proportion to their contribution to the cost of the problem.,, This is consistent with Pearce (p. 43) arguing that it is fundamental to the PPP that “any tax or charge should be at least proportional to the damage done.,,

This alternative pricing rule is, however, not the one that results in least sacrifice of economic efficiency if a constraint on revenue shortfall is imposed. The ideal rule in such a case is to apply marginal cost pricing and finance any shortfall by lump-sum charges (Hotelling 1938). A lump-sum charge is one which is unaffected by the level of consumption<sup>2</sup>. In practice, however, it is difficult to find charges that are true lump-sum charges and which are also capable of financing a deficit (Ruggles 1949-50).

The next-best pricing rule from an economic perspective in such circumstances is Ramsey pricing: the mark-up over marginal cost should vary inversely with each consumer's price elasticity of demand (Atkinson and Stiglitz 1980). Thus the mark-up should be highest for polluters whose environment-degrading activity responds least to how much they are charged for that use. Apportioning conservation costs pro rata to environment-degrading activity, as proposed by the MDBC, is therefore no better than a fourth-best way of applying the PPP if the aim is to maximise economic efficiency (or no better than third-best if a constraint on revenue shortfall is imposed).

## **5. Experience with the Polluter-Pays Principle**

### **5.1 Non-point source degradation**

Much progress has been made in most industrial countries with applying the PPP to pollution from large industrial and municipal point sources of emission (Toby and Smets 1996). The remaining pollution problems typically originate from non-point sources. In such cases application of the PPP is complicated by the considerably greater difficulty of identifying polluters and measuring their emissions. Environmental degradation caused by agriculture often falls into this category.

Difficulties of identifying and monitoring non-point polluters have in some cases been used as a justification for exempting these polluters from liability under the PPP. For instance, the Council of Australian Governments (COAG) (1994) resolved that costs of public benefits or impact management which are unable to be attributed and charged to specific beneficiaries or polluters should be treated as community service obligations. The cost-sharing principles proposed by the MDBC were designed accordingly. Similarly SCARM proposed that the PPP should not apply when it is not possible to identify specific causes of pollution. The OECD Secretariat (1989, cited in Toby and Smets 1996) nevertheless concluded that the PPP should apply to agriculture irrespective of whether its pollution is from point or non-point sources. Similarly, the European Commission (1988, cited in Toby and Smets 1996) stated that the PPP "must of course apply to agricultural activity as it does elsewhere,.. However, these strong statements have usually not been backed up by actions.

Use of environmental subsidy schemes to reduce agricultural non-point pollution is in fact widespread and growing. There are consequent fears that progress in removing production-oriented agricultural subsidies in industrial countries through the Uruguay Round GATT agreement may be dissipated by new forms of production-enhancing support disguised as 'green' payments (Toby and Smets 1996). Principle 16 of the 1992 Rio Declaration recognised the reality that unilateral application of the PPP by a single country may lower the international competitiveness of its industries when it included the caveat that application of the PPP pay due regard to possibilities of distorting international trade and investment.

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<sup>2</sup> Strictly, such a charge must fall on either producers' or consumers' surplus (Ruggles 1949-50).

The problem with applying the PPP to non-point source problems can nevertheless be expected to diminish over time as new technologies reduce the costs of monitoring these problems (Zilberman, Khanna and Lipper 1997, p. 72). Furthermore, Bromley (p. 19) argued as follows that inability to identify and monitor specific sources of pollution does not necessarily preclude application of the PPP through common property arrangements: “ ... one solves non-point-source pollution problems by forming associations within particular watersheds and making the group of farmers collectively responsible for water quality. If pollution fees are levied, they are assessed against the collective as a group. This then forces the individuals members of the group to monitor each other’s behaviour, and to assess miscreants accordingly.,,

This suggests that the term ‘specific ... polluters’ in the above-stated COAG resolution results in non-point source polluters being unnecessarily exempted from liability under the PPP, at least to the extent that it seems to have been widely understood as meaning ‘individual polluters’. However, there are two other reasons why it often has been difficult in practice to apply the PPP to agriculture. The first is that much of the pollution currently observed is the result of past activity.

