Australian Government

Productivity Commission

Promoting Better Environmental Outcomes

Roundtable Proceedings

Canberra, 19-20 August 2008

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the Productivity Commission.

ISBN 978-1-74037-277-0

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An appropriate citation for this paper is:

Productivity Commission 2009, *Promoting Better Environmental Outcomes*, Roundtable Proceedings, Productivity Commission, Melbourne.

JEL code: Q28

The Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

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Foreword

The Productivity Commission convened a roundtable on *Promoting Better Environmental Outcomes* at Old Parliament House in Canberra on 19–20 August 2008. Participants included government officials, academics, consultants, journalists and representatives of environmental organisations and agencies. Keynote addresses were presented by Professor Gary Libecap from the University of California and Professor Robert Stavins from Harvard University.

Over the past decade or so, the Commission has undertaken inquiries, prepared submissions and pursued its own research on a range of environmental policy topics. The focus has been on the efficiency and effectiveness of different policy options, the regulatory burdens they impose and the potential for unintended consequences. In many cases, the projected benefits of policy intervention have not materialised, reflecting the difficulties of formulating effective policy instruments.

The *Promoting Better Environmental Outcomes* roundtable sought to address two questions central to developing good environmental policy:

- under what conditions can governments improve environmental outcomes?, and
- how should governments intervene to ensure effective and efficient results?

The roundtable proceedings are being published to enable a wider audience access to the information and insights that emerged. This volume includes papers by the speakers and a summary of the key points covered in the discussion sessions.

The Commission is grateful to the speakers and other participants whose contributions made the roundtable such a valuable exercise.

Gary Banks AO

Chairman

February 2009

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1 Introduction[1]

Gary Banks
Chairman, Productivity Commission

Environmental amenities like clean water and air, or natural attractions like the Great Barrier Reef or the Snowy Mountains, are fundamental to the Australian community's quality of life and sense of wellbeing. There has been a tendency to take them for granted, as enduring features of our way of life. But increasing population and economic pressures are changing this, posing threats to some important environmental 'services'.

While climate change is the biggest and globally most pervasive issue currently receiving policy attention, many others of purely domestic origin and reach are also manifest. Their impacts are felt not just by sections of the community with a heightened sense of the value of the environment, but also by many households and enterprises whose activities and interests are affected in various ways. Reduction in available water in the Murray Darling basin, for example, impacts directly and indirectly on a range of industries, other than irrigated agriculture. Runoff from disturbed acid sulphate soils poses a threat to much of Australia's coastline, including sections of the Great Barrier Reef. Dryland salinity is reducing arable land in many inland areas. The policy challenges loom large, as exemplified by the current problem in sourcing the environmental flows to revive World Heritage wetlands like the Coorong.

As in other countries, governments in Australia are responding to threats to the environment in various ways, with varying effectiveness. The nature and extent of policy responses depend in part on the pressures brought to bear by the perceived consequences of inaction. They also depend on how strongly the community feels about environmental protection relative to other goals. The policy response must take into consideration how much is being achieved by individuals and the private sector, as well as the potential effectiveness and efficiency of policy interventions. Indeed, concerns raised about environmental policy measures often have less to do

1 Opening remarks to the Productivity Commission Roundtable, *Promoting Better Environmental Outcomes*, Old Parliament House, Canberra, 20 August 2008.

with their objectives than with their effectiveness, the regulatory burdens they impose and the potential for unintended consequences.

This conference principally addresses two questions central to developing good environmental policy:

- First, under what conditions can governments improve environmental outcomes? The answer to this question will determine what are feasible objectives for environmental policy.
- Second, how should governments intervene to ensure effective and efficient results? The answer to this question will guide the choice of policy instruments.

1.1 Why this conference?

Over the past decade or so, the Commission has undertaken inquiries, prepared submissions, and pursued its own research on a range of environmental policy topics. The focus has typically been on the efficiency and effectiveness of different policy options rather than the objectives of policy, although the appropriateness of the objectives is sometimes brought into relief by the analysis.

Environmental policy instruments have proven difficult to formulate. It is often easier to identify what is wrong with them than to design new ones with confidence in their efficiency and effectiveness. Coase's insight that externalities create reciprocal costs and benefits highlights the need to account for the costs of actions to ameliorate externalities as well as the benefits of reducing harmful effects. And, as we know from experience, the efficacy and efficiency of measures to address externalities is complicated for a number of reasons including:

- *non-separability of many environmental services.* The one resource, whether an area of ocean or of forest, often delivers multiple services to multiple users, for economic and other purposes
- *high cost of excludability* from some if not all of the services. There will generally be potential for at least some free riders, and the transactions costs of excluding them will often exceed the costs their use imposes on others. This is particularly the case where the consumption is 'non-rival' (as for non-use benefits from a resource that derive simply from its existence)
- considerable *scientific uncertainty* about the extent of the threat to some environmental services or the effectiveness of proposed actions to remove or abate it. This raises questions about the relative merits of a precautionary approach — moving to protect resources when the extent of a problem is

uncertain — versus delay, not only for the cost savings, but to enable development of better information and solutions that are more effective

- *equity concerns* — whether traditional use of the resource has created an entitlement, or those using the resource are responsible for the deterioration in environmental services, the requirement that policy be seen to be fair is obviously important. This raises issues about compensation and how those who have not been 'responsible' users should be treated
- *institutional arrangements* that are not aligned with the nature of the resource nor the ideal policy instrument. Australia's federal system has considerable strengths, but at both the local and national levels institutional arrangements can hamper policy to address local or national environmental issues. For the biggest environmental challenge — abatement of greenhouse gas emissions — the adequacy of *international* institutions is also a key issue.

These characteristics of environmental problems constrain and help define the policy instruments that will be effective and efficient. This conference is motivated by the need to learn from accumulating experience about what works and why.

1.2 The effectiveness of current approaches to environmental issues

The first session, therefore, provides a stocktake of current approaches to environmental issues and their relative effectiveness. Governments have a natural tendency to reach for regulatory command and control approaches. These have had mixed results, as some examples from Commission work demonstrate.

Fear of prospective restrictions can have unintended consequences

The Native Vegetation Inquiry (PC 2004) found that there had been considerable pre-emptive clearing in Queensland in anticipation of the imposition of restrictions. Total clearing rose from around 330 000 hectares a year over the 1991–1999 period to 758 000 hectares in 1999–2000, when forthcoming restrictions were signalled. Similarly, the Inquiry into heritage protection (PC 2006a) found that the regulations created a disincentive to maintain properties that could be listed.

These experiences illustrate the importance of finding ways to protect socially valued natural and built assets that align the interests of owners with those of the wider community.

Prescriptive standards or approaches can also create perverse incentives

The Native Vegetation Inquiry also found that landholders were clearing regrowth earlier than was efficient, whether from a production or a biodiversity perspective, in order to avoid the areas falling under the regulation (which applied to regrowth over 10 years old).

In a different way, the 'waste hierarchy' adopted by most jurisdictions distorts incentives. The hierarchy puts in order of preference, avoidance, reuse, recycling, recovery of energy, treatment, containment and, only when all other possibilities are exhausted, disposal. The Commission's Inquiry into Waste Management (PC 2006c) argued that this approach failed to appreciate that other inputs were also employed for each of these management options, the costs of which will be context dependent. The neglect of other environmental impacts (such as greenhouse gas from energy consumption or water quality effects) can also lead to perverse outcomes.

Taxes are sometimes levied on activities having little environmental impact

A number of governments in Australia levy taxes on waste disposal to encourage reduction in waste generation and greater recycling, as well as to raise revenue to fund provision of environmental services in other programs. The Waste Management Inquiry found that the waste levies did not reflect the environmental costs imposed by the landfill, and that they were unrelated to the level of effort at a landfill site to reduce leakage and other environmental impacts. Indeed, these taxes were more likely to be levied at large metropolitan landfills that already complied with strict standards for environmental management. The levies also increased the incentives for illegal dumping.

And even if the target is right, it may not be the most cost effective approach

Our report on Rural Water and the Environment (PC 2006b) found that the on-farm incentives offered for water efficiency improvements (to release water for environmental purposes) were, by necessity, higher cost than buying the water in the market. (Otherwise farmers would have implemented them and sold the additional water generated.) Water saving can also be illusory where unused irrigation water would have been returned to the system. The Commission's recent Urban Water study (PC 2008a) presented findings that few, if any, subsidies for

more water efficient appliances were cost effective, for example Crase and Dollery (2005) estimated that the subsidy on AAA rated dishwashers cost over $33 000 per megalitre of water saved.

But there are some success stories — that got the incentives right

The Waste Management Inquiry pointed to the effectiveness of financial assurances, such as those adopted by the Victorian Environmental Protection Authority, in providing an incentive for landfill operators to implement the most cost effective practices to deliver specified environmental outcomes.

The threat of legislation can also be very effective. For example, in our report on the Great Barrier Reef (PC 2003), it was noted that the sugar industry in New South Wales has implemented a requirement for best management practice to reduce disturbance of acid sulphate soils. It is enforced by the mills requiring evidence of compliance as a condition of accepting cane for processing. The industry is reported to have implemented the scheme to avoid a regulatory approach.

And imperfect solutions may still be better than not trying

Despite their unintended consequences, the restrictions on land clearing have greatly reduced the loss of native vegetation. While the contribution to protecting biodiversity is somewhat uncertain, this has certainly helped Australia to meet the Kyoto target for greenhouse gas emissions. This raises questions of whether the good outcomes could be obtained without the bad — and what aspects of instrument design are essential and what are not.

The first session will have contributions from John Freebairn from Melbourne University on the efficient allocation of, and investment in, the environment; Drew Collins from the BDA Group on environmental policies that are proving ineffective, due to poor design or practical difficulties; and Arlene Buchan from the Australian Conservation Foundation on market-based instruments and water recovery in the Murray Darling Basin.

1.3 'Market' and cooperative solutions and the role of government

Market-based instruments have an important place in the toolbox of environmental policy. The second session focuses on these approaches. The Commission, which views policy issues primarily within economic frameworks, has a well known

predilection for market solutions. Our work has shown, however, that there are limits to their applicability and problems from poor system design. In particular, transactions costs, including measurement and monitoring, can be substantial. Then there are issues of equity and managing the potential market power that can be created.

Restrictions on trade reduce the scope for cost effective solutions

The National Water Initiative has established a number of 'accountable environmental managers' who have the mandate to provide water for the environment. Our study on Rural Water Use and the Environment found good prospects for achieving the desired environmental flows through rural water trading. However, the report found the scope to source water was limited by a number of impediments, including restrictions on the purchase of seasonal allocations (as opposed to permanent entitlements), and caps on interregional trade, as well as budget limitations.

In this case the restrictions on trade are a response to farmers' concerns about access to water for irrigation and the risk of stranded assets. In other cases, restrictions can relate to environmental services provided by a resource that are incidental to the primary use. Examples are recreational fishing in fisheries subject to quotas, or bush harvest in areas protected for biodiversity. Such restrictions or permissions can reduce the effectiveness of the market, raising questions of when they should be allowed.

Cooperative solutions need a supporting legal framework

Private markets for environmental services can be 'created' by government establishing a legal framework to enforce contracts and resolve disputes. It may also need to develop an information base to allow monitoring of service delivery where there are significant economies of scale or public good characteristics reducing incentives for private monitoring.

The Commission's Inquiry into the Impacts of Native Vegetation and Biodiversity Regulations reported on the Trust for Nature conservation covenant program in Victoria. This covers the legal costs to landholders of entering into a legally binding covenant on areas of their land to manage and protect in perpetuity. The program also provides advice on management action and periodic visits to assess the condition of the land, and is funded by community and government contributions.

Another approach used by Trust for Nature and similar philanthropic groups is to buy properties through a revolving fund, establish a covenant, and then sell each property to someone who wants a 'private nature reserve'. Enforcement of the covenant restrictions is still essential.

The cost of such voluntary covenant and purchase-resale programs depends on the competition in the supply of properties with the desired environmental characteristics. It also depends on the value that owners place on conservation and their use needs. The effectiveness of the market also depends on the buyer's ability to estimate the environmental value of the area protected by a covenant. This can be difficult in diverse areas or where contiguous areas are required that fall outside property boundaries.

The second session deals with the role of government in creating and supporting market-based approaches to environmental issues. When will markets work and what does government need to do to develop and support market-based solutions?

Gary Libecap from the University of California will talk about promoting better environmental outcomes through property rights and markets, with a focus on opportunities and limitations. David Brunckhorst from Rural Futures at the University of New England addresses the right scale for policy development and initiatives and how to identify the confluence of community interest with environmental services at landscape scale. Suzie Kerr, from Motu Economic and Public Policy Research, will share experiences from New Zealand on consideration of environmental markets to deal with greenhouse gas emissions and nutrient loss into waterways. Dave Pannell from the University of Western Australia will discuss characteristics for policy to generate cost-effective environmental improvements.

1.4 Institutions and incentives to enable better policies

As noted earlier, institutional arrangements are crucial to the effectiveness of policy. The Commission is increasingly involved in tasks that assist the reform work of the Council of Australian Governments (COAG). COAG provides considerable opportunities for the cooperative approaches that can be so important for addressing many environmental issues. The constitution gives the states control of most of the environmental resources in Australia, but environmental planning is often delegated to the local government level. More recently, catchments have formed the basis of regions for environmental and natural resources management. The Commonwealth seeks to influence the states through various means — most notably access to programs funded by the Commonwealth — but also through various laws, and via international commitments under various environmental conventions. The

Commission has found that roles and responsibilities for environmental policy are not always as clear as might be desired. Confluence rarely occurs between the on-ground locations, areas of common community interest, legal responsibilities and capacity for funding.

There is potential for policy inconsistency across and even within jurisdictions

Mandatory Renewable Energy Targets (MRET) were initially established by state governments to raise the share of energy production from renewable sources in the absence of adequate price signals for non-renewables. The national MRET now requires energy suppliers to meet a larger target or face penalties. In doing so they can purchase from the lowest cost producers of approved sources of renewable energy. This is an improvement over the existing arrangements, which have involved differences across jurisdictions in the criteria for approval, reflecting perhaps the influences of different suppliers across the jurisdictions. However, as the Commission's recent submission to the Garnaut Review (PC 2008b) noted, under an effective emissions trading scheme an MRET would be unnecessary and, if binding, would raise the costs of energy through the exclusion of lower cost technologies.

Governments still have to set the rules of the game and are subject to lobbying

Garnaut's Draft Report and the Government Green Paper on an Emissions Trading Scheme have seen intense lobbying efforts from industry, consumer and environmental groups. From exclusions for petrol and trade exposed industries, to compensation for other labour-intensive activities, each seeks to influence policy design to their advantage. Such efforts will arise in any consultative process for policy making, and perhaps it is encouraging that so much is out in the open. Yet it does underline that policy design and governance need to be developed in recognition of the likelihood of 'gaming' and rent-seeking. This is a key practical issue, for example, bearing on the choice between 'cap and trade' and a carbon tax. (PC 2007)

The third session explores the important role of institutions in achieving good outcomes. Rob Stavins from Harvard University will provide an international perspective addressing the institutional challenges for emission trading schemes. Wendy Craik, from the Murray Darling Basin Commission, will provide a domestic focus, drawing on considerable experience with cross jurisdictional institutions.

Henry Ergas, from Concept Economics, will talk about the institutional reforms needed to generate better environmental outcomes.

1.5 Some implications for public policy

Finally, this tour of the Commission's foray into environmental policy issues would not be complete without mentioning the plastic shopping bag issue! A few pages on this issue in the waste management report caused much fuss, but ultimately demonstrated that a little analysis can go a long way. In short the Commission soon found that the evidence cited in support of banning plastic bags was not what it seemed; that in any case a ban would not address the alleged environmental problem, and that the costs of a ban would greatly exceed the benefits. Despite vigorous counter attempts by ban-supporters to 'shoot the messenger', COAG eventually chose not to implement a ban nationally.

The plastic bags story illustrates the pressures on Government to respond to the loudest voices, without taking the time to understand all the dimensions of a problem and whether, with the policy instruments at its disposal, it can make a difference for the better. This of course is not confined to environmental policy. It has to do with the policy development process generally and, in particular, the need to entrench evidence-based foundations to enable political decisions to recognise the economic tradeoffs.

The last session of the day will draw out the implications for public policy in Australia. Geoff Brennan, from the Australian National University, will start the session — as he has done so well at several other Commission events — and the three keynote speakers will then have a chance to reflect on the proceedings and draw their conclusions about what it all means for public policy.

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SESSION 1

STOCKTAKE OF THE EFFECTIVENESS OF CURRENT APPROACHES TO ENVIRONMENTAL ISSUES

2 Allocation of and investment in the environment

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Abstract

The paper explores the case for, and the different forms of, government intervention in the allocation of the environment. Market failures associated with public goods, common property resources, and external costs and benefits are examined. The relative effects and pros and cons of different interventions, namely the creation of property rights, rules and regulations, and market based taxes, subsidies and tradable permits, are explored under different information states of perfect knowledge, probabilistic information and uncertainty.

2.1 Introduction

The environment provides benefits or utility to members of society as a provider of key production inputs, for example, agricultural land, minerals and energy; a place for disposal of wastes, for example, of domestic refuse, building materials and emissions from the combustion of fossil fuels; and the direct provision of environment amenity, for example, for recreation, clean air and water, and protection of flora, fauna and scenery. As is the general economic problem, wants of the environment exceed the limited supply, and allocation choices have to be made between the different uses at any point in time and of uses over time. Also, decisions to invest in protecting and augmenting environmental resources have to compete with other physical and human capital investment options for the limited supply of savings.

In many cases, well-functioning markets can be used, and are used, to allocate scarce environmental resources and to choose investment options. Markets work well where property rights provide for rival consumption and low costs of

exclusion,[1] and competition prevails. Examples in place include the markets for most minerals and energy, agricultural and urban land, while markets are being developed for uses of consumable water and, in a few cases, for the least-cost supply of environment amenity.

In other cases, however, the allocation of and the investment in environmental resources, wastes and amenity encounter serious market failures. Important areas of market failure include the situations of public goods, where the environmental amenity services have non-rival and non-excludable properties; common pool resources, where the non-excludability property is important; and markets with external benefits and costs, where market buyers and sellers do not consider all the social costs and benefits of their production and consumption actions. The presence of a market failure provides a necessary but not a sufficient condition for government intervention to achieve a more socially efficient, and welfare-increasing, allocation of the environment and associated investment decisions. The nature of the market failure also guides the choice of the form and level of government intervention to improve efficiency.

Options for government intervention to correct market failures include the provision of better property rights; rules and regulations (sometimes referred to as 'command and control'); market-based interventions using taxes, subsidies or tradable permits; and the provision of information (and usually information has public good properties which will be under-supplied by market forces) and jaw-boning. In Australia, and elsewhere, we find examples of the different policy interventions. Of particular interest are the relative merits of the different policy intervention instruments, and how the relative pros and cons depend on the type of market failure and on the available information. This paper will focus on the normative and economic efficiency arguments for the level of and form of intervention to correct market failures.

While the focus of the paper is the criterion of efficiency, in practice consideration also has to be given to equity and political feasibility effects. Equity as a criterion, however, is given little consideration on the grounds that there are more direct and effective direct income transfer instruments to meet social equity goals than the instruments to correct market failures which affect product and input prices.[2] Another strand of the literature takes a positive mode of analysis and draws on the

[1] The required property rights have the characteristics of: exclusiveness of the right; transferability; full appropriation of all the benefits and costs with ownership; and are durable and enforceable.

[2] More formally, we might invoke the first and second theorems of welfare economics.

private theory of regulation, as opposed to the public interest theory used here, to explain the predominance of regulations in environment policy intervention.[3]

The rest of the paper is as follows. Section 2.2 sets out the underlying perfect knowledge and static models of market failure and their correction. A description of the different market correction intervention options in this simplified world is provided in Section 2.3, along with some caveats for second best and government failure. In the particular context of environmental external costs and benefits, Section 2.4 then considers how different forms or levels of imperfect and costly information alter the relative merits of the different government intervention options to correct an externality market failure. Section 2.5 concludes.

2.2 Market failure and the environment

Here we present the public finance and environmental economics text book models of market failure (for example, Stiglitz 2000, and Perman et al. 2003), together with illustrative environment examples, for a public good, a common pool resource, and an externality. Other possible market failures associated with the exercise of market power and asymmetric information can be found in the allocation of the environment, but in the interests of space they will not be considered. While both partial-equilibrium and general-equilibrium models can be used, for the most part the key messages about the cause of market failure, the required correction for economic efficiency, and the nature of alternative corrective government interventions can be obtained from the simpler partial equilibrium model.

Public goods, as opposed to private goods for which markets work, have the combined properties of non-rival consumption and high costs of exclusion. Examples in the use of the environment include the preservation of flora, fauna and scenery. Often the amenity value includes not just contemporary consumption but also the option value of future consumption or just the knowledge of existence. With public goods, there is an incentive for individuals to free-ride, since

[3] In practice, in almost all countries and examples of market failure with the allocation of environment resources we observe a much higher dependence on command-and-control interventions than on the market-type interventions proposed by economists and argued for in this paper. An alternative positivistic analysis of the supply and demand for intervention which places a high weight on equity effects and on political processes, for example, as discussed in Keohane et al. 1998, provides support for greater roles for the command–and-control interventions. While these models have been developed primarily for the USA context, and they place great importance on the independence of individual Congress representatives which seems less exercisable in the Australian political context of greater party power relative to individual independence, they suggest a valid alternative complementary paradigm for the study of policy in Australia.

individuals gain the benefits anyway (because of non-rival consumption) and an individual cannot enforce a charge on other users (because of non-exclusion). As a result, with a market as the allocative mechanism too little of a public good is produced and consumed.

An efficient level of a public good, including the environment, defence and law enforcement, would seek a quantity which equates the sum of the individual marginal benefits with the marginal cost of supply (or, in a general equilibrium model, the sum of the marginal rates of substitutions across individuals with the marginal rate of transformation, and in both cases of the public good relative to other private goods).

Application of the efficiency principle to measure the efficient supply and consumption of an environmental public good, such as a national park or a share of water for the environment, would involve the collection of biological and physical information to estimate increments of the quantity of environmental services provided, and then some form of stated preference technique such as contingent valuation or choice-modelling to ascertain individual valuations of the incremental changes in environmental services. In practice, either with or without attempts to measure the social marginal valuation of public goods, political processes as a form of collective or social choice often make the actual decision.

In terms of policy instruments, governments generally would need to take an active role in securing and funding the efficient supply of a public good, including a share of the environment. The intervention could directly increase the supply or share of the public good, or it could operate indirectly by restricting the market-determined alternative private good use of a resource by using regulations, taxes or subsidies.

A second set of market failures in the allocation of the environment is referred to as the common-pool resource. Common-pool resources have the properties of rival consumption and very high costs of exclusion, although exclusion costs depend on technology and, often, on the state of government-provided property rights. Examples of natural resources, and some built resources, which are accessible to anyone with these common-pool properties include the British commons and grasslands before fencing, fisheries, public motorways, some forests and public parks, beaches, etc. In effect, the common-pool resource problem results in a type of external cost as additional users ignore that their consumption draws on the common-pool resource stock and increases the costs faced by all other users of the limited resource stock. From a society-efficiency perspective, the common-pool resource is overexploited and any economic surplus is driven to zero.

A society-efficient level of production and consumption of a common-pool resource would seek to equate the marginal social cost — which recognises both private

costs and the spillover costs on other users — with the marginal benefit. Marginal social costs can be found from the individual firm marginal private cost curve, and treating this as the society-average cost curve. Perhaps ironically, one solution is to provide for monopoly ownership of the common-pool resource; this works because monopoly ownership converts the non-exclusive property of the common-pool resource under a competitive market structure to an exclusive property. Other policy interventions available to government to reduce overexploitation of a common-pool resource include rules and regulations to reduce consumption or the market-based mechanisms of taxes and tradable permits. In each case, the different sets of interventions might be applied directly on the quantity, or indirectly on closely correlated and sometimes easier to measure inputs and production methods.

The third set of situations where markets fail in the allocation of the environment is grouped under the heading of external costs and benefits. In effect, some of the costs and benefits to society are not recognised under existing market transactions between buyer and seller. Pollution associated with the disposal of wastes by households and businesses is the most important example. Other examples where external costs and benefits can arise include land-use choices, building and other structure designs. Within pollution examples, specific details can vary.[4] While such differences clearly are important in the determination of the details of the efficient allocation of resources and investment decisions, and in the specific design of the corrective policy intervention, the general guideline for economic efficiency is to choose decisions which equate marginal social cost with marginal social benefit.

Figure 2.1, which will be used again in the paper, provides one way of showing the externality problem. The horizontal axis shows the relevant measure of the pollution emission, for example the flow or stock of greenhouse-gas emissions. Output Qbau is the emissions output, or business-as-usual decision under a market, where for valued private goods and services, such as electricity and transport involving the use of fossil fuels, marginal private benefits (MPB) are equated with marginal private costs (MPC) at a market price. The horizontal axis can also represent in a crude way a measure of output of these valued goods and services. The vertical axis shows costs per unit of emission. The increasing cost curve MEC for marginal external cost shows the marginal cost to society of extra pollution, a cost ignored by a market, essentially because there is no property right to pollute. The function

4 For example, we can distinguish between local, national and global pollution (for example particulates and local visibility, acid rain, and greenhouse gases associated with the combustion of fossil fuels); between pollution associated with a flow or a stock (for example most household wastes and heavy metals in sewage disposal); between cases where the external costs have a roughly equal incidence across jurisdiction effect or diffuse external costs by geographic area, whether the externalities relate to production and/or consumption decisions; and between point and non-point forms of pollution (see further, for example, Perman et al. 2003).

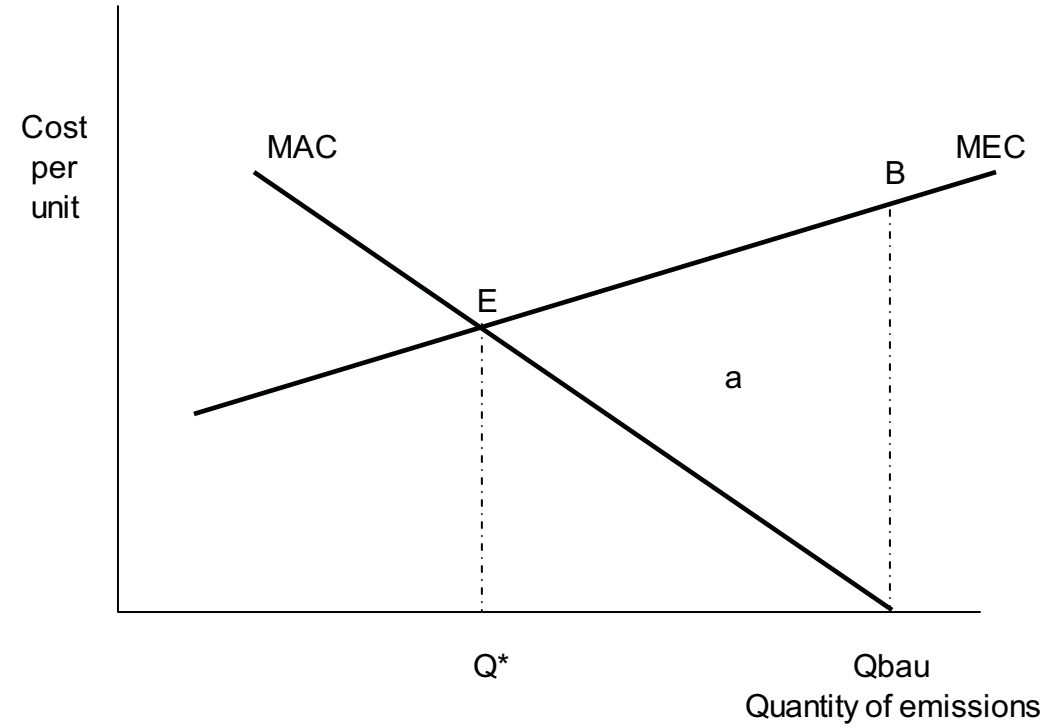
increasing from Qbau is called the marginal abatement cost (MAC). The MAC reflects the fact that as pollution is reduced, producers have to choose more costly production processes that incur less pollution; and/or buyers shift their consumption mix to less pollution-intensive products which are less effective substitutes; and/or society invests scarce resources in R&D to help achieve at lower cost the former two options. In a crude sense, the MAC reflects the difference between MPB and MPC for the desired goods and services as less pollution is emitted. The efficient level of pollution, at Q*, and in turn the efficient choice of products and production processes with different pollution intensities, equates the MAC and MEC curves. This occurs also where MPC + MEC = MSC = MPB (which for completeness equals MSB), where MSC is marginal social cost and MSB is marginal social benefit for the private goods and services.

A number of additional observations can be drawn from figure 2.1. First, a measure of the efficiency gain in shifting from business as usual to the efficient allocation is given by the triangle of economic surplus area 'a'. Second, the optimal solution Q* involves consideration not just of the technical effects of the externality, but also the relative marginal costs and benefits of the externality. Third, and related, seldom will the efficient solution be one of zero pollution. Fourth, both the MAC and MEC curves of figure 2.1 are almost certain to shift over time, both in their position and in their slopes or elasticities. Then, the efficient level of pollution will change over time, and so will also change the quantity of production and consumption, and the production methods, of the goods and services producing the externalities as by-products.

Many arms of government policy intervention are candidates to reduce the level of externalities from the current or business-as-usual level, Qbau, to the socially efficient level, Q*. These include establishing property rights (for example, to pollute); command-and-control regulations on the quantity of emissions, outputs or key inputs; market-based interventions, such as a tax, tradable permits or subsidies to reduce pollution; and moral suasion to reduce pollution. In all cases the regulation, tax, and so forth, should be directed at the size of the marginal external cost at the efficient output level.

Market failures that flow across countries involve additional policy challenges. Where the market failures affect households and businesses within a country, a national government has legal power to compel — although subject to various constitutional and democratic checks. By contrast, where the market failure crosses border boundaries — for example, for global pollution and some public goods — there is no effective international government. In these cases, a solution requires cooperative agreements among the governments of the different countries.

Figure 2.1 **Externality correction**



2.3 Intervention with perfect knowledge

Suppose initially that we have perfect knowledge of the science and economics of the relevant marginal benefit and cost functions, and so we know the efficient allocation of the environment as well as the current allocation with its market failures. Then, in figure 2.1, for a pollution externality, for example, government policy seeks an instrument to change the allocation from Qbau to Q*.

In principle, most of the potential instruments could be employed. A property right to pollute could be designed and managed. As argued in the Coase (1960) theorem, different initial allocations of the new property right, whether to the polluter or the polluted, would lead to an efficient allocation, if transaction costs are negligible. With many players, the low transactions cost pre-condition becomes untenable. A command-and-control strategy would simply require pollution at the efficient level of Q*. Given the likelihood that there is a less-than-perfect correlation between the pollution externality (for example, greenhouse gas emissions), and the desired final good (for example, electricity), or a key input (for example, coal), or a production process (for example, heat exchange), it is preferable to regulate the indicator most

highly correlated with the external cost product — namely the emission itself — rather than a final product, input or production process. If in reality measurement and monitoring costs are lower with the output, input or process indicators, such transaction cost savings might be traded off against errors in signalling the external cost.

Different market-based instruments could achieve the efficient allocation. A tax set at the marginal external cost, namely Q*E of figure 2.1, would internalise the externality in the private costs. The shadow price, or opportunity cost, of a tradable permit set at the efficient level Q* would have the same price and quantity effects as the externality tax. Or producers could be bribed with a subsidy equal to the tax per unit of emission to reduce emissions to the efficient level. As was the case with the command-and-control policy instruments, in general it is better directly to target the tax, tradable permit or subsidy on the pollution source rather than the indirect measures of related, but not perfectly correlated, outputs, inputs or production processes, unless there are large compensating savings in transaction costs.

In terms of redistribution effects, some to all of the costs imposed by governments to restrict pollution will be passed forward to consumers as higher prices under the different forms of corrective government intervention. With the exception of the subsidy, under other interventions the private opportunity cost of production of the externality-creating goods and services increases by the external cost to reflect its social cost. The more elastic is product supply relative to product demand, the higher is the share of the incremental cost passed on as a higher buyer price. Where the marginal cost function is perfectly elastic reflecting a constant returns-to-scale production technology, all of the cost increase will be borne by consumers.[5]

The distributional effects among producers and government will vary with the instrument used to reduce pollution. Where governments initially distribute newly-created property rights to pollute to producers, as is implicit with quotas or tradable permits, the producers (or more generally the other initial property-right recipients) receive a windfall surplus or rent. By contrast, if the permits are auctioned or a tax is imposed, government receives a windfall increase in revenue. A subsidy, by contrast, involves a loss of government revenue. Often regulations to restrict supply are seen by producer lobby groups as a way of creating rents and raising barriers to entry, so favouring the incumbent producers.

Households, and in some cases businesses also, are the beneficiaries of reduced pollution. Importantly, and as noted in the previous section, overcoming market

5 While this result assumes perfect competition, it also is a good approximation, for the different market structures of monopoly, monopolistic competition and some of the oligopoly models, see Freebairn (2008).

failures is a positive-sum game where potentially, if not in practice, the losers can be more than compensated by the winners with some additional economic surplus left over.

So far this paper has proposed a set of interventions which assume that the rest of the economy is acting in a first-best way with no other market distortions. This is an extremely strong assumption and in practice it is an invalid simplification. Where there are distortions elsewhere in the economy — for example, other public goods, monopolistic behaviour, or market failures with other environment choices — adopting a market correction derived on the assumption of market perfection elsewhere will not be first-best. For example, if a product that involves external costs is also a monopoly, monopoly behaviour distorts the economy with too little production and consumption, but this may partly or more than fully reduce output as desired to counter excess production and consumption due to the externality. In principle, using a general equilibrium model, but also with much more information requirements, the appropriate correction in a second-best world can be derived. Recognising the limitations of information, Ng (initially in 1977 and in more recent texts such as 1990) argues that in most cases going for the first-best and ignoring other distortions (in what he terms the theory of third-best) will be close to the mark.

A related consideration is the transaction costs of intervention. Transaction costs include the costs of policy development, and then the costs of administering, monitoring and enforcing compliance with the policy intervention. A net efficiency gain requires that the additional transaction costs exceed the gains to society of the reduced extent of market failure.

In a realistic context of any modern economy and political processes for the determination of economic policy, against market failure has to be balanced government failure. As will be discussed in more detail below, information on the key parameters to correct market failure is imperfect, and costly to obtain. Inevitably the best-intentioned governments will not choose Q* of figure 2.1, and possibly they will choose a much smaller level of pollution that incurs even larger efficiency costs than area ‘a’ generated by the market. The reality of our political processes is that producer lobby groups are more effective lobbyists and suppliers of information cast in their favour than consumers. The objective of politicians to seek re-election need not coincide with maximising economic efficiency, and bureaucrats in part have a selfish interest in interventions that build the size of the bureaucracy and their opportunities for promotion.

2.4 Intervention with imperfect information

Reality is that knowledge about the required functions to choose the level of, and the form of, government policy interventions to correct for market failures — including allocation and investment decisions for the environment — is imperfect. Also, the relevant functions almost certainly change over time, and new information is collected and analysed with the passage of time. In this realistic context, we can draw some differences between the different policy instruments which were not found under the previous section's assumption of perfect knowledge. This section will consider different forms or levels of imperfect knowledge.

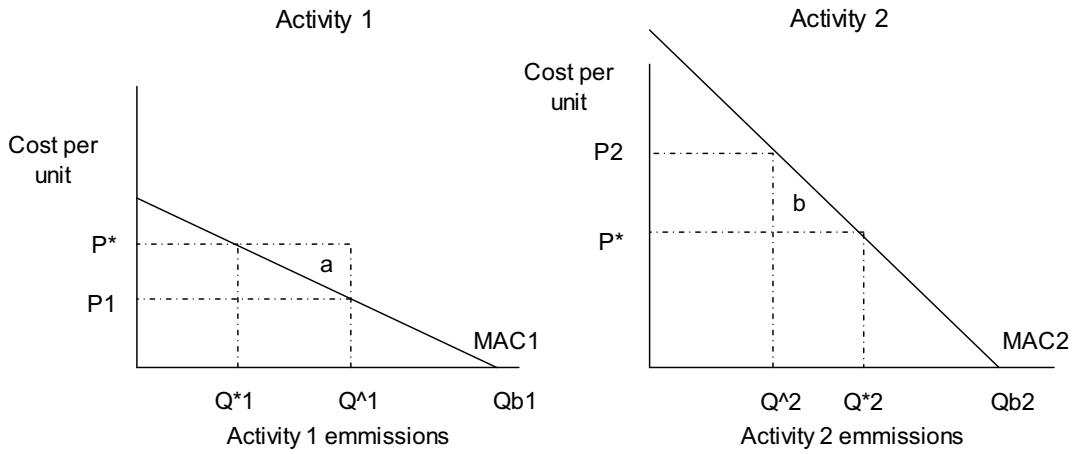
Consider first the case where policy makers have a good idea about the efficient allocation in aggregate, but not the details for individuals. For example, in figure 2.1, there is a good idea of the required reduction of the aggregate level of pollution from Qbau to Q*, or of the marginal external cost Q*E; but policy-makers have much less information for the MAC of the many individual households and businesses. In contrast, individuals have private information on cost-effective ways to reduce emissions.

To illustrate, in figure 2.2 we have two activities producing an external cost, and they have differently shaped MAC functions which are known (or knowable) to the firms but not to government; but government considers that the level of external cost production needs to be reduced x per cent, say a half of Qbau = Q*. A command-and-control regulation might set the same quota for both Activity 1 and Activity 2, namely output Q^1 and Q^2. Note that at these levels, the MAC at the regulated levels varies between the two activities at P1 and P2, respectively.

Market-based mechanisms offer cost-effective ways, and associated efficiency gains, in meeting the aggregate desired pollution levels. In figure 2.2, if the quotas were made marketable transferable permits, it would pay Activity 2 to purchase quota permits (to increase pollution) from Activity 1 (who then would further reduce pollution), until the MAC was equated across the activities at a market permit price of P*. The same aggregate market level of emissions would be achieved with both parties gaining, namely area 'a' for Activity 1 and area 'b' for Activity 2, for a society efficiency gain of area 'a + b'.

That is, a tradable quota system is a cost effective way of allocating a limited resource, such as a common-pool fishery, or meeting a maximum pollution target, such as wastewater or greenhouse gas emissions. As an example, the tradable permit system introduced in the USA in the early 1990s to reduce emissions of sulphur causing acid rain arising from the combustion of coal in power stations was estimated to reduce the costs of emissions reduction by one-third to one-half of the

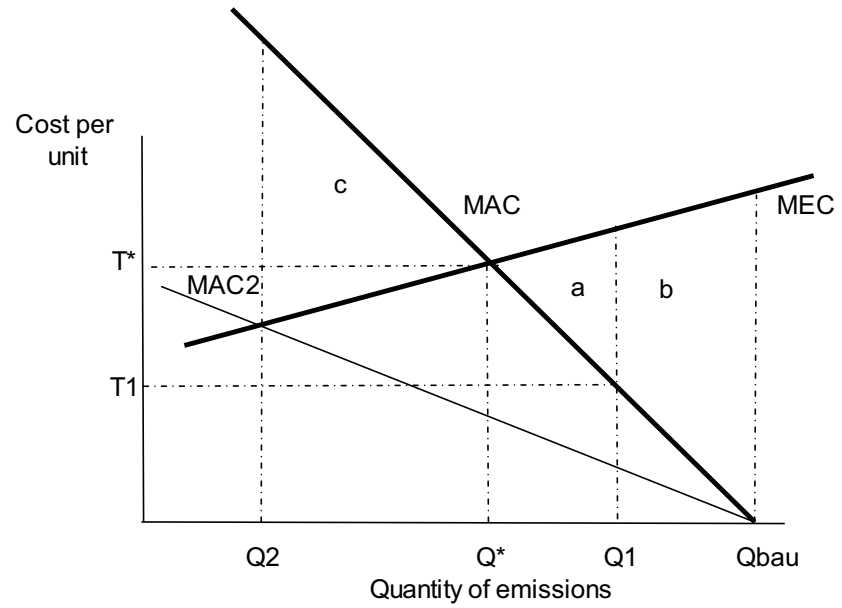
Figure 2.2 **Least cost market instruments**



costs under regulation (Shogren 1998). Alternatively, imposing a tax at rate P* on the pollution maximises the pollution reduction for a given per-unit pollution charge. In addition, the tax or permit price provides continuing incentives to invest in R&D and to seek better and lower-cost ways of using the environment. The self-interest of different players in a market context has them revealing the private information which generally is not available to policy makers.

Information will often be imperfect for the aggregate functions, too. Then, policy intervention in the allocation of the environment generally will not be first-best, and in some cases it will be less effective than leaving allocations to the market. Consider figure 2.3 for a pollution externality. We start at Qbau, for business as usual, with the true, but imperfectly known, MAC and MEC curves with a social optimum at Q*. Suppose that, under imperfect knowledge, the policy-makers choose a tradable quota at Q1 or an emissions tax at T1, which for simplicity are chosen to result in identical realised market outcomes. Relative to the no-intervention state, economic welfare is improved by the trapezoid area 'b', even though an additional potential first best efficiency gain of triangle area 'a' is missed. But under imperfect knowledge, it is also possible that the policy intervention case is less efficient than business as usual; and for illustration suppose that the estimate is MAC2 rather than the true MAC (and with MEC true), so that the area 'c' between MAC and MEC and quantity Q2Q* exceeds area 'a + b'.

Figure 2.3 **Imperfect knowledge costs**



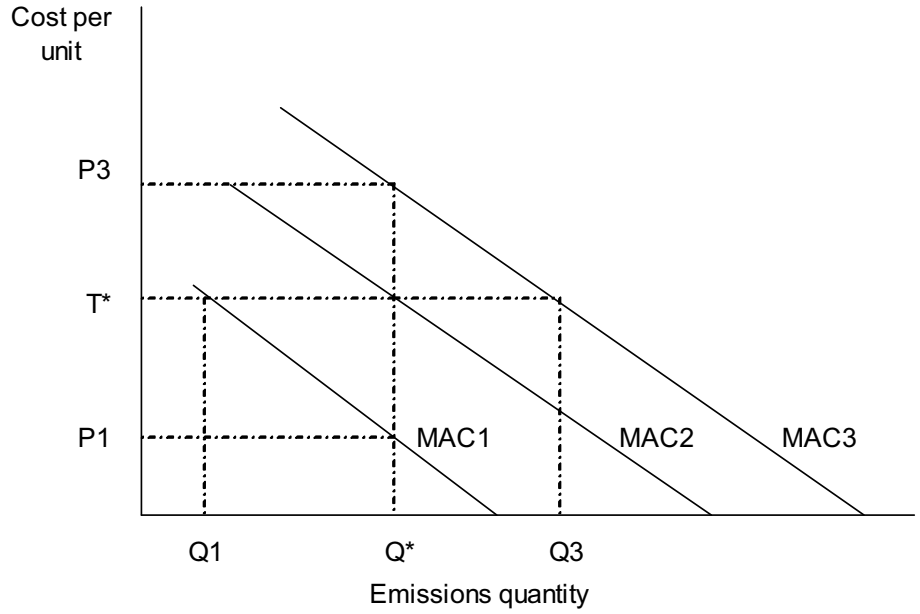
In the context of figure 2.3, and using Weitzeman (1974), we can say something about the relative merits of choosing the tax instrument versus the tradable permit instrument under imperfect knowledge of the positions of the MAC and MEC curves; but with knowledge of their relative slopes, in terms of the relative sizes of the efficiency losses, namely the triangles 'a' and 'c'. Where the MEC is flatter than the MAC, as illustrated in figure 2.3, comparable errors expressed as a percentage of T* in the choice of the tax rate will result in smaller efficiency losses than comparable errors in the choice of the quota or cap Q*; with the reverse of a tradable quota favoured if the MAC is flatter than the MEC.

In most cases, the MAC (and in many cases also the MEC) curve will shift over time — for example, with economic growth, technology, tastes, climate and so forth. Also, the MAC will be more elastic with a longer length of run as there are more opportunities for substitution in production and consumption of the pollution-intensive inputs and outputs. In many cases, the long run will be decades given the long lives of equipment and buildings, and also with the endogeneity of investments in R&D.

Figure 2.4 shows an example of three different positions for the MAC function. Suppose that initially with MAC2 a tradable quota Q* or a tax rate of T* is chosen. Shifts in the MAC2 to MAC1 or MAC3 with a tradable permit result in stability of the emission at Q*, but with volatility of the permit price of P1, T* and P3. By

contrast, with a tax, shifts in the MAC result in price stability at T*, but with volatility of the emission levels of Q1, Q* and Q3. Which of these sets of volatility is least preferred will vary with circumstances, such as the relative shapes of the MAC and MEC curves already discussed, and on the relative effects of price volatility versus quantity volatility for the effectiveness of decision-making by households, businesses and governments.

Figure 2.4 **Price versus quantity intervention**



Economists, and others, often distinguish problems of imperfect knowledge between risk and uncertainty. Under risk, the different possible states can be specified, and there is general agreement about the probabilities for each state. With uncertainty, the possible states might not be known and there are diverse views on the probabilities of each state or, in the case of radical uncertainty, no probabilities can be attached.

For the case of risk, we replace the deterministic procedures of the perfect-knowledge model discussed above with expected outcomes for different actions if risk neutrality is assumed, or with expected utility comparisons if risk aversion is a more reasonable objective in choosing between different forms and levels of policy intervention.

Some cases of market failure with the allocation of the environment will not have sufficient information to form even a rough consensus probability distribution function with which to assess the effects of different policy interventions. Such

uncertainty does not, of itself, nullify the statements of potential efficiency losses in the choice of level of intervention or the relative properties of the different instruments discussed above. But the reality of uncertainty has often given support to a number of regulatory interventions over market-based instruments, to different objectives such as sustainability and the precautionary principle, and to the more explicit and formal recognition of the need for flexibility to respond to new information.

There are different variants of the precautionary principle or option-value approach to government intervention in decisions affecting the environment under uncertainty (see, for example, Weier and Loke, 2007). One interpretation is that where there are actions with a reasonable likelihood of both large and irreversible damage, such actions should not be taken in the framework of a type of a lexicographic-objective function or of a maximin solution to a game-against-nature model of the decision problem. Regulations based on available scientific levels, on safeguards for biodiversity survival, on weak or strong sustainability, and on minimum health safeguards are examples of applications of the precautionary principle. Wills (2006) and others question why the action of 'protect the environment', rather than the action of 'reduce the economic opportunity loss', should necessarily be the worst or maximin state.

Often, complementary policy action involves further research, information collection and analysis to improve understanding, and then the option to revise decisions in the future in the light of the extra information, and investment in capacity to increase the resilience of the system to cope with possible adverse outcomes.

2.5 Conclusion

A mixture of markets and of government intervention to correct for such market failures as public goods, common-property resources and externalities will be required to achieve an efficient allocation of the environment and for investment in its development. When government intervention is likely to improve upon market decisions, then in most cases market-based instruments such as taxes and tradable permits offer more cost-effective ways of changing allocations and investments, because they induce firms and households to reveal information not available to governments about their individual preferences and constraints.

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3 Threats to effective environmental policy in Australia

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Abstract

Recent decades have seen the accelerated use of market-based instruments for environmental management in Australia. Not all instruments, however, have been well directed, appropriately designed or effectively implemented, leading on occasion to limited environmental gains and high regulatory costs. In this paper the use of market-based instruments for environmental management in Australia is canvassed ahead of a discussion on the emergence of a 'sustainable consumption' ideology which is gaining prominence in policy circles to the detriment of effective reforms.

3.1 Introduction

Recent decades have seen accelerated reforms in environmental policy, associated with increased resource scarcity, increased pressures on the environment and heightened community demands for environmental services and amenity.

In many instances, policy reforms have benefited from the establishment of clear environmental goals, articulation of policy targets and increasing use of market-based instruments (MBIs) to drive down environmental compliance costs and ensure that those who can benefit the most from access to resources are able to do so. On this latter point, Australia is a world leader in the development of resource and environmental markets such as in fisheries, water, water pollution such as nutrients and salinity, and with promising developments in relation to native vegetation and biodiversity.

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But not all environmental policy reforms have been well directed, appropriately designed or effectively implemented. Notably, and as discussed in this paper, some MBIs have been poorly applied, and a raft of policies emerging under the banner of sustainable consumption are likely to have dubious benefits. These issues are discussed following a brief overview of developments across several environmental media, particularly water and solid waste management.

3.2 Overview of MBIs for environmental regulation in Australia

Excluding greenhouse gases, air and water pollution control over recent decades have seen significant improvements in controlling point-source emissions, but the application of MBIs has been constrained in some States where regulated activities do not have mass- or load-based discharge limits.

Pollution discharge fees have been introduced in many States, but are typically based only on cost-recovery of licence administration rather than environmental damage costs (as per a Pigovian tax). Some notable emission trading schemes have been established and there have been a number of investigations into more widespread water quality trading under the Australian Government's Coastal Catchments Initiative. The more widespread use of these tools, however, is frustrated by the dominance of diffuse source emissions with associated measurement, enforcement and political difficulties.

Climate change policy has seen the introduction of a raft of energy efficiency incentive programs as well as trading instruments, including the Mandatory Renewable Energy Target scheme (MRET) and the NSW Greenhouse Gas Reduction Scheme (GGRS).

Most have been applied at the State level, but, as identified in the Parer Review (COAG 2002), State policies have generally been poorly targeted and uncoordinated; they compete with each other and create uncertainty. As a result, it is likely that cheaper abatement options exist but are not being taken up.

