Emerging markets for environmental services

Implications and opportunities for resource management in Australia

A report for the RIRDC/Land & Water Australia/FWPRDC

Joint Venture Agroforestry Program

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Foreword

Over the past year or so, market-based instruments have attracted unprecedented attention in Australia as potential management tools for managing environmental problems. The concept of harnessing market forces to reduce pollution or increase the supply of environmental services has captured the attention of governments, both at federal and state levels, and non-government organisations.

Environmental credit trading is one mechanism that has been suggested as policy for managing dryland salinity, biodiversity, and natural habitats in agricultural regions of Australia. While trading programs have been used extensively in controlling industrial emissions, the application of these schemes to the agricultural sector poses a number of challenges. Indeed, there is a distinct lack of documented information about the practicalities of overcoming these obstacles.

This report contains a critical review of several 'real life' markets and early prototypes that have been established in the United States and the United Kingdom. A study tour to these countries in June 2001 was used to develop an understanding of the key 'stepping stones' which have enabled successful programs to evolve from the design phase through to implementation. The tour findings are drawn together in this review.

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This report, a new addition to RIRDC's diverse range of over 700 research publications, forms part of our Agroforestry and Farm Forestry R&D program, which aims to integrate sustainable and productive agroforestry within Australian farming systems.

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Executive Summary

There is a growing awareness that economic incentives have a role to play in addressing land and water degradation problems in Australia. Evidence of this is the diverse range of market based schemes that have been implemented or proposed in Australia during the last five years. The types of incentive instruments that are being experimented with include environmental taxes and subsidies, tradeable permits and credits, environmental accreditation, eco-labelling, and performance bonds. Of this family of market-based instruments, trading programs have received considerable attention as a potential mechanism for addressing problems such as dryland salinity, native vegetation decline, and biodiversity loss.

Several factors are driving the current surge of interest in trading schemes. One contributing factor is advances in satellite and computer technology, which is making it possible to monitor land use changes and environmental quality. Other technological innovations such as the internet have made it possible to conduct transactions at a fraction of the cost of previous methods. A second important factor is the growing body of quantitative information about the state of Australia's land and water resources and the economic trade-offs of alternative resource use options. This new information is prompting resource management agencies to identify a range of environmental targets, which are a preliminary first step towards designing a trading program.

The principle of permit trading is quite straightforward and the theoretical aspects of trading programs have been established for at least thirty years. Numerous fisheries are managed with permit trading schemes and there are many examples where trading has been used to control industrial gas emissions. However, the creation and trade of property rights in environmental services such as carbon sequestration, water filtration, and biodiversity protection is still in its infancy. The prospect of commercialising these services is exciting because it would overcome the current situation where public demand for environmental improvement fails to be communicated to private firms via a market mechanism. Furthermore, a system of marketable rights in these services could promote a cost-effective means of controlling environmental externalities associated with agriculture.

The development of markets for these types of services is challenging and a number of obstacles stand in the way. One complicating factor is the heterogenous nature of the services that are produced in different geographic areas. This causes measurement and accounting difficulties, and potentially limits market size. Another complication is the poorly understood relationships between 'on the ground actions' and environmental outcomes, the time lags involved, and the unpredictability of outcomes caused by variables such as rainfall and temperature. These factors give rise to the problems of risk and who should be legally responsible for underwriting the environmental improvements. Compared to industrial emissions trading, much less has been documented on the practicalities of overcoming these obstacles when designing markets for agri-environmental outcomes.

Several countries are experimenting with various programs for commercialising environmental services. The United States is at the forefront in this endeavour, and the United Kingdom is beginning to investigate alternative mechanisms. This report documents the findings of a study trip that was made to these countries in June 2001. The focus of the study was to critically review several 'real life' markets and prototype programs that have been established for trading environmental services and to identify the key 'stepping stones' which have enabled successful programs to evolve from the design phase through to implementation.

The review looks at three main environmental areas where trading programs and markets are beginning to emerge. These are water quality management, habitat and biodiversity protection, and the supply of carbon sequestration services. The United States is actively promoting trading

mechanisms as a means of managing nutrient discharge into water bodies, and there are now approximately thirty five programs in place. The US Environmental Protection Agency is also encouraging mitigation banking, which allows firms to offset their environmental impacts by purchasing credits from other firms who specialise in rehabilitating similar habitats elsewhere. Formal markets for trading carbon credits are also beginning to evolve in response to climate change policy.

The approach taken for this study is to examine what common elements underpin each of these trading programs, and to establish what design variables are critical to developing a successful program. Six main messages emerge from this analysis:

- enforceable quality targets are required for stimulating sufficient demand for environmental services, particularly when the environmental problem is characterised by a public externality;

- identifying the potential market of an area and the likely benefits from implementing a trading policy are important first steps before commencing program design;

- it is best to 'start from scratch' when designing a program or creating a trading structure: making piecemeal changes to existing regulatory programs commonly produces a complicated array of incentives and disincentives;

- trading rules must be simple and unambiguous; and

- it is important to involve market participants in the design process and to maintain community involvement in the day-to-day management and monitoring of the trading system. The potential for self-regulation is one of the strengths of a trading system, and design features that encourage this mechanism will bolster the success of a market.

These findings are expanded on in the report. The overseas experiences represent important lessons that Australia can learn from as we begin to design trading programs for managing dryland salinity, native vegetation decline, and other agri-environmental problems.

Chapter 1: Introduction

The dawn of environmental markets

Over the past year or so, market-based instruments have attracted unprecedented attention in Australia as potential tools for managing environmental problems. The concept of harnessing market forces to reduce pollution or increase the supply of environmental services has captured the attention of governments, both at federal and state levels, and non-government organisations. This represents a quantum change in mindset among policy makers and lobbyists because, until recently, market instruments were perceived to have little practical application to the control of industrial emissions and even less relevance to the management of dryland salinity and biodiversity.

There is a growing awareness that economic incentives have a role to play in addressing land and water degradation problems in Australia. Evidence of this is the diverse range of market-based schemes that have been implemented or proposed in Australia during the last five years (Table 1.1). The types of programs include environmental taxes and subsidies, permit trading, environmental accreditation, eco-labelling, and performance bonds. These programs all have one thing in common: they aim to change the behaviour of firms through financial incentives rather than explicit directives. In certain circumstances, market based schemes are more efficient and cost effective than the traditional approaches of 'command and control' regulations and voluntary measures.

Table 1.1 Australian market-based schemes for managing environmental outcomes

Instrument	*Example schemes*	*Implementation stage*
Environmental taxes and offset payments	Load based licensing program for water effluent (NSW EPA).	Commenced 1999
	Offset payments for aquatic habitat damages (NSW Fisheries)	Commenced 2000
	Offset payments for vegetation clearing (NSW DLWC)	Proposed 2001
Environmental subsidies and tax concessions.	Auctions for environmental services (Victorian DNRE, WWF)	Pilot phase, 2001
	Landcare tax rebates	Commenced 1997
Credit or permit trading programs	Hunter River salinity trading program (NSW EPA)	Commenced 1995
	Renewable energy tradeable certificates (AGO)	Commenced 2001
	Intra-firm carbon emissions trading (Shell, BP)	Commenced 1999
	Native vegetation and salinity offsets (NSW DLWC)	Proposed 2001
Eco-labelling	Banrock Station winery wetland restoration program	Commenced 1997
Certification and environmental management systems	ISO 14000 certification.	Commenced 1996
	Green slips for salinity management practices (NSW Salinity Strategy)	Proposed 2000
Deposit-refund systems and performance bonds	Great Barrier Reef Marine Park Authority performance bonds	Commenced 1987

While the theoretical aspects of market-based instruments have been established for at least thirty years, policy leaders have been slow to put the principles into practice. It is interesting then to examine what has caused the recent surge of interest in these schemes. Firstly, it is apparent that policy changes in Australia have been influenced by parallel trends overseas, particularly in the United States where trading schemes and other market-based programs have gained credibility as efficient ways of delivering environmental improvements. Secondly, against the backdrop of these international trends, there have been a number of domestic developments that have catalysed a shift in policy focus. These developments are discussed below.