## **5.2 Degradation caused by past activity**

With regard to the conundrum of assigning liability for environmental damage caused by past activities, Tromans (1995, p. 188) commented: “If contemporary environmental harm is difficult to deal with, then the legacy of past activities presents even more problems ... there arises the very difficult question as to which party or parties should be responsible ... The key issue here is the perception of unfairness that arises from imposing liability for activities that, at the time they were carried out, were in conformity with the applicable law, and indeed may have been in accordance with the contemporary good, or at least acceptable, industry practice.,, He continued (p. 190): “Another difficult issue that is often inherent in the cases of historic contamination is the absence of a responsible party, either because that party can no longer be traced, or because they have ceased to exist as a commercial entity, or have become insolvent.,,

In the USA, nevertheless, under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) passed in 1980, liability for pollution was made retroactive (Tilton 1995). This set a precedent whereby firms may be held liable in the future for their behaviour today, even though they are operating within the law and according to accepted industry practices. However, there is no economic efficiency justification for such an interpretation of the PPP. Since it is simply not possible after the fact to change behaviour in an earlier period, past inefficiencies should be regarded as sunk costs.

Moreover, retroactive liability may create future inefficiencies by increasing the risks that firms and other parties face regarding their environmental responsibilities. In compensation, they will require a higher rate of return on invested capital, resulting in higher consumer prices. The risk premium they will demand is also likely to be higher than the public would be willing to pay to avoid the risk, since the public is in a much better position to spread such risks. The CERCLA experience has also been very expensive in terms of the transaction costs of the legal system trying to determine liability (Tilton 1995).

Equity reasons for applying the PPP retroactively seem equally weak. Firms who in the past polluted within the then existing legal framework were operating according to the accepted rules of the day. If society now concludes their pollution was a mistake that should be rectified, the

responsibility for this error lies either with the failure of public policy at the time the pollution occurred or, alternatively, with a changed public preference for environmental resources (Tilton 1995).

The most likely reason for retroactive application of the PPP therefore seems to be governments seeking to limit their expenditures on environmental conservation. For instance, Tilton notes that countries in Eastern Europe, the former Soviet Union, and the developing world, as they privatise public enterprises, have considered avoiding costs of cleaning up old pollution by transferring this liability to the new property owners.

Although Tilton concluded that equity reasons provide a strong case for government being held liable for pollution caused by past activities, he recognised that ‘second best’ solutions may be required if resistance to increasing taxes and to scaling down existing programs means that governments are not in a position to pay. His preferred second best approach is to tax firms on their output or consumers on their consumption, and dedicate these funds to remediation. This shifts liability to third parties in a way that avoids risk regarding the magnitude of that liability. This approach was followed by the European Community Commission in its Communication on Repairing Damage to the Environment adopted in 1993. In this case funds for environmental rehabilitation were to be raised by levying contributions from the economic sectors most closely linked to the relevant damage.

### **5.3 Politics**

Another reason why it has proved difficult to apply the PPP to agriculture is that this principle challenges the myth that ownership of agricultural land confers absolute property rights unaccompanied by a corresponding duty to steward the natural environment (Bromley 1996). In other areas, such as buildings with heritage significance, it is unexceptional for conservation duties to be imposed on land owners without compensation being paid. Bromley suggests the reason for special latitude being given to agriculture is “the political sentimentality of all things agrarian,, (p. 19).

Nevertheless in Australia in recent years there has been increasing realisation of the need to attach an environmental duty of care to ownership of agricultural land. Fargher argued that adoption of the principles of Ecologically Sustainable Development in 1992 by the Federal Government signalled “a transition from resource development to a sustainable resource management approach ... As this transition continues, increasing responsibilities for resource management will be associated with the rights to use land and water resources,.. The PPP would apply where resource users fell short of their duty of care, and the BPP would apply where they went beyond it.

Although the MDBC did not refer to a duty of care, this concept is increasingly being adopted by Australian policy-advisers. The Industry Commission made a draft recommendation that a duty of environmental care apply to agricultural producers. Subsequently SCARM resolved: “All natural resource users and managers have a duty of care to take all fair and reasonable measures to ensure that they do not damage the natural resource base,.. However, the cost to governments of maintaining the duty of care at around current levels (as seems implied by ‘fair and reasonable’) is likely to become increasingly unaffordable, at least if governments continue to meet the major share of costs allocated to public beneficiaries. This suggests a need for the duty of care to be raised over time.

