

THE ENVIRONMENT AND A PROSPEROUS ECONOMY:

Applying Market Solutions to Environmental Issues

ECONOMIC WELL-BEING AND SOCIAL COSTS

INTRODUCTION

Capitalism with its emphasis on individual gain will always be vulnerable to attack from the lofty heights of moral rhetoric. Traditionally the role of wide eyed prophets, taking up the cudgels for such attacks in the present era have been charismatic pop stars and actors.

Perhaps for the same reason that well known personalities with no apparent expertise are chosen to advertise dog food, cornflakes and beer, so Brigitte Bardot, Jane Fonda and Sting seem to win recognition as authorities on seals, nuclear power and aboriginal peoples. Little scrutiny is directed into what special knowledge such personalities might bring to the debates or what research they undertook to acquaint themselves with the causes they espouse. There is just an acceptance of their indignation, an acceptance which is doubtless inspired by guilt on the part of their supporters about the egocentric nature of mankind.

There are of course promoters of environmentalist causes who have studied the matters in considerable depth. Many however tend to discard findings which are contrary to their preconceived notions and like a motorist travelling the wrong way on a dual carriageway allow their minds to shut out information which is contrary to their dispositions.

John McCormick's assiduously researched "Reclaiming Paradise" is such an example. Although time has utterly disproven the catastrophes foreseen by environmentalists like Paul Ehrlich, Barry Commoner and the Club of Rome during the 20 years since their first predictions were made, McCormick simply suggests that their forebodings were premature. Where well documented studies like those of Resources For the Future find that, contrary to previously unresearched assertions, the world is not running out of resources, he attributes this to the vested interest of their commercial sponsors. He makes no attempt to explain why academics would sacrifice their integrity for the relatively modest salaries they draw from a Ford Foundation financed institution. Nor does he attempt to throw light on the intriguing question of why commercial firms would be unable to turn a profit in a situation of shortage. Those who, like Herman Kahn, offer deep analysis of the issues are castigated, in the language of historicism, as fighting a "rearguard" action against a pre-ordained triumph.

Animosity against those who might threaten the environment's commonly owned and cherished assets is understandable. Its collective ownership gives all a stake in its usage and a reason to regret the destruction of any of its aspects. The environment is the source of all that offers life, the colander through which discarded matter may be strained and reused and a means of pleasure and satisfaction. It provides basic inputs like metals, energy and water which are transformed into goods that enrich and secure our lives. Its air, water and living organisms provide mankind's life support system. It acts as a sink into which the discarded matter of all living organisms is dumped, sterilizing and reusing that discarded matter. Finally, it provides amenities which enrich the comforts which mankind has created from its basic ingredients.

The environment is also a dynamic system. The organisms it fosters procreate, mutate, become extinct. In the process, these organisms leave their indelible stamps and change the environment's very nature. The matter/energy which constitutes the basis of the environment can never get used up. It can however be transformed so that its ability to succour particular forms of life changes is modified. In all likelihood, none of the system's creations have had such a marked effect upon it over such a brief period as mankind. What we commonly refer to as the environment has been changed beyond recognition by our cultivations and cities. It has become far more hospitable to our needs than when we first emerged from it. It has, in short, been improved so that it better serves our requirements.

This improvement has not been without its ambiguities. In the process, much of value has been destroyed or depreciated. And just as the environment can be - has been - refashioned better to suit mankind's needs, so the destructions and depreciations from pursuit of those needs can savagely rebound upon their fulfilment. Nonetheless the net outcome to date has been unambiguously to the benefit of the human race. Compared to any previous era, for mankind the present day is an Arcadia of healthy, wealthy living standards. The title of McCormick's book is therefore paradoxical - there never was a paradise to reclaim. Man's natural state was one of ignorance and squalor.

The task is to find paths which might further foster the progress that has been made. At issue are ways and means of discovering better techniques for the creation of wealth and managing economies so that each generation may maximise its income and assign this between its own levels of consumption and those of succeeding generations. To our immense benefit, previous generations have served us magnificently in this respect.

The environment is part of this income and part of the legacy we received and will leave behind us. From the only perspective we can adopt, mankind's own interest, the earth's bounty offers the resources for material prosperity, while providing a quantity and diversity of attributes in which future generations might find pleasure and satisfaction. A facet of this which is doubtless increasing in importance is the need to ensure sufficient resources are allocated for the adequate protection of the environmental milieu. Importantly, this requires that distortions and impediments to choice are removed. For, although environmental questions confronting us are manyfold, fundamentally they boil down to issues of choice about how much some things are valued in comparison with others.

Some of these choices can have far reaching consequences, while others are more akin to choices between different forms of manufactured goods. At one pole, some regard the Greenhouse effect as having cataclysmic overtones consistent with, though having a much more credible scientific basis than, earlier forebodings about the effect of man's presence. It leads many to believe that unless action is taken to arrest and perhaps reverse the impact of present production and consumption levels - or at least to markedly alter their make up - global warming will force a reversal upon us. Such a reversal at a later stage is seen to be more costly for mankind as a whole and especially so for those inhabiting particular areas of the globe.

At another pole, the questions involve trading more welfare in the form of income from a particular development for more welfare in the form of a relatively pristine wilderness. Although this choice could be depicted as one between materialistic greed and aesthetic values, it could be characterised with equal validity as a decision favouring resources for hospitals and shelter rather than more trees or animals.

Unless government is to impose its own preferences upon its citizenry, it must accept rather than modify, the various trade-off values. Importantly, these involve choosing between increments, for both the present and the future, of consumption of man-made and natural goods and services. And the most accurate reflection of those values is expressed in peoples' decisions in the expenditures they make.

In seeking to develop and apply a framework for addressing environmental issues, this work examines alternative approaches for mankind efficiently to pursue increased well being. Although environmental questions are fundamentally about choices regarding the relative values placed on natural and man made goods and services, organisationally they are about how we ensure that these valuations are allowed to be reflected in the decisions people actually take. The valuations are those of individuals and not governments. Whilst elected representatives can legitimately claim to be acting for the interests of the people as a whole, governments that have assumed a wider role in this respect have failed to provide adequate levels of well-being or liberty. Government mechanisms for taking and administering decisions do not have the equivalent disciplines to market mechanisms. Decentralised markets better co-ordinate needs and more effectively bare down on costs than government institutions, which are relatively immune from the any adverse penalties from inadequate asset utilization.

It follows that the role of government in environmental areas is best confined as narrowly as possible to establishing a framework in which individuals' choices can be properly expressed. At a more prosaic level, this must ensure that people receive appropriate rewards and penalties from the decisions they make. Individuals are themselves best placed to judge the adequacy of the values they receive from their decisions and governments are likely to be most effective when they passively accept these decisions and protect the institutional arrangements which allow individuals to seek out their preferred choices.

Such a framework makes use of the wealth generating forces which have evolved with mankind's civilization. The nature of these forces, free markets, property rights and personal responsibility, allows the channelling of people's energies in directions which best serve themselves. As the testimony of present day living standards demonstrates, individual self interest operating in a market system under a rule of law also furthers the fortunes of the community in general.

There are undoubtedly areas where self-interest cannot operate within the traditional restraints without the risk of jeopardising aggregate welfare. Within the kaleidoscope of environmental concerns will be found circumstances where market solutions may not be possible or may not be the most efficient outcome. In the main, these will come about because important property rights cannot be securely vested, thereby undermining individuals' incentives to ensure they obtain the best value from the use of resources. In

some such cases, governments, mainly out of well meaning intent, have sought to specify usages or impose barriers to market operations. Often, in the process, subtleties of the substituted outcomes' remedies have been overlooked. For example, as a result of government providing subsidised water supplies, farmers have engaged in excessive irrigation, which has led to salinity problems. The downstream costs introduced are often far in excess of the gains made by the upstream farmers. The clear solution in such cases is for government disengagement.

In other cases, governmental override of market preferences may be warranted. Clean air is highly valued but market solutions will often be frustrated by the fungibility of air and the inability to prevent those not making any sacrifices for it from benefitting along with others. The unownable nature of elements like the atmosphere, which constitute goods in their own right as well as components of the costs of production, means that individuals cannot directly receive the full cost and price signals on which efficiency promoting market mechanisms are predicated. In many such cases governments can (but have often failed to) enlist available market based instruments as auxiliaries to the override of individual preferences. Where a purely market approach is, for whatever reason, not considered likely to generate optimal outcomes, personal incentives may still be employed to promote low cost solutions. Measures which allow these sorts of cost savings include permitting trading so that those most cheaply able to deliver benefits or ameliorate costs may do so. Thus, where reduced pollution is required, rather than imposing similar standards on all, society as a whole will gain by allowing those able to meet the goals at least expense to overperform and receive compensation from those who would otherwise be obliged to incur high costs.

Application of charges which encourage those causing environmental costs to take them into account is another approach. Like trading, this offers participants cost effective opportunities to meet the standards sought; participants with a direct stake are likely to be more knowledgeable than regulators of the various trade-offs confronting them

The following chapters assess the situations when governmental override may or may not be necessary to combat deficiencies in the market system. Addressing the specific issues, a range of appropriate policies is considered.

1. THE GENERATION OF EFFICIENCY AND ECONOMIC GROWTH

"Many discussions of economic policy boil down to a tension between market allocation and public intervention. Marketeers keep thinking about the doughnut of allocative efficiency and informational economy and *dirigistes* are impressed by the size of the hole containing externalities, imperfections and distributional issues" Robert Solow in the American Economic Association's Ely Lecture 1973

The Fundamental Role of Private Property

Adam Smith's "Wealth of Nations" sought to explore the reasons why market systems without central control allow co-ordination through the generation of incentives. He showed how this process has allowed the emergence of complex trading patterns with increasing cost savings. The key to unlocking the mysteries of increased well-being observable in eighteenth century England and to a lesser degree in many other parts of Europe and in North America was seen to be the near absolute rights which men had over their property and over their labour.

The year 1776 when the Wealth of Nations was published was the same year that the United States adopted its Constitution, which subsequently formed the basis of the constitutions of Australia and other federal nations. The establishment of property rights, long implicit in England, became a fundamental feature of the US Constitution, particularly as a result of the Bill of Rights in 1791 which said "... nor shall private property be taken for public use without just compensation".

The Australian Constitution, like the American, encapsulates the view that individual freedom should prevail alongside a limited role of government, an approach very much a part of the Smithian philosophy. Section 51 (xxxii) requires that if the government acquires property from any State or person, it does so on just terms. These have been defined by the High Court as "full and adequate compensation" where the acquisition is a compulsory taking. Section 51 (xxxii) is however a Commonwealth head of power. The provision as interpreted by the courts does not bind state governments and, indeed, governments in Queensland and NSW have seized mineral rights without compensation. The Commonwealth has also arguably flouted this provision - as in the case of preventing sand mining on Fraser Island and mining at Coronation Hill- by applying regulatory powers from other Sections of the Constitution. And US Governments too have used their regulatory powers to effectively nullify the provisions of the Bill of Rights. Where such

actions were limited to isolated cases, whether as a result of law or tradition, an adequate degree of certainty in property rights was retained.

As Hayek¹ explains, the rules regarding private property grew up without any conscious or deliberate human will and, indeed, the US and Australian Constitutions though enshrining some such rules, like the English Constitution, largely regarded them as implicit. Hayek takes the gradual development of property rights back into antiquity. Rather than stemming from conscious deliberations of lawmakers, he finds both Athenian law and the Roman law of Justinian were based upon "the product of law-finding by jurists and only to a very small extent the product of legislation." With regard to the British system, Hayek points out that "the law which governed the decision of the courts was common law, a law existing independently of anyone's will and at the same time binding upon and developed by the independent courts; a law with which Parliament only rarely interfered and, when it did, mainly to clear up doubtful points within a given body of law." (p85).

Benson² traces the unplanned development which created international merchant law in mediaeval Europe. He demonstrates how an elaborate trading system rested upon detailed rules which were developed without any single government exercising an umbrella of control. The mutual interest of all the parties in ensuring honesty and swift settlement of disputes gave rise to progressive clarifications of appropriate behaviour with the sanction for those failing to abide by the rules being the loss of opportunities to trade. Though national courts have assumed formal jurisdiction over international trade, it remains underpinned by these same principles. And for trade in general, it is the disciplines of the marketplace - the need to offer good value, whilst avoiding deception and preventing inadvertent harm to consumers - that ensures the trader continues in business.

Much of what began as ethical norms requiring that no harm be done from the trade has become enshrined into law. Many laws, like those against deceit, are constantly evolving and being defined and redefined in the course of generations of transactions. With increasing complexity and variety of goods, a greater onus to ensure these requirements are upheld has been shifted on to the seller. This shift reflects the greater efficiency of having responsibility placed on suppliers, as products and distribution systems have

¹ Hayek FA "Law, Legislation and Liberty" Volume 1: Rules and Order, Routledge & Kegan Paul London

² Benson BL "The Spontaneous Evolution of Commercial Law" Southern Economic Journal Vol 55 No 3 p644-662 Jan 1989

become more intricate. In such circumstances the supplier is better placed to detect and rectify faults than the consumer.

Developments such as these have also meant an enlarged role for government. It is sometimes considered to be more efficient to forbid certain trades and require suppliers to increase the information they provide so that uncertainty is reduced (eg regarding physical safety) or so that deception is avoided. While many such overrides are merited, they carry within them seeds which, if unrestrained, might strangle the generation of greater wellbeing which has been provided through the operation of competitive market forces.

Co-ordination by the Market

Smith's evocative phrase "the invisible hand" of the market describes the uncoordinated process under which men, pursuing in the main their individual interests, were able to discover needs for goods and apply their knowledge and capabilities to satisfying these needs by making use of price signals. The potency of this rests upon

- competitive markets, ideally with no buyer or seller having significant power or, more realistically in many markets, with any such power circumscribed by the potential of rivals to compete and exploit opportunities for high returns thrown up by the exercise of influence;
- having all valuable resources individually owned and managed so that their owners can benefit from obtaining maximum value from them;
- comprehensively defining and protecting the rights to property so that all impediments to its known uses are understood; and allowing unfettered transferability of property so that it might be moved to uses which offer higher paybacks.

Defining the scope of property rights does not require designating ownership over those features which are undiscovered. To have done so in the past would have meant intolerable transactional difficulties, for example over the electromagnetic spectrum which passes through property without in any way affecting its previously known use.

Nor does efficiency require that all participants be significantly informed about the costs and opportunities confronting them. The generation of information may be costly. Information, as well as being necessary for trading, is also the outcome of competitive markets and self-interest. The parties involved will take the steps they consider to be appropriate in economically seeking out and transmitting information on the goods they wish to buy and sell. Requiring information be made fully available can mean imposing costs which these parties might find unnecessary.

Prescribing the general availability of information as conditional to the achievement of efficiency also introduces an element of uncertainty. "Full" or even "adequate" levels of information can never be defined. And if a party is able legitimately to renege on an agreement which in retrospect is found to be to its disadvantage, a sharp curtailment in previously profitable opportunities is likely. Moreover insistence upon full information disclosure would discourage potential owners of others' property from seeking out undervalued or unappreciated wealth, thereby reducing the amount of searching to discover new means of applying property to market needs.

Market signals, uncoordinated by any central agency, provide usable input to an Australian farmer on the basis of which he can decide whether to employ his land for beef, dairying or crops; and to determine whether or not additional inputs of fertilizer, labour or water are likely to be worthwhile. He need not know, might not even be aware, of the intricacies of consumer needs in the final market for his products or of the myriad needs his products meet or might meet - all this is neatly captured within the price system. The price system therefore allows the farmer to economise on his information searches and to concentrate on these activities from which he is best able to obtain increased value.

This does not mean that the farmer ceases to seek out ways of obtaining better value and directs his energies only towards established methods of production. It simply narrows the area of search. Where the conditions of stability, security and transferability of rights are present, owners of property and individuals as owners of their own labour are continually investigating the potential for increased value or economic rents. This activity will always detract from increased leisure or income available from producing and of course searching can also be counter-productive where envisaged opportunities fail to materialise.

Where the searches yield net gains to the innovator - and the fact that they have in the aggregate is attested to by increased income levels³ - high profits (economic rents) are created. The entrepreneur who successfully discovers new, highly profitable uses however will be unable to fully capture all the gains for himself and the beneficial effects will "trickle down" to others in the community. In addition, market processes ensure that economic rents are transitory. The discovery of a new way of doing things at a lower cost will be emulated by competitors. In the process, the lower costs are reflected in lower prices as each competitor seeks to obtain a higher market share.

This development unfolds very quickly where emulation is easy. The first grocery stores to take advantage of better check-out techniques and turn themselves into supermarkets were quickly imitated until the traditional grocer, who selected goods from the shelf, virtually ceased to exist. The lower costs involved quickly became factored into lower margins. Similarly, new technology and methods of arranging work in newspaper plants allowed lower production costs. In this case, inertia and trade union monopolies blunted the competitive forces and impeded the flow through of many of the potential cost savings. Once these had been overcome, the lower costs the initiator enjoyed put great pressure on the competitive providers, who were forced to follow the adoption of the improved work arrangements in order to survive. Such imitative action, prevents the initiator from fully capturing the gain which is therefore passed on in terms of lower prices or higher quality.

The consumer need not be the prime beneficiary of innovation and its emulation. Sometimes other producers share more of the gains - where new uses are found for a fishing shack as a vacation house, the area may be progressively converted into a tourist resort and the value of neighbouring real estate will increase. Similarly, new technology in freezing allowed the inventor/entrepreneur to transport produce to higher priced markets; while this lowered the price of meat in England, it also transformed the value of beef in Australia, rearranged the relative incomes derivable from different farming activities and raised the value of land generally in Australia.

Competition as the Engine

³ see Denison E.H. "Accounting for Slower Economic Growth" Brookings Institution, Washington 1980 and Kendrick J.W. "Productivity Trends and the Recent Slowdown" in "Contemporary Economic Problem" ed Fellner W. American Enterprise Institute, Washington 1979

In the process of determining what people want, competition is at centre stage. Competition puts on rival suppliers to ensure their prices are not excessive and that their production and distribution costs are held down.

More importantly, competition means a continued search for ways of providing better value to the customer and earning increased income as a result. Only through experimentation, discovery, failure and success can we bring needs and abilities to supply them into equilibrium.

The decentralised market system whereby prices both reward providers and signal the most remunerative uses has, on the basis of free trade and secure property rights, generated efficient resource allocation both in a static sense and over time. The system can never yield perfection. Human frailty and imperfect information would prevent this even if rights could be defined, policed and traded at no cost. But it allows otherwise inaccessible and indigestible information to be conveyed and processed by individuals in ways that relates to their particular circumstances and interests - matters about which they are likely to be better informed than other parties.

Reinforcing Mechanisms

Security of ownership gives incentives to make use of property to maximise the income derived from it. Maximisation of income is achieved by offering sufficient value to those who freely sacrifice their own income for the goods and services embodied in the use of that property. The worth which buyers and potential buyers attribute to the stream of goods and service from a property also creates the incentives for its preservation and improvement, signalling to its owners ways that it might become more productive (or that it should be allowed to deteriorate).

The market system also provides incentives to clarify property rights and for the owners to engage in self-policing activities - for example, in the case of farmland, putting up fences to keep out neighbouring or wild stock. At the same time it motivates those with secure rights which might be in collision to arrive at an accommodation which is to their mutual benefit. An example of this occurs when common standards to allow interconnection of electrical and electronic equipment are agreed upon. The outcome of such agreements, which may have been organised solely by producers, brings benefits to consumers in terms

of flexibility of purchases and an ability to make uses of combinations which may not have been under contemplation by those directly organising the arrangement.

Self Interest and Altruistic Motives

The efficient outcomes are largely promoted by the self-interest of parties standing to gain. Although this can be caricatured as in the speech used in the film "Wall Street" where the buccaneering share trader told his audience "Greed is good", Hayek has an alternative viewpoint. He says

"When the prophets and philosophers from Moses to Plato and St Augustine, from Rousseau to Marx and Freud, protested against the prevailing moods, clearly none of them had any grasp of the extent to which the practices which they condemned had made possible the civilization of which they were part. They had no conception that the system of competitive prices and remunerations signalling to the individual what to do, had made possible that extensive specialisation by informing the individuals how best to serve others of whose existence they might not be aware - and to use in this opportunities of the availability of which they also had no direct knowledge." ³

Yet "greed" or Hayek's "prevailing moods" are not the exclusive forces motivating mankind. People show great compassion towards those confronted by natural disaster and willingly vote taxes to cushion the misfortunes of those falling upon hard times. In response to common standards of decency people will incur modest efforts to avoid imposing costs on others, efforts for which no real personal compensation is possible. The quite dramatic reduction of littering in Australia over the past two decades - to perhaps only 20 per cent of its previous levels - cannot be accounted for by increased penalties. The market response to avoid aerosols with CFCs largely brought about their disappearance notwithstanding the advantages of CFCs over alternative propellants. Some car models are promoted in the US as pollution free to tap the well-being some potential buyers obtain from imposing fewer costs on the community as a whole - even though the buyers would be aware that their individual actions have a trivial effect.

Many, probably the greater part of, such actions are motivated by factors other than self interest, at least in the commonly understood meaning of that notion.

³ Hayek F.H. "Law, Legislation and Liberty." Volume III p. 166, Routledge and Kegan Paul, London

Most of the philosophers cited by Hayek sought a more intensive tapping of this selflessness, the very existence of which adds considerably to society's broader welfare. Selflessness is not an abundant commodity and few people will offer major personal sacrifices but, when adequately informed, most will voluntarily take steps to avoid imposing costs on others, even when they know their own contribution can only be trivial. This requires that information be made available, although the role for government in providing it is difficult to specify.

The Case for Government Intervention

Income is measured in terms of economic aggregates - exports, industrial production and so on. Yet the process of its creation is one of people largely pursuing their individual interests - applying their energies and creativities; trading off work for leisure; making choices in their purchases of goods and services in accordance with their preferences within the constraints of their income levels.

This highly atomised process based on freedom of choice has served mankind admirably. It has proven to be the most effective means of achieving the goal of economic development. Underpinned by individual property rights under rules of law aimed at avoidance of harm and protection of property, the system works because each person attempts to obtain full value both for the activities he undertakes and the property he owns. At the same time each person must adequately compensate others for any costs imposed on them.

There have been frequent eruptions of dissatisfaction due to the system's imperfections or unacceptable consequences to certain groups. In the past, such dissatisfaction largely rested on the unequal outcomes delivered by the market system, which is grounded upon equal treatment for all - that is vertical equity. An attenuation of these outcomes is widely regarded as necessary so that society supplements the capabilities of those temporarily or permanently in economic distress.

Some would take this further. Many favour political override of the market to foster the pursuit of greater (horizontal) equity between the residents of their country - and some limited distribution of that income to residents of other countries. Those calling themselves socialists also considered (and presumably some still consider) that greater efficiency is possible if the range of state owned or state regulated uses is widened. Under

this view, not only was common ownership of all the means of production promoted as a means of fostering equity but it was also envisaged to be a means of generating increased efficiency. Founded upon a romantic, selfless view of human motivations, empirical outcomes from the application of this theory have disappointed its former adherents and few today find its further exploration relevant.

Major political differences instead focus upon the extent to which control should be exercised over uses of private property and over individuals' decisions regarding their work and consumption preferences as well as more limited pursuit of horizontal equity and the taxation and expenditure ramifications of this.

Regarding control over uses of private property, calls for intervention stemming from environmental concerns are particularly vigorous. The market system is acknowledged as having served us well in the generality of development. Why then should it not now be considered to be operating efficiently?

One reason why some dispute the efficacy of the system is founded on a different set of ethical norms from those which have formed the basis of what we sometimes refer to as Judeo-Christianity. These norms radically extend notions of sanctity of human life to other sentient beings. Within the ambit of this might fall flora as well as fauna. A further extension is a requirement to rectify damage to the earth's surface. An expression of this was offered in the John Ford classic western "The Treasure of the Sierra Nevada" by the actor Gabby Hayes. Having mined all the gold from the mountain, the character played by Hayes, who saw the mountain as having a feminine persona, wanted to repair the damage before leaving. The generally objectionable character played by Humphrey Bogart agreed to help him saying that the mountain had been better to him than any woman he had ever known.

Reverence for the land in setting up nature reserves has been described by Fred Pearce⁴ as a new religion which places peoples as subservient to nature. He describes how the World Wildlife Fund for Nature (WWF) and the International Union for the Conservation of Nature and Natural Resources (IUCN) has succeeded in reserving areas of the Sahel from use by indigenous tribes. The Governments then deny starving people and their herds traditional access to the land. He quotes an IUCN report as saying the Government of Mali

⁴ Pearce F "The Green Missionaries of Africa" New Scientist 21 April 1990

should "discourage grazing of cattle and livestock within the reserves even in times of drought. This puts pressure on wildlife populations when they too are stressed." Similarly in Chad, it proposes tough anti-poaching activities; Pearce opines, "Note the subtle criminalization of traditional native activities. The conservationists move in to declare a region or reserve a national park. Hunting is redefined as poaching and before you know where you are the game wardens are hunting down natives in the name of conservation." A Maasai leader is quoted as criticising the policies of the governments of Kenya and Tanzania in working with the WWF in creating national parks. This policy is depicted as cutting the age old link between the people and wildlife (a link which, incidentally is responsible for the very existence of the great numbers of wildlife in the region). The Maasai leader refers to it as "anti-people preservation policy".

As Pearce notes the IUCN report he quotes is not one sided. It contains articles which, taking the view that drought and famine in the region is a result of the dispossession of poor people from traditional areas of pasture, advocate granting ownership of the land to the local communities. Environmentalists however rarely see merit in approaches that make use of market or quasi-market mechanisms.

Kneese and Schulze⁵ attempted to explore whether environmentalists, in their hostility to costing particular approaches, were following different ethical codes to those based on market outcomes and cost benefit techniques on which economists' judgements are formed. Where cost/benefit techniques are used to replace market outcomes, they are based on neo-utilitarian principles and estimates of peoples' willingness to pay for something. They rest upon people seeking to maximise their own advantage with this resulting in the welfare of society as a whole being maximised.

Kneese and Schulze's investigation of alternative codes of ethics caused them to examine whether living things with a perceived interest in staying alive could be accorded rights. They considered whether their might be an application of the "infants and imbeciles" argument which confers rights - in a sense increased rights - on these without the capacity to reciprocate. They concluded that such a model could not be persuasive. Environmentalists' hostility towards solutions to pollution control which employ market mechanisms and preference for use of less efficient "best available technology" approaches were seen to be based on a moral view that discharges into the atmosphere should not

⁵ Kneese AV and Schulze WD "Ethics and Environmental Economies" Resources For the Future 1985

appear to be legitimate. "Best available technology", as an input approach, does not incorporate the flexibility of outcome based controls. However, whilst allowing neither the cheapest solution nor a greater reduction of emissions at the same cost, it does mean that everyone is doing his best.

While ethical norms which rule out wanton destruction and cruelty are consistent with the concept of man's stewardship over the earth, it is difficult to contemplate the abilities of man as we presently conceive of him to treat other sentient beings with equality. More persuasive reasons for intervention to combat environmental concerns are variously given as being:

- people are unable to contemplate actions with the very long lead times necessary to counter environmental degradation;
- people in general are not adequately informed of the dangers and their representatives should take action for them;
- there are too many external or uncontractable costs involved in normal transactions which impact upon the underlying abilities of the environment to maintain itself.

Long Lead Times

The supposed inability of people to take decisions where long gestation periods are involved is often coupled with risk. It also finds expression within the conception of inter-generational equity, whereby each generation should leave its successor at least as well off as it found itself. However the observed behaviour of mankind has demonstrated a surfeit of endowments - our forebears' bequests have done much to produce living conditions for ourselves which are in stark contrast with those of earlier generations. This outcome is often ascribed to pure chance - had the parents been aware of the extent of their bequests, they would have stinted less on their own consumption. But pure chance is difficult to reconcile with the consistent over-generous actions of parents over many millenia.

Even if mankind's recent activities prove to have been reckless in its pursuit of consumption, it is surely no panacea to cede responsibility for individual actions to

governments solely on the grounds that people are shortsighted. If people act inconsiderately on matters which affect the future, they are likely to reveal equal myopia by selecting representatives who will avoid placing unwanted burdens upon them.

Moreover, government decision making has hardly proven to be more capable than private decision taking of balancing the calculus of long and short term considerations necessary to meet future needs. For example, lands under government control have been used far less productively and protected from harm far less energetically than lands in which individual ownership prevails. Much the same can be said for many government services, where the disciplines of individual self-interest and legal restraint are weaker than in the case of services provided by private enterprise. Thus, a private contractor who allowed Sydney's beaches to be fouled by untreated sewerage would have been destroyed by lawsuits and would therefore have undertaken necessary expenditures long before the State government found these to be unavoidable.

Rather than governments being superior to private decision takers where long gestation periods are concerned, the opposite is true at least for a great many issues. Governments largely work within a political cycle and expenditures incurred are reviewed every one to three years. This must prejudice activities with long pay off periods. By contrast, markets value private firms by their income generating capacity, with this (discounted for time) extending far into the future where appropriate. This allows present and future returns to be combined. For Australia, Bishop, Dodd and Officer⁶ demonstrate that share values reflect returns expected. Others have noted that share prices respond positively to firms announcing R&D expenditures even where the pay off is estimated to take many years and the immediate consequence is lower short term income.

Informational Deficiencies

Full information on likely future outcomes is unattainable but again there can be no presumption that governments are more prescient than the collective forces of the market place. When one considers the contrasting reactions of governments and the market to recent forebodings, this conclusion is reinforced. In the 1950's, just as the European committee to allocate scarce supplies of sulphur was established, the forecast scarcity was replaced by a glut. The massive expenditures by governments in US (and Australia) to

⁶ Bishop S, Dodd P and Officer RR "Australian Takeovers" CIS Melbourne 1987

prove alternative oil technologies and search out shale deposits were only abandoned after markets had resolved the supposed imminent exhaustion of the world's supply. Government instrumentalities from the US Army Corps of Engineers to the Tasmanian Hydro Electricity Commission are now roundly criticised for reckless development of hydro electricity potential at costs which both failed to factor in an appropriate return and which undervalued the destruction of resources.

Externalities

Externalities are the most persuasive reason why markets may not provide efficient development. These are costs or benefits emanating from an uncontracted use of resources or spillovers from transactions where contracting parties make mutually acceptable gains but in the process impose costs (or confer benefits) on others. Externalities contribute much to the distinction between measured GNP and true income, where for example an increase in pollution requiring higher expenditure on cleaning means a greater measured GNP. The exploration and analysis of environmental externalities forms the substance of matters addressed in this work.

2. EXTERNALITIES AND PUBLIC GOODS

The Notion of Social Costs

Although addressed in the 19th Century, a description of goods and services which incorporate valuable but freely available inputs is of recent vintage. Pigou's work on the matter dates from the 1920s but until the 1960s, though acknowledged, it was largely neglected.

Simply put, Pigou posed the issue of a factory making use of inputs for which it paid and inputs (say the atmosphere) for which it did not pay but soiled, to the detriment of its neighbours. The factory's production might offer the following values if it faced diminishing returns and if each private input was valued equally.

<u>Output</u> <u>(1)</u>	<u>Value of</u> <u>Output (2)</u>	<u>Marginal Value</u> <u>of Output (3)</u>	<u>Marginal</u> <u>Input Cost (4)</u>	<u>Marginal Economic</u> <u>Gain to the Owner (5)</u>
	(\$)	(\$)	(\$)	(\$)
0	0	0	0	0
1	26	26	12	14
2	50	24	12	12
3	72	22	12	10
4	92	20	12	8
5	110	18	12	6
6	126	16	12	4
7	140	14	12	2
8	152	12	12	0
9	162	10	12	-2

Under these circumstances the owner would produce up to the level (8 units) where his marginal costs equalled the marginal value of his inputs.

If to this example is added uncontracted costs which, cannot be charged for and these costs rise at a constant rate with each additional unit of output, then the marginal economic gain to society is different from that, shown in column 5, of the owner.

Table 2

Social Marginal Gain from a Factory

<u>Output</u>	<u>Marginal Private Economic Gain (5) (\$)</u>	<u>Value of Uncontracted Costs (6) (\$)</u>	<u>Marginal Social Gain (7) (\$)</u>
0	0	0	0
1	14	2	12
2	12	4	8
3	10	6	4
4	8	8	0
5	6	10	-4
6	4	12	-8
7	2	14	-12
8	0	16	-16
9	-2	18	-20

Freeman, Haveman and Kneese⁷ offer a diagrammatic version of the externalities which Pigou was describing. They do so by examining both negative and positive cases.

Diagram 1: Positive Externalities

With the market demand curve DD, price and quantity are set at P1 and Q1 respectively. However at Q1, the value curve VV which incorporates the positive externalities, yields a price P2 which would be offered. Q2 is the quantity which would be supplied if suppliers could obtain remuneration equivalent to what consumers would be prepared to offer.

Diagram 2: Negative Externalities

Where social costs exceed private costs, curve SS is replaced by CC. At the private which equilibrium quantity Q1, the price offers appropriate compensation at all factors of production is P2. Q2 is the quantity which would constitute equilibrium if suppliers could be appropriately remunerated.

⁷ Freeman M., Haveman R.H. and Kneese A.V. "The Economics of Environmental Policy" John Wiley, N. Y. 1973

From his analysis, Pigou concluded that a tax equal to the uncontracted costs should be imposed, a tax which would bring production back to 4 units.