International developments

The success of the United State's Acid Rain trading program has raised significantly the profile of trading instruments as a cost effective way of reducing pollution. From 1995 through 1999, the program has surpassed expectations, with firms exceeding the sulphur dioxide reduction target at less than one-half the forecast cost (Ellerman, 2000). The cost savings are a consequence of tremendous technological change in the electricity generation sector, which is largely attributable to the flexibility of the trading program. As the encouraging results of this policy 'experiment' continue to unfold, a wide range of other trading schemes are beginning to emerge for improving air, land, and water quality (US EPA, 2001).

Technological improvements have been an important factor in facilitating the development of environmental markets, and are likely to continue to play an important role in reducing transaction costs. For example, remote sensing and real-time monitoring have contributed a great deal to the success of the United State's Acid Rain program. Similarly, the ability to monitor changes in land and water quality with satellite technology is an important step towards developing trading schemes for sequestered carbon, biodiversity, and salinity. Another technological development is the advent of the internet, which reduces the transaction costs associated with markets. Novel applications of internet trading are already being designed for water quality markets in the United States.

Another major factor that has stimulated interest in environmental markets worldwide is the 1997 Kyoto Protocol, which outlines a framework for reducing greenhouse gas emissions. Provisions in the Protocol allow countries to use emissions trading to meet their CO_2 reduction targets. Furthermore, it allows the use of carbon sinks as a means of generating credits to off-set emissions. Despite the Protocol not being ratified, the framework has prompted some early speculative private investment in carbon sequestration projects in Australia[1] and triggered publicly funded research into the design of a domestic emissions trading scheme[2]. The prospect of mandatory emission limits has also prompted some leading companies to adopt an early stance towards abatement. For example, Shell and BP have instigated a system of internal trading to manage emissions from different production centres within their respective organisations.

Domestic developments

In Australia, a combination of several factors has prompted policy makers to look more closely at market-based instruments as a means of addressing land and water degradation. Firstly, the federal government has come to the view that existing agri-environmental policies are failing to provide a satisfactory return on public investment (Industry Commission, 1997). There is a belief that the

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[1] For example the BP oil refinery in Kwinana, Western Australia, has invested in forest plantations in exchange for carbon credit rights.

[2] The Australian Greenhouse Office and the CRC for Greenhouse Accounting have conducted extensive research on market mechanisms and carbon accounting issues.

decade of Landcare, while valuable in terms of awareness raising and capacity building, has under-performed in terms of delivering tangible environmental outcomes. The failure of existing policies to deliver satisfactory outcomes has prompted policy makers to consider alternative mechanisms.

Secondly, water reforms instigated by the Council of Australian Governments have been influential. The reforms have demonstrated that efficiency gains are possible from water entitlement trading and have given governments greater confidence to examine the potential of market-based approaches for managing other natural resources.

A third factor that is influencing policy change is the growing body of quantitative information about the state of Australia's land and water resources and the economic trade-offs of alternative resource use options[3]. This new information is prompting resource management agencies to identify a range of environmental targets. One example is the statutory cap on water abstractions from the Murray River, which has facilitated a market in tradeable water entitlements. Other examples include a proposal to establish 'end-of-valley' salinity targets for catchments within the Murray Darling Basin (MDBMC, 2000) and the NSW Government's intention to set statewide targets for protecting and re-establishing native vegetation (DLWC, 2001). Performance targets are a preliminary step towards designing a trading program in environmental permits or credits.

A fourth factor that is driving the current wave of enthusiasm for market schemes is the desire of governments to facilitate greater private investment in the delivery of environmental public goods. Environmental trading schemes are seen as one way to stimulate this investment. For example, a carbon credit market could encourage industrial firms to invest in the rural sector in return for emission credits generated by tree plantations. The attractiveness of this trade is further enhanced if trees yield multiple public benefits that are surplus to the emission credits. This type of trading program also supports the government's objective of stimulating new agricultural industries, such as agroforestry, in rural areas.

This report

While the concept of a market in environmental services is appealing, the application of these markets to the agricultural sector (as opposed to industrial emissions) poses a range of challenging problems. One complicating factor is the heterogenous nature of environmental impacts that are generated over different geographic areas. This causes measurement and accounting difficulties, and potentially limits market size. Another complication is the poorly understood relationships between 'on the ground actions' and environmental outcomes, the time lags involved, and the unpredictability of outcomes caused by variables such as rainfall and temperature. These factors give rise to the problems of risk and who is legally responsible for underwriting environmental improvements. Compared to industrial emissions trading, much less has been documented on the practicalities of overcoming these obstacles when designing markets for agri-environmental outcomes.

This report aims to close this knowledge gap. It presents the findings of an overseas study trip whose objective was to investigate various environmental markets that are emerging in the United States and the United Kingdom. These two countries were selected for the study because both are beginning to adopt a variety of market-based schemes for managing environmental problems. The focus of the study is intentionally limited to trading and offset programs, with particular emphasis on programs targeted at the agricultural sector. The trip involved consulting widely over a period of several weeks with people from a number of institutions who are leading the way in research, development, and implementation of environmental trading programs (see Appendix for a list of the institutions visited).

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[3] Major studies include the National Land and Water Resources Audit, the Murray-Darling Basin Audit, and numerous State of the Environment assessments at a national and state level.

The four main objectives of the study trip were to:

- produce a synopsis of the fundamental principles that underpin environmental markets;

- critically review several ‘real life’ markets and early prototypes that have been established overseas and highlight the practical lessons that can be learnt from these programs. The goal here was to identify the important ‘stepping stones’ that carried the program through from the design phase to implementation;

- examine the design features of successfully functioning schemes and assess the extent to which these principles can be transferred to an Australian context; and,

- to examine the possibilities that lie ahead for Australian environmental markets, including the potential linkages between the minerals and energy sector and the rural sector.

The report is organised as follows. Chapter 2 provides a brief overview of the basic concepts, definitions, and characteristics of environmental markets. The purpose of this overview is to develop a foundation of fundamental principles before moving onto a more detailed analysis of specific trading applications in Chapters 3, 4, and 5. These latter chapters contain a series of case studies that focus on trading programs that have been established, or are in the process of being developed, for water quality, habitat protection, and carbon sequestration. In Chapter 6 the practical lessons that emerge from these studies are summarised and conclusions are drawn about the possible opportunities and limitations of expanding the use of environmental trading mechanisms in Australia.

Chapter 2: The fundamentals of environmental markets

This chapter provides a brief overview of the basic concepts, definitions, and characteristics of environmental markets. The overview draws on information gathered from consultations with a diverse range of people involved in researching, developing and administering trading systems. The chapter begins by explaining the role that markets have in meeting society's environmental objectives. This is followed by a 'cooks tour' of the different types of trading programs that have evolved since the 1970's, ranging from formal markets that involve multiple firms to less complex offset programs that allow individual firms to make pollution trade-offs within their own operation. The chapter concludes by outlining the key variables that need to be considered in the design of a market system.

A case for establishing environmental markets

The basic underlying cause of environmental services being under-supplied (or the quantity of pollution being over-supplied) is a case of markets failing to send signals to private firms who are having an impact on the environment. To be more precise, it is not so much a case of markets 'failing', but rather the situation where markets do not exist because property rights are not defined for public goods such as clean air and water. Well defined property rights are fundamental prerequisites for a market to function as they provide the necessary elements of access security, defensibility of ownership, and transferability. Property rights are well defined if they are adequately configured in three dimensions. The rights must be:

- defined clearly so as to reside with a specific person or entity;
- defended easily against non-owners who might wish to use or 'steal' the entitlement; and,
- fully transferable by the owner to others on whatever terms are mutually satisfactory to buyer and seller.

When property rights are absent, private firms have no incentive to reduce their emissions or increase the supply of an environmental service because the financial rewards of these actions cannot be secured. Consequently, when a firm lowers the quality of the environment, it does so without taking account of the costs it imposes on other firms or the greater community. This situation produces a problem known as an 'externality', which means that the financial implications of a private firm's actions are external to its decision making process. The goal of market-based schemes is to 'internalise' these externalities by putting a mechanism in place that forces firms to account for the full costs of their actions. The mechanism involves defining and issuing property rights in the environment, alternatively known as the 'securitization' environmental services. For instance, property rights in the atmosphere convey a right to emit a unit of pollutant into the atmosphere. Similarly, property rights in sequestered carbon convey a right to the benefits from selling a unit of sequestered carbon.