## 6. Beneficiary-Pays Principle

### 6.1 The User-Pays Principle

With the PPP having been applied relatively rarely to agriculture, the cost-sharing rule typically used in its place has been the Beneficiary-Pays Principle (BPP). The BPP favours the costs of providing conservation goods (ie, prevention or repair of environmental degradation) being allocated to those who benefit from those goods<sup>3</sup>. Most case studies described in the MDBC report used modified versions of this principle as the basis for negotiating cost-sharing agreements between governments and community groups.

According to Marsden (1996), there are ‘strict’ and ‘weak’ versions of the BPP. The strict version requires that costs are fully distributed among beneficiaries *pro rata* to their shares of total benefits. MDBC called the strict form the User-Pays Principle (UPP). The weak version requires that all beneficiaries meet some portion of the costs and that together the beneficiaries cover full costs. MDBC called the weak form the Beneficiary-Compensates Principle (BCP).

Of the two versions of the BPP, the UPP has tended to be applied when conservation goods are supplied collectively, either by government or by community-based organisations. A district-level drainage scheme in an irrigation area is one such good. Marsden suggested that application of the UPP to cases where the benefits are essentially private and therefore valued in markets is straightforward. Even so, market benefits can vary considerably among individuals and it is generally too costly to measure how much each individual benefits. The solution typically has been to apportion costs among relatively homogenous user groups<sup>4</sup>.

A further complication where a conservation project has a significant public good component is that individuals can free-ride on the non-market benefits from the public good without revealing how much they benefit. Thus it can be very difficult to estimate total benefits and the shares received by various groups. This is less of a practical problem than it seems at first glance, however, because non-market benefits are often ‘incidental’ to the provision of market benefits (Mishan 1971, p. 112).

Incidental beneficiaries are ‘intra-marginal’ in the sense that they are unwilling to pay for greater conservation than market beneficiaries are already willing to pay for. Since intra-marginal beneficiaries are incidental to the decision regarding how much conservation to provide, it is inconsistent with economic efficiency to allocate to them a share of conservation costs. Intra-marginal benefits should therefore be excluded when calculating total benefits and individuals’ shares thereof. Failing to do so may inappropriately ‘price out’ some intra-marginal beneficiaries’ use of the conservation good and may also, by effectively cross-subsidising the marginal conservation costs for other beneficiaries, result in greater conservation than is economically efficient (Haynes, Geen and Wilks 1986). The MDBC’s (p. 18) insistence that “all people who benefit from on-ground works should contribute to their cost,, is thus inconsistent with economic efficiency.

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<sup>3</sup> Siebert (1995) refers to the BPP as the Victim-Pays Principle.

<sup>4</sup> This acceptance of apportioning costs to groups of beneficiaries contrasts markedly with a reluctance to apply the PPP unless it can be applied to individual polluters.

During the 1980s, for instance, the Commonwealth Government moved to recoup its costs of managing coastal fisheries from those benefiting. Although the management effort was primarily directed at conserving fish stocks for commercial fishers, these market beneficiaries argued that it was inequitable to exempt non-market beneficiaries including recreational fishers from meeting a share of costs. Haynes *et al.* concluded, however, that recreational fishers were usually intra-marginal beneficiaries from which it would not be efficient to recoup a share of conservation costs.

Marsden noted that the UPP may also lower economic efficiency by ‘pricing out’ some beneficiaries whose marginal benefits from conservation exceeds the marginal conservation cost but does not exceed the cost allocated to them on the basis of this principle. Recall that a different version of this problem was encountered when discussing the PPP in the context of a government being unwilling to suffer a revenue shortfall resulting from marginal cost pricing. As in that case, the UPP’s response to this problem by way of allocating costs on a pro rata basis is less economically efficient than two-part pricing (marginal cost pricing supplemented by lump-sum charges to cover fixed costs) and Ramsey pricing. Implementation of this last option would need to be applied after careful public consultation, however, to avoid being perceived as arbitrary or biased (Marsden 1996).