Coase⁸ pointed out that there is no more certainty that the pollutees have a right to clean air than the factory owner has the right to use the air. Clean air is a common, open access resource owned by neither party. Mankind begins modifying his environment as soon as his existence is significant. There is a mutuality of interest rather than an automatic onus upon the polluter. The factory owner's costs are capitalized as rents within his production capabilities and should he on-sell the original factory, the new owner would have had the expectation that any free inputs would continue as such.

In a rough and ready way, the acceptance of prior rights had long found its way into English common law with, for example, rights of upstream river polluters being considered to have been granted, if, after 20 years, there had been no objections. This line of reasoning may be even more salient over more recent years where the polluter may have been in situ long before the pollutees and where, indeed, the latter may have even been attracted to their location by the polluter or have experienced advantages as a result of that location. Cheung⁹ refers to work undertaken by Professor Allan Walters into values of real estate in close proximity to airports. That value (presumably reflecting job opportunities and nearness to transport) has risen relative to other areas. In other words, the positive externalities appear to have been of greater importance than the negative externality of noise. Other researchers have however arrived at findings contrary to these - Pearce and Markandya¹⁰ estimate that each unit of "Noise Exposure Frequency" reduces the price of a house by 0-0.4 per cent for Sydney and 0.6 per cent worldwide.

These differences aside, if airports contribute to the wellbeing of users, they will produce increased real income for society unless the noise pollution they bring about more than offsets the value of air services. As there is no serious suggestion that noise negates the value to the community of air travel, it follows that the service is a net generator of income. That being the case, unless house demand were to be uninfluenced by income levels (demand was totally income inelastic), air travel raises the overall value of houses. An

⁸ Coase RH "The Problem of Social Cost" Journal of Law and Economics Vol 3 pp1-44, 1960

⁹ Cheung SNS, "The Myth of Social Cost" Institute of Economic Affairs London, 1978

¹⁰ Quoted in Pearce D., Markandya A. and Barbier E.B. "Blueprint for a Green Economy" p67 Earthscan Publications London 1985

issue therefore is to what degree in a perfect world home owners in the vicinity of airports should be compensated (or should compensate) other members of the community for the externality.

Coase's insights into the reciprocal nature of externalities has applications beyond the issue of fairness. If "victims" are automatically compensated, they have no incentive to take action (e.g. moving away, installing air conditioning) which might be lower cost. This moral hazard problem is fundamental to the insurance industry's avoidance of total compensation for damage. Total compensation means "victims" avoid taking mitigatory actions which are low cost to themselves. Moreover, full payment of compensation is likely to attract "victim activity", where people will locate operations close to a facility in the expectation of receiving a subsidy which more than compensates for any detriment they incur.

As Coase demonstrated¹¹, the factory owner/neighbour problem is a reciprocal one. To return to Table 2, if the neighbours own the right to the clean air, they could in principle extract all the profit. Thus the owner would pay the neighbours up to the value of \$44 ($14 + 12 + 6 + 8$) to be allowed to produce 4 units. The neighbours for their part would be prepared to accept payments of as little as \$20 ($2 + 4 + 6 + 8$) for the same output. For an additional unit of output beyond this, the factory owner would be prepared to pay to the value of \$6 but the neighbours would require \$10 hence no trade could be mutually agreeable. Thus output would be fixed at 4 units with the two parties bargaining over the payment and the price arriving at somewhere between their respective values of \$44 and \$20.

If the owner has the rights, the minimum he would accept to restrain his output to 4 from his preferred level of 8 would be \$12 ($6 + 4 + 2 + 0$). For their part the neighbours would be prepared to offer up to \$52 ($16 + 14 + 12 + 10$) to confine the output to 4. Again no trade is possible below this, since the owner values at \$8 a reduction to an output of 3 units and the neighbours would not be able to offer better than this (they may however offer the same which makes the optimal output between 3 and 4 units equivalent).

¹¹ Coase R.H.

Coase's analysis therefore demonstrated that efficiency will be arrived at where exclusive rights are given either to the neighbours or to the factory owner provided that there are no costs at arriving at the transaction.

There are of course as many complications thrown up by this solution as there are insights it offers. Importantly, it is uncertain how the parties would share the gain at an output of four and transaction costs, especially for the neighbours, might be prohibitively high. The temptation is for each neighbour to avoid offering his own time to conduct the bargain as the share of each will be predetermined. Hence, the neighbours might allocate insufficient resources to bargaining.

It is in regard to this latter point that the solution of having the government impose a tax is often preferred. But there is no certainty that the government can correct the failure at a cost which, in the case where the neighbours are the owners, would be less than the value of the \$16 marginal social gain available in Table 2. As has been illustrated by, among others, Buchanan¹² the ability of parties to communicate can generate much more cost effective solutions. Thus game theory, as the following example shows, can be used to demonstrate how people choose complex solutions offering mutual gain:

	PLAYER B	
	50, 50	20, 60
PLAYER A	60, 20	30, 30

If player A chooses the solution from one of the two rows earning for himself the first value and for player B the second, absent interaction, he will choose the southwest quadrant earning 60 for himself and 20 for player B. The sum (80) is clearly less than the 100 potentially available. The Pigovian solution would place a tax of 10 on player A to equalize his private value to that of the community but even if player B were given all of this he would still only receive 30. This approach is known as the prisoners' dilemma because it models rational behaviour of two criminals, either of whom could obtain lighter sentences by ratting on their accomplice; being interrogated separately neither can be certain that the accomplice will not himself turn state evidence thereby receiving the lighter sentence and imposing a heavier one on his partner.

¹² Buchanan JM "What Should Economists Do?" Liberty Press, Indianapolis 1979

In the market situation with many transactions, some with B imposing his own choice on A, the players will come to recognise the superiority of the northwest quadrant. This choice is what happens in the market generally because communication takes place. Ethical norms are established which allow contracts to be made under which a great deal more is understood than is explicit in the deal. Players choosing the 60, 20 solution find themselves without partners.

Deep-seated problems remain with the Coasian solution. These are centred upon the different values the parties attach to the mutually sought after resource. Rothbard¹³ points out that the parties themselves will not be indifferent to the allocation of property rights and that they will place highly subjective values on the attributes of the assets. He takes issue with any suggestion that the property rights should be assigned on the basis of "efficiency" because this involves constructs which cannot be objectively determined. This highlights a tension between the sacroscent nature required of property rights and the pursuit of efficiency. If on the one hand a solution is imposed this will mean invading a person's "just" property with adverse implications on the incentives to protect and improve property generally. If on the other hand matters are left to parties to resolve and no resolution is possible - perhaps because of "hold out" problems - then a commonly perceived notion of improvement in aggregate community welfare will be frustrated.

Rothbard's position occupies the high ground of theoretical consistency and those contesting it may be driven into offering apparent support for a form of socialist planning. Yet, rights will often be in collision and property rights can never be considered absolute. Beyond a difficult to determine point, the exercise by one party of its legitimate rights will impact so severely on the adjacent rights of others that the former's rights have to be regarded as violable.

Some Approaches to Spillovers

Coase's analysis and increased concerns with externalities during the past two decades has stimulated further exploration of why externalities do not become internalized. Much of this has demonstrated that many previously regarded externalities are in fact internalized whilst others are best neglected.

¹³ Rothbard M.N. "Law, Property Rights, and Air Pollution". The Cato Journal Vol. 2, No. 1, Spring 1982

Demsetz¹⁴ demonstrated that once market transaction costs and the expenses of government bureaus and policing are factored into the equation, the gains from more robust delineations of rights are reduced. Markets do not exhibit zero transaction costs - costs of promotion, policing and definitions of property rights are themselves seldom insignificant. Hence to achieve efficiency it is not necessarily to require a price for every good and service.

He offered the example of parking spaces which are often freely provided within shopping plazas. The instinctive reaction of the economist is to suggest means of charging to recoup costs and ration the availability of spaces. The plaza owner's action may nonetheless be a rational response to the likely usage of the facility, its acquisition costs and the costs of policing it. The parking lot in the shopping plaza may be able to recoup its costs in ways other than levying a direct charge and in doing so savings can be made on parking attendant salaries. Demsetz does not develop a further point, namely that it may also make sense as a marketing strategy if consumers find it more attractive to pay the charges for parking bundled within the goods they purchase.

Demsetz points out that other users may be able to free ride on the uncharged parking - for example nearby shops which are not part of the plaza. Such facilities enjoy a windfall gain which is quickly absorbed into the rental values of their businesses. By analogy to this, he draws attention to the case of externalities caused by sparks from a train igniting farmers' fields located adjacent to the track. A Coasian solution whereby farmers combine to strike a bargain with the railroad to reduce spark fall-out is likely to be impractical. However differential land rent is likely to accrue from the phenomenon. Depressed price of land adjacent to the railroad enables those farmers working it to compete with others. As a result of this lower rent, the railroad may find it profitable to purchase the land and, having purchased enough of it, will have thereby internalized the problem. This in turn may lead to the railroad to take action itself to reduce sparks. However as the critique of such solutions by Rothbard (p. 24) indicated such solutions are not entirely satisfactory. For those farmers who were required to offer the railroad a right of way, it involves an expropriation of their wealth.

¹⁴ Demsetz H "The Exchange and Enforcement of Property Rights" Journal of Law and Economics p11-26, 7 October 1964

That said, since the pathbreaking articles of Coase and Demsetz, many empirical cases of externality fallacies have been discovered. Cheung¹⁵ made a detailed examination of bees following an example given by Demsetz himself of a complex externality (the bees take nectar from the apple orchard from which they make honey and at the same time their activity pollinates the trees). Cheung noted that certain flowering plants - including apple trees - actually produce little nectar while others are prolific sources. He found that side payments between the farmer and the apiarist reflected this - farmers made payments to hive owners when bees favouring their particular plants were introduced and where the plants themselves were poor sources of nectar. Apiarists made side payments to farmers for permission to place their hives near crops which were fecund sources of nectar.

Coase¹⁶ examined the case of lighthouses, a classical form of public good for which externalities and non-excludability were thought to rule out charges. Contrary to this, he found that charges had always been made for the use of lighthouses, charges which were gathered, albeit imperfectly, as part of dues in the port close to which they were located.

Even where externalities in use of resources cannot be internalized by better specification of property rights, it is by no means certain that the appropriate approach is a Pigovian tax. Making the polluter pay where the pollutee has the property rights is not necessarily a sound policy when it involves a net loss to society. This is all the more true when the deficiencies of government decision making are taken into account.

In "Container Deposit Legislation"¹⁷, the BRRU examined the Australia-wide costs of imposing a deposit on cans and bottles to provide an incentive to their re-use (and therefore a penalty on non re-usable cans and plastic bottles). Such a measure was found to bring about a major negative effect on social welfare. The need to collect, wash and return bottles in an Australia-wide scheme (modelled on that of South Australia¹⁸) was estimated to generate nationwide costs of some \$500M per annum. Offsetting these costs were benefits of approximately \$14M in garbage removal and disposal costs (which resulted from the scheme reducing garbage by about one percent). In addition there were likely to be some benefits of lower levels of unsightly litter, though from the evidence

¹⁵ Cheung SNS "The Fable of the Bees" Journal of Law and Economics No.16 p11-33 April 1973

¹⁶ Coase RH "The Lighthouse in Economics." Journal of Law and Economics, No. 17 p101-128 Oct 1974

¹⁷ Business Regulation Review Unit "Container Deposit Legislation" Information Paper No. 14 Canberra 1989

¹⁸ It should be noted that this scheme, involving re-use of the bottles rather than recycling the materials, differs from most other such schemes.

available it was not possible to conclude that South Australia had less littering than other States. Largely as a result of suasion exercises, all States had litter counts which by the late 1980's were only 20 per cent of their levels in the previous decade.

The real problem with externalities is their pervasive nature. Most attention is focussed on the adverse externalities, the "bads" like pollution. However actions of others also result in unmerited increases in wealth. Such positive externalities occur where, for example, a neighbour maintains a highly attractive garden which raises others' enjoyment of their own property and may even increase its value. Other forms of unmerited increases in property values occur where "gentrification" of hitherto blighted inner city properties takes place. Similarly, certain skills like those of business economists become more highly prized when a more liberal banking regime allows increased competition in this sector. Much the same may be true of journalists, telephone technicians and airline pilots following relaxations of regulatory arrangements in areas where they are qualified. A road development will change the value of property around it - possibly reducing that which is adversely affected by noise and increasing that which benefits from the greater transportation convenience it affords.

Wherever possible the agents of change will attempt to garner the maximum rents from the change but full capture will never be practicable. Indeed, it is the lack of full capture of rents that has been responsible for much of the "trickle down" of wealth from those generating its increases to the community in general. Even where, as in the case of intellectual properties, new forms of rights have been developed, the full capture of the benefits of inventions is barely conceivable. It would require the inventor to charge each user a separate price based on the user's willingness to pay.

Public Goods

The foregoing largely treats the role of government in the economy as a holder of the ring within which transactions take place and perhaps as a means of clarifying aspects of the law. Quite clearly however its role cannot be confined so narrowly. Government has always been the provider of public goods, of which national defence is the purest form.

Pure public goods incorporate non-excludability and non-rival consumption between individuals wishing to use them¹⁹. The classic definition of public goods involves no reduction in the value of the goods, no matter how many in the community use them, together with great difficulties in denying their benefits to significant users. Market provision of such goods - at least in the quantities which people would want - is therefore not possible.

To provide an analytical framework, Kopp and Portnoy²⁰ split goods into pure private (individual property rights, excludability, freely traded), quasi-private (individual property rights, ability to exclude, not freely traded) and pure public (collective property rights, non-excludability, not traded on any organised market). Quasi-private goods include public libraries, recreation in parks and TV frequencies (all of which could in fact be totally privatised); pure public goods include air visibility, environmental risk and national defence.

Even some of those nominated as pure public goods are tradeable - like pure externalities, pure public goods are unusual. In the case of air pollution people can and do undertake private expenditures, for example by air conditioning their homes, while the public good of policing activity is frequently augmented by private security systems.

Whilst only by stretching the imagination can we envisage national defence as anything other than indivisible and equally available to all, it is difficult to envisage any good which exhibits no spillover externality involving the use of uncontracted inputs or unpaid residual outputs. Rather than falling within public and private categories, goods are more accurately described as being positioned on a spectrum from public to private.

No distinction is made in the Kopp and Portnoy classification between natural and man-made goods. Yet such a distinction may be of great importance. Many natural goods are likely to be better described as unowned goods, goods which in many cases have no value because they are superabundant. Tax financed public goods are undersupplied (or not supplied) by nature and require sacrifices for their provision. In either case the need for the goods, relative to others, may ebb and flow but naturally available public

¹⁹ Corner R and Sandler T "Easy Riders, Joint Production and Public Goods", *Economic Journal* Vol 94 p 580-98, 1984

²⁰ Kopp RJ and Portnoy PR "Valuing the Outputs of Environmental Programs", *Resources for the Future*, Washington DC 1985

goods may be irreplaceable or very difficult to replace. As a result, their value is likely to increase relative to that of other goods either because they become more highly prized of themselves with increased income/population levels or because increased income puts pressure on their availability. In the case of many natural public goods, pressing scarcities will bring incentives to define ownership of them and allocate their use through market mechanisms. It is this process which government action sometimes inhibits.

Public goods share with (positive) externalities a lack of adequate incentives for their production - difficulties in arranging for their payment are such that they would be undersupplied unless some form of compulsion were to be applied in their provision. Democratically elected governments provide the most legitimate means of determining what public goods should be provided. As Hayek has put it "..... wholly rational considerations will lead each individual, while wishing that all others will contribute, to refuse himself to do so. If on the other hand he knows that compulsion can be applied only if it is applied to all, including himself, it will be rational for him to agree to be compelled. This will in many instances be the only way in which collective goods can be provided which are desired by all or at least by a large majority"²¹ .

The issues involved in provision of public goods have been greatly enlarged in recent years by the increased importance of externalities. Where communities are relatively self-contained, there is a reciprocity between those incidental costs and benefits stemming from contracts between buyers and sellers. More extensive trade together with scarcity of goods like clean air, previously thought of as being abundantly available, puts pressure upon this mutuality of interest.

Diagrams 1 and 2 are equally applicable to public goods as to externalities. Indeed, public goods, which must always be enjoyed (or suffered) by all no matter who originally pays for them, are really only a form of externality. The wedge between private and social gains emerges from market failure. Whereas externalities are advantages or disadvantages obtained by non contracting parties as a by-product of the gains other parties obtain from their business, public goods are the reverse side of the coin. They are goods which have an undoubted value but for which market mechanisms offer insufficient reward for providers to incur the costs required to supply them.

²¹ See footnote 1, Vol III p44

Government Action to Prevent Externalities

Non excludability is the most important feature both of public goods and of goods generating potentially major externality problems. To warrant attention the benefits to be gained from redressing the costs involved in terms of lost value must, of course, outweigh the effort required. The public good must be valued higher than the resources which have to be sacrificed to secure its provision or to ensure that it remains intact; the externality must generate sufficient distortions to allow recompense for the expenditures necessary for its mitigation.

For this reason government intervention to overcome externalities should generally be reserved for those cases where the externality imposes a cost. Where it introduces an unwarranted benefit the contracting parties usually have sufficient incentive to pursue its capture without the intercession of specific government measures. Should this not be the case, the preferred approach is provision as a public good directly or on behalf of the government. Where it occurs, government intervention to allow appropriate capture of benefits is best introduced through widely applicable laws like those involving patents, without which insufficient reward from innovation could be obtained. More ad hoc interventions are, or should be, used sparingly, for example when land grants are made to rail entrepreneurs to allow them to capture a higher share of the increased value their expenditures generate.

Interventions to provide compensation or to promote rationing should be confined to public goods that are in fact scarce. However taken as a whole, public goods for which there is an abundance of supply given demands are apparently becoming increasingly rare. Whilst at one time air, water and fish in the ocean would have been considered to be infinitely available globally, this is not the case today. Goods considered to be in limitless and perpetual free supply would now probably be restricted to solar radiation and some of its effects like sunlight and wind. There are of course public goods which remain to all purposes valueless in some geographic areas - at least to their residents. For example few in a poverty stricken town could be able to mount a claim for compensation against a modest increase in pollution from a new income generating facility.

Market Provision of Non-Rival Goods

Some goods and services, while not indivisible, involve non-rival consumption characteristics. Once such goods exist, there is no cost in making them universally available. It might be argued therefore that such goods should be provided free of any charge.

Common examples of these sorts of goods have in the past included lighthouses and bridges. In both cases however the good itself eventually wears out and some means is needed to determine whether its replacement is sufficiently valued. Moreover in the case of a bridge, some indication is required of when additional capacity might prove worthwhile and charging might also be necessary to ration usage so that congestion is avoided.

Less ambiguous forms of non-rivalry are illustrated by radio and television. No consumer reduces the availability or increases the price of these goods by accessing them, but that access is excludable. Even though the cost of supplying the marginal user is zero, such goods need not be offered free. Indeed unless they are costless to produce, they should not be free to users since this would mean conferring a subsidy. The issue for these sorts of goods is the means of financing their provision. If they are to be made universally available and financed through taxation, there is no readily available yardstick to gauge the degree to which they are valued vis a vis alternative goods - all users are charged for them irrespective of their individual wishes. The principle of charging for public goods where their provision is not costless (or where it means denying the use of the resources involved for production of income) is central to determining whether restrictions should be placed on the use of environmental resources like wilderness areas. Only by levying a charge or constructing a shadow price which people are deemed willing to pay can we determine the merits of such reservation from more conventional uses.

Government Provision of Public Goods

The contractual difficulties of arranging for payment for common goods were recognised at the outset of modern economics with Smithian notions of governmental provision of roads and of course national defence and policing. Some of these functions can be and are internalised (toll-roads, private security services, private arbitration of disputes). Markets have also often proven to be successful in finding new ways to define attributes of needs encompassed in goods which were previously provided in common but where scarcity is emerging or value is inadequately rewarded. Thus, faced with shortages of

previously freely supplied water, means have been found to ration supplies by defining and pricing the good; difficulties writers have faced in receiving appropriate remuneration for their creativity has engendered copyright systems. There remains however a significant rump of public goods for which free riding and other contractual difficulties would mean inadequate market provision.

The conditions under which it might be appropriate for government to assume the role of market actor in its own right call, a propos the previous discussion of public goods, for a wider view of needs than those factored into market supply and demand. Provision by the government is itself required because market provision would fail to reveal the true needs of the community. Importantly, government provision in the absence of private provision requires measuring the utility which consumers obtain in their enjoyment of a good. Such measures of utility tend to be greater than the price that is paid since they incorporate "consumer surplus", the amount of money which consumers would be prepared to pay above the price charged. In a market setting that price is dependent upon the value to the marginal consumer and takes no account of the average value other consumers receive over and above this. Clearly, if discoverable and if a generally available means of factoring consumer surplus into demand were possible, welfare could be improved²². It would be possible to save resources by reducing output of goods for which consumers would readily substitute alternatives and increasing production of those goods for which there is a premium in value purchasers receive over the price. This, in the absence of a market whereby supply and demand are rewarded via individual choice, would require some central allocatory agency.

Arrow²³ demonstrated that the political process could not provide a workable means of making consistent decisions so that utilities are maximised in this fashion. To discover the comprehensive social welfare function was itself, given changing tastes etc., bound to be a search for the Philosopher's Stone. Arrow's insights in his "impossibility theorem" demonstrated that, even if discoverable, there was no means of applying it. He showed that where different players had different and somewhat conflicting preferences, coalitions would be built to trade these off. But the actual decisions would depend upon the way the agenda was set, so that a majority could be constructed, rather than upon the intrinsic

²² It is in fact possible sometimes for a natural monopoly supplier to differentiate markets and in this way capture the consumer surplus when consumers can be segmented into different classes. In such circumstances, pricing based on these principles - known as Ramsey pricing - is likely to be the most efficient form of allocation.

²³ Arrow K "Social Choice and Individual Choice" New York, John Wiley 1951

merits of any particular combinations of positions. A corollary of Arrow's analysis required the abandonment of attempts to develop social welfare functions that were more comprehensive than those entering into the calculations of the commercial market place.

As well as decisively rebutting the case for central planning, this required welfare economists to retreat to the weaker Pareto optimality basis for government decision making.

Pareto optimality does not require interpersonal comparisons of utility to be made. It simply states that a social situation is optimal if no changes can be made from that position without making at least one person worse off. In a very real sense this describes consensus. Its application must therefore be constrained. Those having an indirect interest in a transaction, one which does not impinge upon their own property or physical well being, cannot be given a veto. The blacksmith is not permitted to forbid the development of motor cars, though he would of course be free to prevent them operating on his own land.

As a basis for decision taking, consensus will always be weak. It would be impossible for a government to operate in this way. Some citizens would always oppose defence expenditure, some would always see no value in building a highway. Yet the difficulties in arranging for individual payment of use are the very reasons for governments providing such public goods; unless these sorts of goods are provided by the political process overriding the atomised market system, inadequate quantities of such goods will emerge - individuals will seek to free ride by not accurately revealing their preferences in the prices they offer.

To avoid the need for consensus in the provision of public goods, some form of shadow market demand has to be developed based on what people's needs are and what they might willingly pay if payment could not be avoided. This is however complicated by the fact that all must share the costs while many would truly place little value on the benefits (and some might even see them as negative).

The dilemma is that consensus cannot be a workable framework for decision making where beneficiaries can avoid making payments, yet any other basis requires coercion. The least objectionable means of determining when coercion warranted is to discover what people really prefer. Even though democracy offers some legitimacy for this process, a

popularly elected government can never claim to have a mandate for the detail of its policies. Moreover, democracy unrestrained by laws or traditions can be transformed into populism under which the cloak of majority decisions is used to organise coalitions whereby policies are introduced to exploit and tyrannise the minority. By replacing individual decisions by those of the corporate state in this way, the disciplines essential to efficient market operations are lost.

Efficiency is achieved when units of each homogeneous resource yield identically valued returns on all uses to which they are put. Even though this equilibrium can only be momentary as new uses are discovered, new tastes emerge and new pieces of information are revealed and despite its verification requiring an arguably tautological test of observed equalization of market prices, a criteria is possible. However, once we step out of the framework of willing buyers contracting with willing sellers, we are entering territory for which no criteria of allocative efficiency is possible. Distributional consequences emerging from action (say a tax) to mitigate a market failure will affect the producers (at least until they have rearranged their affairs), buyers, the sufferers of the externality and the unaffected. Each will have a different preference. The economist might be able to construct a means of allowing mutuality of gain based on some form of initial or pre-market resource endowment but in political decision taking other considerations will frequently override this notion of an efficient outcome.

The Public Choice school has explored political decision taking by applying the logic of self-interest in decision making. Buchanan describes its genesis²⁴ as

- drawing upon Arrow's findings that voting patterns can only produce majorities by 'log rolling' which often become the tyranny of the majority
- replacing the Weberian bureaucrat who simply follows orders with the question "What are the rewards and penalties facing a bureaucrat located in a hierarchy and what sort of behaviour would describe his efforts to maximise his own utility?"

²⁴ Buchanan JM "The Economics of Politics" CA Readings 1978

In addition, while it might be possible to take into account preferences at any one point of time, the ability even of the impartial regulator to do so in a dynamic system is severely impaired.

Even prior to the application of the Public Choice analysis, the notion of the rational, impartial administrator objectively pursuing the "public interest" was empirically discredited. Government was increasingly recognised as being driven by continual competition among interest groups. The Public Choice framework offers more rigorous insights into this process of rent-seeking. Unlike rent creation from the discovery of value between willing buyers and willing sellers, rent seeking is a negative sum game. It means that resources are dissipated as agents lobby for preferential treatment in the marketplace rather than by seeking out needs and discovering new or cheaper ways of providing for them. Further, it requires that resources be diverted to staffing bureaucracies to listen to and arbitrate between the various claims for preference.

These concerns about the substitution of political for market place decision making percolate all economic writings (as well as those of non-economists). They are hardly less trenchant where democratic principles prevail. Thus Mishan²⁵, one of the earlier theorists of cost-benefit and not regarded as favouring small government, calls for constitutional limitations on the abilities of government to replace independent decision making. Mishan's own focus in making these judgements is the defence of liberty and, accordingly, he seeks to limit those actions under which externalities are deemed to count. Others, taking liberty for granted, focus more heavily on the efficiency losses likely to follow from intervention.

In these circumstances, lobbying will often be effective in bringing about particular outcomes. In this respect many private goods masquerade under the public goods epithet, making use of the political market for private gain which could not be obtained so cheaply in the commercial market. This form of gain may include sheltered product and labour markets, subsidised input costs etc.. The private gain will be an efficiency loss, first because of the market distortions; and secondly because the lobbying activity itself brings deadweight losses as resources are diverted towards capturing income through political means rather than attempting better to meet the needs of willing buyers.

²⁵ Mishan

Further Considerations in Government Provision

The intrinsic difficulties government has in arriving at a decision making framework which maximises its citizens' utility means that there are no acceptable criteria available of when public goods should be provided (and, as a corollary, when government should intervene to correct externalities).

In addition to the difficulties of determining when it might be efficient for government to take a direct role, the diminished market incentives inherent in government production counsel for its powers to be used sparingly if the economy is to make efficient use of its resources. Even where it might be demonstrated convincingly that a regulatory intervention could produce a positive welfare outcome, caution is appropriate. It is far from certain that the outcome will correspond to that predicted. The rewards facing the manager in the public sector differ from those of the private entrepreneur. The private entrepreneur also has no capacity to use compulsion instead of seeking out willing buyers and providers of input.

The inefficiencies demonstrated to have accompanied government ownership of the means of production and distribution in centrally planned economies are present in all government agencies employing command and control rather than market principles. Indeed freeing activities from government control, as in US telecommunications, or monopoly ownership, as in New Zealand's forest industries, has yielded massive productivity dividends.

The diminished incentives to the promotion of efficiency through public provision compared with private sector provision stem from:

- the absence of a true market which means that the needs which governments seek to fulfil are inadequately known - no true price can be set where customers do not make choices based on sacrificing some of the myriad offerings confronting them,
- the public sector manager not being obliged to confront the need to make a profit after all claimants who have contributed to the production of the good or service have been paid; as a result, the stimulus to minimise costs, economise on information searches and seek out improved ways of meeting

needs is severely compromised; nor can the unsuccessful public sector manager be replaced as readily as his private sector counterpart whose firm, were it to show a less than efficient use of resources, would earn an inadequate return on its assets and face the prospect of takeover or bankruptcy

- decisions on trade-offs in the public sector being likely to follow the relative strengths of the interest groups concerned, strengths which may not - indeed are unlikely to - reflect the forces which have generated market efficiency, namely willingness to pay, willingness to supply and rivalry which motivates firms to supply (and purchase) as cost effectively as possible.

With all this in mind, it is useful to require a premium well in excess of that considered to be potentially available before government intervention to produce public goods or correct adverse externalities is agreed upon.

3. APPROACHES TO ADDRESSING EXTERNALITIES

Common Goods and Common Property Rights

Defined, privately owned and transferable property rights allow the resolution of many externality problems without the intercession of government. By contrast, unowned and commonly owned resources present transactional difficulties in arranging for their care and transfer, use or preservation.

Those communally owned public goods which have their use open to all are best described as unowned goods. Unowned goods are different from other communally owned goods like the mediaeval commons, which had very specific rights attached to them. Moreover, utilization of common land and resources by traditional communities was bound by strict traditions and taboos, which facilitated self policing.

Much of the literature on the commons derives from Hardin's²⁶ poignantly titled essay "The Tragedy of the Commons" wherein the competitive use of common land was portrayed as having brought about declining productivity. Hardin maintained that lack of ownership meant overgrazing, as each farmer pursued his own marginal gain with little concern for the aggregate level of stock which the land could support. Hardin's conclusions are however more relevant to cases of open access to a resource rather than common ownership. In fact, common grazing land embodied strict rights as to how much stock each villager could hold. Other practices of communal agriculture - crop rotation and leaving fields fallow - have long been recognised as the optimum approach prior to technological developments like deep ploughing and chemical controls and fertilizers.

The strength of communal ownership was its ability to allow considerable co-operation. Its weaknesses were the need to obtain consensus-type agreement to implement any change, diminished incentives to searching for more valuable uses of land and difficulties in applying scale economies to production. Nevertheless the laws and taboos which developed in primitive agriculture were efficient. Those communities which adopted them flourished and, in a fashion adapted by Darwin in describing successful species, outperformed other societies which failed to do so.

²⁶ Hardin G "The Tragedy of the Commons" Science 162 1968 P1243-8

The efficient use of the commons was equally true of nomadic societies. Indeed, there is evidence in arid lands that modern agricultural methods, aimed at improving pasture, have had some perverse effects. Thus in southern New Mexico, improved fire control appears to have brought desertification. In the past, fires tended to destroy woody desert shrubs which outcompeted grass; the grass however was faster to regenerate and thus provide food for animals²⁷. This same phenomena explains the practice of Aboriginal hunters of torching an area before moving on after its capacity to support the clan had been exhausted. As torching led to rapid regeneration of nutritious grasses, it was clearly based on ancient wisdom, the origin of which the Aboriginals may not themselves have been aware.

In Australia, early man's agriculture in this way changed the environment. The habitat of mankind, like that of any successful species, is most unlikely to be negligibly effected by his existence. Indeed, it is suggested that the practice of torching areas was responsible for a further vegetational change, the growth of rain forest which replaced the pre-existing eucalyptus forests in those locations where climatic factors were favourable to the rain forest. It is of course well understood that Western Australia's Jarrah forests required fire for their regeneration; whether or not that fire was a result of Aboriginal agriculture or pre dated the Aboriginals is not clear.

Internalising Externalities

Individuals will seek to make intensive use of free inputs whilst economising on inputs for which they have to pay. Under such circumstances, where the free input has a value, society will not be making the best use of its factor endowments. Property which is unowned will lead each individual to maximise his own value with little regard to the ongoing value of the resource. Failure of the individual to take the value for himself will simply mean others will do so. Baden and Stroup²⁸ liken the process to five young boys sucking soda from a glass - the law of capture prevails and no conservation control or temporal allocation of the depletable resource is possible. If the asset's ownership is vested the owner will attempt to maximise its present value, taking into account future alternative uses. By ensuring that others are excluded, a landowner can determine

²⁷ See York JC and Dick-Peddie WA "Vegetation Changes in southern New Mexico During the Past Hundred Years". In McGuinness WG and Goldman BJ "Arid Lands in Perspective" University of Arizona Press p157-166 Tucson 1969

²⁸ Baden R and Stroup J "Property Rights and Natural Resource Management" Literature of Liberty Vol II No 4, September-December 1979

whether the property merits conservation or modification; whether it warrants spending resources to improve its fertility, accessibility, aesthetic qualities etc..

For this reason, Hayek maintained "The aim of the rules of law is merely to prevent, as much as possible, by drawing boundaries, the actions of different individuals from interfering with each other." Drawing of boundaries and further defining them as the need arises has been a major force in allowing efficient trade to take place on the basis of separate pursuit of the individual's own interest. Boundary drawing and minimizing communal and especially unowned property allows the assignment of appropriate values to different inputs. Over time, techniques have been developed to allow this task to be made more accurate and less costly. Policing rangeland boundaries presented major difficulties where cattle roamed at will and where there were no readily available resources from which to construct fencing. The solutions involved employing cowboys as line pickets to keep neighbouring stock out and branding stock to allow it to be returned when it wandered onto land of other farmers. A considerable contribution to reducing the labour costs involved came with the Australian invention of barbed wire.