Encouragingly, the current policy debate is focusing on a broadly-applied emissions trading scheme, but its central rationale — *to maximise compliance flexibility so as to drive down costs* — may be compromised by the multiplicity of policy instruments, 'special case' exemptions and the desire of governments to 'pick winners' under the guise of complementary programs.

To this end, Garnaut (Commonwealth of Australia 2008) has warned that the role of complementary measures is to lower the cost of meeting emissions reduction

trajectories by correcting for market failures, such as in relation to R&D. Once an emissions trading scheme is in place, however, forcing adoption of some measures (such as via the MRET scheme) may displace other low-cost opportunities, increasing the overall cost of climate change responses.

In the area of conserving native vegetation and biodiversity, regulatory limits on clearing have been established in most jurisdictions, although enforcement is at best mixed. The longer-term costs of these restrictions will depend upon available adjustment mechanisms to facilitate high value developments and the rehabilitation and expansion of high-value ecosystems. And MBIs are playing leading roles in providing these adjustment mechanisms, with offset schemes such as the NSW BioBanking and Victorian BushBroker schemes facilitating new development while 'new generation' conservation tenders are, relative to old-style grants programs and input-based incentives (such as for fencing), providing performance-based, cost-effective mechanisms for increasing conservation on private land. For all these adjustment mechanisms, sound metrics, performance auditing and enforcement will be critical.

Water market reforms over recent decades have been substantial. Rural water markets in particular have significantly matured with the introduction of diversion caps, the unbundling of entitlements, inter-state trade, and so on, which have increased the efficiency of rural water use.

More recently, the reform agenda has shifted to reducing the environmental impacts associated with water use and trade. Barriers to trade, however, such as exit fees and quotas, are impeding further economic and environmental gains, largely due to fears for the loss of irrigated production and flow-on impacts for attendant communities. But as noted by Watson (2008), 'an implication of public interest in the environmental consequences of water use is that contraction of irrigation *not* just adjustment is the order of the day'.

Watson and others have also noted that the costs of environmental water secured through 'savings' achieved by investment in infrastructure have generally exceeded the value of the water (as discussed further below), and many claimed savings are illusory when reductions in groundwater recharge and return flows are accounted for.

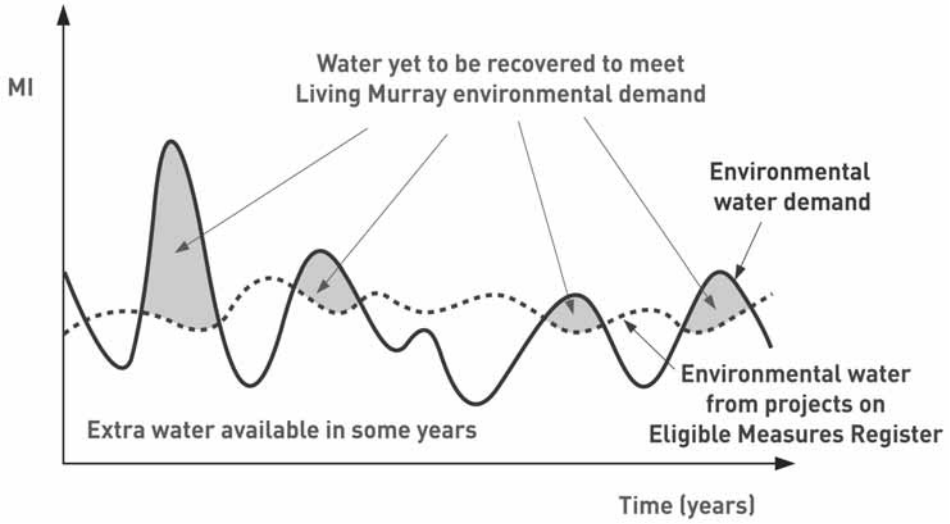
But with the dire state of the River Murray, particularly the Lower Lakes, water buybacks have now taken centre stage. Following a successful pilot buyback of 20 GL of water by the MDBC in 2007, the Australian Government purchased 35 GL on the lower-connected Murray in early 2008, has purchased Toorale Station on the Darling River with its 14 GL water licence, and in September is initiating a second

round of buybacks focussing on the Queensland and northern New South Wales areas of the Basin.

While this market approach has considerable merit, its success will ultimately be judged on the environmental improvements it can deliver. In this regard, governments appear to be chasing water without clear implementation plans. That is, for many environmental sites where water is sought, such as some of the 'Living Murray' icon sites, there is a mismatch between water availability under the irrigation licences being purchased and the environmental watering demands of the sites (such as the need to top up medium-size flood events to deliver water 'over bank' to riparian forests and wetlands).

For example, BDA Group (2006) noted that much of the water needed under the Living Murray First Step will be to meet irregular environmental watering demands both in frequency and size. As much of the water already recovered is of high reliability (notwithstanding climate change implications), the temporal profile of the outstanding water required is even more exaggerated (see figure 3.1).

Figure 3.1 Stylised overview of water recovered and needed under the Living Murray Initiative



Some of these problems will be overcome through a complementary works program that will improve the effectiveness of delivering environmental water.

Otherwise there is a view that environmental water can be traded on water markets to rebalance holdings, perhaps through the use of derivative type instruments such as options contracts. As environmental water is, however, often needed opportunistically, early in irrigation seasons when announced allocations and trade

volumes are low, trading on 'spot' markets will pose difficulties. In the case of options, difficulties in defining triggers that establish whether the environment or irrigator gets the water will be the problem. This is because environmental water demands are not necessarily well correlated with metrics around which irrigators would be confident to develop risk strategies — such as announced allocation, rainfall or dam storage levels.[2] Ultimately, more fundamental property right reforms may be needed to ensure a robust sharing of water between the environment and consumers.

In the case of urban water security, reforms are clouded by the relatively high capacity of households to pay, a lack of competition in supply and constraints on urban rural water trade. Collectively, these are resulting in unduly high budget and opportunity costs. As Watson (2008) notes, 'recycling, desalination and rainwater tanks are put forward as universal solutions to urban water shortages in Australian capital cities when their application is manifestly location-specific'.

The commissioning of a desalination plant for Sydney essentially as a drought reserve is contrary to the economics of the option, which to be competitive would be as a base load supplier rather than a drought reserve with expensive mothballing in between. The preference of the ACT Government for an enlarged dam, and large-scale sewage recycling, to augment drinking water supplies ahead of purchasing cheaper and perhaps more secure water from irrigators sourced from the Tantangara Dam — given the extent of storage and ability to carry water between years — provides another example.

Related to this, and as saliently put by the Productivity Commission (2008), 'there is effectively no market for water in Australia's cities. The charging regimes of monopoly utilities reflect production costs, but not the scarcity value of water. Instead, restrictions are placed on particular water uses and these impose substantial hidden costs on many households'.

With regard to solid waste management, policy in Australia is seemingly not premised on standard public policy intervention criteria of market failure and a net benefit test. This even appears the case where MBIs are used. A pertinent example here is a recent increase in the NSW landfill levy.

In 2005, the NSW Government announced an increase in the waste disposal levy, almost trebling the levy in the metropolitan region, with no mention of its addressing landfill externality impacts (New South Wales Government 2005). Rather, the rationale was to raise revenue to fund environmental water buybacks, with any reductions in waste disposal to landfill viewed as a secondary benefit, as

2 See Scoccimarro and Collins 2006 for an empirical analysis of this issue.

increased waste recycling was argued to provide 'upstream' resource conservation benefits.

The Productivity Commission (2006) in its Waste Inquiry has already commented on the tenuous arguments that such upstream benefits may be significant and that they can be realised through policies such as a landfill levy employed late in supply chains. What has received little attention is whether such levies are sound policy instruments for revenue raising, given potential regulatory burdens. BDA Group (2004) argues:

> The use of charges or levies as fiscal instruments to raise revenue has received little attention in the economics literature directed at waste policy. This is because such instruments do not have an economic basis — they are not designed to promote behavioural change and 'internalise externalities'. Indeed, taxation theory suggests that an efficient fiscal tax is one where behavioural changes are minimised, as this will impose less economic costs on the economy and ensure that the revenue base is not undermined.
>
> When using charges or levies on waste management practices to raise revenue for waste programs, the key economic question for government is whether or not established State fiscal instruments would be more efficient in raising revenue. (p. 73)

The Business Roundtable on Sustainable Development (2006a) estimated that the total net economic costs imposed on the NSW community from the proposed levy increase are some $260 million in present value terms. This excludes the environmental costs associated with increases in illegal dumping and/or the costs of an enhanced anti-dumping enforcement program.

3.3 Emergence of a 'sustainable consumption' ideology

The emergence of a 'sustainable consumption' ideology appears to conflict with economic efficiency principles that have hitherto guided the rationale for and nature of government interventions. This is examined in this section of the paper, which draws on the work of Bennett and Collins (2008).

The concept of sustainable development is widely recognised as an important goal of public policy and, to this end, many State and Federal statutes require sustainability principles to be incorporated into policy processes and administration.

Sustainability has largely been interpreted as a capital[3] stock issue where the challenge is to identify the optimal temporal path of using capital resources. But application is difficult at an operational policy level due to an inability to measure

3 Where capital can be natural, human or built.

capital stocks and rates of use, let alone to determine the use of the resources that will maximise resource-use efficiency within as well as between generations.

In the light of prevailing views across some of the citizenry, therefore, that we are currently consuming 'too much', governments have adopted a pragmatic policy focus to reduce pressures on the resource base — so that we are at least moving toward more sustainable resource-use patterns, albeit towards an ill-defined goal.

That is, sustainability policies have emphasised 'doing more with less'. Governments have looked to apply this dogma across supply chains, with a long policy history of promoting technical efficiency in input use at the production stage and maximising resource recovery at the waste disposal stage.

Promoting technical efficiencies

Incentives for technical efficiencies (e.g., in water and energy) are being provided along supply chains, without due consideration of the relative efficiency of incentives and the extent to which they will be passed along supply chains.

For example, urban water efficiency incentives are often narrowly applied with seemingly no relationship to resource values. Incentives selected from initiatives of the Australian and Victorian Governments demonstrate the range of cost-effectiveness. The Australian Government's *Community Water Grants Program* Round 1 projects averaged $3,297/ML, while Round 2 projects have averaged $6,170/ML. The cost-effectiveness of recent Victorian urban water efficiency initiatives ranges from $770/ML saved under the AAA shower head rebate, $9,069 under the rainwater tank rebate, $23,061 under the high pressure rebate) to $33,395 under the AAA dishwasher rebate.[4]

Rural water savings have also come at greatly varying cost, and generally at a cost in excess of the market value of the water. For example, the cost of infrastructure projects under the Living Murray initiative has generally been around $3,000/ML and up to $5,000/ML, much higher than the purchase price of water entitlements under the MDBC 2007 Pilot Environmental Water Purchase Project, which was conducted in a period of low-water availability and higher entitlement prices (MDBC 2008).

Similar experiences can be found with Australian Government initiatives. For example, included in their Water Smart Australia Program is the Wimmera–Mallee pipeline project at a cost of $4,864/ML and the Bendigo Bounty regional

4 Derived from Victorian Government 2004.

reclaimed-water project at a cost of $7,209/ML recovered. By comparison, water purchases have been much cheaper. Under Water for the Future the Australian Government has committed $3.1 billion to purchase water in the Murray–Darling Basin over 10 years. A public tender in the first half of 2008 yielded 35 GL of water, with the price of high-security water purchased averaging $2,124/ML and general security water averaging $1,131/ML.[5]

Of perhaps greater concern is that technical production efficiencies are now being widely promoted through, at best, poorly-constructed partial productivity measures such as the 'carbon footprint', 'food miles', 'virtual water' (the volume of fresh water used to produce a product, including the sum of water use in the various steps of the production chain), and so on. These measures are being paraded in an evangelical manner to the community, using up the available goodwill and financial wherewithal that might otherwise be used to tackle genuine reforms. At least the previous generation of partial productivity measures — such as gross margin/ML which was wrongly used to vilify the rice industry — had some technical rigour.

Maximising resource recovery

The driving mantra of waste policy in Australia has been the 'waste hierarchy' which decrees that waste avoidance is preferable to reuse, which in turn is preferable to recycling, which is preferable to disposal. The hierarchy is premised on maximising material recovery without any regard to the societal costs of doing so, with its inevitable end-point of 'zero waste', which has been adopted as a policy target in several jurisdictions.

The failure of the Productivity Commission's Waste Inquiry (2006) findings to have any impact on the 'religion' of waste policy is rooted in the 'sustainable consumption ideology' that has gained prominence in the community.

Its genesis is noted by the Business Roundtable on Sustainable Development (2006b):

> In the 1980s the creation of waste became regarded as 'wasteful' and a poor reflection on a consumption-driven society. Reducing waste disposal through recycling became a driving force across many communities in developed economies. Reducing waste was heralded as a further step in the move to sustainable economies.
>
> Communities were keen to embrace broader sustainability practices, and waste reduction was seen as a material way this could be done at an individual and household level with opportunities for everyone to contribute. The mantra 'think global, act local' had real relevance for the community when it came to waste and the environment.

5 www.environment.gov.au/water/mdb/entitlement-purchasing/overview.html (accessed 24/7/08).

> Such community aspirations encouraged governments to broaden the rationale behind waste policy goals, beyond disposal externalities to include upstream life-cycle impacts associated with waste materials. (p. 3)

Some governments are now questioning this policy rationale, as they face significantly increasing costs to realise ever-increasing levels of waste 'recovery'. But governments which have promoted the concept of a 'waste crisis' and the benefits of recycling to the community now find they are captured by community demands for further waste reduction initiatives. Accordingly, sensible waste policy will continue to be elusive until more informed notions of sustainability are accepted by the broader community. And such cultural change must start with government.

Sustainable consumption in a robust policy process

From the perspective of a policy commentator, the critique of sustainable consumption policies will continue to be frustrated by the failure of governments to establish operational inter-generational equity goals, beyond the generalisations of the Brundtland Commission and other writers.

That is, where sustainability policies are to go beyond correcting market failures that are impeding the economically efficient use of resources, and seek to promote inter-generational equity goals, effective policy requires those goals to be clearly articulated. Such explicit determinations of inter-generational equity trade-offs would appear well beyond the sophistication of the current sustainability debate. Therefore, these trade-offs should continue to be implicitly made on a case-by-case basis through an informed political process, rather than pursuing the nebulous notion of sustainable consumption. As noted by Bennett and Collins (in press):

> For governments to identify a specific consumption pattern that would align with an efficiency/equity optimal use of resources poses the same informational challenges as faced by the market. It requires knowledge of the full range of production possibilities across the economy, their technical conversion efficiency, knowledge of the nature, extent and location of production externalities ranging from environmental to public health to social amenity and so on. It necessitates similar knowledge in relation to transport, storage and distribution possibilities. Moreover it requires knowledge of consumer wants and relative preferences, the values they place on convenience, hygiene, fashion, etc., as well as knowledge of waste management, recycling and disposal opportunities.
>
> Given the information deficiencies and asymmetries that governments face in trying to determine a desirable consumption pattern for even a single commodity — given production and consumption substitution effects — a policy approach directed at identifying and promoting 'preferred' consumption patterns would appear doomed.

And even if it were possible, given the dynamic drivers behind resource conditions, production efficiencies and consumer demands, any identified consumption pattern would be but a snapshot in time. This would be as useful in setting resources policy as a single stock market index number would be to guide industry policy.

So while observed consumption levels may be useful from an environmental reporting sense, indicating (possible) shifts in pressures on the resource base, they provide limited value to policy makers and should not be allowed to cloud sustainability policy. Meaningful sustainability policy must relate back to the underlying resource base, regardless of where in supply chains policy interventions are judged to be effective and efficient. That is, in some instances sustainability objectives may be best promoted through policies at the consumption stage of supply chains, but seeking to promote a specific consumption outcome in its own right is not only misguided, but may lead to perverse sustainability outcomes!

Accordingly, policy principles that relate to sustainability in its broader sense of fostering the optimal use and allocation of resources are preferable to those based on a notion of fostering sustainable consumption *per se*.

3.4 Concluding comment

MBIs are being widely employed to promote environmental policy goals. They will only deliver cost-effective gains, however, when they are appropriately directed, designed and implemented. Narrowly-based incentives, particularly those directed at influencing specific consumption choices rather than underlying resource-management problems, will rarely be the best policy intervention.

Accordingly, environmental policies should not be based on narrow and simplistic premises such as 'doing more with less'. Indeed, community goodwill is often being squandered on government promoted tokenism — change a few light bulbs, separate your recyclables, get a new showerhead — rather than garnering support for more fundamental reforms.

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4 Letting markets work for the environment

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Abstract

Rivers, wetlands and floodplains are valuable 'natural capital' in Australia. They provide habitat for native flora and fauna, and their integrity underpins the quantity and quality of water available for drinking, and for supporting irrigated and dryland agriculture and other economically important industries including tourism and fishing. Overuse of water for irrigation undermines the long-term prospects of all these activities and water must be reallocated to the environment, especially in the context of climate change-induced shifts in rainfall and runoff patterns. Although planning is the primary tool for water allocation as set out in the National Water Initiative, and generating water savings through infrastructure investment is the preferred approach by governments, market-based instruments (MBIs) should be the most efficient and effective mechanism for achieving optimum water-sharing arrangements in the severely-stressed Murray–Darling Basin. This paper explores the role of MBIs and administrative mechanisms for environmental water recovery, some institutional and regulatory impediments to water reallocation, and how these need to change so that markets work for the environment.

4.1 Water — the lifeblood of a dry continent

Rivers, wetlands and floodplains are valuable 'natural capital' in Australia. They host a diverse profusion of natural, cultural and economic values. In the Murray–Darling Basin, they have evolved to be perfectly adapted to the 'droughts and flooding rains' that characterise much of southern Australia. Wetlands like Hattah Lakes on the Murray River provide refuges for native plants and animals during droughts when rivers can run dry. When rains return, plants and animals recolonise

the river channel and spill out onto the floodplain in a frenzy of biological productivity that continues until the cycle enters another dry spell.

The rivers of the Murray–Darling Basin provided such an abundance of food and fibre that it supported one of Australia's largest Aboriginal populations prior to European colonisation,[1] and they underpinned an agricultural revolution as they were dammed, diverted, regulated and used to capture, store and provide water upon demand for irrigated agriculture. Seventy per cent of Australia's irrigated agriculture takes place in the Basin, contributing greatly to the 40 per cent of Australia's total agricultural output that originates there — an extraordinary feat, considering that the Basin receives only 6 per cent of Australia's rainfall.[2] The Basin supports an enormous amount of economic activity that depends directly on a healthy environment, including tourism, real estate and commercial and recreational fishing.[3]

4.2 Decline of our natural capital

Despite the importance of this natural capital, a legacy of poor decision-making has resulted in the waters of the Murray–Darling Basin becoming grossly overused, and the system is collapsing. Native fish, birds and trees, and indeed whole ecosystems, are in decline. Water quality is under threat from salinity and blue-green algal outbreaks, affecting its utility for irrigation and drinking water. Many wetlands and floodplains along the Murray have not seen water for more than a decade and are literally dying for a drink.

Today, the average flow at the mouth of the River Murray is less that 25 per cent what it was before regulation[4] and flow ceases 40 per cent of the time compared with 1 per cent of the time, pre-development.[5] As the impacts of overuse are progressively compounded by the ongoing drought, Lakes Alexandrina and Albert and the Coorong wetland at the end of the Murray–Darling system may permanently lose the values for which they are internationally significant, and South

1 See chapter 2 in Sinclair, P. 2001, *The Murray: A River and its People*, Melbourne University Press.

2 See Murray Darling Basin Commission at: http://www.mdbc.gov.au/about/basin_statistics

3 *ibid.*

4 Murray Darling Basin Commission 1995–2004, *Water Audit Monitoring Reports,*: http://www.mdbc.gov.au/naturalresources/the_cap/the_WAM_report.htm

5 CSIRO (Commonwealth Scientivic and Industrial Research Organisation) 2008, *Water Availability in the Murray, Murray-Darling Basin Sustainable Yields* Project, Australian Government Water Fund, July, http://www.csiro.au/files/files/plos.pdf

Australians may be left dealing with the legacy of a toxic waste dump cause by acidification.[6,7]

It is abundantly clear how we got into this situation and that the situation will only get worse as the impacts of climate change start to bite.[8] In its most basic form it is also clear what needs to be done to fix the problem — reallocate a substantial amount of water back to the environment from irrigation. It is in the discussion around how much water should be reallocated, where it should come from, how quickly the reallocation should happen, and which policy tools should be used for reallocation that the pathway to a healthy Murray–Darling Basin and ecologically sustainable irrigation industries becomes less than clear.

4.3 What the Basin needs

A scientific study in 2003 concluded that returning 1500 GL (about three times the volume of water in Sydney Harbour) to the River Murray, combined with infrastructural and operational improvements, would give the river a 'moderate' chance of becoming a healthy working river.[9]

In 2006, record low inflows to major water storages in the southern part of the Basin prompted the then Prime Minister, John Howard, to commission the CSIRO to undertake a 'sustainable yields' study. This study was to estimate the current and likely future (up to 2030) water availability in each catchment and aquifer across the entire Murray–Darling Basin, under best, worst and most likely climate-change scenarios and other activities that might reduce inflows, such as plantation forestry, farm-dams and groundwater extraction.[10] Given that the most likely climate-change scenarios will see inflows reduce by 8–14 per cent and the worst-case scenario will see inflows halve, it is clear that a huge change in water use across the Basin is required.

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6 South Australia Murray-Darling Basin Natural Resource Management Board 2008, *Lakes Alexandrina and Albert Ecological Condition Progress* Repor, April.

7 Muller, K. 2008, A Blueprint for the Survival of the Lakes and Coorong Ecosystem, Indigenous Peoples and Farming Communities. Appended to: http://www.acfonline.org.au /default.asp?section_id=62

8 Various CSIRO Sustainable Yields Project Reports at: http://www.csiro.au/partnerships/ MDBSY.html

9 Ecological Assessment of Environmental Flow Reference Points for the River Murray System Interim Report prepared by the Scientific Reference Panel for the Murray-Darling Basin Commission, Living Murray Initiative, October 2003, http://www.thelivingmurray.mdbc.gov. au/reports/srp_reports

10 See: http://www.csiro.au/partnerships/MDBSY.html

4.4 The National Water Initiative — Australia's national blueprint for water reform

The story of the Murray–Darling Basin is repeated across Australia: many of our rivers and aquifers show a marked ecological decline, driven by water overuse and exacerbated by drought. Governments first acknowledged that the problem required a national approach in the early 1990s and embarked on a pathway of reform through the Council of Australian Governments (COAG). This program of reform was expanded, refreshed and propelled up the national agenda in 2004 with the introduction of the National Water Initiative (NWI), a blueprint for water reform, signed by the Federal Government and all State and Territory governments.[11]

Despite widespread support from stakeholders, the NWI failed to drive change at the scale and pace required, as exemplified by the initial failure of the subsidiary 'Living Murray' program, an intergovernmental agreement involving the Federal Government and the governments of NSW, Victoria, South Australia and the ACT in agreeing to invest $500 million[12] over five years to recover 500 GL of water for the environment.[13] A focus on investing money in water infrastructure and on-farm efficiencies that would reduce seepage or evaporation and provide 'water savings' that would be returned to the environment resulted in very slow progress in water recovery — such projects have long lead-times and even when all cost-efficient opportunities are exhausted they will be able to secure no more than three fifths of the target 500 GL.

This precipitated another historic landmark in water reform on Australia Day in 2007, when Prime Minister Howard announced a $10 billion, 10-year 'National Plan for Water Security' (NPWS) intended to enhance and reaffirm the NWI and to provide adequate funding to drive it. The essential elements of that plan survived the change in Federal Government later that year and became further enhanced in the $12.9 billion 'Water for the Future' plan.[14] This comprises a $3.1 billion 'Restoring the Balance' program to purchase water entitlements from willing sellers,[15] from which an initial $50 million was quickly spent in recovering 35 GL

11 See the full text of the Intergovernmental Agreement on a National Water Initiative and related resources at: http://www.nwc.gov.au/nwi/index.cfm

12 Now $700 million after a further commitment by the Federal Government in the 2006 Budget.

13 The 'First Step' of the Living Murray Initiative (LMI): More details see: http://www.thelivingmurray.mdbc.gov.au/home

14 See: http://www.environment.gov.au/water/index.html

15 Wong, P. (Minister for Climate Change and Water) 2008, Water for the Future, Speech to the 4th Annual Australian Water Summit, Sydney Convention and Exhibition Centre, 29–30 April, http://www.environment.gov.au/minister/wong/ 2008/pubs/sp20080429.pdf

of water for the environment in early 2008,[16] and a $5.8 billion 'Sustainable Rural Water Use and Infrastructure Program' to be spent in improving the efficiency and productivity of water use and management.[17]

It also promises an independent Murray–Darling Basin Authority which will develop a 'Basin Plan' characterised by scientifically-credible, ecologically-sustainable diversion limits on water use combined with environmental watering plans, designed to secure the long-term needs of river and wetland assets and system-wide biological processes.

Finally, it looks as if all the essential elements are in place to efficiently and effectively implement the NWI and most importantly to reallocate water to the environment and put the Basin onto a sustainable footing, at least as far as water extraction levels are concerned.

4.5 Markets to the rescue?

The NWI (Section 23) seeks to achieve a 'nationally compatible, market, regulatory and planning based system' for water management. In terms of planning tools for water allocation, however, the NWI essentially allows existing, State-based water-sharing arrangements to continue until their expiration dates, which for most of NSW is 2014 and for some Victorian rivers is 2019! A multitude of regulatory mechanisms exist relating to water extraction and use but none is directed squarely at addressing overuse and reallocating water from irrigation to the environment. This is unlikely to change, given the prevailing mood amongst governments and industry that regulation is not the preferred tool for achieving environmental or sustainability outcomes. That leaves the market as the key tool for water reallocation, consistent with the development of private property rights as enshrined in the NWI.

Section 79(ii) of the NWI is very clear that acceptable mechanisms for recovering environmental water include 'the purchase of water on the market, by tender or other market-based mechanisms'.[18] This clause has generated a flurry of research, modelling and advice from government and non-government bodies, including the Productivity Commission,[19] ABARE,[20] the Business Council of Australia[21] and

16 See: http://www.environment.gov.au/water/mdb/entitlement-purchasing/index.html

17 Water Under Pressure. Australia's Man Made Water Scarcity and How to Fix It. See: http://www.bca.com.au/Content.aspx?ContentID=100665

18 See: http://www.csiro.au/partnerships/MDBSY.html

19 Rural Water Use and the Environment: The Role of Market Mechanisms at: http://www.pc.gov.au/study/waterstudy/finalreport/index.html

Land and Water Australia,[22] all of which concluded that MBIs are the most efficient and cost-effective way to recover water for the environment.

Using the market to recover environmental water is fair to farmers, who are free to choose whether or not they wish to sell their water or enter into agreements to share water with the environment. They can sell their water during hard times to get out of debt, they can use the money to invest in more efficient irrigation technology or switch to dry land farming, or they can leave the land if that is what they want to do.

4.6 Market-Based Instruments (MBIs) that are suited to water recovery

MBIs that could be used for water recovery are many and varied. Some relate to the purchase of rights on a permanent basis (entitlements) or a temporary basis (annual allocations). The purchase of entitlements will be a key tool in redressing the balance of grossly over-allocated systems and providing base flow for rivers, but it may also be kept in storages and accumulated to provide ecologically-useful volumes. Buying annual allocations may provide opportunities to 'top up' available water on a case-by-case basis, but since the environment tends to need water quite early during the irrigation season, when allocations are low, the temporary market may be less useful and more expensive than might first appear.[23]

Opportunities also exist to develop markets in partial rights such as options and derivatives, as well as attenuated licences that could provide water for the environment when it needs it most, usually in wet years, while leaving legal title and an agreed share of the water with irrigators.[24,25] The development of options, derivatives and attenuated licences allows environmental managers to manage risks better, given that environmental water demand is highly variable and peaky.[26]

20 Various papers at: http://www.abareconomics.com/publications_html/landwater/landwater_06/landwater_06.html

21 Water Under Pressure. Australia's Man Made Water Scarcity and How to Fix It. See: http://www.bca.com.au/Content.aspx?ContentID=100665

22 See Collins and Scoccimarro 2006 at: http://products.lwa.gov.au/files/ER061225.pdf

23 *ibid.*

24 Analysis of a range of possible MBIs for water recovery at: http://www.acfonline.org.au/uploads/res_market.pdf

25 See: http://www.nwc.gov.au/agwf/wsa/docs/File/Murrumbidgee_River_Reach_A4_Final_120907.pdf

26 See Collins and Scoccimarro 2006 *op.cit.*

The variability of environmental water demand in terms of the magnitude, seasonality, frequency and duration of flood events and the different characteristics of existing and novel water products all point toward the need to secure a portfolio of water products tailored regionally to meet the water demands of environmental assets including discreet assets (including wetlands, floodplains, critical habitat areas) and system-wide processes (for example carbon and nitrogen flux throughout the system).[27]

As well as a range of MBIs, there is a range of administrative methods that can be used to implement them which themselves affect some of the pros and cons for different sectoral interests. For example, voluntary purchase of permanent entitlements can happen in a number of ways: by the environmental manager standing in the open market; by the environmental manager making a public offer to buy a particular type of water product at a particular price; or by competitive tender or auction, where entitlement holders compete with each other to supply water to the environment. Environmental managers competing in an open market to buy water entitlements may have quite a different effect on water prices than entitlement holders competing with each other to sell water to the environment. As a result, careful consideration should be given to the choice of administrative method, as well as the choice of MBI used for water recovery.[28]

Further, some non-market factors have a significant effect on the capacity to achieve environmental outcomes with a particular environmental water allocation. For example, the ability to carry over environmental water allocations in dams and let it accumulate until it reaches ecologically useful volumes of water must be considered as part of any environmental water recovery and management package. Studies have shown that, compared to a situation without carry-over, the ability to carry-over water up to a limit of 4.5 times the volume of entitlement held reduced by 70 per cent the amount of water needed to meet environmental demands 80 per cent of the time.[29]

The best triple bottom-line outcomes will probably result from using a mixture of different market and non-market mechanisms for water recovery and management — principally investment in infrastructure improvement which generates water efficiency savings — put together as a package which reflects local environmental and socio-economic circumstances. Nevertheless, the market is the best way to address the core problem of over-allocated water entitlements. This

27 Analysis of a range of possible MBIs for water recovery at: http://www.acfonline.org.au/uploads/res_market.pdf

28 *ibid.*

29 See Collins and Scoccimarro 2006 *op.cit.*

view appeared to be the wholehearted approach of the current 'Water for the Future' plan, given the aforementioned $3.1 billion designated for 'purchasing water to put back in the rivers'.[30] But there remains a catch.

4.7 Impediments to market efficiency

Section 60(iv)(b) of the NWI commits the parties to the agreement to 'the immediate removal of barriers to permanent trade out of water irrigation areas up to an annual threshold limit of 4 per cent subject to review at a later date'.[31] This is clearly a barrier to trade and likely to be a substantial impediment to the Federal Government's ability to roll out its water purchase program, $1.2 billion of which is scheduled to be spent over the next four budget years.

In 2007, the Murray–Darling Basin Commission's 'Pilot Environmental Water Purchase' project had to delay finalising some water purchase contracts until the following year because it came up against the 4 per cent barrier. Last year, trading limits were reached in Victoria after just four months. This year, in the Goulburn-Murray Water irrigation district, the closing date for submitting expressions of interest in selling water was 4 July — four days after the start of the new water year. The outcome of the ballot will be known in mid-August, and it is likely that the 4 per cent cap will be reached in at least some districts at that time. At the time of writing the 4 per cent cap has already been reached in some districts including the Campaspe (Victoria) and the Loxton Irrigation Trust and Lyrup Irrigation Trust areas (South Australia).

This is bad for the environment, and retards the pace of water reallocation because it limits the amount of water that can be bought in these areas and constrains the ability of the Australian Government to roll out its water purchase program. It is also bad for irrigators, because it constrains the ability of willing sellers and willing buyers to do business with each other in a way that promotes adjustment to prevailing drought conditions. This means that struggling irrigators — with large debts, facing another year of low or zero water allocations and a high degree of uncertainty, who might decide that it's time for them to retire — will be unable to sell to irrigators who want to do everything they can to maintain their permanent plantings and improve their prospects in the future. As leading natural resource management economist, Dr Steve Beare, said recently in *The Australian*, 'with all our championing of free trade at Doha, our international trading partners might

30 Water Under Pressure. Australia's Man Made Water Scarcity and How to Fix It, *op.cit.*

31 See: http://www.csiro.au/partnerships/MDBSY.html

wonder why we impose trading quotas on water with no more justification than privileging some local economic interests over others'.[32]

Incredibly, the heads of government threw away the opportunity to redress this impediment to policy implementation at the COAG meeting on 3 July 2008, when Victoria championed the vested interests of the Victorian Farmers Federation and held the other governments to the 4 per cent cap. The heads of government stated nothing more than an 'ambition to increase the cap from 4 per cent to 6 per cent by the end of 2009'.[33]

It is hard to imagine why the Australian Competition and Consumer Commission (ACCC) made no comment whatsoever on the impact of the 4 per cent cap in their Position Paper, 'Water Market Rules', commenting only that 'the water market rules should accommodate the outcomes of this agreement'[34], in a discussion that otherwise promotes the removal of other barriers to trade. Acknowledging that the COAG agreement will stand is one thing, but failing to discuss the impacts of such an agreement objectively is another.

The only justification for trade restrictions is where it is necessary to avoid market failure, such as environmental damage caused, for example, by erosion due to excessive, unseasonal water transfer downstream.[35]

If vested interests continue to pressure governments to put barriers in the way of reform and constrain the use of the water market and exchanges between willing buyers and willing sellers, governments will eventually need to start looking at other options to fix the problem, including the unpopular option of compulsory acquisition.

4.8 Where to from here?

An excellent opportunity for governments, in particular the Australian Government, to deliver immediate and ongoing outcomes for the environment unconstrained by the 4 per cent rule, comes from specifically targeting water held by irrigators that lie outside defined irrigation areas. This would include large parts of the Darling Basin and could include giant water holders like Cubbie Station and strategically important land and water holdings which would deliver large amounts of water to

32 Opinion Piece 'Buy Back Water to Let The River Run', *The Australian*, 14 July 2008, p. 8.

33 See: http://www.coag.gov.au/meetings/030708.index.htm

34 See: http://www.accc.gov.au/content/index/phtml/itemId/834697/fromItemId/3737

35 See: http://www.acfonile.org.au/uploads/res/ACF_Submission_to_ACCC_09_05_08.pdf

the environment if it were no longer captured and used for irrigation.[36] Even within defined irrigation areas, if entire properties are purchased along with their water entitlements so that the entitlement remains in the water district, the 4 per cent cap is not breached. This option should be pursued vigorously.

There are scheduling issues relating to the roll-out of the buy-back program and the infrastructure programme. The changing climate will render some parts of the Murray–Darling Basin no longer suitable for irrigated agriculture. Consequently, a thorough audit of future land and water capability must be done before taxpayers' money is spent in creating world-class irrigation infrastructure if we are to avoid creating world-class stranded assets. The water buy-back should be accelerated to tackle the overuse problem but governments should not be pressured into simultaneously investing in infrastructure improvement until an audit is completed.

Further, the Basin Plan must be informed by a detailed understanding of the hydrological needs of environmental assets across the basin: currently there is a huge information gap in this area. A first priority for the new Murray–Darling Basin Authority is to commission studies to address this so that water recovery can then be tailored to provide water of the characteristics that meet ecological needs.

Likewise there are gaps in the socioeconomic information that is necessary to inform the tradeoffs that will be made in developing and implementing the Basin Plan. Much of this is tied to future land and water capability and should be front-of-mind in conducting the audit mentioned above.

4.9 Conclusion

The NWI provides a good framework for water reform in Australia. It has the capacity to meet the needs of irrigators and the environment and accordingly was welcomed by farmers and conservationists.[37] Its implementation programs for the Murray–Darling Basin in particular through the 'Water for the Future' plan provide the funding and set the pathway for the reform agenda, but governments must stop shying away from using the reform tools that the community and water users have already agreed upon. There are only so many roads to repair and restoration — we can't block them all! Failure to recognise this and press on with the reform agenda will further delay the reallocation of water necessary to achieve a sustainable

[36] See: http://www.acfonline.org.au/uploads/res/Opportunities_to_purchase_water_properties_in_the_Darling_Basin_Aug08.pdf

[37] Press release by Australian Conservation Foundation, National Farmers Federation and the Australian Bankers Association, 23 June 2004, at: http://www.bankers.asn.au/default.aspx?ArticleID=569

balance. Delay reduces the time available for transition and means that we will have to deal with the double whammy of entrenched overuse and the impacts of climate change at the same time.

Leaders must allow markets to work for the environment and fast-track the use of MBIs for water recovery. Market participation on behalf of the environment means that the Australian Government can secure multiple, lasting community benefits and further a major objective of the NWI by returning water extraction to sustainable levels and enable adjustment in the rural sector. Failing to do so is consigning our internationally significant wetlands and their wildlife to a future almost as uncertain as that of our important irrigation industries that must get themselves onto a sustainable footing or face the consequences of a declining natural resource base that will be unable to support the industries that rely on it.

General discussion

An observation from one participant that 'we are better at managing the economy than at managing our natural resource assets' opened the discussion. In response, another participant countered that the economy and environment were intertwined and it was pointless to separate them.

Professor Freebairn's emphasis on economic efficiency was questioned by one commentator, who argued that resilience — that is, the ability to absorb shock — was equally important. It was suggested that some industries, for example dairying, may have become more efficient, but in doing so, had become less resilient.

In response, Professor Freebairn commented that where the market was working effectively, the private sector was better equipped than government to manage issues such as resilience. There was a role for government, however, in cases of market failure, but even when the case can be made, there is still a question as to what form the intervention should take, and what criteria should be used to measure its effectiveness. Arlene Buchan added that authorities charged with managing the environment should have clear objectives, adequate funding and be free to operate without political interference.

Drew Collins was asked to elaborate on the disadvantages of a 'sustainable consumption' ideology. He replied that sustainable development was not necessarily about the amount of consumption *per se*, but overall stewardship of the economy including our environmental legacy. Approaches to sustainability, narrowly based on limiting consumption growth to that achieved from technical efficiencies, may only have a small overall impact on environmental sustainability. 'My concern is that we have a poorly defined sustainability goal in an operational context … what we are seeing is a belief within the community that there is an inherently correct level of consumption that if achieved, means the rest will look after itself.'

One participant commented that resistance to market-based reforms, noted by Drew Collins and Arlene Buchan, was actually resistance to government involvement in resource allocation in general — similar resistance would be experienced against other forms of government action (for example, planning or regulation). Drew Collins suggested that adjustment support policies, rather than constraints on

market-based instruments, should be used by governments to overcome any negative impacts of reform.

In relation to the water buyback program, one participant asked what the recovered water will be used for, and whether there was adequate understanding of the environmental assets to be maintained. Arlene Buchan argued that although more information was needed about the ecological assets and hydrological needs of the Murray Darling Basin, the significant loss of environmental assets that has already occurred means that 'no-one can run the argument that getting water back to the environment isn't an absolute priority … at the moment, any water buyback, any water reallocation, is a good thing'. The $50 million that the Commonwealth Government has already spent on buying back water was specifically targeted to restoring ecological assets, she said. Professor Freebairn suggested that one area for further debate was the right to store water.

SESSION 2

MARKET AND COOPERATIVE SOLUTIONS: STRENGTHS, LIMITATIONS AND THE APPROPRIATE ROLE OF GOVERNMENT

5 Promoting better environmental outcomes through property rights and markets: opportunities and limits

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Abstract

There is growing movement toward adoption of market mechanisms to address environmental and natural resource problems. Using US ocean fisheries and fresh water as examples, I make two key points: One is that despite the attractions of more definite property rights, they remain controversial, limiting or slowing their adoption. They generally are adopted only late, after conditions have deteriorated for many regulated resources. Allocation is one of the most controversial aspects. Accordingly, compensation to parties who expect to be made worse off must be considered in policy discussion. The form of that compensation, especially if it is in the form of preferential access privileges, however, must be designed carefully because it can influence the effectiveness of the property regime adopted. Second, because broader political and social values often are associated with resource use, common property, which involves more stakeholders, rather than narrower private property rights, can seem an attractive alternative. Important trade offs, however, must be kept in mind in policy design. As the number and heterogeneity of the parties increase, common property becomes much less effective. Indeed, it may offer little improvement over regulation. Hence, it may be preferable to adopt private property rights with use restrictions, rather than a more inclusive common property arrangement.

Four direct policy implications are drawn from the main points of the paper:

1. Because property rights institutions are costly and often controversial they often are best implemented late, after a resource crisis reveals their benefits clearly.

2. In devising side payments to address the distributional concerns, where possible avoid constraining the property rights granted or providing preferential, but inefficient rights to certain parties with limits on transferability.
3. Common property as an alternative to private property rights works best if: (a) the number of parties is small; (b) they are similar in the expected net gains of agreement; (c) there is little uncertainty regarding the size and distribution of costs and benefits (information, measurement, bounding, and compliance costs are small); and (d) the aggregate gains of taking action are large relative to the costs.
4. Evaluate the tradeoffs of common property carefully. If too inclusive and complex, common property may offer no advantages relative to the assignment of private property rights with use regulations.

5.1 Introduction

In one way or another, most environmental and natural resource problems — too much air pollution; insufficient investment in natural habitat and biodiversity; too rapid drawdown of groundwater; and overfishing — arise from the incomplete assignment and definition of property rights. Under these circumstances, decision makers do not fully internalise the social benefits and costs of their actions, and hence overpollute, overextract, overharvest as well as underinvest in amenities and other public goods. These are classic externalities.

Until fairly recently, the primary response to externalities has been command and control regulation of inputs and/or outputs in order to bring production to more socially optimal levels. Unfortunately, in many cases, the regulatory record has not been one of much success. For these reasons, there is an accelerated trend toward assigning property rights of some type to resources in order to mitigate the losses of the common pool.[1] A recent survey found that tradable use permits were used in nine applications in air pollution control, 75 in fisheries, three in water, and five in land use control.[2] These institutional innovations have taken place as the resources

1 See Stavins R.N., 2007, 'Market-based environmental policies: What can we learn from US experience (and related research)?', in Jody Freeman and Charles D. Kolstad (eds), *Moving to Markets in Environmental Regulation*, Oxford University Press, New York, pp. 19–47.

2 Tietenberg, T. 2007, 'Tradable permits in principle and practice', in Jody Freeman and Charles D. Kolstad (eds), *Moving to Markets in Environmental Regulation*, Oxford University Press, New York, pp. 63–94, 69.

have become more valuable, as they have faced growing open-access losses, and as dissatisfaction has increased with existing centralised regulation.[3]

There are multiple advantages to property rights and market arrangements, including flexibility, cost savings, information generation, migration to high-valued uses, and better alignment of incentives for conservation or investment in the resource. The more complete are property rights, the more the private and social net benefits of resource use are meshed, eliminating externalities and the losses of the common pool.[4]

By contrast, centralised regulation — which typically relies upon uniform standards, arbitrary controls on access, constraints on timing of use, and/or limits on technology or production capital — suffers from a variety of well-known problems including high cost, inflexibility, ineffectiveness, and industry capture. Further, regulatory decisions take place in the absence of information about alternative uses that market trades generate. Finally, centralised state regulatory rules may or may not align with the incentives of actual users of the resource. Generally, no party involved — actual users, regulators, politicians — is a residual claimant to the social gains from investment or trade.[5]

Accordingly, decisions about extraction, production, investment, and allocation are based on other factors that are apt not to be consistent with maximising the economic or social value of the resource or of conserving it. Indeed, the experience with many central regulatory regimes has not been satisfactory — fisheries continue to be depleted; air pollution abatement targets have not been achieved; and water has not been managed effectively.

I make two points in this paper. One is that, despite the attractions of more definite property rights, they remain controversial, limiting or slowing their adoption. They generally are adopted only late, after conditions have deteriorated for many regulated resources. Allocation is one of the most controversial aspects because of

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3 Stavins, R.N. 1998, 'Economic incentives for environmental regulation', in Peter Newman (ed), 1998, *The New Palgrave Dictionary of Economics and the Law*, Macmillan, London, vol. 2, pp. 6–13.

4 Libecap, G.D. 1989, *Contracting for Property Rights*, Cambridge University Press, New York; Dahlman, C. 1979, 'The problem of externality', *Journal of Law and Economics*, vol. 22, pp. 141–62.

5 Johnson, R.N. and Libecap, G.D. 1994, *The Federal Civil Service and the Problem of Bureaucracy: The Economics and Politics of Institutional Change*, University of Chicago Press, Chicago, pp. 156–71.

the distributional implications involved in moving from open access or central regulation to a property regime.[6]

In many cases, at least some constituencies, including regulators, who benefited from the previous regulatory arrangement, will be disadvantaged under a new rights system. Some parties who previously used the resource will be denied access. Production under a property rights regime has a different composition of inputs and timing from what occurs under either open access or regulation, with negative impacts on certain groups of labour, input sellers, service organisations, and processors. These production changes are inherent in the efficiency gains of privatisation, but not all parties directly benefit from them. Further, as the resource rebounds and becomes more valuable, new owners have wealth, status, and political influence not available to those without access privileges.

Accordingly, compensation of parties who are concerned that they will be made worse off must be considered in policy discussion. The form of that compensation, especially if it is in the form of preferential access privileges, however, must be designed carefully because it can influence the effectiveness of the property regime adopted.

The second point is that, because broader political and social values are often associated with resource use, common property, which involves more stakeholders, rather than narrower private property rights, can seem an attractive alternative. Important trade-offs, however, must be kept in mind in policy design. As the number and heterogeneity of the parties increase, common property becomes much less effective. Indeed, it may offer little improvement over regulation. Hence, it may be preferable to adopt private property rights with use restrictions, rather than a more inclusive common property arrangement.

To sum up, I offer four direct policy implications from the main points of the paper:

1. Because property rights institutions are costly and often controversial, they are often best implemented late, after a resource crisis reveals their benefits clearly.
2. In devising side payments to address the distributional concerns, where possible avoid constraining the property rights granted or providing preferential, but inefficient, rights to certain parties with limits on transferability.
3. Common property as an alternative to private property rights works best if: (1) the number of parties is small; (2) they are similar in the expected net gains of agreement; (3) there is little uncertainty regarding the size and distribution of costs and benefits (information, measurement, bounding, and compliance costs

6 Definition and enforcement costs for mobile, unobserved resources are also issues, as discussed below.

are small); and (4) the aggregate gains of taking action are large relative to the costs.

4. Evaluate the trade-offs of common property carefully. If too inclusive and complex, they may offer no advantages relative to the assignment of private property rights with use regulations. Other more detailed recommendations regarding common property also are provided in the text.

The arguments of the paper are presented as follows: I briefly summarise the problems with command and control regulation that can arise and the benefits of property rights. I then turn to delay in the assignment of property rights to address environmental and natural resource concerns due to limited information, uncertainty, and distribution disputes. Finally, I discuss the conditions under which common property will be useful and when it might not be. I illustrate these points by reviewing experiences in US fisheries and water allocation controversies in the western United States. I conclude with a short discussion of the use of markets in addressing environmental and natural resource objectives.

5.2 Regulation, property rights, and markets

Command and control regulation

The initial response to open access generally has been state regulation of entry and production to include: a) restrictions on access or time of use; b) equipment and other input controls; and c) extraction or production regulations. State regulation is the initial resort for a number of reasons. One is that it avoids the complex, costly, and controversial allocation of more definite property rights, which could directly address the problem of externalities. Second, state regulation may involve lower costs of measurement, bounding, and enforcement, and, if the resource is of relatively low value, more definite property rights may be too costly to be an option.[7] Another reason is that state regulation is consistent with the notion that many natural resources are rightly 'public' with ownership reserved in the state rather than in private parties. Similarly, if there are important public goods associated with the resource, then state ownership and regulation of access may be optimal. Finally, state regulation can advantage certain influential political constituencies who mould regulatory policy in their behalf. While market processes

[7] See Alston, L.J., Libecap, G.D. and Schneider, R. 1996, 'The determinants and impact of property rights on the frontier: Land titles on the Brazilian frontier', *Journal of Law, Economics, and Organization*, vol. 12, no. 1, pp. 25–61, for discussion of the emergence of property rights as resource values change.

are relatively transparent, political and bureaucratic processes are less so, facilitating preferential treatment to certain parties.[8] This situation underlies the notion of regulatory capture.

One of the constituencies in regulation is the bureaucracy itself, which develops a stake in the maintenance and expansion of state authority and resistance to property regimes where more decision making responsibility is granted to actual resource users. Agencies often are relatively insulated, especially when resource management requires scientific knowledge that may not be generally available to citizens. Hence, agency officials can manage the resource to maximise budgets and regulatory discretion, to advantage particular favoured constituencies, and/or to advance certain political, scientific, and professional views of resource access and use. Since neither politicians nor bureaucrats are direct residual claimants to the resource rents that are saved by mitigating the losses of open access, their regulatory decisions may or may not increase the social or economic value of the resource.

For all of these reasons, when the costs of central regulation become large and its effectiveness in stemming open-access losses questioned, other options come to be considered. If the resource is of high enough value to warrant more definite property rights, then they can be adopted. But property rights arrangements are costly and often controversial, and how they are implemented affects their efficacy in addressing the losses of the commons.

Advantages of property rights and markets

Property rights are directly relevant in confronting open access because, if fully assigned, they close the externality directly and thereby link individual incentives with social objectives for resource use. With a single owner or a limited number of them, decisions about resource investment and use can be made quickly. When the rights structure includes the right to transfer the asset and transaction costs are low, adjustments to changes in price and cost can occur rapidly and flexibly. Optimal production sizes can be achieved.