## 6.2 The Beneficiary-Compensates Principle

In contrast to the UPP, the BCP has tended to be applied where conservation goods are supplied privately. An example is protection of remnant native vegetation which provides private benefits to a farmer in the form of shelter for livestock and public benefits in the form of biodiversity preservation. MDBC (p. 19) provided a further example of “privately owned and managed wetlands that may increase climatic stability and bio-diversity .....,

Under the BCP, those who are able to privately supply a conservation good are compensated by public beneficiaries wanting more of that good than would otherwise be provided voluntarily<sup>5</sup>. Thus beneficiaries pay private parties, in contrast to the UPP where they pay a collective provider (which has usually been government). The principle underlying the BCP is that the public should free-ride on private initiative as much as possible: “When we decide interfering with the market is justified on public benefit grounds, we only need to do just enough to change the behaviour of market participants in the manner desired ... Throughout the economy public benefits frequently free ride private investment. Good policy takes advantage of this ....., (Hussey 1996, p. 11). Thus compensation should not exceed the additional costs incurred in providing the extra increment of conservation.

Due to the difficulty of apportioning compensation costs to specific public beneficiaries, these costs have typically been met by government as community service obligations as resolved by COAG (1994). Confusion persists, however, regarding which level of government should pay: “it is not certain where the boundaries lie between national, state and local governments when it comes to sharing the costs of activities such as biodiversity conservation, stopping road damage or research and development,, (Fargher 1996).

Furthermore, Hussey has been critical of the presumption that government should always meet the costs of providing public benefits: “In regard to most natural resource management issues, I think the case for any general taxpayer funding to secure the much talked about benefits is very weak if non-existent. I reach this conclusion because I think most spillovers can quite easily be internalised

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<sup>5</sup> Thus Hanley, Kirkpatrick, Oglethorpe and Simption (1996) refer to the BCP as the Provider-Gets Principle.

to a particular area or region. Any benefits which might spill beyond an area or region are likely to be of a nature which the general community can free ride. It must be remembered that maximising public free riding is in the national interest ... Until such time as we have adequate pricing of individual spillovers, we should apply methods of raising the necessary funding from the catchment population. Only after this has been carefully considered should we even contemplate the question of whether any general taxpayer funding is justified or needed,.

Such concerns seem to have affected SCARM which resolved: "Government may agree to contribute to land and water management activities where the cumulative up-take of these activities provides significant public benefit or where there is market failure. *However, given the restriction in government funds, it does not follow automatically that government funds should be used,* (italics added). However, raising funds directly from the relevant publics requires an appropriate institutional framework which is largely lacking at present. This is because these publics often cross over several local government jurisdictions. In NSW the Catchment Management Act, 1989, makes provision for this problem to be solved by formation of Catchment Management Trusts which can raise funds directly from specific sub-populations. However, continuing government willingness to pay on behalf of local publics has meant that few such Trusts have been formed.

### **6.3 Second-round benefits**

Finally, there is a need to address the question of whether second-round effects should be considered when applying either form of the BPP. Examples of first-round effects of conservation activity are increased production or reduced production losses, reduced production costs, local government savings on urban water treatment or maintaining recreational facilities, and enhanced recreational experience. Effects such as these typically lead to second-round effects. For instance, increased farm profits due to higher production or lower costs may increase land values. In its list of examples of benefits from conservation works, MDBC (p. 6) included the following second-round benefits: increased land value, increased value of shire real estate and increased regional activity covering several shires.

MDBC also presented a case study of the cost-sharing arrangements for the Upper South-East District in South Australia. From Table B.2 in the case study it is apparent that a range of second-round benefits were included when apportioning cost-shares. These included increased regional economic activity, increased (state) indirect tax revenue, pro-rata gain in state owned land, increased state economic activity, increased (Commonwealth) tax receipts, welfare costs avoided and increased national economic activity.