Paradoxically, the traditional response by governments to externalities has been one of 'command and control' which weakens rather than strengthens property rights in the environment. Centralised approaches, which are divorced from a market mechanism, can lead to considerable inefficiencies. The setting of minimum performance standards, or the stipulation of 'best practice' technologies for cleaner production, does not provide any financial incentive to firms to make quality improvements beyond the minimum requirement. The standards may even act as a perverse disincentive for firms to adopt cleaner technologies if businesses perceive that they will be held to a higher standard of performance as a consequence of their actions. Furthermore, there is no opportunity for firms who find it costly to meet the performance standard to 'off-load' their obligation to firms who can provide quality improvements at lower cost.

These inefficiencies do not arise in market-based system because inter-firm trade in pollution rights or offset credits allocates the burden of meeting an industry performance standard to those firms that are able to reduce emissions at least cost. In addition, firms have an economic incentive to reduce emissions below the minimum requirement because there is an opportunity cost associated with continuing to pollute. That is, firms that continue to pollute forego the opportunity to sell credits or surplus emission permits. The same principle provides firms with an incentive to innovate and develop low-cost ways of reducing emissions. These features of a market system provide a strong *prima facie* case for greater use of trading mechanisms as a means of managing environmental externalities. However, the potential benefits of establishing a trading program need to be weighed up against the costs and practical feasibility of implementing the program. In some cases, the costs of administration, enforcement, monitoring, and other transaction costs may be prohibitively high.

Trading and offset programs

A variety of different types of trading schemes have evolved since the United States first started experimenting with rights-based policies for industrial emissions in the 1970's. Perhaps the best known scheme is the 'cap and trade' system, whereby an aggregate emissions target (or cap) is set for an industry and individual firms are allocated tradeable permits that entitle each firm to emit a specified share of the cap. Examples of this type of scheme include the United State's Acid Rain Program, which controls sulphur dioxide, and California's Regional Clean Air Incentives Market (RECLAIM), which controls both sulphur dioxide and nitrogen oxides. These programs have allocated most of the allowable emissions under the cap to existing sources, but have set-aside a proportion of allowances for new sources which are auctioned off over a period of time.

Another type of trading system is 'baseline and credit', whereby a baseline level of environmental performance is established for individual firms and improvements beyond this baseline generate credits for the firm. Often existing regulations dictate the baseline. Baselines may be set according to a firm's historic level of environmental performance or be set at a more stringent level, requiring the firm to reduce its emissions over time[4]. A firm with a surplus of credits can either sell the credits to other firms who wish to exceed their baseline, or the firm can retain the credits for later use should it exceed its baseline in future periods (a mechanism known as credit 'banking'). Depending on the pollutant, firms can generate credits by adopting cleaner production methods or by investing in technology that offsets emissions (eg. carbon sequestration). Baseline and credit systems are now used in a wide range of contexts, including water quality control, wetland protection, recycling of waste packaging, and meeting renewable electricity targets.

Baseline and credit systems originate from a number of schemes that were developed in the United States during the 1970's and 80's. These schemes do not involve a formalised market but they do allow firms to make 'trades' within their own operations and, in the case of offset schemes, some limited trades between firms. The schemes are intended to give firms greater flexibility in meeting emission standards. The main types of policies are as follows:

Offset schemes. This policy dates back to 1976. It was formulated to ensure that new facilities or industries do not increase the total level of gas emissions in a specified geographic region. When a new facility is to be set up in an area that is subject to a cap on total emissions, the firm must obtain

[4] Baselines for pollution are either specified in terms of pollutant concentration (eg. grams per megalitre of discharge) or in terms of the total amount of allowable emissions. The former is known as an 'open system' because total emissions are not capped, while the latter is known as a 'closed system' because the pollution limit is binding.

emission credits from existing sources in a proportion determined by the offset rate applying to the particular area.

Bubble programs. The United State's bubble policy was introduced in 1979. An emission bubble allows an individual firm to increase its emissions in some production centres, provided these increases are offset with emission reductions other centres. The term ‘bubble’ is used to connote an imaginary bubble over a source such as a refinery or steel mill that has several emission points, each with its own emission limit. Firms are judged to be in compliance if the sum of individual emissions does not exceed the limit set for the bubble.

Netting. This mechanism was first introduced in the United States in 1980. It provided firms with greater flexibility in meeting an existing ruling which stipulated that firms must meet more stringent emission levels if they plan to modernise and expand existing facilities. The netting program exempted firms from this ruling on the proviso that any additional emissions from the modernised facilities are offset by reductions at existing sources.

Emissions averaging. This mechanism was first used in the mid 1980's. It allows individual firms to average emissions across their product range. For example, the automobile manufacturers in the United States must build engines that meet a specified emissions rate. However, firms are given the flexibility to produce some engines that exceed the limit provided they can offset these ‘overshoots’ with other models that have cleaner engines.

Similar types of mechanisms are also used in the context of land and water management. For instance, the United State’s Wetland Mitigation Program allows developers to offset damages to wetland habitat by creating or improving wetlands elsewhere (see Chapter 4 for a detailed account). Other offset programs require firms to pay a predetermined sum of money into a conservation trust fund as a means of financing offset actions. This policy is essentially a tax rather than a trading instrument. Consequently, there is no mechanism for ‘price discovery’ because the offset payment is set by a centralised authority rather than being determined by a market in offset credits.

Are caps or baselines essential?

The case of public externalities

For markets to function effectively there must be sufficient demand for pollution rights or offset credits. In the situation where the environmental problem is characterised by public externalities, enforceable caps or baselines on resource use are almost always required to create sufficient scarcity, and hence value, in pollution rights or credits. This is because the benefits from removing a public externality accrue to the whole community and are not excludable. It follows that under these circumstances there is no incentive for private individuals or interest groups to invest in environmental services.

One alternative to setting mandatory targets is for the government to step in and purchase environmental services, which could involve the purchase and retirement of credits from a trading program. This represents a one-off subsidy to polluting firms for a permanent reduction in emissions. The use of subsidies as an incentive for reducing pollution is generally less efficient than a market in tradeable credits because firms do not have an incentive to abate below the amount stipulated by the contract[5].

Other mechanisms that could stimulate demand for credits in an environmental market are:

[5] Furthermore, if firms do not have to competitively bid for the subsidy there is no incentive for firms to seek out the most cost-effective method for reducing pollution.

- Credits could be linked to a certification scheme. If there were sufficient economic rewards from certification (eg. from market price premium or market access), then firms may have an incentive to purchase or generate credits.

- Government could reward firms who purchase or generate credits with extra services such as technical information and advice. This equates to an indirect subsidy.

- The implementation of enforceable caps on one sector could create a demand for credits from another unregulated sector. For instance, an emissions trading policy that is targeted at an industrial sector could generate a demand for offset credits from the agricultural sector.

The case of private externalities

If the environmental problem is mainly characterised by private externalities, it may not be necessary to impose an enforceable cap to stimulate market demand. This is because in the case of private externalities, the removal of the externality produces an excludable benefit to ‘downstream’ firms. Under these circumstances it may be sufficient to define property rights in the form of environmental credits, then leave the rest to the market. If benefits are truly excludable, then ‘downstream’ firms may form a cooperative and purchase credits from ‘upstream’ firms. An example of this type of trade is a Memorandum of Understanding that was signed in 1999 by NSW State Forests and Macquarie River Food and Fibre (a farmer cooperative comprising over 600 irrigation farmers). Under this arrangement, the cooperative has agreed to purchase salinity control credits generated by new forests planted in the salt prone Macquarie River catchment. The credits are defined in terms of the quantity of water transpired from 100 hectares of newly planted forest.