The sale or other exchange of property rights also generates valuable information regarding alternative uses and opportunity costs that promote efficiency in resource allocation and application. The asset flows to high-valued uses and thereby maximizes social benefits. Indeed, one of the most critical contributions of property

[8] For discussion of the problem of oversight when information is limited, see: Johnson, R.N. and Libecap, G.D. 2001, 'Information distortion and competitive remedies in government transfer programs: The case of Ethanol', *Economics of Governance*, vol. 2, no. 2, pp. 1001–34.

rights is that they provide the basis for exchange or bargaining among parties to tackle open-access problems. The critical agents are identified as owners, the ones who bear the benefits and losses of taking action or not doing so.

Allocation of property rights

The allocation of property rights is contentious because of the associated assignment of wealth and political influence that comes with ownership. Property rights are political institutions and, as such, political negotiations influence the nature of the rights arrangements that are implemented and change their adoption times and effectiveness.

Property rights allocation is also affected by other factors, including the physical nature of the resource, the number and heterogeneity of the parties involved, equity norms and precedents, and the legal environment.

There are several allocation mechanisms:

First-possession rules

First possession is the dominant method of establishing property rights.[9] It assigns ownership on a first-come, first-served basis or first-in-time, first-in-right. First-possession rules are attractive because they recognise incumbent parties, who have experience in exploiting the resource and hence may be the low-cost, high-valued users. Incumbents also have a direct stake in access to the resource and will be important constituents in any property rights distribution. They are concerned about past investment in specific assets, which otherwise would not be deployable to other uses. Since first-possession rules recognize these investments, this security may encourage future outlays. Allocations that do not consider the position of incumbents will face opposition, raising the costs of rights assignment and enforcement. Accordingly, grandfathering in the initial allocation has been a necessary ingredient in building the political support necessary to implement the approach.

First possession is criticised for possibly encouraging rent dissipation as parties rush to 'capture' the resource by establishing excessive use patterns. If the competing parties are homogeneous and ownership is short-term, then full dissipation is

9 See Libecap, G.D. 2007, 'The assignment of property rights on the western frontier: Lessons for contemporary environmental and resource policy', *Journal of Economic History*, vol. 67, no. 2, pp. 257–91.

possible. If, on the other hand, the parties are heterogeneous and use rights are long-term, then first-possession assignments to a flow can mitigate rent dissipation.[10]

First possession is also criticised for its equity implications. Its use can provide windfalls to past users instead of providing funds to the state that might be used under some circumstances to compensate losers from privatisation, and it discriminates against new entrants.[11]

Uniform allocation rules

Equal sharing rules avoid the distributional concerns associated with first possession and better reflect egalitarian goals. If there are no restrictions on subsequent exchange of property rights and transaction costs are low, there are few efficiency implications. The resource still migrates to high-valued users. Uniform allocations also avoid the measurement costs of verifying claims of past production or use or of documenting precedence claims that are part of first-possession assignments. They can also avoid the costly pursuit of property rights when first possession is known to be the allocation rule.

Lotteries are examples of uniform allocations because each claimant is given an equal, random draw in the assignment of rights to the resource, and the allocation granted is generally partitioned equally among lottery winners. Uniform allocations via lotteries are most effective when applied to new resources where there are no incumbent claims and all parties are relatively homogeneous. They can also be used when the access and use rights granted are short-term and no long-term ownership is implied, such as with lotteries for annual hunting licences.

Auction allocation

A third allocation mechanism, often favored by economists, is auction. It can directly place assets into the hands of those who have the highest value for the asset. It thereby avoids the transaction costs of reallocation. Auctions also generate resources for the state and avoid the windfalls that might be considered unearned and divisive. Auction returns can be used to cover the costs of defining and enforcing property rights and other costs of resource management. As with lotteries,

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10 Johnson, R.N. and Libecap, G.D. 1982, 'Contracting problems and regulation: The case of the fishery', *American Economic Review*, vol. 72, pp. 1005–22, show that heterogeneity among fishers limits rent dissipation even under open access and the rule of capture.

11 Stavins, R.N. 1995, 'Transaction costs and tradable permits', *Journal of Environmental Economics and Management*, vol. 29, pp. 133–48, refers to grandfathering as a give-away. Inefficiencies would come through a race between homogeneous parties.

auctions work best for new, unallocated resources where there are no incumbent claimants and where resource values are very high. By granting more of the rents to the state, auctions reduce the distributional implications of first-possession or uniform allocation.

As with other allocation arrangements, there are costs to auctions. The state must be able to measure and enforce resource boundaries and individual allocations secured by auction. The terms of the auction may also be influenced by competing claimants who lobby for rules that provide them with specific advantages.

Collective action issues and delay in the assignment of property rights

The brief discussion of allocation mechanisms suggests that there is often an underlying collective action problem associated with the definition and assignment of property rights and, hence, why they generally are adopted late in resource use. For example, Scott Gordon wrote his classic article on waste in open-access fisheries in 1954.[12] Individual Transferable Quotas (ITQs) were suggested by fishery economist Francis Christy in 1973, but it was not until 1986 (32 years after Gordon wrote his article) that New Zealand adopted the first rights-based approaches.[13] Similarly, in air pollution control, the notion of tradable emission permits was put forward by Thomas Crocker in 1966 and by J.H. Dales in 1968 when air pollution was becoming a growing problem in the United States, but adoption of such permits took another 30 years.[14]

The main reason why formal property rights are adopted late in resource use (even after extensive periods of open-access losses) is that they involve high resource and political costs relative to their expected gains. These issues become even more problematic when there are multiple parties claiming a stake in the resource, a point that is addressed in more detail below.

Property rights have formidable information and input requirements in allocation, measurement, bounding, and enforcement, and they can have substantial distributive effects when there is too much uncertainty as to the impact on key constituencies. These resource and political costs hamper the assignment of

12 Gordon, H.S. 1954, 'The economic theory of a common-property resource: The fishery', *Journal of Political Economy*, vol. 62, no. 2, pp. 124–42.

13 Hannesson, R. 2004, *The Privatization of the Oceans*, MIT Press, Cambridge; Newell, R.G., Sanchirico, J.N. and Kerr, S. 2005, 'Fishing quota markets', *Journal of Environmental Economics and Management*, vol. 49, pp. 437–62.

14 Crocker, T.D. 1966, 'The structuring of atmospheric pollution control systems', in Wolozin, H. (ed), *The Economics of Air Pollution*, W.W. Norton, New York, pp 61–8; Dales, J.H. 1968, *Property and Prices*, University of Toronto Press, Toronto.

property rights to address open access. As argued above, when the value of the resource or the cost of the externality is relatively low, prescriptive regulation to limit exploitation through uniform restrictions can be cost-effective and politically acceptable. Information demands are limited to the setting and administering of general rules and standards; it does not involve obvious redistribution; and reliance upon standardized regulations reduces uncertainty regarding the impact on constituencies. The various parties involved can generally predict how they might be affected, and their current political and wealth standings are unlikely to be significantly altered. At the same time, however, these policies incompletely address the externality, leaving many margins for rent dissipation unconstrained.

Property rights are relevant because they address the externality directly and link individual incentives with social objectives for resource use. But they are typically adopted only when their costs are offset by the aggregate rents that are saved from overexploitation. Because these transaction costs can be quite considerable, the value of the resource and the nature of uncertainty determine the optimal time for introducing formal property rights. Crises that suddenly and sharply raise benefits and lower uncertainty accelerate this process.[15] Crises here are events or spikes that dramatically raise the wastes associated with open access and at the same time lower the transaction costs of collective action by providing new information about the benefits of institutional change to combat the problem.

Collective action, which may not be possible early, can become more practical after delay, as transaction costs fall. Additional information emerges regarding the severity of the problem, reducing uncertainty and measurement costs and eliminating information asymmetries; the resource becomes more valuable (perhaps due to greater depletion, raising the benefits of action); new technology or techniques are developed to lower the costs of closing the externality; and the number of parties declines as the private returns to exploitation fall. At this point, distributional concerns can become subordinate to the overall need to respond to open access, and successful group efforts become more likely.

These problems are compounded, however, when the externality is larger, spreading across multiple groups or constituencies, so that its resolution requires broader government involvement and the associated efforts of politicians. When there are numerous constituencies affected differently by the problem and the costs of mitigation, politicians must balance constituent interests to maximise political support for taking action.

15 Libecap, G.D. 2008, 'Open-access losses and delay in the assignment of property rights', *University of Arizona Law Review*, vol. 50, no. 2, pp. 379–408.

When constituencies are heterogeneous in the net gains of collective action, politicians must devise side payments from high gainers to those who expect to do less well in order to build a political consensus. Transfers that seem too obvious and as unfairly rewarding particular groups can bring a reaction from general taxpayers. Accordingly, camouflaging transfers, linking them to popular public goods, and tying them to broad distributional norms can reduce their political costs. Their design, however, may lower the overall effectiveness of the government regulation of the externality.

Uncertainty in predicting aggregate costs and benefits of addressing externalities and their distribution across constituencies complicates the crafting of side payments by encouraging disputes over the size, nature, and direction of compensation. These disputes increase political risk and reduce the expected politicians' benefits from deal-making to address the externality.

As a result, politicians select policies that lower uncertainty and raise expected net gains for key constituents. These policies include postponing any action; encouraging research in information about the externality; promoting new technology that lowers costs; investing in resource-stock enhancement, including restricting access by non-citizens or other politically-weak groups; and adopting standardised regulations that reduce the externality while appearing to remain neutral and not changing the existing distribution of wealth and political power.

Politicians will support property rights only if it is politically beneficial to do so — when command and control regulation has not worked, when they have the support of key constituencies, and when it is possible to construct side payments to influential groups that might be harmed. Accordingly, to build political support, politicians shape the assignment of property rights in a manner that achieves other distributional objectives or meets the demands of those who claim to be harmed. These adjustments, which, however, attenuate the property rights that are granted, also weaken the ability of the rights regime to reduce the losses of open access.

Common-property regimes

When private property rights seem to be too controversial to be adopted, more inclusive common-property options may be considered. Such institutions seem to be especially attractive when there are many divergent claimants or interests associated with a resource, as can be the case with ocean fisheries and related aquatic habitats as well as with fresh water. Both resources have public good aspects; are seen as inherently public by some; have many distributional implications from single ownership; and their fluid physical nature raises the bounding costs of assigning private rights.

In these cases, common-property regimes are often presented as a viable option that avoids the political conflicts associated with private property. While this may be the case, an extensive body of theory and empirical evidence regarding common property exists to illustrate when such institutions are likely to be effective in addressing open access and when they are not. If common property is to be considered as an alternative to private rights and markets for the reasons described above, the tradeoffs should be considered explicitly in public policy decisions.

A number of points are worth making. First, any common resource must still be bounded in some manner, so that group members (perhaps citizens or other designated stakeholders) have access and set use rules so as to protect the resource and avoid rent dissipation. Non-group members are denied access. Hence, bounding and enforcement costs remain to be addressed by policy makers. Second, there is the critical issue of internal decision making and responsibility for resource use.[16] If this process is impaired, common property can be costly, with misalignment of member incentives for maximising the social value of the resource. Cooperation within the group depends upon resource, group, and management characteristics.

Resource characteristics

1. The smaller, the more observable, and the less mobile the resource, the lower the transaction costs of bargaining within a group to address commons problems. These conditions allow appropriators to observe the waste of open access, to define accurate external boundaries for the resource, to evaluate the response to management efforts, and to police entry and use. All of these are issues of information. Changes in the technology of transportation, observation, and communication generate more information, allowing the resource size to be larger and less observable. A policy role for the state can be to provide credible scientific information about the resource, its character, and its boundaries to encourage collective action.
2. Clearly-defined resource boundaries allow the group to police entry, allocate access among its members, monitor their compliance, and invest in the stock (conservation). Changes in bounding and enforcement technology, also possibly promoted by policy, can lower the costs of marking resource perimeters and thereby can promote group action.
3. A well-defined commons problem or, alternatively, good information about the resource and the losses of open access, allows the group to agree on the significance of the problem and the benefits of addressing it. If the losses are

16 Baland, J.M. and Platteau, J.P. 1996, *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?*, FAO and Clarendon Press, Oxford, p. 187 discuss these two problems in the use of common property to address resource issues.

controversial (as assessments vary) or small, then there is less pressure to take action.

4. Similarly, the less uncertainty about the commons problem and the resource reaction to it, the greater will be the identification of the returns to cooperation and less disagreement among the parties. Accordingly, policies aimed at providing information about the commons problem and methods of addressing it can make common property (indeed, all property arrangements) more feasible and effective.

5. Finally, all else being equal, more valuable resources will have more costly externalities and greater losses from open access. The gains from group action to address the problem rise. At the same time, rights and other management arrangements for more valuable resources have greater enforcement costs. The benefits of defection are greater. Indeed, high value and cheating are argued as reasons for adoption of private rights.[17] Value may rise from exogenous price increases, changes in social values (greater appreciation of biodiversity, ecology) or new extraction technology. These factors could invite outside entry and raise the costs of cohesive group action.

Group characteristics

1. Clearly-defined membership in the group is important so that members can be identified for bargaining and enforcement and for avoiding open access through unlimited entry.

2. Smaller groups are more effective. Olson (1965) emphasised the costs of bargaining, allocation, and enforcement as group size increases. It is more difficult to bring parties into agreement and to observe cheating as group size rises. Incentives to free-ride rise with group size, because enforcement is more difficult and the cost borne by each party from violating agreements on average falls.[18]

3. More homogeneous groups are better able to address commons problems collectively.[19] They are more likely to have similar consumption or use patterns and, accordingly, common objectives. They are apt to have comparable time horizons for resource management and, if relevant, similar extraction costs. Members of such groups also are more likely to have similar information about

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17 Demsetz, H. 1967, 'Toward a theory of property rights', *American Economic Review: Papers and Proceedings*, vol. 57, no. 2, pp. 347–59.

18 Olson, M. 1965, *The Logic of Collective Action,* Harvard University Press, Cambridge, MA; and Baland, J.M. and Platteau, J.P., *op.cit*. pp. 77, 298, 'Small is beautiful'.

19 Ostrom, E. 1990, *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge University Press, New York; Baland, J.M. and Platteau, J.P., *op.cit*., p. 75.

the resource and the problem of over-extraction. These conditions lower the transaction costs of bargaining because they facilitate agreement on the problem and the allocation of benefits and costs that are inherent in any management solution.[20] On the other hand, less homogeneous groups may face problems due to differences in the expected net gains of cooperation.

4. A common understanding about the resource and the potential for open-access losses and how the resource system operates promotes action. This condition includes an appreciation of the link between harvest and depletion. Outside claims of potential losses that appear inconsistent with local experiences, or are difficult to verify, are unlikely to be considered credible. This is a key aspect of homogeneity. As such, government policies that limit entry into a common-property regime to similar groups may be worthwhile to make it more effective. At the same time, however, these policies reduce the ability of common property to be more inclusive. Even so, absent a common understanding or objective, the transaction costs of agreement will be higher. Asymmetric information about the problem and the costs and returns of various management options raise bargaining costs because the parties will have different views of how they will benefit from action relative to the *status quo*. It may not be possible to devise side payments to bridge these disagreements. Neutral, objective information provided by outside sources or government agencies, however, may promote agreement.

5. Group dependence upon the resource and a history of past depletion raise the expected gains of addressing the commons problem. Crises provide information about the seriousness of open access, lowering transaction costs.[21]

6. Effective communication within the group is another important characteristic of successful common property. This attribute is closely linked to group size and homogeneity. Greater communication makes agreement on a management plan more likely, and lowers the cost of monitoring. Repeated interaction builds trust, lowers the transaction costs of bargaining, and raises compliance. Communication can make contributions self-enforcing.

7. Close proximity of group members and frequent interaction lower the transaction costs of bargaining and communication, increase information, and reduce enforcement outlays.

8. Leadership also is important for group success. Although economists are not well equipped to model leadership, there is considerable empirical evidence that in cases where group members are not homogeneous and where some

[20] Wiggins, S.N. and Libecap, G.D. 1985, 'Oil field unitization: Contractual failure in the presence of imperfect information', *American Economic Review*, vol. 75, no. 3, pp. 368–85.

[21] Libecap, G.D. 2008, *op.cit.*

disproportionately benefit from taking action, those parties are often leaders in implementing a management plan.[22] They can make credible commitments, and have incentives to achieve effective action.

9. Shared moral norms within groups promote cooperation.[23] These norms are internalised rules of conduct that promote coordination though clear group identity, trust, and reduced free-riding. When moral norms are present, formal extraction rules are less necessary. Such customs are more likely to be found in small groups and less so in large ones where formal rules are more important. In small groups there can be continuous interaction which is observed and memorised. For larger, more heterogeneous groups, there may be no internal mechanism for lowering bargaining and enforcement costs. In this case, central regulation or private property rights are apt to be more effective solutions to open access.
10. Group stability and tradition also matter. Stable groups have limited size and are more homogeneous. Further, they can rely on past customs to address commons problems.

Management characteristics

1. Observable indicators of management performance that are predictable are necessary to assess the results of group action.
2. The distribution of the benefits and costs of resource management across the group should be proportionate. If this is not the case, then the net returns from management will vary among members, changing incentives. Those who benefit more from some actions and share less in the associated cost will naturally support those efforts, even if they are not optimal in the aggregate.[24]
3. Appropriation or allocation rules that are consistent with local conditions are important. They blend with available knowledge, can be observed, and are consistent with group notions of equity.
4. Local resource-use rules should dominate, so that affected group members participate in allocation and investment decisions.[25] The alternative of

[22] Baland, J.M. and Platteau, J.P. *op.cit.*, pp. 79, 114, 337.

[23] Baland, J.M. and Platteau, J.P. *op.cit.*, pp. 116, 119, 176.

[24] This is illustrated by experiences in oil field unit contracts when participants do not share proportionately in unit revenues and costs from certain investment and production decisions. These units are not successful. Prudhoe Bay is a prime example. See: Libecap, G.D. and Smith, J.L. 1999, 'The self-enforcing provisions of oil and gas unit operating agreements: Theory and evidence', *Journal of Law, Economics, and Organization*, vol. 15, no. 2, pp. 526–48.

[25] See summary by Libecap, G.D. 2007, *op.cit.*

centralised regulation by bureaucracies involves problems of limited information as well as of incentives. Neither politicians nor bureaucrats are typically residual claimants in the benefits of cooperation, and they may have short time-horizons.

5. Local monitoring and sanctioning of member compliance are generally more effective than are external regulations.
6. Graduated sanctions that are deemed fair promote agreement.
7. Low-cost local arenas for resolution of conflicts should exist to encourage group action.
8. Group rules should be recognised by governmental authorities and not undercut by them.
9. Economic incentives for conservation are provided by the state to the group.
10. Nested enterprises are in place for rules regarding appropriation, provision, monitoring, enforcement, conflict resolution, and governance.

Given all of these requirements, common property can be a helpful intermediary between regulation and private property rights, but the conditions under which it is effective must be kept in mind.

Generally, collective action to address open access is promoted if: (1) the number of parties is small; (2) they are similar in the expected net gains of agreement; (3) there is little uncertainty regarding the size and distribution of costs and benefits (information, measurement, bounding, and compliance costs are small); and (4) the aggregate gains of taking action are large relative to the costs.

Important deviations from these criteria, however, hinder group efforts. If aggregate net gains are limited — that is, the common resource is of low value and/or the transaction costs of addressing the problem are high — there are few incentives for action until values increase or costs fall. As group size grows, bargaining and compliance costs rise. If the aggregate benefit is a public good (having high bounding costs), while the costs of taking action are private, free-riding and defection are encouraged.

With this background discussion of delay in the assignment of property rights, the allocation issues involved, and the conditions for successful common property, we now turn to two empirical examples in ocean fisheries and fresh water.

5.3 Fisheries

Property rights: delay, potential benefits, restrictions

The first government reaction to open access in fisheries has involved implementation of uniform restrictions on access and fishing effort. These regulations have minimised information requirements and avoided significant deliberate changes in *status quo* economic and political rankings among the parties involved. Uniform regulations, however, are unlikely to be fully effective because they do not align the incentives of the parties with the objectives of reduced harvest and conservation of the stock.

Accordingly, if the fishery is sufficiently valuable, at some point there has been a turn to property rights of some type. But these have come late, generally only after the stock has collapsed and declining returns have made existing practices untenable. Even then, conflict over the nature of the rights to be granted and their allocation has slowed adoption of a rights regime, constrained the privileges assigned, and limited the overall benefits obtained.

To illustrate these points, Rögnvaldur Hannesson, Ragnar Arnason, and Ross Shotton, among others, outline a common process of open-access losses, delayed regulation, and finally, a limited adoption of ITQs or Individual Vessel Quotas (IVQs).[26]

Under ITQs and IVQs, regulators set the total annual allowable catch based on assembled biological information, anticipated environmental conditions, and expected harvest impacts. Each authorised fisher or vessel is granted a share in the annual catch based on the allocation rule, and the quotas generally can be traded, although with varying restrictions. The most common allocation rule is based on first possession or historical catch. Past investment in vessels and equipment is also often taken into account. The advantage of ITQs over regulation is that they better align the harvest practices of fishers with practices that protect or enhance the stock. The value of their quotas, which often can be major sources of wealth, depends upon the long-term health of the fishery. Hence, there are incentives for self- and

26 ITQs are the most widely applied form of property right in fisheries (Hannesson, R. *op.cit.* p. 56). See also Arnason, R. 2002, 'A review of international experiences with ITQ', Annex to *Future Options for UK Fishing Management*, Report to the Department for the Environment, Food and Rural Affairs, CEMARE, University of Portsmouth, UK; and Shotton, R. 2000, 'Current property rights systems in fisheries management', in Shotton, R. (ed), *Use of Property Rights in Fisheries Management*, Proceedings of the FishRights99 Conference, Fremantle Western Australia, FAO, Rome, Fisheries Technical Paper 404/1, pp. 45–50.

group-monitoring of compliance; and importantly, ITQs, as a property right, are the basis for further contracting among fishers to reduce fishing pressure.

The beneficial effects of ITQs are impressive. Many studies — among others, Grafton, Squires, and Fox (2002); Shotton (2000); Arnason (2002); Newell, Sanchirico, and Kerr (2005); and Wilen (2006) — report increases in fishery product value, improved efficiency, and enhanced stock conditions.[27]

The adoption of ITQs in the United States, however, has been slow and contentious.

ITQs are more limited and are a weaker property right in the United States than in many other major fishing countries.[28] As late as 2002, after years of open-access losses and ineffective regulation, only four US marine fisheries operated under ITQ regimes: the Mid-Atlantic surf clam and ocean quahog fishery, the Alaskan halibut and sablefish fishery, and the South Atlantic wreckfish fishery, all adopted in the early 1990s. This situation compares with at least 20 ITQ-managed fisheries in Australia, covering about 34 per cent of the volume and 22 per cent of the value of the country's fisheries and 40 fisheries in Canada, accounting for over 50 per cent of the value and volume of landings as of 2002.[29] Two extensions of ITQs were under consideration in 1995 for the Gulf of Mexico red snapper and Pacific sablefish fisheries, but tabled in 1996.

In these discussions, there has been an effort to preserve the relative position of regions, communities, fleets, capital, and crew by limiting the assignment and trading of ITQs. Some US ITQs are reserved for community development and not granted to individuals. There also are formal limits on the size of individual quota holdings and their transferability.

In the Alaska halibut fishery, for example, only transfers from larger to smaller vessel classes are permitted, and no individual is allowed to own more than 0.5 per cent of the total quota.[30] Other controls over share concentration are designed to

27 Grafton, Q.R., Squires, D. and Fox, K.J. 2000, 'Private property and economic efficiency: A study of a common-pool resource', *Journal of Law and Economics*, vol. 43, no. 2, pp. 679–713; Arnason, R. 2002, *op.cit.*; Shotton, R. 2000 *op.cit.*, pp. 45–50; Wilen, J.E. 2006, 'Why fisheries management fails: Treating symptoms rather than the cause', *Bulletin of Marine Science*, vol. 78, no. 3, pp. 529–46; Newell, R.G., Sanchirico, J.N. and Kerr, S. 2005, 'Fishing quota markets', *Journal of Environmental Economics and Management*, vol. 49, pp. 437–62.

28 Arnason, R. 2002 *op.cit.*, pp. 52–7.

29 *Ibid.*, pp. 3–17.

30 *Ibid.*, pp. 54–5.

limit holdings and maintain a targeted number of vessels in the halibut fleet.[31] Further, in 1996, the Magnuson–Stevens Fishery Conservation Act (*Sustainable Fisheries Act, 16 USC 1801*) placed a four-year moratorium on the adoption of further ITQs in US fisheries.

Common property: Regional Fishery Management Councils

The political push for adoption of the Magnuson-Stevens Act not only illustrates the distributional conflicts over assignment of ITQs, but also the pressures to broaden the number of stakeholders and interests to be included in any management plan. For the reasons described above, the increased scope of issues to be considered (multiple species stock conservation, provision of biodiversity, and ecosystem services) as well as the expansion of parties involved (commercial vessel-owners, crew, community leaders, processors, environmental groups), suggest that any institutional response to open access in fisheries is likely to be cumbersome at best and ineffective at worst. These actions include adoption of Territorial Use Rights to Fisheries (TURFs) and Regional Fishery Management Councils (RFMCs) as common-property regimes.[32]

In the debate leading to enactment of the Magnuson-Stevens Act, vessel-owners and larger distributors generally backed ITQs, whereas representatives of fishing communities, part-time fishers, crew, and processors, typically were resistant. The provisions of the law also reflect the many issues at stake (reducing by-catch, conserving habitat, preventing overfishing) as well as opposition to further extension of private property rights to the stock: the Act 'shall not create, or be construed to create, any right, title, or interest in or to any fish before the fish is harvested'.[33]

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31 Singh, R., Weninger, Q. and Doyle, M. 2006, 'Fisheries management with stock growth uncertainty and costly capital adjustment', *Journal of Environmental Economics and Management*, vol. 52, pp. 582–99, 594–95.

32 For discussion of the RFMCs see Hanna, S. 2006, 'Will structural reform fix fishery management? Commission policy recommendations and the US Regional Fishery Management Council system', *Bulletin of Marine Science*, vol. 78, no. 3, pp. 547–62.

33 Some key provisions of the Sustainable Fisheries Act include:

- Preventing overfishing, and ending overfishing of currently depressed stocks
- Rebuilding depleted stocks
- Reducing by-catch and minimizing the mortality of unavoidable by-catch
- Designating and conserving essential fish habitat
- Reforming the approval process for Fishery Management Plans (FMP) and regulations
- Reducing conflict of interest on Regional Councils
- Establishing user fees.

As argued above, as the number of stakeholders rises and as they become more heterogeneous in their objectives, the more difficult it is to reach agreements on fishing rights and collective action regarding habitat. Some RFMCs already are well known for being mired in debate.[34]

The RFMC system was established by the Magnuson-Stevens Fishery Conservation and Management Act of 1976 for the purpose of managing fisheries in the newly-recognised exclusive economic zone between three and 200 miles offshore of the United States. The eight RFMCs are decision-making bodies and develop and recommend specific management measures in the form of fishery management plans. Unfortunately, the RFMCs generally are not viewed as successfully meeting conservation objectives, of providing for the long-term economic productivity of fisheries, or of protecting ecosystems.[35] They face many divergent interests and ambiguous goals, and no single entity is responsible for ensuring that management objectives are met.[36] It is likely that they are too large and too complicated for effective coordination.[37] Even so, there are pressures to make them even more inclusive, for example through extension of the public trust doctrine that asserts the 'inherent' common nature of the marine resource.[38]

A key problem is that generally no party has property rights within the RFMC to internalise the benefits and costs of decision making. Indeed, the absence of property rights means that there is no basis for exchange among the parties regarding different fishery values.

Where ITQs are implemented and other public good issues exist (by-catch, biodiversity), restrictions on certain actions, such as through use of marine easements in a manner similar to those applied to land–owners, could be considered

http://www.nmfs.noaa.gov/sfa/SFA-Report-FINAL7_1.pdf; NOAA 'SFA Update', 1997; http://www.nmfs.noaa.gov/sfa/juneup.pdf; Opposition to property rights: Source: STAT 3576-3577;http://www.nmfs.noaa.gov/sfa/sustainable_fishereries_act.pdf.

34 See Fluharty, D. 2000, 'Habitat protection, ecological issues, and implementation of the Sustainable Fisheries Act', *Ecological Applications*, vol. 10, no. 2, pp. 325–37.

35 Engle, J., Newkirk, S. and Thompson, B.H. Jr. 2003, *Taking Stock of the Regional Fishery Management Councils*, Pew Charitable Trust, Washington D.C., pp. 1–2.

36 Hanna, S.S. 2006, 'Implementing effective regional ocean governance: Perspectives from economics', *Duke Environmental Law and Policy Forum*, vol. 16, pp. 205–16, 211. See also the other articles in this issue.

37 *Ibid.*, p. 215.

38 Fletcher, K.M. 2006, 'Regional ocean governance: The role of the public trust doctrine', *Duke Environmental Law and Policy Forum*, vol. 16, pp. 187–204, 200.

as an alternative to common property.[39] Regulated private rights may be more effective than use of common property where all parties have a say in the provision of the many fishery services but no associated bearing of the opportunity and direct resource costs involved.

5.4 Western US fresh water

Water rights: delay, potential, limits

In the face of rapid urban population growth, greater demands for recreational and environmental uses, and possibly more limited and/or variable precipitation with climate change, there are pressures to move water from historical uses in agriculture to meet urban and environmental demand. Currently, agriculture uses approximately 80 per cent of the water and, on the margin, water values are much higher in urban and agricultural uses. For example, some farmers in southern California's Imperial Irrigation District pay $20 per acre-foot of water while the City of San Diego has offered ten times that amount — $225 — per acre-foot for the same water.[40] Even so, water markets have been slow to develop.[41]

In the US west, the appropriative rights structure potentially allows for water markets to address some of these reallocation pressures. Under the appropriative doctrine, the first claimant can divert a certain amount of water from its natural course for private beneficial purposes on land remote from the point of diversion. Subsequent claimants can also divert water with lower priority rights. Because appropriative rights can be separated from the land, and sold or leased, they can be the basis for private water transfers in response to changing economic conditions and water values. But trades that change the location of water diversion, nature of use, and timing, especially if they are large relative to stream flow, are restricted by State law and regulated by State agencies. Some States have more restrictive regulations regarding transfers than do others.

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39 Deacon, R.T. and Parker, D. forthcoming, 'Encumbering harvest rights to protect marine environments: A model of marine conservation easements', *Australian Journal of Agricultural and Resource Economics*.

40 See Donohew, Z. forthcoming, 'Property rights and western US water markets', *Australian Journal of Agricultural and Resource Economics*; Brewer, J., Glennon, R., Ker, A. and Libecap, G.D. 2008, 'Water markets in the west: Prices, trading and contractual forms', *Economic Inquiry*, vol. 46, pp. 91–112.

41 Young, R.A. 1986, 'Why are there so few transactions among water users?', *American Journal of Agricultural Economics*, vol. 68, no. 5, pp. 1143–51.

In a recent study, Brewer et al. (2008) detail the nature of water transactions over 19 years across 12 western States. There is considerable variation in the extent of water trading and, of reported data, only about 2 per cent of water consumed is annually traded.[42] Much of this activity is among farmers through one-year leases or between agricultural and urban users. Trades to environmental uses are rarer and usually due to court rulings and government mandates.

There are a number of reasons for the comparatively limited movement of water through market processes.[43] One is that surface water is difficult to bound, so that multiple parties might be affected from any privately-negotiated transfer. For instance, out-of-basin transfers may reduce recharge and stream flows and, hence, the amount of water available to lower-priority water claimants.

A second, and more critical, factor is that water-rights owners have only usufruct rights and many parties (farmers, members of environmental and wildlife groups, urban users) claim an interest in water allocation and use. In this way, water is similar to ocean fisheries where the number of constituencies and objectives of management have grown, as noted above. Accordingly, there is resistance to recognising existing water rights and paying for them as part of any reallocation effort. Such payments are controversial because they appear to recognise an ownership right that does not formally exist. Further, such payments might drain the budgets of advocacy groups or State agencies. Third, monopoly conditions might be encountered where key water rights owners were in a position to hold out or extract most of the social surplus of the movement of water to environmental and recreational uses.

Nevertheless, market transactions have values of their own. First, they generate information about relative water values and hence, the nature of opportunity costs. Since owners have the option of selling, they have incentive to determine just how much water they require and how much might be sold. Buyers have incentive to determine how much water is actually required to meet urban or environmental demands in the face of alternative uses. Second, water transactions and market values encourage investment in the stock of water by current owners. Third, market transactions can take place routinely and quickly to meet new social demands as they do for many other resources. Because owners are compensated, they have less incentive to block socially-valuable water movement. Accordingly, such transactions can be smooth and uncontroversial.

42 Brewer, J., Glennon, R., Ker, A. and Libecap, G.D. 2008, *op.cit.* There are undocumented, routine exchanges among farmers within irrigation districts.

43 There are issues of quality and conveyance, but given rapidly rising water values, these factors are not likely to be binding on markets.

Despite these advantages, water transfers to meet environmental demands are often very contentious and lengthy. They occur through arbitrary reallocation, typically without compensation and implementation of common property-like regimes. The delay and wastes involved in these conflicts dissipate resource values. The Mono Lake case illustrates these issues and how they affect the response to environmental concerns. The alternative of greater reliance on water rights and trading is presented with discussion of the actions of the Oregon Water Trust.

Common property: the public trust doctrine and Mono Lake

The famous Mono Lake controversy, involving Los Angeles' water, illustrates the use of common property through the public trust doctrine instead of private property rights. Between 1930 and 1940, the Los Angeles Department of Water and Power acquired riparian water rights to the four tributaries that feed Mono Lake, an alkaline and hypersaline lake situated in the eastern side of the Sierra Nevada mountains, roughly 300 miles northeast of the city.[44] The agency applied to the State Water Resources Control Board (SWRCB) in 1940 for permits to appropriate the water and, in 1941, finished constructing an aqueduct and began diverting the water for urban use. In 1963, to further augment urban supplies, construction began on a second aqueduct, which was completed in 1970.[45] While between 1940 and 1970 an average of 57 067 acre-feet was exported to Los Angeles, with new aqueduct capacity exports increased to 100 000 acre-feet or more through 1975.[46] At the time, water for urban consumption was viewed as the highest and best use of the water. Indeed, the Mono Basin alone accounted for about 15 per cent of the city's water.[47]

Over time, however, these water exports had substantial adverse effects on Mono Lake and its surrounding environment. The tributaries dried up below the diversion points and the level of Mono Lake began to decline by about 1.6 feet a year. Between 1941 and 1981, the lake's level fell about 46 feet, with one-third of that decline occurring after 1970. The surface area of Mono Lake diminished from 90 to

44 For discussion, see: Libecap, G.D. 2007, *Owens Valley Revisited: A Reassessment of the West's First Great Water Transfer*, Stanford University Press, Palo Alto, pp. 132–7.

45 http://wsoweb.ladwp.com/Aqueduct/historyoflaa/aqueductfacts.htm.

46 *National Audubon Society v. Superior Court* (33 Cal. 3d 429). See also Libecap, G.D. 2007, *op.cit.*, p. 138.

47 Libecap, G.D. 2007, *op.cit.*, pp. 132–7.

60 square miles, and its salinity increased from 50 grams per litre to 90 grams per litre.[48]

As Mono Lake levels declined, the National Audubon Society, Friends of the Earth, the Sierra Club and a new coalition of environmental activists, the Mono Lake Committee, that had formed in 1978, brought suit under the public trust doctrine in May 1979 to curtail Los Angeles' export of water. The plaintiffs charged that the public trust doctrine applied not only to navigable waterways, but to streams used for recreation, wildlife habitat, and ecological study; that Mono Lake was being harmed by Los Angeles; and that the city's diversion was not a reasonable and beneficial use, as required by the State's appropriative water rights system. This public trust argument posed a clear challenge to Los Angeles' water rights.

The 'public trust' is a common-law principle creating the legal right of the public to utilise certain lands and waters, such as tidewaters or navigable rivers, and other waters and natural resources with high amenity or public good values. Under the doctrine, the rights of the public are vested in the State as owner of the resource and trustee of its proper use. As a result, public trust resources are effectively common property with stakeholder membership very broadly defined.

On 17 February 1983, in *National Audubon Society v. Superior Court* (33 Cal 3d 419) the California Supreme Court held that exercise of appropriative water rights is subject to limitation by the State in order to protect public-trust values, including those of wildlife habitat: 'Thus, the public trust is more than an affirmation of state power to use public property for public purposes. It is an affirmation of the duty of the state to protect the people's common heritage of streams, lakes, marshlands and tidelands…' (33 Cal 3d 441). According to the court, public-trust regulatory responsibilities applied *ex post* to existing water rights, and these rights were use rights only that could be reconsidered in light of changing perceptions of the trust. Regulatory agencies were required to monitor water use and reallocate it in a manner consistent with shifting notions of the public trust.

Under this common property arrangement, constituencies with standing as part of the 'public' could lobby for changes in water use whenever they believed that current practices were inconsistent with the public trust. State agencies and courts would be responsive to these demands whenever they were politically salient and within the guidelines of past judicial rulings. No costs, however, are directly assigned from these actions, except for those borne by current water users, who are not compensated.

48 For discussion see Brewer, J. and Libecap, G.D. forthcoming, 'Property rights and the public trust doctrine in environmental protection and natural resource conservation', *Australian Journal of Agricultural and Resource Economics*.

In the case at hand, Los Angeles' water rights were rejected and — facing the loss of valuable water rights as well as the value of past fixed investments in aqueducts, dams, reservoirs, and hydroelectric facilities — the city fought the reallocation of its water. It took over a decade of a complex series of subsequent court rulings and appeals before the California regulatory agency, the SWRCB, halted virtually all water exports until Mono Lake's level reached 6377 feet above sea level.

In the end, it took nearly 20 years from the initial effort to reduce diversions from the Mono Basin until the agency handed down its final decision. Millions of dollars were spent in the litigation. All the while, Mono Lake's environment continued to worsen, streams remained dry, and riparian and aquatic habitats remained unrestored.

Following the Mono case, other public-trust efforts have been launched to shift water from current uses, generally in agriculture, to environmental and recreational applications. These too typically have been very divisive, costly, and long-lasting.[49]

A market-related response is an alternative approach for addressing conflicting public and private values as occurred in the Mono Lake case. In such a situation, rather than rejecting Los Angeles' water rights under public-trust claims, State and Federal agencies might have purchased water to restore Mono Lake's level to address public concerns. Where narrower private interests were involved, such as with individual stream fisheries, private fishing groups could have bought or leased water from Los Angeles. Organisations, such as the Oregon and Montana Water Trusts, regularly secure water from farmers in those States to maintain riparian habitats for fish and other species.

Reliance on market transactions would have the advantages of producing more information about the relative values of water for current and proposed uses, and of reducing the conflict associated with uncompensated reallocations. Extreme demands encouraged by open standing under the public trust would have been tempered by the requirement to purchase. Where no voluntary agreements on water transfers for public environmental or recreational uses were forthcoming due to bilateral monopoly conditions, eminent domain with compensation could be used for government acquisition of water. The Oregon Water Trust is an example of an organisation that relies on markets for reallocation of water.

[49] See, for example, the controversy over Friant Dam water releases: Friant Water Users Authority (FWUA) 2006, *Settlement Press Release*, http://www.fwua.org/settlment/supplemental/docs/SJRS_ final_News_Release.pdf

Actions of the Oregon Water Trust as an example of water market processes for environmental benefits

Under State laws in Oregon and some other western States, private organisations may acquire water rights by purchasing, leasing, or accepting donations for environmental applications, such as maintaining streamflow to protect fish stocks during dry periods. Once those rights are transferred from the previous water-rights owners (often irrigators) and converted to in-stream use, they must be assigned to the State and held in trust for in-stream public uses.

In Oregon, such organisations include the Oregon Water Trust, the Deschutes River Conservancy, and the Klamath Basin Rangeland Trust. All three are not-for-profit groups formed to acquire water rights to enhance river flows for ecosystem restoration. Oregon's laws permit several methods for converting existing water rights to in-stream use: standard leases, split-season leases, permanent transfers, and time-limited transfers. Split-season leases allow a water-right holder to use the water for an existing purpose, such as irrigation, for part of a year and leave the water in-stream for another part of the year.

Split-season leases were developed so that irrigators could use their water in agriculture in the spring and early summer when instream flows are high and the additional value of putting more water in-stream is low. In late summer, the second half of the irrigation season, the water right is leased for in-stream use when flows are low and the value of in-stream water to protect environmental amenities is higher. Time-limited transfers allow for the water to be reallocated for short periods, such as for short-term drought, and then reverting to its original use.[50] Funding for the organisations comes from donations from private individuals, foundations, and the State and Federal governments.[51]

The overall magnitude of these water market activities to provide environmental benefits is small, but growing. In Oregon, where there is the most activity, there were approximately 140 transactions in 2005, involving approximately 70 000 acre-feet of water annually. One-year and five-year water leases were most common.[52] The advantage of these activities is that they occur routinely, rapidly, and without contention. Further, they underscore existing property rights to water

50 King, M.A. 2004, 'Getting our feet wet: An introduction to water trusts', *Harvard Law Review,* vol. 28, no. 2, pp. 495–534; Landry, C.J. 1998, *Saving Our Streams Through Water Markets: A Practical Guide*, pamphlet, Political Economy Research Center, Bozeman.

51 For example, see the 2006 Annual Report for the Deschutes River Conservancy. Substantial support comes from Bonneville power administration from the Columbia River basin. The Texas Water Trust is a State agency.

52 Oregon Water Resources Department. In 2005, there were 868 leases and 34 sales.

and thereby maintain any beneficial incentives for investment in water quantity and quality. Finally, these exchanges generate information about the value of water in environmental uses and, hence, guide water allocation and use among both irrigators and those concerned about aquatic habitats.

5.5 Concluding remarks and policy implications

There is increased interest in the assignment and enforcement of property rights and the associated use of market mechanisms to provide environmental quality. Property rights and markets are attractive because they better align the incentives of the parties directly involved for reducing environmentally-damaging externalities.

With command and control regulation, the setting is often one of extractors, harvesters, and emitters versus the state in the implementation and enforcement of regulatory policies. There are major incentives for free-riding. Little information is generated in this process to know exactly how much environmental quality to provide and at what cost. Once in place, regulations generate constituencies, creating inflexibility and, often, inefficiencies.

With markets, on the other hand, the setting becomes more collaborative because with ownership there is potential for the parties involved to capture both costs and benefits.

Self-enforcement becomes more prevalent. Ownership also identifies parties for bargaining over resource use and protection, creating the basis for trade to achieve environmental benefits. These trades provide valuable information to guide policy on the cost and value of environmental quality. And there are private incentives to invest in the resource.

Two points have been made in this paper. One is that despite the advantages of property rights and markets, they typically are not the first response to the losses of open access. Rather, they are adopted late after considerable waste has occurred. There are important resource costs of bounding and enforcement, as well as important political costs due to allocation disputes. How these conflicts are addressed by public policy can influence just how effective the property-right structure might be.

The second point is that broadening the scope of 'ownership' to include multiple and very different stakeholders can undermine the effectiveness of property regimes in providing environmental benefits. The pressure to be inclusive with common property is understandable, especially in light of the potential for public goods, such as biodiversity and other ecological services. Common property works best when

the number of parties is small, and they are in agreement on resource management objectives. Movement from these conditions, however, can lead to paralysis and ineffective measures to advance the environment. For these reasons, it may be preferable, when feasible, to define private property rights as the primary mechanism for governing resource use, but to regulate them to constrain behaviour and thereby reduce any externalities.

Two US examples are used to demonstrate these arguments: fisheries and surface fresh water. In both cases, greater reliance on property rights and markets has come slowly, with delay. Crises have been instrumental in pushing privatisation. Even so, the process has been contentious. Inclusive common property, such as creation of regional fishery management organisations in fisheries and emphasis on the public trust doctrine in water either have or are likely to have limited effectiveness. Costs and benefits are not internalised individually in either case and there are no bases for private negotiations to provide environmental benefits. There may be cases where common property is optimal, but the tradeoffs between greater inclusion and higher decision-making and enforcement costs must be considered in policy debates.

To conclude, there are growing institutional options to meet the increased demand for improved environmental outcomes. Property rights and markets are a key part of that menu. By sharpening incentives, reducing externalities, establishing trading opportunities, where they are feasible, private property rights and markets can promote the provision of environmental and natural resource benefits more smoothly, rapidly, and at lower cost than command and control regulation. And they may be superior to common-property regimes where the number of parties is large and heterogeneous. These insights are likely to be helpful in the design of policies as worldwide environmental and natural resource values rise.

6 On common ground: designing strategic spatial governance to advance integrated natural resource management and environmental outcomes[1]

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Abstract

Despite a growing body of theory that emphasises the importance of socio-spatial aspects in the representation of community interests, regionalisation for natural resource governance remains dominated by river catchments. At the same time, across many nations, local governments are being given increasing responsibilities for environmental and resource management, but work within boundaries that are largely historical artefacts. The confluence of these trends suggests that it is timely to examine the requirements for spatial definition of resource governance regions. A considerable body of research on 'place' attachment, social networks, and participatory resource management combined with institutional theory and political science suggests that joining forces to take responsibility for collective action towards sustainability is more likely within particular social-ecological contexts and scales.

[1] This paper summarises several pieces of research that have benefited from input from many colleagues, in particular: Ian Reeve, Graham Marshall, Phil Morley, Elaine Barclay, Lin Ostrom, Meg McKean, Karl Bock, Michael Coleman, Margaret Shannon, Justine Graham, Richard Stayner, Phil Coop and Judith McNeil. Local governments, government agencies, community groups and individual farmers have also contributed. Elements of this research have been funded by Land and Water Australia, Rural Industries R&D Corporation, the Australian Research Council, New South Wales Department of Lands, and the Heinz Foundation (through US Department of Agriculture and US Fish & Wildlife).

This paper outlines some conceptual background, and then briefly describes three policy-relevant examples from recent research. The first two relate to 'on-ground', cross-property resource collaborations; the first at a quite small 'local' landscape scale across four grazing properties (totaling 1 300 ha) within a small first-order stream sub-catchment on the New England Tablelands of New South Wales, and the second across several large ranches and National Forest Land in Idaho, United States (totaling around 700 000 ha). The third briefly describes the application of a new technique developed to delineate more appropriate spatial units, reflecting social-ecological context and other institutional design principles, at three nested scales. The Eco-Civic regionalisation technique could be applied across the continent to develop an improved regional framework for natural resource management (NRM), environmental stewardship, planning and regional development, and service delivery.

6.1 Spatial resource governance across landscapes of property and policy: 'Tilbuster Commons … beyond the boundary fence'

Under conventional property rights regimes, primary producers are required to fully utilise the resources available within their own property title boundaries in order to survive economically. Properties have tended to be 'split up', with reduced resource or economic viability. A typical landholding may comprise some high quality soil that is suitable for cropping, grazing land that is generally not suitable for cropping, and some poorer areas barely suited to grazing. The type and mix of these areas will vary depending on the topography and soils of the region. Faced with various family and economic pressures and with only these resources at the landholder's disposal, there is often no option but to overuse, or inappropriately use, each type of resource. The productive riparian land is inevitably cropped, possibly for summer as well as winter feed for livestock. But grazing land might need to be cropped also. Stock will usually have access to the creek for water. The mid-quality land will be grazed throughout the year and the poorer areas will slowly decline due to the impacts of livestock 'wintering over'. Input costs tend to increase to help production and counter negative trends of water quality, parasite load and reducing production from both farmed and grazed areas.

Developing a cross-property or 'common' resource collaboration

The 'Tilbuster Commons' project embarked on the challenging experiment of forming a contemporary 'common', simply by agreeing to a collaborative grazing enterprise across their individual landholdings (to which they retained title).

Individual graziers contributed land, livestock, infrastructure and labour to form the common-property grazing resource arrangement. The project, developed as an 'on-ground learning-by-doing' experiment, aimed to understand how such a collaborative model might be established and evolve in a way which might be acceptable, in some situations, to 'traditional' farming families. The model needed to be able to demonstrate equivalent financial returns plus other benefits to collaborating landholders, or better, while delivering improved sustainability of the productive resource through the allocation of resources for the maintenance of ecological integrity, achievable only through an integrated management regime at a more appropriate scale (Brunckhorst and Marshall 2007). While the Tilbuster Commons group of collaborating landholders and their families 'self-selected' their participation on the basis of their shared values, concerns and future aspirations, the project area was selected as it contained many of the social and ecological issues and challenges that face rural communities. The four grazing families involved in the Tilbuster Commons experiment own adjacent properties of varying size totalling a land resource base of approximately 1300 ha. The land types associated with each member's land parcel vary greatly. The smaller properties were not insignificant, because they consist almost entirely of very high quality alluvial soils. Two of the larger landholdings consist of more variable soil types, but also contribute some high value conservation areas. Whilst there are larger single landholdings on the New England Tablelands, these four farms are typical of many of the landholdings managed in the area and issues associated with small farm size.