As well as the need to draw boundaries, the quotation from Hayek recognises that there are limitations to how far this process should extend. Almost all activities impose some cost or benefit on other parties and, though externalities have been the subject of a lengthy literature, the normal procedure both for the community as a whole and in economic analysis has been to neglect them. To a considerable degree this corresponds with efficiency. Arranging and monitoring contracts can be expensive; to attempt to build ledgers of all cross-payments each of us owes and is owed would impose excessive costs and inflexibilities.

This explains one reason why the broad sweep of externalities has received only cursory attention in the past - they have not much mattered. Clean air was abundantly available. Where externalities became important, as in the case of downstream pollution or noise, law developed to take them into account by adapting property rights. Often the increased importance of such externalities, by revaluing assets has generated incentives for new techniques to be developed in order to control them better.

Property Rights and Flexibility

Transactional difficulties, free riding and hold-out problems, externalities and informational deficiencies all generate impediments to the maximisation of welfare from the resources available. The efficient solution to welfare maximisation so often appears blindingly obvious and the strategy for achieving this, government ownership or control, self evidently apparent. Yet, for reasons which have already been addressed, both the premises and the outcomes of this approach are wrong. Allowing the owners of property to make their own judgements improves incentives which will produce the more efficient outcomes in all circumstances but those where the tensions generated by externalities are overwhelming.

This still leaves room for judgements about what constitutes overwhelming. Mindful of the licence any latitude in this respect offers, many favour constitutional limitations against governments taking any actions which usurp property rights. An unswerving attachment to the inviolability of individually owned property however presents a major dilemma, one which can be exemplified in the demise of the commons.

Thus, though communal agriculture offered advantages, given extant states of knowledge, few would argue that the transfer of the commons to individual ownership was anything but beneficial. And yet that transfer was accomplished in the main not by unanimity but by Acts of Parliament which usually followed the agreement of 70-80 per cent of the communal landowners to changes of title. Hence the 20-30 per cent of communal landowners opposing the change were coerced by a majority. But the results clearly meant increased productivity and the alternative was to have a minority coerce a majority.

For its own part, government acquires land to build roads using compulsory purchase powers. Although such powers require "equitable" reimbursement for the property, presumably the owner in many cases does not consider the price he receives worthy of the value of the land to him. As with the commons, it is difficult to argue that such involuntary transfer is to the disadvantage of society.

Yet the essential truths of the case for the inviolability of property rights remain. It is free decisions of willing buyers and sellers, not coercion by Government that has generated efficiency. Lack of absolute security of property rights is bound to create uncertainty. At best it will lead to inadequate investment in preserving the value of the property, at worst it entails over-exploitation and social waste via rent-seeking lobbying activity.

These problems in establishing unvarying rules for resources which are owned are amplified many times over for resources like the atmosphere which are unowned.

Where ownership of open access resources can be vested, considerable economic gains are possible. Fisheries is such a case. Until relatively recently fish in the ocean were sufficiently plentiful, given the techniques available for catching them, to be regarded as abundantly available. There was no value assigned to the fish themselves only to the output of fishing activities.

This has changed so that operations in most known fisheries (99 per cent of the fish catch is from waters within countries' territorial limits) are controlled. For the most part the control consists of limitations on numbers and sizes of vessels, gear and times during which fishing might take place. In general such limitations have been successful in allowing sustainable yields from fishing grounds.

These command and control solutions are however intrinsically inefficient. They require development of suboptimal types of capital and constraints on its use and on labour inputs. In addition, the policing costs of the controls are substantial and the controls need to be modified as fishermen find ways of adapting to the constraints and raising their catch levels.

New Zealand has adopted a property rights approach to all its fisheries. Individually transferable catch quotas comprising equal portions of the total available catch have been assigned and may be freely traded. This vesting of the property right and abandonment of previous engineering controls has brought a rapid rationalisation of the industry. In Australia, implementation of a similar scheme covering the valuable Southern Bluefin Tuna fishery resulted in a 62 per cent increase in catch per boat. In addition, because each operator has an interest in protecting the value of his property, self-policing activity can replace a great deal of the public costs. Moreover, each fish forms a part of the quota and effort is made to ensure that only the more valuable of the species is targeted and more attention is paid to preserving the value of the fish once caught rather than quickly moving on to locate the next shoal²⁹.

²⁹ For a more comprehensive analysis see "Australian Fishing Industry" Business Regulation Review Unit, Information Paper No 11, Commonwealth of Australia, Canberra March 1988

Quiggin³⁰ considers that common property approaches akin to that actually used in the mediaeval commons should be adopted for goods like the atmosphere which are not divisible. In one sense the fisheries solution is a direct application of this. He sees the need to specify

- rights as comprehensively as possible
- the group of interested parties
- a means of establishing a decision making framework

He points out that the very strict application of the constitutional limitation approach generates considerable problems for resolving contemporary issues. Thus, applying a Coasian resolution in the case of pollution where the "victims" rights prevail would, if the polluter compensated one victim, lead to many others coming forward; if the polluter had the rights, the "victim" making a settlement with one polluter would encourage other potential polluters to establish themselves and seek compensation.

For this reason, the parties with an interest need to be defined at the outset and others denied any standing in the issue. Even so, transaction costs present considerable difficulties where there are large numbers of "victims" each with different preferences and propensities to hold out for the outcome which best suits them within the knowledge of their own preferences and an awareness of those of their neighbouring "victims".

Property rights and the Global Commons

To many, externalities now pose a considerable threat not only to human comforts but to economic and even planetary health as a whole. Clearly the driving force behind these portentions is the uncontractable or at least uncontracted nature of externalities. If the externalities could be internalized, that is could be owned, bought, sold, improved and have value added in the same way as other goods, the threat would disappear. To be sure there would be claims that the outcome was imperfect. As in conventional market activity, some would make unfortunate decisions, others would sell their birthrights for a mess of pottage, still others may consider that they have been duped.

³⁰ Quiggin J "Private and Common Rights in the Economics of the Environment" Journal of Economic Issues p1071-1087 Vol XXII No 4, December 1988

But with some basis of initial distribution of rights to the environment and some way by which the repercussions of people's individual actions with regard to these rights would be largely to their own individual benefit or detriment and not (except to the extent that a 'hard mattress' social security safety net was put in place) impact on others, we could leave the problem to market forces. As such it would be largely removed from the political sphere with all the inefficiencies and log rolling inherent in political decision making. By allowing individuals responsibility, the questions about how to reconcile both use and maintenance of the biosphere, how much fauna and wilderness to preserve, how much to spend on clean air, how much waste would be dumped into the ocean would resolve themselves. The answers would emerge in the same way as answers emerge from decisions about how much beef to grow, how many restaurants there should be, how many cars should be produced.

This is not to say that the same outcomes would emerge irrespective of to whom the rights were initially given. People's preferences differ. But unless the distribution of individual allocations was highly skewed, by and large those outcomes would more accurately reflect societies' choices and satisfy these more efficiently than alternative means.

It would however be optimistic to be confident that practical solutions will be found to enable the combatting of all inefficiencies especially when the commons appear to be indivisible. One person's clean air is part of the clean air of all others - at least all others within the locality - and it is difficult even to conceive how property rights can be assigned and each use rationed by market processes.

Moreover there may be considerable risks in awaiting an automatic market response. Regulatory solutions have proven to be the only means of successfully combatting urban air pollution. And in the Northern Hemisphere, even where mutually affected parties are located in friendly nations sharing similar legal systems, they have failed to develop mechanisms to satisfactorily control acid rain without government direction. These risks are exacerbated where the destruction of some things can never be retrieved. If the ozone layer were to be destroyed there is no way it can be replaced; when species are lost their genetic material goes with them; if mankind is indeed creating a Greenhouse effect, its reversal will be most difficult. At least in the case of Greenhouse and ozone depletion, the resources themselves are not divisible, the numbers of possible contractees involved are too great, the inputs too diverse and, arguably, the repercussions too uncertain to await a possible solution based exclusively on private property rights. This is not to say that

property based market solutions cannot be employed to facilitate more efficient regulatory outcomes.

It is however all too easy to swing towards a conclusion that government action is the only solution. Aside from the likely inefficiencies this involves, many supposed problems turn out to be less than pressing when subjected to close examination. Others are either self-correcting or can be corrected more cheaply at a later period. Although the earth's systems may well prove fragile in some matters, in others nature has exhibited considerable resiliency. European colonisation of the Eastern part of the United States destroyed most of the natural forests but very few species of plant or wildlife were eliminated. Development in Puerto Rico involved cutting down all the natural forest but a policy reversal has brought its almost total regeneration. Action to clean up air pollution in a great many industrial regions has also been relatively successful.

The Political Forces at Work

In many cases, goods for which no boundaries have been drawn and no individual ownership conferred have remained unowned or communally owned because powerful forces favour this.

The wish to see lands retained in public hands with all the uncertainties this brings can be compounded when the reallocation means land is auctioned off. Nelson³¹ considers that the move to sell off public lands in the western US states, where over half the land is government owned, failed because the interested parties opposed it. Environmentalists were always opposed but ranchers and loggers, with long standing rights to use public lands at a low rent, realized that an auction, though giving them greater security, would bring considerable cost increases. For the US western states, Nelson suggests that established practice over the uses of the land, with users having long standing rights to that usage, is gradually creating a property right which cannot be readily changed. Be that as it may in the US, loggers in the eastern part of Australia who are seeing withdrawal of areas previously regarded as permanently available to them would not share this perspective. If the view is taken that the loggers do not have a de facto property right to use the resource, it is likely that, as in the US, access to the resource is undercharged.

³¹ Nelson RH "Why the Sagebrush Revolt Burned Out" Regulation p27-35 May/June 1984 and p20-47 July/August 1984

The extent of this problem and approaches to its resolution comprise one major dimension of the poles in the political spectrum. In Australia, environmentalists, comprising, perhaps like all political movements, a cadre of activists with a broad body of less enthusiastic support, confront usually smaller groups with a vested interest in preserving what is, or what is perceived to be, their rights over property. This conflict of possible uses has increasingly meant alliances of enterprises and unions to combat opposition to threatened activities like logging and mining. But the lines of conflict and cooperation are often more complex. For example, farmers find common cause with environmentalists to support funding to combat soil erosion, small businessmen involved in recycling support taxes to foster this activity, tourist firms support moves to prevent logging in some areas and wetland development elsewhere.

Alliances of this nature to promote political intervention are predictable. Their analysis, starting from Stigler's³² 1971 article, which sought to establish a theoretical framework around which regulatory intervention could be addressed, led to the by-now conventional view of the motivations behind business regulation. Those seeking regulation make income gains at the expense of the wider community and are able to apply political pressure to obtain the preferred treatment necessary for these gains.

Although highly persuasive as the wellspring and mainstay of *economic* regulation (tariffs and other barriers to competitive market entry), to assign a central role of vested economic interests in instigating *social* regulations is less than convincing. Some economic interests may stand to gain from the foreclosure of particular opportunities because of embargoes on developments or costly requirements, say for a competitor's pollution control. Crandell³³ points to regulations in the US which require uniform pre-treatment of coal to reduce sulphur impurities, notwithstanding the fact that this is unnecessary for low sulphur coal. He rightly sees this outcome to be crucially determined by a conjunction of interests between environmentalists and East Coast miners not wishing to see themselves placed at a competitive disadvantage to Mid West mines. By examining the political forces behind the regulations, this hypothesis can be confirmed.

It is however unconvincing to present the vested interests as central to the development of such stipulations. Economic motivations are subsidiary to wide community concerns.

³² Stigler G.J. "The Theory of Economic Regulation", Bell Journal of Economics and Management Science, Vol. 2, No. 1 1971

³³ Crandell R.W. "An Acid Test For Congress?" Regulation, September/December 1984 p21-28

Hence rather than the regulations stemming from a concentrated economic interest, their origin is to be found in forces of a diverse and often disinterested nature.

This points to a curious reversal of the perceived regulatory impetus. Under the conventional analysis, concentrated forces which stand to gain considerably from a regulation are able to use political means to have their views prevail. Those who stand to lose are dispersed and their individual losses are in any event often quite trivial. Indeed under such circumstances, it will not be worth their effort to even familiarise themselves adequately about the issues to be aware of those costs let alone to have them influence their voting intentions. Yet, contrary to this model, environmental regulations in which the winners make small gains and the losers are concentrated are clearly assuming an increased importance.

Although alliances between environmentalists and economic interests are observed, more common is conflict between use and reservation from use of a natural resource. At the present time environmentalists are in the vanguard of seeking a reinterpretation from previous notions of "orderly" and planned development to mean no possible development. Land use externalities will continue while ownership is in public hands and the goals of that ownership are left undefined. Of course, defining these goals to exclude the production of private goods from use of the land means income is foregone; defining them to allow development which changes cherished natural functions may mean the destruction of an irreplaceable asset.

In either case, the losing party might prefer a temporary compromise on which it can build. In this respect, the description attributed to former NSW Environment Minister Bob Carr of the environmental activists is enlightening. Mr Carr is said to have likened them to a famished dog being given a lump of meat which it swallows in one gulp and immediately looks around for the next piece. At one time such similes were reserved for supposedly rapacious capitalists seeking opportunities for ever increasing profits.

For all environmental issues, the heart of the problem is either imprecisely defined property rights or the inability of a wide range of owners to come together to arrange adequate payment for the use of property. The latter is surely an element in wetland and rain forest preservation. But its resolution is not unattainable. In places where forest value competes with forest harvesting and residential development, market mechanisms including an access charge for camping and visiting can allow sufficiently accurate means of

comparing relative value. The North Maine Woods in the US represents an area of over 4000 square miles of privately owned near wilderness which combines some logging with tourism, hunting and fishing charged for on a daily basis. A seemingly acceptable compromise of use is arrived at. Nonetheless this involves an unusual form of joint ownership which resolves the contractual difficulties otherwise present with large numbers of free riders and conflicting interests.

Of course, some would argue for the usurping of certain property rights, maintaining that their owners are extending inadequate care to the resource. In some cases such views have prevailed but they represent a dangerous departure from the essential principles upon which successful and affluent societies have been established.

Solutions which make use of property rights will not be possible for many of the attributes of the environment but market approaches based on vesting of ownership are available to some and market approaches based on allowing trades are applicable to others. In the absence of an ability to vest ownership, other means, involving some form of command and control, must be used to resolve those externalities which warrant attention.

Reducing Unwanted Residuals

Where unwanted outputs are to be reduced this can be accomplished by:

- lower production of the good of which it is a by-product; this might entail changing the composition of national income so that resources are redirected to outputs having a lower level of deleterious by-products
- improved efficiency in producing the good so that fewer adverse side effects accompany its output
- recovery of residual materials and recycling them
- dilution of the "bad" so that its effect is less concentrated. Huber³⁴ puts the case for this with characteristic wit "dilution may in fact be a very good control strategy. As countless cancerous rats might attest, many things are

³⁴ Huber

harmful in large concentrations but innocent or even beneficial in small ones".

Bernstam³⁵ demonstrates how the relationship between residuals and output is non-linear and varies over time and between economic systems. Thus in the US, between 1940 and 1970, prior to major efforts to reduce pollution, emissions increased by 30.1 per cent while GNP increased by 212 per cent. From 1970 to 1986, total pollution declined (by one third), in part because of regulatory action. In the main however both periods' trends were attributable to shifting composition of national income and technological improvement spurred on by the ceaseless contest of competitive firms to improve their profitability - one of the means to which is conserving on the use of material inputs.

Bernstam also shows that this same pattern is not in evidence in the Soviet Union, where emissions of air pollution in 1987 were more than twice those of the US even though national income was probably less than one third that of the US and population only 17 per cent higher.

In the USSR, the economic system is driven by forces other than a profit based meeting of consumer needs at the lowest price. As a result, two factors bring about a considerably higher level of waste and unwanted residues than in comparable market economies.

First, excessive inputs are allocated to capital production due in part to inefficient machinery. Thus the share of consumer goods in national expenditure has fallen from 60.5 per cent in 1928 to 24.9 per cent in 1987 and capital investment's share is at least twice that of typical market economies, without growth compensating for this denial of immediate consumption. In short, excessive resource inputs are spent on machines and residual outputs emerge while providing little contribution to well-being.

Secondly, the command and control mechanisms used in the absence of profit related measures must focus upon inputs: the productive unit has its price controlled and its output levels established for it and the only way it can obtain a higher "profit" is to raise its

³⁵ Bernstam M.S. Productivity of Resources, Economic Systems Population and the Environment: Is the Invisible Hand Too Short or Crippled?" Centre of Policy Studies, Monash University, 1979. To be included in Davis K. and Bernstam M.S. eds. "The Endless Frontier and Resources," Cambridge Univ. Press, New York 1990

production costs by requiring increased inputs. In this way the firm is able to pressure the planners into lowering its production quotas and raising its output prices.

The foregoing is not to argue that market systems resolve the problem of excessive usage of inputs and overproduction of unwanted residuals. Though market systems have demonstrated superior outcomes in these and other respects, the externality problem remains due to the considerable incidence of unpriced goods and "bads".

Use of Market Mechanisms

Whilst employing the most direct approach - applying command and control solutions - might be the most obvious approach to resolving adverse spillovers, this is by no means most certain to achieve the goals set for it. Nor is it likely to be the most cost-effective means. The command and control approach includes forbidding particular technologies, requiring the installation of "Best Manufacturing Practice" techniques, placing absolute bans on types of development in specified areas and prohibiting the taking of certain animals.

But for every requirement to undertake particular expenditures, there must, if only implicitly, be a goal being targeted. For manufacturing emissions this might be expressed in terms of the aggregate level of pollutants or pollutants per unit of finished product. That being the case, it is preferable to specify limits for and install measuring equipment to monitor the level of residues being combatted than to require this be undertaken in particular ways. Firms are likely to be much better informed about the available techniques for reducing residues in the most cost effective manner than are government officials. Interestingly, Greenpeace has adopted this philosophy in its demands regarding Tasmanian pulp mills, where it is calling for certain levels of emission to be met.

It follows from this that further economies are available from allowing trading of pollutants between different sources. Crandell³⁶, for example, found that the cost of controlling emissions from paper mills was threefold that of controlling similar ones from metal working factories - fewer pollutants could be achieved at the same social cost by concentrating on the latter. Emission trading has been allowed in the US since 1979. Hahn and Hester³⁷ estimate there to be 132 "bubbles" within which trading takes place

³⁶ Crandell, R.W. "Controlling Industrial Pollution", Brookings, Washington, 1983

³⁷ Hahn RW and Hester GN "Marketable Permits" Ecology Law Review Vol. 16 No. 2 1989 p361-406

and these brought a cost savings of \$435M between 1979 and 1985 while having had a neutral effect on pollution levels. These savings are in addition to savings of up to \$12B estimated to have accrued from "netting" - allowing firms flexibility to overperform in some areas of a plant to compensate for underperformance in others.

Levin³⁸ quotes some specific examples where these approaches have allowed gains to be made. Dupont, facing a requirement to reduce emissions by 85% in each of 119 stacks, negotiated to reduce 99% of emissions in seven stacks which proved faster and over-achieved the aggregate goal at a saving of \$12M in capital cost and \$4M a year in operating costs. General Electric was allowed to forego \$1.5M in capital expenditure and \$300,000 in operating costs required to meet emission controls in Louisville by negotiating with International Harvester which was able to overperform mandatory requirements relatively cheaply.

Taxation Based Controls

A second approach, which for long had been preferred by economists, is to apply pollution taxes. Like trading, this allows greater flexibility for firms in designating the appropriate means of meeting output levels. It also allows compensation of the community at large for residuals in excess of those considered appropriate.

Buchanan³⁹ sets the strict conditions under which an externality can legitimately be countered by the imposition of a tax. He suggests that

- all persons must be equally damaged
- all must be consumer/buyers purchasing in equal quantities
- the revenue must be equally shared

In such rare cases he suggests the price would rise so that the "bad" would be economised upon.

Buchanan maintains correctly, that without his strict conditions for governmental action to combat an externality there will be distributional consequences, consequences which will

³⁸ Levin M.H. "Building a Better Bubble at EPA" Regulation, March/April 1985 pp.33-42

³⁹ Buchanan JM "Market Failure and Political Failure" Cato Journal V8 No 1 p1-14

be determined by the political market, and generate social costs via lobbying and government failure. Some redistribution is inevitable where any departure from equal usage and production occurs.

Others, for example Terkla⁴⁰, take the view that effluent taxes improve welfare because they charge the polluter the true economic cost and allow the replacement of other taxes which are designed to raise revenue and unintentionally distort economic choice and resource allocation. Terkla suggests that the total revenue raised from an efficient tax, which in 1982 he estimated would optimally be set to raise between \$1.8B and \$8.7B, would generate considerable efficiency gains. Based on Browning's estimates of the welfare losses generated by levying income tax, \$0.35 per dollar collected, he estimated effluent taxes would raise welfare by \$630M - \$3.05B.

Terkla's effluent tax is therefore seen as more efficient than the alternative means of raising revenue. Like others, he sees merits of such a tax system in allowing the market to discover the most efficient means of adapting to a new incentive structure. His estimates are based on effluent taxes not generating the sort of losses from attempted avoidance on which Browning's estimates are projected. Hence, although many would dispute the predicted cost effectiveness, there is wide agreement that making use of the market in this way will generate economies.

Notwithstanding that taxation is likely to have superior results to direct regulation, producers often favour the latter. Their position is rational, as Buchanan and Tullock have demonstrated⁴¹. Even though a tax offers greater flexibility in combating an externality, if regulation places a limit on output, incumbent providers are likely to benefit from increased prices. Incumbent firms will of course see considerable merit in a regulatory approach which grandfathers in some way existing facilities thereby creating a barrier to entry; many may prefer a stipulated engineering solution where they feel their competitors would, in its absence, be better able to take advantage of output controls to gain an edge.

⁴⁰ Terkla D "The Efficiency Value of Effluent Tax Revenues" Journal of Environmental Economics and Management II P107-123 1984

⁴¹ Buchanan JM and Tullock G "Polluters' Profits and Political Response" American Economic Review p139-147 March 1975

This introduces a less ambitious sister concept to cost/benefit analysis, namely cost effectiveness. Cost effectiveness attempts to examine how market mechanisms would operate with regard to a particular policy approach or change. It may be used to analyse which externality-correcting intervention might operate at least cost.

A wide number of studies has demonstrated how output controls and exchanges of rights to pollute can allow considerable economies⁴².

Many of these, as previously alluded to, find that the regulatory arrangements have been set in place with protectionist goals as a major focus, for example in requiring equal pollution expenditure even where inputs differ markedly in the residues they produce. Sometimes it is claimed that specific engineering requirements offer surveillance economies to output controls and are adopted for this purpose notwithstanding the inflexibilities they introduce. Such claims are however clearly hollow in a great many situations. Measuring techniques at emission points are simple and readily available. They also have the advantage of providing more accurate monitoring of residue production than is achieved by specifying equipment which will vary in its performance with the state of its maintenance and quality of inputs to which it is applied.

In practice, taxation of residuals has not found favour. Those facing the taxes have of course objected whilst environmental activists have opposed this policy approach because of the apparent endorsement it implies to the generation of pollution.

There are in addition several practical difficulties in devising a workable taxation regime. Buchanan points to one major such difficulty⁴³. The various parties are likely to have different interests. Those producing or using most intensively the output of the polluting facilities are likely to wish to see the tax levied at as low a rate as possible; those on whom the impacts of the residues fall most heavily are likely to favour a prohibitive level of tax; taxpayers who are relatively indifferent to the pollution and the output the facilities' produce are likely to favour a tax which maximises the revenue raised so that other taxes might be reduced. How are these differences to be reconciled? The obvious gains will

⁴² see Crandell "Clean Air and Regional Protection". The Brookings Review 1983 p17-20; Campbell LS "Using Market Incentives to Curb Acid Rain" Eastern Economic Journal Vol X No 4 Oct/Nov 1984 p389-410; Huber P "The I-Ching of Acid Rain" Regulation p15-65 Sept/Dec 1984

⁴³ Buchanan J.M. "Market Failure and Political Failure" Cato Journal Vol 8 No.10 p 1-14

lead the parties to engage in the wasteful lobbying exercises to promote their particular interests. Can we be confident that governments will arbitrate dispassionately?

Pollution taxes adopt the fundamental principle that the polluter pays. Yet this tends to treat the polluter as the malefactor and the pollutee as the victim. In fact there is a mutuality of interest. The unowned resource did not belong to the pollutee in the first instance. As soon as mankind breathes air some impression is made on the natural environment. It is no more certain that the population surrounding a polluting factory has the rights to clean air than the owners of the factory have the rights to soil it. This statement is even more graphical in situations where the factory owner was there first and the "victims" moved in later, perhaps to take advantage of the opportunities to improve their wellbeing offered by locating close to the factory.

The Different Approaches - a Recap

No technique for controlling externalities offers an ideal solution for all circumstances. Some externalities like those we confront in our every day life - the next door neighbour's unsightly garden etc - are best left alone. Hence, while "the polluter pays" might be a useful tenet on which efficiency is generated, monitoring, definition and policing costs are often such for this to be inferior to a policy of masterful inactivity.

Where a facet of production or consumption is definable, defensible and transferable at an acceptable cost, internalising the externality by conferring property rights is generally the solution most conducive to ensuring efficiency and sustainable development. In this way the spillover ceases to be an externality and normal market disciplines will ensure its unwanted (or undervalued) attributes are factored into the choices regarding its use. Granting tradeable rights to externalities is a feature of this internalisation process. Where these rights are determined by government, this is inferior to a vesting which evolves with the definition of property because it requires the intercession of, necessarily arbitrary, authority to specify the permitted level of externality rather than leaving this to the mutual agreement of contracting parties.

Setting taxation rates to reduce the output of externalities both discourages the aggregate output of the goods produced alongside the externalities and encourages actions to reduce the proportion of residuals to output. This is inferior to and more costly than trading because it does not allow production of goods with lower residuals to be increased at the

expense of diminished production of goods with higher levels of residuals; nor does it allow economies to be made by permitting producers who are able to outperform the standard cheaply to do so and incur costs on behalf of those for whom meeting standards is more expensive.

Specification of methods designed to minimise externalities is the least preferred approach. It relies, implausibly, upon the regulators being able to determine how the externalities can be minimised at least cost and on the regulated firms keeping to the spirit of the requirements by maintaining machinery in peak working condition.

Outright bans on certain activities are still less preferable than this and offer no flexibility for trading an objectionable cause of harm for one which may be even more unpleasant. But where enforcement costs of applying market based approaches are prohibitive, specification and bans may have a place.

4. ASSESSING THE NEED FOR REGULATION

Cost Benefit Techniques

While noting that the perfect market as described by theorists can seldom exist, Hayek draws attention to the need to compare the outcome of the lack of perfection with alternatives, "The test should not be the degree of approach towards an unavailable result, but should be whether the results of a given policy exceed or fall short of the results of other available procedures."⁴⁴ Any examination into possible areas where government might override the decisions buyers and sellers freely reach must operate within this framework.

Cost-benefit techniques were pioneered where a shadow market must perforce be used to determine whether a project should go ahead and to determine the relative worth of different projects. At the heart of this is an assessment of the willingness of consumers to pay in a situation where payment might be avoided. Some such analyses have always been employed by governments in deciding upon the provision of public goods.

Where contracting costs are too large or the difficulties of excluding non-paying free riders too great, government provision is essential. And these very reasons for government provision also mean that the common yardstick of the desirability of a project - that the revenues it generates exceed by some appropriate amount the costs its provision incurs - cannot be employed. Mishan⁴⁵ put the distinction as, "Instead of asking whether the owners of the enterprise will be made better off by their firm's engaging in one activity rather than another, the economist asks whether society as a whole will be made better off by undertaking this project rather than not undertaking it, or by undertaking, instead, any of a number of other projects".

Where provision of a public good is contemplated, benefits are estimated by examining first how much more cheaply will the project allow existing demands to be provided; secondly, what new demands will be generated by the lower cost and how much are these valued over and above the expenditures foregone.

⁴⁴ See footnote 1, V III (p67)

⁴⁵ Mishan EJ "Cost-Benefit Analysis", Praeger Publishers, NY 1971, p.7

These benefits, discounted for time and with risk factors introduced, are compared with the costs of the project, again discounted for time and risk.

Because benefits are assessed from summing the total value consumers gain from a project, cost-benefit techniques will overstate the value of a project in comparison to value determined by market economics. The following diagram illustrates this

A pure public good priced at zero would be held to provide benefits equal to all the area under the demand curve DD_1 . If charge P were to be applied to this public good both to restrain usage and defray costs, the value would be assessed at $DTQO$ comprising the area $PTQO$ for which consumers pay, and DTP , the consumer surplus for which no return is obtained. All but the marginal consumer would obtain value over and above the price paid. In a market situation, the supplier would need to obtain adequate rewards. If the price were set at P , DTP would once again be a consumer surplus but would be irrelevant in the value calculation (unless the provider were able to discriminate in its pricing to capture this surplus). It is partly because the externality DTP is relatively large and partly because of free riding and the inability of market provision to obtain sufficient remuneration, that the provision of the good by the government is justified. But this, from the start, means that the estimation of whether provision of a public good is required, includes elements not present in the calculus a private provider would employ. Hence supply of goods outside the market system on the basis that provision will satisfy the consumer surplus (DTP) will always appear more attractive than supply by market forces. Yet this is clearly an illusion.

Furthermore, funding of public goods requires taxation. This of itself necessitates obtaining funds in ways other than willingly provided by consumers. It means some people providing resources for projects which they do not value. And though it can be argued that in a democracy the consumer, as voter, is signalling a willingness to part with the resources necessary, it would be heroic to view governmental allocation in this light. As has been previously discussed, neither the sum of government expenditures nor their allocation (or for that matter their execution) can be regarded as having equivalent efficiency features to those of the market.

In addition to this, there is the loss of income, previously alluded to, generated by avoidance activity from the raising of taxes.

With all its limitations - the need to develop consistent shadow prices to account for consumer surplus, factor in uncertainty and select investment criteria - there is little alternative to applying cost benefit analysis to determine the need for public goods. But the methodology was pioneered in the construction of capital projects like roads and dams, private provisions of which was considered impracticable; moreover, negative externalities from these sorts of goods, at the time, were thought to be negligible.

The difficulties in applying cost/benefit analysis are considerably increased where issues like toxic waste and pollution are involved. In these cases, cost benefit is being employed not to determine whether the government should supply something but whether the government should prevent or restrain private sector the supply which causes these residuals. And because the construction of shadow prices for the avoidance of economic "bads" is so much more difficult than in the case of public "goods", confidence in the technique's outcomes is further reduced. In addition, even in cases of dam building, where cost-benefit analysis is commonly employed, almost all assessments of such activities in the US, where great scrutiny has been applied to the cost/benefit outcomes, have concluded that excessive dam building has taken place.

Uses in Aggregate Demand For Public Goods

It is not possible to determine, in any aggregate sense, the degree to which people prefer to trade off more private goods for more public goods. It is only possible to say that some public goods are required, that their provision requires fees to be levied (or cost amplifying regulations to be imposed) and that people will therefore place a progressively diminishing value on them. By the same token, people may be prepared to sacrifice private goods for public goods, the more of the former they have.

The construction of an economy's production possibility frontier, with private goods on the one hand and public goods on the other, presents fewer unknowns. To be sure we can never be certain of the direct effects and can do little more than guess about the secondary effects the imposition of a tax (or non-tax regulation) might have on the production of private goods but there is a body of statistical knowledge available on demand and supply elasticities, responses to taxation and interlinkages within the economy. The production frontier possibility between a private and public good is likely to appear as follows

Hence, although we cannot determine a unique point along XQ, we can attempt to measure whether a change in policy is desirable by determining whether those favouring the change are capable of compensating those opposing it.

Cost-Benefit Analysis Applied to Natural Resource Development

Much of the literature on environmental goods attempts to determine the value attributable to non-development. Commonly that value is assigned three components:

- (i) Use value. This incorporates the value which people actually place on the facility. Ways of estimating this have most frequently employed two means, hedonic values and travel costs. The hedonic approach attempts to measure changes in property value resulting from some other change. Applied to noise, comparisons can be made between house values in close proximity to freeways or airports with similar stocks of housing elsewhere. However such measurements are highly uncertain, as was illustrated by an earlier reference to conflicting findings regarding real estate prices near airports by Walters, and Pearce and Markandya. Development often brings benefits as well as costs and to attempt to factor all these into the decision will be computationally impossible. Nonetheless, applying hedonic techniques can be used as one means of guiding decisions on what might or might not be done by government in the interests of the community as a whole.

Measures employing travel costs, for example to reach a favoured recreation ground suffer from somewhat greater deficiencies. In a sense all that is being measured are some of the costs entailed in the total package of utilities sought. Using this approach, it would be equally applicable to incorporate the travel costs of reaching a holiday hotel or of driving to the supermarket within the total value of the sought after goods and services. A value based on the costs which are incidental to the target goods and services places only a lower bound on their value. More importantly, unless we undertake the same calculation for market goods and services, it can tell us nothing about what value we place upon the non market goods and services relative to market goods and services.

- (ii) Option Value. By deferring usage of something valued today, we may obtain greater value for it in the future. The tapping of an expected option value is the traditional function of the speculator who reserves goods from immediate usage in the expectation that society will value them more highly in the future. As Friedman⁴⁶ demonstrated the speculator performs a useful function, akin to that of insurance, by reducing intertemporal differences in price.