The potential for these localised markets to develop is limited by high transaction costs, including the initial cost of setting up a trading system and the ongoing cost of verification and monitoring. Localised markets, by definition, are ‘thin’ markets meaning that the volume of credits traded is low. This hinders the price discovery process. Another limiting factor is the high risk associated with the production of environmental outcomes. Private firms would be reluctant to buy credits if the rights do not provide them with a guaranteed improvement in environmental quality. Given these constraints, government involvement is usually required to stimulate markets by setting up a trading program with a regulatory cap or baseline.

Key variables in trading program design

There are a number of key variables that influence the shape and form of a trading program. A checklist of the main variables is provided below.

Specification of rights

- What is the commodity being traded? This may take the form of an emission permit, an offset credit, or an abstraction right[6].

- What is the physical basis? The basis of a right is the measurable action or output underpinning the right. For example, an emissions permit may have a ‘performance’ basis defined in terms of the annual quantity of allowable emissions. Alternatively, the basis may be specified in terms of a pollution process (eg. expected run-off or recharge). In some cases an input basis, such as the permissible rate of fertiliser application, may be appropriate.

[6] Abstraction rights are relevant to water markets and other extractive activities such as fishing, mining, and logging. These markets are not discussed in this report.

- What is the duration of the rights? Emission permits or reduction credits may be valid for a finite period or given number of periods (in which case they are comparable to a rental contract) or they may be valid indefinitely (in which case they are comparable to property rights).

Scope of the market

- What is the minimum number of participants? Simulations have demonstrated that markets require at least eight participants to function properly. The price discovery process fails in markets with too few participants.

- Who can participate? It may be necessary to place restrictions on transfers of rights to prevent a concentration of ownership. Some trading programs disallow the transfer of emission rights to organisations that plan to retire the rights (eg. conservation groups). Other rulings apply to the involvement of brokers and speculators.

- At what level can trading occur? Depending on the program's objectives, trades may be allowable between individual firms, groups of firms each operating within separate bubbles, or different countries.

- What is the geographical area over which trades can take place? The spatial scope of a program should be considered initially from an environmental perspective. That is, where is the pollution coming from? Markets that operate over a large geographical area have greater potential for delivering economic efficiency gains. However, with increasing spatial scope there is a greater chance that emissions at different locations will produce unequal damages, and that credits generated at different locations will have unequal impacts. The problem of non-equivalence can be addressed with trading ratios. Another potential problem associated with markets that operate over large areas is the development of pollution 'hotspots' caused by a localised concentration of pollution permits.

Trading rules

- Are trading ratios specified? Trading ratios stipulate the exchange rate between offset credits and emissions permits. Ratios that differ from 'one-to-one' are required if credits and permits have different bases (for example, a credit based on recharge and a permit based on discharge). Trading ratios can also be used to adjust for non-equivalence when exchanges take place between different geographic locations. A third potential use for trading ratios is to reduce aggregate emissions by requiring new sources to purchase multiple credits to offset one unit increase in emissions.

- Is cross pollutant trading allowed? Very few programs are designed to allow emission permits for one pollutant to be exchanged with permits for a different pollutant.

- Is banking and borrowing a feature of the program? These features add to the flexibility of trading programs. Banking enables firms to generate credits in one period and to use them to offset emissions in a later period. Borrowing enables firms to exceed their emissions in a current period by partially utilising their emission rights from a future period.

Organisation of transfers

- What institutions are in place to administer trading? Large trading programs such as the US Acid Rain Program have increased efficiencies by establishing a centralised permit exchange. Brokerage services have also become a feature in these large markets.

Monitoring and enforcement

- What forms of monitoring are involved? Monitoring involves a range of tasks, including checks on the performance of permit holders, verification and certification of credits, and the recording of transfers. Compliance with emission requirements can readily be checked provided that reliable information systems are used to record performance and transfers.

- Who is responsible for monitoring? Monitoring tasks could be performed by government, by authorised third parties, or by market participants themselves if adequate mechanisms are in place to encourage self-regulation.

- What enforcement mechanisms are in place? There is a wide range of possible sanctions that can be applied to those firms who do not comply. Some examples include: fines, forbidding future participation in transfers, reduction in the firm's permit holdings, obligation to fund compensatory activities aimed at enhancing the environment, or legal action.

- How costly is monitoring and enforcement? For some markets, monitoring and enforcement may be too costly for the establishment of the market to be a practical proposition. In others, it may be possible to establish self-enforcing schemes through internal incentives. To a certain degree, trading programs have can ‘in-built’ mechanism for self-regulation because market participants have a vested interest in ensuring that the value of their permit or credit rights are not undermined by fraudulent actions.

The following chapters examine several different trading programs that have been developed to meet specific environmental objectives. All the programs have similar underlying principles but the specific configuration of design variables differs depending on the characteristics of the environmental problem.

Chapter 3: Water quality markets

Background

This chapter examines how trading programs are being used to manage water quality in rural catchments. The United States is at the forefront in developing water effluent trading programs, and some applications are show-cased in this review. The main water quality issue in the US is nutrient discharge but other pollutants such as sediments, salt, and pesticides are also evident in some States. Effluent is discharged from both point and non-point sources. The point sources include sewage treatment plants and industrial facilities, while run-off from agricultural land constitutes a non-point source that cannot be observed or measured.

Until recently, the US Environmental Protection Agency (US EPA) has focused primarily on controlling point sources of pollution. Under the National Pollutant Discharge Elimination System, point sources require a permit to operate and limits are set on the quantity of each type of effluent that can be discharged. While these measures have brought about significant improvements in water quality, the effluent contributions from non-point sources remain an outstanding obstacle to achieving water quality objectives. To date, subsidies and voluntary programs have been used to encourage farmers to adopt best management practices but these programs have generally not delivered satisfactory reductions in run-off (Ribaudo et al 1999).

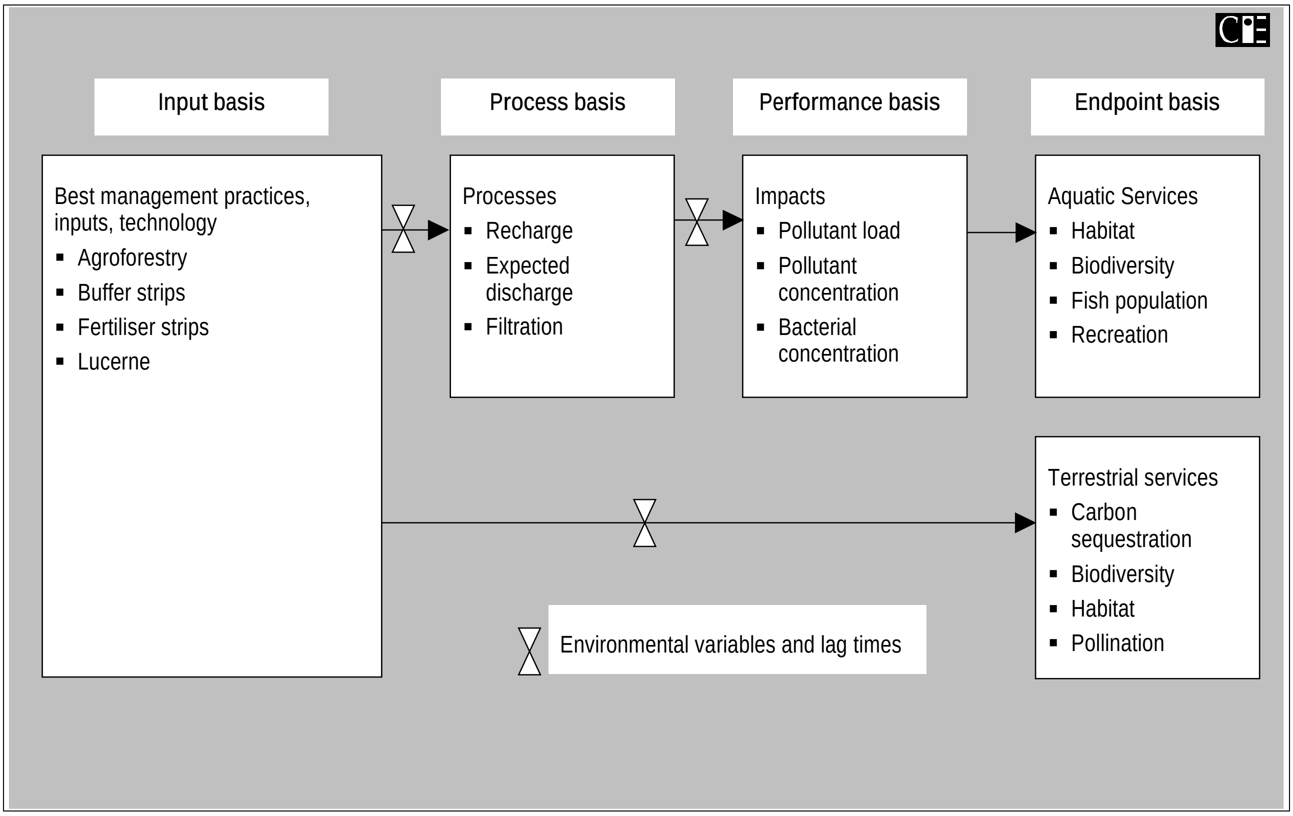
Over the last two years, there has been a strong push by US State and Federal governments to develop formal management plans for watersheds where pollution exceeds acceptable standards. These management plans specify a total maximum daily load (TMDL) limit for a watershed, and take into account all sources of discharge. The limit is set at a level that ensures water quality standards are met. The plans also establish load allocations for each point source and for non-point sources. At this stage, only the point source allocations are to be enforced, but under the Clean Water Act of 1972 there are provisions that would allow the EPA to make discharge limits on the agricultural sector enforceable.