Considerable discussion and planning led the group to consider the kind of legal structures and corporate arrangements they needed. The group felt strongly, however, that a simple company structure, which farm families are generally comfortable with, would also provide both the flexibility required and a means to expand or 'disassemble' the Commons in response to future pressures of change. The range of issues discussed included livestock management, planned grazing and pasture management, the strategic allocation of conservation and environmental rehabilitation areas, and the issues associated with the operation of the Commons (such as management structure, bookkeeping and accounting). Other issues at the forefront of discussions included the allocation of land to the Commons (small areas are retained for private use, primarily the areas around each member's home), the selection of key infrastructure, the development of a 'formula' which represents the interests of each member in the common and the allocation of land or resources to the maintenance of ecosystem function which is recognised as underpinning the productive sustainability of the common. The arrangement of landholders as equal directors of the company, however, established a 'conflict of interest', because the landholders are also directors of the company. This is a valuable and useful tension between the individual landholder's interests and the collective interests of the group of landholders represented in the company. With both hats on, individuals are

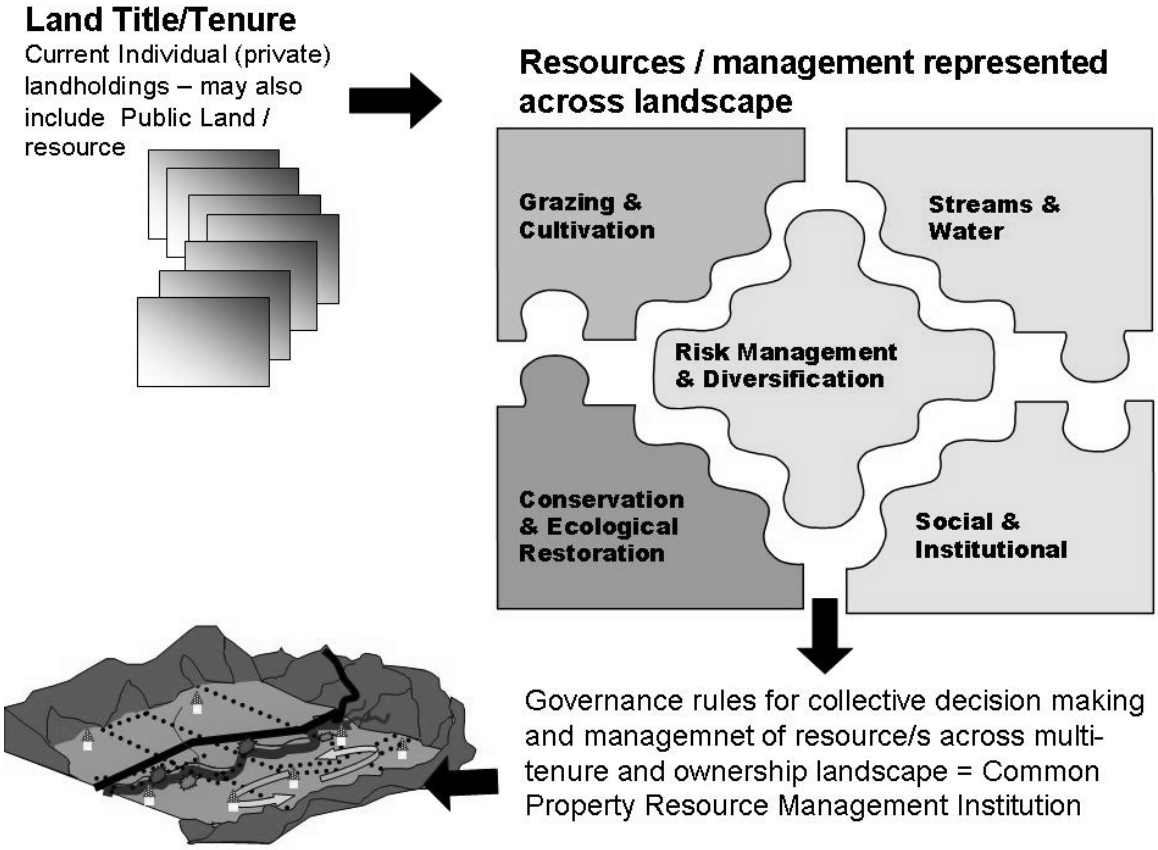
always considering the best options of benefit to themselves and the other members through the company. Informal operational rules can be enforced; when the livestock are on your property, for instance, you are responsible for managing them. The landholders, as directors of the company, have a share issue based on the formula agreed by all (representing proportional contributions of land, stock, equipment and so on contributed by individual landowners), which also forms the basis for sharing profits. As company directors they are making the collective decisions for running the enterprises of the collective and managing the whole resource base that their land, and the creek that runs through it, represents across the landscape (Williamson, Brunckhorst and Kelly 2003).

Individual and collective benefits of collaboration

Individual and collective social benefits of collaboration include freeing up of time and labour and pooling of various expertise. This in turn helps build flexibility and resilience. For example, some simple but highly regarded benefits enjoyed by the participating landholders include more efficient accounting and management practices, shared labour (but also less labour such as eliminating the need to crop for winter feed), the chance for families to 'get away' to have a real holiday and being able to leave the gate open when the livestock herd are on another property (for detailed discussion see Marshall 2005, Brunckhorst and Marshall 2007).

A valuable aspect of cross-property resource management collaborations is the ability to allocate the available resources more efficiently, but within their functional capacity. By recognising the distinction between resource allocation and utilisation (the geographical elements) and land tenure (a part of the institutional elements), these landholders may consolidate their herds and graze them across all collaborating properties (figure 6.1). This allows the utilisation of grazing techniques such as planned grazing regimes over a much wider area (across all properties). Input costs were greatly reduced and production increased, offering benefits including improved pasture and weed management, water and drought management (Brunckhorst and Coop 2003). In addition, pest issues such as external and internal parasite control are now managed far more effectively, but with reduced costs in terms of fencing or chemical needs. No cropping for winter feed (nor purchase of feed; trace minerals are provided for livestock health and soil replenishment) has been necessary so far and, while essential natural minerals are provided for stock, no superphosphate or similar fertilizer applications are now used.

Figure 6.1 **Separation and allocation of landscape resources for collective management across landscapes of property and policy**



The Tilbuster Commons collaboration managed to completely remove the impacts of livestock on the creek system across properties. Water quality in the creek has measurably improved. This is partly due to the landscape scale of pasture management and the grazing plan which allows long rest periods and generally a high standing biomass of pasture, together with fencing and rehabilitation of the creek across the properties. Alternative stock water could be made available, even piped (cost-effectively) across properties as necessary. Collectively these farming enterprises are more efficient and include the potential for scaling up to more suitable resource use across all properties of the collective. Finally, reducing input costs, freeing up labour and time, increasing pasture production and drought resilience all add up to better financial returns and well-being while building a more sustainable (resilient) landscape.

6.2 Regional resource governance across landscapes of property and policy: Idaho ranchers and Forest Service … 'dancing with wolves'

Policy-makers, planners, landscape ecologists and conservation scientists are increasingly finding themselves at odds with property and policy systems that create barriers to effective ecological management and conservation. Rather than fighting such embedded institutions, innovative approaches to circumvent such barriers might be more efficient and effective for 'scaling-up' landscape planning and management. Combining lessons from successful — old or new — cross-tenure management arrangements and collective (cross-property or common property) resource management institutions can provide a means of collaboratively managing landscapes.

A variety of land and resource tenures, and policy decrees, have a considerable influence on social-ecological systems resilience. Various forms of property and resource rights (private, public, collective) are a key influence on landscape change and the degradation (or potential resilience) of ecological resources and ecosystem services at regional scales. Property rights play an important role in resource management, but create problems in the management of externalities. Our systems of property rights, administrative jurisdictions, policy and resource-management institutions, need to be more seamlessly integrated at various levels of resource governance and institutional arrangements to match landscape scales of social-ecological interdependencies. An increasing number of examples demonstrate novel arrangements for cross-tenure and cross-jurisdictional resource management and conservation. Building flexible adaptive capacity from novel 'on-ground', cross-tenure and cross-jurisdictional, collective action will also provide transferable and adaptive solutions with appropriate incentives to enhance multiple scales of resource and environmental management. The following project is one of several which have developed through adapting knowledge about cross-property institutions for collective, integrated NRM, building further on the lessons from the Tilbuster Commons experiment.

Collaborating for grazing and environmental restoration across public and private tenure

A group of public and private land managers have joined forces to collectively manage such areas along with more sustainable rotational livestock grazing practices across properties and tenure. Along these adjoining private ranches and public land of the National Forest Service in Idaho in the Unites States, the riparian areas and wetlands have been enormously degraded in recent decades, not simply

from domestic livestock, but more from large wild grazing ungulates such as elk, moose and deer. The Lava Lake Land and Livestock Collaborative in southern Idaho manages almost 310 000 ha of public and private land for sheep and cattle ranching, conservation, and river and wetland restoration. Therefore, one component of the conservation and restoration of wetlands and streams has been the reintroduction of the wolf — along with adopting new ways of planning and managing livestock grazing to avoid the wolves. The wolves keep large native herbivores such as elk from continuously 'camping' on, and degrading, stream-side vegetation. Over the past four years, to everyone's delight, there have been no livestock losses to wolves, probably due to the use of different grazing management techniques. These management strategies include keeping stock in tight groups, giving them long grazing rotations, and protecting them at night with temporary electric fencing.

Some of the keys to success, however, include good communication, planning, and clear rules of engagement designed — and upheld — by all the collaborating parties (see Ostrom 1990, McKean 1996, Marshall 2005). The ranchers and public land managers have adapted well to managing their land and livestock differently. They are enthusiastically observing the surprisingly fast regeneration of pasture and other grasslands (prairie), streams and wetlands.

Two other similar projects, one in northern Oregon and another in Idaho, are also providing insights into successful cross-property collaborations across public and private tenure for regional landscape-scale integration of community development, sustainable grazing, forest use, ecological restoration and biodiversity conservation. Similar adaptations, for example, kangaroo-based enterprises — very large scale, across property and tenure — could assist sustainable environmental management in Australia's rangelands.

6.3 Strategic regional governance — institutions and landscapes in understanding regions as cross-scale Eco-Civic frameworks

Along with many areas of public policy, integrated catchment management has shifted from technocratic planning to various forms of participative planning. In Australia, this shift took place in the late 1980s and early 1990s, with little consideration either of the implications for the definition of resource governance regions, or of the considerable body of theory in the social sciences that is relevant to the regionalisation issue, such as theories of place attachment, central places, gravity modelling, institutional design and hierarchy theory. During the same period, local government has increasingly been given a considerable responsibility

for local environmental planning and management. The emergence of catchments and watersheds as the dominant method to delineate regions for resource governance has assumed that soils, vegetation, other biodiversity, land use, and ground water, along with community engagement and collective action, are best defined by such entities. Within the integrated catchment management literature, most authors accept unquestioningly that catchments should form the areal units within which natural resource governance takes place.

There is a growing weight of evidence, however, against the assumption that catchment-based regions or local government areas automatically incorporate all environmental and resource governance issues and their communities of interest. Accordingly, there are an increasing number of critiques of catchment boundaries as spatial frameworks for integrating multiple resource governance. At least part of the reason for these shortcomings is that catchments usually do not represent very well either the 'place attachment' and communities of interest for civic engagement and participation, or the ecological resource base (Brandenburg and Carroll 1995, Barham 2001, Cheng, Kruger and Daniels 2003, Blomquist and Schlager 2005). Ecological and biophysical regionalisations and land-use regions also demonstrate that similar biophysical attributes, land use and climate have little correlation to watershed topography or to areas of interest to land use communities (Omernik and Bailey 1997, Getches 1998, Brunckhorst 2000, Ewing 2003, Lane, McDonald and Morrison 2004, O'Neill 2005). In practice, catchment management has a history of inefficiency, inappropriate monitoring and high transaction costs associated with it. Syme, Butterworth and Nancarrow (1994) went so far as to suggest that organisation of community involvement on catchment boundaries acts against the achievement of the stated goals and purposes of integrated catchment management.

Three principles might underpin the development of regionalisations for government administration of, and community participation in, natural resource governance. The principles relate to the spatio-social context representing communities of interest, optimised for homogeneity of the ecological landscape, and spatially bounded in a nested hierarchy to facilitate scaling of institutional arrangements for management of externalities. While a few small catchments and watersheds might possess these characteristics, most do not. The majority of non-metropolitan local government areas do not reflect these characteristics either, especially in relation to local-to-regional 'communities of interest' in the twenty-first century. Policy makers would be wise to match a nested framework for natural resource governance with local government and other service delivery 'regions' that best capture the area of interest to local residents for representation, economic activity, resource activity and civic engagement.

Eco-Civic regionalisation for resource governance

Despite the mounting criticisms of catchments as natural resource governance regions, and the growing conceptual and theoretical development in socio-spatial aspects of natural resource governance, there have been surprisingly few attempts to propose and apply empirical techniques of regionalisation that might address some of these criticisms and build on this growing body of theory around the concept of 'Social Catchments' and 'Communities of Interest'.

What is a 'region' for resource governance? The placement of boundaries to define regions for integrated resource governance warrants more careful analysis than it has been accorded in the past. With growing emphasis on community engagement, there is also increasing understanding by both scientists and policy makers that many resource governance issues relate to the complex interdependencies of social and ecological systems operating at various scales (Berkes and Folke 1998). Concepts of federalism (polycentric governance) for efficiencies in ecological and economic management, useful in simplifying complexity and assigning levels of responsibility, have been employed to demonstrate design of administrative and spatial units for planning and management. In developing the Eco-Civic regionalisation technique, it was necessary to distil from the growing literature on socio-spatial aspects of natural resource governance some principles that could inform the detailed methodological development.

Three key principles are considered to be of particular importance in defining spatial boundaries of regions for resource governance. The first required condition is for regional boundaries that maximise the representation of 'place identity', community social networks and the local areas of most interest to community residents (Hillery 1955, Brandenburg and Carroll 1995, Feld and Brasso 1996). The second condition that assists with planning and resource management is the relative homogeneity of multiple biophysical characteristics of regional landscapes. The third condition is for optimal collective representation of social-ecological contexts at multiple scales, as nested local-to-regional contexts for decision-making levels and institutional design in order to deal with social-ecological interdependencies including externalities (Brunckhorst, Coop and Reeve 2006).

Empirical derivation of resource governance regions

The method developed for empirical derivation of resource governance regions required the formulation of the concept of a 'social surface' or 'social topography' which geographically represents (by height and extent) the shared community area of interest (see Brunckhorst, Coop and Reeve 2006, Reeve and Brunckhorst 2007). The technique consisted of three major components:

1. derivation of a hierarchy of biophysical regions (to satisfy Principles 1 and 3)
2. derivation of a social surface and a hierarchy of 'civic' regions defined by the 'valleys' in social surface (to satisfy Principles 1 and 2)
3. optimisation of the boundaries of the two hierarchical regionalisations so that all three Principles are satisfied to the maximum degree possible.

The biophysical regionalisation was based on elevation, soil moisture, soils, and climate data at scales of 1 km or finer, using the ERDAS Imagine 8.5 classification routine. The result was a hierarchical biophysical regionalisation comprising eight major regions (level 1), each of which was divided into sub-regions (level 2). The level 2 sub-regions were further subdivided into two or more level 3 sub-regions.

Derivation of a social surface or topography of communities of interest was approached through development of a modelling technique that initially used primary data to inform secondary data and modelling parameters specific to different regional contexts (for example, coast, tablelands, slopes, plains). This modelling approach was founded on results from an earlier study, focused on northern New South Wales, based entirely on primary data gathered via a spatially even, social survey that included maps for respondents to correlate with a variety of question framings (Brunckhorst, Coop and Reeve 2006), and which utilised insights from theories of place and cognitive mapping (for example, Brandenburg and Carroll 1995, Feld and Brasso 1996, Cheng, Kruger and Daniels 2003). The shape, orientation and sizes of the community areas which respondents had drawn suggested that it would be possible to model community areas for extension of the methodology to a study of the whole of the state (for methodological details, see Brunckhorst, Coop and Reeve 2006, Reeve and Brunckhorst 2007). To avoid excessive population of home points in metropolitan areas, a continuously variable population fraction was used, where the fraction was an inverse function of population density (for details refer to further reading list). The State was divided into five regions, each region having different modelling parameters in accord with contextual variables chosen to reflect the variation known from the earlier study. The final step in the modelling procedure was to assign each simulated community area a height of one unit in a third dimension at right angles to the north-south and east-west dimensions of the map of New South Wales. Working in this three-dimensional space, the simulated community areas were summed to produce a 'social surface' (see Brunckhorst, Coop and Reeve 2006). High points on this surface corresponded to points that lay within the community areas of relatively large numbers of people (strictly, large numbers of simulated home points). Low points on the surface corresponded to points that lay within the community areas of relatively few people. As proposed in Principle 2 above, it is these low points in the

social surface that are suitable areas through which resource-governance region boundaries might pass (figure 6.2).

To produce a hierarchy of regions based on the simulated social surface it is necessary to locate major and minor 'valleys' in the social topography. Boundaries based on the major 'valleys' will define larger level-1 regions, and boundaries following the 'valleys' within these regions will define the smaller level-2 sub-regions. Once again, boundaries on minor 'valleys' within the level-2 sub-regions will define the yet smaller level-3 sub-regions. In some areas, the 'topography' of the social surface did not necessarily give a strong indication as to the placement of boundaries. This was a consequence of broad shallow 'valleys' in the surface, or the presence of several 'valleys' in close proximity that were equally good candidates for the location of a boundary. For this reason, verification via a telephone survey of a number of community organisations with hierarchical structures of local, regional and state branches was undertaken. In addition, 'key informants' were also surveyed as an efficient way of gathering surrogate data and for 'on ground verification'. More than 400 interviews with key informants of the Country Women's Association, Hockey Associations, Soccer Associations and Netball Associations were completed. Interviewees were asked about the localities where their organisation interacted as part of social activities and/or sporting competitions. Information from the telephone survey of community organisations and the 'network of social valleys' were combined to produce a three-level hierarchical regionalisation of the modelled social surface.

The accuracy boundaries derived from the combined modelling approach were compared against boundaries derived from primary spatial survey data. The earlier studies provided primary data to measure empirically the social surface and associated set of civic regions for north eastern New South Wales, against which the modelled civic regions could be tested. A classification matrix was used to record, for each civic region, the proportion of home points that were assigned to the same civic region when the modelled surface was used to derive the boundaries between the regions. The level of agreement between the modelled boundaries and the measured boundaries in north eastern New South Wales was extremely good, with correct classifications of more than 98.6 per cent of the 1 973 home points in the region for which primary data was available (Kappa = 0.982, $p<0.0005$).

Optimisation of derived Eco-Civic regions

The boundaries that define the biophysical regionalisation do not necessarily coincide with the boundaries of the civic regionalisation, although the coincidence is fairly good along the eastern escarpment of the northern tablelands. This is because a sparsely settled area coincides with a major climatic, floral and faunal

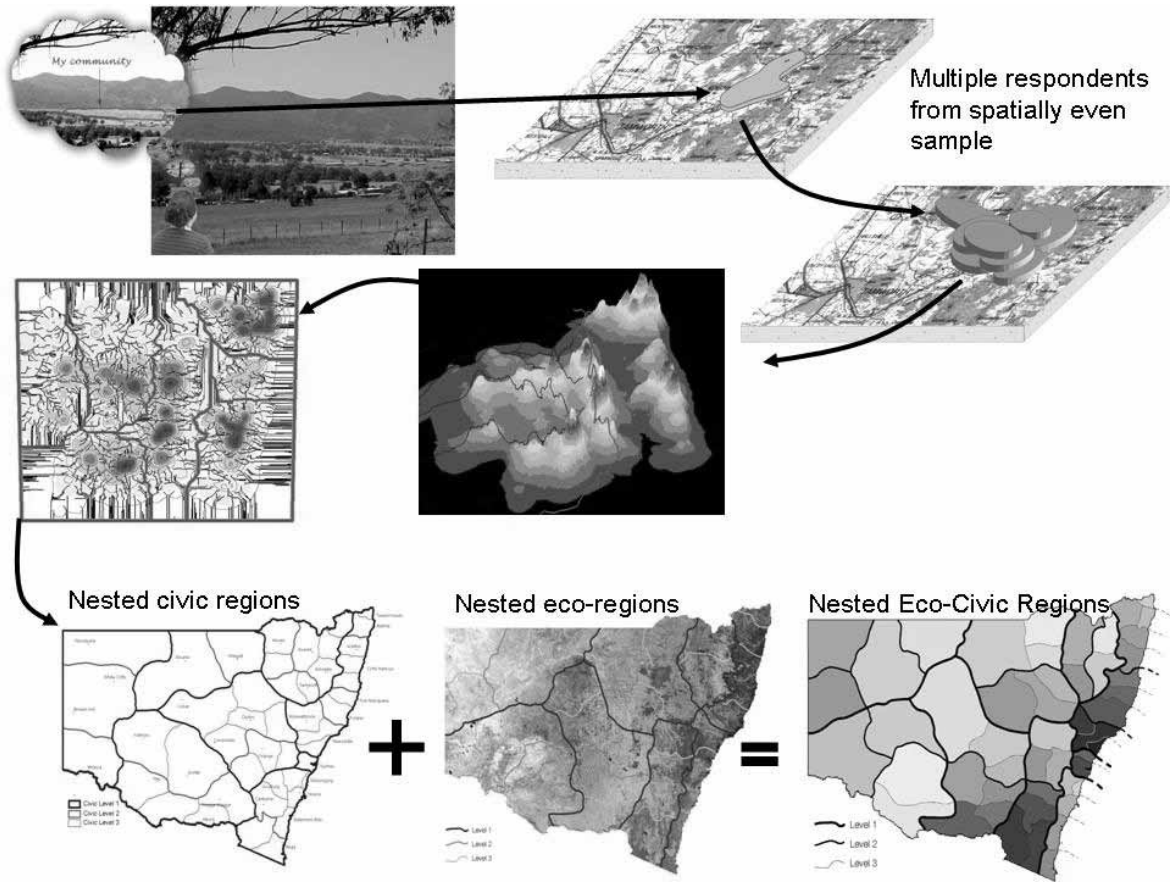
discontinuity in the landscape. In many areas, it is necessary to adjust the boundaries of the civic regions to bring them into closer coincidence with the boundaries of the 'eco-regions' of the biophysical regionalisation. Flexibility in options for boundary placement is possible because the 'valleys' in the social surface can be quite broad. This is particularly so for the 'valleys' at lower 'altitudes' in the social surface. A boundary can therefore be moved reasonable distances within the confines of a 'social valley', without causing a significant increase in the number of community areas that are intersected (that is, dividing communities of interest) by the boundary. At broader scales (that is, level 1), therefore, the optimisation routine can give more weight to the biophysical boundaries. However, at finer scales (that is, level 3), it is necessary to ensure that the optimisation routine does not shift boundaries into relatively high areas on the social surface. The general procedure and results of the Eco-Civic regionalisation for New South Wales are shown in figure 6.2. (Details of the method and results can be found in the listed published papers and the Institute website (www.ruralfutures.une.edu.au).)

Comparing the performance of 'regions'

For any given administrative region, some community areas will be wholly within the region boundary, while others will be intersected by the region boundary. The proportion of a local resident's community that is wholly within a region boundary, compared to the total number of people living within that boundary, provides an index of the performance of the particular resource governance region's boundaries, in terms of its ability to include the areas that are of interest to residents. The 'Community Capture Index' (CCI) provides a means of comparing the performance of different regions in terms of the extent to which people's community areas are intersected by region boundaries. In conformity with Principle 2 above, a regionalisation with boundaries that intersect fewer community areas (higher value of the CCI), is preferable to a regionalisation that intersects a greater number of community areas (lower value of CCI).

Comparison of CCIs of the three levels of the Eco-Civic regionalisation, and for a range of current administrative regions in New South Wales, including the Catchment Management Authority (CMA) regions which are based on catchment boundaries, was undertaken. The results demonstrate that the current administrative boundaries and those of the CMAs are poorly located if the intersection of people's community areas by these boundaries is to be minimised. They do not encompass the majority of the areas of interest to local communities for civic engagement in NRM and governance. Indeed, local government boundaries and CMA boundaries

Figure 6.2 **Summary diagram of the Eco-Civic regionalisation method and results for the state of New South Wales**
(After Reeve and Brunckhorst 2007)

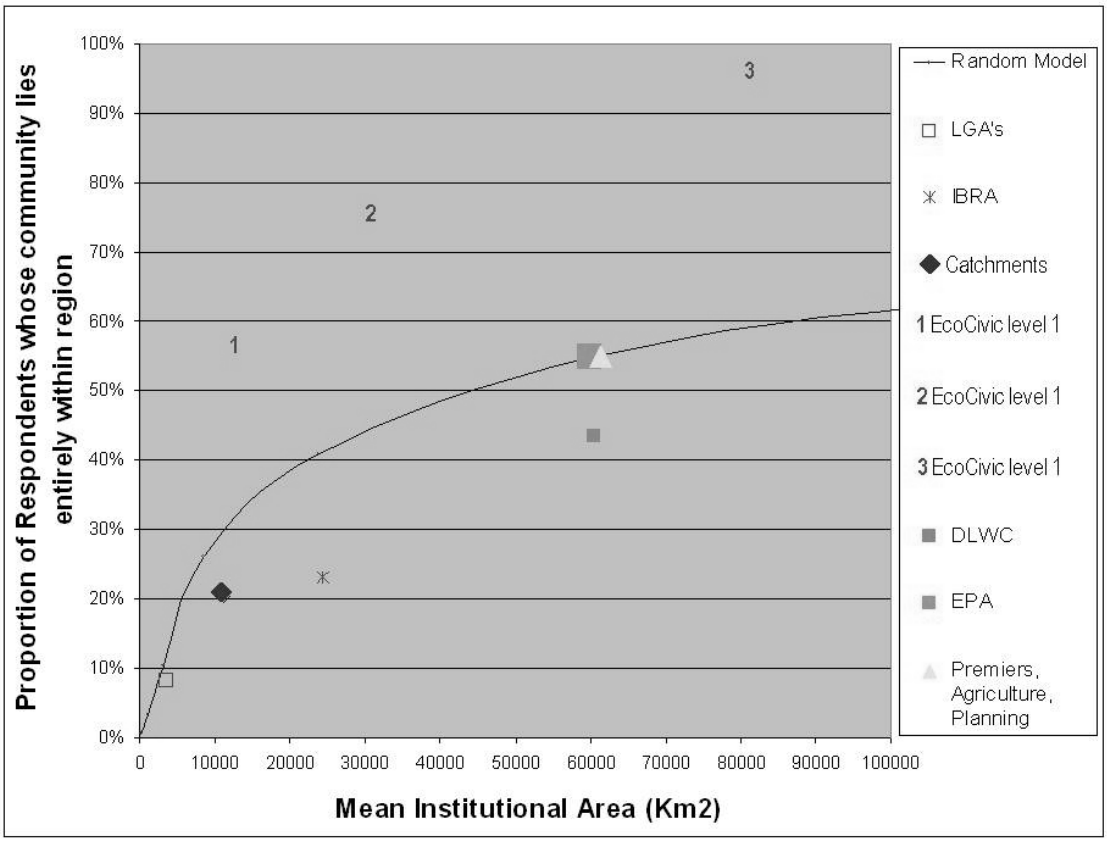


perform worse than a random allocation of regional boundaries would in representing communities of interest, whereas the Eco-Civic regions perform well (figure 6.3). Fragmentation of residents' areas of collective interest reduces participation and effectiveness of planning, creates logger-heads and increases transaction costs. Potential institutional (re-)design is likely to be more effective given the spatially-nested 'common grounds' provided by the Eco-Civic regionalisation technique (Reeve and Brunckhorst 2007).

The Eco-Civic research has established a practical method to produce a hierarchical regionalisation that will satisfy the proposed principles. This approach involves identifying where boundaries between resource governance regions should pass so as to minimise the fragmentation of the areas of the landscape with which local people identify and in which they have an interest for civic participation. Boundary placement is further optimised to ensure that natural resource issues and ecosystem

Figure 6.3 **Community Capture Index (CCI) for various administrative regions and Eco-Civic regions**

The line tracks CCI values that would be achieved by a random allocation of regions



functions are as homogeneous as possible within the regions defined by the boundaries. Applied nationally, an Eco-Civic regionalisation of Australia would improve civic engagement and integrative capacity of policy. In particular, it would provide for the design of spatial frameworks for local-to-regional governance, within which to plan and manage towards sustainability across multiple scales of human living areas, communities and natural resource management including water management.

6.4 Conclusions

Ecological systems, services and resources need to be managed to increase resilience and sustainability of interdependent social-ecological systems across landscapes of property, policy and place. While adaptation to climate change, including trading schemes for adjustment to carbon and water futures, are of necessity in the long term, Australian governments and communities currently face

crippling environmental degradation of the nation's already limited resources base and natural capital for food production and other resource use and management. The spatial context of social-ecological interactions is critically important for building institutions leading to resilience and sustainability.

Novel approaches to strategic spatial governance, coupled with institutional design at appropriate cross-scale levels, are likely to improve engagement with and outcomes from environmental and natural resource management. Australian NRM regions are in need of re-thinking and re-design to represent levels of social-ecological systems and externalities appropriately within matching institutions. A national Eco-Civic regionalisation would contribute to this purpose and facilitate new policy directions to improve environmental outcomes of NRM, regional planning and local government.

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7 Greenhouse gases and nutrients: the interactions between concurrent New Zealand trading systems

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Abstract

Emissions trading and nutrient trading interact in critical ways. The agricultural sector is a major emitter of both nutrients and greenhouse gases in New Zealand. Thus the simultaneous implementation of such systems will have a large impact on the farmers in affected catchments. Many of the mitigation options that are available to farmers, for example reducing animal numbers, will reduce both nutrient loss and greenhouse gas emissions. Thus the combined cost of control could be much less than the sum of the costs of the separate systems. The allocation of units under each system will also affect the same people. Monitoring systems for each pollutant could have common elements, but could also impose a double burden. The interactions between the two systems will complicate the decision-making process for farmers and need to be considered when the policies are designed so that they are as complementary as possible.

7.1 Introduction

New Zealand authorities are considering market-based instruments as a way of dealing with pollution externalities including greenhouse gas emissions and nutrient loss causing water pollution. Nationally, an emissions trading scheme (ETS) is in development to assist in meeting our Kyoto obligations. In some catchments, nutrient-trading systems are being considered, or implemented, to control nutrient loss into waterways where water quality is declining. A nutrient trading system is already in place for the Lake Taupo catchment and Environment Bay of Plenty is actively considering the use of a nutrient trading system for the Lake Rotorua catchment.

The two types of system interact in critical ways. The agricultural sector is a major emitter of both nutrients and greenhouse gases in New Zealand. Thus the simultaneous implementation of such systems could have a large impact on the farmers in affected catchments. If the ETS is implemented at farm scale, some farmers would be required to determine and report both pollutants leaving their property, and buy and sell allowances as their land-use and management practices change. They will face compliance costs (understanding the systems and reporting), will need to change land use and management in response to their new economic circumstances, and will face financial costs to the extent that they mitigate and need to purchase allowances.

The cost of responding to both systems may be lower than the sum of the costs of each individual system. For example, many of the emission reduction and mitigation options available to farmers will reduce both nutrient loss and greenhouse gas emissions. This is not always the case, however. Enhanced wetlands decrease nutrient loss off farmland, but do not decrease — and in some cases may even increase — greenhouse gas emissions. In addition, monitoring systems for each pollutant could have common elements but could also impose a double burden. Interactions between the two systems will complicate the decision-making process for farmers and need to be considered when the policies are designed so they are as complementary as possible.

This paper surveys interactions between one specific nutrient trading system, that proposed for the Lake Rotorua catchment, and the agricultural component of the New Zealand emissions trading system. We discuss issues of price, reporting and verification, scope, mitigation costs, motivations for free allocation, and externalities over time. While we offer only a brief outline of each of these issues, the paper draws on our extensive policy research and integrated modelling work in each system.[1]

Nutrient trading

Nutrient trading applies market-based instruments to the problem of water pollution. Our work looks specifically at nutrient trading in the Lake Rotorua catchment, but it could be applied in a wider range of places. The system we propose is cap and trade: it has a cap on the total amount of nutrients coming into the lake and tradable allowances equal to the cap. The cap is equal to the level of nutrients required to meet an agreed environmental goal.

[1] www.motu.org.nz/nutrient_trading and www.motu.org.nz/climate

Each year, farmers report the nutrients leaving their property using a computer-based model, and surrender allowances to match. If farmers hold more allowances than they require, these can be sold to farmers with insufficient allowances. The trading process will determine market price for these permits.

Nutrients reach the lake through groundwater and surface flows. They cannot be seen or measured, and instead must be monitored using a model. The particular model being developed in New Zealand is called OVERSEER, though alternatives exist. Farmers input their activities and the farm's geophysical characteristics, and the model estimates the amount of nutrients leaving the property each year. In particular, farmers must report animal numbers and fertiliser use.

Emissions trading

Agricultural emissions trading is very much in development as a core component of New Zealand's ETS. The New Zealand government has an allocation of Assigned Amount Units (AAUs) under our Kyoto obligations, which equates to New Zealand's allowable tonnes of carbon emissions. We can supplement these with carbon sequestration, and we can also buy units on the international market.

The national cap-and-trade system is similar to that described for nutrient trading, but differs in that it is essentially embedded within a bigger cap-and-trade system. The national system is an attempt to devolve responsibility for emissions to individual actors who are capable of behavioural change. To do this, private sector actors will be required to acquire NZ units through free allocation or by purchase. Private actors are responsible for reporting information that can be used to model greenhouse gas emissions from their chain of production. The sum of individual actors' emissions across all sectors and gases (plus any small sources excluded from the system) should sum to the national obligation. For agricultural emissions trading, the default point of obligation for emissions is the processor, though assessing emissions at farm level also remains under consideration. These details of the scheme are yet to be determined.

For the purposes of this paper we consider agricultural emissions trading at the farm level of obligation. As for nutrient trading, private actors surrender emission units to match emissions inferred using a model. Under a separate component of the ETS, if farmers have the benefits of post-1990 forestry or native regeneration on their land, they can claim emission units to match sequestration.

Scientific background

We are concerned with two related sets of emissions. Agricultural emissions trading controls the greenhouse gases, nitrous oxide and methane. Nutrient trading controls nitrates and phosphorus, which cause hazardous algal blooms in waterways in New Zealand. Both pollutants are produced predominantly by pastoral agriculture.

Farm management designed to reduce greenhouse gases can also reduce nutrient loss. Reducing stocking rates reduces methane and nitrous oxide roughly in proportion to the consequent reduction in feed intake and can reduce nitrate loss even further. If you are already controlling gas emissions, by felicity you can also control nutrient losses, and vice versa.

In some instances, the effects will not be so felicitous. For example, using straw bales to catch run-off reduces nutrient loss, but may increase nitrous oxide. This is because capturing nutrients creates more opportunity for them to escape into the atmosphere.

In many cases, however, greenhouse gas regulation may not be a significant extra burden for farmers who already control for nutrient loss. Introducing an emissions trading system effectively reduces demand for nutrient allowances, leading to a price drop in the nutrient market. In effect, farmers will pay less for nutrients and will instead start paying for greenhouse gases.

7.2 What are the similarities and differences between nutrient trading and emission trading?

The burden of nutrient trading and emissions trading depends on a number of potential interactions between the two proposed schemes. This section sets out issues of price, reporting and verification, scope, mitigation opportunities, motivations for free allocation, and externalities over time.

Price

For nutrient trading, the Regional Council sets the nutrient cap, and the price is determined entirely by what happens within the catchment.

By contrast, New Zealand has very little control over greenhouse gas emission prices. The Kyoto cap is set internationally through negotiations in which we are a very small player. For the global ‘carbon’ market we are price takers and therefore exposed to international changes.

In both systems, the council or government could choose to protect farmers from extreme prices and volatility by providing a 'safety valve' or price at which they will provide additional units.

Reporting and verification

If agricultural emissions are reported at farm scale, reporting and verification is very similar for both systems. Both involve pollutants that cannot be directly measured, but can be modelled through OVERSEER.

The challenge is to design a model with verifiable data inputs that accurately reflect nutrient losses and greenhouse gas emissions. The data must be verifiable or it would be impossible to determine compliance. The data inputs should also enable a range of mitigation options. Farmers want to be able to respond to both systems in ways that will not cost too much.

For both systems there is a real issue about the acceptability of regulation based on uncertain, inaccurate science. You can hear murmurings about nutrient trading and also emissions trading, saying 'Why are we bearing cost when you're not even really sure what's going on?' There is quite a lot of resistance on this basis. Traditionally, resistance where science has been uncertain has been beneficial to farmers because it has allowed them to avoid regulation. In this case, however, once the inevitability of Kyoto obligations or nutrient targets is accepted, acceptance of some of the uncertainty in modelling of mitigation options would allow farmers more flexibility and lower the burden on them.

This raises an economic question: what is the value of extra information? Perfect accuracy is not possible in this situation, but how valuable is it to be more accurate? This question is a transactions cost versus accuracy trade-off. There is an economic cost if negative perceptions lead to the system working inefficiently.

Scope

Another issue that arises in both systems is determining who should participate. For nutrient trading there are arguments for higher participation and arguments for lower participation. Applying the same arguments to emissions trading suggests that direct participation in the latter scheme should be somewhat lower overall.

To maximise environmental benefit from a nutrient trading system, it is desirable to have as many sources monitored and covered by the regulation as possible. It can also be difficult to monitor the activities of those who are not included. This has been seen in New Zealand fisheries, where commercial fishing is tightly controlled

and recreational fishing has very few controls. Those not included in the system as direct participants have less incentive to mitigate their nutrient losses, which leads to loss of efficiency. Nonparticipants may not use low-cost mitigation options because they do not lead to economic advantage through the sale of allowances. A greater number of participants might increase market liquidity, which could be an issue if the number of projected participants is really low. More participants might also avoid some market power problems.

Transaction costs are the primary reason to limit involvement. It costs to comply with this sort of system, to determine and report farm nutrient losses and to learn how to gain the most benefit from trading. Dealing with many participants is also costly to the regulator who needs to verify reports and enforce compliance. In the prototype nutrient trading system, we propose that very small properties are simply made the responsibility of the district or regional council, which has the choice to pass on a nominal cost, potentially in combination with regulation to lower nutrient losses. This ensures that all activity is included within the overall cap, but avoids considerable effort from individual landowners. For the same reasons, we remain undecided about whether to create tradable permits for phosphorus alongside those for nitrous oxide. Nevertheless, both gases would be monitored as part of the nutrient cap.

The emissions trading system differs in two areas: liquidity is not an issue and nor is comprehensiveness of coverage of gases.[2] This is because we are working within an international market, whose associated regulations define all sources that are monitored and how monitoring is done. Actions in New Zealand will not affect the liquidity of the global market, and that would argue for lower participation in the trading system. In the short run, while the international market is relatively underdeveloped, the development of brokers who specifically deal with NZ units, and the Kyoto units that will be accepted in New Zealand, would help local liquidity. A system with lower participation would exclude sources with higher transaction costs and low emissions.

Cost bearing and mitigation

The major financial impact of both systems is on farm profitability, and, as a consequence, land values. Landowners are likely to bear the majority of the cost because lower land values will lead to a loss of equity. In the short run, if capital markets are relatively inflexible, introducing the trading systems could lead to

[2] The New Zealand government is choosing not to regulate sources that are not covered by Kyoto and are closely mirroring the international rules in domestic legislation.

possible bankruptcy even of farms that will be viable in the long run, particularly for people who bought farms recently and have large debts.

Initial costs are likely to be higher than ongoing costs for a given cap or price, because farmers will gradually begin to reduce and mitigate emissions. We lack robust empirical evidence on how much they can mitigate and the costs of doing so. We do know that greenhouse emissions per unit of output vary considerably across farms, which indicates scope for mitigation. This is the case even for methane, where it is possible to change the efficiency with which grass (dry matter) is used to produce meat and milk. The question is to what extent it will be possible for farmers to manipulate this variation, improving their productivity and hence mitigating their emissions.

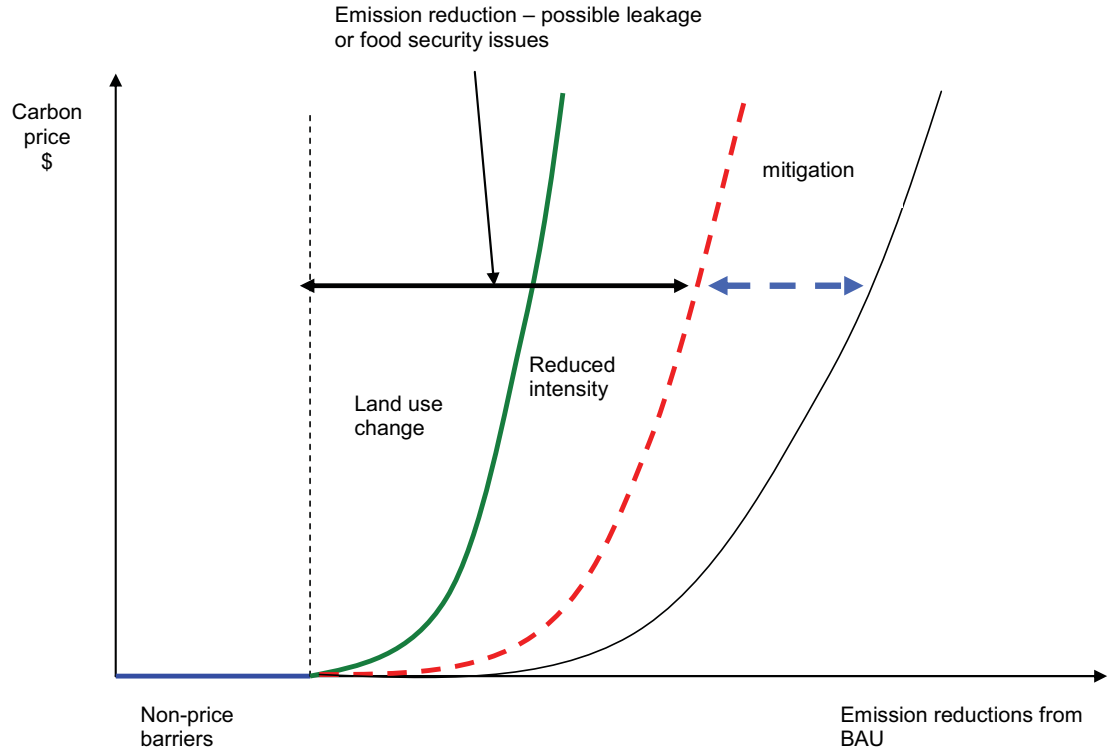
We use two farm models, FARMAX (for sheep and beef farms) and UDDER (for dairy farms) combined with OVERSEER, to explore these questions. These models do not involve explicit optimisation algorithms. Skilled users must try different options that they consider physically feasible to find an optimal outcome for the specific farming situation. Based on the inputs, farm geophysical characteristics and management practices defined by the user, and using a set of production functions for the farm and animal type, the model will produce predictions of output as well as farm profit.

A difficulty with this modelling approach is that, in general, farmers do not currently optimise their activity in accordance with this type of model. Some of this may be due to rational differences between a farmer's decision problem and that actually modelled; part may be due to non-price barriers to more efficient farm operation. Different farmers may have different preference for average returns relative to risk as well as across management options that require their input. Although models may appear to offer cheap (or negative cost) mitigation opportunities, these barriers may be real and certainly won't be addressed solely through the ETS.

Figure 7.1 illustrates the empirical question. We would like more robust numbers about how much farmers would optimally pursue each of the three broad types of activity — land use change, reduced intensity and mitigation — at different carbon prices. The more flexible farmers responses are, the lower the individual and aggregate costs of the system will be.

If farmers' responses are to change land use or reduce intensity and hence output, this could have negative effects in three ways. First, 'leakage' could lead to higher global emissions as a result of the ETS. Leakage arises when, as a result of carbon regulation in New Zealand and an incomplete global agreement, production falls in

Figure 7.1 **Emission reduction/mitigation cost curves**



New Zealand and rises in a country that is not covered by the Kyoto cap. Regardless of New Zealand's relative GHG efficiency in production, a movement of production to an uncovered country will raise their emissions above business as usual (BAU), while the sum of emissions under the Kyoto cap will be unchanged. Thus, global emissions will rise relative to BAU. Offsetting this somewhat, there may be local environmental benefits from reduced production. These could include improvements in water quality, biodiversity and reduced erosion.

Second, the fact that we are competing with unregulated countries in the short term may lead to production going offshore, something which in the long run we would regret when (or if) there is a global agreement. If New Zealand is relatively GHG-efficient in livestock production, we will have a long-term comparative advantage in production and we will want a strong livestock sector in the long term. Losing efficient production in the short term could lead to long-term regrets if New Zealand loses key skills, if infrastructure (including processing capacity) and the quality of herds decline in ways that are hard to reverse quickly or, if land moves into forestry or indigenous regeneration which is relatively costly to reverse in the short term. Short-term reductions in output could also lead to unnecessary social pain as small rural communities struggle to adjust to lower local economic activity.

Third, if the fall in New Zealand's food production is not replaced by increased production overseas, it will exacerbate the current global problem of food insecurity and high food prices. The less emissions leak, the more we contribute to food shortages. The challenge is to trade off the lower burden in New Zealand from allowing production to fall (also avoiding the costs of protecting production) against the emissions leakage, long-term regret, and food insecurity effects.

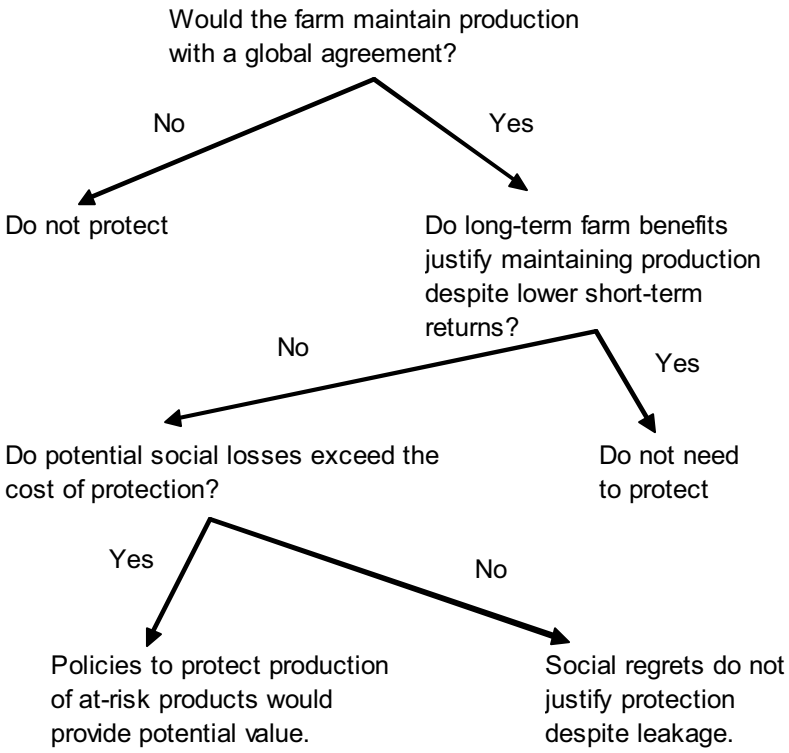
Motivations for free allocation

Allocating free allowances is a contentious issue in any trading system because of the high value of the allowances and the considerable costs that regulation can impose. For nutrient trading in Lake Rotorua, the key issues are fairness and smoothing transition into the new market regime. We propose that landowners initially receive allowances proportional to but lower than their current nutrient loss, so that landowners bear some of the costs of achieving the environmental target. Over time, our proposed allocation mechanism would transition to one based on potential nutrient loss on each land parcel. This avoids locking in current land use, or rewarding high nutrient-loss properties indefinitely. For example, land that is currently in forest, with very low nutrient loss, but that has high potential for sheep farming, or Maori land that is currently underdeveloped, would be penalised if allocation were entirely on the basis of current nutrient loss. A measure of potential nutrient loss is yet to be developed, but will need to incorporate land characteristics and potential stocking rates alongside a basic model of 'standard management practices'.

For agricultural emissions trading, where there are 33.7 million tonnes per annum of free units to allocate, the key issues are fairness, transition, and production falls leading to emissions leakage, long-term regrets and food insecurity. Free allocation is the only mechanism available to address leakage in the current scheme. Emissions leakage does not apply to nutrient trading, since the proposed scheme is self-contained within the Lake Rotorua catchment. The other effects on water quality elsewhere or food security are likely to be small and are not considered a critical local issue. There is no possibility of long-term regret because changes in profitability as a result of the scheme are not transitional or dependent on external agreements.

Figure 7.2 explores the decisions required to allocate to avoid leakage and economic regret in the ETS. The final question in this decision tree asks whether the potential social losses exceed the cost of free allocation, which is very expensive. This is another question requiring empirical evidence. We are working to collect evidence on potential production falls and emissions leakage in agriculture

Figure 7.2 **Decision tree for allocation to address leakage and economic regrets**



to give us a more robust idea of the sources and likely magnitudes and the effects of that leakage.

Timing of environmental effects

Another issue shared by the emissions and nutrient markets is that actions at one point in time can have environmental consequences at different times. In the Lake Rotorua catchment, nutrient loss can take between zero and 200 years to reach the lake, depending on a property's geophysical characteristics and location. Excess nutrients from some properties can go straight into the lake and cause water quality issues now; while nutrients from other properties will take 200 years to filter into the soil and through an aquifer before reaching the lake.

Our proposed nutrient trading system addresses this issue through vintage allowances. We propose creating a series of markets with their own targets, each related to a particular time period. Each property will have a groundwater lag associated with it, and landowners will purchase (or be allocated) allowances for the time period at which their nutrients reach the lake. For example, a property with a

one- to five-year lag will surrender 2010–2014 allowances to match 2009 nutrient loss. A property with a sixty-year lag will surrender 2059–2069 allowances to match the same action on their farm. This allows authorities to meet water quality targets with greater confidence than would be possible with a single market.