It is usually reasonable to assume that second-round effects of similar value (although of different character) would occur elsewhere in the Australian economy if the resources to be used in a conservation activity were put to other uses. Thus second-round effects generally represent transfers rather than net benefits to the national economy and should not be considered within benefit-cost analysis (Department of Finance 1991). Similarly, from the national perspective there is no economic justification for including second-round beneficiaries when applying principles for cost sharing (Haynes *et al.* 1986). Of course there may be net benefits for smaller geographical areas from a local conservation project generating second-round effects nearby rather than further away. If this is the case, however, then it should be local beneficiaries that share project costs rather than the general taxpayer population (Haynes *et al.* 1986, Hussey 1996). This appears to be the position

adopted by SCARM: “ ... primary beneficiaries should contribute. Contributions from secondary beneficiaries ... will, where appropriate, be negotiated with the primary beneficiaries.,,

## 7. Compensation

Compensation of those losing as a result of public policy often seems justified by fairness. This is the case with the BCP where private ownership of agricultural land is widely accepted as being unaccompanied by a duty to provide a particular conservation good. However, economists are aware that compensation needs to be handled carefully if it is not to create incentives which are inconsistent with policy objectives. This problem has been recognised particularly with respect to compensation of pollution victims: “ ... victims typically have available to them a variety of responses to reduce the damages they suffer ... [C]ompensation of victims is not economically efficient because it weakens or destroys entirely the incentive to engage in the appropriate levels of such defensive activities., (Baumol and Oates 1988, p. 24). It follows that revenues raised by charging polluters for the damages they cause, as required by the PPP, should not be used to compensate the pollution victims.

Some of the perverse behaviours that can arise were indicated by Ferraro and Kramer (1997, p. 196) in their discussion of whether compensation should be paid for wildlife damages to crops, livestock and human lives resulting from declaration of a wildlife reserve: “... the guarantee of full compensation may entice residents to engage in activities that would never have been considered optimal in the absence of assured compensation. Compensation may also reduce the incentives that residents have for engaging in certain behavior changes that may be part of the optimal solution. For example, while it may be more efficient for some residents to emigrate from the area or to intensify production on their current land rather than expand production on new land, compensation may diminish the incentives for such behaviour. Compensation of victims may lead to an increase in immigration to the peripheral zone of the protected area, which may lead to a socially excessive and ecologically damaging amount of activity in the peripheral zone. Such immigration also has the potential to increase the costs of compensation to levels far greater than originally anticipated.,,

Rather than compensating victims, however, the BCP involves compensating polluters for opportunity costs of reducing their levels of pollution (since pollution is the opposite of conservation, this is the same as compensating polluters for agreeing to conserve more). If this principle is applied as intended and the compensation provided equals the opportunity cost, profits are unaffected and there are no longer-run consequences. However, polluters often have considerable scope for strategically distorting the information they volunteer about profit losses and other opportunity costs (Wills 1997).

In practice, therefore, application of the BCP can be expected to result in polluters being over-compensated, with the result that rents can be earned from pollution-reduction. This creates perverse incentives for existing polluters and others to increase their capacities to pollute<sup>6</sup>. Thus inefficiencies can arise to the extent that the BCP results in over-compensation for pollution-reduction. These inefficiencies could be reduced if it were possible to design a compensation scheme in such a way that scope to rent-seeking was strongly constrained. However, practical and political considerations often hamper such efforts. For instance, lack of data on pollution levels prior to

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<sup>6</sup> Tietenberg (1996) illustrated this with the analogy of a hi-fi owner paid by neighbours to reduce noise-making. With noise production thus becoming a profitable activity, formerly quiet neighbours may strategically increase their hi-fi volumes in the hope of extracting similar bribes.

negotiations often means that pollution levels toward the end of negotiations are instead used as the benchmark against which compensation is paid. The often lengthy period of negotiations can provide substantial scope for individuals to rent-seek by raising this benchmark as high as possible.

## **8. Some practical issues**

### **8.1 'In-kind' fulfilment of farmer cost share commitments**

A number of the cost-sharing arrangements finalised to date have relied partly on farmers agreeing to pay a substantial share of their cost share 'in kind'. Farmers generally agreed to contribute by investing in 'best practice' on-farm works which have conservation benefits. However, Hussey's dictum that "public benefits should free-ride private investment to the maximum extent possible," appears to have been overlooked in many of these cases. In general, the full cost of the investment in on-farm works has been allowed as an in-kind contribution despite these works usually providing considerable private benefits to the farmers adopting them.