The TMDL plans have provided the necessary impetus for water trading programs to develop because in many watersheds, point sources are facing costly reductions in discharge to meet the new quality standards. The US EPA is promoting trading as a cost-effective way for point sources to meet the new standards and is currently supporting the development of several demonstration programs. There are now approximately thirty five trading programs in various stages of development and implementation (US EPA, 2001). Most of these programs allow trading of emission credits between point sources and also allow point sources to offset their emissions by purchasing credits from farmers. The point-to-point trades enable firms with high abatement costs to purchase credits from firms with lower costs of abatement. Point/non-point trades also have the potential to yield significant cost savings because the cost of reducing nutrient discharge is generally much lower for farmers than industrial firms.

Characteristics of non-point source pollution

A number of factors complicate the design of trading programs that allow point/non-point trades. The first hurdle is that non-point source discharge cannot be measured directly or observed. Because non-point discharge cannot be measured, it is not possible to use discharge 'performance' as a physical basis for an offset credit. Nor is it possible to use ambient water quality as a basis because the contributions made by individual farmers cannot be established. Instead, the basis must be defined in terms of expected effluent discharge (a process basis) or in terms of one or more agricultural inputs (an input basis). Chart 3.1 illustrates how a farm practice such as agroforestry could generate credits for a water trading program and the two bases that could be used to underpin the effluent credits. A third type of basis, termed a ‘performance basis’ could be used to define discharge permits for point sources. Other potential products of agroforestry include carbon, biodiversity, and pollination credits. These credits are underpinned by an 'endpoint' basis because a product such as sequestered carbon can be measured directly from the tree plantation.

3.1 Environmental services from a 'best management practice' and four bases for defining credits or permits



A second hurdle to developing a water effluent market is the need to establish a reliable relationship between agricultural management practices and expected run-off. This is difficult to model and is confounded by geographical location, geophysical factors, and weather conditions. Furthermore, there is often a time lag between non-point discharge and ambient water quality. It is critical that the model used to calculate the credits is defensible, otherwise the integrity of the trading program is weakened and subject to legal challenge. Even if a reliable model is available and can be calibrated for different locations, a third hurdle remains; namely the difficulty of monitoring individual farm practices or inputs.

Despite these challenging obstacles, considerable headway has been made in the US to incorporate non-point sources into water quality trading programs. The Lower Boise River Trading Program in Idaho provides a good illustration how these issues are being addressed.

Case study: Lower Boise River Trading Program

Background

The Lower Boise River watershed encompasses about 1290 square miles in southwest Idaho. In 1997 the US Environmental Protection Agency (EPA), in partnership with stakeholders in the watershed, began to examine the potential for setting up a trading program as a means of reducing the costs of meeting new water quality standards to be introduced in 2001. Sewage treatment plants, factories, and agricultural producers all discharge phosphorous into the Boise River. It was decided to develop a demonstration program for trading phosphorous reduction credits. Initial investigations suggested that trading would yield net economic benefits because the costs for nutrient reductions range widely among sources. At present, development of the trading framework is nearing finalisation and the program is expected to be operational by 2002.

Trading framework

The proposed program consists of a 'baseline and credit' system involving point/point trades and point/non-point trades. The existing National Pollutant Discharge Elimination System (NPDES) enforces point sources to comply with an individually-specified discharge limit. Once the TDML plan is implemented, it is expected that these limits will be more stringent. The trading program will allow point sources to generate credits by reducing emissions below the required limit and sell these credits to other point sources who wish to operate above the required limit. The agricultural sector is not subject to an enforceable baseline level of discharge, but the trading program will allow non-point sources to generate credits by adopting approved 'best management practices' (BMPs). If a farmer enters into a contract to supply and sell credits, the firm will be required to retire a proportion of the credits from the system. This is known as a 'water quality contribution' and its objective is to reduce the total amount of phosphorous discharge from the agricultural sector.

Point to point trades

A point source will be able to increase its effluent limit by receiving the transfer of a credit generated by a point source located within the same watershed. Credits will be specified by the amount of phosphorous reduced per unit of time. Credits can only be used in the same month in which the underlying reduction occurs. The trades are to be executed through private contracts between trading parties, thereby avoiding the need to seek EPA approval for every trade. The transfer of a credit will be registered on a trading database by submitting a Trade Notification Form, signed by both buyer and seller, to a Trading Association. It is proposed that this association (to be named the Idaho Clean Water Cooperative) will be responsible for trade tracking and the day-to-day management of trading. It will be a private, non-profit association comprised of interested participants and all trading parties.

Non-point source credits

Non point sources will be able to generate transferable credits by implementing BMPs that appear on a standard list of approved practices. The list is currently being developed by a BMP Technical Committee which is a standing work group. Example BMPs include buffer strips, wetland construction, irrigation control systems, and tillage systems. The BMP List specifies minimum design construction, maintenance, and monitoring requirements for each BMP. Credits will only be issued in circumstances where a non-point source has changed its management practices in adopting a new BMP. That is, credits will not be issued retrospectively.

Non-point sources will be able to generate two types of credits: 'Measured credits' apply to those BMPs for which discharge reductions can be readily measured and recorded by an independent assessor. For some BMPs it is technically infeasible or too costly to measure and monitor discharge reductions, so credits must be 'calculated' using a model. The number of calculated credits from a BMP will be adjusted by an 'uncertainty discount' which accounts for the variability in effectiveness of the practice. Both type of credits will be specified in terms of the quantity of phosphorous reduced per unit time in a given month. Once the credits have been verified, a Reduction Credit Certificate specifying the number of credits created will be lodged with the Trading Association. It is proposed that this verification process be undertaken by the buyer, as outlined below.

Monitoring and enforcement

The point source who purchases non-point source credits is held responsible for ensuring that the BMP has been installed and is performing according to specifications. The buyer then signs and submits the Reduction Credit Certificate. The buyer will be held liable for failure of the BMP to deliver nutrient reductions, so point sources must also pay for ongoing monitoring of the BMP. This task could be undertaken by an accredited third party. The EPA will retain the authority to perform spot audits and to apply appropriate penalties for non-compliance. Point source emissions will continue to be monitored by the EPA as is currently the case. In addition, point sources will be required to submit a Discharge Monitoring Report summarising actual discharge and trades.

Trading ratios to adjust for spatial factors

The objective of the TDML plan is to meet a water quality target which is measured at the mouth of the Boise River. However, the sources of pollution are distributed unevenly through the catchment and therefore marginal increases or reductions in discharge by a particular source will have a differential impact on the target depending on where that source is located. In order to take this into account, three separate trading ratios have been devised for the trading program:

- River location ratios have been developed for different regions along the Boise River. A mass balance model is used to estimate the unit change in phosphorous loading at the river mouth due to a unit change in discharge at the source location.