Speculative demand for land which has attributes of unspoiltness is likely to increase the amount of land held back from development if that development is considered to be irreversible. Speculators do this with knowledge of the opportunities for income, that is for supplying peoples' needs, which are thereby foregone. The question arises as to whether governments can do this more efficiently than a decentralized marketplace and once again we come up against the familiar paradigm of market failure versus government failure. With the benefit of hindsight both might arrive at the appropriate decision.

In any event, it is questionable whether option value is really a separate component of value. It may merely reflect the expected value of future rather than present uses. Obviously the generation of more information will allow the option to be better understood and improve decision making but economies are necessary in allocating resources for this purpose. It is always plausible to argue for delay in following a particular course while its imperfectly understood ramifications are further explored. But to do so brings time costs in postponing its benefits. It might even generate immediate losses where the denial of a new use means the continuation of more harmful existing practices. This dilemma is often confronted in novel pharmaceutical formulations. Moreover the generation of information about whether something should be preserved will often require some 'development' in order to obtain that information. And if it is to be preserved for use, rather than nonuse, that use, say tourism, will itself constitute development.

⁴⁶ "In Defense of Destabilizing Speculation" in Friedman M "The Optimum Quantity of Money" Macmillan 1969

Closely related and treated here as part of option value is bequest value. Leaving things unspoiled for future generations to enjoy may be an appropriate approach but, if so, it is one which is more properly subsumed within the notion of option value.

Option value is often used in another sense. It may be regarded as the price people with no intention of making use of a good will pay for the option of using it. This is a form of risk insurance that people take out on an opportunity. Many people living in major metropolises value the existence of opera and theatre groups even though they have no intention of taking advantage of their services. Indeed, the existence of these facilities itself has a multiplier effect by encouraging people who value them to gravitate toward the city thus enriching its cultural life in ways which might be of more direct use to those willing to allocate only a modest option value on the activity itself.

- (iii) Existence Value. The fact that something exists even though of no foreseeable use is considered by many to be an attribute of value. People in major cities who do not and never intend to visit a wilderness often consider its very existence to be of value. It is difficult to determine to what degree they do so because it leads to some general enrichment of their lives or whether it is simply something the pure existence of which they value.

Freeman⁴⁷ questions the amount of attention given to option, bequest and existence values. He says, "The arguments about motivation seem to be offered for the primary purpose of persuading the reader of the plausibility of the hypothesis that nonuse values are positive. But the real test will come from the data." In further saying that there is little concern for these motivations in demands for private goods - that we do not talk of "prestige" value or "speed value" in the demand for automobiles - he is somewhat overstating the case. In fact the private producers of such goods are intimately concerned about these attributes and go to considerable expenses to discover their worth.

An Application of Cost Benefit to Wilderness Development

⁴⁷ Freeman AM III "Nonuse Values in Natural Resource Damage Assessment" Bowdoin College and Resources for the Future, forthcoming

Krutilla and Fisher⁴⁸ wrote at length on proposals to install new hydro capacity on the Snake River at Hells Canyon in the Northwest USA. In doing so they developed a blueprint for assessing further such proposals.

First they examine the benefits. They compare a thermal facility with the building of a dam which would flood a wild and scenic river gorge. Plausible assumptions are made about the costs of the alternatives which take into consideration:

- the negligible 'fuel' input cost of hydro
- the flexibility of thermal fuel in supplying off peak power to an area which already has a considerable base load hydro power
- the net gain (4 per cent per annum) in productivity over time which can be expected, by extrapolating past trends, to occur in thermal power generation which has a shorter period of 'frozen' capital
- the incidental benefits which hydro brings to flood control.

The proposed hydro facility was found to have a present value \$55m below its thermal equivalent alternative (using a 9 per cent discount rate). Neglecting the net productivity gain of thermal would reduce the relative disadvantage of hydro to \$26m. They speculate that the electricity local company favoured the dam, notwithstanding their sharing these estimates of the outcome, because it obtains tax breaks on bonds used to finance facilities, benefits from transmission subsidies to remote centres and is risk averse, given inflation, to the relatively larger share of labour operating costs required of a thermal facility.

Krutilla and Fisher also draw attention to the proclivity of public power authorities in favour of massive capital expenditures. It is certainly also the case in Australia that public power authorities have shown a marked preference for highly capital intensive projects like the proposed Franklin River Dam and the very large coal fired stations in NSW and Victoria. Swan's analysis⁴⁹ has demonstrated that not only do these public sector facilities exhibit overstaffing and low utilization their construction also represents a misplaced neglect of the risks which chunky power sources bring about both in the case of breakdown and where demand projections are over-ambitious. Analysis of US power

⁴⁸ Krutilla JV and Fisher AC "The Economics of Natural Environments: Studies in the Valuation of Commodity and Amenity Resources" Baltimore, The Johns Hopkins University Press for Resources for the Future, 1975

⁴⁹ Swan P.L. "Where Do We Go From Here, Corporatisation, Privatisation and the Regulatory Framework for the Electricity Sector" Paper presented at the IAC Workshop, May 1989

utilities shows that private sector concerns tend to choose smaller stations for this reason. In addition, very little role is afforded to pricing action to ration demand as an alternative to building new facilities.

Krutilla and Fisher stress that the results of their own analysis are very much dependent upon the prior existence of much hydro capacity serving the area and by up-stream dams already allowing flood control.

Analysis of a smaller project making use of only one of the dams in the original proposal, showed a positive benefit of \$14m over the period 1976 to 2025 using a discount of 9per cent and identical assumptions to those in evaluating the original proposal.

This proposal too is demonstrated to yield negative real value once externalities are factored in. In their analysis of the environmental costs of the development, they point to the superb natural features of the Snake River, especially the gorge which would have been flooded by the development entailed by the smaller project (known as High Mountain Sheep). They employ what they regard to be conservative principles by:

- leaving unquantified, the value to science of the peculiar geomorphological formation
- not including an option value of retaining the facility from an irreversible consequence which would cut off the opportunity for making superior use of it in the future
- not incorporating any "preservation" value. This notion is the bequest value our heirs might place on demand 'in situ' for the services

The initial year's conservation benefits are estimated and taken forward before being discounted to obtain a consistent basis for comparison with the cost savings.

To arrive at base levels of usage the number of visitor days for recreation and angling are measured. Comprising 46,700 days in 1969, these were estimated to grow to 84,000 in 1976. They place a value on this of \$5 per day (based on the costs incurred and the fact that no alternatives are available). For hunting they segment the market and attribute consumer value for big game hunting at \$25 per day, bird hunting at \$10 per day and the

diminished value of the hunting experience of existing hunters at \$10 per day. About half the total notional value was for angling and sightseeing and half for hunting. The willingness to pay values they used were based on the area having unique characteristics - the willingness to pay was largely a function of the expenditures people actually incurred in the process of travelling to the area; whilst uniqueness might be a feature of some areas, as with any other good, the appropriate welfare value in a cost benefit analysis is the willingness to pay over and above the cost of the next best alternative. Though founded upon sound theoretical analysis, the values assigned are highly speculative.

The benefits they identify are considered likely to increase rapidly with income growth - demand for recreational services is highly income elastic and they assume real income growth of 3% per annum; a growth rate in usage was estimated from this at 10% per annum, gradually tapering after 20 years, partly because of capacity restraints, until the growth rate was equal only to population growth.

On these premises, a present value for preservation of \$140m was arrived at based on a discount rate of 9 per cent a value which, once unmeasured values were included, is far in excess of the present value of the dam itself and justifies it not proceeding.

In the event dam did not proceed and a nuclear facility was constructed. The cost of the nuclear plant was, perhaps as a result of unnecessarily rigid regulatory requirements imposed upon the construction of these facilities, far in excess of that envisaged. This increased cost required the consumers of electricity in the area served to face price hikes of well over 100 per cent. Such increases meant that the foreshadowed increase in demand did not occur.

Extending the Analysis

Michael Lewis's best-seller "Liars' Poker"⁵⁰ describes the activities of brokers, mainly still in their 20's. They earn incredible salaries and work horrendous hours watching computer screens and stitching up deals which make vast sums for their firm, Salomon Brothers, themselves and their clients. Finding new markets, obtaining inside information and fast reactions to a crisis has a role in all this, but there are many sharks looking for the opportunity indicated by a disaster, new data on the US trade deficit and other indices.

⁵⁰ Lewis M. "Liar's Poker" W.W. Norton, New York, 1989

Liar's Poker epitomises the best opportunities for active traders in the hurried message to the narrator from his colleague Alexander in the wake of Chernobyl "Hi, buy potatoes, gotta hop". Here is interconnectedness distilled. Chernobyl was going to affect the availability of foodstuffs across Europe, especially root crops like potatoes. Radiation free potatoes were going to exhibit a price hike as Chernobyl would require the destruction of affected stocks and plants.

This knowledge of interconnectedness which is second nature to market traders and so basic to economic analysis appears to be overlooked by economists of the stature of Krutilla and Fisher when their "homo economicus" is usurped by their environmental zeal. Their analysis assumed the alternative of thermal energy at a somewhat higher price than hydro. Nowhere did they examine the externalities of that method of power production. In the utility's preferred solution these might have included the much publicised long term costs of nuclear waste and accidents. Krutilla and Fisher suggest that a coal based facility might have been a better solution but the externalities of this would have included:

- environmental impacts of the mining on the land and the area surrounding the mine (which in this case would be open cut)
- increased road expenditure to carry the coal
- possible damage to the environment and loss of human life in the process of that carriage
- emissions from coal burning, which in the near pristine air considered to be desirable in the Rocky Mountains are particularly difficult in control (indeed a feasibility study presently under consideration by the US Environmental Protection Agency seeks to fully cost the elimination of sulphur emissions from a proposed power plant in the Grand Canyon which would mean an increase from 10 to 15 days per year during which the sulphur will combine with other elements to reduce visibility from 200 to 150 miles; initial estimates put the cost of this at \$130 M per year).
- the effect of increased thermal emissions in contributing to the possible greenhouse effect

There are, in addition the costs of human life in the production of coal which may or may not be fully factored into the labour and other remuneration involved in its mining. Nor did the authors take into consideration risks of changed energy input costs (the study was

conducted just prior to the 1973/74 energy price hike). Energy costs could go up or down in real terms but thermal would probably warrant a risk premium over and above that from the riskless continued costless supply of water.

Finally, the benefits of environmental preservation are mightily influenced by increased projected income levels. As these increased income levels are themselves dependent on development, they would be reduced if development is not allowed to proceed. And in fact, in the US (as in Australia) real per capita income levels have shown a very much slower rate of growth than the 3% assumed.

It should also be noted that over half the recreational value of retaining the facility is in hunting, an activity which has since been seen to be in conflict with preservation.

Wider Implications of Political Intervention

An individual decision by government to block the go-ahead of a specific proposal is unlikely to have a major economy wide impact of itself but many such decisions could impair the productivity of the economy particularly if they introduce new uncertainties. Australia's Wesley Vale pulp mill proposal was abandoned in 1989 after the partners faced public opposition and what they saw as governments imposing an escalating requirement for the preparation of information.

One can readily dismiss claims by political activists that equivalent expenditures to those envisaged would generate greater income levels if applied in other directions. Commonly there are calls for such expenditures to be directed towards fostering small business. Political activists prepared to champion such priorities do so without offering their own money to promote the form of development they favour.

On the other hand, those favouring a project's approval are also likely to exaggerate the net benefits it is estimated to generate. In this respect, it is not relevant to claim the costs of preventing the development from proceeding amount to the income thereby foregone. Cost benefit analysis must be applied to alternative uses of resources and alternative means of creating value. Providing the decision's effects are self-contained, what is foreclosed is a frontier affect. Capital and labour which would have been applied to such a project retreats to its next best use. It is the profit and labour remuneration over and above that next best use which is being sacrificed.

Thus the opportunity benefit of a project like the Wesley Vale mill would be only a proportion of the revenues it would generate. Say, after suitable discounting for time, those revenues were estimated at \$1B per annum and were accounted for by \$300m in wages, \$400m in supplier inputs, \$200m in interest costs and \$100m profits for the managing partners. The gain to national income might comprise

- \$50m out of \$300m representing the opportunity wages of labour
- \$50m out of \$400m representing the opportunity revenue of logs and other inputs into the mill's operations
- probably a negligible part of the \$300m interest paid on borrowed capital
- the part of the profit accruing to the Australian partners (who were to provide half the equity capital) representing profit foregone as a result of investing in their next best opportunity. This might amount to 10 per cent of the total or \$10m.

The annual income gain would therefore be \$110m per annum.⁵¹

Whatever the benefits seen to accrue from the Wesley Vale proposal, the social or externality costs associated with it would have been small. In the Australian context they might represent lost opportunity of recreation in a lightly populated area with abundant alternative recreational locations. Such a lost opportunity would not have been great. Just as the closing of a children's playground in an area which contains many such facilities would not be considered as significant as a closure where there were few proximate facilities of the same nature, so the withdrawal of a natural recreation area under similar consideration would be valued less highly than where other options are available. There was also some suggestion, since then discounted, that toxic emissions from the mill might have had a negative effect on fishing in Bass Strait.

Moreover if these costs were to be assessed on a global basis, they would surely be negative and reinforce the case for the proposal. Any pollution brought about would be more than offset by reduced pollution, perhaps in overseas locations. The mill would

⁵¹ The actual decision to terminate examination of the proposal had another dimension. Its viability required use of depreciation provisions designed to reduce effective taxation rates which would have lapsed before a review decision giving the go-ahead could have been announced. To some this indicates that the project was marginal in any event. To others it signifies a wider penalty which the tax system imposes upon development.

either mean the phasing down of older capacity, which would be certain to have higher levels of residual pollution, or it would displace alternative new capacity (presumably with an attendant cost saving in pulp prices). In the latter case, siting the mill in a remote area of the globe may allow mankind as a whole to obtain better environmental value than by siting it in alternative areas already experiencing higher levels of pollution. (Other considerations would include to what degree a relatively untouched area is valued higher than if the alleviation of pollution in an area presently experiencing adverse effects of emissions).

All this aside, there is a wider issue of the demonstration effect on other investors which a policy approach seen as being at best prevaricatory is likely to have. This points to a more insidious danger than that stemming from the foreclosure of a specific opportunity. Lack of certainty about the conditions under which development might proceed could substantially raise the risk assessments firms would place on proceeding with the costly business of exploring opportunities. The more assurances government requires prior to allowing projects to proceed, the higher the costs of projects. In addition, the more willingness government exhibits to intervene, the higher will be the incentives to undertake lobbying costs, costs which produce no value to society as a whole.

Limitations of Cost Benefit Analysis

The foregoing is not intended to offer judgements on the specific decisions to prevent the flooding of Hell's Canyon or the manoeuvring which pre-empted the go-ahead for Wesley Vale. The truth of the matter is that we no more have the information about peoples' preferences and the various linkages between facets of the economy to make decisions on the allocation of goods between public and private uses than we have sufficient such information to operate a fully planned economy.

Informational deficiencies of what peoples' preferences really are, together with massively complex computational problems, continue to bedevil cost benefit analysis as a useful approach. These difficulties have led Rowley to suggest "Society would be better off if the 'problem' of social cost had never been discovered".⁵²

⁵² Rowley CK "Prologue" in Cheung SNS "The Myth of Social Cost", Institute of Economic Affairs, London 1978

Cost benefit techniques with shadow pricing to take into account social valuations are enormously more ambitious than conventional market activity in which the entrepreneur seeks to maximise the value of his residual income after all other factors are paid for.

All this underlines the necessity for using cost benefit analysis sparingly and for preferring to allow markets to determine optimal usage patterns. It is especially not legitimate to claim a role for public decision making over resources which are privately owned. Governments have no more knowledge to determine optimal time paths of resource usage than private sector owners - and indeed are considerably more likely, as a result of political preferences and weaker efficiency incentives, to make sub-optimal decisions on resource use.

Furthermore, governments will seldom have access to better information than resource owners especially where that information is related to the specific attributes of property owned privately. Whilst there is a need to apply cost benefit analysis to situations where externalities, contractual difficulties and free rider problems make public provision inevitable, intervention of the benevolent economic dictator has no place where the outcome of the owner's decisions are basically self-contained.

Contingent Valuation

Notwithstanding the severe difficulties involved in attempting to incorporate externalities in decision frameworks, their existence is incontrovertible. The fact that costs are attached to their removal is equally clear. One emerging approach to placing value on externalities is the contingent valuation method⁵³.

The Method of Estimating Values

Contingent valuation seeks to elicit people's preferences by finding out what they are willing to pay. Commonly questionnaires are devised, describing the goods under scrutiny and asking how much respondents would be prepared to pay. The techniques of market research are well known and used extensively both in business and politics. In

⁵³ Mitchell RC and Carson RT "Using Surveys to Value Public Goods", Resources for the Future, Washington, DC 1989; Freeman AM "Non Use Value in Natural Resources Damage Assessment", in Kopp et al (RFF forthcoming)

politics however they are rarely applied to attempt to quantify how much voters are prepared to pay for a measure that is favoured.

Mitchell and Carson construct a taxonomy of benefits from an improvement in freshwater quality as follows:

<u>Benefit Claim</u>	<u>Benefit Category</u>	<u>Benefit Subcategory (examples)</u>	
USE	IN STREAM	. Recreational (swimming, skiing, fishing).	
		. Commercial (fishing, navigational).	
		. Municipal (drinking water, waste disposal).	
	WITHDRAWAL	. Agriculture (irrigation)	
		. Industrial(waste disposal, process treatment).	
	AESTHETIC	. Enhanced near water recreation, (hiking, picnicking)	
		. Enhanced routine viewing (home/office views)	
	ECOSYSTEM	. Enhanced recreation support (duck shooting)	
		. Enhanced general support (food chain)	
	EXISTENCE	VICARIOUS CONSUMPTION	. Diffuse others (general public)
			. Inherent (preserving remote wetlands)
		STEWARDSHIP	. Bequest (family, future generations)

. Significa:

Similar taxonomies can be developed for clean air, national parks and certain endangered species.

Some Contingent Valuation Findings

With regard to non-use values, Freeman surveys a dozen studies. He cites a study by Samples, Dixon and Gowen (1986), the findings of which were that respondents would be prepared to pay \$35-60 each for the preservation of the humpback whale; in another study, people were prepared to pay \$4-6 for the preservation of the striped tiger, a minnow with no recreational value, and \$10-75 for the bald eagle.

Some of the difficulties of attempting to assign values in this way are exemplified in a study by Tolley and Randall⁵⁴. Researchers inquiring in the Chicago area about the value of preserving air quality in the Grand Canyon expressed the question in two different ways

- (1) For the Grand Canyon alone, after respondents had been shown photographs
- (2) As part of a three part sequence which sought values for cleaner air in Chicago, in the Eastern United States and in the Grand Canyon.

In the first study, the value for clean air in the Grand Canyon was \$90, whilst in the second it was \$16.

As an element of the Resource Assessment Commission's (RAC) Inquiry into mining in the Kakadu Conservation Zone, a contingent valuation (CV) exercise was carried out to measure the value the Australian community would place on avoiding such a mining operation. The broad outcome of the exercise valued a veto over mining activity at \$647m per year over the ten year life span of a mine which would, by assumption generate a relatively minor impact on the environment. This figure, if valid, overwhelmingly swamps the benefits that would be generated by any mine and the logical progression of analysis would be to conclude that mining should not be permitted. Indeed, if broadly applied, the approach might turn off almost all new mining activities in Australia.

Among the specific deficiencies of the approach applied in the Kakadu case, it is unclear what area is being valued - the one hectare of the mine, the Conservation Zone itself or the whole of Kakadu National Park. It could be argued that the areas are not separable in the services they provide. But this is not consistent with changes to the boundaries of the Park which have been made over the years.

The Kakadu result, should it be based on a sound application of contingent valuation principles, would call into question the entire methodology. The Conservation Zone comprises some 50 square kilometres of land which is well represented throughout the top end of Australia and has been subjected to previous mining activity and infestation by buffaloes.

⁵⁴ Tolley GS and Randall A "Establishing and Valuing the Effects of Improved Visibility in the Eastern United States" report to the US EPA

The Government is believed to have spent less than \$5 million in resuming the 6726 square kilometres of the two properties (Gimbat and Goodparla) within which the Zone previously fell. For this and other reasons, the outcome of the Kakadu study, that the community would be prepared to spend \$647 million per annum on preserving 50 square kilometres of relatively undistinguished land, is beyond the bounds of credibility. It places an annual rental value on the land of \$130,000 per square kilometre - possibly ten thousand fold its market rate. An alternative interpretation, that people would willingly spend such a sum on avoiding the development of just the one hectare, which constitutes the mine, is even more bizarre - it would value the land at several times the most expensive real estate in the world. It would, for example, value the hectare at 100 times that of prime Melbourne CBD land and more than twice that of prime downtown Tokyo office space. Given all the other goods that our daily spending patterns reveal as desirable, we would, as a nation very soon run out of money to afford such expenditures.

It is significant that preservation of Kakadu as a whole - let alone the Conservation Zone - did not rate strongly. Twenty-two per cent of respondents did not know where it was. Only 2% volunteered that preservation of Kakadu National Park *as a whole* as an environmental matter of most importance to Australia. By contrast, 48% volunteered logging of native forests as a most important issue, 24 times the number ranking Kakadu as a matter of environmental importance. Could this be interpreted to mean that, for a cessation of logging, the community would wish to spend 24 times the \$647 million annually, which would supposedly be willingly foregone in the Coronation Hill survey. Although the questionnaire *said* that there would be other expenditures on intangible goods over and above those of the Conservation Zone, did respondents understand just how many such expenditures there potentially are?

Some of the ironies the report highlights concern the population multipliers. Simply assembling a valuation and multiplying it by the adult population will lead to illogical numbers. Supposing for example that the adult population of Australia were 36 million not 12 million, would the valuation then be \$1741 million per annum for 10 years? Furthermore, can we assume that those valuing the land are solely Australians? How do we factor in the values that the rest of humanity might attach to this remote area? This point may be particularly relevant in view of the international tourism potential of the Park.

No political party would show sufficient faith in findings of the sort revealed to base their tax and expenditure manifestos on the numbers they imply. If indeed the findings are credible, a political party could promote its chances of re-election by offering to raise monies of these magnitudes, through general taxation, and redirect those monies as compensation to the losers.

Those who would simply use the findings to deny development are effectively saying that they would expropriate the value the owners have in the land; at best they would be arguing (erroneously) that income foregone is considerably less valuable than income withdrawn.

It is conceivable that Australians might value the whole of Kakadu being kept in its present near pristine state at \$647 million per year. Is this the real finding of the Coronation Hill survey? If so and if the lands adjacent to the Park can be used for other purposes - as they have been in the past - without destroying the integrity of the Park itself, the findings are irrelevant to the policy issue.

The techniques of market research, on which contingent valuation is based, are well established and proven in enhancing the forecasting and general efficiency of many businesses. These techniques, however, are only valuable when questions they pose are firmly anchored within people's frameworks of knowledge and experience. Even when respondents are familiar with the goods or matters being researched, they will tend to express a higher preference for a proposed new product than would be manifested in their purchasing decisions, if only because they are interested in a greater availability of products. Skilled market researchers have developed techniques to adjust for such biases.

Contingent valuation can only be effective if people clearly see the trade-offs they must face, and adequately understand the characteristics of the product which is being tested. It works best where it focuses on those directly affected - for example those impacted upon by a development in their neighbourhood. The more remote the good being tested, the more doubtful is the worth of any answer yielded by the test.

Cases like this exemplify the pitfalls inherent in contingent valuation. The approach's deficiencies are first, it specifies values based upon average utilities whereas demand and supply for goods in general is determined by marginal costs and marginal benefits. Thus a given consumer may value Bounty Bars at \$20 and at a market price of \$1 obtain surplus value of \$19 but this surplus value is irrelevant to decisions about whether or not the good is produced. This vertical aggregation of individual demand curves follows Samuelson⁵⁵. It is in contrast to the normal method under which demand curves are summed horizontally.

⁵⁵ Samuelson P "The Pure Theory of Public Expenditure.", Review of Economics and Statistics Vol 36 pp387-9 1954

Even if, as suggested by Freeman, a more accurate replication of markets can be constructed using choke-off prices, the methodology is suspect. Choke-off prices are determined by attempting to construct a demand curve by asking people what they would be prepared to pay for an improvement and then estimating the total revenue 'raised' at the price required to correct the current externality.

In determining their choices of goods and services, people face a galaxy of options but are only able to satisfy a limited number of needs. If, added to the air pollution questions in the Tolley and Randall study cited above, respondents were also asked about preservation of wildlife, forests, river purity, parkland in their neighbourhood and the whole host of other facets of life which could be considered externalities, and if people were to be confronted with the real trade offs between these goods and correspondingly fewer of the goods they would normally purchase, the values would likely be only a tiny fraction of those assignable from seeking answers to single issues.

Freeman expresses a scepticism about the non-use values reported in these studies. He says "At issue is whether the responses are measuring a true willingness to pay as defined in our basic theory of individual preferences or whether they are indicators of a general sentiment for environmental protection or preservation that is only imperfectly related to the willingness to commit resources in a true market or quasimarket setting".

It is clear that the application of the CV method is fraught with difficulties. It must be questioned whether the method is sufficiently reliable to be used in the economic analysis of resource development issues. The experience gained by practitioners in the U.S. certainly shows that, without the use of substantial care and expertise, inaccurate results can be achieved.

As with any other piece of research, the results should be verifiable or at least be consistent with what might be revealed in a well functioning market. On this score, \$647 million per annum, the Kakadu study attributes to one piece of remote land with no outstanding features, places a value on it which is among the highest in the world. If the piece of outback Australia which constitutes the mine is typical of Australia (and, as previously maintained, it is by no means exceptional), the value of non-development of the Australian land mass is 10,000 times the nation's total national income! Quite clearly that study fails any elementary test of consistency of outcome against known values. The conclusion must be that it is measuring how people would optimise their welfare where they faced no income constraint.

The CV method must also be regarded as being in a state of continuing development. Many advances have been made in the technique over the past two decades. The substantial criticisms that have been levelled at the method have encouraged these advances and are likely to continue to do so. This is of great significance as there remains a strong and growing demand for the economic assessment of non-market benefits and costs. Contingent Valuation may play a major role in satisfying that demand. However policy makers will need to be aware of the method's limitations. Similarly, practitioners - as well as being capable of using the technique wisely - will need to be modest in their claims for its results. CV studies will be useful in policy formulation but will need to be considered only as a part of the jigsaw puzzle being pieced together and not the magic wand of problem solving.

Doubtless, as the number of contingent valuation studies continues to grow, we shall find values attributed to all sorts of things, values which if aggregated would imply our incomes are much higher than under any conventional test. People are certainly willing to pay to avoid things being impaired. But there is a limit to this willingness. Already in Australia some 38 per cent of GDP is spent on public goods financed out of general taxation. There is clear evidence that such sums are higher than people would prefer. Similarly, there is evident unease about regulatory costs which are over and above those embodied in government taxation and spending.

People want to retain higher shares of their incomes for themselves. The danger with contingent valuation studies is that they might be used to justify forms of expropriation of income which have the apparent, though erroneous, effect of not impacting upon the community at large.

Even with the most carefully constructed contingent valuation research, it is dangerous to use these techniques for services for which people do not readily relate to paying. Are we measuring a true willingness to pay as defined in the basic theory of individual preferences? Or are we simply measuring a general sentiment favouring environmental protection or preservation? If the latter, then there is no real willingness to commit resources in a true market or quasi market setting.

These reservations have undoubted merit. However, survey methods do allow the development of a method of estimating the value placed on particular resources by those seeking their preservation. And, by placing upper boundaries on the amounts of resources available, more rational choices may be possible.

A Possible Wider Application

Once it is accepted that tradeoffs are necessary between rival uses of resources and that the public good, free riding and contractual difficulties necessitate some forms of intervention which will entail costs, then the contingent valuation approach offers a means to set an appropriate framework.

Contingent valuation could be used, first to determine what value in terms of income foregone people place on externalities. This would allow the construction of a "shadow" budget. An aggregate national outlay could be determined upon and segmented into various components using the sort of typology which Mitchell and Carson offer. Again, survey methods might be employed to take into account citizens' preferences regarding the competing matters of concern.

If the shadow outlay budget were to be parcelled out to different agents of government, these would be able to combine in certain ventures. For example, the agency handling the "appropriations" for forest preservation would often find common ways of combining its "expenditures" with that responsible for wildlife preservation.

As all agencies would have a shadow "budget", there would be incentives to seeking out efficient means of delivering their goals. They should therefore be more inclined towards regulatory methods which make use of the skills of the regulated to minimise their own costs. This would tend to lead them to favour the sorts of output controls, previously addressed, rather than mandating the use of specific engineering technologies.

Market research techniques used in contingent valuation offer some prospects both for limiting the degree to which intervention by government is employed and providing a rational ranking system for tackling those matters identified. That ranking system would, in principle, take into consideration both the benefits and the costs involved. It might help avoid some of the anomalies thrown up from regulatory interventions which the US Office of Management and Budget has identified. It might for example provide disciplines to reduce the dispersion of costs per theoretical human life which was illustrated by Morrall⁵⁶ in his comparison of costs of risk-reducing regulations. The cost of the regulations per life saved varied from \$100,000 (steering column protection and unvented space heaters) up to \$72B (for formaldehyde).

⁵⁶ Morrall JF "A Review of the Record" p25-34 Regulation Nov/Dec 1986

For each agency, a shadow budget would force a clearer evaluation of priorities as well as the greater emphasis on cost effectiveness. However, the difficulties inherent in its application are legion. Whereas the USA requires the quantitative identification of costs and benefits prior to a regulation going forward, deficient though such estimates may be, in Australia and most other countries any such clarification of costs and benefits is rare. Of course, quantification is itself a public good and it might be said should be as rigorously undertaken for regulation as it is in the fiscal budget before any costs are imposed.

Even with the requirement under US Executive Order 12291 requiring cost benefit analysis of proposed regulatory interventions, informational deficiencies and differential impacts considerably reduce its value. Added to this are the rent-seeking and lobbying costs which would be unlikely to be reduced by a contingent valuation system and the familiar problems which Arrow's analysis of voting have revealed. For these reasons, the field of government action to combat externalities should first be narrowed by allocating property rights since this is a more certain means to their low cost resolution.

That said, areas where externalities continue to plague the pursuit of efficient resource usage are certain to remain. Accordingly, some consistent basis upon which government must allocate a part of society's resources is necessary. Moreover the process would facilitate embryonic attempts to more fully comprehend the costs and benefits of regulatory intrusions into economic activity.

SPECIFIC ENVIRONMENTAL CONCERNS

5 THE DEVELOPMENT OF ENVIRONMENTAL CONCERNS

Precursors to the Modern Concerns

Although the pressures of uses on unowned resources previously regarded to be abundantly available is a relatively recent phenomena, environmental concerns are not new.

In the United States the growth of the environmental movement from the 1860s resulted in vast areas of land, beginning with the Yellowstone National Park (1872), being reserved as national parks. It achieved its apogee in that era with the Presidency of Theodore Roosevelt and his Secretary for the Interior, Gifford Pinchot. In England too there was a great upsurge in appreciation of nature and by the late 19th Century. McCormick⁵⁷ quotes estimated membership of the hundreds of field clubs as some 100,000. Paul Johnson⁵⁸ describes a similar environmental movement in Continental Europe, especially Germany during the early 20th Century featuring opposition to pollution and protests against the growth of cities.

A further minor environmental upsurge was particularly strong in England during the 1930s when fell-walking clubs were successful in re-establishing rights to public footpaths over private lands.

Such movements were of course preceded by earlier concerns about the environment addressed by Malthus and Ricardo, where the issues of looming shortages were picked up. These issues re-emerged in 1972 with the Club of Rome's "Limits to Growth" and subsequent analyses it spawned. Nor were the periods in between void of environmental activism. The present day movement might be said to have been launched in 1970 when at least 300,000 Americans took part in Earth Day. Rachel Carson's "Silent Spring", published in 1962, did much to galvanise this support as did a number of lesser known works. The new environmentalism is however more political in its methods and anti-establishment than previous, often conservative groupings and is focussed more upon the deprivations of man and the risks his presence generates.

⁵⁷ McCormick J "Reclaiming Paradise" Indiana University Press, Bloomington 1989

⁵⁸ Johnson P "A History of the Modern World" Weidenfeld and Nicholson, p18 London 1984

The dimensions of the environmentalists' debate has differed. The "dismal science" practitioners, the American Progressives and the Club of Rome saw incipient resource shortages as the key elements. Their analyses were based upon examining existing usages and extrapolating these forward. The Club of Rome and subsequent similar projections were especially naive in the light of prior knowledge of other forecasts of catastrophes.

Nineteenth century and early twentieth century concerns about resource shortages stemmed from a belief that capitalism, though largely a beneficial system, provided inadequate incentives to preserve depletable resources for future generations or to take measures appropriate for a steady state production (or rejuvenation of harmed natural resource bases).

Whilst the philosophic framework of many modern environmentalists is similar to that of the "Progressive era" - specifically a concern that markets will not operate satisfactorily - the modern environmentalists would find themselves diametrically opposed to many of the prescriptive approaches of the Progressives. Thus, whilst the Progressives favoured State control over land, they did so in order that dams could be built, logging forests planted and soils made more fertile for agricultural production. Their concerns reflected the same issues which led to the foundation of the American Economic Association in 1885, namely that the prevailing notions of laissez-faire were inadequate to ensure the continued economic progress of mankind.⁵⁹

Modern day environmentalists have a more profound distrust of the market system as an efficient allocator and, for many, there is a basic scepticism about the merits of continued increases in living standards where these involve some trade-off with usage or disturbance of the natural ecology. For many modern environmentalists, atavistic rather than materialistic goods are to the fore. Their concerns are less about making the market system work more efficiently and more about value transformations from income to the more abstract and romantic perceptions of the good life associated with the virgin planet and, in principle, a simpler less technologically affected lifestyle.