For instance, the cost sharing arrangements proposed for the Berriquin Land and Water Management Plan included the full value of on-farm expenditures on 'best management practices' (eg, laser levelling, improved pasture management, drainage reuse and storage systems) as an eligible in-kind contribution by farmers against the cost apportioned to them as a beneficiary group (Berriquin Land and Water Management Plan Working Group 1995). This was despite these practices having significant private benefits and despite a recognition in some cases that the benefit from the Plan would largely arise from farmers adopting best practices sooner rather than from increasing the ultimate level of adoption.

In an economic approach to this issue only farmer costs in excess of what they would have incurred without the Plan would be eligible as in-kind contributions. Where best management practices advocated by a Plan are sufficiently profitable that they would be eventually adopted in any case, the Plan would increase farmers' costs only in a present value sense if farmers were required to adopt practices sooner they would have otherwise.

A further issue concerns the risk that farmers will fail to 'deliver' on their in-kind contributions. To the extent that in-kind activities are part of an integrated conservation program, failure to honour such commitments renders a cost-sharing agreement inequitable and means the benefit-cost justification of the program should be revisited. The risk of 'shirking' arises because of the difficulty of establishing contracts with individual farmers regarding fulfilment of their in-kind commitments. These commitments have generally been specified for local farmers as a group, with social forces such as peer pressure relied upon to overcome the temptation for individual farmers to free-ride on others' willingness to honour the group commitment. However, experience demonstrates that such forces need to be strong if shirking by individuals is not to undermine the good intentions of farmers as a group.

### **8.2 Present values as the appropriate basis for cost sharing**

Arrangements for cost sharing usually must deal with costs and benefits of conservation being spread over a considerable period. Since the timing of when particular costs and benefits occur can have a significant effect on their present value, an economic approach to cost sharing requires that all values be converted to this common denominator. Otherwise the arrangements will favour

beneficiaries who receive benefits sooner at the expense of those benefiting later. Also, those incurring costs later will be favoured at the expense of those who incur costs earlier. This seems to have been overlooked in cost sharing arrangement devised to date. For instance, in calculating cost shares for the Berriquin Land and Water Management Plan nominal benefits and costs were summed irrespective of when they were expected to occur (Berriquin Land and Water Management Plan Working Group 1995).

### **8.3 Farmers' capacity to pay**

An issue that often emerges at the stage of actually apportioning project costs on a beneficiary-pays basis is the capacity of farmers to afford the costs allocated to them. There are two reasons why such a concern may arise. Firstly, as noted above, application of the UPP may mean that the cost apportioned to some beneficiaries exceeds the private benefits they obtain from the project. We have seen that this problem can be solved by two-part pricing or by Ramsey pricing.

Secondly, adverse seasons or prices might mean that farmers are temporarily unable to fulfil a cost-share commitment even though their private benefits from a project exceed the cost apportioned to them. However, this is only a real problem if financial institutions are unwilling to provide credit. If this is indeed a problem then the efficient policy response would seem to be for government itself to provide short-term credit until farms are able to trade out of their temporary cash flow problems.

## **9. Conclusions**

The foregoing discussion has demonstrated that the criterion of economic efficiency does not provide an unambiguous basis for choosing among cost-sharing principles in any situation. The efficient rule depends on how property rights are defined, and property rights to many attributes of the natural environment are controversial. Only governments can reduce this ambiguity by better defining these rights. As discussed in section 5.3, there has in fact been increasing interest recently in achieving this outcome by attaching an environmental duty of care to ownership of agricultural land.