- Drainage delivery ratios have been developed to allow for the fact that some sources do not discharge directly into the river, but discharge into a drainage canal or tributary first. Reduction credits generated by sources located at distance from the river channel will have lower offsetting power than those generated by sources who discharge directly into the river. The drainage delivery ratios adjust for these discrepancies.

- Site location ratios have been developed to address the potential for diversion and reuse of water below the point of discharge into the drain or tributary. For example, if non-point discharge flows into a canal and is reused by downstream irrigators, then the impact of discharge reductions will be lessened.

These ratios are used (as multipliers) to determine the amount of transferable credit that arises when a point source or non-point source reduces its nutrient discharge. All 'local' reduction credits are firstly converted to a single currency (the Parma Pound), which is the amount of phosphorous reduction expected at Parma, the mouth of the Boise River. Secondly, the buyer then determines the number of Parma Pounds required to offset his emissions. Thirdly, once the trade is completed the number of Parma Pounds purchased by the point source is converted back to local credit ‘currency’ and the firm’s effluent limit is adjusted accordingly.

Trading restrictions

Two trading restrictions have been imposed. Firstly, credits can only be purchased by point sources in the Lower Boise River watershed for the purpose of offsetting discharge. The credits cannot be sold to other parties such as non-government organisations who may wish to lower aggregate emissions by retiring the credits. Secondly, in order to avoid localised concentrations of pollution, there may be the need to impose restrictions on the extent to which some point sources can use credits as offsets. There is the potential for localised hotspots if a firm which is increasing its emissions (by purchasing credits) is upstream of a firm who reducing emissions (selling credits). In this situation, the upstream section of the river could become over-polluted. A possible solution could be to place a cap on the quantity of credits that upstream firms can purchase.

Innovative features of this program

The program has involved extensive consultation with stakeholders throughout the design phase and is therefore likely to be acceptable by all parties. It also seeks to decentralise the trading process by allowing participants to enter into a private contracts which are not subject to trade-by-trade reviews by the EPA or other government agencies. It is anticipated that this feature of the program will facilitate rapid processing of transactions and lower transaction costs.

The proposed establishment of a private Trading Association is also an innovative feature. It will help connect buyers with sellers, develop and maintain the trade-tracking database, prepare monthly watershed-wide summary of trades, and provide support to the trading system as requested and agreed to by its members. In a related project, the World Resources Institute (a non-government organisation based in Washington DC) is currently developing an internet-based trading exchange called Nutrientnet[7]. It is proposed that this on-line exchange will be a 'one-stop-shop' for buyers and sellers wishing to partake in the nutrient trading market. For instance, non-point sources planning to sell credits will be able to quickly estimate the current level of discharge from their properties, the quantity of credits that could be generated from alternative BMPs, and the approximate cost of generating the credits. There is also a section that provides tools for posting offers to buy or sell reduction credits, and registration of completed trades. The World Resources Institute predicts that brokers will play an important role in bundling up parcels of credits from numerous non-point sources and offering them for sale to point sources. Nutrientnet is soon to be used by an effluent trading program in Michigan.

Problems and issues outstanding

Several other water effluent trading programs have been in operation for some years now, and it is useful to look at these programs for insights to potential problems. For example, the Dillon and Cherry Creek Reservoirs in Colorado have had a trading program in place since 1985. Trade in discharge allowances is allowed between point sources and industrial firms can purchase credits from non-point sources. However, very few trades have been recorded to date. Discussions with the US EPA and Department of Agriculture revealed that the lack in trade is attributed to a number of factors:

- population growth in the watershed has been low in recent years, so the emission limits imposed on point sources have, to date, not been a real constraint to point sources;

- many point sources who did experience binding constraints on their emissions were able to install abatement technology at a relatively low cost, so firms took this option rather than trade;

- in the absence of an enforceable cap on non-point source emissions, point sources who purchase credits from non-point sources bear all the risk of abatement failure, which has discouraged point/non-point trading;

- non-point sources are unwilling to generate credits in case they get labelled as polluters and become subject to an enforceable cap; and,

- the Clean Water Act demands that existing, expanding, and new point sources meet specific technology-based requirements. This feature of the Act has tended to stifle innovation and thus discourage point/point trading.

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[7] See www.nutrientnet.org

Conclusion

This review of water effluent markets in the United States highlights the need to pay careful attention to the design of trading programs. It demonstrates that credibility, transparency, and enforceability are paramount if a market in environmental services is to be realistically contemplated. Furthermore, the case study illustrates the need for a solid framework of trading rules and underpinning science to ensure that equivalence is maintained when credits are used to offset credits.

The control of agricultural discharge of nutrients into waterways holds direct relevance for Australia as eutrophication and salinisation are both serious problems in this country. There is much to learn from the US experience with water effluent trading. In the case of dryland salinity, non-point sources are almost entirely responsible for the discharge. Therefore, compared to effluent trading in the US, there is much less scope for industrial firms to become involved in a salinity market and to shoulder the abatement costs. Developing an equitable cost sharing policy would be critical to the success of an Australian trading program for salinity.

Chapter 4: Markets for habitats and biodiversity

Background

Biodiversity and natural habitats provide a wide range of environmental services, many of which are characterised as public goods. Biodiversity provides mankind with services that assist with agricultural production, as it provides a source of genetic material and facilitates pollination and pest control. Biodiversity also acts as an insurance policy against disease epidemics and serves as a buffer against environmental change. In addition, some of the individual species that contribute to biodiversity are known as 'keystone' species: The extinction of these could lead to a very large change in ecosystem functioning (Heal, 2000). For these reasons, efforts are now being made world-wide to conserve natural habitats that sustain high levels of biodiversity. Some natural areas are also valued for recreation and tourism.

There are three main directions in which markets for these various services are emerging. Firstly, there is a trend towards the commercialisation or privatisation of some types of services. For instance, pharmaceutical companies are taking out patents and intellectual property rights for specific genes and knowledge derived from bioprospecting, while ecotourism companies such as Earth Sanctuaries Limited in Australia are preserving native species by establishing private wildlife sanctuaries.

The second direction in which markets are emerging is via public purchases of environmental services from private firms. For example, the Conservation Reserve Program of the US Department of Agriculture (USDA) pays farmers to take environmentally sensitive land out of production and establish a form of land cover that will conserve it. The USDA uses an Environmental Benefits Index to take into account the extent to which land offered to the program provides wildlife habitat, its vulnerability to erosion, and the level of air and water quality benefits from reduced erosion. Agri-environmental policy in the UK is structured around two programs: the Environmentally Sensitive Areas (ESA) Scheme and the Countryside Stewardship Scheme (CSS). The former provides subsidy payments to farmers for protecting existing habitats in sensitive areas. The latter is targeted to the creation of new habitats. Both schemes have standard payment rates and firms meeting the prescriptions receive the same payments.

This chapter focuses on a third mechanism that is gaining momentum as a useful tool for stimulating markets in biodiversity and habitat protection. The tool referred to is the establishment of mitigation banks and subsequent trade in credits. It is becoming increasingly common for governments in developed countries to impose a statutory cap on the level of habitat degradation. The US now has legislation in place which outlaws any net loss of wetlands (the Clean Water Act) and prohibits actions which could jeopardise the safety of endangered species (the Endangered Species Act). Both of these Acts make provision for compensatory mitigation to offset unavoidable damage to wetlands or endangered species, respectively. Details about the mitigation programs are provided below.

Case study: Endangered species mitigation banking

The Endangered Species Act (ESA) imposes tight restrictions on land use if an endangered species is discovered to be residing on a property. Thus, there is great dislike for the scheme among landowners and developers who are confronted with the reality of having an endangered species residing on their land. However, there have been some early moves by some US States to loosen the rigidity of the ESA restrictions by allowing firms to offset potential damages to endangered species habitat.