Resource Depletion and Degradation

⁵⁹ Nelson CH "The Economics Profession and the Making of Public Policy" The Journal of Economic Literature p53 Vol XXV No. 1 March 1987

As a spokesman for the "progressive" environmentalists, Theodore Roosevelt addressing the 1911 White House Conference on National Resources said

".... the time has come to enquire seriously what will happen when our forests are gone, when the coal, the iron, the oil and gas are exhausted, when the soils have been further impoverished and washed into streams, polluting the rivers, denuding the fields and obstructing navigation.

In fact, none of the predictions implicit in Roosevelt's plea have come about.

Added fuel to the concerns which Roosevelt expressed was offered by visual evidence of the despoilation of land. Indeed, as late as 1974, Marion Clawson, the Acting Director of Resources for the Future claimed "Croplands in the US, almost invariably privately owned, have been subjected to severe soil erosion, and it has been public efforts which helped to modify use of these private lands."

Yet analysis has proven these concerns to be totally unfounded (see p.).

The dynamics of supply and demand are clearly such that the price system will expand supply and constrict demand to allow augmentation or rationing. Nor, although resources are clearly limited, has this mechanism operated mainly on the demand side. Indeed, adjusting for inflation, it is hard to identify a natural product which has seen its real price rise. More often than not a tightening of supply has led to increased searches and discoveries or to the finding of more abundant alternatives, as in the case of whale oil and firewood. In the case of both renewable and depletable resources, technological change has allowed increased supply to outpace demand, a phenomenon which is manifest in the steady decline in the terms of trade for primary products. (A decline which simply reflects a fall in the real cost of production primary products' and their falling share within total output).

Resources are in fact abundantly available to be used at existing growth rates. Based on a crustal abundance geostatical model, de Vries⁶⁰ estimates that metals like iron, aluminium, titanium and manganese are virtually inexhaustible. Some metals like uranium tungsten, tin, copper lead and zinc would require reduced levels of output once exploitation reaches

⁶⁰ De Vries F.N. "Effects of Resource Assessments on Optimal Depletion Estimates.", Resources Policy, September 1989, P.253-268.

two to three times present levels. In all cases the modelling assumes real price levels 50 per cent higher than those presently prevailing. In most cases the limits of growth would be pushed back by higher prices both making additional reserves economic and encouraging increased substitution of the scarcer metals.

Market failure in the form of the user's unwise application of his own land for income purposes remains a concern today but is an unconvincing rationale for government intervention. It is hard to understand why a disinterested, even if expert, body can better judge an individual's true interest than the individual himself. After all, ownership of farms in private hands world-wide has produced increasing levels of productivity over the long term. Private ownership has brought more increased levels whilst maintaining, and in the main enriching, the ongoing productivity of the land. This form of ownership has most certainly outperformed public control and management.

More significant concerns are where the users of private land generate externalities on other users. Significant among these is water usage (both from rivers and aquifers) and salinity of river systems caused by irrigation practices. But in Australia, as in the US, much of this results from excessive use of irrigation generated by the sale of water from government constructed dams at a fraction of its true value and cost.

Environmentalism Today

Of singular importance in the years between the heyday of progressivism and today has been the identification and increased importance, at least potentially, of externalities and public goods. The former, involving the costs of income generation by use of resources which are not owned by the direct beneficiaries of that income generation but imposing costs upon others, is the crucible of modern environmental concerns. As has been shown however, externalities can be positive as well as negative.

Over recent years environmentalism has assumed a hegemony over all other forces which seek to harness the power of government in order to enforce compassion and caring upon a populace judged to offer too little of this from individually motivated actions. In assuming its hegemony, environmentalism has displaced the great ideology of yesterday, socialism. It has marginalised more contemporary allied movements which seek to replace free transactions by coercion. Feminism, aboriginal rights, peace offensives, even consumerism can maintain themselves only as side-shows within its shadow.

Many depict environmentalists as being simply socialists diverted from their previous antinomian activities. Under this analysis, it is no coincidence (to use Marxist phraseology) that the rise of environmentalism occurred during the 1980s, in the wake of the unambiguous failure and internal decay of the previous sixty years' socialist experiments. Indeed, in announcing the dissolution of the pro-Moscow Communist Party of Australia, its leaders said that they were doing so to free their attention towards environmentalism and other contemporary issues which they associated with capitalism (paradoxically in view of the severe pollution problems which have become publicised in Eastern Europe⁶¹).

Fukayama⁶² resurrects Hegel's somewhat over-dramatised notion that the Napoleonic triumphs of 1806 constituted the end of history and reapplies them to the collapse of socialism in eastern Europe. Just as history and conflict did not end in 1806 so they will not end in 1991. But the the future threads of the tapestry on which such conflict is weaved are certain to be composed of a different set of fibres. Napoleon's victories gave a new set of dimensions on which conflict would rest, ushering in nationalism, rivalry based on political ideas and eventually socialism as fulcrums that would balance discord and friction. It might be said that those wishing to contest the bedrock on which market based societies operate no longer have a beacon illuminating alternative organisational approaches and that their opposition is diverted into other directions. While this view of environmentalists may be rather sweeping, it does offer some useful insights. But emphasising them may detract from comprehension of the issues environmentalism sees a need to promote and the deficiencies in welfare which it considers can and should be rectified.

As with all previous ideologies and indeed any popular movement, environmentalism contains truths and important perspectives about matters of growing concern. Increasing income levels means more goods and more goods in turn mean greater pressure on using resources which are unowned, resources which because access to them is open to all will, whenever possible, be used as intensively as possible. The route to limiting this over-exploitation can be either control or else a more comprehensive specification of

⁶¹ Environment Australia (vol. 2 No. 2, 23 July 1990) quotes the West German ministry of the Environment as saying that 70 per cent of East German industry would have to be shut down if West German law applied now

⁶² Fukayama F " The End of History?", reprinted from the National Interest in Quadrant No. 258 Vol. XXXIV Number 8, August 1989 P. 15-29

property rights. It is however very seldom that environmentalists would favour a property rights and market based solution even where this is demonstrated as being less costly.

The forces of dissent are readily crafted by an education system which must, if it is to generate innovativeness, stress criticism of the status quo. It was Schumpeter, among the first economists to recognise the importance of entrepreneurship, who expressed a profound pessimism about the outcome of highly educated elites critical of a society in which their actual rewards did not correspond to their own view of their rightful share.

Behind the Growing Concerns Regarding Externalities

Concerns about externalities reflect the growing interaction of human existence. Population increases and higher per capita consumption put greater pressure on unowned resources. In addition increased wealth has generated a premium on goods like clean air, recreational opportunities and the quality of lifestyle - goods which are less highly prized when income levels are low.

When property rights were first established, land was relatively self-contained and its income earning potential was assigned precedence over most other uses. Courts had no difficulty in declaring that owner B had the right to shoot the dog which owner A might care deeply for when it attacked his sheep. This prior right for the sheep was granted even if they happened to be on common or open access land. In 1962 the US Courts found in favour of apple tree owners rather than the owners of ornamental red cedar trees, which contain an organism that destroys apple trees⁶³. Schmid⁶⁴, an institutionalist favouring government intervention, considers that the court's decision was unduly influenced by the market for apples rather than any deep analysis of constitutional rights and suggests that Buchanan might take a similar view and favour a Coasian bargaining outcome. Be that as it may, the courts have in that case determined the property rights issue and bargaining can take place - with the red cedar owners free to offer payment to the apple orchard owners for the rights to grow their trees.

⁶³ In 1928, Virginia's Supreme Court found in favour of apple orchardists rather than the native cherry trees, many of which carried organisms poisonous to apple trees, and required the destruction of the cherry trees close to apple orchards. 276 U.S. 272 48 S.Ct. 246 72 L.Ed. 568. MILLER et al. v. SCHOENE, State Entomologist. No. 199.

⁶⁴ Schmid AA "Property Powers and Public Choice" NY 1978

But the fact of greater complexity in modern economic life has given rise to spillovers on to others from the enjoyment of their property and correspondingly less certainty and less absolute control over legally vested property. Take the case of housing. Less than two hundred years ago, where on his own property an owner built his house, how it was painted and anything done within it was (if not criminal) purely his own business. General laws of nuisance and trespass were the sole constraints.

Today he would certainly be subject to ordinances and regulations although many of these might simply be codifications of common law. Such regulations would stop him using his home to slaughter animals because of the olfactory intrusion this would create; they might be successful in preventing him painting it the colour he prefers because of the visual intrusion; they could similarly object to the application of modern technology to build a multistory structure; and could limit the owner's enjoyment of amplified music.

In part, increased constraints emanate from the increased possibilities which technology has provided for the pursuit of one's own enjoyment whilst at the same time detracting from the wellbeing of others. It is also partly due to the greater premium which people set on avoiding visual, olfactory and noise intrusion, a premium which largely stems from high levels of income.

But in addition to these constraints to the harming of proximate neighbours, for whom legal redress is always available, there is the increased production of "bads" with a more dispersed effect. There are in addition concerns that man's presence on earth may be undermining its ability to cope. These include, at one pole, vexed questions about increased pressure on indigenous flora and fauna caused by economic development; and at another concerns that air and water pollution will generate irrevocable change and threaten the very existence of our progeny. Many of these concerns are soundly based - after all there is a finite amount of natural capacity of the earth and its surrounds to succour man and there will inevitably come a time when the earth's resources are depleted . Swaney⁶⁵ puts the view for governmental intervention

"..... both the societal and biotic community must be preserved because our knowledge is, and probably will continue to be, inadequate to foresee ecological imbalances, lost scientific opportunities, and other adverse consequences of the extinction of living species A related implication is the need for conservation of

⁶⁵ Swaney JA "Neoinstitutional Environmental Economics" Journal of Economic Issues p1739-1779 Vol XXI No 4, December 1987, p1741

resources When you consider the phenomenal power mankind possess for manipulating the environment, it should come as no surprise that he is succeeding in unforeseen ways 'Innocent until proven guilty' is not only unjustified for production processes and lifestyles, but is a dangerous and thoughtless approach perpetrated by outmoded habits of thought and defenders of the status quo"

The more urgent calls for action see the planet earth being steadily converted into a tumbrel conveying the human race to its own oblivion. Yet as already addressed, previous doomsday calls for urgent intervention by government have so often been aimed at a nonexistent target. Problems foreseen have melted away with the sands of the hour glass rather than been exorcised by the regulator. Malthus's population concerns have ebbed and flowed but today few consider them critical; Roosevelt's timber shortage fears proved as unfounded as Bennett's concerns over soil erosion; the critical shortage of sulphur during the 1950's turned into a glut just as the institution to combat it was established; the Club of Rome and energy crisis aficionados found the calamities they expected resolved themselves without government intervention.

This poor track record combined with the antinomian political agenda of many of those calling for intervention makes it tempting to dismiss all their forebodings. Nonetheless there are issues which have proven intractable to market rectification. London's smog, so harmful to the asthmatic William of Orange, was first countered by coal's replacement of much more pollutive and harmful woodfires and finally largely eliminated by anti-pollution laws. It would be heroic to go along with Friedman and Friedman⁶⁶ and dismiss developments like this as victories for the middle class preference for clean air versus the additional production and heating costs which impact adversely upon real income and job opportunities for the poor.

It would certainly seem that most governments have accepted that on the balance of probabilities the upper atmosphere ozone layer depletion is taking place and that there is no action other than institutional regulations (albeit making use of market mechanisms) which is available to counter this. It is also a possibility that the carbon dioxide by-product of mankind's energy generation will have the foreshadowed greenhouse effect (though whether this is adverse or advantageous depends on whether one has real estate in the Snowy Mountains, is an inhabitant of a South Pacific island or is a farmer in Canada or the Ukraine).

⁶⁶ Friedman M and R "Free to Choose", Penguin, Middlesex, England 1980

Similarly, at least in an age when wildlife was valued less than it is today (and the species diversity of "worthless" wildlife had no value) governments have proven a potent force capable of preserving fugitive wild animals. The North American bison and whooping crane would certainly have become extinct, whilst the numbers of others would have been much reduced, as their counterparts in Europe were, without government protection - without, in other words, the government assigning a value (often infinite) upon them which the marketplace was unable to do.

There are therefore likely to be areas where government must play a role - perhaps an increasing role - in combating externalities. The fact of this should not obscure the value of the teachings of the Public Choice School and others warning of the likely inefficiencies and perhaps threats to liberty, brought in the train of exclusive provision of services by government.

We need first to be assured that the externality will not be prove to be the Shibboleth which so many previously identified externalities have been shown to be. In this respect we must be sure - if necessary explore the possibility - that a means of combating the externality is not possible by the use of new or more comprehensive definitions of property rights. In some cases this may occur without any conscious direction. Wherever value can be identified or emerges, there will be incentives to discover or create new forms of property right.

Secondly we must be sure that the cost of combating the externality outweighs the cost it imposes. Externalities are all around us, some beneficial some detrimental. In other cases, as with disposal of garbage, the social costs of intervention to enforce more sensitive use or lower levels of use may not approach the costs involved. The point where the social costs of disposal start to approach private costs of use will often be shifted by measures, like domestic streaming of garbage, increased charges for multiple numbers of bins, charges for visits to tips, all of which reduce the collection and landfill costs involved.

Thirdly, the measures we introduce should be as cost-effective as possible. Often this will entail having them performed privately and using tenders to select the supplier.

6 COSTS OF ENVIRONMENTAL REGULATION

Administration of Regulatory Intervention

Whether or not presently envisaged measures to combat the Greenhouse effect prove necessary, regulation is rarely a cost effective solution. According to estimates published by the Business Regulation Review Unit, regulation in Australia brings a gross cost of 9-19 per cent of GDP per annum⁶⁷. These costs included the wide terrain of regulatory interventions with about half of them concerning 'economic' regulation and half covering the 'social' regulation of which environmental issues are a major part.

The Industries Assistance Commission⁶⁸ estimated that in transport, communications, electricity and manufacturing and agriculture, regulations and inefficient government ownership imposed costs amounting to \$16 billion per annum - some 5 per cent of GDP. In the light of this sort of evidence, it is clear that the regulatory solution is likely to be inefficient and should be adopted only if alternative approaches are not possible.

Across many market economies, growth in real income levels per capita has markedly slowed in recent years. For market economies as a whole there was no growth in per capita GDP in the decade to 1987. The fact that planned economies' growth rates, when measured appropriately, fared even worse provides little solace. It would be reasonable to conclude that this slowdown, at least in part, has represented the harvest of increased government intervention which was exhibited by virtually all countries in the previous two decades.

In Australia, as in most countries, the adverse effects of governmental preemption of national income has been generally accepted for a number of years. Particularly since 1985, energetic steps have been taken to reduce the share of government expenditures and taxation levels. While some similar advances have been made in many areas of hidden taxation and expenditure - economic regulation - other areas of regulation have tended to increase.

The scope of these social regulatory interventions extends beyond the subject matter of this book. In addition to environmental matters they include consumer protection, special

⁶⁷ Business Regulation Review Unit, Information Paper No 2 Canberra 1986

⁶⁸ Industries Assistance Commission Annual Report 1988/89, Canberra ACT.

regulations for minorities and women, occupational health and safety and labour remuneration.

The impact of regulations on productivity will change over time. The monopolies of medieval guilds when initially obtained probably only reflected the status quo. Over the years they became an impediment to the cost effective fulfilment of changing needs. Australia's minimum wage introduced in the 1909 Harvester Case may only have endorsed general remuneration practices but in many periods it has priced labour out of jobs and considerably diminished output. (Some labour laws, like those adopted for Aboriginal stockmen in 1969, were always intended to modify market outcomes, in that case to raise Aboriginal wages; but because government cannot control both demand and supply something must give as a result of such laws and in this case it was Aboriginal employment which declined precipitously).

Environmental Regulatory Costs

It is often pointed out that ecology and economics have much in common in so far as both start from the premise that everything is interconnected. Many point to a comity of interests between the two frameworks. Some, like Hamrin⁶⁹ suggest that the application of environmental standards on emissions required by government regulations will actually benefit both the environment and the economy by saving energy, virgin resources and so on. Such assessments glide over the costs in terms of resources required and income foregone in achieving the regulatory standards.

Others, more conventionally, suggest that such a comity exists and would be the natural outcome of market forces if property ownership rights could be adequately defined to prevent excessive use of "unowned" resources and the consequent externalities generated. Fred Smith⁷⁰ goes further than this and maintains that modern technology can allow all externalities to be internalised.

The mainstream view is that for some goods the externality looms so large and the difficulties of internalizing it are so great that interventions by government are essential. Such interventions can only be legitimate where they are based upon the construction of

⁶⁹ Hamrin R "Environmental Quality and Economic Growth" Council of State Planning Agencies, Washington 1981

⁷⁰ Smith F "Environmental Policy: A Free Market Proposal p32-37 Tulanian Summer 1989

shadow markets for evaluating the worth of those activities where externalities inhibit provision by natural markets. Values are assigned to attributes of the proposal and cost/benefit analysis employed to determine whether projects making use of unowned resources should go ahead.

In order to accurately estimate costs of interventions, it is important to make use of analyses which takes into account the consequential actions (compensating variation) of buyers and sellers confronted by a price increase. This approach however tends to take preferences and technical capabilities as given. In fact both consumer behaviour and producers can make rapid adjustments. And over time alternative needs and new means of meeting them are found - both supply and demand curves for a particular good tend to become flatter .

In the case of consumers for example, the introduction on congested bridges of express lanes which may only be used by multiple occupancy cars brought considerable behavioural changes both in Sydney and in San Francisco. Consumer adjustments to picking up or accepting rides from total strangers was remarkably swift and it is difficult to argue that the costs estimated at the outset prevail in anything like their original magnitude after a short transition period. On a larger scale, adjustments following the implementation of major infrastructural changes within cities, changes which were envisaged markedly to affect property values have been absorbed without lasting declines in these values. For example, converting vehicular roads within cities to pedestrian malls has often brought very rapid behavioural changes on the part of shoppers which were unanticipated and which totally negated the adverse effects previously expected.

For producers, the very rapid adjustment of some industries to the fourfold increase in oil prices which took place in the 1970s reveals great flexibility. The Japanese steel industry converted from oil firing to making more efficient use of the coal, a formidable energy saving innovation. Entrepreneurial reactions like this cannot be incorporated into general equilibrium models except by using non-scientific "fudge factors". Indeed, the inability to account for the role of the entrepreneur in seeking out opportunities constitutes perhaps the greatest shortcoming of all economic modelling.

Although there have been no analyses of the aggregate costs of environmental regulation in Australia, a number of studies of the costs of air and water pollution control have been conducted in the US. These include many estimates of the costs of environmental

protection on economic growth by Crandell; Christainson and Haveman; and Conrad and Morrison. But perhaps the most rigorous has been those of Hazilla and Kopp.⁷¹ Taking the Environmental Protection Agency's (EPA) cost estimates of federally mandated pollution controls (\$425B in 1981 dollars, \$648B in 1981-1990 current dollars), the authors apply elasticities of substitution, both to the economy's outputs and inputs. Because of substitution, the initial estimates are lower than those derived from EPA's engineering based estimates. Both consumers and producers take actions to alleviate the cost burden which regulation imposes, for example by switching purchases to goods which do not have additional cost requirements. In this way the aggregate cost imposition are muted. But the dynamic, secondary impacts of these costs must also be factored in. In addition, the effects of the intervention cannot be confined to one particular time period but will flow on into subsequent periods. The resulting costs from making these adjustments are estimated at \$977B, which by 1990 translates into a diminution of real GNP of 5.9 percent and of investment by 8.4 percent.

Using a similar methodology, but a data base derived from the Bureau of Economic Analysis, Jorgenson and Wilcoxon⁷² estimated effects of environmental regulation at only half of those estimated by Hazilla and Kopp (a reduction of 2.6 percent and a capital stock reductio of 3.8 percent). Part of the difference is due to the exclusion of "Superfund" clean-up under CERCLA from the Jorgenson and Wilcoxon data.

Because of compensatory variation, it is probable that the economic analysis of environmental quality regulation overstates the costs for society. Technological changes consequent on a shift in demand or supply can be modelled only by changing the parameters.

There are however other factors which would tend to operate in the opposite direction. One is that entrepreneurship itself is a scarce resource and energies directed at ameliorating an intervention might be energies which would otherwise be directed at discovering new means of adding value. In addition, modelling assumes zero transaction costs, perfect factor mobility and other notional attributes which we tend to group under the heading of perfect markets.

⁷¹ Hazilla M and Kopp RJ "The Societal Cost of Environmental Quality Regulations: A General Equilibrium Analysis", Resources for the Future, March 1989

⁷² Jorgenson D.W. and Wilcoxon P.S., "Environmental Regulation and US Economic Growth", Rand Journal of Economics, Vol. 21 No. 2, Summer 1990 p. 314-340

The work of Hazilla and Kopp, was originally commissioned by EPA and has a strong following within the agency, even though its findings have not been formally endorsed and publicly EPA quotes a more conservative, less comprehensive cost of environmental interventions which amounts to only 1.7 per cent of GNP. Nonetheless it constitutes the state of the art in the making of estimates of environmental costs and, because it examines the total picture, is superior to those estimates which confine their impacts to specific sectors.

The costs of environmental regulation estimated by Hazilla and Kopp incorporate only the costs of those regulations falling under the control of the US Environmental Protection Agency. These cover air and water pollution and waste disposal. They do not include other regulatory interventions which fall within the environmental embrace such as use of forests and wilderness, protection of flora and fauna and measures to combat soil erosion.

Benefits of Environmental Regulation

Studies which attempt to estimate monetary benefits to set against these sorts of costs are somewhat more scarce. For the US, Freeman⁷³ placed the benefits of air and water pollution control at 1.25 percent in 1978, with about half of the total benefits emanating from improved health and one tenth in the form of savings from less soiling and cleaning.

Pearce et al (op cit) quote data offered by Schulze to indicate that the annual damage of air and water pollution, in Germany at about 4 percent of GDP in 1985.

⁷³ Freeman M "Air and Water Pollution Control: a Benefit-Cost Assessment" Wiley, New York 1982

7 POLICIES FOR SPECIFIC ENVIRONMENTAL ISSUES

The Resolution of Externalities

The omnipresence of externalities and their different impacts requires that some attempts be made to categorise them in ways that might be useful for policy treatment. The political process sufficiently to warrant government intervention. Such intervention must be implemented in the most cost effective ways - broadly speaking this will mean making maximum use of market allocational processes.

Political actions are likely to have goals other than efficiency and, indeed, political activists may not share the views that market processes contain the key to income creation.

Because government activities have fewer self-correcting mechanisms than those of the market, government attempts to remove externalities by direct action will often result in higher costs than those engendered by the failure itself. Examples of this can be observed within industry policy, with instruments like tariffs and subsidies. Some framework for narrowing the area of government activity and providing guidelines is therefore necessary.

Environmental Externalities

Matters which might be seen as threatening sustainable development fall along a spectrum of "regrets". At one end is the loss of species which are either of no conceivable value to man or are indeed harmful to him. Indeed much medical research is organised to eradicate species which damage mankind's health.

At the other end of the spectrum are the cataclysmic issues of ozone depletion and possibly the Greenhouse effect. In between are matters of urban pollution, land erosion and protection of wildernesses.

The following is a suggested taxonomy of environmental externalities:

- . Garbage disposal and littering
- . Land spoilage, erosion, exhaustion, unsightliness

- within the private owners boundaries
 - beyond these boundaries
 - in public reserves
- . Water usage
 - rivers
 - ground water
- . Water pollution
 - rivers
 - ground water
 - the sea
- . Air and atmospheric pollution
- . Spread of disease
- . Ensuring species diversity

The approaches used to combat the externalities encompass socialising them (public ownership), regulation through controls, regulation through taxes/subsidies and permitting the area of private ownership to be extended. In addition there is the solution, of allowing the externalities to continue. It may have been President Nixon who commented that it seemed whenever a problem occurred, government advisers offered three solutions none of which was 'do nothing' and yet so often this is the best option.

For the purposes of the analysis of their work, the various matters threatening sustainable development may be placed within one of the three following categories:

- self contained environmental harm;
- activities directly or inadvertently impacting upon others; and
- activities with only a remote and incidental effect on others.

1. **Self Contained Environmental Harm**

This includes on-farm erosion and land exhaustion and the effects of mineral extraction. In both cases the consequences are sheeted home directly to the owners.

Land Usage

On earlier pages uneasiness about Australian land depletion was addressed. Considerable apprehension continues to be expressed. CSIRO⁷⁴ claims, "Since European settlement some 52 per cent of Australia's agricultural and pastoral lands have been degraded. Many believe that the value of the lost production is in excess of \$600m million per year." (p 2) On page 14, this \$600 million is broken down into \$300 million from acidification and salinisation and \$300 million from " structural decline and soil erosion". There is also said to be annual "ongoing nutrient losses valued at replacement cost of \$350 million of nitrogen, \$140 million of phosphorus and \$60 million of potassium." Elsewhere, (P 26), CSIRO suggests a more conservative but still alarming degree of degradation comprising 430,000 square kilometres of rangeland, an area twice the size of Victoria.

Systematic analysis by Crosson⁷⁵ has demonstrated that soil erosion, which was estimated in 1939⁷⁶ to have virtually destroyed almost one sixth of American cropland and considerably impaired the productivity of a further one third, has had remarkably little long term effect. Crosson points out that the natural development of topsoil is 0.2-1 cm per annum - considerably in excess of the 0.1 cm maximum tolerable erosion specified by the USDA. Examination of the 50 million acres said to be irretrievably lost has shown that crop yields on these acreages 1950/54 to 1976/80 increased at about the same high rate as that experienced nationally. Even an examination of supposed irretrievably damaged lands compared to undamaged lands on a county by county basis indicated that the former's productivity was less than 2% below that of the latter for corn and 1.5% for soybean.

Moreover, land considered to be especially badly affected, as a result of gullying, was by the mid 1950s restored by making use of heavy machinery to rearrange the contours and the effects of public expenditures, estimated to have been \$15B over the past 30 years have made a negligible contribution to this outcome. Crosson's research counters a recurrent

⁷⁴ Institute of Natural Resources and Environment, CSIRO "Australia's Environment and Its Natural Resources.", Canberra 1990

⁷⁵ Crosson P.R. and Stout A.T. "Productivity Effects of Cropland Erosion in the United States" Resources For the Future, Washington D.C. 1983

⁷⁶ Bennett H "Soil Conservation" McGraw-Hill, New York 1939

criticism of doomsayers (and one which can often be levelled at cost benefit analysis) that technology is assumed to remain at its current level, whereas in fact there has been a steady rate of innovation and its application.

Nowak⁷⁷ acknowledges that earlier calls for the farmer to adopt conservation in order to reap productivity gains now appear to be misplaced. He refers to a paradigm shift whereby the previous calls for conservation to foster higher output levels have been converted to calls which seek to modify the effects of agriculture for other reasons. He argues, "Conservation is now being funded and promoted to protect the interests of non-farmers. No longer do we hear about maintaining the nation's agricultural productivity of protecting the interests of the landuser. Instead justifications are based on phrases containing 'water quality', 'wildlife', and 'human health'." Improvements in technology, seeds and fertiliser have outpaced the damage to the soils and, aside from satisfying the wishes of non-owners, the case for measures to conserve the land rests even more strongly upon externality effects.

Nowak himself regards the true costs of on-farm land erosion as remaining significant but hidden from the farmer. He cites costs often overlooked as including depletion of natural chemicals leading to increased pest pressures, increased emergencies, machinery wear and tear and higher fuel usages from tillage of heavier soils, and increased irrigation costs because of a lower water holding capacity of eroded soils. In addition, he draws attention to the unaccounted off-farm costs.

The latter apart, it is however hardly credible to view the millions of individual farmers as overlooking significant avenues for cost reduction. Farmers make very detailed trade-offs between different sorts of machinery, with regard to stock carriage and field recovery, between different crops on different soils, in terms of the amount of water to employ and the tolerable salinity of irrigation water. Granted, as with any other business decision, some judgements will be incorrect and more than frequently new research will reveal that previous practices can be improved. But for the sorts of on-farm issues which Nowak addresses, it is most unlikely that farmers would be unaware of potential wealth enhancing practices readily available to them.

⁷⁷ Nowak P.J. "The Costs of Excessive Soil Erosion", *Journal of Soil and Water Conservation*, July/August 1988, p. 307-310

Senator Walsh, the former Minister for Finance in an address to the Western Australian Farmers' Federation Conference (1 March 1990) discussed Australian experience in these matters. He pointed to the costs which have resulted from government intervention impacting adversely on the efficient use of land and that the great majority of Australian farmland - which has not been subject to government interference - is now more productive than it has ever been.

Even in areas selected for media commentary as having been destroyed by rapacious farming practices that assessment turns out to be true. Thus the highly publicised case of salination in the WA shire of Tammin made no mention of the fact that grain production between 1950 and the late 1980's increased three and a half fold whilst wool production doubled. He points out that assertions of land degradation, said to cost Australia \$700M a year in foregone production, must be set against the increased production which the cause of this - land clearing - has allowed. This he put at \$15B per year.

Taken as a whole, productivity of Australian land has increased significantly - including over the most recent years when community concerns have become most vocal. According to the Australian Bureau of Agricultural and Resource Economics the following levels of aggregate output have been experienced.

Table 3

<u>Farm Production 1979/80=100</u>	
Total Production	
1952/53	49
1962/63	67
1972/73	82
1982/83	89
1988/89	112

Wheat and coarse grain and oil seed yields have shown marked increases in spite of wheat acreage doubling, that of coarse grain quadrupling and that of oilseeds increasing tenfold (presumably in each case by bringing less preferred land into cultivation). Thus

Table 4

<u>Australian Crop Yields (tons/hectare)</u>			
	Wheat	Coarse Grain	Oil Seed
1950/51			
-1954/55	1.14	0.89	
n.a.			
1960/61			
-1964/65	1.29	1.08	0.74
1970/71			
-1974/75	1.20	1.23	0.70
1980/81			
-1984/85	1.27	1.34	1.13
1985/86			
-1989/90	1.44	1.56	1.41

Although these broad figures do not paint the full picture because they take no account of inputs other than land, one such input, labour, has continued to decline and it is certain that after all adjustments have been made, the net outcome would tell the same story.

This is not to argue that output can continue to increase indefinitely. Over the longer term water and water retention in the soil is perhaps the ultimate constraint. More immediate restraints on output include shortages of nitrogen, phosphates and potassium but, should these be capable of resolution, a threefold expansion in output is possible before the barrier of water shortages and soil retention is reached.

In view of demonstrable on-going improvements in agricultural productivity, the CSIRO figures cannot be accepted uncritically. However, even if they are accurate, they very largely refer to damage to "unowned" crown land and damage imposed by farmers to property and valued resources downstream from their own holdings. Self-contained land degradation, exhaustion and erosion - that is where it affects only the individual's own property - is one of the great fabrications of alarmists and rhetoricians. As preceding analysis has demonstrated it is completely unfounded as a major concern. In Australia it is unlikely that soil generation occurs at the rate referred to earlier as common in the US. Sargeant⁷⁸ quotes sources putting the creation of soil from Australia's old and heavy rock and clay formations other than from movement of material (which may in fact be the most

⁷⁸ Sargeant I, "Soils in Southeast Australia - Lifetimes of Endowment", Search, Vol. 21 No. 3 April/May 1990 p99-101

prolific means of soil creation) as being of the order of only 0.003mm to 0.02mm per year. Even so he estimates that existing management practices would take 1000-2000 years to exhaust the soil. And he points to techniques already in use which considerably extend that life and other more effective techniques likely to be found over coming years.

Hyberg⁷⁹ in his study of severely degraded farmland in the New South Wales Murray/Darling Basin examined the capital improvement which the application of changed management practices had brought about.

For the dozen farms he examined, data over a five year period indicated that net revenue from the 10% of land considered to be most severely eroded had been improved by \$7-8 per acre. All up, this infers a value of \$4M per annum for NSW. Hyberg was not attempting to assess the application of best practices but nonetheless the scope for possible improvement is, on the data presented, quite minor.

Some estimates, of a highly speculative nature, were also made by Hyberg of increased externality costs, other than salination (largely flood caused road repairs). These were put at about \$10M per annum.

The generally satisfactory prospects and outcomes of existing agricultural practices do not necessitate government having no role whatsoever. By far the least contentious role for government is in facilitating research. Some such research is likely to be engendered by its sponsors' prospects of gain, particularly where know-how can be sold. In this way, recent moves to allow ownership of plant varieties has encouraged development of new strains for which their owners can charge fees.

Other means of allowing the market provision of know-how to allow enhanced output is through the development of agricultural consultancy services to advise on soil preparation and protection. Commonly in Australia such services are provided free or at much reduced cost by government agencies. It is argued, with considerable plausibility, that sub-optimal research into soil preservation would be provided by market forces because contractual difficulties would prevent farmers coming together to finance appropriate levels of such activity; the abilities of farmers to free ride on findings from nearby properties may also mean that recompense, which could be obtained from research and

⁷⁹ Hyberg S (publication forthcoming Australian Bureau of Agricultural and Resource Economics)

sales of such information, is insufficient to generate justified expenditures on resources. Hence a strong case can be made for publicly financed research (perhaps on the basis of mandatory levies on all farmers) and common provision of this information.