For emissions trading, the comparison is not location but emissions type: carbon dioxide, methane and nitrous oxide each have different environmental outcomes over time. The NZ ETS converts each pollutant to CO_2 equivalents using global warming potentials (GWPs), following UNFCCC and Kyoto rules, but these rules do not distinguish medium- and long-term effects.

It is an open question whether the vintage approach can be applied to the global climate agreement. The relative treatment of different gases and the current use of GWPs is an important issue for New Zealand where we have high levels of emissions of methane, which has a very high global warming potential but whose current emissions will have little or no impact on the climate in 100 years. Two or more international markets for mid-term and long-term emissions targets would increase the accuracy of the environmental targeting and the economic efficiency of the global mitigation effort.

7.3 Conclusions

Emissions trading and nutrient trading are two related markets developing at the same time. We can take advantage of this situation by maximising complementarities and benefit from learning across markets. The markets have common challenges requiring innovative economic thinking and more empirical analysis.

8 Environmental policy for environmental outcomes

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Abstract

In order to generate real environmental improvements in a cost-effective way, environmental policy programs need to have a number of characteristics. Among other things, they need to: (a) draw on good-quality scientific technical information about environmental degradation, and about the links between actions and environmental outcomes (b) account well for the behavioural responses of land and water managers to policy interventions (c) prioritise investments well, consistent with an appropriate role of government (d) select realistic targets that can drive good monitoring and evaluation (e) select policy mechanisms that are appropriate for the circumstances (f) strike an appropriate balance between mitigation and adaptation (g) account for negative side-effects of proposed environmental management actions.

Environmental managers need to be encouraged by program rules and procedures to pursue environmental outcomes cost-effectively. Recently completed national programs, the National Action Plan for Salinity and Water Quality, and the Natural Heritage Trust, fell short on all of these criteria. Improving matters will be difficult for reasons that include capacity constraints in government agencies and time pressures on policy development. Some alternative directions for environmental policy are discussed, including a stronger reliance on market-based policy instruments.

1 For related writings, see www.davidpannell.net.

8.1 Introduction

This paper summarises a number of features that environmental policy needs to have if it is to deliver environmental outcomes cost-effectively. The discussion is illustrated using two major national environmental programs that came to an end on 30 June 2008: the National Action Plan for Salinity and Water Quality (NAP) and the Natural Heritage Trust (NHT).

Background to NAP and NHT

The two programs were largely delivered through 56 regional natural resource management bodies, which I will refer to as Catchment Management Organisations (CMOs). Billions of dollars from the Australian Government were provided, conditional on matching funds being provided by State governments, CMOs were responsible for developing and implementing integrated regional plans for environmental investment. They appointed their own staff, but also relied on community participation and support by State government agencies. The approach was intended to be based on the idea of Integrated Catchment Management, where managers plan and prioritise, based on a detailed consideration of physical, biological, economic and social information.

The two programs have been widely criticised. In my judgement, they were not very effective in achieving environmental outcomes. Many of the projects funded within these programs will have little enduring environmental benefit. In my view, their poor performance was easily avoidable using knowledge that existed at the times they were established. Problems with program design and implementation were pointed out in commentary at the time (e.g., Pannell 2001a, 2001b) and subsequently raised in a number of official enquiries (Auditor General 2004, 2008; SSCECITA 2006; HRSCSI 2004; SKM 2006). There were no substantial changes to the programs in response to these enquiries. Key issues determining the effectiveness of such programs are discussed in subsequent sections.

Use of scientific technical information

Environmental problems are often technically complex and uncertain. Sound decisions about their management need to be based on good knowledge about (a) the degree of threat or damage to environmental assets at risk, and (b) the extent to which this threat or damage can be reduced by particular changes in management. In many cases, generic knowledge about an issue is not sufficient — we need locally specific knowledge.

The NAP and NHT programs did not require CMOs to make good use of scientific information when formulating their investment priorities and plans. In general, CMOs did account reasonably well for threat or damage, but with very few exceptions they did not use adequate information about the link between proposed actions and environmental outcomes. They were not provided with technical support to do so and they were not required to demonstrate that they had done so in the course of their plans being accredited by government. Concerns about lack of science in the programs were identified repeatedly in the various enquiries and reviews commissioned by government. For example, it was highlighted that decisions should be 'based in sound, up-to-date science' (SSCECITA 2006, p. 221); that in dryland areas, 'Links between actions and resource condition change … are often not confidently quantified...' (SKM 2006, p. 1); and that 'NAP/NHT have only been partly successful in enabling the flow of scientific and technical information into the catchment management planning process' (Chartres et al. 2004, p. 4). Furthermore, CMOs were highly constrained by the programs in their investment in research to collect missing information required for sound decision making. Funding was expected to be spent on 'on-ground works'.

Use of socioeconomic information

If the works or changed practices needed to protect an environmental asset require changes in behaviour by private land or water managers, investment managers need to consider whether those works will be attractive or unattractive to the people who would have to adopt them. There are many well understood reasons why conservation practices can be unattractive to land and water managers (Pannell et al. 2006). If the practices are highly unattractive in a particular case, it will be expensive and difficult to get them adopted, and the viability of investing in that environmental asset will be reduced. It is important to appreciate that, even if the works are relatively attractive when implemented at small scale, they may be highly unattractive at large scale.

Seymour et al. (2008) found that CMOs have little capacity in the use of social or economic information relating to landholder behaviour. The programs did not provide carrots, sticks or support to fill this gap. 'Additional attention needs to be directed to issues associated with farm economics and profitability in natural resource planning' (Chartres et al. 2004, p. 3). In general, the likely response of landholders to interventions was not considered in any depth, if at all. At national, state and regional levels, it was generally naively assumed that, with sufficient effort and skill on the part of extension agents, landholders would respond on an adequate scale to extension and the payment of small, temporary grants. The fact that they often did not do so could readily have been foreseen. Pannell (2001b)

highlighted the fact that in many regions there was a lack of sustainable land-management practices that were readily adoptable by farmers. Pannell et al. (2006) argued that 'If such innovations cannot be identified or developed, there is no point in falling back onto communication. Promoting inferior practices will only lead to frustration for all parties' (p. 1421). That did occur very commonly.

Appropriate prioritisation of potential projects

There is a strong tendency for environmental programs to attempt to achieve too much, allocating too few resources to too many projects. The projects they do fund tend to be of widely differing merits. Some of the investments receiving funds are worthwhile, and some are not worthwhile at all. Given that project budgets are generally very small relative to levels that would be required to manage environmental degradation comprehensively, the need for tight and careful targeting of investments is obvious.

The highest priority environmental investments should have at least these four characteristics: they should relate to (a) particularly valuable environmental assets; (b) facing threatened or current high degradation; (c) with high feasibility of reducing that threat or degradation at reasonable cost; (d) with the required works being reasonably attractive to relevant land or water managers. If even one of these elements is neglected, there is a high risk of selecting poor investments.

In the NAP and NHT, no consistent framework for planning and prioritisation was provided to CMOs. Each developed its own approach and, not surprisingly, there was wide variation between regions in the approaches used. I have been unable to find any region with a prioritisation framework that I would rate as 'good'. Indeed, very few would rate better than 'poor'. There are hardly any assets funded under the two programs for which all four of the above required characteristics were assessed in any depth.

Again, this deficiency was recognized in official enquiries, but not redressed. 'Close attention must be paid to … actively encouraging regions to put in place measures that are well targeted' (Auditor General 2004, p. 15). It was recognized that investment decisions should be 'outcome focused' and 'subject to a cost-benefit analysis' (SSCECITA 2006, p. 221).

Good prioritisation requires good information and good analysis, which takes time. Programs need to be run with the patience to allow this to happen. In the NAP and NHT, CMOs were under severe time pressure to complete their planning processes and commence spending the money, irrespective of the quality of those plans.

Ridley and Pannell (2005) developed an investment framework for salinity (called SIF3) which explicitly addresses all four characteristics. The Senate Standing Committee on the Environment, Communications, Information Technology and the Arts (2006) recommended that governments should 'keep a watching brief' on our framework, 'with a view to potentially implementing it (or a modified version of it) across the country' (pp. 229–30).

Balance of investment between current works and technology development

'For some environmental issues, the real challenge is to find or develop innovations that are not only good for the environment, but also economically superior to the practices they are supposed to replace' (Pannell et al. 2006, p. 1421). In my view, this is underrecognised, including by economists. If economists do consider innovation, we tend to take the view that the right policy settings will foster innovation among polluters, resulting in the creation of lower-cost methods for pollution abatement. This may work for some sorts of pollution, but for the sorts of environmental problems covered by the NAP and NHT (often highly diffuse or dispersed problems caused by many small businesses), we cannot expect that they would be able to develop the sorts of new land-use options that would be required. The task would require research on a scale, and with a level of expertise, that is far beyond any individual or group of farmers. The NHT program made a minimal investment in this area, and the NAP made no investment that I am aware of.

Again, the need for more investment in this area was well recognised in official enquiries but not acted on. 'Limited availability of commercially attractive treatment options for regions [is a] key risk that require[s] careful management' (Auditor General 2004, p. 14). 'The Committee recommends that the Australian Government give greater emphasis through its investments in salinity science to develop new, economically-viable land and water use systems' (HRSCSI 2004, p. 167).

Balance of investment between mitigation and adaptation

Where mitigation is not justified on benefit-cost grounds, there may be net benefits in investing in adaptation to a degraded environment. This becomes particularly important in problems like dryland salinity and climate change, where much degradation is physically impossible to avoid, and where even more degradation is not economically efficient to avoid. In the original NAP program documents, the focus was entirely on mitigation. Although there were eventually some investments

in adaptation, the appropriate balance between the two was never, in my view, properly considered.

Use of appropriate policy mechanisms

Pannell (2008) shows that the best choice of policy tool depends on the mix of public and private net benefits from proposed changes. Therefore the choice of policy mechanism needs to be sensitive to local conditions, as well as to the general characteristics of a problem. In the NAP and NHT programs, the great majority of funds were spent on extension and small temporary grants. As argued earlier, these were often used in circumstances where they could not deliver environmental outcomes, often because they were used to promote conservation practices that were not adoptable. Investors should either have used different policy mechanisms or taken no action.

Avoidance of adverse side-effects

In some circumstances, works undertaken to improve one natural resource problem can have negative consequences for another. For example, many trees were planted with the intention of reducing saline discharge into rivers, but in circumstances where they had a more important negative impact on the yield of fresh surface-water into the same rivers (for example, Nordblom et al. 2006). Because the NAP and NHT programs did not deal adequately with the science of cause and effect, this was largely unrecognised by CMOs, who provided payments to encourage some actions that should have been discouraged.

Monitoring and enforcement of compliance

In circumstances where the preferred conservation practices are attractive to landholders, CMOs do not need to use incentive-based mechanisms to encourage adoption, and consequently they do not need any enforcement mechanism. But where an incentive mechanism is used to compensate for the negative private net benefits of a conservation practice, or to prevent adoption of an environmentally-damaging practice that is attractive to landholders, monitoring and enforcement needs to be part of the program. NAP and NHT had little monitoring and, as far as I am aware, no mechanism for enforcing agreed changes in land management, other than refusing to extend payments to a second phase. In practice, even this option was not always used. I am aware of cases where landholders received an incentive payment to adopt the same practice three times, but gave it up each time.

Setting appropriate targets

Environmental targets should be consistent with the known biophysical information about the asset's response to management, the known behavioural responses of land and water managers to policy interventions, and the resources available under the program. Clearly, you cannot select such targets unless you have undertaken high-quality analysis of the investment options. In the NAP and NHT, the program required CMOs to specify targets, but did not require those targets to be in any way realistic. Indeed, in some ways realism was discouraged within the guidelines imposed. Not surprisingly, '80 out of the 163 resource condition targets identified in the plans [of eight regions examined] did not meet the identified criteria in terms of being measurable or having a specific timeframe' (Auditor General 2008, p. 19).

The lack of realistic targets also infected the high-level goals of the programs: 'The consensus, from consultations during the course of the audit, indicates that [it] will not be possible [to meet the program goal to stabilise or reverse salinity trends] within the eight-year timeframe originally envisaged for the NAP' (Auditor General 2004, p. 18).

Monitoring and evaluation linked to management

Good evaluation is closely related to good planning. If the analysis has been done to select investments and establish high-quality targets, monitoring and evaluation is relatively straightforward, and results can feed into ongoing management decisions.

Many CMOs did not understand how to undertake monitoring and evaluation so that they provided sound and useful data for evaluation and ongoing management (SKM 2006). The programs did not require them to do so. Monitoring in NAP and NHT focused on accountability for funds spent, but neglected the achievement of environmental outcomes. This focus sent a message to CMOs that the government was not really concerned about the achievement of outcomes, only with spending the money. Weakness of monitoring was also observed at the program level: 'At the present time it is not possible to report meaningfully on the extent to which these outputs contribute to the outcomes sought by government' (Auditor General 2008, p. 16).

Supporting and creating appropriate incentives for environmental managers

In a program where decisions about actual investments are devolved to individuals or groups separate from the funding body, it is important for the funding

arrangements to be set up in a way that provides incentives for environmental managers to seek environmental outcomes cost-effectively. Programs should also provide support to address important knowledge and skill gaps that managers may have.

As we have noted above, NAP and NHT provided inadequate support: 'enhancing guidance to the regions must be given a higher priority' (Auditor General 2004, p. 15). They also provided almost no incentives for CMOs to pursue environmental outcomes. Targets were not required to be realistic, and accreditation of plans was very weak, particularly in relation to their use of science and socio-economic information. The Senate Standing Committee on the Environment, Communications, Information Technology and the Arts (2006) recommended that Government should 'strengthen the accreditation process for regional bodies' and 'ensure that funding is conditional on rigorous investment planning' (p. 221).

Consistency with an appropriate role for government

Broadly speaking, government policy may seek to: (a) increase aggregate social welfare through reducing market failure; (b) protect or enhance publicly managed resources, (c) address areas of inequity, inequality or disadvantage; or (d) pursue political objectives to generate benefits to the government. In evaluating any program, I assume that item (d) is to be judged inappropriate. For the NAP and NHT, specifically, I believe that item (c) is of minimal relevance, although a very narrow and illogical view of the importance of equitable sharing of program funds pervaded both programs. The key issues here, then, are the extent to which the programs were targeted to addressing market failures, their success in reducing them, and their contributions to protection or enhancement of publicly-managed assets.

The main market failures relevant to the NAP and NHT programs are public-good problems (non-rivalry and non-price excludability) associated with externalities, or associated with information failures. For example, land management on one farm can cause negative externalities due to salinity affecting water resources, environmental assets, public infrastructure, or agricultural land on another farm. Information failures may arise, for example, if farmers are unaware of or have misconceptions about land management practices that would be in their interest to adopt.

Ostensibly, the NAP and NHT could be seen as targeting these market failures, through the payment of grants to farmers to internalise externalities, and the use of extension officers to promote changes in farming practices. But a deeper assessment reveals problems in both areas.

For an intervention to be judged as efficiently managing a negative externality, its overall benefits must exceed its costs. In the case of the NHT, there was no evidence that particular investments under the program would generate positive net benefits for the community. In the case of the NAP, there was evidence that they often would not. Benefits of managing salinity are often small and they may be highly localised (Pannell, McFarlane and Ferdowsian 2001). On the other hand, the costs of reducing externalities from salinity are often large, requiring very substantial changes in land management (for example, Dawes et al. 2002; National Land and Water Resources Audit 2001) and the recommended changes often have high opportunity costs (for example, Kingwell et al. 2003), especially when applied at large scale (Bathgate and Pannell 2002). Overall, the net benefits of acting to reduce salinity externalities would very often be negative. Identifying cases where they would be positive requires a detailed and sophisticated analysis. From the previous subsections, however, it is clear that the program did not include or support such analysis.

As noted earlier, most of the advocated salinity-mitigation practices in most regions are unattractive to landholders for economic (Kingwell et al. 2003) or other (Pannell 1999) reasons. This means that farmers' non-adoption of these practices does not constitute an information failure, and so use of extension to promote these practices is not justified on a market-failure basis.

On the other hand, some investments in direct action by government, such as pumping saline groundwater to prevent discharge into the Murray River (River Murray Water 2006), or pumping to lower saline water-tables under rural towns in Western Australia (Department of Agriculture 2004), seem much more likely to be justified on a benefit-cost basis. Unfortunately, investments of this type were the exception within the NAP and NHT, probably due to a view that they should be the responsibility of State governments. An assumption built into the program, presumably for political reasons, was that most funds should be directed to supporting land-use change on farms. It would have been better for the program to select policy approaches that were best suited to local conditions for particular environmental problems, rather than building in assumptions about the policy mechanisms to be used.

Capacity requirements of policy agencies

Policy officers designing programs for management of complex environmental problems should ideally have a good understanding of those problems and be able to draw on the scientific and socioeconomic evidence about their management. In my observation, the scientific knowledge used to design the NAP was superficial, based on a highly simplified and stylised understanding of the problem, and not

encompassing the latest relevant research. It did not involve effective integration of biophysical and socioeconomic information in the design of the program. I have found that many environmental policy officers in Canberra lack a deep knowledge of the environmental issues for which they are responsible. In part this is a consequence of the rapid movement of staff between jobs and agencies that is the norm in Canberra. I believe that this is a very serious and under-recognised problem. In my view, good quality environment policy cannot be developed by people who do not have very strong content knowledge.

A part of this problem is the time pressure under which policy officers typically operate. Policy development always seems to occur in an unseemly rush, which inevitably reduces the quality of the resulting policies. The rush could be reduced if agencies pre-emptively invested more time and resources in the sort of analysis required to make good decisions about policy priorities, before an existing program is concluded.

Alternative policy approaches

The programs discussed here involved partial devolution of responsibility to regional organisations with community membership. Planning and prioritisation was conducted by committees, and for on-ground changes they relied primarily on voluntary actions by landholders. I have indicated how a system of this broad type might be improved: through providing carrots, sticks and support to those regional organisations so that they have the incentive and the capacity to take the science and economics of the problems seriously, undertake better integrated analysis, target funds more tightly to high-payoff investments, use a broader range of policy tools better matched to particular circumstances, and so on.

One problem with this set of prescriptions is doubt about whether it is realistic at the bureaucratic level — about whether the government departments themselves have the incentive and the capacity to deliver the necessary reforms. It would also be a major challenge to change their cultures so that they give priority to the efficient achievement of environmental outcomes. With this sort of concern in mind, the late Peter Cullen proposed that an independent body be established with the responsibility for designing and overseeing the main environmental programs. This body would be more independent of politics than government departments are, and they would be judged strictly according to their achievement of environmental outcomes. I have some sympathy for this proposal.

Whatever happens at that organisational level, there is a question about the appropriate mechanisms to deliver change on the ground. Some economists argue that we should rely more on market-based approaches to improve the efficiency of

environmental investments. The NAP program did include a small pilot program for market-based instruments, and some CMOs have dabbled in the use of conservation tenders, but, overall, the more sophisticated economic policy instruments have been little used within national conservation programs. The leading proponent and practitioner of this approach has been the State of Victoria, under the encouragement and guidance of Gary Stoneham, now at the Department of Sustainability and Environment (for example, Stoneham et al. 2003). Economic policy instruments look likely to play a major and very positive role in Victorian conservation programs in coming years. The Victorian approach solves the problem of prioritising investment using good science and good economics. I do, however, have some observations about a potential national rollout of market-based approaches.

- The success in Victoria appears to rely very much on the high capability and determination of Gary Stoneham's group, and their strong influence on policy-makers. It is hard to see this being replicated in other States or at the national level. The sophistication of the approach is a great strength, but also a constraint on its broader application. Approaches that take short cuts on the underpinning analysis are unlikely to offer large improvements over more traditional approaches.
- Market-based instruments are not always the most appropriate response to an environmental problem. For example, the available conservation practices may be so unattractive to landholders that the prime need is to develop improved practices, or so attractive to them that extension alone is sufficient. Or, given the property rights regime in place, enforcement of a perceived duty of care may be required. Or for a specific environmental outcome, the population of landholders may be too small for a market to operate.
- Market-based instruments are just one tool within the class of incentive-based policy tools, and incentive-based tools are just one class of tool within the overall toolbox. In my judgment, the choice of the right class of tool (Pannell 2008) is more important than the choice of a specific tool within that class.
- Even if we do eventually move to a much stronger reliance on market-based approaches nationally, this is likely to take some considerable time. In the meantime, there is a pressing need to improve the institutions, the tools and the information used within the existing national system.

In response to our perceptions of the needs of environmental policy programs, Anna Ridley and I have developed INFFER (Investment Framework For Environmental Resources, see: www.inffer.org). It is strongly based on our experiences with SIF3 and includes similar principles, processes and frameworks. The aim is to ensure that environmental managers bring a benefit-cost analysis mindset to their consideration

of investment options. It is designed to be as simple as possible to use, but includes all of the key factors that need to be considered (as discussed earlier). It guides investors towards investment in assets with a high likely net payoff, and advises on the most appropriate class of policy tools to use. We have been promoting INFFER to governments and CMOs.

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General discussion

Professor Stavins commenced discussion with questions and comments to panellists:

- he asked Professor Libecap to clarify whether the US Congressional moratorium on Individual Transferable Quotas (ITQs) was still in place, and for his views on the social efficiency (in terms of the social benefits and costs) of the Californian court decisions on Mono Lake
- he commented that the notion of common property resources did not eliminate the potential for market failure – it was not a dichotomous choice between common property and open access, and there was potential for significant market failures across the full spectrum
- he asked Suzi Kerr to identify any lessons for the United States that might be learnt from New Zealand's experience with ITQs.

Professor Libecap confirmed that the moratorium on ITQs under the Magnuson-Stevens Act had expired. He explained that the point he was making was that in the United States, relying on common property regimes such as marine fishery management councils, was not very effective.

Suzi Kerr said that New Zealand had the most extensive ITQ system in the world, with more than 500 separate markets operating under one unified system. The market was working well on the whole, there was evidence of species recovery, and the value of the fisheries industry had increased. There were some challenges, however, including governance issues and high regulatory costs relative to benefits in some areas.

Suzi Kerr challenged Professor Libecap's view that environmental markets tend to be introduced only after a crisis. Fisheries markets were introduced early in New Zealand, and this meant political conflict was avoided and simple and efficient processes could be implemented. 'In contrast, US fisheries are in crisis with very entrenched local communities, and the social issues of adjustment are very significant. If [market reforms] had been implemented earlier, before fishing communities were collapsing, it would have been much easier.'

In relation to the Mono Lake decisions, Professor Libecap said: 'We just don't know whether or not it's the right decision. It cost Los Angeles about US$1 billion

in terms of stranded capital and opportunity costs, but we don't know whether the [social and environmental benefits] are worth that much. This is symptomatic of the problem of addressing reallocation issues through judicial processes rather than through water rights'.

In response to Professor Stavins' comment about common property and market failure, Professor Brunckhorst said that common property was a form of private property, rather than part of a broad spectrum of open access. The issue was not the type of property ownership, but achieving the right institutional rules and monitoring systems.

Professor Freebairn asked the panellists to discuss the transaction costs of the different types of instruments: regulations and property rights and markets. Professor Libecap observed that the first response to a variety of open access problems was generally regulation — usually restrictions on either inputs or outputs — not the implementation of a property rights regime. Why was that? Were there any reasons why this might be an efficient approach? There are clear costs involved in property rights regimes, and the more valuable the resource (and the more contention around it), the greater are the costs. Economists tend to overlook the cost of defining and enforcing property rights. 'This raises an important empirical question: "What does it cost to put regulation into place?". When the problem isn't a big one, it could be that regulation is the best response. But as regulation doesn't solve incentive issues, problems tend to grow over time, and that's when a property rights regime is effective.'

Professor Libecap added that trading systems, such as those described by Suzi Kerr, were also costly, and that these costs might be incurred without achieving the desired outcome (that is, a reduction in global warming). 'We might need to have a big crisis before we resolve the uncertainty of how China, India and the United States will participate', he said.

The question of whether perceptions of equity generated institutional constraints on market instruments was raised by one participant. Professor Pannell replied that notions of equity, based on expectations of support created by existing environmental programs, often prevented the adoption of different approaches. Professor Brunckhorst agreed that perceptions of equity were very important but could be managed by appropriate institutional rules and monitoring (which should be subject to constant adjustment and adaption) and, if necessary, sanctions (including cultural sanctions).

SESSION 3

INSTITUTIONS AND INCENTIVES FOR PROMOTING BETTER POLICIES AND OUTCOMES

9 Getting serious about global climate change: post-Kyoto international climate policy architecture

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Abstract

I examine some of the challenges the world faces in developing a successor to the Kyoto Protocol to address the threat of global climate change. I begin by highlighting key lessons learned from the Protocol, and then describe the major types of alternative policy architectures that can be employed in a successor international agreement, which may be negotiated at the Fifteenth Conference of the Parties to the Framework Convention on Climate Change in Copenhagen, Denmark, in December 2009. Drawing upon research from the Harvard Project on International Climate Agreements, I identify some of the key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international policy architecture. I also examine links between international policy discussions and likely US actions on climate change. I conclude by commenting on an international policy architecture that may already be emerging.

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9.1 Introduction

In this essay, I examine global climate change policy, reflecting both on what is grabbing the headlines and — more important — what is happening behind the scenes in the development of public policy. Many people will remember the mega-disaster film, 'The Day After Tomorrow', about the apocalyptic consequences of the greenhouse effect. That film had less scientific basis than 'The Wizard of Oz'. But reality is disturbing enough. The message from the scientific community is that man-made emissions of greenhouse gases are likely to change the earth's climate in ways that many people will regret.

Climate concerns have gone mainstream, even in the United States. If this was not obvious from the 2006 *Time* magazine cover story about climate change, featuring a polar bear stranded on an ice flow, then it should be clear from the reality of a cover story in *Sports Illustrated* magazine in 2007, featuring a staged photo of a well-known baseball player, knee-deep in water in his Florida stadium. Both stories were replete with misleading statements, particularly from an economic perspective, but that is not my point. My point is that concerns about global climate change are now widespread, and mainstream.

We have witnessed the galvanizing effect of former US Vice President Albert Gore's award-winning film, 'An Inconvenient Truth'. Although the Vice President deserved his Nobel Peace Prize for having raised public awareness of the climate problem, which is what the Nobel citation indicated, from an economic and policy perspective the film was unfortunately misleading. Indeed, it may be said that a striking inconvenient truth is the fact that meaningful reductions of carbon dioxide and other greenhouse gas emissions will be very costly for the United States and many other countries. In the United States it will be approximately equivalent to the cost of complying with all other federal environmental regulations combined. And that is just for the relatively modest, short-term targets of the Kyoto Protocol.

Of course, this does not mean that it is a bad idea to take action, but it does mean that the costs should be recognized if governments are to design meaningful policies that will be environmentally effective, economically sensible, and politically feasible. I will return to that later, but for now I simply wish to reinforce the point that concern about global climate change is mainstream and widespread in many parts of the world.

These concerns have been reflected in international policy actions and domestic policy debates in many countries, and in the statements and actions of prominent business leaders, including calls from some leading corporations for climate regulation (such as the environment-business coalition in the United States known as USCAP). The subject of domestic US climate policy is an interesting and

important one, but climate change is a global commons problem, and unilateral actions by individual countries — no matter how necessary — will never be sufficient, because the benefits to individual countries will always be less than the cost. This means that a cooperative, international, if not global, approach is key. Of course, that is the fundamental logic behind the Kyoto Protocol.

I begin by focusing on the global climate policy challenge, commenting on international policy architecture. Then I turn briefly to the outlook for US climate policy, and then return to the global context.

9.2 The global climate policy challenge

The Kyoto Protocol came into force in February 2005, without participation by the United States. However, even if the United States had participated, the Protocol's direct effects on climate change would be very small to non-existent. At the same time, scientific evidence and economic analysis now point to the need for a credible international approach.

Lessons learned from the Kyoto protocol

It is helpful to reflect on lessons that can be learned from the Kyoto Protocol, examining the Protocol's strengths as well as its weaknesses. First, with regard to the strengths of the Kyoto Protocol, the agreement contains within it provision for a market-based approach, and therefore holds promise, at least, of being cost-effective. I am referring to the well-known flexibility mechanisms which are part of the Kyoto Protocol. First, under Article 17, there is provision for emissions trading among the Annex I countries, which take on targets under the Protocol, whereby these parties to the Protocol — the individual governments — can trade their targets, their 'assigned amounts'. Second, there is Joint Implementation, which provides for project-level trades among the Annex I countries. Third, there is the Clean Development Mechanism (or CDM), which provides for project-level offsets created in non-Annex I countries — the developing countries of the world — to be used by firms in Annex I countries to help achieve their targets.

A second advantage of the Kyoto Protocol is that it provides flexibility for nations to meet their national targets — their commitments — in any way they want. In other words, the Protocol provides for flexibility at the national level, that is, domestic sovereignty. The importance of this provision (Article 2) should not be underestimated in terms of its political importance for the agreement having been reached in Kyoto.

Third, the Kyoto Protocol has the appearance, at least, of fairness, in that it focuses on the wealthiest countries and those most responsible for the current stock of greenhouse gases in the atmosphere. This is consistent with the principle enunciated in the Framework Convention on Climate Change of 'common but differentiated responsibilities'.

Fourth and finally, the fact that the Kyoto Protocol was signed by more than 175 countries and subsequently ratified by a sufficient number of Annex I countries for it to come into force indicates the political viability of the agreement, if not the feasibility for individual countries to comply with their targets.

In the realm of public policy, as in our everyday lives, we frequently learn more from our mistakes, from our failures, than from our successes. So, too, in the case of the Kyoto Protocol, and therefore, I now examine some of the key weaknesses of the Kyoto Protocol and how those lead to potentially valuable lessons for the path forward.

First, it is well known that some of the largest emitters are not constrained by the Kyoto Protocol. Some of the largest and most rapidly growing economies in the developing world do not take on targets under the agreement. Importantly, China, India, Brazil, South Africa, Korea, and Mexico are not part of Annex I. The rapid rates of economic growth in these countries, and therefore their rapid rates of growth of energy use, and hence CO_2 emissions, result in the fact that the developing world will soon overtake the industrialized world in emissions. Indeed, in 2008, China's CO_2 emissions exceeded those of the United States for the first time, and thereby China has become the leading emitter in the world (Blanford, Richels, and Rutherford 2008).

In addition, these realities raise the possibility that the Kyoto Protocol does not represent the fairness which was originally intended, at least in today's world. More than 59 non-Annex I countries — countries of the developing world, as well as others — now have higher per capita incomes than the poorest of the Annex I countries.

A second weakness of the Kyoto Protocol is that the United States — until recently the world's largest emitter of greenhouse gases — has not ratified, and indeed will not ratify, the agreement. I will return later to some of the reasons for this, but for now this fact must be accepted as one of the weaknesses of the Protocol, as implemented.

A third weakness of the approach of the Kyoto Protocol is associated with the fact that a relatively small set of countries are tasked with taking action — the Annex I countries of the industrialized world. Although this approach may have been well-

intended, the result inevitably is that the costs will be driven up of producing carbon-intensive goods and services within the coalition of countries taking action; indeed, that is the intention of the Protocol, and it is fully appropriate. However, that means that through the forces of international trade, comparative advantage in the production of carbon-intensive goods and services — directly in proportion to their carbon intensity — will shift from the participating nations (the industrialized world) to the other countries of the world, that is, developing nations.

The result is that as greenhouse gas emissions are reduced under the Protocol within the coalition countries, we simultaneously will witness an increase in economic activity to produce carbon-intensive goods and services outside of the coalition countries. This means that at the same time that emissions are being reduced by the Annex I countries, there will be an increase in emissions by the non-Annex I countries, leading to so-called 'emissions leakage'. This leakage will not be one-for-one, but nevertheless, it results in a reduction of cost-effectiveness, reduces the environmental performance of the agreement, and perhaps worst of all, pushes developing countries onto a more carbon-intensive growth path than they otherwise would have been, rendering it even more difficult for these countries to join the agreement later.

A fourth weakness of the Kyoto Protocol concerns the nature of emissions trading. For reasons I have written about in detail elsewhere, the provision in Article 17 for international emissions trading is unlikely to be effective, if indeed it is utilized at all (Hahn and Stavins 1999). The entire theory behind the claim that a cap-and-trade system is likely to be cost effective depends upon the participants being cost-minimizing entities. In the case of private-sector firms, this is a sensible assumption, because if firms do not seek to and indeed succeed in minimizing their costs, they will eventually disappear, given the competitive forces in the market. But nation states can hardly be thought of as simple cost minimizers; many other objectives obviously affect their decision making. Furthermore, even if nation states sought to minimize costs, they do not have sufficient information about marginal abatement costs at the multitude of sources within their borders to carry out cost-effective trades with other countries.

There is also great concern regarding the Clean Development Mechanism in the Kyoto Protocol. This is not a cap-and-trade approach, but rather is an emissions-reduction-credit system. That is, when an individual project results in emissions below what they would have been in the absence of the project, a credit — that may be sold to a source within a cap-and-trade system — is generated. But inevitably, this system raises the challenge inherent in the necessary comparison of actual emissions with what they would have been otherwise. The baseline is unobserved and fundamentally unobservable: what would have happened had the project not

been put in place. In fact, there is a natural tendency, because of economic incentives, to claim credits precisely for those projects which are most profitable, and hence would have been most likely to have been executed with or without the promise of credits. This is the so-called 'additionality problem'. It is a serious issue. Although there are ways of reducing this problem through restructuring and reform of the Clean Development Mechanism in the future (Keeler and Thompson 2008), this surely must be taken as one of the weaknesses of the Kyoto Protocol.

Finally, the Kyoto Protocol — with its five year time horizon (2008 to 2012) — represents a relatively short-term approach for what is fundamentally a long-term problem. This is because greenhouse gases have lag times in the atmosphere of decades to centuries. Furthermore, in order to encourage the magnitude of technological change that will be required to address seriously the threat of climate change, it will be necessary to send long-term signals to the private market for investment and significant technological change (Newell 2008).

Can the Kyoto protocol provide the way forward?

So, the Kyoto Protocol has been criticized. The overall costs are much greater than need be, due to the virtual exclusion of developing countries. By conservative estimates, the costs are four times the cost-effective level. Second, the agreement will generate trivial short-term climate benefits over the period 2008 to 2012, and fail to provide a long-term solution for this long-term, stock — not flow — environmental problem. Third, it is ironic that these insufficient short-term targets are actually excessively ambitious, in that they would foster premature capital obsolescence. They are particularly ambitious and costly for the United States, because of the Kyoto Protocol's base year of 1990 and the remarkable economic growth that took place in the United States subsequent to that year. The result is that the United States' apparently modest 7 per cent reduction target translates into an actual target of reducing emissions by 35 per cent compared with business-as-usual emissions. Thus, the Kyoto Protocol is too little, too fast. Not a very pleasing combination.

Alternative policy architectures for the post-Kyoto period

Despite its deficiencies, can the structure — the architecture — of the Kyoto Protocol provide the way forward? After all, the Protocol also has some very positive attributes, as I noted above. Whether one thinks the Kyoto Protocol was a good first step or a bad first step, everyone agrees that a second step is required. A way forward is required for the post-2012 period. With this in mind, we launched the Harvard Project on International Climate Agreements, which I co-direct with

Dr. Joseph Aldy of Resources for the Future, a think-tank located in Washington, DC. The Harvard Project is a global, multi-disciplinary effort to help identify the key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international policy architecture.[2]

We are drawing upon leading thinkers from academia, private industry, government, and non-governmental organizations around the world. Indeed, we have 28 research teams operating in Europe, the United States, China, India, Japan, and Australia. In addition to carrying out research, the Harvard Project has important outreach elements, which include our role as technical consultant to the Danish Prime Minister in his role as Incoming President of the Fifteenth Conference of the Parties to the Framework Convention on Climate Change, which will take place in Copenhagen in December 2009, where most people think — or at least hope — the post-Kyoto agreement will be struck or initiated.

Three categories of international policy architecture

In our book, *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World*, published by Cambridge University press in 2007, we describe potential post-Kyoto international policy architectures as falling within three principal categories: targets and timetables; harmonized national policies; and coordinated and unilateral national policies (Aldy and Stavins 2007). I will say a few words about each of these in turn.

This first category — targets and timetables — is the most familiar. At its heart is a centralized international agreement, top-down in form. This is the basic architecture underlying the Kyoto Protocol: essentially country-level quantitative emissions targets established over specified time frames. An example of an approach that would be within this realm of targets and timetables, but would address some of the perceived deficiencies of the Kyoto Protocol would be establishing targets that are formulas rather than numbers. With so-called 'growth targets', an individual country's target is a function of its gross domestic product (GDP) per capita, for example. As countries become more wealthy, their targets become more stringent. When and if countries face difficult economic periods, the stringency of their targets is automatically reduced.

[2] The Harvard Project consists of three stages: (1) discuss among key international policy constituencies the proposition that the nations of the world ought to explore a range of options for a successor to Kyoto; (2) conduct economic modelling and policy analysis to develop a small set of promising policy frameworks and key design elements; and (3) explore key design principles and alternative international policy architectures with domestic and international audiences.

Such an approach does not divide the world simply into two categories of countries, as in the Kyoto Protocol, but rather allows for a continuous differentiation among the countries of the world, thereby including all countries, and hence reducing if not eliminating the problem of emissions leakage, but still addressing the key criterion of distributional equity, and doing so in a more careful, more sophisticated manner than is done under the Kyoto Protocol.[3]

The second category, harmonized domestic policies, focuses more on national policy actions than on goals, and is less centralized than the first set of approaches. In this case, countries agree on similar domestic policies. One example of this, frequently discussed by academics, but receiving little favorable attention from policymakers, is a set of harmonized national carbon taxes.[4] With this approach, each participating country sets a domestic tax on the carbon content of fossil fuels, thereby achieving cost-effective control within its borders. The taxes are set by nations, and the revenue from taxes stays within the respective nations. The taxes could be revenue neutral, that is, returned to the economy through proportional cuts in other, presumably distortionary, taxes, such as those on labour and capital. In order to achieve global cost-effectiveness, the taxes would need to be set at the same level in all countries. This would presumably not be acceptable to the poorer countries of the world, and therefore significant financial transfers, that is, side payments, from the industrialized world to the developing world would need to accompany such a system of harmonized carbon taxes to make it distributionally equitable and hence politically feasible.[5]

The third and final category into which we sort potential post-Kyoto climate policy architectures is coordinated and unilateral national policies. These are the least centralized approaches of the three. They are essentially bottom-up approaches which rely on domestic politics to drive incentives for participation and compliance. Although these approaches are the least centralized, they should not be thought of as necessarily the least effective. Indeed, later in this paper, I describe one example of such a bottom-up approach — linking independent national and regional tradable permit systems — which holds promise of being a potentially effective approach.

3 In the Harvard Project on International Climate Agreements, one of the research initiatives focuses precisely on this approach, namely Frankel (2008).

4 Cooper (2008) has made such a proposal in the Harvard Project on International Climate Agreements.

5 For further discussion of equity considerations in the post-Kyoto climate regime, see Posner and Sunstein (2008). Issues of political feasibility are examined by Keohane and Raustiala (2008).

Summary of Kyoto and post-Kyoto architecture

The Kyoto Protocol has come into force without US participation, and without compliance by other countries, such as Canada, which likely will miss its Kyoto target by more than 30 per cent. In any event, the effect of the Kyoto Protocol on climate change would be trivial to nonexistent. At the same time, scientific and economic consensus point to the need for a credible international agreement that is scientifically sound, economically rational, and politically pragmatic. Various alternative policy architectures exist — some more promising than others — and some of these alternatives will be thrashed out in Copenhagen in December 2009 at the Fifteenth Conference of the Parties to the Framework Convention on Climate Change.

9.3 US climate policy outlook

While international discussions continue, a topic of great interest is how will the United States respond when it takes action to reduce net emissions of greenhouse gases. What means — what instruments of public policy — will the United States government use to bring about greenhouse gas reductions? Because of their great advantages in this realm, most attention has been focused on market-based instruments. Most proposals have featured tradable permit systems, in particular, cap-and-trade systems. This is partly because of theory, but mostly because of experience.

Market-based policy instruments in the United States

Cap-and-trade systems are an effective approach that can achieve environmental targets at minimum cost and send price signals for long-term technological change, which is absolutely key in the case of climate change policy. This is the approach used in the United States in the 1980s to phase out leaded gasoline from the market at savings of approximately $250 million per year, compared with a conventional command-and-control approach (Stavins 2003). It is also the approach used in the United States since 1995, to cut sulfur dioxide emissions by half, saving about $1 billion per year in compliance costs (Carlson et al. 2000). Likewise, this is the approach used by the European Union and its path-breaking emission trading scheme to reduce CO_2 emissions across the continent (Ellerman and Buchner 2007).[6] It is also the approach used by the northeastern states in the United States to control CO_2 emissions from power plants in the Regional Greenhouse Gas Initiative

6 See, also, Ellerman (2008), for an examination of the implications of the European system to a potential global regime.

(Stavins 2007). Finally, it is the same approach being considered in California to implement the aggressive climate goals of Assembly Bill 32 (Market Advisory Committee 2007).

Another market-based approach to climate change is a carbon tax, which has some real merits compared with the trading approach, but also some real disadvantages.[7] Also, importantly, there are hybrids of taxes and permits, which combine some of the positive elements of each (Stavins 2007). The political attention in the United States, however, has been focused almost exclusively on the cap-and-trade approach.

A US cap-and-trade system

The key merits of a well-designed cap-and-trade system for climate change in the United States are as follows.[8] First, this approach can provide cost effectiveness, while achieving meaningful reductions in greenhouse gas emissions levels. Second, it offers an easy means of compensating for the inevitably unequal burdens imposed by a climate policy. This can be done through free allocation of allowances or through returning revenues generated by an auction of allowances. Third, the overall performance of a cap-and-trade system is unlikely to be degraded by political forces, in contrast to carbon taxes. Fourth, this approach has a history of successful adoption and implementation. And fifth and very importantly, it provides a straightforward means to harmonize with other countries' climate policies.

There are a considerable number of proposals for cap-and-trade systems of various design in both the Senate and the House of Representatives of the US Congress. The most prominent of these — the Lieberman-Warner legislation in the Senate — utilizes a fundamentally upstream, economy-wide cap-and-trade system with a set of targets over time which are approximately equivalent to meeting the US Kyoto Protocol target level in 2020, rather than in 2008–2012, as intended under the Protocol itself. The new Presidential administration and the new Congress in 2009 may move in this direction or some other, although real action may be delayed to 2010 or even later, due to US and world economic conditions. But, in any event, further action in the United States will not mean anything in the absence of some sort of meaningful global action, and so I return to the global policy context.

[7] For a comparison of taxes and cap-and-trade for CO_2, see Stavins (2007).

[8] For further discussion of a meaningful, upstream, economy-wide cap-and-trade system for the United States, see Stavins (2007), produced for the Hamilton Project at the Brookings Institution.

What will the future hold for US participation in an international climate agreement?

The Bush administration's announced plan of 'slow, stop, and reverse' emissions makes basic sense, but dates and targets are required for the 'stop and reverse'. Also, the plan's embrace — in principle — of market-based instruments is positive, but a real cap-and-trade system is required, not simply voluntary programs. What has been missing most from the Bush administration's approach to climate change has been action, if not leadership, in the international domain. President Bush appropriately criticized the Kyoto Protocol as a flawed international approach, but what was absent for many years was the administration's proposed alternative. In its final years in office, the administration has made movements in that direction with its series of meetings among the major economies of the world, although this process appears to have been too little, too late.

What about a future Democratic administration? First of all, it is important to keep in mind the vote in the United States Senate on the Byrd-Hagel Resolution in the summer of 1997 leading up to the Kyoto Protocol. Many people, particularly outside of the United States, seem to think that opposition to the approach embodied in the Kyoto Protocol has been partisan in the United States. But the Byrd-Hagel Resolution, which indicated that the United States Senate would not ratify an agreement which did not provide for meaningful action by key developing countries, was passed by a vote of 95 to 0. President Clinton did not submit the Kyoto Protocol to the US Senate for ratification, nor would Vice President Gore had he been elected President, nor would Senator Kerry had he been elected President. Likewise, this year's Democratic candidate for President, Senator Barack Obama, has indicated that he is not supportive of the Kyoto Protocol (as has Senator John McCain, the Republican candidate).

Thus, no matter who occupies the White House in the coming years, a Kyoto Protocol type treaty will not be submitted to the United States Senate for ratification (and if it were, it would not be ratified). State and regional initiatives in the United States will advance, and we are likely to see a meaningful national program — a cap-and-trade system — by 2010 or 2011 that will be endorsed and signed into law by the President.

The key remaining question is when will the United States begin to work with others on a better international agreement, and the answer is that this will happen in 2009 no matter who is elected President. Two important caveats, however, should be added to this claim. If the economy is mired in a deep and prolonged recession, or if there is a major — or even minor — terrorist incident on US soil, then

consideration both of domestic climate policy, as well as US activity on the international front will be decreased and delayed.

9.4 An emerging post-Kyoto climate policy architecture

Interestingly, the new international policy architecture may be evolving on its own, based upon the undeniable reality that tradable permit systems are emerging worldwide as the favored national and regional approach.[9] Among the greenhouse gas tradable permit systems that have emerged are: the European Union's emission trading scheme; the Regional Greenhouse Gas Initiative in the northeastern United States; and systems in Norway, Switzerland, and other nations; plus a global emission-reduction-credit system, the Clean Development Mechanism.

Furthermore, cap-and-trade systems now appear highly likely to emerge as the chosen approach to reducing greenhouse gas emissions in an additional set of industrialized countries. Even before the change of government in late 2007, Australia had set itself on a course to develop a cap-and-trade system to achieve ambitious reductions in carbon dioxide emissions. Canada, which is likely to miss its Kyoto target, will most likely adopt a cap-and-trade approach when and if it attempts to move towards its Kyoto targets, or at least for the post-Kyoto years. Also, Japan, which had long indicated its interests lie in a sectoral approach to lowering greenhouse gas emissions, indicated in the summer of 2008, that it will develop a cap-and-trade system to reduce greenhouse gas emissions. And finally, within the United States, it appears likely that the United States Congress will adopt a comprehensive, upstream cap-and-trade system for carbon dioxide and possibly other greenhouse gas emissions in 2009, 2010, or at the latest, 2011. In addition, in California, a cap-and-trade system is being developed as a central part of the state's portfolio of approaches it will use to achieve the ambitious targets set out in Assembly Bill 32 (AB 32).

International linkage — incentives, merits, and concerns

Because of the emergence of this diverse set of cap-and-trade systems and emission-reduction-credits systems around the world, there is now increased attention and increased pressure — both from governments and from the business community — to link these systems. For example, in late August 2008, Australian Prime Minister Rudd and New Zealand Prime Minister Clark agreed that it was

[9] This section of the paper draws on Jaffe and Stavins (2008), prepared for the Harvard Project on International Climate Agreements.

important for both countries to design their respective climate policies (cap-and-trade systems) so that 'there are no barriers to linking the schemes'.

By linkage, I refer to direct or indirect connections among tradable permit systems through unilateral or bilateral recognition of allowances or permits. The benefits of linkage are, first of all, significant cost savings. These cost savings are brought about by linkage in the same way that a cap-and-trade system reduces costs, compared with separate regulation of sources. In addition, linkage across countries of one tradable permit system with another reduces overall transaction costs, reduces market power (which can be a problem in such systems), and reduces overall price volatility.

There are also some legitimate concerns about linkage, and some of these are very reasonable concerns. Most important is the automatic propagation of cost-containment design elements, that is, banking, borrowing, and safety valves. If one cap-and-trade system has a safety valve, for example, and another system does not have a safety valve, and the two systems are directly linked, then the result will be that both systems will now share the safety valve. Given that the European Union seems opposed to using a safety valve in its emissions trading scheme, and given that it appears quite likely that a safety valve will be a key element of the future emissions trading system in the United States, this automatic propagation of cost containment design elements is a serious concern.

More broadly, as a result of linkage, nations have reduced control over allowance prices, emissions impacts, and other consequences of their systems. However, it is important to recognize that this loss of control over domestic prices and other effects as a result of linking is simply a special case of the general proposition that as a result of engaging in international trade through an open economy, nations lose some degree of control over domestic prices. Indeed, the only way for a nation to have complete control over the prices within its borders, whether those be the prices of shoes or emissions allowances, is to close a country's borders to international trade, thereby impoverishing one's own economy and citizens.

Nevertheless, concerns about automatic propagation of design elements are significant, and these mean that advance harmonization of some design elements will be necessary prior to direct linking of cap-and-trade systems across international borders. Such requirements to harmonize systems before linking mean that two-way, direct links between cap-and-trade systems will be challenging.

An emerging post-Kyoto architecture

Interestingly, there are ways to gain the benefits from linkage of cap-and-trade systems, but without the downside of requiring advance harmonization. If a cap-and-trade system links with an emission-reduction-credit system, such as the Clean Development Mechanism, that linkage is of necessity a one-way link, since an emission-reduction-credit system has no use for allowances. If two cap-and-trade systems both link with the same emission-reduction-credits system, then the two cap-and-trade systems are indirectly linked with one another. All of the benefits of linkage occur: cost-effectiveness for the pair or set of cap-and-trade systems; and more liquid markets that reduce transaction costs, market power, and price volatility. But the downside of automatic propagation of key design elements from one cap-and-trade system to another does not occur when the linkage between the systems is indirect through an emission-reduction-credit system.