Even so, it is useful for economists at this stage to review the extent to which the various cost-sharing principles currently being considered are consistent with economic efficiency. A summary of conclusions reached in this respect follows:

- there appears to be no economic efficiency rationale for limiting cost-sharing arrangements to on-ground works (section 2);
- the PPP is consistent with economic efficiency insofar as it taxes polluters rather than subsidises them (section 4.2);
- if conservation involves fixed costs, the MDBC approach to the PPP of allocating conservation costs pro rata to environment-degrading activity is less efficient than allocating costs according to (in descending order of efficiency) marginal cost pricing, two-part pricing and Ramsey pricing (section 4.2);
- the non-point source nature of agri-environmental degradation does not necessarily exempt agriculture from the PPP (section 5.1);

- retroactive application of the PPP is not consistent with economic efficiency (section 5.2);
- if conservation involves fixed costs, the MDBC approach to the UPP of allocating total costs pro rata to shares of total benefits is less efficient than allocating costs according to (in descending order of efficiency) marginal cost pricing, two-part pricing and Ramsey pricing (section 6.1);
- allocation of costs to intra-marginal beneficiaries under the MDBC approach to the UPP is also inconsistent with economic efficiency (section 6.1);
- economic efficiency requires that costs of providing public benefits be apportioned to the population which receives those benefits. In some cases this involves determining which level of government is most appropriate. In other cases this will require raising funds directly from beneficiaries (section 6.2);
- from the national perspective there is no economic justification for considering second-round effects when applying the BPP (section 6.3);
- consistency of the PPP with economic efficiency requires that revenues raised not be used to compensate the victims of pollution (section 7);
- the BCP is likely to be inconsistent with economic efficiency since farmers in practice are likely to be over-compensated, resulting in perverse incentives to increase pollution capacity (section 7).

Conclusions reached concerning efficiency aspects of various practical issues encountered to date in implementing principles for cost sharing were:

- only farmer costs in excess of what they would have incurred in the ‘without conservation project scenario’ should be eligible as ‘in-kind’ fulfilment of farmer cost share commitments (section 8.1);
- such in-kind agreements should be permitted only where they can be adequately enforced (section 8.1);
- cost-sharing calculations should be based on present values rather than sums of undiscounted costs and benefits (section 8.2).
- if adverse seasons or prices mean farmers temporarily do not have the capacity to fulfil a cost-share commitment *and* credit is unavailable from private sources, the efficient policy response is for government to intervene to arrange credit rather than for farmers’ cost shares to be reduced (section 8.3).

## References

Atkinson, A.B. and Stiglitz, J.E. 1980, *Lectures on Public Economics*, McGraw-Hill, London.

- Barr, N.F. and Cary, J.W. 1992, *Greening a Brown Land: the Australian Search for Sustainable Land Use*, Macmillan Education Australia, Melbourne.
- Batie, S.S. 1986, 'Why soil erosion? a social science perspective', in Lovejoy, S.B. and Napier, T.L. (eds), *Conserving Soil: Insights from Socioeconomic Research*, Soil Conservation Society of America, Ankeny, Iowa, USA.
- Baumol, W.J. and Oates, W.E. 1988, *The Theory of Environmental Policy*, Cambridge University Press, Cambridge, 2nd edition.
- Berriquin Land and Water Management Plan Working Group 1995, *Berriquin Community's Land and Water Management Plan*, Berriquin Land and Water Management Plan Working Group, Deniliquin.
- Bromley, D.W. 1996, 'The environmental implications of agriculture', Paper prepared for an OECD Conference on the Environmental Benefits from a Sustainable Agriculture, Helsinki, Finland, September 10-13 (Working Paper no. 401 of the Department of Agricultural and Applied Economics, University of Wisconsin-Madison, USA, October).
- Council of Australian Governments 1994, Water Resources Policy - COAG Communiqué.
- Department of Finance 1991, *Handbook of Cost-Benefit Analysis*, Australian Government Publishing Service, Canberra.
- Fargher, J. 1997, 'Cost-sharing: A tool for implementing integrated catchment management', *Proceedings of the 2nd National Workshop on Integrated Catchment Management*, Australian National University, Canberra, September 29-October 1, River Basin Management Society.
- Ferraro, P.J. and Kramer, R.A. 1997, 'Compensation and economic incentives: reducing pressure on protected areas', in Kramer, R., van Schaik, C. and Johnson, J. (eds), *Last Stand. Protected Areas and the Defense of Tropical Biodiversity*, Oxford University Press, New York and Oxford.
- Hanley, N., Kirkpatrick, H., Oglethorpe, D. and Simption, I. 1996, The provision of public goods from agriculture: modelling the 'provider-gets principle' for Moorland conservation in Scotland, Working Paper E96/4, Department of Economics, Stirling University, Stirling, UK.
- Haynes, J., Geen, G. and Wilks, L. 1986, Beneficiaries of fisheries management, Discussion Paper 86.1, Bureau of Agricultural Economics, Australian Government Publishing Service, Canberra.
- Hotelling, H. 1938, 'The general welfare in relation to problems of taxation and of railway and utility rates', *Econometrica* 6, 242-269.
- Hussey, D. 1996, 'An economic perspective', in Price, R. (ed.), *Sustainable Management of Natural Resources: Who benefits and Who Should Pay?*, Occasional Paper No. 01/96, Land and Water Resources Research and Development Corporation, Canberra, pp. 8-12.