These remarks are particularly apposite to the debate presently underway in Australia about sustainable development. Salinity in irrigated areas is a major manifestation of spillover costs. A recent report of the Victorian Department of Agriculture⁸⁰ found evidence of productivity growth declining in some areas as a result of salinity both in northern dry land farming areas and in the irrigated areas of the Goulburn Valley. Small areas have become totally unproductive and in others the water table has risen to levels which seriously threaten cropland productivity. Some estimates have placed at \$70 million the loss of Victorian output which results from this - a loss which would amount to seven per cent of output. Such a loss, it should be noted, is being offset by gains in other areas of farm management.

Awareness of the problem has brought together local 'landcare' and 'salinity' groups, some of which have modest government funding, to resolve the problems. Their programs involve water conservation tree planting, and planting of crops like lucerne which assist in stabilizing the water level. These voluntary community efforts using 'moral suasion' have been highly successful.

Development of information and its provision aside, there is little room for direct government in matters involving the management of privately owned land where that management involves little spillover costs to third parties. Secure title will be far more effective in ensuring that the right amount of energy is directed to preservation. Just as privately owned houses are better maintained and last longer than those that are publicly owned, privately owned land is far more productive. Indeed, where agricultural land is publicly owned, as in the Soviet Union, the outcome in terms of productivity growth and degradation has been far inferior to that seen in western economies.

So powerful has individual ownership been in promoting sustainable development that its application is considered desirable for promoting sustainability of many aspects of the natural environment.

Mineral Extraction

⁸⁰ "Towards Sustainable Land Use", The Victorian Draft Decade of Landcare Plan, Victorian State Government, May 1991

Mineral extraction by definition involves transforming the pre-existing resource. But with firm title, the owner will seek to ensure that the extraction takes place as cost effectively as possible including over the most appropriate time span. Like farming and other usages of land, mineral extraction might also impact upon others where the process of extraction has major effects on the environment causing pollution and widespread disturbance in areas of sensitivity.

In the main, however mining is confined to small and isolated locations. Moreover, as the naturalist Harry Butler has made clear⁸¹ almost all land which has been mined can be readily restored. In the case of beaches, restoration is particularly straight forward, indeed operators of tourist buses on the northern NSW coast ask their clients to nominate which of the beaches they see before them have been sand mined knowing that the differences are imperceptible. For other areas, restoration may be more costly and involve retaining different layers of the original soil and replacing it. Even so, such procedures are now widely practiced. Doubtless this adds costs to mine development, costs which in restoring the land to its original condition might be several hundred fold the value of the restored land.

At any one time mines account for less than 0.02 per cent of Australia's surface area⁸² and it is likely that less than 0.5 per cent of Australia's area has ever been mined. Of this some would be economically viable for restoration, other areas especially those near population centres would have a value as land fill sites. Still others are more valuable left as disused sites, forming as they do a part of the nation's heritage.

For all these reasons, whilst it may not seem unreasonable to expect rectification of land after mining has ceased, requiring such costs to be absorbed may be rational in neither an economic nor a wider social sense. There may be room for bargaining solutions to be adopted based on the value of the land being returned to its original condition and the cost of undertaking this activity.

⁸¹ ABC "Uncertainty Principle" 15 April 1990

⁸² Submission to the Inquiry into Mining and Minerals Processing by the Association of Mining and Exploration Companies, Industry Commission, Canberra March 1990

In Australia land ownership confers rights only over the surface of the land. This accords with developments in most common law jurisdictions where the landowner's traditional rights to all that lays beneath the surface have been taken by the state.

Although the traditional common law rights to the subsurface in Australia no longer exist, rights to deny access, which may be thought of as de facto ownership rights, have been identified by the Australian Mining Industry Council (AMIC) as comprising 27,000 square kilometres in Tasmanian and 250,000 square kilometres in Western Australia. In addition Aboriginal land gives the owners veto powers over exploration and development activity.

The efficient solution to economic activity requires that ownership be securely vested and rights be transferable. The various features of ownership should also be divisible so that, for example, owners are able to transfer their rights to use water without at the same time having to transfer title to their land. This allows resources to be used by those in the best position to earn the highest return from them.

If land is thought of as comprising the surface, the subsurface and the area above the ground, the present division of ownership might be regarded as conforming to efficiency. The area itself includes attributes which its owners do not value, do not know about and which therefore their custody cannot be said to enhance. Thus, it might be argued that ownership of the area above the ground confers rights over the electromagnetic spectrum. If so, those rights have never been recognised. A landowner must permit unhindered the electronic transmission of messages through that part of the spectrum which lies above his property. To have adopted any alternative approach would have meant intolerable transaction difficulties for those seeking rights to transmit messages by this medium. For these reasons, because the miner only wants to extract particular minerals, seperability of the ownership between different features of the land is also required.

Much the same can be said about mineral resources as the resources above the ground. The knowledge of the existence of valuable minerals requires considerable outlays and bargaining between groups of owners and mining companies would severely overload transactional vehicles. This problem is much diminished where ownership is vested over large areas - as occurs with Aboriginal land - and the owner is able to contract with developers.

For the great bulk of land, the mineral rights are worthless. Those where the rights are valuable require costly exploration activity to find reserves and prove their viability.

Having mineral rights included within the land ownership title, even where this can be divided, has proven to have considerable disadvantages in the past. Hold out problems where land is subdivided and inability to contact absentee landlords were among the reasons for general abandonment of traditional common law approaches in Australia.

Governments instead assumed formal ownership themselves but have not taken on the role of mining. Landowners are normally required to allow access by exploration companies and subsequent development of any valued resources. The landowner is given compensation for any loss and inconvenience. A form of taxation has been levied, usually as a royalty, on those developments that take place. Although these are differing regimes for allowing payment to the owner and some (eg those based on profit rather than output) are in principle more efficient than others, the key feature is the need for certainty.

An exploration lease requires only a nominal fee to be paid. The expectation of the explorer is that in the event of successful findings he will be free to develop on payment of a royalty to the government. It should, given sovereign risk, be on generally applicable terms. Powerful tradition dictates that the successful explorer will not have his development rights allocated to another firm but increasingly, due to environmental pressures, governments may disallow any development. In addition to the general royalty, where a landowner has rights, normally governing access, a further payment on mutually agreeable terms may be struck. In the case of Aboriginal land, the government may rescind its own royalty.

There are unlikely to be high levels of "resource rents" accruing Australia wide. Aggregate returns from mining do not indicate that the activity confers any form of super profit. The available rents are largely dissipated in exploration activity so that miners/explorers have over the long term, at best, average rates of return. In the main the owner would therefore not be able to command a fee for allowing exploration. But for those areas which have high levels of prospectivity some such charge, preferably at the front end, is warranted. This method of allocation is superior to an administered system which would give rise to wasteful lobbying expenditures. In theory these could amount to as much of the value of the lease being contested. The leases in such areas should, in short, be auctioned both as a means of tapping the rent and to allow distribution to the party which

expects to obtain greatest value. Elsewhere first-come-first-served is a preferable basis for allocation.

If the full value of the rent were to be extracted by the property owner, leaving the explorer/developer of a valuable find with only normal profits, this would constitute a major disincentive to further exploration. The nature of mining activity is such that exploration (research and development) will only demonstrate viable reserves in a tiny minority of the acreage explored. The full value of the rent from a successful exploration activity is therefore a quasi-rent. It cannot be appropriated from the explorer without adversely impacting upon the inducement to further exploration. The mining company must budget on obtaining high rewards from some prospects in order to finance research elsewhere. The prospector only has an incentive to fund the search for hidden value where he has a certainty of reaping the benefits.

It may of course be that the property owner (usually the crown in Australia) wants some flexibility in negotiating a share of rents. For the individual property owner this would mean a reduced likelihood of exploration proceeding. For society as a whole, it would also mean less exploration but, by definition, this would accord with the preferences of the parties concerned. In any event known rules should be established so that the parties can proceed with certainty. It should not, for example be required that in the event of a successful find the explorer should be obliged to offer the property owner a further opportunity to negotiate.

Governments have over recent years demanded more information prior to allowing development to proceed. The uncertainty and cost implications which increased scrutiny introduces raise risk premiums on new ventures; for those which are not permitted to commence, net income is lost, whilst for those which are delayed losses involving the time value of money are incurred.

Within the former category have included sand mining ventures, the effects of which are perhaps more easily repaired than any other surface mining activity, and uranium.

One of the most prolonged debates, addressed earlier in the discussion of contingent valuation techniques, has concerned a new Australian mining opportunity at Coronation

Hill in the Northern Territory⁸³. The proposed mine includes gold, platinum and palladium reserves; mineral reserves in the area are estimated by the Bureau of Mineral Resources to be worth over \$7 billion. The area in question adjoins and now forms a part of the Kakadu National Park. It has been mined and farmed during the past. In this respect, the present boundaries of the park contain many disused small goldmine sites which were worked during the past 50 years - at a time when present concerns for ecological damage prevention were largely absent. Even though those earlier mining processes made extensive uncontrolled use of chemicals like cyanide to facilitate mineral recovery, the outcome has not apparently harmed the natural environment.

There is no question that future mining would rely so heavily upon nature's resiliency. In any Australian mining site assurances would be demanded and readily given about safe disposal of toxic waste. By the same token, the procedures the Coronation Hill developers have been obliged to follow is extraordinarily costly both to the developers and the community in general. Twelve Government Departments and 23 Acts which can affect mining in the region have been identified. The companies involved in the project claim government vacillation on the matter and changed ground rules have caused both unnecessary expense to themselves and have generated a climate of uncertainty for the industry. In addition, they criticise Aboriginal rights legislation which, they maintain, has offered incentives for local Aboriginals to claim the area as a sacred site. The joint venturers consider this claim to be spuriously manufactured.

The announcement in 1973 that the Kakadu park was to be established identified its area as being well to the north of the prospective mining area; at the time the government also said that exploration activity would, under appropriate conditions, continue to be permitted; the Kakadu National Park Act 1973 made provision for exploration and recovery of minerals under controlled conditions.

During the following eight years the area of the national park was extended but still remained well to the north of the Coronation Hill region.

During 1984 the first indication of valued mineral resources was discovered and shortly after the Northern Territory Aboriginal Sacred Sites Protection Authority (ASSPA)

⁸³ see "The Coronation Hill Joint Venture" Submission to the Industry Commission Mining and Mineral Processing Inquiry March 1990

registered the area as a sacred site complex. The ASSPA however gave its permission for work to continue.

In 1986 an extension of the Kakadu National Park was proposed but Coronation Hill, which remained outside the designated area, was to be permitted to proceed subject to normal clearances. The policy was further re-affirmed during the subsequent year although at that time the National Parks and Wildlife Conservation Act was amended to prohibit mining and exploration in a national park.

An Environmental Impact Statement, work on which had commenced in 1985, was formally presented to the Government in September 1989. At that time the Government announced a further extension of the national park so that further exploration outside Coronation Hill was prohibited. In addition, the Government referred the matter to the newly established Resources Assessment Commission.

From the mining companies' perspective these developments have constituted

- a progressive enlargement of a national park from an area a hundred kilometres away from the prospect, to its borders and thence to cover the whole area;
- a change of policy in that mining in national parks became forbidden under any circumstances; and
- an invitation to Aboriginal groups to lay claims to an area previously unrecognised as containing sacred sites so that an additional share of the profits could be obtained.

On this analysis, governments have failed to develop a stable political environment and have indeed been active in reducing certainty. Whether or not such increased expenditures to promote environmental issues are justified has become secondary to the basic stability of what has previously been regarded as a firm basis on which property rights might be established.

These developments are milestones along a road of progressively increased mining regulation.

During the 1960's, the Western Mining Corporation discovered nickel at Kambalda in Western Australia. Instead of setting about an exhaustive program of testing, after drilling two holes, the company proceeded to develop the site as a major mine. The gamble paid off and the Kambalda mine was in operation within two years. It subsequently became the backbone of the company which was to flourish into Australia's most important indigenously owned mining concern.

Ten years later during the mid 1970's, that same company discovered an equally significant lode at Roxby Downs consisting of uranium, gold and other minerals. The minimum time before the Roxby Downs mine will reach development will be fifteen years after its discovery.

During the 1960's Western Mining needed just two approvals from government regulatory agencies to proceed with Kambalda. Scarcely a decade later, fully 54 separate approvals were required.

Although the two ventures are different - the mineralization in Roxby Downs is deeper and some approvals relate to the specific nature of the minerals - the truly distinguishing characteristic between the two cases was the phenomenal growth of the regulatory industry during the decade to the mid 1970's.

There are of course some benefits to society from the highly intensive regulatory infrastructure which has been set up for mining developments : we can be better assured that damage to the environment will not occur, we can ensure that Aborigines sacred sites are protected, we can better plan transport systems and so on.

But there are very considerable costs. These comprise:

- . the deferment for a number of years of profitable activities; even at a highly conservative discount rate of 6 per cent, a twelve year delay means the value of an investment is halved
- at a 20 per cent discount rate, the present value of a dollar after 25 years is only one cent and, in order to break even, the return on the dollar's expenditure would need to be at least \$95.

. Other costs include:

- modifications required to conform with the law which make the venture less productive
- private sector costs in providing information to the approval processes
- public sector costs in staffing the agencies which rule on the approval applications.

In the case of Roxby Downs, the prospects are so outstanding that the development will go ahead in any event but less attractive propositions would surely fail to be pressed. Perhaps of greater importance, given the hurdles for development which have been erected, firms must implicitly or explicitly adjust their approaches to exploration. The greater risk that development will not be allowed to proceed must reduce exploration activity.

2. Activities Directly Impacting Upon Others

Falling within this category are externalities including

- . garbage disposal and littering
- . air pollution
- . excessive water usage
- . river and aquifer pollution and salination
- . off-farm land erosion and degradation
- . erosion from timber gathering

Garbage Disposal and Littering

Garbage is the residual of matter taken from the earth's resources to where it is returned at a different location usually in a transformed state. All residues are simply natural products moved from one place to another. Only the Almighty and, conceivably, atomic science can actually create matter. Nonetheless unwanted material left over after consumption and production is an issue of major disquiet and vital political importance.

Worldwide concerns about waste disposal have prompted much greater emphasis upon recycling. The matter of waste disposal is common to a great many of the issues discussed in the following sections. Residuals from productive activities constitute a major focus of environmental issues with the more significant being:

- leaching of hazardous waste into rivers and ground water.
- escalating costs of tips for household and industrial waste.
- urban atmospheric and river pollution.
- degradation of the upper atmosphere and the open oceans.

Some forms of waste are particularly hazardous and generally required to incur higher costs to ensure their transformation to more benign forms. If significant amounts of this waste are also finding their way into regular tips, considerably increased levels of expenditure will be required in treating it and/or lining the tips themselves.

The options for dealing with residuals include: reducing them, cleaning them up and placing them in locations where they are less bothersome or less harmful, allowing them to remain where they are deposited (leaving natural forces to transform them), and recovering and recycling them. The choice of approach depends upon the costs and benefits involved.

Reduction of residuals can be accomplished by:

- (i) Reducing output
- (ii) Increasing the efficiency with which inputs are transformed - if a price is imposed on the offensive input this will result in goods being engineered to take it into account in aggregate costs; a tax on cardboard would result in less packaging.
- (iii) Increasing the life of products so that they last longer before being discarded.
- (iv) Changing the composition of national income away from outputs which have higher residuals - taxation favouring services would tend to have this effect.

Allowing residuals to remain where they are deposited is generally not an option acceptable in a modern society with its concerns about public health. These objections are exacerbated by the potential for visual and other intrusions from use of considerable quantities of packaging material, which modern production and distribution systems require.

Cleaning residuals up involves collecting, transporting and depositing them in locations where they can do little harm or are unobtrusive. If the resources involved in this were free, this would tend to be the favoured approach.

Recovery and recycling is the approach often favoured. Ostensibly it has the attractions of conserving virgin resources and saving on transport and tip costs. Where natural resources are underpriced because of government action, a case can be made for subsidising the use of recycled products but, in line with the conventional approach to such inefficiencies, the preferred solution is to remove the original distortion. The full costs of recovery should be factored in to any recycling strategies as well as savings like avoidable tip costs which might be made.

Somewhat ironically, the most effective approaches to control of unwanted residues are either their dilution or concentration. The optimal approach will differ both over time and between areas. Dilution allows residues to be rendered harmless by allowing them to be broken down or simply remain present in quantities that are acceptable. Concentration allows residues to be consolidated in areas where they are less likely to be harmful or intrusive. Where modest amounts of pollutants are emitted dispersal is often the best approach but with increasing quantities the capacity of the atmosphere or receiving waters to cope with them becomes over-taxed. Thus, the traditional policy for factory emissions has been to insist on their dispersal by the use of tall chimney stacks. With higher levels of residues, this policy is replaced by measures that seek to concentrate residues by, for example cleaning or using less pollutive inputs.

Domestic garbage disposal is almost universally carried out as part of local government activities. It is in the main not charged for on a usage basis and these municipalities doing so have been declining in number rather than increasing. Although the cost of collection and disposal comes out of local government charges, there are few direct disciplines upon households to reduce their waste. Those disciplines employed usually involve limiting free collections to one or two bins per pick-up.

Litter and garbage removal is seen as a public good. It may however be undertaken by private contractors in order to ensure productive efficiency and such contracting out would appear to be a sound policy (the work of Savas⁸⁴ among others demonstrate this to be far more cost effective than public provision). As far as allocative efficiency is concerned, any inadequacies in the disciplines household might have as a result of leaving waste disposal as a public good are outweighed by the increased littering and illegal dumping likely to accompany specific charges. Specific charges which resulted in major problems along these lines could give rise to higher public clean-up costs and perhaps boost public health costs.

Given the vast numbers of parties, it would not seem possible to establish property rights to specific quantities of garbage per household and allow trading. That said, the normal approach of permitting a fixed numbers of bins per household and relying on laws against unauthorized dumping comes close to this approach. Charging on a per bin/per collection basis would doubtless lead to considerable monitoring problems and has been observed to increase illegal dumping. An explicit charge attributable to all garbage has therefore not proven to be an efficient solution. However, requiring disposal beyond a certain amount to be financed by the household and requiring self-financed disposal of certain forms of garbage (eg garden waste) has been found to be workable. In these cases there appears to be adequate civic responsibility developed by citizens to abide by injunctions to a sufficient degree.

According to an Australian Bureau of Statistics survey conducted in April 1986, the following measures were taken regarding recycling by households

<u>Table 5</u>		
<u>Households Recycling Refuse</u>		
	Taken to Special Area	Collected from houses
Glass and Bottles	15.7	18.3
Paper	7.9	21.4
Aluminium and steel cans	15.5	3.9

source cat. 4115.0

⁸⁴ Savas ES "Privatising the Public Sector" Chatham House New Jersey 1982

Glass bottle and can collections were highest in South Australia where deposit legislation is in place. Paper collection rates reached a zenith during 1989 when demand was too great for recycling uses.

The crucial issue in determining whether a change in present arrangements is warranted concerns the costs of tips and of cartage. In Australia disposal costs have been estimated at an average of \$50 per tonne (see BRRU Information Paper 14 op. cit.). Costs tend to be higher in some capital cities and lower in rural areas. Overseas costs of six or seven fold this have been cited and there are suggestions that the costs in Australia are understated because of undercharging of tipping sites, which are normally located on public land. (There may also be an element of excessive charges if the public administration of these facilities leads to cost-padding).

If land suitable for tips is becoming scarcer, this will need to be reflected in charges for garbage disposal. In fact suitable sites in areas of western Europe and the north-east USA are indeed becoming difficult to find at the prices the authorities are prepared to pay.

In most US cities household garbage is now streamed - sometimes by voluntary action, sometimes as a result of regulations. Such developments have taken place over a remarkably brief period, prior to which successful voluntary action would not have been considered possible and proposals for mandatory action carried considerable political risks. Streaming of garbage considerably facilitates recycling and to foster this there is, at the least, a strong case for governments employing moral suasion on their citizens. In attempting to extend this form of behaviour, regulators should be wary that its availability is limited. Increased calls for, in effect, altruistic action might result in a progressive reduction in compliance. Nonetheless greater care for the environment has engendered an increased willingness of a sufficiently large proportion of the public to spend energies in activities which they consider might reduce environmental deterioration. Streaming refuse into paper, plastics and so on adds to collection costs but this may be more than offset by allowing tip costs and the use of land for garbage disposal to be reduced together with providing commercial disposal of waste in a more usable form to buyers.

The relative costs of externalities in this area will vary from economy to economy. In Information Paper 14, the BRRU estimated that compunction designed to reduce public costs of disposal in the case of the most often targeted component of garbage, soft drink

and beer containers, generated societal costs far in excess of those sought to be combatted. It also noted that relatively low cost publicity, mainly industry (ie consumer) financed together with increased fines had contributed to a quite dramatic reduction - perhaps fourfold - in quantities of measured litter.

The Paper found that in Australia, the levying of a tax to encourage re-use of bottles and discourage use of disposable beer and soft drink containers could result in reductions of some 265,000 tonnes of garbage with a saving of at most \$14M. The costs of this in terms of increased production expenses and loss of consumer and manufacturer surplus was estimated at \$500M.

The system examined was that presently in operation in South Australia. Although alternative approaches involving mandatory or tax incentivised recycling (as opposed to re-use) would be less costly than this, any such forced attempts are likely to have a doubtful cost effectiveness. Australian garbage disposal costs even in Sydney, where these are highest, do not approach the sums involved in attempting to levy an indirect tax on consumers by forbidding (or punitively taxing) forms of waste other than those which have particularly undesirable characteristics and are easily traceable to specific sources (eg toxic waste). Compared to the average disposal cost of \$50 per tonne, the overall cost of reducing garbage through the container deposit legislation like that in operation in South Australia works out at some \$1,800 per tonne. The BRRU paper therefore argued against placing taxes on cans and one trip bottles, notwithstanding their relatively easy substitutability for re-usable bottles.

One aspect of garbage disposal of particular public concern regards sewerage. Sydney has suffered from well publicised deficiencies in its sewerage disposal system leading to fouling of beaches. It is difficult to envisage sewerage ever being other than a public good. Difficulties experienced on Sydney beaches appear to be more to do with insufficient investment in sewerage treatment capacity and in the length of sewerage pipes than with any intrinsic problem. After all the proportion of people in relation to the available ocean anywhere in Australia is dwarfed by these magnitudes in other countries.

Industrial and Commercial Garbage

The foregoing addresses domestic garbage disposal. In the case of commercial and industrial disposal, the solutions of levying cost related charges are more readily available

and indeed applied. Providing that such major point sources are not able to impose costs on others by avoiding use of disposal services, an acceptable outcome will be brought about. Establishing accurate costs and charges will allow choices to be made which conform to social welfare preferences as between discarding, reusing and conserving on waste generating purchases.

An issue brought to the fore in Rachel Carson's 'The Silent Spring' is pollution of the land by chemicals. F.L. Smith⁸⁵ traces the notorious case of the development known as Love Canal. Having manufactured at the site, Hooker chemicals went to considerable trouble to seal the residues of its chemicals in clay and concrete and refused to sell the property on which the residues were buried. The local township acquired it for a school under compulsory purchase over Hooker's protestations. Later, when pupil numbers fell off, they sold the land for a housing development, again despite Hooker's protestations. The developer used heavy machinery scooping away the chemical encasement in the process of constructing the estate and sewers were drilled through the previously sealed residues.

Naturally the chemical waste leaked out. The luckless Hooker was blamed and compensated households who felt obliged to move (in fact there has been no discernible increase in mortality or morbidity of the former residents).

The Love Canal case illustrates the issue involved in government failure rather than market failure. Indeed the fact that Hooker paid out compensation demonstrates weaknesses in liability law where, as appeared to be the case in this instance, government is able to avoid penalties for its own remissive actions and impose them on other parties.

Hazardous waste in the US is controlled under the Resource Conservation and Recovery Act (RCRA) of 1976 and the Comprehensive Environmental Responses, Compensation and Liability Act of 1980 (known as "Superfund"). The former of these aims to protect ground water by providing a cradle to grave tracking system for waste and a permit and standards system. Superfund is financed by a special tax on companies producing 42 chemicals and requires companies to clean up waste defined as hazardous.

Definition of hazardous waste has proven to be an enduring problem. Tens of thousands of waste sites have been identified, several hundred of which are nominated for priority

⁸⁵ Smith FL 'Superfund is a Hazardous Waste of Taxpayers' Money,' Human Events, August 1986

cleanup. The process of granting permits and undertaking control mechanisms progressed slowly. According to Penoyer⁸⁶, three years after the commencement of the process only 1,700 of the estimated 8,800 facilities had been granted interim permits; none had been denied; and nine new facilities had been authorized. Penoyer criticises the program on several grounds including the complexity of the arrangements, the lack of criteria of what constitutes "hazardous" and the lack of staff qualified to assess each facility.

Nonetheless in 1984 the program was extended. Facilities producing between 100 and 1000 kilograms of hazardous waste were brought within its ambit. Such facilities included school science labs and were estimated to amount to 130,000 small generators.

More importantly, the 1984 amendments virtually prohibited land fill disposal of hazardous waste. The only option to landfill is incineration, the costs of which are often tenfold those of landfill. Moreover, there is considerable difficulty in obtaining approval for incinerator sites especially with the prevailing "not-in-my-backyard" philosophy.

Water Pollution

Major Sources of Water Pollution

Only a minor part of water pollution is derived from industrial waste. For the US, Harrington⁸⁷ estimated the following sources of discharge:

Table 6

DISCHARGE OF CONVENTIONAL POLLUTANTS TO WATERWAYS BY SOURCE				
(Percent of Total Discharge)				
Biochemical Oxygen Demand	Total Suspended Solids	Total Dissolved Solids	Total Phosphorous	Total Nitrogen

⁸⁶ Penoyer RJ "Reforming Regulation of Hazardous Waste" Centre for the Study of American Business, Washington University, St Louis 1985

⁸⁷ Harrington W "Assessment of Nonpoint Source Pollution Control Policies" Resources For the Future", Washington DC 1984

<u>Point Sources</u>					
Municipal	18.0	0.1	1.7	2.9	7.9
Industrial	25.0	1.5	15.6	10.3	3.9
Subtotal	43.0	1.6	17.3	13.2	11.8
<u>Nonpoint Sources</u>					
Cropland	21.0	30.4	25.6	27.3	37.0
Urban	2.0	0.3	0.4	0.1	-
Other*	34.0	67.7	56.7	59.4	51.2
Subtotal	57.0	98.4	82.7	86.8	88.2
TOTAL	100.0	100.0	100.0	100.0	100.0

* Includes construction, mining, erosion, irrigation return flow, oil spills, unsewered household discharge, forestry, and livestock activities.

The largest separately identified source was from croplands, with industrial discharges accounting for between 25 per cent (for biochemical oxygen demand) and 1.5 per cent (for suspended solids).

Approaches to Major Point Sources

As with air pollution, the options are setting limits for pollutants, and requiring "Best Management Practices" for specific sorts of source, taxing polluters or establishing trading rights. Targeting major sources of water pollution is unlikely to offer a comparable range of improvements to those available to air pollution because of the preponderance of non-point discharges.

The preferred approach is to make use of market mechanisms. Tramontozzi⁸⁸ quotes estimates of expenditures at \$25B per annum in capital and operating costs to comply with the 1972 Amendments to the US Federal Water Pollution Control Act which was based upon application of Best Available Technology for individual plants and involved some 75,000 permits. Notwithstanding this, it is claimed that the outcome has been disappointing. He cites evidence that the removal of 90 per cent of toxic heavy metals

⁸⁸ Tramontozzi PN "Reforming Water Pollution Regulation" Centre for the Study of American Business, Washington University, St Louis 1985

exceeds the costs of removing an additional 5 per cent. Models using an effluent fee approach along a 30 mile stretch of the Black Warrior river demonstrated how trading could generate savings of about one third of the costs incurred with no loss of water purity. In that case, utilities and a coke producer would overperform and permit two chemical plants to underperform.

Recent work by Lukan, an EPA economist who regards himself as being on the environmentalist wing of the profession, has demonstrated the costly effects of misplaced regulation on paper mills. For the 65 mills where he was able to gather clear data, Lukan showed that federally mandated regulations had required over \$1B to be spent on measures to limit BOD pollution of the rivers they affected. Even applying the most extreme valuations over the increased purity which these measures had generated, Lukan concludes that net social welfare has been severely diminished by the programs.

A "rational" system of regulation might have concentrated on just some of the mills where the natural features of the waterway would not have sufficiently restored their oxygen within some miles of the waters being useful for recreational purposes. An even more "rational" approach would have focussed upon output measures rather than the engineering controls which in this program, as in others, are normally mandated. Certainly a regulatory approach applying the objective principles of sound administration could have been successful in achieving much more cost effective goals.

Some of these spillovers are capable of being internalised. British riverine rights have ensured that most rivers, in what is arguably the world's most heavily industrialised country, have low levels of pollution. The ownership of the rivers requires that upstream users usually must offer compensation to downstream users for any pollution. As the rivers themselves are valuable recreational property, the upstream users will take energetic steps to avoid the occurrence of harm from major pollution sources.

Similar procedures are possible to prevent pollution of aquifers, if their ownership can be vested collectively to those under whose land the waters flow. Damage to aquifers presents one of the potentially more intractable problems associated with waste disposal but again this cannot be said to be an uncontractable externality. Those having firm title in an aquifer would pursue those who reduced its value in the courts in the same way as a house owner would seek compensation from an underground mine owner where excavations impact upon the house's foundations.

Where this ownership approach is not possible, the alternative approaches in order of preference for emission control are:

- . establish tradeable rights
- . impose taxation incentives
- . apply command and control requirements.

Commonwealth Standards for Pulp Mills

The Commonwealth standards for new bleached kraft pulp mills are based on allowable emissions into the atmosphere and receiving waters. Atmospheric standards are set separately for the capacity of final discharge for recovery furnaces, other furnaces, rotary lime kilns, other lime kilns. Particulates have separate standards for the recovery furnace, lime kiln and power and boiler and sulphur from the recovery furnace and lime kiln. Other standards specify maximum atmospheric emission of sulphuric acid, hydrogen chloride, other chlorine and chlorine components and oxides of nitrogen.

Emission into receiving waters are specified for suspended solids, biochemical oxygen demand and organochlorines (in kg per day per air dried tonne of pulp) and absolute limits are specified for acute toxicity and dioxines.

For the most in part mills fall under State standards which, though also emission based, vary between each of the States.

Within the preferred control framework, although Australian standards have the merit of not specifying particular technologies, they have several disadvantages.

First, there is no provision for trading. There is not even scope for "netting" of emissions within a factory - overperforming say on particulates in furnaces and underperforming in kilns. If rights were to be established, older mills could more easily be replaced by mills with greater output or higher levels of productivity for the same level of pollutive residuals.

Secondly, some of the standards are set in terms of emissions per tonne of pulp whereas the important figures are the absolute level of emissions. It may make sense to reduce

output to enable the meeting of an acceptable level of pollution rather than to forego production entirely.

Thirdly, the standards are inflexible. The Commonwealth standards cover only bleached kraft pulp mills discharging into the ocean. Other standards will have to be developed for other sorts of pulp and paper mills. Clearly some waters have a greater capacity to dilute and absorb material than others. Rivers with leisure value are also worth differing amounts in relation to this attribute - the value being dependent upon accessibility, alternative venues and other matters.

In this latter respect, it is probably unwise to attempt to establish any form of national standards. Local standards allow those with the greatest stake to trade-off pollution for other features. Such trade-offs need not - indeed have not in Australia - led as is sometimes feared to competition for new mills driving down standards of residue controls. Over recent years the opposite has occurred as State governments, especially in Tasmania and Victoria, have steadily raised the levels of control they insist upon. Nor do uniform standards accord with efficiency. Just as it would be a needless and costly intervention to require remote areas to undertake equivalent treatment of sewerage from outflows to those located in close proximity to an urban area, so remote locations have a greater capacity to carry other forms of pollution compared to those close to built-up areas.

Non Point Sources

In American rivers, over one third of discharges of solids, dissolved solids, phosphorus and nitrogen are from croplands and a further large proportion from livestock activities. In Australia these figures are likely to be higher.

Where pollution results from excessive use of farm chemicals (and even more so where it stems from farm animals) the control problem are significantly increased. One rather obvious means of reducing this form of pollution is to cease subsidising fertilizer usage, as Australia has now done. Subsidies of this nature are difficult to justify in any event but once it is recognised that they not only distort production inputs but that their residual outputs also impose costs, the policy approach encompasses double jeopardy.

Should this be insufficient, there may be a case for further discouraging use of pollutive chemicals by imposing taxes upon them. Aside from the political anguish that such a

measure would engender, as it would not be possible to impose the tax on selected users, it would also impose needless costs on these producers whose activities were not contributing to cost imposing pollution.

Point sources of water pollution are much more susceptible to rational economic solutions than non-point sources because by definition they are measurable and monitorable. As previously discussed in the context of salinity, it might be possible to devise mechanisms for measuring river borne emissions from individual farms as a basis for developing market based approaches.