Such indirect linkage of cap-and-trade systems through the CDM is already occurring, because virtually all cap-and-trade systems that are in place, as well as those that are planned or contemplated, allow for offsets (to some degree) from the CDM to be used to meet domestic obligations. Thus, this kind of linkage among the world's cap-and-trade systems may already be evolving into the *de facto*, if not the *de jure*, post-Kyoto international climate policy architecture.

Let me emphasize that I am not recommending this particular post-Kyoto architecture as the best approach. Rather, I highlight it because it is an interesting departure from the typical centralized, targets-and-timetables approach that we typically think of as serving as the logical successor to the Kyoto Protocol, and because it may be evolving spontaneously. It is being examined in just one of the 28 research initiatives of the Harvard Project on International Climate Agreements (Jaffe and Stavins 2008).

9.5 Conclusions

National governments are pursuing a variety of individual climate policies. Europe has called for emissions to be 20 per cent below the 1990 level by the year 2020. The target likely to emerge in the United States by 2010 is 6 per cent to 7 per cent below 1990 emissions by the year 2020, which is similar to current European Union action, although it is less then stated European aspirations.

Cap-and-trade systems are clearly emerging as the preferred approach to address climate change in most countries of the industrialized world. And there is continued, very strong interest from developing countries in the Clean Development Mechanism. The United States will likely be much more aggressive in 2009 with a

new Presidential administration and Congress in place, both with regard to domestic action and with regard to US participation, indeed, leadership, in international negotiations regarding the post-Kyoto climate regime.

Even if the post-Kyoto international policy agreement is not decided in Copenhagen in December 2009, serious negotiations will at least be initiated at that time. Although it is not clear what all of the elements of that agreement will be, some key features are beginning to emerge. The key question, of course, is what architecture and what circumstances will bring China and other key developing countries into the coalition of action.

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10 Institutions and incentives for promoting better policies and outcomes: challenges of achieving environmental outcomes that require coordination across multiple jurisdictions

Wendy Craik and James Cleaver
Murray–Darling Basin Commission

Abstract

The Murray–Darling Basin Commission (MDBC) is an unincorporated joint venture involving six governments. Its mandate is to provide coordinated planning and management of environmental (chiefly water) resources in the Murray–Darling Basin. With a history of over 90 years, the MDBC has evolved from an engineering-focused, state-based organisation for river management and operation, mainly for consumption and navigation. It is now a natural resource management organisation operating in a politically-charged environment of fundamentally reducing water availability and increasingly centralised control and funding. The mandate and structure of MDBC and decision-making arrangements have proved sufficiently robust over the longer term, where lengthy negotiations preceded significant decisions. This may be much less satisfactory in an environment of unforeseen and rapidly reducing water availability, a rapidly moving media cycle and highly politically-sensitive issues. The institutional arrangements and factors which have underpinned the organisation's progress to date are outlined with particular emphasis on one of the MDBC's major programs — The Living Murray (an environmental water recovery program).

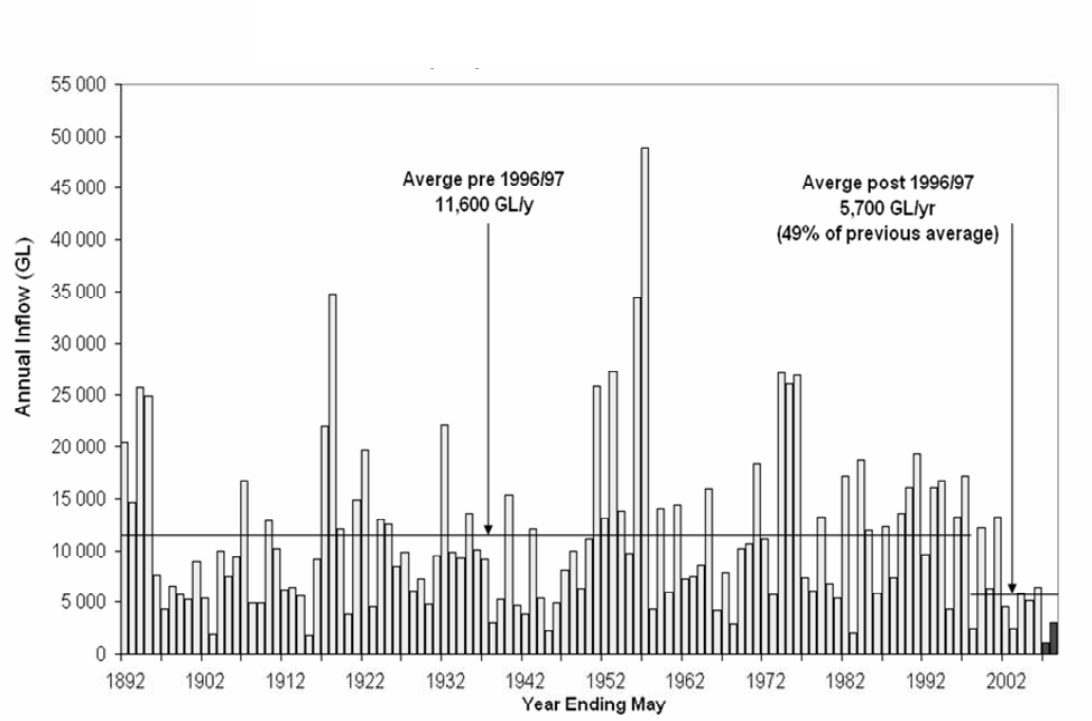
10.1 Geography and water use in the Murray–Darling Basin

The MDB covers 14 per cent of south eastern Australia, approximately one million square kilometres. Two million people live in the Basin and are dependent on it for their drinking water, as are another 1.2 million residents of the city of Adelaide, which is outside the Basin but draws its main water supply from the Murray River. Long-term average rainfall in the Basin is approximately 500 000 GL per annum, yet the vast majority does not flow into rivers. Long-term average annual runoff is 24 300 GL (5 per cent of rainfall) with approximately 11 400 GL of long-term average extractions. In the River Murray system, long-term average runoff is 11 600 GL (pre-1996–97). Conditions have, however, been significantly drier in recent years (figure 10.1). The driest year on record occurred in 2006–07 with 1040 GL of inflows, (less than 60 per cent of the previous recorded minimum inflow).

The MDB accounts for 40 per cent of the gross value of Australia's agricultural output. Only 2 per cent of MDB land is irrigated and yet this produces 70 per cent of the gross value of Australia's irrigated agricultural output. Water use in the Basin has reflected the reliability of its supply. Annual cropping, such as cotton and grain, suits the episodic water availability of the Northern Basin (as a result of extremely variable rainfall and small storages). Consequently, Northern Basin permanent horticulture relies mostly on groundwater. The Southern (Murray) system, with a historically more reliable surface water supply, supports significant permanent horticulture as well as annual cropping and irrigated pasture, including for the dairy industry.

Long-term average water diversion in the Murray system is approximately 4068 GL. There is, however, a total of 5280 GL of Murray River water entitlements. Of these, approximately 2487 GL are high-reliability water entitlements, and approximately 2793 GL are low-reliability water entitlements. The attributes of high- and low- reliability irrigation water entitlements vary between states and river valleys. On the Murray River, the long-term average allocation against the high reliability Victorian entitlement, called a 'water right', is 99 per cent. The long-term average allocation against the low-reliability Victorian entitlement, called 'sales water' is 80 per cent. Approximately 350 GL of Murray River water is used by urban and domestic consumers each year. The largest consumer of this water is the city of Adelaide (260 GL), near the end of the Murray River. Delivery of 350 GL of water for human consumption requires an extra 1000 GL approximately.

Figure 10.1 **River Murray system inflows 1891–2008**



10.2 A brief historical perspective

The MDBC is an unincorporated joint venture of four States (New South Wales, South Australia, Victoria, Queensland), the ACT and the Commonwealth Government. It was first established as the River Murray Commission in 1914, following prolonged debate between the three southern States and the Commonwealth at the time of Federation, driven by severe drought and concern about navigation and water security. Constitutional control of navigation and trade lay with the Commonwealth, while control of water lay with each State, thus the underlying challenge of reaching water management outcomes in the interest of the Basin as a whole has its genesis in the Australian Constitution.

The current Murray–Darling Basin Agreement is reflected in parallel legislation of each partner government. The Agreement and subsequent decisions of the Ministerial Council and the Commission provide the legal basis under which the Commission operates. The only sanction is 'name and shame'. Unresolved disputes are ultimately to be resolved by a Tasmanian judge.

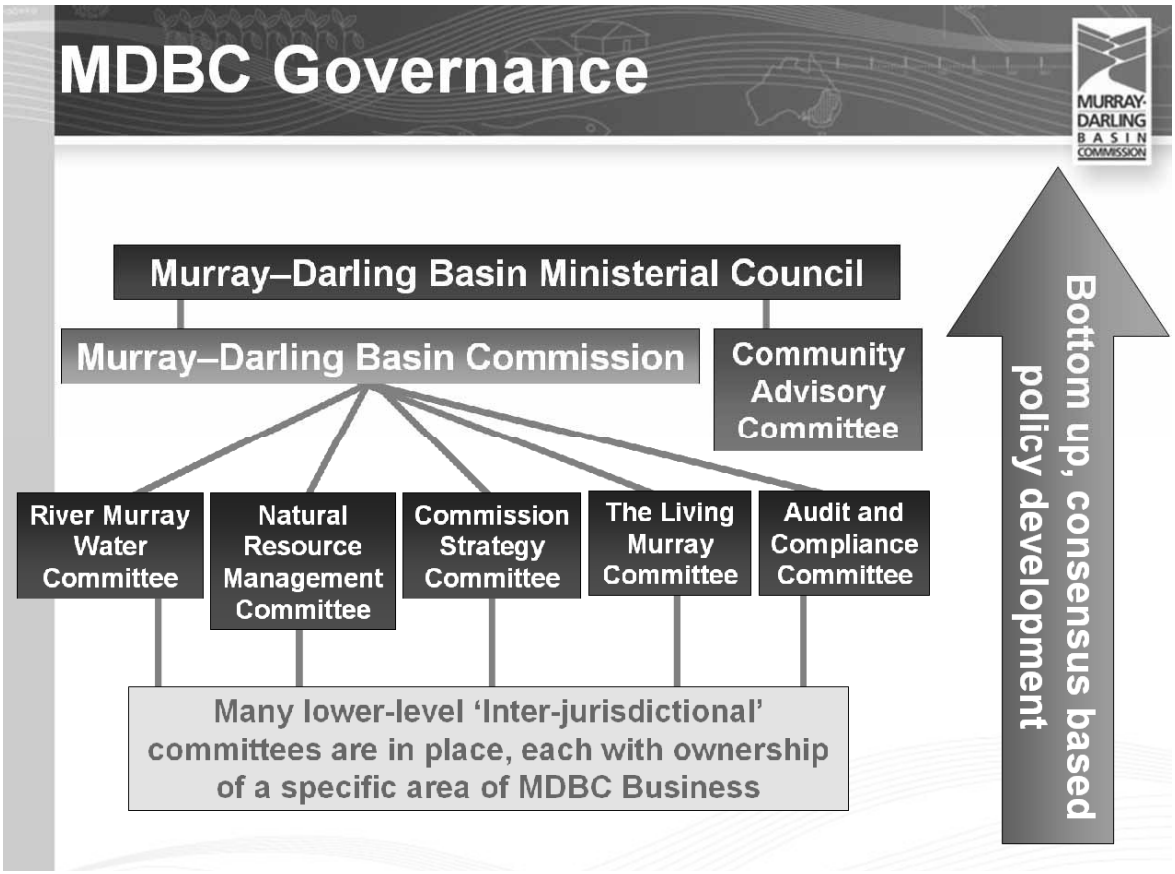
10.3 The role and structure of the MDBC

The MDBC has evolved from an agency entrusted with directing the management and operation of water storages — from Dartmouth Dam to the Murray Mouth and including the lower Darling — into a broader range of responsibilities, including environmental management and planning for the future. Its mandate, captured in the Murray–Darling Basin Agreement, is to coordinate effective planning and management of natural resources in the Murray–Darling Basin. Salinity, native fish, interstate water trade and water policy development are examples of other areas into which the MDBC's role has expanded. A Ministerial Council and a Commission of jurisdictional representatives, chaired by an independent president, oversee the organisation. The MDBC office provides the secretariat for the Ministerial Council and Commission, including administrative services, technical advice, project funding and acting as a program coordinator and facilitator of the partner governments, which deliver the on-ground projects.

An extensive network of interjurisdictional committees has developed beneath the Ministerial Council and Commission (figure 10.2), each with a technical focus on specific areas of MDBC business. Whilst these committees are not decision-making, they underpin the MDBC's inclusive and consensus-based approach by evaluating options at the detailed level and making robust recommendations to the Commission and Ministerial Council which maintain a more strategic focus. The committees and working groups also provide strong links between the policy development and on-ground project implementation of Commission and Ministerial Council initiatives. This process can be time-consuming, but it leads to far quicker and more robust decision making by the Commission and Ministerial Council. A Community Advisory Committee provides advice to both the Council and Commission and individuals participate in the advisory committees.

Under the MDB Agreement, decisions need to be unanimous to be implemented. Achieving unanimity of decisions that initiate significant new policies can be time-consuming. The original River Murray Agreement took 22 years to negotiate, and both the Cap (a limit on surface water diversions) and The Living Murray First Step each took about a decade to resolve. Once taken, however, the decisions are durable. Although the MDBC decision-making progress has been the subject of significant domestic criticism because of its lengthy gestation periods, it is highly acclaimed internationally as a successful model.

Figure 10.2 **Murray–Darling Basin Commission governance structure**



The success of the MDBC as a coordinator and facilitator is dependent on a number of factors:

- its decisions are unanimous
- jurisdictions jointly fund MDBC programs, including those implemented by the States
- the MDBC's 'river operation' and hydrological modelling functions afford traction to the environmental and natural resource management programs, policies and outcomes, which are enhanced through the cooperation and integration of 'river operations' and natural resource management programs
- the MDBC shares all information with all jurisdictions
- the MDBC fosters cooperation and collaboration with jurisdictional partners, through strong links with jurisdictions' natural resource management agencies. Jurisdictions are engaged in policy development, and the design and implementation of programs at all levels
- the MDBC has a high level of technical expertise

- the MDBC has a basin-wide focus, as opposed to the jurisdiction-centric focus of particular governments
- the MDBC commissions independent audits of all its major programs with agreed auditors.

10.4 Achieving environmental outcomes

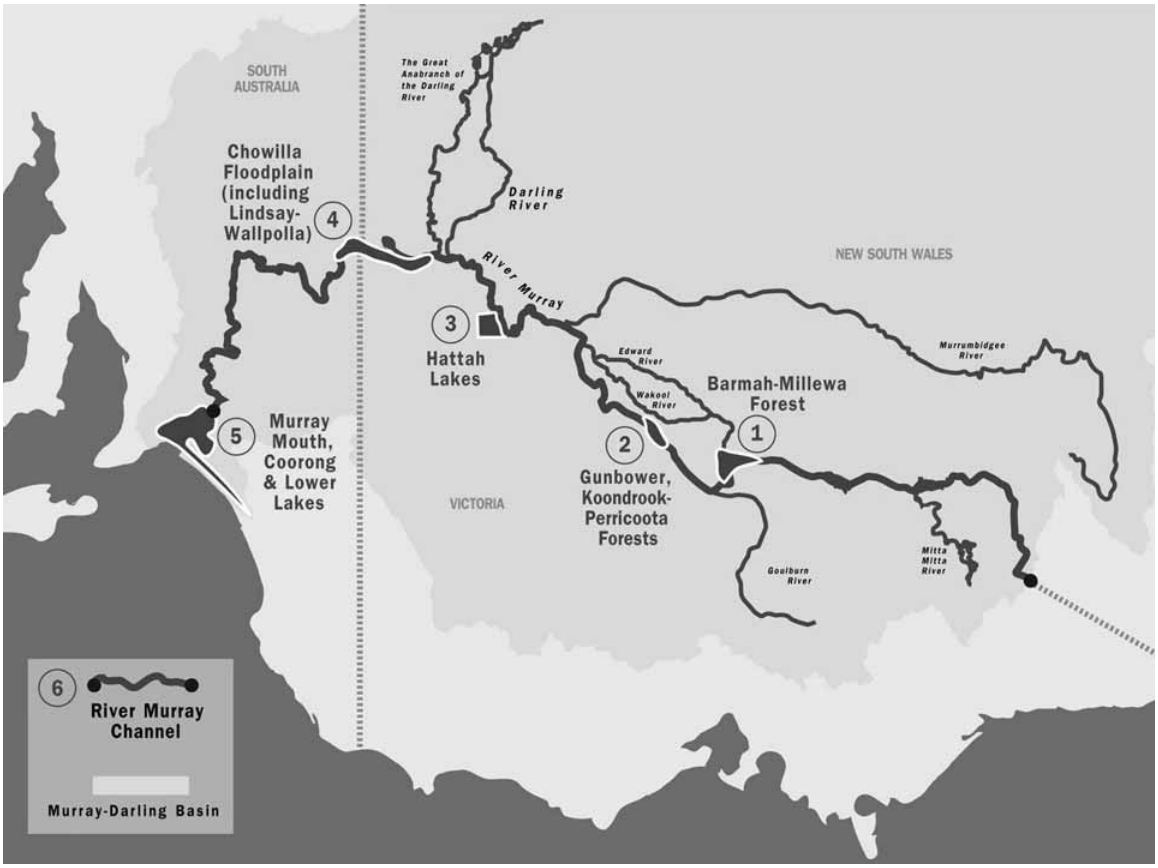
In 2002, in response to increasing evidence of environmental degradation in the Murray system, the MDB Ministerial Council requested an independent review and assessment of options to address environmental decline, combined with a comprehensive process of industry and community engagement. Since it was understood that overallocation of water (coupled with unnatural river operation) was a significant cause of environmental degradation, the independent review assessed the likely impacts of three water-recovery volumes: 350 GL, 750 GL and 1500 GL.

Significant community concern, particularly from irrigators about the method of water recovery, led the governments of the Murray system (all jurisdictions except Queensland) to provide, in August 2003, $500 million over five years for water recovery in the Murray. The Commonwealth Government contributed a further $300 million in June 2006. Strong disagreement about the value of volumetric water recovery targets alone resulted in an approach that led to the development of objectives for agreed individual Icon Environmental Sites identified by the Commission. The objectives are specific measures of fish, birds and vegetation, which provide a tangible assessment of Icon Site condition.

In November 2003, the MDB Ministerial Council took the First Step Decision to recover 500 GL of water and to achieve environmental objectives at six Icon Sites along the Murray (figure 10.3). The program was called The Living Murray (TLM) 'First Step' because it was understood to be the beginning of the river restoration process. The First Step was underpinned by an Intergovernmental Agreement (IGA), signed in June 2004, binding the governments to the objectives, water targets and financial commitments of TLM, and providing a deadline of June 2009.

Under TLM, the MDBC coordinates five programs: (1) recovering water for environmental use; (2) construction of environmental works and measures (structures and actions which facilitate the flow of water); (3) delivering water for the environment; (4) monitoring ecological outcomes; and (5) community engagement including Indigenous partnerships. The institutions, incentives and features of each program are described in order to identify success factors of multi-jurisdictional coordination.

Figure 10.3 **Living Murray Icon Sites**



Water recovery

The Living Murray First Step aims to recover 500 GL of water to improve the health of the Murray system, with an initial focus on the Icon Sites. The Southern Basin jurisdictions all contribute to the water recovery target: New South Wales (249 GL); Victoria (214 GL); South Australia (35 GL); and the Australian Capital Territory (2 GL). The targets reflect each State's consumption. The water recovery targets are a firm commitment, agreed in TLM IGA. Methods of water recovery and priorities were determined by the Ministerial Council, hence the initial focus on infrastructure over water purchases.

It is a necessarily long process to recover water, requiring a robust assessment of the volume, reliability and ultimately cost-effectiveness ($ per ML). The water recovery institutional arrangements have been established to recover cost-effective permanent water to achieve environmental objectives at the six Icon Sites. This objective is achieved by: a committee process that fosters cooperation and jurisdictional ownership of the outcomes; the expertise of the MDBC and

jurisdictional staff; and an independent review at the completion of the process. The Ministerial Council considers the outcomes of the independent review and agrees the amount that will be credited on the Environmental Water Register. These amounts contribute to those volumetric targets to which each jurisdictional government is committed.

Initially, a number of cost-effective infrastructure projects were available and there was some community opposition to market-based water recovery. But infrastructure-based water recovery projects are generally increasing in cost $ per ML, especially against the market value of a comparable water entitlement. In 2007, the MDBC Community Advisory Committee's strong statement in support of developing market-based water recovery measures was a factor in the MDB Ministerial Council's decision to pilot an environmental water purchase of 20 GL. The environmental water purchase was very successful, closing several weeks early due to high interest and over-subscription of the 20 GL target. The pilot identified a number of risks associated with water markets, including those associated with probity and due diligence.

There are currently approximately 400 GL in projects on the water recovery Eligible Measures Register. Water entitlements amounting to 133 GL have been transferred to TLM environmental water register. The significant increase in the price of permanent water in recent years is another factor that must be taken into account; infrastructure projects that were previously deemed too expensive may be reconsidered.

Construction of environmental works and measures

The strategic placement of regulators, channels and levies on the Icon Site floodplain allows more efficient delivery of TLM water to achieve environmental objectives. The Environmental Works and Measures Program (EWMP) assesses several criteria in order to achieve the greatest environmental return from investment at each of the Icon Sites, including: water requirements; cost, area of inundation; construction issues; and environmental outcomes. 'Objective' measures of cost and inundation provide a relatively easy comparison between projects and outcomes. The Taskforce also, however, looks for 'subjective' analysis of overall environmental outcomes that can be expected from the project.

Figure 10.4 **The MDBC environmental water purchase was positively reported in the media**

Farmers rush to cash in rights

Selina Mitchell

FARMERS have rushed to cash in their water entitlements, selling 20 billion litres worth under a scheme that aims to revive the Murray River.

The call for water sales has closed four weeks into an 11-week pilot being conducted by the Murray-Darling Basin Commission. About 180 irrigators have offered their water for sale, for up to $3500 a megalitre.

The popularity of the pilot is in stark contrast to a failed attempt by the Howard Government to buy water from irrigators for the environment, undertaken earlier this year. The failed scheme relied on farmers finding extra water through efficiency measures such as fixing leaky pipes, but the commission pilot simply invited irrigators to sell water entitlements at market prices.

It is this less complex purchase system that is likely to be used to deal with over-allocation under a $10 billion federal takeover of the Murray-Darling now before parliament.

The water purchased in the pilot will be used to address environmental issues at wetlands and red gum forests along the Murray.

An increasing number of irrigators are investigating the sale of their entitlements because of the drought, experts said yesterday. "They need the cash and as the dry continues, more and more people will want to sell," the managing director of Percat Water, Bob O'Brien, said.

According to the August drought report, storages in the Murray-Darling Basin are about 2000 billion litres less than at this time last year.

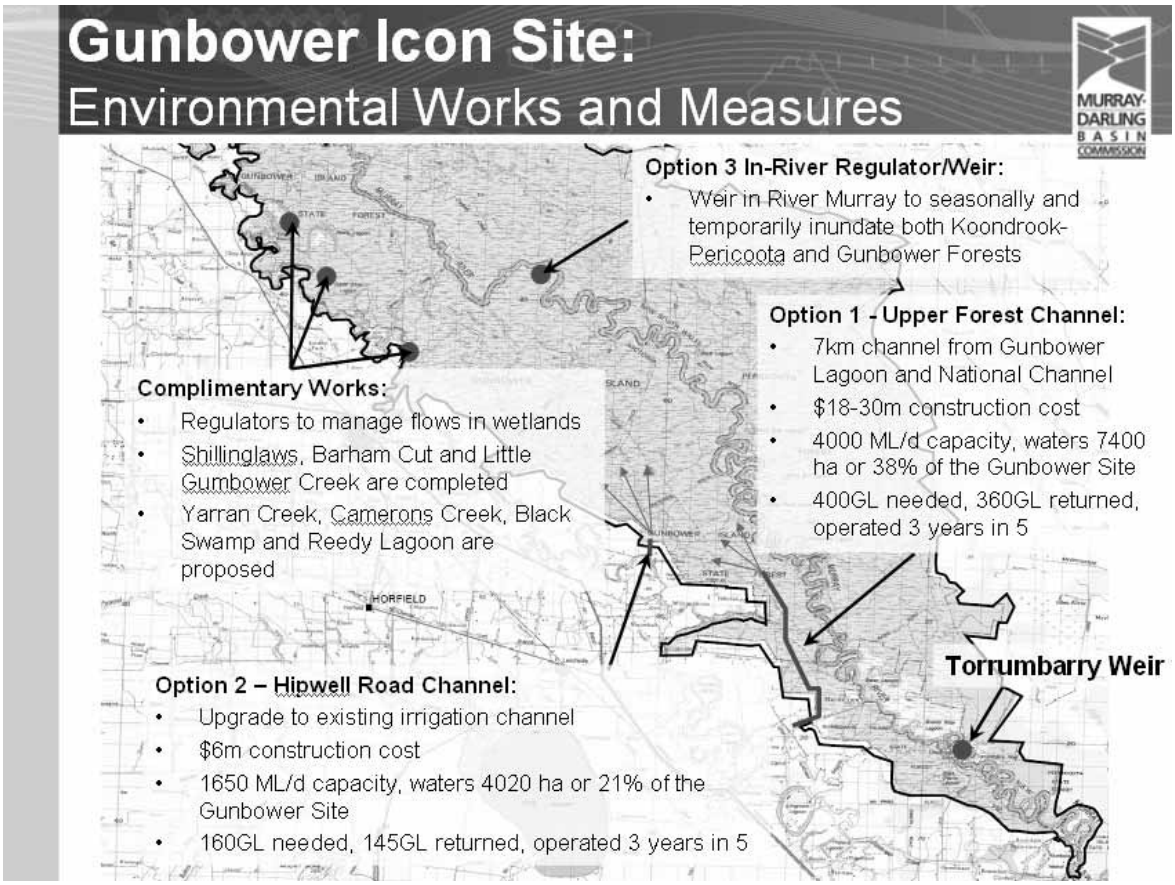
To optimise these criteria, the MDBC coordinates a 'blueprint and prioritisation' process — through the multijurisdictional 'technical' taskforce and more 'strategic' working group (under the auspices of the Commission and Ministerial Council) — which informs a holistic assessment of the projects' value for money in achieving Icon Site objectives. During this process, strong links are maintained with the partner governments, who deliver the on-ground component of the projects, and other MDBC programs. The Native Fish Strategy (to assess the impact of the structure on native fish, including the need for a fishway in floodplain works), Basin Salinity Management Strategy (to assess the impact of flooding on salt mobilisation) and River Murray Water Asset Managers (to provide feedback on design and construction, as well as ongoing operation and maintenance) are all engaged in the process.

An example is in the Gunbower Forest, where three works options vary in terms of cost, complexity, water consumption and inundation (figure 10.5).

Environmental water delivery

The environmental water delivery program is an umbrella program of TLM. It combines long-term planning to achieve the ecological objectives at each Icon Site, with an annual process to allocate available environmental water between Icon Sites.

Figure 10.5 **Options for works at the Gunbower, Koondrook, Pericoota Icon Site**



The mechanisms for long-term planning are the Murray System level Environmental Watering Plan and the Icon Site-level Environmental Management Plans, both of which are approved annually by Commission. The Environmental Watering Plan creates a framework for short-term decision making and priority-setting, which maximises the environmental outcomes across all Icon Sites. The Icon Site Environmental Management Plans provide the building blocks necessary to achieve specific Icon Site objectives. Computer modelling of environmental water delivery options is the next key input into the Icon Site Environmental Management Plans. The partner governments have developed Icon Site-specific models, which combine inundation, water depth, frequency and duration of flooding. These models are used to canvass management options for all sites, including by estimating the likely ecological outcomes from alternative flooding regimes, comparing various potential locations of environmental works on the floodplain and priority water recovery measures.

Short-term planning is conducted through the Annual Watering Plan process. The Annual Watering Plan allocates available water to Icon Sites on a needs basis according to the framework set out by the Environmental Watering Plan. This process recognises that sharing the available water equally between states will not necessarily achieve the best outcomes. The Annual Watering Plan begins with a bidding process, whereby each State Icon Site manager submits environmental watering proposals for the coming year. The MDBC supports a multijurisdictional committee, which ranks each proposal against the agreed set of weighted eligibility criteria. The result is a list of watering proposals approved by the MDBC which is sequentially implemented. The MDBC Chief Executive is delegated to approve a reordering of the list in the event of changed circumstances. But if new priorities emerge, which are not already on the list, higher level approval from the MDBC is required.

As a result of extreme dry conditions, there has been very little water available for environmental purposes (approximately 16 GL in 2007-08) and many Icon Sites are in severe stress. The MDBC has approved an interim set of ecological objectives, a clear and robust process to guide environmental water allocation, while extreme dry conditions continue. These are to: avoid loss of threatened species; avoid irretrievable damage or catastrophic events; and provide refuges to allow re-colonisation following drought.

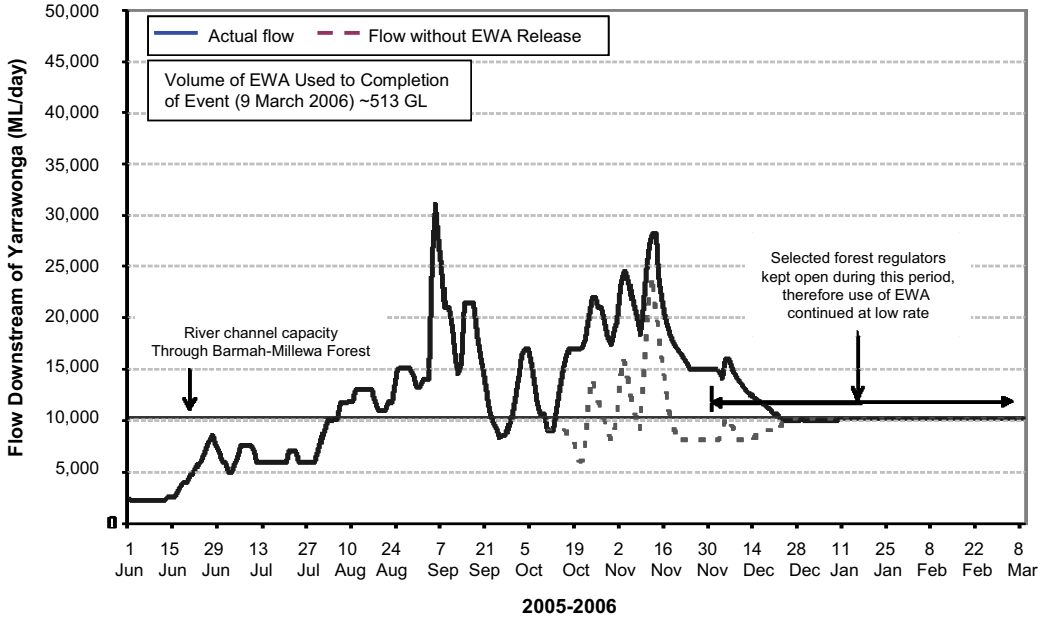
Environmental water should be delivered to the Icon Site as efficiently as possible. 'Piggybacking' an environmental flow on natural high flow is often the most efficient way to deliver water. For this purpose, the MDBC Environmental Manager is delegated to direct the release of environmental water for an approved (by the annual watering plan) purpose. In October 2005, an opportunity was identified to coordinate an environmental release from the Hume Dam with an unregulated high flow from the Ovens River. Strong links between river operations and environmental managers, both in the MDBC and partner governments, together with flexible arrangements to authorise the release of environmental water, achieved significantly greater flooding in the Barmah–Millewa Forest than would have been achieved from the environmental flows alone (figure 10.6).

Monitoring environmental outcomes

The purpose of TLM environmental monitoring program is to evaluate the progress toward the Ministerial Council-agreed Icon Site ecological objectives. TLM aims to put into practice the principles of adaptive management by using consistent methodologies for monitoring, and by establishing strong links between environmental monitoring outcomes and decision making. This will maximise

Figure 10.6 **Barmah-Millewa Forest environmental flow event, 2005–2006**

Actual flow in River Murray downstream of Yarrawonga versus probable flow without environmental release



feedback into future management practices and thereby optimise environmental outcomes.

Specific ecological objectives have been developed for each Icon Site, which address fish, birds and vegetation, for example:

- successful breeding of thousands of colonial water birds in at least three years in ten (at the Barmah–Millewa Forest)
- thirty per cent of River Red Gum forest in healthy condition (at the Gunbower and Koondrook-Perricoota Forests)
- increasing the population size and breeding events of the endangered Murray Hardyhead, Australian Smelt, Gudgeons and other wetland fish (at the Hattah Lakes).

These ecological objectives are the basis of the environmental monitoring program. In order to be effective, they must be clearly defined and consistently monitored. The MDBC has developed a monitoring framework called the Outcomes Evaluation

Framework (OEF). The OEF has been agreed by the partner governments and sets out monitoring, evaluation and reporting arrangements across the Icon Sites.

The monitoring framework gathers information at a number of resolutions:

- River Murray system-scale and Icon Site condition monitoring are designed to monitor the effectiveness of TLM at the Murray System scale and Icon Site scale respectively, during the implementation of the First Step decision.
- Intervention monitoring is designed to monitor the effectiveness of individual management interventions at the Icon Site-scale, for example the decision to pump water into an Icon Site.
- Compliance monitoring determines if management actions, particularly water delivery, are being implemented as agreed.

Collecting and analysing data at these resolutions is a key input into future decision making and the objective of adaptive management. Through the multijurisdictional Environmental Monitoring Taskforce, the MDBC coordinates analysis of the data into a monitoring synthesis, which is submitted to decision makers to inform future watering priorities and decisions.

Community consultation

TLM coordinates two forums for community and Indigenous consultation: the Community Reference Group (CRG) and Indigenous Partnerships Program (IPP). These forums aim to provide community and Indigenous input into decision-making processes, as well as to increase awareness, understanding and support for TLM programs. States also coordinate individual Icon Site consultation groups.

The IPP is beginning to engage Indigenous people in the management of Icon Sites through a process called ‘use and occupancy mapping’. The objective is to map Indigenous peoples’ contemporary relationship with the Icon Site. As part of an IPP pilot project, use and occupancy maps have been produced at two Icon Sites.

10.5 Success factors for achieving environmental results

TLM is a holistic process to maximise the environmental outcomes at the six Icon Sites. The program’s institutions and procedures have been established with a view to identifying the most cost-effective and water-efficient ways to achieve real environmental benefits at sites across multiple jurisdictions. It is proposed that the

success factors for achieving environmental outcomes in a multijurisdictional environment are:

- *Unanimity in decision making*: without agreement from all implementing parties, progress can be slowed by passive non-implementation.
- *Agreeing to clear objectives and targets, and monitoring and reporting against them*: TLM sets out agreed criteria for funding and decision making to achieve clear and tangible Icon Site-scale targets. These are underpinned by agreed approaches for monitoring and reporting. Institutionalised links between environmental monitoring and other TLM programs provide feedback on the effectiveness of individual management actions into future decisions.
- *Initial clarity of objectives and targets* rather than prescriptive process description has proven helpful in making progress.
- *Setting clear roles and responsibilities*: all TLM programs combine MDBC coordination with jurisdictional on-ground delivery of projects that often span state borders. Clear definition of roles and responsibilities is critical. TLM IGA sets out the roles and responsibilities of the partner governments with regard to objectives, targets and funding arrangements. Governance approaches have been designed to deliver against these both in the short and long term.
- *Robust processes*: throughout the long-term planning processes the TLM committees and independent reviewers canvass all options on the trade-offs required to optimise systemwide outcomes. Unanimous agreement is required throughout the committee process. Whilst this requirement may slow some decisions, a more robust outcome is achieved in the longer term. Clarity in objectives and targets, roles and responsibilities, and decision-making criteria is an important tactic against 'filibustering' in forums that require unanimity.
- *All partners make a financial contribution*: TLM IGA sets out the financial commitments of all partner governments to the programs. The programs benefit from a high level of interjurisdictional ownership and engagement with the decision-making process because all parties have a financial stake in the outcomes.
- *Adequate resourcing*: since 2006 the MDBC has had sufficient resources to enable it to provide adequate staffing and construction funds to meet objectives. As part of the coordination process, the Commission has increasingly funded jurisdictional project officers for major programs. This helps ensure that state resources are available to undertake the necessary work.
- *Independent review*: the MDBC coordinates independent reviews of many TLM work programs, including individual water-recovery measures and cost-time delivery models for EWMP. An annual whole-of-program independent audit is also conducted, which brings together all the elements of TLM, assessing issues

and risks to the delivery of the Icon Site objectives. These annual audits are presented to the Ministerial Council and made public.

- *Maximising inter-jurisdictional and interdisciplinary cooperation*: the MDBC coordinates a series of committees that support the MDB Commission and Ministerial Council. The committees provide technical and policy input, weigh up different opinions and priorities as well as providing authorisation of projects decisions of escalating cost and consequence.

10.6 Meeting future challenges

TLM was established as a river restoration project to address the impacts of long-term overallocation in the Murray System. Given an initial low level of detail and the implication of low water availability at the time of the First Step decision, significant progress has been made in the past four years. This paper describes practical institutional processes and incentives that have been implemented, using the example of achieving TLM objectives, and indicates broad success factors for achieving environmental outcomes in a multijurisdictional setting. Severe drought and critical water shortage have exacerbated environmental decline in the Murray System and restricted remedial options, forcing TLM to focus on preventing species loss and preserving drought refuges.

Under a multijurisdictional system, where there is no ability to impose action or direction, it is difficult to identify additional measures that may have been implemented. But the 'competition policy' approach of incentive payments for achievement of specific outcomes may provide another mechanism.

The obvious downside of the MDBC structure is the time- and resource-consuming nature of decision making. Jurisdictions wish to be engaged in many decisions that would normally be the prerogative of the Executive Team under a broad agreed framework. Jurisdictions recognise this problem but are loath to cede authority.

Proposed institutional change for the MDB provides the Commonwealth with a much greater role in key areas — determining sustainable river extraction limits that reflect all available water and are climate-change sensitive. Water quality and environmental watering plans for the entire Basin will be established by 2011. Institutional arrangements regarding compliance are also much more clearly defined under the new arrangements.

11 New policies create a new politics: issues of institutional design in climate change policy

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Abstract

This paper covers three institutional aspects of current debates about climate change policies. They are first, the issue of where responsibility should lie for determining the implied price of carbon in an ETS; second, whether part of the funds raised through an ETS should be used to provide compensation; and third, whether some of those funds should be hypothecated or earmarked for R&D.

11.1 Introduction

Institutional design focuses on the task of providing accountability and effective monitoring of decision-making by bodies vested with the coercive powers of the state in a context where information is inherently limited, costly to acquire and asymmetrically distributed.[1] These information imperfections create scope for rent-seeking, which results in both an allocative inefficiency — in the sense that the policies pursued do not reflect underlying preferences — and in productive inefficiency, in that policy objectives are pursued at higher than efficient cost. While the conventional prescription for reducing vulnerability to rent-seeking is to insulate the policy process from interest group pressures, this conflicts both with effective accountability and with the need for policy to adjust to changes in preferences, information and choice sets. Further aggravating the difficulties is the

[1] The underlying assumption is that effective monitoring will yield decisions that accord with the preferences of voters. Of course, voters may choose to structure institutions so as to achieve goals other than effective monitoring, but then that merely raises the question of how those institutions will be controlled. For a general discussion of institutional design, see Komesar 1997.

inherent conflict between this need for policy adaptability on the one hand, and the contribution that policy credibility and stability can make to the efficiency of policy on the other. These three elements of the institutional design dilemma — limited information, rent-seeking, and costly commitment — define a world where there are no solutions but only trade-offs.

Although these trade-offs are not very different across policy areas, our focus today is on environmental policy. Within environmental policy, few areas are as high on the current agenda as climate change. I will therefore focus my remarks on climate change policy, and specifically on the proposals advanced in the June 2008 Draft Report of the Garnaut Climate Change Review ('Garnaut Report'), and in the Government's July 2008 Green Paper on the Carbon Pollution Reduction Scheme ('Green Paper').

In particular, I will examine, first, the proposals for how revenues raised by the sale of emissions permits would be used; and, second, the proposed governance arrangements for the emissions trading scheme. Each of these raises interesting and important issues of institutional design, and of broader policy analysis. I will examine for each of these the broader principles of institutional design that are involved, and then apply those principles to the specific proposals.

11.2 Use of ETS revenues

According to the Green Paper:

> The Government has committed that every cent raised for the Australian Government from the Carbon Pollution Reduction Scheme will be used to help Australians — households and business — adjust to the scheme and to invest in clean energy options. (p. 277)

Revenues raised from the scheme have, in other words, been earmarked for outlays on adjustment, compensation and the promotion of 'clean energy', including through investment in low emissions R&D.

Generally, the revenues raised through Pigovian taxes are large relative to the direct efficiency changes those taxes induce.[2] As a result, the efficiency with which those revenues are spent can dramatically affect the overall efficiency of the Pigovian scheme.[3] It is therefore important to examine the extent to which the proposed

2 Simply put, this is because the revenues raised are a rectangle, while the efficiency change is a triangle.

3 This is one reason why the conventional prescription in the case of Pigovian taxes is for the revenues to be used to provide lump sum transfers to taxpayers.

earmarking is likely to encourage the efficient use of the revenues generated by the ETS.[4]

Earmarking generally

Earmarking, also commonly referred to as revenue hypothecation, can enhance the quality of public expenditure in three broad ways.

First and most important, it can signal the tax price of achieving particular outcomes and thereby improve accountability for, and public decisions about, public expenditure. For these improvements to occur, there must be a rational relation between the tax and the outcomes (so that the tax is a payment for the benefits, rather than serving some other purpose),[5] expenditures on the outcome must be determined at the margin by the tax (that is, the hypothecation must have bite), and taxpayers must be able to monitor the linkage and the use of the revenues.

Second, earmarking could alter incentives for program administrators, including by constraining spending decisions and changing the marginal costs and benefits associated with alternative options. For example, where two activities are complements (that is, an increase in the supply of one reduces the marginal cost or increases the marginal benefit of an increase in the supply of the other) but diligence in one is observable while diligence in the other is not, bundling the two and ascribing to them a dedicated revenue stream may be efficient.

Third, earmarking may be a way of increasing the credibility of promises, reducing the inherent incompleteness of the implied contracts between government and the public. As well as any direct benefits arising from greater credibility of commitments, this may allow proponents of programs to signal the quality of the programs, of the proponents or both. For example, in the model of Brett and Keen (2000), a commitment to dedicate revenues to a particular use, which is of value to the public but would not be of value to a 'poor quality' politician, can support a separating equilibrium in which politicians signal their quality to the electorate.

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4 Useful discussions of earmarking can be found in Bird and Jun 2005, Eklund 1972, Glazer and Proost 2007, Spackman 1997, Teja 1988, and Wilkinson 1994, among many others.

5 Some hypothecation — such as the widespread linking of revenues from government lotteries to 'merit goods' such as education or culture — is obviously unlikely to improve the quality of public decision-making in that there is no meaningful sense in which the 'price' of culture at the margin is the loss of welfare associated with the holding of lotteries. As a result, the hypothecation does not signal the cost of expanding the supply of culture, will not induce revelation of marginal valuations of culture, and will not 'unbundle' tax-payer decisions about the supply of culture from other decisions.

That said, there are also at least four important ways in which earmarking can reduce efficiency in public expenditures.

First, earmarking implies inflexibility in the allocation of revenues among competing uses. If the earmarking is substantive, in the sense of being effectively constraining, social rates of return are unlikely to be equalised at the margin across uses. Tax rates, expenditure levels or more likely both, will be distorted as a consequence.

Second, reserving revenues to a program gives it a monopoly over those revenues, encouraging and potentially perpetuating technical inefficiency in its supply.

Third, earmarking can facilitate rent-seeking by allowing the interest groups that benefit from the hypothecated revenue stream to focus their activities more effectively. Rather than competing against other interest groups for a larger share of general revenues, the relevant groups can limit their efforts to seeking an increase in (or protecting from erosion) the hypothecated tax. At the same time, the political commitment they secure is potentially made more credible by the earmarking, increasing both the 'price' that the interest groups are willing to pay in exchange and the resources they are willing to dissipate in obtaining it. Rent-seeking coalitions therefore become easier to create and sustain, and the aggregate costs to the community from rent-seeking rise, as Kimenyi, Lee and Tollinson (1990) found in their study of the US Highway Trust Fund.

Fourth, these adverse consequences are made all the greater by the risk created by earmarking of fiscal illusion, that is, of the hypothecated revenues not being as visible as other forms of public revenue and expenditure. The Garnaut Report provides a striking example of fiscal illusion when it claims that using revenues from ETS auctions for the earmarked purposes allows those purposes to be achieved 'without placing pressure on public finances' (page 372) — ignoring the fact that devoting the revenues to those purposes has an opportunity cost.

By and large, empirical studies of earmarking find that these harmful effects outweigh the positive effects that hypothecation can have. For example, a series of recent, careful, assessments of earmarked transport programs in Europe — where congestion or road toll charges have been earmarked for public transport programs — generally finds that the hypothecation has been wasteful.[6] First, putting income distribution consequences aside, congestion and higher road use charges should lead

6 See de Palma, Lindsey and Proost (eds) 2007.

to lower subsidies and higher prices for public transport,[7] but hypothecation has caused the effect to go in the opposite direction, causing an efficiency loss. Second, many of the programs funded, or proposed to be funded, by hypothecated funds have had very low social rates of return, both in absolute and relative to alternative uses of the funds. Third, any income distribution consequences of the changes in road pricing would be more efficiently dealt with through direct transfers, rather than through public transport subsidies, which, given use patterns of public transport, are a poor way of achieving distributional goals. Fourth and last, welfare would have been increased by instead using the funds raised by the charges to reduce other, more distorting, taxes.[8]

Earmarking in the Garnaut Report and the Green Paper

As the transport case illustrates, any assessment of earmarking needs to look to the specifics of the proposal, and the earmarking proposed in the Garnaut Report and the Green Paper are no exception to this rule.

At the most general level, it seems obvious that the earmarking proposed by these documents bears no relationship to the Lindahl-Buchanan approach of benefits taxation. In particular, there is no sense in which the proposed charges are the 'tax price' of the outcomes being sought through the outlays. Moreover, there is no commitment to limit expenditures on those outcomes to the quantum of the revenues raised. Finally, the bundling of outlays on compensation, income support, spending for energy efficiency and for investment in 'clean energy options'

7 Subsidies to public transport are justified to a greater or lesser degree by the under-pricing of road use. When road use charges are set at (or closer to) Pigovian levels, the efficient subsidy to other transport modes declines.

8 In most cases, the direct burden of taxation is larger than necessary to raise a given amount of revenue. This is because taxes alter individual incentives and economic decisions at the margin, and therefore affect economic outcomes at the margin and in the aggregate. In driving a wedge between bid and ask prices for economic resources, taxes eradicate the opportunity for individuals to exploit all gains from trade. Because the revenue raised is typically not sufficient to offset the value of the foregone gains from trade, the direct burden exceeds the revenue collected, and so most taxes are said to create an excess burden or deadweight loss. The size of this deadweight loss is proportional to the extent to which individuals divert resources towards lower-valued uses in response to the tax. The marginal excess burden (MEB) of a tax describes how the excess burden changes as a tax is changed by a very small amount. Some taxes have a higher MEB than others, but they may also raise more revenue at the margin. Thus, a natural measure of the welfare cost of a tax that can be used to compare the efficiency consequences of different kinds of taxes is the normalised marginal excess burden (NMEB) of a tax, which measures the MEB per dollar of revenue raised. By definition, a pure Pigovian tax involves no deadweight loss, that is, it causes no excess burden. As a result, using the revenues from a pure Pigovian tax to reduce other taxes increases welfare by the extent of the excess burden foregone.

undermines the transparency that is integral to the effectiveness of earmarked schemes of benefits taxation.

The resulting concerns are made all the greater by the specific proposed uses of the funds. While there has been extensive public discussion of the proposed compensation to especially emissions-intensive industries, the other elements in the package can also be shown to be of concern.

First, some of the alleged market failures on which spending is to be targeted seem poorly thought through. The discussion of buildings in both documents is a case in point, with the Garnaut Report claiming, for example, that the fact that rented houses contain older, less 'energy-efficient', appliances than those found in owner-occupied houses is evidence of a market failure that should be addressed through subsidies and regulations (section 18.7).

However, rented accommodation may be older and/or generally lower quality than owner-occupied housing: usually, the most efficient way of providing lower-quality accommodation is to build high-quality accommodation and allow it to deteriorate over time.[9] As a result, rental housing will embody older vintages, and — as in the rest of the economy — it is incorrect to think that efficiency is increased by the forced scrapping of vintages whose operating costs, though relatively high, are still less than the effective average total costs[10] of more recent equipment. Additionally, to the extent to which tenants value more 'energy-efficient' appliances at more than their effective average total costs cost, it is not obvious why this outcome would not be achieved through appropriate contracts with landlords. And if there is an impediment to that outcome being achieved, it seems more likely to lie in tenancy laws, which reduce landlords' incentive to invest in higher quality,[11] than in any market failure as such.[12]

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9 See the discussion of equilibrium in the housing market in O'Flaherty 2005, pages 410 and following. The intuition behind this result is simple. Assume the objective is to provide low-quality rental accommodation in ten years' time. One way of doing this is to set aside today an amount sufficient to build such accommodation at that time. The alternative is to build high quality accommodation now and allow it to deteriorate gradually over time. So long as the rental rate on high quality accommodation is more than the interest rate, the latter alternative will dominate. In equilibrium, the rental rate will decline to the point which just makes these options equivalent.