One example is an agreement reached between International Paper and the US Fish and Wildlife Service concerning the red-cockaded woodpecker (Heal, 2000). This company owns forests which harbour the endangered woodpecker. The agreement allows International Paper to harvest the forest at will, provided that it maintains sufficient habitat to support a target number of breeding pairs, as stipulated by the Fish and Wildlife Service. Further, if the company exceeds the minimum target of breeding pairs, the agreement allows the company to generate credits which can be 'banked' and used to offset the firm's activities in other forests which are subject to ESA restrictions with respect to the red-cockaded woodpecker. There may also be a future possibility of granting International Paper the right to sell the 'woodpecker credits' to other landowners who are subject to ESA restrictions.

Mitigation banking is the term given to this mechanism of credit generation and storage for subsequent use or sale. The mechanism reduces the cost of complying with the ESA requirements without reducing the ESA's effectiveness. The company also has an economic incentive to encourage the woodpecker to nest in its forests because surplus credits are a valuable asset, both in terms of a mechanism for offsetting impacts in its own operations and in terms of an asset that is potentially saleable to other businesses.

Case study: Wetland Mitigation Banking

Background

The US Clean Water Act makes provision for the use of compensatory mitigation to offset unavoidable damage to wetlands and other aquatic resources through, for example, the restoration of wetlands. The principle of compensatory mitigation (or offsets) has been applied to wetlands since the early 1980's but it is only recently that credit banking has been officially recognised and promoted as a valid means of meeting the Clean Water Act’s (CWA) requirement of 'no-net loss' in wetland function (Federal Register, 1995).

The current scheme operates as follows: Firms that want to develop a wetland site (eg for agriculture or real estate) can obtain permission to do so in some states provided they create an equivalent amount of new wetland elsewhere or if they purchase wetland credits from a mitigation bank. Credits are defined in terms of a unit attainment of wetland function, where function is typically indexed to the number of wetland acres restored, created, or enhanced (in exceptional circumstances, the preservation of existing wetlands in perpetuity may be authorised as a legitimate way of generating credits). Similarly, debits are measured in terms of a unit loss in wetland function at a project site. Before a mitigation bank can be used, firms must first satisfy the government that all appropriate and practical steps have been undertaken to avoid and-or minimise adverse impacts to wetlands. On-site mitigation is preferred, and the use of mitigation banks is only permitted if there is no practical alternative or if the use of off-site credits will lead to a better environmental outcome.

Mitigation banks are created through a memorandum of understanding among federal and state officials and a bank administrator. The sources of land for a mitigation bank commonly include existing natural wetland areas, pits created by the removal of landfill material, and lands that have previously been drained for agricultural use. State highway departments have established approximately one-half of existing banks to provide a means for mitigating wetland losses due to highway construction. Conservation groups, non-government organisations, and private commercial firms have also set up banks that offer mitigation credits for sale. About 100 banks in at least 34 states are currently in operation and more are in advanced stages of planning.

Equivalence issues

In order to ensure that credits adequately offset debits, each mitigation bank has a stipulated 'service area' within which credits can be sold. The geographic extent of the service area is defined on the basis of hydrological units and-or ecoregion maps. Furthermore, in-kind compensation of wetland impacts is generally required, meaning that the credits should embody functions that are identical to the functions lost by wetland development. For example, non-tidal wetlands are not used to compensate for the loss or degradation of tidal wetlands. Limiting the service area to a local region also prevents the possibility of developments becoming concentrated in a particular state and a disproportionate area of rehabilitated wetlands in another state.

Temporal issues

In most cases, a bank can only sell credits once a satisfactory level of wetland functions are attained. That is, advance sales of credits are generally not permitted. However, there are cases where banks with adequate financial backing and a strong reputation for delivering sound environmental outcomes have been permitted to sell credits in advance of the wetland becoming fully functional. The wetlands in a bank are usually protected in perpetuity with appropriate real estate arrangements (eg. conservation easements). The bank operator is responsible for securing adequate funds for the operation and long term maintenance of the bank.

Enforcement and monitoring

The operator of the mitigation bank is responsible for ensuring that the credits have a sound basis (that is the environmental outcomes are actually delivered as per the credit specifications). The operator is also responsible for securing sufficient funds or other financial assurances to cover contingency actions in the event of mitigation failure. Financial assurances may be in the form of performance bonds, casualty insurance or other instruments. An additional responsibility of the bank operator is to monitor the success of the bank using scientific methods and performance standards outlined by the US EPA. The operator is required to submit annual monitoring reports to the EPA. The state or federal agency overseeing the program retains the right to visit the site(s) and verify the bank's performance.

Advantages of mitigation banking

Mitigation banking offers numerous advantages over the situation in the early 1980's where offsets were restricted mainly to on-site mitigation activities:

- environmental values are better protected in large scale developments rather than the fragmented wetlands which often result from on-site rehabilitation efforts;
- economies of scale can be achieved by creating, protecting and enhancing large parcels of wetland;
- the cost of wetland mitigation actions can be made known to developers very early in the development process;
- mitigation banking offers greater assurance of long term management of the protected area; and
- allowing firms to purchase credits overcomes a problem of 'slippage' which was experienced prior to the advent of mitigation banking. Slippage refers to the cumulative effects of many small individual losses in wetland functions which, on their own, were deemed to be impractical to offset (King, pers comm 2001).

Conclusion

Staff from the US EPA and other leaders in this field are expressing cautious optimism for mitigation banking to grow in importance as a valuable tool for reducing the costs of meeting habitat protection goals. Interest has been expressed in the potential for such a scheme to be extended to the minerals industry, where the environmental impacts of mining operations could be mitigated with offsite rehabilitation works. However, as yet there has not been any specific applications of mitigation banking to the mining industry in the US or UK.

Of particular note is the fact that programs such as wetland mitigation banking have taken time to develop and 'bed down'. Early applications of the scheme failed to deliver satisfactory results because there were insufficient resources allocated to monitoring and no provisions for securing financial assurances from credit suppliers should mitigation fail. These problems have now been largely overcome by the judicious use of trading ratios, which provide a buffer against mitigation failure, and financial assurance mechanisms such as performance bonds. Perhaps the greatest challenge to applying mitigation banking to other habitat protection objectives is the difficulty of measuring habitat quality and functionality.

Chapter 5: Carbon markets

Background

The Kyoto Protocol has catalysed the development of several key markets for carbon sequestration credits. The Protocol is an agreement reached in Kyoto, Japan in 1997 between members of the United Nations Framework Convention on Climate Change. The essence of the agreement is a set of coordinated moves to reduce the production of greenhouse gases and to encourage the sequestration of carbon dioxide using 'vegetative sinks' such as forests. Provision is made for three types of flexibility mechanisms to be employed to assist countries to meet their stipulated targets, namely:

- international emissions permit trading;
- joint implementation (JI), which allows countries to earn 'emission reduction units' by providing financial support to another industrialised (Annex I) country for project-level activities that reduce emissions or that sequester carbon in the host country; and,
- clean development mechanism (CDM), which allows industrialised (Annex I) countries to invest in emission reduction projects or sinks in developing countries in exchange for 'certified emission reductions'.

The Protocol has not yet been ratified and the United States has recently withdrawn from the process. However, negotiations among member countries are continuing and a recent round of discussions held in Bonn during July 2001 produced an outcome whereby the European Union agreed to use carbon sinks as a means of generating credits (formerly the EU were opposed to this mechanism). This development suggests that carbon trading, possibly at an international level, is one step closer to becoming a reality.

Despite the fact that the Protocol's emission reduction targets, and the mechanisms to achieve those targets, have not yet been ratified, a significant number of large firms have committed to voluntary reductions in greenhouse gasses. For instance, the Royal Dutch Shell Group has launched an internal cap and trade system that aims to make a 10 per cent cut in emissions by 2002 relative to its 1990 levels. Similarly, BP Amoco has pledged to reduce its emissions by 10 per cent from a 1990 baseline over the period to 2010 and have adopted an internal trading scheme. These companies have already invested in forestry projects for the purpose of obtaining carbon sequestration rights.