If the river were privately owned, this would allow trade offs of pollution for revenues so that adequate compensation for the lack of pure clear water could be obtained. The costs a river owner would attribute to pollution would have many dimensions

- some pollutants, like lack of oxygen in the water, correct themselves within several kilometres depending upon the speed the river flows and other factors
- some pollutants, eg nitrogen, are relatively harmless for some activities like swimming
- minor pollution is imperceptible: phosphorus, nitrogen, suspended solids are naturally present in all waters
- beyond a point, pollution is likely to be so severe that the river is "dead" and further pollution does not matter (except to the extent that the owner is liable for the health and safety of those living adjacent to the river, should he not own that area himself)
- the value of the river for leisure activities, fishing etc will vary according to its location, natural scenic properties and the existence of alternative venues
- there will be varying values of the use to which the river can be put for irrigation, power supply, drinking water, waste disposal, industrial inputs and so on.

In view of the plethora of different usages and the different valuations and prices which could be extracted, no two rivers would have identical purities. Just as any two pieces of land would never be used for identical purposes so no two rivers - or even two stretches of the same river - would see identical uses and identical prices charged.

It follows that any attempts to improve regulatory standards of a universal nature on river use are bound to generate inefficiency. Yet if rivers are publicly owned, we cannot be certain that their usages will be market rather than political (or, worse still, graft) based.

At best, some attempt to categorise rivers and possibly stretches of river for certain usages will allow some approach to the flexibility market systems offer.

If a maximum level of point sources pollution were to be set and the rights to this auctioned - or given to existing pollutees - more efficient outcomes would result than if each user were to be controlled. If each user were to be controlled, this is best achieved by output controls, perhaps, should low cost technology be available, by measuring net additions of pollutant from each farm.

Farm Pollution Controls

The OECD⁸⁹ has itemised the problems for the environment generated by agriculture as including

- human health effects from residues
- destruction of species
- contamination of ground and surface waters and eutrophication of surface waters from nitrates and phosphates
- air pollution from crop spraying
- salinization of soils and soil erosion
- losses of landscape and wildlife habitats

The OECD also notes the beneficial effects of agriculture, including food production and indeed the restructuring of former wilderness areas into landscapes which most people prefer and the drainage of wetland areas which also contributed to elimination of malaria.

⁸⁹ "Opportunities for Integration of Environmental and Agricultural Policies" OECD Env (88)10, Paris 1988

It recognises that government intervention has been at the root of many of the deficiencies generated in the course of the favourable developments in agriculture. In particular subsidies of fertilizer usage and product prices are seen as having led to land usage which would otherwise not have occurred, and have been employed for production which would not have generated externalities or not used as intensively as an income source to its own and others' detriment. Where such distortions cannot be removed, further countervailing intervention is favoured on the assumption that a wiser generation of politicians and bureaucrats will this time get it right. The approaches advocated include suasion and using price stimuli to arrive at more acceptable outcomes.

In the case of fertilizer application, evidence is available of over-use. Data is quoted from the US cornbelt to suggest that over half the nitrogenous fertilizer applied was not needed to achieve maximum profits and research in Sweden is cited as demonstrating similar findings. Land use regulations have been introduced in some countries, notably Denmark, where each farmer must prepare a fertilizer management plan and, to mitigate run-off, ensure that at least 65 per cent of his land is under green cover at autumn.

Taxes on fertilizer and pesticides have also been introduced, at 10 per cent in Sweden, with the revenue hypothecated to finance extension services. The OECD, on the basis of research conducted in Germany, considered such rates to be too low to have any marked effect; however the outcome, partly because of the publicity of adverse environmental effects from nitrate run-off, has been a considerable reduction in usage.

The land use regulations introduced in Denmark have in effect a major voluntary component since policing is not effective. Moreover as they apply to the total area of each farm in effect they employ "netting" - the farmer has scope to determine where the green areas will be located. Because of the form of command and control approach adopted, this is likely to have a more efficient outcome than a taxation based approach. Taxation of inputs has to apply to all sales to avoid arbitrage and farmers imposing no damage are needlessly penalized.

If an emission based regulatory approach is to be used, its "netting" element will be most effective in reducing costs the larger the area over which it applies. Larger farms are more likely to have the flexibility to find more cost effective ways of handling the imposition. If residuals are specified on a regional basis and trading can be arranged, the costs are likely to be still less onerous.

Pollution of Rivers and Groundwater in Australia

Reliable data on Australian river pollution is difficult to obtain. In Melbourne, the Yarra over recent years seems to have shown reduced levels of pollution largely as a result of more stringent controls on emissions. The controls have not made use of market principles but have been applied on a case-by-case basis.

For Australian groundwater contamination, Jacobson and Lau⁹⁰ trace a total of 106 incidents covering introduced impurities other than saline intrusion. Some of these go back 90 years. Those having a serious affect on water quality comprised the following:

Table 7

Serious Groundwater Pollution Occurrences in Australia

<u>Location</u>	<u>Date</u>	<u>Contaminant Type</u>	<u>Plume area(ha)</u>	<u>Remedial works</u>	<u>Current Monitoring</u>
Kwinana WA	1970	industrial	108	Yes	Yes
Australind WA	1983	industrial	32	Yes	Yes
Welshpool WA	1980	industrial	6	No	Yes
Thornlie WA	1957	agricultural	-	n.a.	n.a.
Far East SA	1900	agricultural	50,000	No	Yes
Millicent SA	1900	domestic	-	n.a.	n.a.
Allansford VIC	1964	Food Proc	150	No	No
Footscray VIC	1950	industrial	4,500	Yes	Yes
Sydenham VIC	1945	industrial	1	No	Yes
Laverton VIC	1967	industrial	40	No	Yes
Deer Park VIC	1965	industrial	700	No	Yes
Alphington VIC	1972	-	-	No	No
Captains Flat NSW	1962	mining	-	No	Yes
Ravenswood QLD	1985	mining	-	Yes	Yes
Perthville NSW	1980	sewage	2	Yes	Yes
Tinamba VIC	1978	sewage	-	n.a.	No
Rum Jungle NT	1954	mining	-	Yes	n.a.

⁹⁰ Jacobson E and Lau JR "Groundwater Contamination Incidents in Australia: An Initial Survey" Bureau of Mineral Resources, Geology and Geophysics, Report No 287 AGPS Canberra 1988)

Anna Bay NSW	1986	petroleum	1	No	No
Harrietville VIC	1900	sewage	-	n.a.	No
Narromine NSW	1986	leachate	-	No	Yes
Toowoomba QLD	1957	sewage	-	No	No

Whilst advocating the greater use of prevention methods, the authors note that Australian groundwater pollution is minor compared to the US where it is estimated that 1-2% of usable groundwater is polluted.

Major sources of pollution are more susceptible to the use of economic incentives than is the case with household garbage. If the community can determine an appropriate level of waste from major sources, systems for charging for that waste, and possibly allowing trading, can be devised. NSW has introduced bonds covering 100 companies which will be forfeited should the companies fail to reduce their pollution levels within an agreed time. The State Premier's environmental statement⁹¹ sees scope for both trading and netting. Companies are left to determine for themselves how to reduce their pollution and the financial penalties are designed to introduce the required incentives.

Providing the correct judgements are made on the balance of the costs and benefits of the lower levels of pollution, this approach is much more likely to yield a cost effective outcome than stipulating specific levels source by source. For major point sources, equipment to measure outputs of pollutants is readily available and indeed more accurate than controls on production procedures. However difficulties emerge where more than one site is involved and where the different sites have varying capacities for absorbing and diluting waste. In such situations, procedures for allowing netting and trading in situations may be excessively complicated.

Air Pollution

Use of the atmosphere, for long the classic case in the Pigovian tax approach, takes us further into territory for which ownership vesting is not a feasible solution to resolving the externality problem. Air pollution agents are manyfold. Those specifically targeted for control normally include particulates (smoke), ozone, sulphur dioxide, carbon and lead.

⁹¹ Greiner N " The New Environmentalism" NSW Government 22 April 1990

Reference has already been made to the fact that air pollution in cities pre-dates the industrial revolution. Over the years the problem in western countries has been successfully addressed. Thus in London in 1952 some 4000 deaths resulted from an extended period of air pollution. Today the air is much cleaner, notwithstanding much increased traffic and higher energy generation. Diseases associated with pollution like influenza, pneumonia and tuberculosis were responsible for about one quarter of deaths at the turn of the century and now account for less than five per cent in a population where life expectancy has increased by over a half. It might be said that the market for death is declining and the market share of pollution related causes falling! To be sure, much of the improvement stems from factors like improved medical treatment but to a major extent it is due to a cleaner urban environment.

Curiously, one of the patron saints of environmentalism, Paul Ehrlich, also takes the view that air pollution is a readily resolvable problem. Ehrlich's view might be conditioned by his ideological battles within the environmentalist movement in the course of which he has sought to propel population growth to an ascendancy which others have rejected. In his interview in *The Ecologist* in 1973⁹² he said: "from the point of view of an ecologist..... (air pollution is) one of the relatively trivial problems. It is amenable to rather rapid technological cure and is just a symptom of some of the things we're doing, rather than something ecologically serious." Of course, it could be argued that Ehrlich, who was forecasting widespread famine by the early 1980's as a result of Malthusian analyses of population growth, is somewhat discredited outside of a particularly bizarre wing of the environmental movement.

Air pollution levels in major Australian cities have generally shown an improvement over recent years. In Melbourne, sulphur dioxide levels have trended downwards and in 1988 were less than one third of the maximum acceptable peak levels. The chart below illustrates peak SO₂ and airborne particle trends for the industrial suburb of Footscray.

SOURCE: Environmental Protection Agency

⁹² Pole N "An Interview with Paul Ehrlich" *The Ecologist* Vol 3 No 1 Jan 1973 p18-24

Carbon monoxide levels have also trended down to magnitudes well within the maximum acceptable, although nitrogen dioxide levels have remained relatively close to their maxima and ozone levels are above those defined as acceptable.

Source EPA

The abatement of urban air pollution levels have been achieved by forms of regulation and continuation of such approaches to regulation seems to be inevitable. The questions largely turn on the nature of the regulation. It is useful to break air pollution into its three primary causes: automotive, household energy generation and industrial facilities. In each case the economist's solution would be to impose a tax or introduce tradeable rights. The decisions between these and outright regulation of inputs should depend upon policing costs.

Automotive and Households

In the case of motor vehicles, governments the world over have introduced standards and emission requirements, more recently for lead free petrol. Notwithstanding that in Australia, citizens of places like Albury Wodonga with little pollution would not obtain value from the increased capital and operating costs involved (the latter partly hidden by governmental requirement that lead free petrol be cross subsidised by leaded petrol) a general approach may be the rational solution.⁹³

The move to lead free petrol has contributed to a marked reduction in the level of lead in urban areas. Thus both in the centre of Melbourne (where it was previously at double the levels set as acceptable) and in the suburbs lead levels have exhibited a considerable decline.

⁹³ Interestingly however a survey about environmental concern conducted by the Australian Bureau of Statistics (cost 4115.0) listed concern about pollution as being highest in the two Australian regions, the Australian Capital Territory and the Northern Territory, where problems in this regard would be much less evident than elsewhere. This may reflect the preferences of people living in those two regions. It may also reflect a heightened awareness about environmental matters generally, a possibility which is perhaps corroborated by generally enhanced levels of concern registered about other environmental issues including nuclear, nature conservation, soil erosion, water salinity, etc.

Source EPA

Grenning⁹⁴ is critical of Australian mandatory emission control standards adopted in Australia Design Rule 37 (ADR 37) during 1986. He favours emission charges over the technical solutions introduced. Grenning maintains that the standards adopted were overkill because

- any problem which occurs is confined to Sydney and to a lesser degree Melbourne (which together on the widest interpretation might account for 30 per cent of the vehicle population)
- Pollution levels in these cities had began to decline anyway as a result of industry restructuring and relocation.

ADR 37 meant a cost per vehicle at 1985 prices of \$70-160 which is in addition to a slightly higher impost introduced by the previous standard. Important shortcomings of a standard like this are that they apply only to new vehicles - and perhaps therefore to only 12 percent of the annual stock. In addition, the increased cost (and reduced performance) creates disincentives to replace existing vehicles and therefore to some extent at least has perverse effects. Furthermore, achieving the targeted output of emissions by using a command and control approach is far from certain. It depends crucially upon the vehicles being properly maintained and is totally negated if owners disconnect the control mechanism.

Grenning favours a charge based on the outcome of emissions as measured at the annual vehicle test. Although making use of more direct and effective controls, this would also have shortcomings:

- the annual inspection is only a once per year measure and there will be ways discovered which would allow vehicles to demonstrate a short term measured acceptability in emissions
- it may entail greater costs if owners are required to have modifications undertaken retrospectively

⁹⁴ Grenning M. "Australian Motor Vehicle Emission Policy A Costly Mistake" CEDA Monograph No. 80 November 1985, Melbourne

- it entails some administrative costs and if cars can be registered in areas where these additional costs are not required there will be considerable incentives for evasion.

Leaving aside the issue of whether or not mitigation of emissions specified for Australia was necessary, it is therefore not clear that the command and control solution is inferior to the generally preferred output based solution in this particular case.

In the case of households, many locales have banned coal and wood burning, though the latter somewhat ironically has more recently shown an increase in popularity because it is thought to be more of a natural fuel. Prohibition would not be the preferred solution of most economists yet it may well be more efficient than imposing an easily evadable tax. As with garbage, it is not easy to see how contractual difficulties can be overcome to allow tradeable rights to operate in this source of air pollution.

Industrial

Industrial air pollution is more easily combatted by granting tradeable rights to pollute. Means of monitoring major sources of pollution are readily available and technology is accessible further to effect this. Hartley and Porter⁹⁵ draw attention to the application of deuterated methane, a chemical tracer which mimics SO₂ to detect sources of pollution in southern Utah.

Tietenberg⁹⁶ assembles eleven empirical studies of market based approaches to pollution control compared with the command and control approach.

Table 7				
EMPIRICAL STUDIES OF AIR POLLUTION CONTROL				
Study	Pollutants Covered	Geographic Area	CAC Benchmark	Ratio of CAC Cost to Least Cost

⁹⁵ Hartley P R and Porter M G " A Green Thumb for the Invisible Hand" Tasman Institute , Melbourne June 1990

⁹⁶ Tietenberg TH "Economic Instruments for Environmental Regulation" Oxford Review of Economic Policy, Vol. 6 No. 1 ,Spring 1990 p17-33.

Atkinson and Lewis	Particulates	St Louis	SIP regulations	6.00 ^a
Roach <i>et al.</i>	Sulphur dioxide	Four corners in Utah	SIP regulations Colorado, Arizona, and New Mexico	4.25
Hahn and Noll	Sulphates standards	Los Angeles	California emission	1.07
Krupnick	Nitrogen dioxide regulations	Baltimore	Proposed RACT	5.96 ^b
Seskin <i>et al.</i>	Nitrogen dioxide regulations	Baltimore	Proposed RACT	14.40 ^b
McGartland	Particulates	Baltimore	SIP regulations	4.18
Spofford	Sulphur Dioxide	Lower Delaware Valley	Uniform percentage regulations	1.78
	Particulates	Lower Delaware Valley	Uniform percentage regulations	22.00
Harrison	Airport noise	United States	Mandatory retrofit	1.72 ^c
Maloney and Yandle	Hydrocarbons	All domestic DuPont plants	Uniform percentage reduction	4.15 ^d
Palmer <i>et al.</i>	CFC emissions from non-aerosol applications	United States	Proposed emission standards	1.96

Notes:

CAC = command and control, the traditional regulatory approach.

SIP = state implementation plan.

RACT = reasonably available control technologies, a set of standards imposed on existing sources in non-attainment areas.

^a Based on a 40 µg/m³ at worst receptor.

^b Based on a short-term, one-hour average of 250 µg/m³.

^c Because it is a benefit-cost study instead of a cost-effectiveness study, the Harrison comparison of the command-and-control approach with the least-cost allocation involves different benefit levels. Specifically, the benefit levels associated with the least-cost allocation are only 82 per cent of those associated with the command-and-control allocation. To produce cost estimates based on more comparable benefits, as a first approximation the least-cost allocation was divided by 0.82 and the resulting number was compared with the command-and-control cost.

^d Based on 85 per cent reduction of emissions from all sources.

As Tietenberg points out the estimated savings are theoretical - they are gains achievable on the basis that sunk costs have not been incurred, perfect information is available and multilateral trades take place. Moreover, if emission credits are traded on a pollutant-by-pollutant basis rather than on an amalgam of pollutants, the trades themselves are rendered considerably more complex. Nonetheless the wide number of studies, each of which demonstrates considerable gains from applying market principles, present powerful evidence against command and control methods.

In recognition of the economies in allowing trading in pollution and mindful of the need for industrial competitiveness, US governments have allowed limited areas in which pollutants may be traded.

Hahn and Hester⁹⁷ explain how the EPA has allowed netting (trading within plants) since 1974, offsets (external trading) since 1976, bubbles (trading of different pollutants within a given aggregate limit) since 1981 and banking (allowing credits to be earned for over performance and subsequently used or traded). They estimate the effect of this 1979 through 1985 as follows:

Table 8

Estimated Effects of Emission Trading 1979-1985					
	Bubbles	Offsets	Netting	Banking	
Number	132		1000	8000	100

⁹⁷ Hahn RW and Hestor GL "The Market for Bads" Regulation 3/4 1987 p48-53

Cost Saving (\$M)	435		n.a.	4000
small				
Air quality impact	neutral	neutral	slightly negative	slightly positive

They consider the effects to have been less than satisfactory because of arrangements by environmental groups which have thwarted some proposals and because of uncertainty by firms. They attribute this latter effect to the need for EPA approval to be specifically granted and the discretion EPA has and is thought likely to use especially with regard to bankable emissions. Moreover since 1986 the EPA has insisted that bubble trades be "taxed" so that there is a net reduction in emissions of 20 per cent.

These problems notwithstanding, the notion of emission trading as a cost effective interventionary tool is gaining increased currency. Congress is presently (March 1990) debating a scheme which would allow the United States to be split into two areas with unlimited trading of SO₂ emissions permitted within each of them.(DN)

Aside from the issue of urban air pollution - one which largely involves health and unpleasant smells - there are issues of rural air pollution. In the main these involve maintaining a pristine air quality. Such issues have not assumed any importance in Australia to date and major industrial sources of air pollution facilities in areas of high natural value are most unlikely to be economically justified.

Rivers, Aquifers and Water Usages

The principles developed in the House of Lords judgement on Rylands vs Fletcher⁹⁸, where the mineowner's use of land led to the inadvertent flooding of his neighbour's mill, have been extended to encompass a range of externalities. Those principles, which require a neighbour to employ care and that in pursuit of his own interest no harm be done to the interests of others provides a sound basis for overcoming many externalities without government intervention.

Even so, there are considerable complexities where the cause of damage to resources emanates from the activities of many different landowners each rationally pursuing their

⁹⁸ LR 3 HL 330, 1868

own interests. Where ownership cannot be clarified and delineated, a role for government to intervene by employing specific incentives, taxes or production constraints will often be the best solution.

Commonly, water in streams is unowned. Frequently provision of water for irrigation is heavily subsidised and not transferable. This leads to over-use and inadequate conservation. Salinity of rivers, of which that of the Murray is most serious in Australia, is very much a by-product of excessive irrigation washing out salts in particular soils; this itself is attributable to the underpricing of water and its non-transferability between user.

Allowing ownership of rivers so that some usages could be forbidden or controlled would permit market mechanisms to direct waters to uses which offer the best return to society. Moreover, because the river owner would wish to see the asset's capacity to provide income retained for as long as possible prior to it running into the sea, there would be major incentives provided to prevent its value being undermined by salination. An owner would therefore take steps to avoid allowing the waters for extensive irrigation where that form of agriculture seriously devalued the river's worth to customers further downstream. He would of course be less concerned where the value the downstream customers placed on non saline waters was less than that placed on irrigation usage by those upstream. Ownership would therefore provide a mechanism by which the values placed on different uses could be balanced.

Similar vesting of ownership is possible in ground water. Oil companies have long employed a procedure, unitization, in which the common ownership of a reserve can be managed effectively to allow efficient development and avoid wasteful competitive exploitation. Such a form of private ownership of aquifers would also encourage those in which it is vested to take sufficiently energetic steps to combat any pollution of the resource which might take place.

Where such an approach is considered to be impracticable there remain a number of actions which governments might take to ameliorate any problems generated. These include ceasing to subsidise the provision of irrigation waters by introducing pricing systems which reflect the costs of providing the water. If rivers are to remain public property and excessive irrigation is seen to be the cause of salinity problems, an element of the price should reflect this. Higher priced irrigation water will both encourage farmers to economise on excessive usage and provide funding to facilitate steps to reduce the

quantity of salt absorbed by the river. It may also be possible to arrange for salinity measuring equipment to monitor waters as they pass through individual properties and impose charges which reflect the increased salt content of the waters.

The problems generated by lack of ownership of waterways are exacerbated by rights to use water often being non-transferable, "usufruct" rights which if not directly used by the farmer having access to them are lost to him. Clearly this creates incentives to use the resource as intensively as possible. Often a more sparing use of the waters, perhaps seeing them transported to other farmland, would see their salinity generating properties considerably reduced.

The Victorian government is introducing de facto ownership and transferability of private water rights, a long overdue reform which will do much to mitigate the salinity externality as well as allow valuable water resources to be used more productively. That government's proposals will grant municipalities and other users rights to specific amounts of water and allow banking and trading of these rights. The quantities vested are based upon the individual authority or user owning a share of a reservoir and its inflow.

In addition those having rights to the water will be able to trade them, thereby allowing a more economic utilization of the water and reducing the damage which maximum use of free water does in terms of increasing river salinity and imposing erosion costs downstream.

The measure proposed is not without its difficulties. Importantly, because the watercourse is vested in the crown, measures will be necessary to ensure that the statutory right to collect and use water on ones own land does not prejudice the flow of water through the system. Victoria has 170,000 farm dams and cumulatively they must have an affect on some rivers' aggregate flows. It is therefore intended that where overcommitment becomes apparent, an area would be declared a "conservation area" and new storage capacity would require approval, which is envisaged to be carefully examined where the storage is for irrigation purposes. It is also envisaged that the watercourses over which such authority extends will be considerably increased so downstream users will have rights to appeal along the lines of those previously enshrined in common law.

3. Activities with Remote and Incidental Impacts

Falling within this category is

- . oceanic pollution
- . degradation of wilderness
- . loss of species
- . upper atmospheric pollution (ozone depletion; carbon emissions)

Ocean Pollution

Ocean pollution has achieved considerable notoriety in recent years following the international conventions against dumping waste in sea and the major oil spill caused by Exxon Valdez. For the most part, oceans remain the most efficient means of disposing of unwanted by-products. This does not of course hold true where the oceans are enclosed, as was the case of the seas off Japan, the fish of which absorbed excessive quantities of dumped heavy metals causing 'Minimata disease'. Concerns are also registered about the absorption of these materials by predator fish like shark and swordfish and their progressively greater concentration moving up the food chain.

At some time, limits on open disposal at sea may be warranted and the above may be an early warning of dangers to be alert to. But for the present, most oceans have far greater cleansing and dilutary capacity than the soil and an ability to perform this function less injuriously to man than the atmosphere.

The capacity of ocean waters to clean waste has been demonstrated by many oil spills in the past and is presently being demonstrated even in the relatively enclosed Prince Edward Sound. The pollution residues from the Exxon Valdez will have vanished long before the litigation they have generated disappears, just as the millions of tonnes of oil pollution from World War II's carnage of tankers was absorbed within the oceans before we realised that they might pose a problem.

For the most part, at the present time oceanic activities remain the surest low cost means available to break down waste and render it harmless. While damage occurs when detritus and pollution is washed ashore, the open oceans themselves are too vast to be spoiled by it. Apart from within areas of great sensitivity, the economic case for taking action to prevent oceanic pollution is slender.

There is however clear evidence of an emotional reaction against oceanic pollution. Perhaps engendered by incidents like those resulting in Minimata disease, allegations that the North Sea's capacity to absorb waste (especially chemical waste) is exhausted and particular problems seen in areas of the Mediterranean, there is strong opposition to suggestions that the oceans remain an open access dump for mankind's refuse. That opposition appears to be motivated less about alarm for fishing and other income producing activities and more about the sorrowful plight of wildlife. It appears to have no economic dimension and is based purely on emotional attachments to creatures which hardly anyone will ever see, the continued existence of which is not in doubt - and even if it were, their absence would not be noticed.

Yet the wish to see the oceans unsullied and their features left intact seems to be powerful. In recognition of this, nations have signed treaties to restrict dumping at sea and Exxon has spent over \$1B in Prince Edward Sound.

As all things are of value only to the extent that people assign worth to them, the question is posed as to whether there is a shift occurring in the value placed on goods (at least among the population of richer countries) which transcends their tangible worth. Such shifts have occurred in the past especially with the built environment and indeed for "worthless" private goods like rare postage stamps and gold. Whether the oceans and other goods with environmental attributes are in the process of being revalued (or, rather, given a positive value) on a permanent basis is not clear. If they are, whatever the merits based on previous notions of usage, that changed value ought to be reflected in the price.

In his Presidential Address to the Southern Economic Association, Kerry Smith⁹⁹ suggests, if somewhat abashedly, that such a shift has occurred. He cites the Economist's analysis (2 September 1989) of New York Times/CBS polls from 1981 to 1989 of the people who agreed with the statement "protecting the environment is so important that requirements and standards cannot be too tight, and continuing environmental improvements must be made regardless of cost". Those agreeing with this statement increased from 40 per cent in 1981 to 80 per cent in 1989.

Although, as Kerry Smith recognises, positive answers to a statement like this are likely to reflect a general disposition rather than a true valuation involving sacrifices, sophisticated

⁹⁹ Kerry Smith V "Can We Measure the Economic Value of Environmental Amenities" Southern Economic Journal Vol 56 No 4 April 1990 p865-877

contingent valuation methods have the potential to develop more meaningful appraisals of worth. However if such valuations can be agreed upon, to introduce some method of charging would still require clearing the formidable obstacles found wherever property is unowned.

Wilderness Areas and Wildlife

The Value of Wilderness Areas and Wildlife

It is only in recent years that wilderness has come to be accepted by large bodies of the population as having any value. Economic textbooks even during the late 1960's generally saw wilderness as a valueless "unimproved resource".

Moreover, the concept of a wilderness remains elusive. It is doubtful that any area of the world, except possibly Antarctica, could be considered as pristine and undisturbed by man. Certainly in Australia, the Aborigines, their dogs and agricultural practices has left no area of the continent untouched. Furthermore, even in those areas not subject to serious disturbance following European settlement, exotic species of fauna, pigs, cats, rodents, buffaloes, as well as flora have had a marked effect both as predators and in outcompeting native species.

Areas which are relatively undisturbed, widespread exotic introductions notwithstanding, are clearly valued. That valuation takes many forms. Recreational value is the most obvious and, in principle, most susceptible to analysis to determine appropriate land use.

The actual price people as consumers pay to visit recreational parks, wilderness or otherwise, can be estimated from the expenditures they incur to travel there and, where appropriate, any fees involved. Computing a welfare value from this presents more difficulties. Some way of measuring the consumer surplus over and above the price paid is required together with a measure of the value of the next best alternative. In addition, many outdoor recreation areas are likely to suffer from congestion costs and the demand for their use is growing because of changing preferences and, providing real income levels increase, because they are income elastic. At least however a set of shadow market prices for this particular use can be developed.

Recreational value is not incompatible with many alternative uses and may indeed be enhanced where, for example, it shares infrastructure provided by other uses as is the case where mining or logging roads make an area more accessible. In some cases recreation value might be enhanced by development - indeed it is claimed that many tourists visit mine sites as part of the experience of enjoying the outback diversity. Developments like a dam will create an improved recreational facility of one sort while destroying that of another sort.

In addition to recreation, wilderness is however clearly valued highly by some who have no intention of ever visiting it. Such values represent two motives. First there is the vicarious consumption - the thing is valued simply because it is there. This would certainly be the case with Ayers Rock, the Kakadu National Park and many other relatively untouched areas. Secondly, it is valued as an option for the future. Things are valued because we feel our progeny will consider them of value or because we may (probably correctly) be aware that in opting for development now the loss of some opportunity might be regretted in the future.

A further consideration is the related issue of the positive externalities forests confer on the atmosphere - a matter of considerable importance in the greenhouse debate (which is addressed more fully in a later section). According to Repetto¹⁰⁰ the earth's forested area has declined by about 20 per cent from pre-agricultural times. Most of the loss has been in developed countries, although forest area in these countries has stabilized over the past 60 years. Tropical rainforest had suffered little loss, about 4-6 per cent, until recently however deforestation of developing countries appears to be accelerating. Forests still cover 40 per cent of the earth's land surface (eg cropland 12 per cent).

Policy Approaches to Preservation

Preservation of wilderness and less pristine areas of the national estate has become the great political football of our time. Government decisions on this matter - first subsidising the destruction of wilderness, then selling its riches at prices which barely cover costs, then withdrawing it from use - contain the indelible imprints of faulty decision-making by public institutions. Cost/benefit analysis might offer an improved basis for decision making but it too must inevitably operate within a political context.

¹⁰⁰ Repetto R and Gillis M eds "Public Policies and the Misuse of Forest Resources" Cambridge Univ Press 1988

The costs and uncertainties inherent in the decisions concerning the alternative uses to which the national estate might be employed cry out for a more stable, less contentious decision making framework.

The issues involved in publicly owned land are perennial. They encompass the cost effective stewardship of that land. The alternative uses - logging, mining, recreation, wilderness - of aspects of these are deemed by some to be always incompatible and there are clearly cases where the alternatives are unambiguously so. .

In addition there is the value of wilderness as a system to preserve genetic diversity - something of value both in itself and as a means of offering future benefits the need for which we may not yet be aware and the unlocking of which we may not yet be capable.

The public choice solution of allocating unowned land or wilderness by gift or auction to specific owners does not seem to appeal, especially to those who seek to pre-empt its use from any income earning activity. In the absence of a clear allocation and transfer, preferably de jure, decisions on usage will oscillate with the political winds. Lack of secure ownership will also mean an incentive for those with temporary rights to expend, in the course of their income earning activities, insufficient energies to ensure preservation. Only where land tenure includes vesting of full responsibility for its alternative uses and incomes which might be earned from it can we be confident that it will be efficiently managed. With individual or corporate ownership, the alternatives will be subjected to the test of how much income and other benefits the owners can obtain for different uses. The alternative bids for that usage will allow an allocation which best meets the community's preferences given the level and distribution of its income.

Contingent valuation might have a use in this respect. It might be possible to determine the value the community places on these lands and measure this against the value of the lands for economic activities which degrade their recreational, existence and option values. Some means of apportioning the land could then be devised so that some of it is sold for commercial uses and some allocated (possibly free) to institutions, like the Wilderness Society which would be expected to preserve it. In that way the owners could manage their lands for the uses which they considered most appropriate.

Such ownership would not preclude multiple usage. Just as there are many examples of logging and recreation coexisting in public forest so this might be expected to continue on land where ownership is vested. In the United States there are many examples of lands, even those containing rare species of wild life, being owned by private environmental bodies and also used, under carefully controlled conditions, for mining. The environmental body owning the land has the responsibility of preserving it using voluntary subscriptions together with commercial means. As an owner, that body is confronted with choices in the use of its endowment and might trade off minor encroachment in one area to finance inviolability in another. At the very least it no longer has the option of lobbying for "free" use of national income to preserve its own preferred form of welfare.

This is not to say that we should be indifferent to whom the property is given. All people have different preferences, different notions of what constitutes income in the widest sense of the term. Offering the land to a group who place a higher value on environmental goods is likely to see a different use of the land being resolved than if it were to be offered, say, to the poor who may place a higher priority upon other forms of income.

It has already been acknowledged that large scale proposals to privatise state owned lands have not fared well. In the US Western States, proposals to partition the national estate (which comprises about half of the land in those States) fizzled out¹⁰¹. Environmentalists preferred to continue using the public purse to finance their preferred land use, while ranchers and loggers considered they had gradually acquired proprietorial rights to the lands they were using (and for which they paid very low rents) and preferred the status quo.

In Australia however solutions like this have in effect already been introduced for Aboriginal land. The indigenous owners already contract out for commercial uses (especially tourism and mining) the land to which they have title, thereby trading off the value of income against the intrinsic value of undisturbed lands.

In addition, secure vesting offers opportunities for strategic purchases by private agencies which can pressure owners of major blocks to encumber their previously intended use. The strategy whereby property owners "hold out" for special deals when they know that a major development encompassing the acquisition of many property titles is involved can

¹⁰¹ Nelson R H "Why the Sagebrush Revolt Burned Out" Regulation May/June 1984 p27-35 and July/August 1984 p20-47

be combatted by various counter strategies. These include secrecy and devising alternative options to circumvent it. In turn some environmental organisations, notably America's Nature Conservancy, make use of purchases of strategic parcels of land in areas of particular environmental interest to bargain with developers for a land usage more compatible with the preservation of valued environmental features than was intended. This represents a case of countervailing interests achieving compromises without seeking the intercession of government.

The foregoing should not be taken as dismissing the possibilities of private landowners taking energetic steps to preserve and restore wilderness areas under their direct control. In the eastern and southern US states the International Paper (IP) company profitably manages its extensive holdings (1.65 million acres) both for tree harvesting and as a wildlife reserve¹⁰². The opportunity to undertake such ventures in those areas of the US which, like Australia, are under public ownership and have free or below cost access is more limited. Nonetheless, examples are available of private environmental parks. In South Australia a large landowner, Mr. Tom Brinkworth, has established several areas of wetland in association with other local property owners. These are financed by charges (\$20 per gun) for private duck shoots. Revenues are paid into a "Wetland Trust" to enhance existing wetlands and create others¹⁰³.