10 These costs are higher than average total costs for owner occupiers, both because of transactions cost and because of higher rates of depreciation associated with moral hazard (that is, the tendency of tenants to take less care of equipment that they do not own).

11 See again, O'Flaherty 2005, pages 372 and following.

12 Capital market rationing is sometimes said to lead to inefficiently slow scrapping of outdated vintages of consumer durables. While this is obviously possible, the same capital market failures would affect a wide range of household investment decisions, and it is not clear why

All of this merely highlights the more general point, which is that, especially when price signals are set correctly (as is the aim of the ETS), 'energy efficiency' is not a sensible goal in itself, any more than is 'making Pavlovas using less passionfruit', as it may indeed be efficient in an overall sense to use more energy per unit of output rather than less in particular situations.[13]

Second, while it is likely that there is a case for promoting innovations that reduce the carbon intensity of output, the approach proposed in the Garnaut Report and the Green Paper seems flawed. The essence of this approach is to link the funding of this R&D to ETS receipts, and through that linkage, to increase outlays on that R&D substantially.

This link between the funding of these innovations and receipts from the sale of emissions permits, however, seems unreasonable. In effect, it is a straightforward application of the Sandmo rule for Pigovian pricing in the presence of substitutes (Sandmo 1976) that the greater the likelihood of investment in low-emissions R&D succeeding, the lower should be the current ETS price and hence the receipts from the ETS, but the greater should be the investment in low-emissions R&D. As a result, the linkage is likely to distort the carbon price, the volume of resources devoted to low emissions R&D, or both.

Additionally, rather than providing a dedicated revenue stream for low-emissions R&D, it seems preferable to include realistic estimates of any positive externalities in the assessment of the benefits from R&D proposals generally, and then to subject those proposals to the same decision criteria, regardless of the technology or industry to which they relate.[14] To the extent to which the general process for allocating R&D funding is flawed, the Government's current review of the innovation system provides an opportunity to address those flaws.[15] In contrast, the

welfare would be improved by addressing them in respect of one type of appliance (namely, those that are especially energy intensive). Moreover, capital market rationing is not likely to affect investment decisions by landlords.

13 For instance, the rental housing may actually be provided at minimum social cost, even if it involves using older appliances that have higher energy use than do the most recent vintages. It is an obvious fallacy to think costs are minimised by constantly scrapping older vintages so as to always use equipment of the most recent vintage.

14 There is no reason to believe that this is more difficult for low emissions R&D than it is for other types of R&D, but even if it were, this could be dealt with by applying a mark-up to the measurable benefits.

15 This is consistent with the Tinbergen theorem: that if a policy instrument can directly address a market imperfection then it should be relied on, rather than an alternative instrument that can only indirectly address the issue (Tinbergen 1956). This is because any indirect intervention distorts economic choices, is likely to have a weaker impact on the intended indirect target than direct regulation there, and the impacts of the indirect approach are likely to be harder to predict than those of the direct approach.

approach proposed by the Garnaut Report and the Green Paper would distort the allocation of resources as between competing uses of scarce R&D resources.

These distortions are likely to be all the greater given that the supply of research scientists and engineers is likely to be relatively inelastic, even in the medium term. Additional earmarked funding for one type of R&D is then likely merely to increase payments to scientists and engineers as the favoured form of research bids resources away from other, less favoured, types of R&D.[16] Assessments of earmarked R&D projects find that the earmarked funding increases the output of scientific research, as measured by number of publications, but that the publications have relatively low citation rates. This fact suggests that these displacement effects can be socially highly costly.[17] Accentuating these concerns is the more general finding that especially (but not solely) for basic research, progress primarily reflects scientific and technological opportunity, and attempts to speed up the rate of progress lead to rapidly decreasing quality, rapidly rising costs, or both.[18] The frequently observed inefficiencies in the selection and governance of large publicly-funded R&D projects only make these risks more acute.[19] The inefficiency arising from distorting the pattern of R&D would then be compounded by ineffectiveness in actually promoting scientific and technological advance.

Finally, to the extent to which the results of low-emissions research are indeed a public good, or at least confer substantial benefits on the world as a whole, that needs to be taken into account in determining the appropriate level of funding, exactly as we would in other areas.[20] This is even more plainly the case where the results of that research (for instance, in renewables) could reduce world demand for

16 The impact of the elasticity of supply of scientists and engineers was discussed in Ergas, 1984 and is examined in Goolsbee 1998. The fact that (according to ABS 81090DO003_200607) environmentally-related R&D already accounts for 20 per cent of all Government funded R&D in Australia — exceeding health and defence, and only slightly less than is spent on primary industries — itself suggests that further expansion may be difficult and highly costly.

17 See for example Martin 1992 and Payne 2002. Typically, these studies refer to congressional earmarks in the US, rather than to hypothecated funding as such. The causal mechanisms that lead to poor-quality outcomes are likely, however, to be similar — the restriction of competition for the funding and the fact that with given funding, the scarcity of high-quality projects means that some low-quality projects will be funded.

18 The hypothesis that the underlying rate of scientific progress is not all that responsive to rates of effort was famously set out by Derek de Solla Price (see, for example, de Solla Price 1986, pages 92 and following). See also, for basic research, Stephan, P. E. and S. G. Levin 1992. George Stigler's well-known 'law' (Stigler 1963) that at any one time there are no more than 14 really first class scholars in any field of research, is fully consistent with de Solla Price's results.

19 See for example Jewkes, Sawers and Stillerman 1969; Henderson, 1977; Ergas, 1984 and 1987; Finon 1987; Keck, 1988; and Cohen and Noll 1992.

20 See for instance Alston and Mullen 1992, and Alston, Freebairn and James 2004.

(and the prices we receive for) Australian exports, for instance of coal.[21] In that case, increasing funding for those technologies could involve a two-fold loss to the Australian economy, as Australians would pay both through the carbon tax and through the loss of income consequent on the use of the technology.

Third, the proposed compensation to low- and middle-income earners may be both unnecessary and inefficient.

The case for that compensation is explained in the Green Paper in terms of the higher share of emissions-intensive goods in the consumption baskets of low-income households. What would seem to matter more from an equity perspective, however, is the share of those goods in the consumption of low-consumption households, as some households (notably the elderly) with low incomes may be living off accumulated capital and, in that sense, not be particularly disadvantaged. Indeed, US evidence suggests that while the emissions intensity of consumption is relatively high for low-income households, it is not equally high for low-consumption households, and the income-related gap in emissions intensity is even lower when income is measured on a lifetime basis (thus eliminating the effect of transitory income shocks).[22] As a result, it remains to be demonstrated that the price changes consequent upon an ETS will cause disproportionately large real income losses for disadvantaged households.

That said, truly disadvantaged households in Australia are likely to be recipients of government pensions and other benefits, and those payments are indexed in a way that appears to cope relatively well with relative price shocks.[23] As a result, the Government's commitment to provide compensation above and beyond the effect picked up through benefit indexation suggests a real increase in benefit levels. The justification for such an increase is unclear. It is even less clear why specific compensation would also be provided to middle-income households. As for the notion, suggested in the Green Paper (see for example p. 80), that the budgets of those households, that is, of the vast majority of Australians, could be fully compensated for the impact of an ETS, it seems difficult to reconcile with the fact that introducing a binding carbon tax must impose a cost on the economy and hence reduce at least some real incomes.

21 Obviously, the same issues arise if the R&D results in supply shifts that transfer surplus to foreign consumers, as would occur, for example, if exports are a significant share of output and the supply shift is pivotal rather than parallel.

22 Hassett, Mathur and Metcalf 2007.

23 See the estimates of growth in the real value of pensions provided in Farmer 2008, for example at pp. 77–8.

Be that as it may, the effect of thus providing compensation, in a way slanted to low- and middle-income earners, would be to increase the effective progressivity of the tax/benefit structure, that is, the effective marginal tax rate on labour incomes. It seems, however, likely (Bovenberg and de Mooj 1994, and Parry and Oates 2000) that a carbon tax will itself increase the tax on labour relative to leisure, thus accentuating the disincentives to work arising from the tax structure.[24] Further increasing the distortion, thereby increasing the economic cost of the carbon tax, seems very difficult to justify.

In short, the proposed earmarking does not seem likely to increase the quality of public expenditures. Rather, the earmarked expenditure programs appear to be of low quality, at least from the standpoint of aggregate welfare. It would probably be greatly superior to use the revenues from the scheme to reduce distorting tax rates: for instance, by flattening the structure of the personal income tax.

Indeed, as explained by Fullerton and Metcalf 2001, this policy prescription — that the revenues collected through the sale of pollution permits should be used to fund reductions in other, distorting, taxes — is fairly robust. In effect, the revenue raised from the sale of the permits reflects a scarcity rent associated with restricting access to the pollutant. The effect of that scarcity rent is to increase production costs by more than the minimum necessary, as firms must both incur the 'real' outlays associated with reducing emissions and pay the tax. This will reduce real net wages, with adverse consequences for labour supply. It is difficult to do better, from an aggregate welfare perspective, than to use the revenues to offset this effect through a reduction in other taxes on production.

In contrast, the earmarking proposed in the Garnaut Report and the Green Paper seems likely to inflict a double loss on the Australian economy: the loss associated with the increase in production costs; and the loss associated with wasting the funds raised through the sale of permits.

11.3 Scheme governance

I turn now to the issues associated with scheme governance. Attention here focuses on the question of where responsibility should lie for determining the path of emissions, administering targets and allocating compensation, and what role, if any, should be played in these by a carbon 'central bank'. The more general question is that of the appropriate division of labour between differing kinds of institutions, notably executive government (Ministers and their departments, answering to

[24] While Australia has a relatively low average tax rate on labour income by OECD standards, the progressivity of the personal income tax structure is relatively high (OECD 2007).

parliament) on the one hand, and what are often referred to as 'non-majoritarian institutions' (such as independent agencies and courts) on the other.[25]

These non-majoritarian institutions reflect the delegation, by the electorate as the principal, of authority to an agent, with the extent of that authority being defined by the scope of the delegated powers (in substance, the policy discretion) granted that agent relative to the control instruments (that is, powers to shape, constrain, reverse or annul outcomes) on which the principal can rely. While non-majoritarian institutions play a wide variety of roles in democratic systems of government,[26] and have an especially long history in Australia,[27] two efficiency objectives that can be served by thus delegating powers are of particular interest. These are, first, resolving commitment problems, that is, enhancing the credibility of actual or implied promises, and, second, reducing vulnerability to rent-seeking.[28]

These objectives can be enhanced by delegation if delegation confers what can be very loosely described as 'greater distance' from immediate pressures and provides incentives for those to whom power is delegated to act in ways that reflect that 'greater distance' while nonetheless conforming to the public interest, at least in

25 Such an institution can be defined as one that (a) possesses and exercises a grant of specialised public authority separate from that of other institutions; and (b) is neither directly elected by the people nor directly managed by elected officials. See Thatcher and Sweet 2003, p. 2, and also Vibert 2007.

26 See for instance Holmes 1995.

27 Thus, Parker, writing in the 1960s, noted the 'long-established habit, carried further, perhaps, in Australia than in any other advanced society, of institutionalising the resolution of conflicts over the allocation of values. Its central feature is the attempt to remove important allocative decisions from a process of ad hoc bargaining or trials of strength, based on the relative power of competing interest groups, to a system of adjudication by committees, boards, tribunals, departmental agencies, autonomous corporations and similar institutional devices' (1965, pp. 88–9); see also Hughes 1980 for a more extensive review of the history and role of delegated powers in Australia.

28 A third efficiency objective often ascribed to these institutions is that of overcoming information asymmetries in technical areas of governance through the development and deployment of specialised expertise. It is not apparent as a general matter, however, why similar expertise could not be secured within executive government, and there is little evidence that non-majoritarian institutions enjoy a clear advantage in this respect relative to executive government, for example in the Australian system of government. That said, where the primary reason for delegation is to secure access to expertise, one would expect the relevant agency to have limited substantive decisional independence, for instance, in terms of making and implementing policy. This is consistent with the observations in Thatcher and Stevens, who find that 'expertise-based' agencies are more likely to have what amount to advisory roles (or at least, are more readily overruled) than do agencies that seem to be aimed at addressing credible commitment and rent-seeking issues.

some net sense.[29] As with earmarking, there is a 'tying the hands' effect, in which, in principle, governments improve outcomes by reducing the scope of their discretionary powers. Inevitably, that reduced scope has some cost, and the issue is whether that cost is worth bearing. In considering that issue, I will deal first with the question of the credibility of long term commitments and then with that of rent-seeking.

The credibility of commitments becomes especially important when it is desirable for economic agents to make investments that have an element of irreversibility in reliance on actual or implied policy promises, and which hence are vulnerable to loss should those promises not be kept. Time inconsistency is the canonical form of this commitment problem in economics, with the term referring to situations in which conduct by a policy-maker that is rational *ex ante* is not (and is known not to be) rational *ex post*, so that rational actors will discount the probability of a commitment to that conduct being maintained.

The problem of time consistency is readily illustrated. Consider a central bank facing a trade-off between inflation and unemployment, in which current inflation depends also on expectations of inflation in the future (Schaumburg and Tambalotti 2007). The credible announcement of a future tightening of policy, in excess of that needed to curb current inflationary pressures, lowers inflationary expectations, thereby easing today's trade-off. Given that, it is optimal for policy to seek to exhaust the marginal benefits of this announcement effect. Once the recession this tightening implies arrives, however, the optimal policy is to reverse course, renege on the announcement and avoid the recession. But for the original intention to have the desired effect, it must be believed to be credible. In other words, for the sacrifice ratio (the cumulative increase in unemployment that is due to the disinflation effort divided by the total decrease in inflation) to be improved, investors, wage-setters and other price-making actors must believe that the central bank will not deviate from the policy it has announced, regardless of the consequences. The lower the probability attached to the central bank staying the course, the less effect the announcement will have on the costs of disinflation.

At least analytically, a similar issue of time consistency arises in respect of pollution taxes, in so far as the objective of those taxes is to induce investment, including through innovation, that once made is sunk.

Laffont and Tirole (1996), for example, model a pollution tax that is intended to promote low-pollution innovation, where the innovation, once made, has low constant marginal costs. The government issuing the permits can then act

[29] In other words, the gains from the delegation exceed the costs in terms of reduced responsiveness to community preferences.

opportunistically, expanding (or threatening to expand) the supply of permits post-innovation, reducing the innovator's bargaining power with respect to potential users. *Ex post*, this allows the government to pursue its objective of reducing pollution at lower social cost; but the likelihood of this time-inconsistent behaviour reduces the *ex ante* incentives to innovate, thereby increasing costs overall. The greater the likelihood of *ex post* opportunism, the higher the aggregate social costs will be of achieving the pollution reduction target.[30]

When the *ex post* profitability of innovation depends on artificial scarcity — as is the case in an ETS — there is, in other words, a risk that does not arise in other contexts: that to expropriate the innovator, government may not need to modify intellectual property rights (which would likely be highly politically costly) but can simply rely on its ability to alter the supply of pollution rights. As with time-consistency risks generally, the scope this offers for opportunistic conduct will deter otherwise efficient investment.

In Stanley Kubrick's 1964 film 'Doctor Strangelove', the time-consistency problem is solved through a commitment technology — the 'doomsday machine' — that, once put in place, will, in the event of a surprise nuclear attack, automatically 'destroy all human and animal life on earth', despite the fact that it 'is not a thing a sane man would do'.[31] In the economic literature, the institutional equivalent of the 'doomsday machine' is the independent central bank, which, vested with the discretion to control inflation, does not succumb to the temptation to seek short-term gains in real output at the expense of long term price stability.

This occurs because the central bank, unlike the executive government, does not internalise (or internalise to the same extent) the political benefits that short-term output expansion would create. In other words, by delegating the control of inflation to the central bank, the government severs the costs and benefits of the inflation-real output trade-off, assigning the price stability objective to an agent whose benefits depend mainly or solely on the inflation rate. In its simplest form (often referred to as 'Rogoff delegation', after Rogoff (1985)), this is done by vesting control of the central bank in individuals who are especially 'conservative', in the special sense of having an unusually strong aversion to inflation, that is, having a utility function in which immediate real output gaps have little weight relative to long-run price

[30] Additionally, it can be shown that the slower the rate at which the new technology is likely to become obsolete, the greater the incentive for the permit issuer to act opportunistically: see Levine, Stern and Trillas 2005.

[31] The underlying principle of seeking to achieve deterrence through credible commitments to mutually assured destruction is classically set out in Schelling (1960) 1980. The origins of this principle are discussed in Ayson 2004.

stability. Given those preferences, commitments to price stability will be regarded as credible, reducing the costs of disinflation.[32]

Whether this account of central bank independence is plausible is a matter of intense debate, both as regards the solidity of its theoretical foundations[33] and its empirical relevance.[34] So too is the question of whether, as a factual matter, central bank independence, however defined, actually reduces the sacrifice ratio, with perhaps the best that can be said being that the case in favour of independence is not proven.[35]

That said, it may be that time-consistency issues would have greater weight in the context of the introduction of an entirely new set of 'fiat rights', such as those involved in an ETS.[36] This view is expressed in the Garnaut Report, which notes that 'markets can quickly collapse if their credibility is shaken. This is all the more pertinent for markets that owe their existence solely to government decree' (p. 363). To the extent to which the key issue, however, is that of underpinning confidence in irreversible investments in abatement (that is, abatement investments whose profitability depends on the path of future carbon prices), this leads to somewhat different conclusions than might be initially thought.

In particular, unlike the central bank case — where the bank must be assumed to have (or be induced to act as if it had) an unusually strong preference for price stability — in an ETS, the entity setting policy, were it seeking to overcome perceived risks of time inconsistency, would need to place a particularly high weight on industry profits, as compared to abatement.[37] This is simply because *ex*

[32] The same outcome can be achieved by other means: for instance, by assuming that the central bank owns a 'reputational capital stock' that would be devalued in the event of time inconsistency, making deviation from an anti-inflation stance costlier for the central bank than for other decision-makers.

[33] See notably McCallum 1995 and McCallum 1997. More generally, any credible account of central bank independence that justifies independence on the basis of time consistency must explain why the arrangement is not vulnerable to renegotiation, especially if politicians would, in fact, derive significant benefit (even if only short-term) from acting in a time-inconsistent manner. This inevitably goes to issues of political structure, which are discussed in Keefer and Stasavage 2003, Lohmann 2003 and Moser 1999.

[34] For example, Bell 2004, in his review of the development of central bank independence in Australia, concludes that time-consistency issues played no role.

[35] See for example de Haan and Eijffinger 2001, who conclude that independence does not reduce, and may in some conditions actually increase, the sacrifice ratio, and more recently, Crowe and Meade 2007, who find that any significant relation between central bank independence that may have been found in earlier data sets no longer persists.

[36] Lohmann 2003 discusses 'fiat institutions' and their credibility.

[37] This is similar to the utility regulation case, discussed in Gilbert and Newbery 1994, and in Levine, Stern and Trillas 2005.

post (that is, once successful innovation has occurred), the greater the weight placed on abatement, the greater the attractiveness to the agency will be of acting opportunistically, forcing down the price of the new technology and thereby securing widespread use. What is therefore required *ex ante* is a credible commitment to forgo what in *ex post* terms are socially profitable opportunities for abatement, thereby increasing the expected return on investment in innovation. Moreover, the greater the uncertainty about the fixed costs innovators will incur, the greater must be the willingness to allow prices *ex post* to be marked up above cost, thereby further reducing *ex post* abatement.[38]

What the relevant theory would recommend, in other words, is selecting as the agent setting future price paths one who places an especially low, rather than an especially high, weight on abatement, relative to industry profits.

Of course, such an assignment of policy responsibilities would have costs, as well as potential benefits. So as to limit monitoring and agency costs, delegation is frequently accompanied by rigid rules, which must impede the response to new information, including changes in the public's preferences. Moreover, so as to allow economic actors to distinguish opportunism, on the one hand, from justified changes in policy conditional on new information on the other, the institution itself needs to rely on rule-conforming behaviour, even when that is costly.[39] This is especially likely to be true when institutions are relatively new. Finally, the stress on rule-conformity in decision-making is likely to be especially great when agency performance is difficult to measure in terms of outcomes, or when the relation between instruments, outputs and final (welfare-determining) outcomes is uncertain. All of these factors are likely to be relevant in the context of a carbon 'central bank'.

The greater the need for ongoing flexibility, the higher the cost of rule-oriented delegation will be. As well as those direct costs, delegation of a specific task (such as that of setting a path for future emissions reductions) may prevent the 'bundling'

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38 There is, in other words, an information rent, which in expectational terms, must be greater, the greater is the information asymmetry about the cost of the innovative technology.

39 Indeed, an agent that is seeking to develop and preserve a reputation for time consistency faces the problem that the parties with respect to whom it seeks that reputation can find it difficult to distinguish the response to new information from opportunistic conduct. The extent of the problem can be reduced through transparency of decision-making, and there is a significant trend among central banks towards ever greater disclosure — see for instance Mahadeva and Sterne 2000. Given that disclosure is never complete, however, and explanations of actions may be viewed as self-serving, some part of the burden of establishing and retaining credibility is borne by adherence to simple, observable, rules, such as the Taylor Rule in monetary policy. Adherence to these rules inevitably involves a loss relative to the first best response to new information. This is another form of the 'rules versus discretion' issue.

of responses to new information with other policy instruments, with the failure to secure economies of scope as between these instruments causing an efficiency loss.[40]

In practice, new information will emerge not only with respect to the climate change policies of other countries — as is stressed by both the Garnaut Report and the Green Paper — but also about the severity, or otherwise, of climate change as a problem and the costs and benefits of addressing it. As a result, it seems important to retain the flexibility to amend policy, and to have direct political accountability for that policy, thus enhancing the likelihood of a timely response. This suggests that it is indeed desirable to locate responsibility for setting the emissions path, and the political accountability for that path, directly in a Minister, rather than delegating that responsibility to an independent body (whose response would be hindered by its statutes and operating rules).[41] The fact that decisions as to the trajectory of emissions reductions can have such major effects on Australia's prosperity, and are not capable of being reduced to a clear and fixed formula or set of rules that a third party could be given responsibility for implementing, make the case for direct Ministerial responsibility all the stronger.[42]

To that extent, an independent agency should not have 'outcome independence', that is, the scope to set its own targets. This is perhaps comparable to the position of the Reserve Bank (which under the Statement on the Conduct of Monetary Policy has an inflation target set by the Government),[43] though such an agency would also have less 'instrument independence' (that is, control over the mix of instruments) than has the RBA. In effect, under an ETS without price caps, the objective and the instrument essentially coincide, in that setting the emissions reduction path

40 The costs of delegation are analysed in Alesina and Tabellini 2007(a) and Alesina and Tabellini 2007(b.)

41 The literature on central bank independence stresses that for the independence to be credible, it must be costly for government to alter the mandate and operations of the central bank. As a result, effective delegation involves constructing bulwarks against change. The need to then maintain controls against misbehaviour by the agency then induces the imposing of further constraining rules, to an extent that depends on the costs and likelihood of misbehaviour.

42 The impossibility of devising such a formula, and the high error costs involved in inappropriate decisions, would make monitoring costs very high, undermining the efficiency gains from delegation. It can be shown that the smaller the extent to which the agent's behaviour can be made to be rule-bound, and the higher the costs of the inappropriate use by the agent of its discretion, the greater the other limitations that must be placed on its substantive capabilities — see generally Komesar 1997. As these limitations erode the quality of the agent's decisions, they reduce and may entirely eliminate the net gains from delegation.

43 The scope of the RBA's statutory independence is controversial, but in practice, likely to be substantial by convention. That said, the RBA does not have the degree of statutory or practical independence of the European Central Bank, which both sets its own objectives and controls its choice of instruments.

automatically determines the volume of permits to be issued. As a result, the agency's role, as far as the ETS itself was concerned, would seem to be relatively narrow and essentially regulatory (that is, ensuring compliance), though it might have some responsibilities for monitoring and better promoting efficiency and stability in the secondary market. Whether this is an appropriate or sensible role for an agency that might otherwise not require much substantive economic and financial expertise is an open question.

In short, while there may be issues associated with time consistency, it does not seem that they warrant the delegation of responsibility for setting emissions reduction trajectories to a 'carbon central bank'. Absent that responsibility, such an entity would, in an ETS without price floors and ceilings, have a rather limited decision-making role, certainly compared to the RBA, as the Government's decisions about the emissions trajectory would effectively determine the settings for the primary instrument (the volume of permits).

The Garnaut Report and the Green Paper suggest that the agency should also be given responsibility for addressing compensation claims, presumably so as to reduce the costs of rent-seeking. This assumes that independence provides assurances against rent-seeking, which runs counter to both theory and experience with regulatory agencies.[44] These suggest that the costs of rent-seeking (including by the agency itself) are not effectively constrained by the mere fact of distance or otherwise from the political process. Rather, they are best constrained by a combination of, first, procedural safeguards, including constraints on the forms and nature of interaction between the parties seeking the relevant rents and the decision-maker;[45] and, second, by narrowly confining discretion in the determination of claims, both through clear rules that can guide the disposition of those claims and by providing for substantive rights of review. Given such constraints on discretion, the allocation of the initial decision-making power — be it to a Minister, a Ministerial Department, or a statutory agency — is not likely to be of great significance.

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44 See Dal Bó 2006 for a recent survey of the relevant literature.

45 Thus Komesar 1997 stresses the role that constraints such as the adversarial and public nature of litigation place on the extent to which courts are vulnerable to rent-seeking relative to administrative agencies. In a classic article, Vilhelm Aubert explained the 'formalism' associated with adjudication as a means of converting the parties involved into 'professional strangers', limiting the scope for improper influence to be brought to bear (1967, p. 45). Fuller 1978 explains that this 'formalism' is only effective where disputes can be resolved into matters of right, and highlights the tendency of 'polycentric disputes' (which lack clear 'guiding principles') to degenerate into forms of adjudication that are merely 'a kind of continuation of bargaining behind closed doors' (1978 p. 397).

11.4 Conclusions

The introduction of an ETS would be an event of obvious significance for Australia's economic prospects. Designing the institutional arrangements for such an ETS raises important questions about how to deal with the constraints arising from limited information, with the risks of rent-seeking and with problems of policy credibility.

The standard recipes for dealing with these issues involve a broad range of options, including earmarking of revenues, as a way of improving public choice, and the delegation of key decisions to independent agencies, so as to enhance policy credibility and reduce vulnerability to rent-seeking. This paper has examined those options, so as both to clarify the general principles involved and to assess their applicability to the specific proposals made in the Garnaut Report and the Green Paper. Four broad conclusions can be drawn from the discussion.

First, while earmarking can have merit, the specific proposals advanced in the Garnaut Report and the Green Paper do not. These proposals are more likely to reduce efficiency than to enhance it. The community would be better off if the revenues raised through the ETS were used to reduce other, more distorting, taxes.

Second, there may be an issue of time consistency in respect of an ETS, and to the extent to which there is such an issue, the effect would be to reduce otherwise desirable investment and innovation. Were such an issue to be dealt with by delegation of responsibility for setting the emissions trajectory to an independent 'carbon central bank', that bank, if it is to give investors confidence that their investments would not be expropriated, would need to develop a reputation for placing greater weight on industry profits than on abatement. This is the opposite of what is commonly supposed.

Third, delegation of responsibility for setting the emissions trajectory to an independent 'carbon central bank' would not, however, be costless. Rather, so as to reduce agency costs, any delegation is likely to require the entity to operate according to fairly tightly defined rules, which limit the extent to which it could respond to new information. Moreover, delegation to a specialised agency would reduce the ability to achieve economies of scope across policy areas, imposing further costs. Given the many uncertainties that surround the science, economics and international politics of climate change, it would seem preferable to retain ministerial responsibility for setting the emissions trajectory. As a result, any 'carbon central bank' would have little or no 'outcome independence' and (in an ETS without price caps and floors) very limited 'instrument independence'.

Fourth, delegation to such an independent entity of the responsibility for determining compensation claims is no panacea against rent-seeking. In effect, theory and experience suggest that the mere fact of independence has little impact on the extent of rent-seeking and may indeed create rent-seeking opportunities for the independent agency itself. Rather, rent-seeking costs are best reduced by setting out clear rules for the allocation of any compensation, formalising the processes involved in seeking and obtaining compensation, and providing substantive rights of review of decisions. With those in place, the location of decision-making powers at first instance is of limited significance. Given that, it is a matter of opinion whether there is a clear case for establishing an independent agency, especially since its role should be so limited.

All of this suggests a far simpler institutional design than proposed in the Garnaut Review and the Green Paper, with no earmarking of revenues and little role for new institutions. These conclusions seem out of step with the spirit of the times, however, and it is worth concluding on why that might be the case.

In his famous 1935 study of the US tariff, Elmer Schattschneider observed that 'within limits, every regime can choose and formulate the pressures to which it will be subjected'. Thus, through 'the protective system', governments 'stimulate the growth of industries dependent on this legislation for their existence'. It is these industries, he noted, that 'form the fighting legions behind the policy'. Equally, 'the losers adapt themselves to the new conditions imposed upon them, find themselves without the means to continue the struggle, or become discouraged and go out of business'. By these means 'new policies create a new politics'.[46]

Indeed, shaping such a 'new politics' is fundamental to successful policy entrepreneurship, which requires developing actors and coalitions that can support and sustain the policy into the future. It does not seem far-fetched to suggest that the institutional designs set out in the Garnaut Report and the Green Paper pursue this objective, rather than being informed by the grander goals of economic efficiency.

Thus, even putting aside the payments to emissions-intensive firms, the earmarking provides a very substantial stream of net revenues to scientists and engineers, as inelastic supply encounters a significant increase in spending, driving up prices. Moreover, the greatest rewards would go to those scientists and engineers involved in emissions-related research, cementing a community that has been, and could remain, a strong supporter of an ETS. At the same time, the earmarking promises what could be substantial side payments to low- and middle-income earners, thus reducing the opposition to rising implied carbon prices. Further support would come from industries receiving compensation, especially if that compensation locked in

46 Schattschneider (1935) 1974 at p. 288.

rents that increased with the ETS price. However inconsistent these uses of the ETS revenues are with standard welfare maximisation, and however fallacious the notion that everyone (or nearly everyone) can be compensated for the costs of a scheme that must reduce real income, they may well be highly politically efficacious.[47]

At the same time, any independent agency created to operate the ETS would probably be an additional advocate for the scheme, much as has happened with such agencies in many other policy domains. Moreover, such an agency might well have the ability, through the allocation of compensation revenues, to create coalitions that unconditionally support its efforts, reducing rather than enhancing the scheme's long run efficiency.

In short, institutional design is likely to be shaped first and foremost by the primacy of politics. The pity of it is that the economic costs could be so high.

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[47] Now is the hour for all good men to come to the aid of the party. How now brown cow. Get out of my face.

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General discussion

Discussion opened with questions to Professor Stavins about the proposed Australian emissions trading scheme (ETS): should the scheme aim to reduce the *production* of emissions; or should it aim to reduce the *consumption* of emissions? In other words, should exports be exempt and imports included, or *vice versa*? What's happening in other countries and does it matter if Australia were to go in a different direction?

Professor Stavins replied that, while he was unable to comment on the domestic Australian debate, a starting point was not to think of the regulation of carbon emissions, but the upstream carbon content of fossil fuels at the mine mouth, as well as at the point of import. Under an allowance trading system, all fossil fuels brought into the economy, including imports, would be subject to an allowance allocation, and exports would be exempt.

Professor Stavins predicted that a significant issue would be political pressure from private industries subject to international competition, concerned about imports of carbon-intensive bulk goods such as aluminium, bulk glass, cement, rolled steel and bulk paper. He observed that in the United States, the Lieberman-Warner bill[1] included an import allowance requirement specifically for these products which was equivalent to a border tax. Furthermore, as there is an extremely strong protectionist stream in US politics, there was a risk that the cure might be worse than the illness. He noted that the European Union had indicated that it was opposed to import allowance requirements. If, however, the United States were to implement such a scheme, then the European Union would likely retaliate.

While an aim of the import allowance requirement — which would only apply to countries that do not have domestic climate policies commensurate with those of the United States — was to encourage developing countries to adopt such policies, it was doubtful whether this outcome would be achieved. He raised the example of

[1] *Editor's note:* The America's Climate Security Act of 2007, also known as the Lieberman-Warner bill, was introduced to the United States Senate in October 2007. The bill proposed a national cap-and-trade scheme for greenhouse gas emissions (in the electric utility, transportation, and manufacturing industries) in which polluters would mostly be allocated right-to-emit credits based on how much greenhouse gas they currently emit. The cap would get tighter over time, until by 2050, emissions would be reduced to 70 per cent below 2005 levels. In June 2008, the bill was defeated.

China, which is the largest producer of cement in the world. Ninety-seven per cent of its cement production is for domestic consumption. The question was whether China would adopt policies that affect the cost of all its cement production, in order to protect the 3 per cent that is exported to the United States.

In another question from the floor, Suzi Kerr asked panellists to comment on how the current silo-based approach to environmental policy and institutional arrangements could be overcome, so that the inherent conflicts and tensions across different environmental issues could be better resolved. Wendy Craik replied that the Murray Darling Basin Commission recognised the importance of this issue and undertakes reviews of the interactions between various policies, but only on a case by case basis — for example, interactions between salinity and Living Murray policies were assessed. There was little evidence, however, of this being done anywhere in a formalised, structured manner.

Professor Stavins agreed that this was an important issue. In the environmental sphere, policies that solve one problem may make another problem worse. In the United States, there is much concern about national energy security, which means reducing imports of petroleum and liquid fuels. These concerns can be addressed by developing biofuels or through the liquification of coal — but these are horrible for climate change. When there were multiple market failures (that is, multiple social problems that merit being addressed), multiple policy instruments were required. In the case of climate change, for example, it was important to get the climate policies right, recognising that there will be both positive and negative impacts, and then develop policies to address the negative impacts, rather than playing around with climate policy, because this blunts the instrument and nothing is achieved.

Professor Libecap asked if there had been any studies on the sensitivity of emissions trading systems to macroeconomic effects; and whether, given the potential for rent seeking, it made sense to auction allowances, or whether it would be better to grandfather them.

Professsor Stavins replied that the environmental performance of cap-and-trade systems was not affected by the business cycle, with the possible exception of an extremely strong economic contraction when the cap could become non-binding.

In answer to the second part of Professor Libecap's question, Henry Ergas said that analysis by Bovenberg and de Mooj of the general equilibrium impact of an ETS showed that because an ETS accentuates the distortion associated with the tax wedge on labour, efficiency will be maximised if the revenue raised from an ETS was used to at least partially offset that distortion. Research by Fullerton and Metcalfe showed the same effect with Pigovian taxes. So a credible commitment to using ETS revenues to reduce distorting taxes in the economy was important. The

problem was that it could create a new political economy around those with an interest in driving up carbon prices.

Professor Stavins commented that while it would be meritorious to use revenues from either a carbon tax or from the auction of allowances to cut distortionary taxes, it was important to recognise that 'there is no way in heck the political process is going to cut the distortionary taxes in the way that every one of those models assumes. They won't even come close … Political systems just aren't going to do it. They are more likely to use the revenue to provide tax credits for favoured industries.'

SESSION 4

REFLECTIONS FOR PUBLIC POLICY

12 Reflections for public policy: a drawing together and drawing apart. Comments on proceedings

Geoffrey Brennan
Australian National University

12.1 The great divide

My task this afternoon is to provide a kind of grand synthesis of all that has gone on in the course of this event. It is, I'm afraid, a task that is beyond me.

Indeed, instead of drawing the ends together, I am actually going to try to draw them apart. That is my ambition because — although everything on the table since Warwick McKibbin began to talk last night has been connected in one way or another with the 'environment' — I think that that commonality of subject-matter has served to mask what I regard as a more basic, and quite crucial *distinction (*one that I regard as ultimately economic in character) between the intranational and the international aspects of environmental policy. Simply put, there is I believe a categorical distinction between the 'global warming/climate change/greenhouse gas' issue, and everything else on today's agenda.

So, on the global side of my conceptual divide, I place the McKibbin and Stavins papers, with perhaps Suzi Kerr having a little each way. All of the other papers fall on the national and sub-national side of the divide. (As I shall try to argue, I consider that balance entirely proper.) So, problems of water extraction in the Murray–Darling system (the Buchan and Craik–Cleaver papers) or the NAP and NHT initiatives (Pannell) or the fine-tuning of political institutions and geographical domain in sub-national environments (David Brunckhorst's paper) are all examples. I place Henry Ergas' paper in this group because it is concerned primarily with the purely domestic issue of how best to use the revenue from carbon-reduction schemes.

Equally, the Libecap and Freebairn papers (though at a more general level) are directed at the national policy design problem — dealing with the comparative evaluation of alternative instruments for externality problems *within* a given political boundary. Although both papers have an 'environmental' gloss, the basic issues are ones that arise in a wide variety of policy areas: the exercise is largely one of taking a general analytic framework from public economics associated with Samuelson and from micro-economics associated with Coase (and perhaps political science associated with Elinor Ostrom) and applying that framework in the environmental setting.

Of course, the two dimensions of environmental policy — the national and the global — are related, in a variety of ways and at a variety of levels. And I shall later want to say a little about a number of those connections. But at this point, I want to underline the logic of the global/national distinction — partly because I am deeply uneasy about much of the discussion of carbon emissions policy. I am uneasy because I am not quite sure whether people who ought to know better are putting their blind eye to the telescope as a kind of Nelsonian heroic gesture or a rhetorical manoeuvre; or whether they don't really understand the magnitude of the challenge, or worse, the real nature of the problem.

Let me put the point a slightly different way. I confess that I have never been much impressed with that economist joke that has as its punch line: 'Assume a can-opener!'[1] It has never seemed to me to be either particularly funny or particularly apt. Until recently. Because these days I hear a lot of talk in exalted policy circles about the details of Australia's projected policy to combat CO_2 emissions and stop global warming — and I can't help wondering where the can-opener has come from!

So, back to basics. There is a long tradition of thought, beginning perhaps with Thomas Hobbes, running through David Hume and Adam Smith and familiar to economists from Samuelson's canonical public goods papers, that sees the primary rationale for government as lying in what we would identify as the n-person version of Tucker's prisoner's dilemma. The common claim is that we need institutions that possess coercive power (the power specifically to tax and/or regulate) because decentralised decision making cannot produce public goods in anything like optimal quantities. As Bob Stavins rightly remarked, we cannot rely on voluntary behaviour to solve the policy problems that our emissions create. We just wouldn't be here talking about global warming or climate change issues if that were so.

[1] I assume that every economist knows that joke. Those who do not can find it on Google under 'economist jokes'. Some sources attribute it to Paul Samuelson.

This is something that economists *know*. We know it because we understand the structure of individual interaction and we have good evidence for thinking that people are less than totally altruistic.

Global carbon emissions reductions are, as I understand the science, a classic case of a global public good. That is, the greenhouse gases that are released from any source are pretty rapidly diffused into the atmosphere — if Australia's carbon emissions affected only the Australian climate, then things would be different. But the effect on Australia's atmosphere of any reduction in Australian carbon emissions is just to reduce carbon by the proportion represented by Australia's share of world carbon emissions. Australia's actions on CO_2 emissions therefore have negligible effect on Australia's climate; Australian policy to reduce carbon emissions will only have a proportionate effect on Australia's climate if Australia's policy action *causes* all other countries to impose the same reduction in CO_2 emissions — and it is the essence of independent action that Australia's action does *not* cause identical policy in all other countries!

Recall that in an independent adjustment equilibrium in the provision of a public good, it must be the case for every individual contributor that the marginal value of a dollar's contribution to public goods provision is a dollar. (At optimality, each, on average, has a marginal evaluation of the public good equal to 1/n dollars; so it won't be rational for any individual to contribute at that optimal level unless she is part of an n-person compact in which each contribution is matched by the contributions of all others.) If one or other of the individuals in question is highly altruistic, then that individual may contribute a large amount to the public good. But an increase in that individual's contribution is, under a variety of assumptions, likely to cause an equal reduction in the total contributions of others.

This is all so familiar as to be boring. Sadly, however, although it is boring, the reasoning is also entirely valid. And it is presumably *exactly* what Stern and Garnaut (and economists generally) have in mind when they say that global warming/climate change is the most difficult problem the human race has ever had to face. With all due respect, that problem is *not* the problem as to whether carbon taxes or cap-and-trade or hybrid price/quantity restrictions represent the best mechanism for Australia's policy on this matter. Those latter issues only make it onto the agenda when we have a conceptual solution to the global public goods problem. I say 'conceptual solution' here, because I don't have in mind a requirement that we have an actual treaty with real teeth to which every nation has signed on and to which we have some reason to expect faithful compliance by all players. I mean by 'conceptual solution' that we have at least *some* idea of what would actually motivate the governments of nations to act in ways that are systematically contrary to their *national* interests! In the absence of an answer to

that question, I have to say, it seems like just another case of the can-opener, all over again!

The contrast with *domestic* environmental issues is that these issues are, at least in principle, something we can do something about. We may not know exactly how to measure the marginal benefits of, say, restoring the marginal wetland. We may concede that negotiating the political process (with the complications of our Federal structure) in order to secure what we believe to be genuine environmental gains is a tricky business. But at least there is a political process to negotiate. The policy ends are something Australia can deliver on — and policy-makers can be held politically accountable on their performance in delivering those ends. There is, in short, a collective institution, the Australian polity, that can be an appropriate addressee of any policy recommendation — that can tax citizens to provide the means to buy back water; that can define and assign property rights and enforce the terms of any exchange; that can experiment with the modification of subnational political and social boundaries in the manner that David Brunckhorst recommends.

Generally I don't believe in categorical distinctions: I deal a lot with philosophers and for my taste they use categorical distinctions much too much. I prefer to think of differences in terms of positions along a spectrum. But here, I think, there is something close to a conceptual knife-edge. Given what I take to be a fact, that national boundaries are a prevailing institutional feature of the current world order, I think national and global policy are of different 'institutional kinds'. They are as conceptually separate, perhaps, as the modern state is from Hobbesian anarchy.

On the basis of this distinction, I want to say a little more about both sides of this divide — though, slightly apologetically (for reasons that may already be clear and which I shall restate at the end), mostly on the global side.

12.2 The global aspect

There is, it seems, a consensus within the relevant scientific community: first, that there *is* 'global warming' (or at least 'climate change') of significant magnitude; second, that it is *caused by* increased CO_2 emissions — or, at least, could be substantially ameliorated by a significant reduction in CO_2 emissions; and hence, third, that the global consequences of doing nothing about CO_2 emissions are potentially catastrophic.

Apart from a kind of habitual scepticism about predictions concerning the end of the world, I have only the very weakest grounds for questioning that 'consensus'.[2] It seems to me that at this point we ought take the science as given. And that is what I shall do here.

But I also think we ought to take, as presumptively authoritative, the no less broad consensus within the economics profession concerning incentives to free-ride in public goods provision, that I have already discussed. By way of summarising that consensus, let me put the point starkly: *if the Australian government were an utterly faithful agent of its citizens' interests, it would simply free-ride in the matter of CO_2 emissions.*

In the face of that latter consensus, I confess that I found the conclusions of the Stavins paper puzzling. As he observes, there seems to be some evidence that countries are acting unilaterally in the face of global emissions. Many did sign on to the Kyoto protocol (some, like Australia, more reluctantly than others). Europe is developing its own policy — just as Australia now seems to be. There are good prospects that the United States will do something, despite the resolute opposition to the Kyoto approach. California has its own purely state-based proposal. Broadly, and despite his acceptance of the necessity for government action *within* nations, Stavins seems optimistic about the prospects for decentralised unilateral action *among* nations — with cooperation emerging perhaps in due course. I find this puzzling because Stavins must ultimately be claiming that, while individuals cannot solve n-person prisoner's dilemma problems *qua* individuals, they *can* go much closer to solving them via what we might call the 'partitioning' solution. That is, we partition the set of individuals into two hundred or so groups, such that there is coercive power *within* groups, but where the relation between groups is one of independent action, just like the relation between individuals prior to partition.

That there might be such a solution to the public goods problem strikes me as an interesting speculation, and I shall want to explore it a little in what follows. But I have to say that I know of no formal treatment of any such speculation in the literature.[3] And I cannot find any defence of it in the Stavins paper itself. So we are left with a puzzle. It is one I want to engage briefly.

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[2] These grounds relate to some niggling doubts about incentives and selection biases in the funding of science.

[3] One might claim that a 250-person prisoner's dilemma is easier to solve than a several billion-person prisoner's dilemma. That I freely acknowledge. But I do not think that that entitles us to think that the 250-person version is solvable. And in any event, the standard solution involving explicit cooperation among potential contributors is not what Stavins has in mind.

I said that if governments were faithful agents of their citizens' aggregate interests, they would not act to curb CO_2 emissions. But virtually no serious scholar of politics I know, whether of the standard 'public choice' school or of the revisionist variant of rational choice political theory that I favour, thinks that government actions faithfully reflect aggregate citizen interest all the time.

The standard public choice account

Take the standard public choice argument first. As a whole slew of regulations and tariff 'protection' measures testify, democratic politics is hospitable to policies that serve to redistribute to well-organised interests away from relatively unorganised ones, at the expense of aggregate interests. Those same general forces that make genuinely free international trade such an elusive policy goal can conceivably be mobilised to promote CO_2 emission reductions. As I see it, orchestrating just such a mobilisation is the agenda that Warwick McKibbin sets for himself in his 'hybrid' approach. Although he declared himself last evening to be dissatisfied with the 'trade' analogy, I think the tariff parallel is useful. Rights to emit, like tariffs, serve to create rents. Who gets those rents is an artefact of the particular regulatory instruments used. McKibbins' aim is to construct those instruments and their allocation so as to establish a more or less stable political coalition supporting the maintenance of the policy that gives those instruments their value. His strategy is rather like that of a company, seeking tariff protection, which gives out shares to a well-devised majority coalition so that that majority will reliably support that tariff in future elections. As our experience in trade negotiations indicates, the political forces supporting 'protective' measures can be extremely stable and impervious to change even when it is in the country's *aggregate* interests to change them. McKibbins' ambition is to do for emissions restriction instruments what jolly Jack McEwen attempted to do for tariffs — create a regime of 'protection all round' in which a critical mass of political forces see themselves as having a stake in the maintenance of that regime. That will serve to embed a policy that will impose net costs on Australia — but it will distribute those costs in a way that is politically profitable.

Put the issue a slightly different way. Just why are Australian business interests generally in favour of the current round of carbon emission entitlements? The answer is surely that they expect some significant proportion of those entitlements to be *given away* to existing businesses. Contrast the creation of these emission entitlements with a general carbon tax — something that Henry Ergas argues persuasively could be a rather better arrangement in efficiency terms, assuming that

most of the revenue were used to substitute for high marginal income tax rates.[4] The carbon tax creates revenues for government. Those revenues can also be given out to special interests — but how that is done remains at the discretion of the government of the day and so is subject to future change. The emission entitlements by contrast effectively assign the revenue value of that carbon tax to those who are given the entitlements: the rent transfers are an intrinsic feature of the policy instrument. Of course, under the carbon tax, exemptions can be granted. But it is by no means easy to disguise tax exemptions; whereas the precise pattern of giving out entitlements is not a salient policy feature. The McKibbin scheme involves, as I understand it, giving some proportion of the entitlements to ordinary citizen-voters, as well as to business interests, presumably with an eye to building around the carbon scheme a robust 'coalition of the willing'.

In any event, this is my reading of the current preference for retradeable permits over taxes. It might all seem somewhat Machiavellian — but another way to read it is as shrewd politics. We create some monopoly-cartel rents in the CO_2 policy process as a means of buying business approval. All this, of course, for a policy that creates net harm for Australia — though if the science is right, probably net benefits for the rest of the world.

If this were all there is to be said about democratic political process, it would not be good news. Taking a step back from the particular environmental application, the logic suggests that it is possible to create political support for almost any policy by a strategic manipulation of the redistributions to which that policy gives rise. If McKibbin can do it for carbon emissions, why couldn't any special interest do it for whatever madcap scheme happens to be on their agenda?

One important part of the answer to this question lies in the constraints imposed by broad public opinion, as revealed in electoral processes. It is one thing to be able to construct a policy framework that will buy off special interests. It is another to do so in a manner of which the electorate will approve. Jack McEwen can deliver 'protection all round' only if there is a general mistrust of free trade and a climate of community support for tariff regimes *in principle*. The standard public choice line is that securing electoral approval does not involve any test independent of the distributive structure of policy, because individual voters can be 'bought off' by strategic redistributions in the way that special interests can. McKibbin's scheme to involve a critical mass of ordinary citizens in the allocation of emission permits suggests that he endorses that standard line. (Note that this involves finding a critical minority of Australians who are going to have to bear the full burden!) But I think that the standard line is at best partial and at worst misleading. Indicating why

[4] Which interestingly in the Australian case does not mean the rates on upper incomes so much as rates on welfare recipients with sharp means tests.

brings me to my revisionist 'expressive' account of voter behaviour; and to a second line of hope for a solution to the global emissions issue.

Expressive voting

The expressive account of voting offers a distinct reason why policies may not be in the aggregate national interest — because votes do not reliably track the voters' individual interests.

The account takes as its point of departure the fact that no individual voter can reasonably expect to be decisive — that the probability of my vote determining who wins in an election is asymptotically negligible. This means, among other things, that voting in accord with my conscience becomes a pretty cheap activity.