- Industry Commission 1997, *A Full Repairing Lease: Inquiry into Ecologically Sustainable Land Management*, Draft Report, Industry Commission, September.
- Lichbach, M.I. 1996, *The Cooperator's Dilemma*, University of Michigan Press, Ann Arbor, USA.
- Marsden, J. 1996, 'Cost-sharing - the Murray plans', in Price, R. (ed.), *Sustainable Management of Natural Resources: Who Benefits and Who Pays?*, Occasional Paper 01/96, Land and Water Resources Research and Development Corporation, Canberra, pp. 53-66.
- Mishan, E.J. 1971, *Cost-benefit Analysis*, 3rd Edition, George Allen and Unwin, London.
- Murray-Darling Basin Commission 1996, *Cost-Sharing for On-Ground Works*, Murray-Darling Basin Commission, Canberra.
- OECD 1975, *The Polluter Pays Principle: Definition, Analysis, Implementation*, OECD, Paris, France.
- Pearce, D.W. 1988, *Economic Values and the Natural World*, Earthscan, London.
- Pearce, D.W. and Turner, R.K. 1990, *Economics of Natural Resources and the Environment*, Harvester Wheatsheaf, New York.
- Ruggles, N. 1949-50, 'Recent developments in the theory of marginal cost pricing', *Review of Economic Studies* 17, 107-126.
- Sappideen, B., Gross, R. and Barr, N. 1992, 'A review of salinity management planning in Victoria', Paper presented to the 36th Annual Conference of the Australian Agricultural Economics Society, Australian National University, Canberra.
- Siebert, H. 1995, *Economics and the Environment: Theory and Policy*, 4th edition, Springer-Verlag, Berlin, Germany.
- Standing Committee on Agriculture and Resource Management 1997, Draft Resolution. Natural Heritage Trust: National Principles for Government/Community Cost Sharing, Meeting no. 10, Darwin, 6 August.
- Tietenberg, T.H. 1996, *Environmental and Natural Resource Economics*, 4th edition, Harper Collins College Publishers, New York.
- Tilton, J.E. 1995, 'Assigning the liability for past pollution: lessons from the US mining industry', *Journal of Institutional and Theoretical Economics* 151 (1), 139-154.
- Toby, J.A. and Smets, H. 1996, 'The polluter-pays principle in the context of agriculture and the environment', *World Economy* 19(1), 63-87.
- Tromans, S. 1995, 'Environmental liability: the issues and dangers', *International Journal of Environment and Pollution* 5(2-3), 180-193.

- Wills, I. 1997, *Economics and the Environment. A Signalling and Incentives Approach*, Allen and Unwin, Sydney.
- Woodhill, J. 1997, 'Resource sharing for on-ground change. A systemic perspective', *Proceedings of the Second National Workshop on Integrated Catchment Management*, Australian National University, 29 September - 1 October, River Basin Management Society.
- Young, M.D. 1992, *Sustainable Investment and Resource Use. Equity, Environmental Integrity and Economic Efficiency*, The Parthenon Publishing Group, Carnforth, UK.
- Zilberman, D., Khanna, M. and Lipper, L. 1997, 'Economics of new technologies for sustainable agriculture', *Australian Journal of Agricultural and Resource Economics* 41(1), 63-80.