The rationale for voluntary participation

There are a number of reasons why firms agree voluntarily to reduce their greenhouse gas emissions and enter into a self-styled trading program. The main motivating factors are:

- intra-firm trading has the potential to improve production efficiencies across a firm’s production centres;
- firms are willing to invest time and resources into learning about trading mechanisms so that they will be better prepared if and when greenhouse gas limits become mandatory;
- early movers may gain an advantage over competitors in terms of more favourable treatment by the regulator or may have an opportunity to shape the design of the trading program in its favour;
- the public-relations benefit associated with having a clean, green image. These benefits could materialise in the form of access to new markets or higher product prices; and,

- the threat of future regulatory constraints on emissions poses a significant financial risk to large industrial firms. If equity markets identify that a company is exposed to this risk, it may increase the firm's cost of obtaining finance. Furthermore, companies with higher risk profiles generally incur higher insurance premiums and higher interest rates on borrowed capital.

Developments in the US

There is no mandatory requirement for US companies to reduce their greenhouse gas emissions. Nevertheless, some companies are partaking in voluntary abatement programs. One of the most recent developments in the US is a proposal by the Chicago Board of Trade (CBOT) and Environmental Financial Products (a Chicago-based consulting company) to establish a Climate Exchange for trading greenhouse gas emissions. A pilot 'cap and trade' program is currently being designed for seven Midwestern States of the US. The program aims to:

- encourage firms to sign on to voluntary emission reductions; the goal is to reduce participants' emissions by five percent below 1999 levels over five years;

- establish mechanisms for monitoring, verification, tracking, and reporting; and,

- allow credits to be created for targeted domestic and foreign emissions offset projects, including methane destruction, solar and wind energy projects, and certain carbon sinks.

The program is due for launch in the second half of 2001. At the time of writing this report, 25 companies and non-profit organisations have agreed to participate in the market design phase, including manufacturers, electric utilities, agricultural cooperatives, and conservation groups. The utility companies involved in the design phase represent almost 20 percent of greenhouse gas emissions in the Midwest region. If the pilot program succeeds it will provide an opportunity to discover the price of carbon, something that to date has been the subject of speculation.

Developments in the UK

The UK has taken a relatively aggressive approach to reducing greenhouse gas emissions and is about to implement a hybrid instrument that comprises an energy tax linked to an emissions trading scheme. In April 2001 the UK introduced an industrial energy tax called the Climate Change Levy. All industrial firms will be required to pay the levy, but firms belonging to the energy intensive sector are eligible for an 80 per cent discount on the levy provided that they enter into negotiated agreements with government that set 'challenging targets' for abatement. These agreements, known as 'Climate Change Levy Agreements', allow companies to choose between an absolute reduction in carbon dioxide emissions or a target defined in relative terms (ie. a reduction in energy consumption per unit of output).

Running in parallel with this energy tax and Levy Agreements is a national trading scheme for emissions permits and reduction credits. This scheme originated largely as a result of lobbying pressure from the group of industries who were not given an opportunity to obtain a discount on the levy via the Climate Change Levy Agreement (CCLA) mechanism. As of January 2002, companies belonging to both sectors will be able to participate in the 'cap and trade' scheme. Participation is voluntary, and participants will still have to pay the full Climate Change Levy (unless they have entered into a CCLA). Those companies that have taken on absolute targets under the CCLA will be able to obtain credits from their abatement. Companies who have taken on a unit reduction target will be able to purchase credits to offset their energy reduction targets (subject to a predetermined exchange rate) but cannot generate credits for sale.

The UK government has agreed to establish an incentive fund that will be used to provide incentive payments to companies that agree to take part in the trading scheme. The incentive fund will only be available to those companies that are not covered by a CCLA (ie. companies will not be able to receive both the tax discount and an incentive payment). It is anticipated that the payments will be allocated using an auction mechanism whereby companies will be asked to submit bids in terms of emission reductions. The extent to which the trading scheme will increase the demand for sequestered carbon is unknown at this stage. However, the scheme has established a framework within which UK companies can potentially partake in an international market for carbon credits- including credits from forest sinks- if and when a market comes into being.

Chapter 6: Lessons from overseas experience

A number of recurring messages emerged from the consultations undertaken on this study trip. Six main points stand out as important lessons that hold relevance to Australia as we begin to design trading programs to address environmental problems in this country. These points are outlined briefly in this chapter.

1. Enforceable caps are the key

An enforceable cap or baseline level of environmental quality is the most effective way of stimulating demand for environmental services. In circumstances where the externality has public good characteristics, a regulatory stimulus is essential. However, the imposition of enforceable targets must be justified by a preliminary economic assessment that demonstrates the policy will lead to a net welfare gain after accounting for all costs and benefits. Policy makers also need to be cognisant of the equity implications of imposing targets. Mechanisms for cost-sharing between government and landholders may be appropriate. One such mechanism could be a percentage rebate on the cost of credit purchases made by landholders.

2. Start from scratch

A clear message from consultations with numerous people who have been involved with designing trading programs is the need to commence the design process from scratch rather than make piecemeal changes to existing programs. This is not to say that existing regulations should not be given due consideration. Instead, the emphasis should be on developing a program that is simple to understand by all stakeholders and puts in place the correct incentives to address the externality problems.

3. Understand the market potential

The US approach to designing water effluent markets highlights the value of gaining an initial appreciation of market potential. Program designers in the US firstly make an assessment of the potential economic benefits to be gained from trading. To a large extent, this will hinge on whether there are an adequate number of firms in the watershed who would be interested in participating in a market and whether these firms are sufficiently heterogeneous in terms of their abatement costs. The design process does not proceed past stage one unless these basic prerequisites are fulfilled. If there is sufficient evidence to suggest that a trading program will yield efficiency gains over an alternative instrument, then the process continues to phase two, which involves framework development, and then to a third phase of implementation.

4. Involve stakeholders

It is evident that the success of a trading program relies heavily on the extent to which interested parties are involved in the planning and design phase. Furthermore, there is a strong case for government to decentralise the day-to-day management of a trading scheme by passing this responsibility onto a community-based association. US water effluent programs such as the Lower Boise River Trading Program now involve market participants in self-monitoring, with the EPA taking a background role of auditing and enforcement.

5. Keep trading rules simple

Experience shows that unnecessarily complicated trading rules are a primary factor responsible for causing trading programs to fail. There must be sufficient transparency in the trading process and a minimum of bureaucratic intervention. Furthermore, restrictions on trade should be kept to a minimum.

6. Get the science right

This review has demonstrated that it is critical to define a physical basis for the emission permits or offset credits which is measurable, able to be monitored readily, and is defensible against legal challenge. In Australia this may involve refining the methods and criteria used to measure biodiversity and habitat function. An empirically sound method for measuring the physical basis is required for establishing confidence in the market. In the case of non-point sources of pollutants such as salinity and nutrients, robust models are required to define the impacts of land use practices on subsequent discharge. These models need to be calibrated for different spatial locations, which will allow program designers to formulate appropriate trading ratios for the purpose of maintaining equivalence in trades.

Environmental systems are inherently variable and indeterminant. Therefore it must be accepted that we will never be able to model the relationships with complete accuracy. However, the US water effluent trading programs demonstrate that a highly accurate model is not required: What is needed is a model that adequately describes the relationships within a known margin of error. Trading ratios can then be used to buffer against uncertain outcomes. If trading instruments are to be applied to dryland salinity in Australia, a key step forward would be to develop a broad understanding of the relationship between recharge and discharge for different parts of the landscape, and establish the margin of error associated with the predicted outcomes.

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Appendix

Institutions visited on the study trip

Centre for Social and Economic Research on the Global Environment, University College London.

Environmental Defense, Washington DC

Environmental Financial Products, Chicago.

Environment and Natural Resources Program, Harvard University, Cambridge, Massachusetts

International Institute of Environment and Development, London.

Massachusetts Institute of Technology, Cambridge Massachusetts

Oxford Economic Research Associates (OXERA), Oxford

Political Economy Research Centre, Bozeman, Montana

Resources for the Future, Washington DC

US Department of Agriculture, Washington DC

US Environmental Protection Agency, Washington DC

World Bank, Washington DC

World Resources Institute, Washington DC