Suppose that there's a policy that, if implemented, will cost me $10 000 a year. I think that it's the right policy from a global point of view. But $10 000 a year is a lot of money. On the other hand, what does it really cost me to vote for that policy? Not $10 000 a year. Rather, $10 000 a year times the probability that my vote will determine the outcome of the election! To simplify just a little, $10 000 a year times the probability that there will be an exact tie among all other voters! (In all other cases, my vote is outcome irrelevant: if I made a mistake in voting and somehow voted for my less favoured candidate, that mistake wouldn't actually change the outcome!) Now, the probability of an exact tie among twelve million other voters is a small number. (Actually, the relevant magnitude is the probability of an exact tie in the marginal electorate in an election won by one seat — times the probability that my electorate will turn out to be the marginal one!) This probability is almost certainly small enough to make the cost to me of voting my conscience on this $10 000-a-year matter something like a mere dollar or two. Acting as my conscience dictates may not be worth $10 000 a year; but it is likely to be worth a few dollars.

What this means is that if individuals were truly rational (and held rational beliefs about the probability of being decisive), individual interests would predictably play not much role in politics — and certainly a much smaller role than they do in market settings, where agent choice *is* decisive over options. The right way to think about voting behaviour is in terms of cheering at a football match — not choosing a car or a house or an assets portfolio. When you cheer at a football match, you express your desire that a particular team win: you show your support for your chosen team. But your cheering is not causally efficacious — it exercises negligible effect on the actual outcome. Voting is more like a 'speech act' than it is like a market action — closer to an opinion poll than, say, selecting your portfolio manager!

A direct implication is that the things that *are* relevant in electoral competition, and hence in determining electoral outcomes, are the factors that make individuals cheer (and boo). And one thing that lots of people are likely to cheer for is the environment. Who, after all, wants to express support for global catastrophe?! On this basis, large numbers of voters can *quite rationally* vote for carbon emissions policies that will make them individually considerably worse off (and almost certainly Australia worse off as a nation) because they believe that it is the morally and globally responsible thing to do. And expressing that moral position in a context where they are just expressing their views is much cheaper than doing so in a setting where each only pays if she speaks up.[5]

It is therefore by no means inconceivable that enough citizens in enough of the democratic countries around the world will support policies that inhibit CO_2 emissions entirely unilaterally — and that emissions *will* fall to a level such that potential catastrophe will be averted. And this notwithstanding the fact that the national interest does not support emission reductions in any of the countries involved.

I say that this is not inconceivable. I do not say that it is especially likely. Personally, I am sceptical. My prediction is that, in the medium term, some countries will have made significant sacrifices, but that the level of global CO_2 emissions will nevertheless have increased — with its attendant climatic effects. When that happens, enthusiasm will start to run thin: pre-emptive suicide is not, after all, an especially popular policy. (This, we might observe, is the fate of many popular enthusiasms — like wars that go on longer than a year; or megalomaniacal public projects when the real cost comes home to bite. There is a flurry of electoral support when they are first introduced, but unless there is manifest 'success' the support is hard to maintain.)

Moreover, the danger in expressive politics is that it encourages symbolic policies. I do not, for example, regard it as at all surprising that Kyoto had little overall effect on CO_2 concentrations. Drew Collins made the remark in passing that 'much environmental goodwill had been squandered on tokenism' (nice turn of phrase, that!); but again, that is what I think we ought to expect. For example, when I remarked earlier that, if the Australian government were a totally faithful agent of its citizen's interests, it would simply do nothing about carbon emissions, I did not

5 The line of argument at stake in this view has been elaborated and defended extensively in Brennan, G. and Lomasky, L. 1993, *Democracy and Decision: The Pure Theory of Electoral Preference*, Cambridge University Press, New York. It has implications for policy that are extremely general. Of course, this is not the context to spell those implications out in even minor detail. The remarks here will, though, perhaps be enough to suggest that the expressive account of voting offers a better account of environmental politics than do rival accounts of voting that treat the voter as if she believed that her vote actually determined the electoral outcome!

claim that that is what the Australian government would *say* that it was doing. On the contrary, the demands of international respectability almost certainly require countries to pay lip-service to international environmental agreements; and even to be active promoters of the development of such agreements. And at the domestic level, there will be a lot of emission reduction rhetoric; but there will also be a lot of trying to manage a symbolic commitment to global environmentalism without imposing too great a cost on ordinary producers and consumers. We have already witnessed a little of that here in Australia in terms of the petrol price debate.

In short, I predict a lot of 'I'll fumble; you pay' across the international community; and perhaps even greater than usual amounts of political hypocrisy across the Western world, as self-imposed CO_2 emissions regimes start to bite. That itself presents an interesting policy challenge. 'Hypocrisy' doesn't, I like to think, come naturally to economists — so balancing the requirements of political respectability against considerations of the national interest, truly conceived, is no small ask. And I sympathise with those who are going to have to negotiate the questions. Of course, many here are familiar with that challenge; but I suspect it is going to get worse — much like the environment itself.

From the global to the local

I have spent almost all of my word allocation (and time) talking about the global case. This instantiates what I often say in meetings like this: that there is an important difference between academics and policy makers. We academics can focus on what is interesting (and I have to say that I personally find the global issues fascinating); whereas public servants and policy advisors have to focus on what is relevant. And it should be clear by now that I think the relevant challenge lies with environmental issues that appear at the domestic level.

But although I have drawn a sharp conceptual distinction between global and local, I do not want to suggest that they are unrelated. Indeed, focusing on the connections between the two levels will perhaps serve to sharpen the force of my overall judgement of the proper policy response.

- First, to reiterate the conceptual point. If unilateral action in the global warming case is rational for Australia (or more modestly constitutes a 'political equilibrium' for any individual country), then public goods problems can't be of quite the severity for decentralised institutions that the standard public goods analysis assumes. So, international success or otherwise in the carbon emissions area will have interesting implications of a general theoretical kind for how we think about public goods and common property problems more generally — and specifically at the more domestic level.

- Experience of success or failure in more national/local environment problems can inform us as to the prospects of success in international ones. If the fact that political jurisdictions are overlapping creates problems for, say, resolution of the Murray–Darling problem, when the number of governmental players is small, what are the prospects for tolerable solutions to the carbon emissions issue when the number of players is huge and highly heterogeneous, and there is no overarching political authority?
- The severity of purely local environmental problems is likely to be a function of the more global situation. For example, climate change will affect rainfall levels, with implications for water management in river systems (a prospect that both Arlene Buchan and Wendy Craik note in their papers in relation to the Murray–Darling). More generally, as Gary Libecap notes, norms and policy régimes that have governed management of common property resources reasonably satisfactorily can become deeply problematic when external (climatic) circumstances alter significantly. Arrangements that have been in place for some time acquire the status of de facto 'rights' with all the moral freight that rights carry and all the potential for moral outrage when the rules of the game are changed. (Such moral outrage problems may be exacerbated if the Australian government gives voters an expectation that their sacrifices will actually solve the global problem.)
- Resources deployed by the Australian government for tackling global warming are resources that could otherwise be used for tackling national environmental problems (such as water buy back). I want to emphasise this 'resource competition' both because I think it is empirically very important and because it is an aspect of things that economists are distinctive in recognising. Environmental scientists tend to think of environmental policy as a seamless web of interconnected relations. As Suzi Kerr put it in her presentation, methane gas emissions and nutrient leakage into lake water are similar because they involve the same source of pollution and the same 'science'. But, as I have argued, they also have quite different status in policy terms. And there is a real choice about where we focus our efforts.
- These 'resources' include, at the most general level, not just fiscal dollars (or GDP) but also the scarce attention of politicians and bureaucrats and for that matter, of citizen-voters. For policy purposes, this may be a yet more significant source of conflict.

Ultimately, my advice to the policy advisors, somewhat tentatively given as always, tracks my advice to students in relation to exam strategy: 'start with the easy problems, the ones you think you can solve. Worry about the harder ones later'.[6]

I do not of course pretend that domestic environmental problems are simple. But they are ultimately something we can actually do something about. And that seems to me to distinguish them from their global analogues. Domestic environmental problems are where I see the expected policy payoff to lie. For that reason, I think that the papers presented here today, focusing as they have on the domestic cases — at both practical and theoretical levels — have got the balance right.

Australian policy should focus on domestic environmental issues — and on the global front, focus on *optimal response to the fact of global warming* rather than on Quixotic attempts at prevention. As David Parnell put it, the main game is adaptation, not mitigation. This is not because it is impossible to imagine that the world might luck into a kind of solution to the global emissions problem. I have tried to give reasons why that is not an inconceivable outcome. But I think it distinctly against the odds.

6 Of course, the exam advice comes in a setting where 'all questions are of equal value'. That may not be the case in the environmental area. But I still think that it's a fair rule of thumb not to spend all your effort on problems you are very unlikely to be able to do anything about!

General discussion

Suzi Kerr commenced discussion with three comments:

- the potential for linkages between systems in the post-Kyoto international framework, as described by Professor Stavins, should not be limited to the Clean Development Mechanism — countries should be free to both buy and sell carbon credits
- there was evidence supporting Professor Brennan's point that people will cooperate even when theory suggests it was not in their best interests
- while a lot more work on adaptation should be undertaken, as the marginal costs of both adaptation and mitigation activities are initially low, we should be undertaking more of both.

Points raised by other participants included:

- carbon trading from biodiversity plantings on farmland could provide a win-win situation for farmers, government and the corporate sector — although another participant noted that such win-wins may not be straightforward, for example, planting trees in the upper catchments of the Murray–Darling Basin can affect water availability for downstream users
- people's orientations may not be individualistic.

The session chair, Gary Banks, then invited the panel to make some concluding comments. A selection follows.

Professor Freebairn

I would like to make two comments. The first is in relation to concerns about equity. We need to recognise that government intervention is a positive sum gain. There is no reason for intervention if it is not. But distribution *is* important in relation to the issue of whether tradeable permits are provided for free, or whether they are auctioned.

Second, we need to identify the economic, rather than the statutory, incidence of a policy. That can be tricky. In simple partial equilibrium models it depends on the relative elasticities of supply and demand. The difficulty lies with traded products,

either export or import competing and particularly if Australia goes it alone. This will have exchange rate effects, so a general equilibrium model was required. Greenhouse policies are largely an origin-based tax falling on all Australian production. This will reduce Australian exports and increase imports and cause a currency depreciation. All these effects have to be taken together.

The issue discussed by Suzi Kerr and Professor Libecap about the timing of reform was important. Suzi Kerr indicated that if there was no need for redistribution, reform was easier. On the other hand, Professor Libecap said that this won't attract the attention of politicians. So there was a trade-off between political involvement and redistribution.

A related issue is what is the most appropriate greenhouse tax base for Australia in the event that we go it alone? Are we going to use an origin base or a destination base, or exempt both imports and exports? Understanding all the potential effects of these options will require a general equilibrium model that includes exports and imports with different carbon intensities and exchange rate adjustments.

Professor Libecap

While Professor Brennan provided us with a division of the topics discussed today in terms of the size of the externality or the open access problem, another way to consider the issues was by mitigation versus adaptation. Cap-and-trade programs are an attempt to mitigate the size of global warming and its effects; whereas adaptation is about designing institutions to address a global environmental and resource problem.

There is a question of whether early mitigation would reduce subsequent adaptation costs. I studied under Oliver Williamson so I'm always thinking about information costs and transactions costs. Initially, the information costs are so large that it's hard to know exactly what the nature of the problem is and how it should be addressed. Moreover, the collective action costs are high because parties aren't sure what the net economic gains will be from committing to a particular policy. Then, after a crisis occurs — fisheries collapse or water becomes scarce — we have better information about the issue, and collective action problems are reduced.

If you include all the information and transactions costs, then early mitigation may not be socially or economically efficient. Since empirical observation supports this, it suggests there may be an underlying efficiency reason for such patterns of response. For this reason I'm quite optimistic about the likelihood of property rights regimes emerging in areas such as water, fisheries, and land use, because we are facing crises there, and the gains from a property rights regime are evident.

Professor Stavins

The notion of focusing on the easy problems first was an interesting one. I happen to be a highly risk averse individual and so I tend to do that in my personal life. Of course, that's neither efficient nor wise. It can be a prescription for allowing the larger problems to become insurmountable.

Having said that, is climate change the most important problem in the world? Absolutely not. Is climate change the most important environmental problem in the world? In my opinion, no. The environmental problems that are more important than climate change are located in the developing world, and they are indoor air pollution from cooking fires, and lack of potable water supplies.

Obviously, a global commons problem means it is in the narrowly-defined interests of individual countries not to take action — that's why a cooperative arrangement of some kind is required. On the other hand, it's striking to observe that (perhaps foolishly) the European Union, and a number of other countries, *are* taking action. Even the state of California is adopting a unilateral global climate policy. The costs to California will be vastly greater than the benefits. The smaller the political jurisdiction, the greater this problem becomes.

So it's happening and it will continue. In my opinion, by 2009 or 2010, the United States will have a meaningful cap-and-trade program, reducing emissions to 50 per cent below 1990 levels by 2050. There are two caveats on this: a deep and prolonged recession does not occur; and a major terrorist incident does not take place on US soil. Either of those would push consideration of domestic climate policy off the political table.

A border tax has tremendous political support in the United States. As I suggested, if the United States does introduce such a tax, Europe will do the same within six months, followed by the other industrialised countries. It is quite possible that the cure could be worse than the illness, unless such measures are carefully structured so as to act only as inducements for participation in the international climate regime.

In relation to international climate policy, after the 2008 presidential election, the United States will re-engage with the world in various ways, particularly under the Framework Convention on Climate Change. The big question — and this is something Australia should worry about — is whether the United States will be ready to meaningfully participate in the United Nations Climate Change Conference in Copenhagen in December 2009, given how long it takes for political appointments in a new administration to be confirmed by the Senate.

It may turn out that the post-Kyoto climate change architecture will emerge from the bottom up — for example, the linking of domestic and some regional cap-and-trade programs through emission reduction credit programs or other kinds of mechanisms.

Finally, an important way to think about climate change is to recognise that as a policy problem it has less in common with issues such as stratospheric ozone depletion and chlorofluorocarbons, than it does with issues such as global democracy or economic development in poor countries. A single policy instrument, whether negotiated or unilaterally put in place, is not going to solve either of these latter problems. What matters is whether a policy increment taken by one country or regional grouping is helping or hurting.

Having said that, it's also true that a key objective of the international process is to bring all major emitters on board, including the key developing countries. This is a huge challenge, and will require significant research in economics and good political thinking. Hence, my last comment is that there is plenty of work remaining for the Productivity Commission.

Professor Brennan

I think it is more appropriate to view Australia's unilateral global emissions plans as an act of international charity, rather than an attempt to play a role in solving a public goods problem. I would like to explore Professor Freebairn's comment that if government is to be engaged in this activity, it has to be a positive sum activity. I don't see any empirical evidence of that. Governments do lots of things (including, for example, military adventurism) which are clearly not positive sum, even in the global sense.

Second, when we talk about positive sum or win-win situations, we have to be careful to specify who the winners are. If they are not parties to the contracts — if they are not able to express the fact that they win — then whether it's a win or a loss is a second-order consideration. There are lots of win-win situations if you draw a small enough barrier — for example, cartels are win-win situations for the members of the cartel. You have to specify all the normatively relevant persons — these could be all the citizens of the world. If you do, then Australia's activity in reducing emissions is a morally appropriate thing to do. But economic tradition tells us to be sceptical about the extent to which people will pursue outcomes for purely moral reasons.

It's very likely that by 2020 we will have solved the Murray-Darling problem, but I'm not so sure that the emissions problem will be solved. Obviously Professor

Stavins thinks there is good empirical evidence of an increasing commitment to solving the problem. My question is how long is this going to last? How robust will this commitment be when countries make significant sacrifices and the level of global carbon emissions continues to rise? I think it's difficult to be optimistic under those circumstances.

Professor Freebairn

In cases of market failure, if government interferes, it should do so only on the basis of a positive sum game, even though sometimes it will get it wrong. It is also true that government has a role in redistribution, which is not necessarily a positive sum game in efficiency terms. And government has a role to play in macroeconomic stability, which I guess it hopes is a positive sum game (but they usually aggravate the cycles rather than smooth them). So I will stick with my proposition, but with these qualifications.

Concluding remarks: Gary Banks, Chairman, Productivity Commission

One of the reasons why the Productivity Commission exists is to help overcome the gap between what government should do and what it actually can do in the political context. Professor Stavins observed that there was plenty of research work for the Commission in this area and I think all participants will have ideas for further work that have come out of today's very rich discussion.

When we designed this conference some months ago, we weren't thinking that greenhouse issues would be the central focus. The fact that it featured so prominently in discussion indicates how important that issue is. Even if it's not the most significant environmental problem, it's probably the most important policy issue, particularly in countries, such as Australia and New Zealand, which are contemplating action in advance of other countries.

The Commission is aiming to provide constructive support for an evidence-based approach to policy in this area. There is a clear need for more evidence to inform both government decision making and wider community opinion. A recent survey found that although a majority of the Australian population supported an emissions trading system, there was little understanding of what an emissions trading system was.

There is plenty to do and a lot of ideas have been generated by today’s discussion. I would like especially to thank the overseas speakers who prepared papers and came to Australia for this one-day conference. Professor Libecap and Professor Stavins will also be presenting seminars at the Commission, so we will benefit further from their insights. It’s been a great day and I thank everyone who participated.

13 Lessons for climate policy from monetary history

Dinner address

Warwick McKibbin
Australian National University

It is difficult to say something new about climate change policy to a group of people who have a great deal of expertise in the area already. What I want to do in this talk is offer a way of thinking about climate policy from a perspective that is different from the usual. This presentation draws heavily on my recent 2007 Shann Lecture on *A New Climate Strategy Beyond 2012: Lessons from Monetary History*, and on a decade and a half of collaboration with Professor Peter Wilcoxen from Syracuse University.

When someone is new to a policy debate they often look for insights from experience in other areas. In a number of countries, including Australia, there are well trained economists who start working on climate policy and immediately look to trade policy for an analogy. This can be good and it can be bad. While there are important lessons to be drawn from trade debates, there are some fundamental differences between climate policy and trade policy. If you are a trade policy expert you conceptualize the problem of emissions reductions as similar to the debate on tariff reductions. Reducing tariffs to zero will generate economywide gains with ultimately enough benefits to share around. It will not matter about the pain that is caused during the adjustment period because the gains will be larger than the losses for the majority, so it becomes a question of income distribution. All that is needed to reduce tariffs to zero is to push the vested interests out of the way. A similar argument is made about fossil fuel intensive industries in the carbon reduction debate.

13.1 Climate policy is not trade policy

The trouble with climate policy is that it is not as easy as trade policy — nor are the lessons from the trade experience necessarily the most relevant for climate policy. First, in reducing carbon emissions we are talking about a transformation of the economy that is highly likely to be costly. So, instead of sharing benefits, policymakers need to worry about sharing costs. Second, the nature of the institutions in a trade policy world are not the type of institutions needed for implementing climate policy — consider, for example, the recent negotiations under the auspices of the WTO that have stalled in the Doha Round. This outcome is not what we need for credible climate policy. For most aspects of the climate policy issue, the trade policy approach is the wrong way to think about the problem. Unfortunately this mindset tends to drive the debate in Australia.

I (together with my co-author Peter Wilcoxen) propose an alternative perspective on climate policy — one that is unconstrained by political promises or political compromises that tend to dominate political reports. It is useful to think about climate policy from the point of view of monetary history because we learn a lot from looking at the history of the evolution of international agreements and collaboration between countries in the monetary area. What I first want to do is briefly touch on what we know from climate science and how that should drive policy — probably in a different way to how most people think. I then want to draw out a couple of lessons for climate policy design from our experience with the global monetary system. It will be a mix of theoretical insights but with a large dose of practical reality.

13.2 Lessons from monetary history

There are several points to stress. First, we have learnt from monetary history that common currencies do not last, which suggests that maybe a common carbon market will not last (for the same reasons). Second, there is no gain from short-run interest rate volatility so perhaps, for the same reasons, there are no gains from short-run carbon price volatility. Third, time consistency really matters in designing policies. It is a very good idea to tie the hands of future governments to prevent them from re-optimising policy decisions after economic agents have committed to an investment strategy. This constraining of policy revision can be done by creating balancing constituencies within an economy to prevent the government from reneging every time they think it is in their own self interest.

Fourth, it is really important to build independent institutions with clear goals to implement the policy. It is critical to get the institutional design right. It is not a

good idea to put climate policy in the hands of either Treasury, or the Climate Change Department. It should be put it in the hands of an independent institution like a central bank of carbon.

Fifth, the whole debate in the 20th century about the transfer problem and the Dutch disease issues caused by attempting to transfer large amounts of wealth between economies is relevant for the climate issue. Mixing climate policy with big income transfers from one part of the world to another, or from one part of society to another, makes it very much harder to implement. It is critical to take the transfer problem into account when designing global and national policy. Attempting too many goals with a limited number of instruments is problematic.

Finally, I want to discuss how climate policy should be designed, and deal directly with these issues. What I propose is not a perfect approach, but I think it is an approach that deals effectively with these core issues and does so better than recently published reports on climate policy design for Australia.

The good news is there are no big models required to evaluate this approach in 2050 or 2100 — there are no equations — but the unsurprising news is that the McKibbin–Wilcoxen hybrid will eventually emerge as the preferred approach.

13.3 Climate science

What do we know? We know quite a lot. We know that climate is a complex system that is always changing. This is not a situation that economists usually face. We are dealing with something that is continually changing and never reaches a steady state. This is a very difficult policy environment.

Average temperatures have risen roughly 0.7 degrees in the past century. Both natural variability and human-induced climate change are occurring. Unravelling how much is human induced and how much is natural variability is a complex question. We also know that we are pumping enormous quantities of greenhouse gases into the atmosphere, more than 7 gigatonnes per year. This is unlikely to be sustainable.

The problem is that there is an enormous vacuum in policy, globally and nationally in most countries, and this vacuum is causing significant economic losses. Even if you are a sceptic about human-induced climate change, the ‘do nothing’ option is costly because investment in energy infrastructure is not being undertaken due to the policy uncertainty. Everybody is waiting for the policy framework to be put in place. Even if you are a sceptic, it doesn’t mean do nothing is the best policy, because to do nothing actually costs. You need to take out insurance.

What else do we know from the climate science? First, scientists make it clear that it is not greenhouse gas emissions in any year that matter but the accumulation of these emissions in the atmosphere over time. These accumulations are known as concentrations. Science does not tell at what level concentrations of greenhouse gases should be to avoid dangerous climate change. There are different views among the scientific community as to the level of concentrations at which dangerous climate change occurs, but there is a pretty convincing argument that we should be heading towards concentrations of 450 parts per million. I should stress that this number has changed a lot since I started working in this area 18 years ago, but it is a good starting point.

The bottom line is that science should guide policy formulation, but science can not tell us exactly what we should be doing. Suppose we did know the global concentration target. Suppose scientists agreed that we cannot go past 450 parts per million. Science does not tell us how precisely to get there — do we cut emissions or increase sequestration? How quickly should emissions be cut? The profile of emission reductions to meet a given concentration target is not a scientific question. Science does not tell us whether we should cut sharply now, and then do very little, or cut mostly later but then do a lot. The issue of costs and benefits of different strategies is an economic or moral question posed in the context of risk management.

Science also tells us nothing about what a national emissions target should look like, because the way the global emissions pie is divided between countries is not a scientific decision. It is partly an economic decision. An economist would propose choosing the least cost emissions abatement opportunities to meet the global target. It is partly a moral or ethical question about who should bear the burden of the cuts. It is not a scientific question. Any national study which starts with the idea that science tells us that as a nation we have to cut emissions by a certain percentage is not based on any science that I am aware of. The climate change issue at the national level is an issue of not just science but of economics and morality, of politics, and a whole range of other issues, which makes it a very difficult policy debate.

What are the implications of this complexity? Many economists who start working on climate policy start with the idea that a cap-and-trade emissions trading market would be a good approach. Cap and trade is based on the idea that we know what the annual cap should be, or we know what the cap should be over a period of time, but that's really an assumption rather than an implication of science. We know from science what we need to do more broadly — we need an approach that moves towards a global concentration target that is uncertain. But this target is likely to vary over time as we obtain more information on the complex overall climate

system. Within the global concentration target, one of the key issues is to equalise the cost across countries, and minimise costs over time. This does not appear to be the current approach in international negotiations. The essence of the focus should be on how to design a global system that achieves the scientific goal but at minimum global and relative cost across countries. To stress again, science does not provide a national emissions target and timetable framework, but that tends to be the premise of the Garnaut and Stern Reviews and other studies.

13.4 What should be the focus of climate policy?

So what should climate change policy focus on? In my view it should focus on managing risk and dealing with climate uncertainty. That is the essence of the climate problem. We don't know how much to cut, but we think we should be cutting significantly. We want to manage the risks to the environment, and to the economy, so we have to design systems — markets in particular — that let us deal with uncertainty. It is not about picking arbitrary targets and meeting the target no matter what. That is a political argument, not a scientific or economic argument. The focus should be on creating a system that enables society as a whole to manage risk — the government should not bear all the risk. We need to create markets so that individuals and corporations can make decisions using markets and other mechanisms to manage their own risk. That is important when we are dealing with the sort of energy system development and technology deployment that is needed. Creating long-term robust institutions, globally and nationally, which steer the global economy to a low emissions future, is fundamental.

The institutional structures have to be thought about very carefully. When constructing a global system, starting from the top down and forcing countries to take action is not going to work. The starting point should be countries taking action that they see as in their own self interest, and then these national or regional policies can be knitted together into a global system with an overarching framework that helps sustain the national actions. The idea that you get uniform global agreement and consensus has not worked, and is unlikely to work in the future despite politicians' optimism about the Copenhagen conference in December 2009. They were also optimistic in 1997 when the Kyoto Protocol was negotiated and global emissions are much higher today than almost anyone predicted.

13.5 Pricing carbon is a necessary but not sufficient condition

A whole range of different policies are required. The carbon price needs to be at the core because it is a way of coordinating the carbon-emitting and carbon-abating decisions of all of the agents, all over the world. Yet the carbon price has to be designed and implemented carefully. There is no doubt that the short-term carbon price is a cost to the economy. If we change the price of carbon tomorrow, it will be costly. On the other hand, long-term carbon prices are, in my view, opportunities for the economy. People get these two time dimensions mixed up, either because they do not understand the key issue of investment incentives or because it is in their own self interest to confuse this point. Many argue that there should be a high carbon price today because that is the only way to stimulate renewable energy. My view is that a high initial carbon price is going to hurt the economy, and what matters for renewable energy sources is not the price of carbon today, it is the expected price of carbon over the next 20, 30 or 50 years. Everybody is focussing too much on the short run. We need to set very clear long-term carbon prices for the global economy that enable individual countries to manage their own domestic costs of carbon abatement to suit their own national and global self interest.

There are many ways to put a price on carbon. One way is a carbon-trading market. First, you create a regulation that requires carbon emitters to obtain a permit to emit carbon. But there are different ways of creating a carbon-trading system. First, the government could limit the supply of permits, creating a fixed amount of carbon. The market determines the price because carbon permits are scarce. A cap on emissions is called a cap-and-trade permit system. There are different versions depending on whether banking and borrowing of permits is allowed so that the cap is not binding in a given year but is over a period of years. The alternative approach is to set a price at which you can buy permits from the government, and allow as many permits to be bought as required in a particular year. This approach is the equivalent of a tax.

The advantage of the cap and trade approach is that once the cap is established, the environmental outcome is known. The disadvantage is that the cost is unknown, and there could be a lot of volatility in the short-term carbon market, because there is no flexibility in the supply. The advantage of a tax is that the carbon price is known — but the emissions outcome in any one year is not.

There are other differences between these approaches to pricing carbon which are of a long-term nature. The beauty of a carbon market where permits are allocated is that the allocation itself creates constituencies that change the nature of the interaction between the private sector and the government. The problem with a tax

is that if you are trying to generate a long-term carbon price, it is not clear what the tax will be in the future if the government has not credibly committed to the future tax profile.

In relation to the differences between national and global markets, there are attractions from an economic point of view in allowing global permit markets to emerge. In our modelling, the Australian carbon price for a plausible carbon target tends to be much higher per unit of carbon than an American or Chinese carbon price. If there is only a national market in Australia, it could be very expensive to reduce carbon in the Australian economy, when permits could be bought from an offshore market and abatement costs therefore lowered by effectively paying for abatement elsewhere.

The idea of using a global market to reduce the costs in Australia if it proves difficult to meet an annual emissions target, is the essence of the argument for a global market in the Garnaut Review and the Green Paper. Countries with high marginal abatement costs can buy permits from countries with low marginal abatement costs. This trading reduces costs within the national economy and a global market for carbon emerges with a common price. This is an efficient outcome. The price of carbon in any part of the world would end up the same.

Trading is good in theory and in our modelling work we demonstrate that it can significantly reduce the costs of abatement, but it does not solve the problem of uncertainty. Even though a target for Australia can be selected, and if it turns out to be too expensive, the costs can be reduced by trading offshore, the global cost of the target is not reduced. In other words, global costs can be shifted around but can not be reduced overall under a standard cap-and-trade system.

There are also problems associated with the allocation of permits. Trading permits across borders effectively transfers resources from one country to another through the trading mechanism. If an Australian buys a permit offshore they are transferring wealth to other markets. A third problem with trading across countries is that a lot of short-term price volatility is possible. The European trading system is a great example of how markets can trade from 36 Euros down to 2 Euros because some information is revealed to the market. Shocks in one market would be transmitted instantly to all linked markets.

There are no gains from short-term permit price volatility — the gains and the price discovery are in the long term. Who gets the rights to emit in each trading period is critical. If a series of national markets are created, as in the European or Australian systems, with a five or ten year horizon, property rights are re-allocated continuously. This is a waste of resources in terms of rent seeking activity.

There are some historical lessons to be learnt about linking markets. First — this is a lesson from economic history in general — our modelling work in the mid-1990s indicated that the way permits were allocated was important. Once trading starts, if there are big transfers from one region of the world to another, this can lead to large fluctuations in real exchange rates and trade balances, which can destabilise world trade. These effects are related to the Dutch disease and the classic transfer problem debates.

Trading permits is not just trading pieces of paper. Trading permits transfers resources from one part of the world to another. Why is that a problem? If you look at the experience of the United Kingdom when North Sea oil was discovered in the 1970s, Britain suddenly had a comparative advantage in oil. Resources had to shift from the manufacturing sector to the oil sector, so UK manufacturing industries had to be restructured. The country was better off in aggregate because wealth increased overall, but there were serious adjustment problems getting the resources from the non-traded sectors to the oil industry.

That would be a real problem if China or India were given an enormous volume of permits which are then bought by other countries, because this would change the comparative advantage of the Chinese and Indian economies from labour intensive manufacturing economies to carbon abating economies, which could be a very significant internal shock. Keynes wrote about this issue after World War I: how could German reparation payments be transferred out of Germany to the rest of the world without causing a major disruption to world trade? This may or may not be a problem in the climate change debate, depending on how permits are allocated. This depends on a lot of things — including how the world economy evolves, and how the price of carbon changes over time — which we are not good at predicting, but nothing can be ruled out.

The second lesson relates to the fact that there is not a single world currency. Countries have tried periodically to move towards a single world currency but this has failed to varying degrees although there have been some notable regional successes. I believe that there is not going to be a single world permit market because emission permits are very similar to money. An emission permit is not a physical commodity like a pork belly. Permits are government promises to meet an emissions target in the same way that a unit of money is a government promise to maintain purchasing power. The value of that promise depends on the government's credibility. Different governments in the world have different degrees of credibility and different incentives over time to debase their currencies, so problems may arise if governments renege on carbon-trading markets and debase the global currency. We have seen the consequences. The world tried to have a common global currency

after the end of the World War II under the Bretton Woods system, and when it unravelled in the early 1970s it was a significant shock to the global economy.

The third lesson from monetary history is how many countries have converged in the way they run monetary policy. Economists used to think that you could target the quantity of money and then let short-term interest rates fluctuate and that would result in a good outcome with the quantity of money tying down the price level. Policymakers discovered very quickly that this nice theory did not work very well in practice. In addition, there were substantial costs from short-term interest rate (or price) volatility. The gains to policy came from tying down expectations about the policy goal. In different countries nowadays, the target for monetary policy tends to be inflation, or inflation over the cycle, or other nominal targets. The policy is implemented through manipulating the short-term price of money while gradually adjusting to the long-term goal. This is exactly the lesson that we should learn for climate policy.

The carbon policy should have a short-run price goal, which is the price of carbon to the economy, and a long-run quantity goal, which is atmospheric carbon concentrations. Movements from the short term to the long term should occur in the same way that monetary policy works. Transparency, and flexibility in minimizing costs in transitioning from the short run to the long run are critical. We have learnt a lot about how to create a global monetary regime. You do not do it by having a big meeting every year where everyone makes a promise and then goes back to their own economies to run policy. You have national or regional monetary systems working in the national or regional self interest and you coordinate these across countries to internalise the global externalities. In the case of climate change, the externalities are orders of magnitude bigger than the externalities from monetary policy and these externalities are a large part of the climate policy story.

It is clear from the discussion so far that climate policy is more like monetary policy than it is like trade policy. The world and Australia need a system where there are clear targets, not necessarily timetables. There should be an independent agency at the national level charged with reaching those targets and managing the costs of adjustment, free from political interference. There needs to be a very clear long-term price for carbon, because, just as it is the long-term interest rate that drives investment, not the short-term interest rate, it is the long-term carbon price that will drive greenhouse-gas-reducing investment. It is the long-term carbon price that will drive technologies, not the short-term carbon price, but the short-term carbon price should be controlled in the same way that interest rates are controlled to minimise disruptions in the economy. The argument that if Australia does not have a carbon market today, at $35 per tonne, then you might as well forget it, is the wrong way to think about carbon pricing. I care much less about what the price of carbon is today.

I care much more about what the market says the price of carbon will be in 10, 20, 30 or 40 years into the future.

13.6 The McKibbin–Wilcoxen hybrid: a monetary approach to climate policy

So far I have drawn an analogy between climate policy and monetary policy but how can this be implemented? The answer is contained in a book and many articles I have authored jointly with Professor Peter Wilcoxen. The McKibbin–Wilcoxen hybrid (previously called the Blueprint until there where too many blueprints being proposed) is the monetary approach to climate change although it is usually described as a hybrid of emissions trading and carbon taxes. It is a cooperative approach based on a series of national systems that are plugged together. It could also be implemented as a global system if agreement from most countries was obtained.

How does the McKibbin–Wilcoxen hybrid work? First, the aim is to impose a long-term concentrations goal — we do not discard targets for emissions, only timetables. We argue for a particular concentrations target, but we are not sure when we are going to get there. We also propose a way to distribute this target across countries and across time. Second, we use this emissions commitment to determine a price, within a market, for a long-term carbon target within each national jurisdiction and that is what will drive energy investment decisions. At the same time, short-term costs are controlled. The problem of trading off the costs with the environmental benefits is at the core. We also want to create markets to enable corporations and households to manage their own climate risks. If a company wants to build a gas-fired power station in the LaTrobe Valley, using new technology, they can have a way of hedging that investment so they can proceed despite the risks. If the carbon price rises dramatically in the future because we need to cut emissions more quickly than expected, there is nothing to prevent closing that investment down and cashing in the long-term carbon rights, and moving to a different technology platform.

13.7 Components of the McKibbin–Wilcoxen hybrid

What are the components of the policy? First, we create what we call long-term permits. These long-term permits are a bundle of annual permits with different dates for each permit. The annual permits embodied in the long-term permits get smaller and smaller over time, so effectively the permits eventually disappear. The rights created are a diminishing right to a resource and the supply of these is fixed at the

national long-term target. The long-term permit reflects this target. They are allocated freely to households and to industry. The government gets no revenue from the allocation process. These rights are like real estate contracts, they are in the community owned by vested interests throughout society and they are traded in a long-term market. Why is that important? It's important because you want to create a constituency that owns the rights to the carbon, and can offset any government backsliding on future policy commitment.

The long-term permits can be thought of as a government bond which provides an annual coupon that gets smaller every year. As a company owning these emission rights, if you do nothing to change your emissions, you are going to run into a problem because long-term permits you have been given for free effectively disappear over time. The total initial emission for an economy in 2010 would be set 10 per cent below current emissions, so there is already a shortage. There is scarcity in the market, and each one of these annual permits can only be used in the year for which it is issued. This gives you the long-term pre-committed *ex-ante* target of the Australian government. By 2100 these long-term permits are gone.

The second component of the policy which is critical — and this is where the central bank of carbon comes in — is that the central bank of carbon can print annual permits to maintain a pre-announced price of carbon. This is the annual price that will apply for the next five years. If an emitter cannot get enough emissions from their long-term allocation, they can go to the central bank of carbon and get an annual permit for a fixed price.

This means there is a permanent elastic supply of these annual permits at a fixed price. This acts like a safety valve. In the US debate, it is a safety valve. In the Australian debate, this is what I presume the government and the Green Paper and the Garnaut Review mean by holding the price fixed at a low rate initially, because I don't know how you have a quantity target and a price target in a system unless you do it this way. This means that in any given year a company can reach their emissions allocation, either by using an annual coupon from the long-term permit or buying a coupon from the central bank. That's why the policy is called a hybrid, because it involves permit trading of the long-term permits and effectively a carbon tax implemented as the annual permit — the payment to the central bank of carbon is a tax. Emissions targets can be satisfied from either source. Since there is scarcity in the long-term permits from the very beginning, the annual price of permits will be the fixed preannounced price of annual permits, unless there is a miraculous innovation that drives the price down below that annual price — which would be very good news given the deep cuts proposed in the target path.

At a national level, the system controls the short-term cost because we do not know what the rest of the world is doing, and if the rest of the world has done nothing, we

can keep the price low forever. But if there was a global agreement and countries implemented policies to reach that agreement, there would be an international agreement to step up the short-term price over time, based on where global concentrations were heading. Thus, the price-stepping approach can be implemented either through national action or through a global agreement.

What is the issue facing an innovator? Suppose you are making investment decisions about a technology that may be worthwhile to invest in now, but needs a threshold of $50 per tonne of carbon to be worthwhile. Looking out along the yield curve of carbon prices generated in the long-term market, and the associated derivative markets, you might see that by 2020 or 2040 the price of carbon is expected to be $80 per tonne. At this price that technology would be viable. At that future date, if the price is lower than expected, you can take a short position in this market to bankroll the technology, and if the price ends up collapsing you can close down the technology and trade in your assets, and still make money out of the venture. This encourages investment in alternative technologies because you are managing your own risk.

More importantly, the value of long-term permits is the present value of the bundle of short-term permits contained in the long-term permit. Suppose that the annual permit price starts at $10 per tonne. A lot of people would say that at $10 per tonne nobody is going to do anything. But because these permits have been given out to all society, where you can reduce one tonne of carbon, in a standard carbon market you would save $10. In a McKibbin–Wilcoxen market you have that carbon right for a 100 years, you don't save $10, you save possibly $1100 because the saving is the present value of something that has been saved forever. The hurdle rates of return by using these long time frames are transformational. This approach totally changes the cost/benefit analysis for all sorts of different technologies, significantly changing the incentives people have to reduce their abatement, because if you reduce a unit of carbon today, it is a permanent reduction in carbon and should be rewarded that way.

The way I see the global system evolving is that each country will have their own system. It might be a carbon tax in a Scandinavian country, it could be the McKibbin–Wilcoxen hybrid in the United States and the European Union, but across the system there is a uniform price at the short end. Why is that an efficient outcome? Because there are no gains from trade in the way we have designed the system — a US company has no gains from buying a permit from a European company because they can buy the permits from their own government. You end up with an efficient market without cross-border transactions. Therefore you can partition policy in the United States, you can partition the European Union, you can partition Japan. Partitioning, or building firewalls between these permit markets, is

important because if there is a shock (for example, Japan pulls out of the system) it does not change the price of permits in the other systems. Under a global carbon market, you would destroy the market. Thus, a global permit market is more vulnerable to collapse from the actions of individual countries.

13.8 Bringing in developing countries

One of the big problems in negotiations is how to bring in developing countries, particularly when they are legitimately arguing that they do not want to bear the same costs as industrial countries. What can be done is to negotiate, in the international forum, a much larger allocation of long-term rights than a developing country currently emits. The short-term price of carbon in these economies would start at zero because they are not facing a constraint today, and the firewall between markets is binding. However, these countries would face a transparent constraint in the future. Thus the long-term carbon price in a developing economy will be non-zero (it is the expected value of future prices). Eventually, the short-term price would rise over time until it is equal to the price of carbon in developed economies.

This is differentiation based on the level of development, but the catch up in price is based on capacity to pay, which is determined by the allocation.

13.9 Summary of difference between standard approaches and the hybrid

There are several critical differences between the hybrid approach and the standard cap or taxes. First, as already discussed, the hybrid creates long-term returns for short-term actions. If you own the rights for carbon for 100 years and you change something you do today, the benefit is the present value of a 100 year benefit. That changes the hurdle rates and returns for different technologies. It also enables you to finance your own innovation because you can say to a bank or to a fund manager: 'Here is a technology, I can hedge the investment, lend me the money up front and the assets are in place to back the loan.'

Second, the hybrid is creating constituencies within the domestic economy who own the long-term rights to carbon in the economy. They are not owned by the Treasury, they are owned by a lot of corporations and individuals in superannuation funds. Any government that tries to tinker with the future of carbon policy would face the wrath of the voters. For example, governments in this country do not say they are going to take all real estate contracts and cancel them and reallocate the real estate. Thus, a constituent balance would be achieved that would not be

achieved in a taxed-based system or a carbon-allocation system, where you might get three to five years worth of pre-allocation, and after that who knows who is going to get the long-term rights.

To sum up: climate change policy is a serious issue. Dealing with climate change uncertainty is what matters. Any effective policy will be a major change to the Australian economy. A new market has to be created. It is not a short-term carbon market. It is not a new tax. It is a long-term market in trading climate uncertainty, which is needed at the national and global level.

The second point is that there is still a great deal of uncertainty about where the world is heading, so if a Garnaut-type approach is taken, where you commit to a precise target or a range of targets on the off-chance that you would be able to trade your way out of it by buying cheap permits offshore, and the permit market does not develop offshore, what do you do? You may have locked yourself into an international agreement with no safety valve. Relying on the development of a global trading system without a safety valve domestically is a very risky policy.

The final point I want to make is that we need to get away from the idea that we know exactly where we want to go and that there are no trade-offs in getting there. That's called religion. We have to deal with the trade-off between the environmental benefit of taking action, and the economic costs of getting there. If this is not acknowledged, international agreement will not occur, because it is over cost issues where the international negotiations are failing. Developing countries have bigger problems to deal with, from their own viewpoint, than climate change, but they are willing to be part of the international process if it is designed the right way.

Monetary history has a lot to teach policymakers about how to design effective climate policy at the national level within a cooperative global agreement. It is time to move in the direction of building a transparent, credible, national or regionally-focussed policy framework, with flexibility to adjust in a clear way over time towards a global concentrations goal. The almost religious focus on targets and timetables regardless of costs is the biggest hurdle to overcome in the climate change policy debate. There are better ways to generate carbon prices than what is currently proposed. One such better approach has been the focus of this presentation.

References on the McKibbin–Wilcoxen hybrid

McKibbin, W.J., Morris, A. and Wilcoxen, P.J. 2008, *Expecting the Unexpected: Macroeconomic Volatility and Climate Policy*, Discussion Paper 08-16, Harvard Project on International Climate Agreements, Cambridge, Mass.; also CAMA Working Paper 35/2008, Australian National University, http://www.cama.anu.edu.au/Working%20Papers/Papers2008/McKibbin_Morris_Wilcoxen_352008.pdf

McKibbin, W.J. and Wilcoxen, P.J. 1997, 'A better way to slow global climate change', *Brookings Policy Brief* no 17, June, The Brookings Institution, Washington D.C.

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A Roundtable program

Day 1 – Tuesday 19 August 2008

6.30 – 7.00 pm	*Pre-dinner drinks*
7.00 – 10.00 pm	*Dinner*
	*Welcome by **Gary Banks**, Chairman, Productivity Commission*
	Guest speaker:
	Professor Warwick McKibbin *Executive Director, Centre for Applied Macroeconomic Analysis, ANU*

Day 2 – Wednesday 20 August 2008

8.30 – 9.00	***Registration***
Welcome and introduction	
9.00 – 9.20	**Gary Banks**, Chairman, Productivity Commission

Session 1 — *Stocktake of the effectiveness of current approaches to environmental issues*

Chair: Gary Banks, Chairman, Productivity Commission

9.20 – 9.35	**Professor John Freebairn**, Melbourne University
9.35 – 9.50	**Drew Collins**, Managing Director, BDA Group
9.50 – 10.05	**Dr Arlene Buchan**, Healthy Rivers Campaign Coordinator, Australian Conservation Foundation
10.05 – 10.35	Roundtable discussion
10.35 – 10.50	***Morning tea***

Session 2 — *Market and cooperative solutions: strengths, limitations and the appropriate role of government*

Chair: Dr Neil Byron, Commissioner, Productivity Commission

10.50 – 11.30	*Keynote speaker*: **Professor Gary Libecap**, University of California
11.30 – 11.45	**Professor David Brunckhorst**, Rural Futures, University of New England
11.45 – 12.00	**Dr Suzi Kerr**, Director, Motu Economic and Public Policy Research (NZ)
12.00 – 12.15	**Professor David Pannell**, University of Western Australia
12.15 – 12.45	Roundtable discussion
12.45 – 1.45	***Lunch***

Session 3	***Institutions and incentives for promoting better policies and outcomes***
	Chair: Bernie Wonder, Head of Office, Productivity Commission
1.45 – 2.30	*Keynote speaker*: **Professor Robert Stavins**, Harvard University
2.30 – 2.45	**Dr Wendy Craik**, Chief Executive, Murray Darling Basin Commission
2.45 – 3.00	**Henry Ergas**, Chairman, Concept Economics
3.00 – 3.25	Roundtable discussion
3.25 – 3.45	***Afternoon tea***
Session 4	***Reflections for public policy***
	Chair: Gary Banks, Chairman, Productivity Commission
3.45 – 4.00	**Professor Geoff Brennan**, Australian National University
4.00 – 4.30	*Panel discussion*: **Professors John Freebairn, Gary Libecap** and **Robert Stavins**
4.30 – 4.55	Roundtable discussion
4.55 – 5.00	*Closing:* **Gary Banks**

B Roundtable participants

Dr Helal Ahammad	Branch Manager, Australian Bureau of Agricultural and Resource Economics
Gary Banks	Chairman, Productivity Commission
Professor Jeff Bennett	Director, Environmental and Economics Research Hub, ANU
Professor Geoff Brennan	Research School of Social Sciences, ANU
Professor David Brunckhorst	Director, Institute for Rural Futures, University of New England
Dr Arlene Buchan	Healthy Rivers Campaign Coordinator, Australian Conservation Foundation
Dr Matthew Butlin	Commissioner, Productivity Commission
Dr Neil Byron	Commissioner, Productivity Commission
Ian Carruthers	First Assistant Secretary, Department of Climate Change
Drew Collins	Managing Director, BDA Group
Dr Wendy Craik	Chief Executive, Murray Darling Basin Commission
Henry Ergas	Director, Concept Economics
Greg Evans	Director, Australian Chamber of Commerce and Industry
Robert Fitzgerald	Commissioner, Productivity Commission
Professor John Freebairn	Department of Economics, University of Melbourne
Ross Gittins	Economics Editor, *Sydney Morning Herald*

Professor Quentin Grafton	Research Director, Crawford School of Economics and Government, ANU
Peter Harper	Deputy Australian Statistician, Australian Bureau of Statistics
Dr Steve Hatfield-Dodds	Dept of Climate Change
Dr Jenny Gordon	Principal Adviser Research (Canberra), Productivity Commission
Lisa Gropp	Principal Adviser Research (Melbourne), Productivity Commission
Dr Steven Kates	Commissioner, Productivity Commission
Dr Bruce Kennedy	Chief Executive Officer, National Environment Protection Council
Deb Kerr	National Farmers Federation
Dr Suzi Kerr	Director, Motu Economic and Public Policy Research, New Zealand
Professor Gary Libecap	Donald Bren School of Environmental Science and Management, University of California
Angela MacRae	Commissioner, Productivity Commission
Professor Warwick McKibbin	Executive Director, Centre for Applied Macroeconomic Analysis, ANU
Alan Mitchell	Economics Editor, *Australian Financial Review*
Professor Warren Musgrave	Musgrave Consulting
Ray Nias	Conservation Director, World Wildlife Fund
Professor David Pannell	ARC Federation Fellow, School of Agricultural and Resource Economics, University of Western Australia
Professor Jonathan Pincus	Visiting Professor, University of Adelaide
Simon Pryor	Business Council of Australia

Heather Ridout	Chief Executive, Australian Industry Group
Brian Scarsbrick	Chief Executive, Landcare Australia
Professor Robert Stavins	John F. Kennedy School of Government, Harvard University
Louise Sylvan	Commissioner, Productivity Commission
Malcolm Thompson	First Assistant Secretary, Department of Environment, Water, Heritage & the Arts
Matthew Warren	Environment Reporter, *The Australian*
Philip Weickhardt	Commissioner, Productivity Commission
Dr Stuart Whitten	Institutional Analyst/Economist, CSIRO Sustainable Ecosystems
Dr John Williams	Member, Wentworth Group of Concerned Scientists
Bernie Wonder	Head of Office, Productivity Commission
Mike Woods	Deputy Chairman, Productivity Commission

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David Uren	*The Australian*
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Paul Belin	Productivity Commission
Monica Binder	Productivity Commission
Dr Michael Kirby	Productivity Commission
Alan Johnston	Productivity Commission
Margaret Mead	Productivity Commission
Terry O'Brien	Productivity Commission
Dr John Salerian	Productivity Commission
Gary Samuels	Productivity Commission