Rather more ambitious is a \$15 million venture being planned by Mr. Barry Cohen, the former Minister for the Environment. Mr. Cohen intends to open an environment park on 170 acres of native bushland at the Hawkesbury River and on the central highway. The plan is to have a sanctuary for animals, giant aviaries to allow free flying birds, an artificial wetland and enclosures for some animals like koalas and possums and for some reptiles. The project is to be financed by a charge of \$12-14 per head and by a kiosk and craft section.

Moving From Common to Private Ownership

As well as the practical difficulties of privatising public land, there is a key matter of principle. It will be recalled that in Chapter 2, the discussion of externalities referred to

¹⁰² see Tasman Economic Research, Submission to the Resources Assessment Commission's Inquiry into Options for the use of Australia's Forests and Timber Resources, Tasman Institute, Melbourne May 1990

¹⁰³ Information from Mr. David Hawker MP

readjustments in rental value when a windfall gain was made (eg a shopping plaza's unpriced parking lot from which adjacent shops also benefit) or as a result of a loss (eg sparks igniting a farmer's field). Such readjustments still mean an unwarranted net gain or loss has been incurred by the landowners.

By the same token, if privatisation changes previously unrestricted access to parkland or wilderness, adjacent landowners might expect to see the value of their property decline. A private owner of a previously public property would try to obtain the value others would be prepared to pay for use of its services. For adjacent landowners this means features of their property previously absorbed within its value are removed. For example access may be charged for. Indeed the new private landowner might seek to obtain recompense for the view as well as access, although resolution of this sort of clash of rights is relatively well traversed within the common law (and often regulated in cities by zoning ordinances which draw from legal precedent).

The fact remains that privatising a previously commonly owned property will lead to a readjustment of land values and constitute precisely the sort of arbitrary change which government should avoid if the community is to harvest the full fruits of secure property rights. In decisions on this matter we confront the tensions between constitutional rights to the full enjoyment of property and a vesting of open access rights which may be expected to bring about more efficient utilisation. Those who would opt for reallocation into private hands of unowned or communally owned property will acknowledge cases where this is seen as being too great a disruption of existing rights attached to adjacent properties; determining when this might be the case requires a political decision with all the rent-seeking and lobbying inefficiencies this entails.

Australian Forests

The National Association of Forest Industries (NAFI) has classified different uses of Australian forest. The allocation made by NAFI is subject to challenge by environmentalist groups but presents a useful basis for analysis and the following table is derived from it.

Table 9

	<u>Million Hectares</u>	<u>Comments</u>
Total Native Forest	35.3	
- Private	10.3	Open to logging but with restrictions in Vic and Tasmania on forestry practices
- Public	25.6	
. Parks	5.0	No logging
. Vacant or leased	7.6	Mainly poor quality but some logging
. Reserved	5.8	No systematic logging generally permitted
. Logging Forests	7.3	Managed on a sustainable yield basis
Private Plantations	0.3	Logging forests
Public Plantations	0.6	Logging forests

On this classification, the total forested area comprises some 7 per cent of Australia's land area.

Removal of Australian forests has been much more extensive than has occurred in most other developed economies. In the 200 years since European settlement, it is estimated that almost 60 per cent of the former cover has disappeared. In the main, this was a result of land clearing and often followed government subsidies or requirements to undertake such activity. In addition, selective logging up until recent years had reduced the quality of the forests. Previously, forest regeneration had occurred as a result of natural or Aboriginal fires which allowed a fresh start. Where selective logging - for example of Cypress Pine - took place, canopy cover remained and the previous stands of Cypress were replaced by eucalypt. The original forests were therefore degraded.

More modern methods involve clear felling which more closely resembles the natural affects of fire, although the loss of visual and other amenities following the felling is resented.

Ensuring an Adequate Public Return from Forestry Activities

Issues for forest management are:

- what amount, if any, should be reserved from logging
- what is the most efficient means of managing the forests.

The loggers and green activists are bitterly opposed to each other on the first question. Loggers claim that only 30 per cent is open to them and this area is harvested on average only every 30 years. Green activists claim up to 80 per cent of the forest area is unprotected from logging.

It would seem that some resolution of what areas are available for economic use must be determined upon. The most rigorous solution involves requiring each use to satisfy market needs, the most direct measure of which is the revenue derived from it. This would involve total sale of all lands with the ultimate owners determining the use largely on the basis of what revenues might be expected.

It is unlikely that this would lead to the eradication of national parks as we presently know them or even of wilderness areas. If, as is confidently expressed, there is a genuine and growing demand for the outputs of such facilities, many landowners would see merit in preserving and protecting them and deriving revenues from access charges.

Such a solution would be considered by many parties to be too risky, at the very least. It might indeed fail to take adequate account of options and existence values which have recently appeared as concepts in the overall evaluation system. In addition there is the need to preserve flora and fauna.

That being the case, contingent valuation methods might be employed to determine the true worth of forested areas under various forms of land use title. The value that the community places on successive increments of land being reserved from any activity, except tourism, could be ascertained (and some land might need to be reserved even from

tourism). If a sufficiently sophisticated means of surveying can be devised, that value can be further determined so that value of gradations of use could be established.

Set against this valuation for purposes like recreational, existence and animal refuge would be the value of the land for logging, or indeed other uses which might be claimed to have an even more severe impact upon its value.

The value placed on the land for other than direct economic usage could offer a guide as to the quantity and nature of land reserved. Title to the reserved land with an annual grant (which together would be consistent with the value the community places on its reservation) could be given to responsible environmental bodies so that they might manage it as they see fit.

For the remainder, the land could be auctioned so that commercial (or environmental bodies) might use it. In both cases merit is likely to be seen in multiple usage - for example tourism combined with logging.

Whether or not this sort of solution finds favour, the present uncertainty over protected areas is likely to have an adverse effect both on the economic use of forests themselves and in their efficient management. It is, for example, claimed that in the East Gippsland area of Victoria a major victory of conservationists in halving the timber output of the region by doubling the area of national park was followed less than two years later, in January 1990, by a further area of considerable size being reserved from logging. Faced with uncertainties over title, loggers are likely to have slight regard for the sustainability of the yield. And whilst policing by the authorities might prevent damaging forms of harvesting, such policing is expensive and certainly less effective than self policing which firm title ensures.

Public Ownership Charging

Unlike the US system, loggers seeking access to many Australian forests compete for contracts. It is claimed however that auctioning even where it takes place is restricted. Even so, the royalties ("stumpage") charged contributes income of the forestry commissions which more than offsets their costs. In NSW, for example, the Forestry Commission's 1987/88 income was \$63M and its expenditure \$50M. There are perennial

questions about the appropriate price to be paid and it would seem that at least until recently, inadequate charges were made for the use of public forests.¹⁰⁴

This raises the further issue concerning efficiency - namely the management of the public lands which are open to logging. Although forestry commissions profit from stumpage, resources they use deplete most of the revenues which would otherwise accrue to the public purse. Sale of lands - possibly with the title encumbered to ensure replanting as presently occurs with private Victorian and Tasmanian native forests - could save considerable administrative and policing costs for the community. The alternative of auctioning freely the rights to log offers some efficiencies over the granting rights to take selected logs but suffers from the disadvantage that contestability of incumbent mills is attenuated.

Wildlife Preservation

Wildlife is likely to be among the attractions of wilderness areas. In addition to its value in these regards however, species diversity has a major and very tangible role in disease eradication and improving the yields of food sources.

Worldwide, there are thought to be about five million separate species of plant and animal life. The environmentalist, Norman Myers¹⁰⁵ estimated that about 1000 species per year were becoming extinct although the methodology used in arriving at that estimate is likely to overstate the true magnitude¹⁰⁶. Even so, in North America some 500 species are known to have become extinct during the last 500 years compared to only 100 during the 3000 years of the last Ice Age. However the species that have disappeared have largely been those in previously isolated ecosystems - over 80 per cent of North American extinctions have been in Hawaii or the Southwest desert region. Moreover, Puerto Rico, where 90 per cent of the forest was destroyed then allowed to recover (again with virtually no loss of species), demonstrates the resiliency of natural areas.

¹⁰⁴ see Industry Commission etc.

¹⁰⁵ Mayer N "The Exhausted Earth" Foreign Policy No 42 Spring 1981 p141-155

¹⁰⁶ see Harrington W and Fisher AC "Endangered Species" in "Natural Resource Policy" Ed Portnoy PR. John Hopkins, Baltimore 1982

According to information assembled by the Resources Assessment Commission¹⁰⁷, Australia supports about 18,000 vascular plants and about 36,000 non-vascular plants (mosses, lichen, etc). At least fifty are presumed extinct and 150 threatened. Of the 200 species of mammals known to be present 200 years ago 17 are presumed extinct; one of the 730 species of bird is also presumed extinct. Invertebrates are poorly understood but some 108,000 species are thought to be in existence.

While the loss of any species is likely to be a matter of concern, given Australia's previous isolation, native species' lack of defences against introduced species, together with the absence of any preservation policy until recent years, Australia's loss has not been great. It certainly compares favourably with the equally isolated areas of the south east United States and Hawaii.

Mankind cultivates about 150 species of plant (with wheat, corn and rice accounting for half of the output). However in addition to these plants other varieties have immense value as medicines and for hybridisation.

About half of all drugs contain substances derived from living matter and in many cases the substance is unique to one species. The armadillo is the only creature, except man, known to contract leprosy and was therefore of major value for growing the bacillus before it could be synthesized. Certain species of crustaceans might prove equally useful in developing cures for cancers. The dangers of species becoming extinct is that they cannot be subsequently revived. Their genetic make-up, uses for which have not yet been discovered, is irretrievably lost.

Similarly, many wild varieties of cultivated crops have in the past proven to have immense value in the creation of hybrids. The resistance of cultivated strains to disease tends to atrophy and their genetic material needs to be reinvigorated - plasma from a wild variety of peanut found in the Amazon has been used to counteract the vulnerability of cultivated varieties to disease and saved an estimated \$500m. There are prospects of crossing corn with perennial wild varieties saving perhaps \$20B worldwide in planting costs. America's durum wheat was largely wiped out in the early 1950's by stem rust whilst European vines in the nineteenth century were decimated by phyloxera - in both cases the introduction of exotic strains enabled restoration.

¹⁰⁷ Resources Assessment Commission "Australia's Forest and Timber Resources" Background Paper March 1990

The market cannot place an appropriate value on these medical and food uses of endangered species since, because they are unowned, any value from them cannot be internalized. Unlike man-made varieties, nobody can own the genetic stock of naturally endowed plants and animals. Any findings of value will automatically be widely available. Even plants like rubber and coffee which originated in one country were rapidly cultivated elsewhere notwithstanding energetic steps to maintain proprietary rights.

All this said, these utilitarian bases for preserving species are quite slender. To be sure species have in the past provided keys to unlocking technology of direct benefit to mankind but these have been a tiny minority. And in any event pharmaceutical companies' R and D activity is placing decreasing priority on searching for solutions through examining wildlife and correspondingly more on laboratory work, which is cheaper to undertake.

The prime motive in species' preservation, like that of oceanic preservation has to be because the continued existence of the flora and fauna is valued for itself.

The response to threats to genetic diversity has been the 1975 signing of the Convention on International Trade in Endangered Species (CITES). This has allowed lists to be established of species which may not be traded. This response is related to earlier movements for the protection of animals from slaughter, movements related to the foundation of the forerunner of the Royal Society for the Prevention of Cruelty to Animals founded in 1824. Particular focus of the Society was on killing of birds and its Indian branch was behind perhaps the earliest laws against international wildlife traffic, the banning of exports from India of bird skins and feathers in 1902.

CITES has not been successful in preventing the taking of many highly prized species like elephant and rhino. In these cases and others, where the product of the wildlife is highly valued at the present time, institutionalized protection by banning the taking and export is a misplaced policy.

According to Myers¹⁰⁸, "for much of emergent Africa the only long term hope for the big mammals of the savannahs depends in part on a radical new line of thought : you either use the wildlife or lose it".

¹⁰⁸ Myers N "A Farewell to Africa" *International Wildlife*, Nov/Dec 1981, p36

Vesting of property rights to wild herds of species in particular areas makes use of the potency of individual property in preserving things of commercial value. Even for highly migratory animals property rights vesting can allow control to be exercised. British trout rivers and Australia's usage of individually transferable quotas for the Southern Bluefin Tuna demonstrate the effectiveness of property rights both as a mechanism to allow a balance between taking and preservation on a sustainable yield basis and to permit considerable economies in public policing costs. Some similar mechanism must surely be feasible for Australian parrots and be therefore both more effective and allow higher incomes to be earned than the present blanket ban on exports. Such a ban that leads to excessive taking (the poacher has no interest in preservation since he cannot benefit from it) and excessive loss of the product due to the clandestine methods of transport which smugglers must use.

Examples of externalities being internalised have been identified and researched in the preservation of wildlife. Traditionally in Europe private land ownership had enabled deer, boar and bears to survive as fugitive animals to be hunted. More recently, allowing private ownership of wild elephant herds in Africa has had dramatic effects quite contrary to those experienced in publicly owned game reserves. Simmons and Kreuter¹⁰⁹ detail the different experiences of contrasting property regimes on elephant herds. Kenya, where the national parks are owned by the government, has seen its elephant herds depleted by poachers and encroaching peasants over many decades. Between 1979 and 1989 the country's elephant population fell from 65,000 to 19,000. This is in spite of trade in elephant products being banned and poachers facing the most severe punishment. By contrast in Zimbabwe and Botswana, where elephant hunting is permitted and peasant villages have forms of property rights to the elephant and allow hunting and sale of products, numbers have risen. Over the 1979 to 1989 period Zimbabwe's herd grew from 30,000 to 43,000 and Botswana's from 20,000 to 51,000.

In this particular case the reaction of the world community to the plight of the elephant seems to be misjudged. Rather than encouraging preservation approaches which have enjoyed such spectacular success in southern Africa, the response to Kenya's problem has been for developed countries to ban elephant product imports. This means that the value of these products is markedly reduced and correspondingly less incentive to hunt wild

¹⁰⁹ Simmons RT and Kreuter UP "Herd Mentalities" Policy Review, p46-49 Fall 1989

elephants is introduced. It does little to discourage the encroachment by peasants of land used by elephants in Kenya. Moreover it vastly devalues the worth of southern Africa's protected and harvested resource - income producing assets are at a stroke transformed into pests which trample crops to the detriment of peasants' income earning potential. The outcome will almost certainly be contrary to the intentions of the sponsors of the ban. Unless the approach is reversed the herds in southern Africa will, like those in eastern Africa, become endangered.

Privatising control over an asset, whether it be land, wildlife or housing generates considerable incentives for its preservation. Just as mediaeval European princes went to great lengths to prevent their wildlife from being poached, self-policing of this nature can be demonstrated to be considerably more effective in African game parks than public ownership provided there are adequate incentives to allow income to be earned or utility to be enjoyed equivalent to that of alternative uses of the resource.

This is clearly the case with the African elephant, just as it was the case for deer with mediaeval princes (and even recently dethroned East European autocrats) given their relative preferences for income and leisure.

The issue becomes more problematical where the wildlife or wilderness land competes with other uses for which it is incompatible. Africa's growing population and need for crop and rangeland make it barely conceivable that wildlife numbers could continue at the level of their previous eras. African gazelles compete with cattle for fodder; elephants do likewise and in the process trample crops; lions prey on native cattle. Although European settlement in Australia brought increased numbers of native animals, as a result of the introduction of more productive grasses, this rather felicitous outcome is unlikely to occur in lands which were not isolated

For species of known commercial value, a Coasian solution would see an individual acquiring rights to the taking of parrots over a particular area. Having such rights in perpetuity (which may be coterminous to the rights of farmers in the area) he would take steps to ensure the birds' survival. This may involve coming to arrangements with landowners to prevent them shooting birds and to ensure the maintenance of critical habitats both in the areas where they are harvested and over areas which they migrate.

Goldstein uses the contrasting outcomes of puffin colonies' survival in Iceland to demonstrate the effectiveness of property rights. In these communities where the birds are effectively privately owned, careful husbandry is practical and flocks are flourishing. In those areas where annual permits are granted and hunters have no long run claim, colonies have declined.

He also points to limitations of property rights approaches. Where there is a decline in demand - as in the case of Iceland's privately vested eider birds - other uses of the land will tend to make preservation less valuable. Moreover the competition for land in Iceland is much less pressing than in the tropics and he is sceptical of the success of PNG's crocodile farms for this reason.

Goldstein laments "It is not noble to consider and engage in the exploitation of the earth's species in order to create conditions under which they are valued enough to be preserved. (However) in the light of the precarious status of numerous species, it would be even less honourable to avoid consideration of commercialisation because of its offensive nature"¹¹⁰

Although a property rights approach might be applicable for certain species, it is much less easy to envisage such solutions to ensuring the continuation of species for which no value is presently envisaged. Some such species we want to eradicate or at least to maintain only under the most controlled circumstances. Thus the armadillo's usefulness for investigating leprosy is a means to an end of exterminating the organism responsible for the 34,000 annual cases of the disease. Few would wish to see the malaria bearing tsetse fly preserved in any great number.

The option for preservation in these cases are in situ or ex situ preservation. Zoos and wildlife parks are major ways of ensuring ex situ preservation of animals. The International Board of Plant Genetic Resources has stored about one million species of plant. Neither of these methods is fully satisfactory. The species kept under such conditions do not evolve alongside their natural predators; moreover the keeping of genotypes of such species is totally impracticable.

Refugia - lands set aside - especially those with an abundance of species, offer a better, though much more expensive solution. The more important of such areas are found in the

¹¹⁰ Goldstein JH "The Prospect for Using Market Incentives for Conservation of Biological Diversity"
Paper to Workshop on Conservation of Genetic Resources, Lake Wilderness, Washington June 1985

tropics. Some tropical developing countries, notably Brazil and Indonesia have already set aside large areas of land as refugia.

Well endowed environmental bodies in the west have likewise bought large tracts as land in tropical countries as refugia. This application of property rights to ensure conservation.

Hence, it is not always possible to marshal the power of markets by allowing ownership of and trading in endangered species whereby owners standing to profit from the trade will ensure their protection.

Where ownership is not possible, bans on taking may be the only recourse but, where the species' activities conflict with farming and where its appeal as a tourist sight is slender, its future existence is likely to be precarious. Moreover, where absolute bans are placed on activities which harm endangered species, it is likely that previously unknown species will be discovered when major developments are in prospect. Such discoveries will present extremely difficult political decisions - as has occurred in the US case of the Tenneco Dam and the previously unknown dart minnow. As the Australian Government has recognised in the aftermath of the Wesley Vale proposal, some general rules are essential to avoid rhetoric taking over from considered analysis.

In spite of competing demands, increased tourist accessibility means acceptable equilibria can be developed for a great many species of fauna and flora, equilibria which are best ensured by defining and protecting private property rights so that the externalities are internalised.

This is of course not the case with flora and fauna which has no obvious commercial or commercially related use. Nor is it the case for example with many migratory species around which boundaries cannot readily be drawn and ownership defined in some way. These same issues arise with the negative externality of pollution wherein sources cannot always be identified, property rights are unclear and contractual difficulties are presented by diverse populations of pollutees.

It is argued that, because of inevitable free-rider problems, the protection which private markets are able to confer upon beasts like the elephant, the bison or the elk is insufficient for the value these animals generate. The externality benefits of existence value can

probably never be properly captured but we live with a great many such externalities. The ultimate value, the only yardstick of real merit, is the price people would be prepared to pay for preservation of these goods if they were fully informed about the choices confronting them.

Part of the problem of assigning values is the free access which is made available by publicly owned wilderness areas. The lack for the most part of an entry price into these areas means that, first inadequate revenues are gathered to ensure their protection and secondly no mechanism is in place to allow rationing and mitigate congestion.

There are however three other classes of wild animal for which the market solution is far more problematical. These comprise first, wildlife which is not valued in the sense that nobody would pay to see it; secondly wildlife which has a negative value - the brucellosis organism or tsetse fly for example; and thirdly the wildlife that is undiscovered or at least undocumented.

These other creatures are valued less by man and action to ensure their preservation can therefore be said to be worth less. Some have unknown value for their medical and research properties. Others have value to which people willingly and voluntarily pay to preserve through subscribing to organisations like the Wilderness Society which allocate funds for particular causes on behalf of the subscribers.

A mature stable state never existed even before the onset of man. Species die and mutate; new species evolve. As Clawson¹¹¹ says, it is by no mean certain that 400 year old Douglas Firs represent maturity because the hemlock growing in the undergrowth may take over. That said, mankind undoubtedly has vastly accelerated any previous rates of changes. Brundtland¹¹² offers the estimate that species previously became extinct at the rate of about 0.9 per year and suggests "the present human-caused rate is hundreds of times higher, and could even be thousands of times higher".

For many creatures, wildlife refugia present the most promising approach to ensure their continued existence. Such areas also allow species to evolve since their natural predators are present.

¹¹¹ Clawson M "Economics of National Forest Management" RFF Washington 1976

¹¹² Brundtland Report "Our Common Future" World Commission on Environment and Development, Oxford Univ. Press, Oxford, 1987

It must always be recognised that not all things are worth preserving. Some 99 per cent of all the creatures which have ever existed are now extinct and only a tiny proportion of these extinctions are due to mankind. If we wish to reduce the impact our own activities have on some natural rate of extinction, markets and voluntary action offer useful approaches. By substituting compulsion for willingness governmental intercession will often serve to frustrate the effectiveness of markets, and in the process reduce the effectiveness of the search for innovation solutions to preservation.

The Upper Atmosphere

Global Atmospheric Degradation

The United Nations Environment Program's Intergovernmental Panel on Climate Change¹¹³ estimates that emission of greenhouse gases will lead to a global warming of 0.3°C per decade up to the year 2100, under its "business as usual" scenario. The anthropogenetically caused gases are mainly CO₂ (60 per cent) and CFC's and methanes (26 per cent). Since pre industrial times, atmospheric CO₂ has increased by 26 per cent and atmospheric methanes and CFC's have increased markedly from negligible levels.

Accompanying the increase in temperature, there is an estimated increase in sea level by 6cm per decade. Many uncertainties surround these forecasts. Importantly, CSIRO¹¹⁴ has criticised the theoretical constructs used by the IPC (specifically the Box Diffusion Model) and reiterated the importance of the unknown variables in the IPC report. These variables include

- cloud behaviour
- the behaviour of the oceans
- the sources of the emissions and importance of sinks
- polar ice sheets.

Scientific observation has not demonstrated the existence of the greenhouse effect. Temperature increases, though occurring, have been less than predicted and the rise in the

¹¹³ United Nations Environment Program (UNEP) Intergovernmental panel on Climate Change (IPCC)DITTO, Working Group 1 June 1990.

¹¹⁴ Source Angus McEwan, Chief, Division of Oceanography.

ocean levels, at less than 2cm per decade has only been one third the model's central predictions.

Should greenhouse be occurring, there will be increased global precipitation and "enhanced levels of carbon dioxides may increase productivity and efficiency of water use of vegetation" (IPCC p2). Some species may not be able to adapt or migrate. Changes in the incidence of tropical storms cannot be determined whilst mid-latitude storms might tend to diminish.

Aside from the continuing uncertainty about the existence of the Greenhouse effect, a major issue which has largely been assumed away is whether it would be appropriate to attempt its arrest. It is of course unfashionable to view man's effects on the environment as being anything other than harmful. Yet the preponderance of the changes we have made have been beneficial - at least to ourselves. And whilst it is true that net benefit has rarely occurred where the changes have been unintentional, such outcomes would not be totally unknown. To what degree, for example, is the world's fish stock increased as a result of the expansion of ocean nutrients which man's presence has brought about? The much beloved countryside in Western Europe was largely created by man cutting down forest for agriculture and in until the eighteenth century to manufacture charcoal.

In the case of a greenhouse effect, the greater precipitation and higher levels of carbon dioxide would in net terms allow higher levels of food production. Almost certainly, these benefits would be sufficient to offset the deleterious effects of climate change in some areas and the inundation of certain islands.

The earth is a closed system. All material created has been due to the fusion of certain elements. The soils, minerals, atmosphere and oceans were either always present or have been created by "natural" forces of sunlight. In many respects, the energy minerals we use and expel into the oceans and atmosphere represent the "banked" energy created from solar radiation over the millenia.

In "banking" those energy sources, the planet has at the same time changed its nature and created the conditions under which living creatures today can thrive. Withdrawing these resources must therefore have some effect on those conditions. Withdrawing and replacing other minerals will not affect the life forms on the planet. Withdrawing natural vegetation and replacing it by other forms will have a variable effect. Replacing wild

savannahs by croplands is likely to enhance the earth's biosphere - or rather make it more benign for mankind since the grasses replaced make a more fruitful use of solar radiation. Replacing tropical forests, and perhaps earlier replacements of temperate forests, appears to detract from the abilities of the earth to cleanse itself in a way which makes it more habitable to ourselves.

In all this we should not lose sight of the fact that concerns about the global situation are centred upon mankind. They are not concerns about some natural state, which in the real sense never existed, but concerns to achieve a stasis of the environment as it has existed for the past 20,000 years - a mere blink of the eye in the history of the world.

The present day concerns which merit most attention are that the side effects of production are transforming too much of the earth's naturally "banked" carbon material. Concerns about mineral resource depletion, land degradation, urban pollution, transformation of wilderness and loss of species are bit players, in the main readily resolvable. The concerns about global warming, if true, require quite substantial shifts in arranging production and, on present estimates, significant reductions in living standards.

The issues involved are momentous and the costs of combating them equally great. One body of opinion calls for urgent action, even in the absence of conclusive evidence, since awaiting such evidence may require higher or even prohibitive costs in the future. Whilst this line of reasoning is appealing, the long list of previous forebodings which have proven unfounded tells us that, had we taken the advice of those offering it, the world today would be much the poorer for it. Some caution against precipitate and costly action is therefore warranted. By the same token, the massive impacts some of these forecast effects may entail may well justify taking lower cost actions without conclusive evidence of the need to do so.

Marks et al¹¹⁵ quote the Scientific American as showing carbon fluxes being absorbed into the ocean at the rate of four billion tonnes per annum, an annual increase of 0.01 per cent per annum, and into the atmosphere by three billion tonnes (0.4 percent). The net increase compares to natural flows of carbon of 200 billion tonnes per annum. Nonetheless the more reliable evidence of temperature changes, that covering the past 140

¹¹⁵ Marks RE, Swan PL, Dixon PB, Johnston DT, McLennon P and Schodde R "The Feasibility and Implications for Australia of the Ad option of the Toronto proposal for Carbon Dioxide Emissions" Report to CRA 1989

years, does not show an unambiguous relationship. The build up of carbon dioxide over that period has accompanied temperatures which, though they have increased, have done so in a highly irregular and unpredicted manner.

Marks et al estimate that for Australia to reduce carbon dioxide emission by 20 per cent by 2005, in line with the Toronto target, would mean real increases of electricity tariffs by at least 41 per cent and fuel prices by somewhere between 84 per cent and 169 per cent. Real wage levels, which in the base case are estimated to grow by 0.29 per cent per annum (the low rate reflecting the need to stabilize overseas debt) would decline by 0.18 per cent per annum. Thus an aggregate increase in real wages over the seventeen years of 5 per cent would become, instead, a decrease of 3 per cent. In the overall picture, these magnitudes are not large and are certainly affordable. The increased energy prices are indeed perhaps only half of those experienced in the 1973/74 oil price hikes. Although that event triggered a world recession, its amplitude was in part due to the sudden nature of the oil price increases and the policies of governments which exacerbated the strains it caused. In part however it stemmed from a jockeying amongst potential income losers as they sought to eliminate the effects of reduced aggregate income on themselves; this sort of disruption can be expected of any future measures involving diminished income.

Hence, although whatever adjustments which may be necessary to ensure sustainable nature are, in the broad sweep of world income levels, relatively minor, mechanisms to effect them are unproven. Experience in handling even modest reductions in income levels provides little confidence that an enforced reduction in income levels would be smooth.

The issues are to determine which matters need to be addressed, how to do so most cost effectively and how to arrange co-operation of different nations to effect those adjustments considered to be necessary.

Ownership Vesting

As has been shown, the tragedy of the commons was not the excessive exploitation of unowned resources but the lack of flexibility of individually owned land in the context of changed technology and market opportunities. Common holdings were successful in combining productive use of land with its preservation and, indeed, enhanced fertility. Rights to use the land were implicitly understood and restricted to the common holders;

sanctions on improper use were protected by powerful traditions made especially potent by the close-knit nature of the communities who worked the commons. For unownable commonly used resources such outcomes appear unlikely. And ownership of the upper atmosphere and ozone layer at the present stage is impossible to envisage.

Drawing upon Demsetz¹¹⁶ and Hardin¹¹⁷ the likely conclusion is that agreement to internalise global property externalities will be impossible and, furthermore, an agreement to act in concert will fail as a result of free-rider problems. Each country would do better for itself if it refrained from joining (or joined and subsequently reneged on) any agreements providing others incurred the costs of keeping them. In the absence of world government, sanctions on agreement breakers would not work. Furthermore, developing countries in particular would see much less gain in cooperating if the system took as given existing usage levels of, say ozone depleting substances and carbon emissions, when their own usage of these substances is not the cause of any problems generated.

Inter-Governmental Agreements

Barrett¹¹⁸ notes that some international agreements do seem to be operating satisfactorily without any real sanctions. He regards the 1946 Convention for the Regulation of Whaling to have been woefully ineffective; even so, whaling activities have been sharply curtailed and previously endangered genotypes of whale are increasing in number. He considers the more successful agreements to have been the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, the World Heritage Convention and the European "Thirty Per Cent Club" to reduce transborder sulphur emissions. To these could be added limited but significant areas where the world community has adopted sanctions, e.g. financial and other sanctions against South Africa, banning arms supplies to certain "renegade" states and preventing trade in narcotic substances and (probably misguidedly) in certain endangered species.

Barrett attempts to model how far countries would find it in their interests to undertake abatement activities. In the diagram below, each country is assumed to be identical and able to choose a level of abatement whereby its marginal costs equalled its marginal

¹¹⁶ Demsetz H., "Toward a Theory of Property Rights", American Economic Review No, 57 1967 p347-359

¹¹⁷ Hardin G, "The Tragedy of the Commons" Science No. 162 1968 p1243-1248

¹¹⁸ Barrett S. "The Problem of Global Environmental Protection", Oxford Review of Economic Policy Vol. 6 No. 1, Spring 1990 p68-79

benefits. If Q1 is the optimal level of abatement for each country chosen on the basis that all others would co-operate in a similar fashion, these choices would sum to Q2 which would be the optimal global level of abatement.

As Barrett notes, these gains from cooperation would be frustrated by free-riding where the countries' own marginal benefit is achieved whether or not it incurs the necessary costs itself. Indeed the outcome could be inferior to that preceding any failed agreement.

There are some important insights in the above diagram. The aggregate gains from abatement depends upon the slopes of the global marginal benefit and each country's marginal abatement cost curve. The prospects of achieving cooperation are stronger where the costs of undertaking abatement are low and the benefits from such action are high.

Thus, drawing from US estimates, the global costs of winding down usage of CFC's are of the order of \$200B whilst the benefits in preserving the ozone layer are many times this. The costs of dispensing with ozone depleting substances or substituting for less destructive forms are relatively low. Given all these factors, workable levels of global cooperation appear likely to be achieved. But this is much more difficult to envisage with carbon emissions. Aside from the greater uncertainty concerning the deleterious effects of burning fossil fuels, of which coal is regarded as the most injurious, it is considerably more expensive to take evasive action in shifting out of coal and lowering production generally. Moreover the consequences of greenhouse are less certain and will vary between different countries (and may even be positive in aggregate).

Using Market Mechanisms

Quesada¹¹⁹ points out that we have recently seen a change whereby global demand on environmental services has meant that they may now be no longer in excess supply. He considers that individual property rights vesting will not be possible but advocates a global treaty which sets values on the (negative) economic value of carbon dioxide and other greenhouse gases and allows a mix of actions to counter the threat. Those actions could

¹¹⁹ Quesada A U "Greenhouse Economics, Global Resources and The Political Economy of Global Change" Environmental Policy and Law Vol 19 No 5 1989 p154-161

comprise regulation to reduce outputs, taxation of emissions and subsidies for global sinks to allow carbon build-up.

In this he recognises the value of assigning prices and allowing trading with the prices passed on in the form of discounted costs of flooding and other deleterious consequences.

Tolba, the Executive Director of the UNEP¹²⁰ also sees an opportunity to make use of market mechanisms by having developed nations compensate poorer countries for not engaging in expanding their use of ozone depleting substances. He estimates the worth of such measures (which he says should be additional to on-going aid disbursements) are some \$2B to \$5B over the next 10 years. To raise these sums, he advocates a form of user fee to be paid into and disbursed by an international agency. In allocating the funds, he envisages particular priority would go to preservation of natural forest and other environmentally valued goods.

Somewhat incongruously, Tolba adds that the fees "cannot, of course, be used as a licence to pollute". That aside, his proposal has merit if it could be administered and fees collected without falling foul of the political manipulation and overstaffing which seems to be a feature of UN bodies.

Where particular countries have especial scope to engage in abatement strategies which benefit all countries, the opportunity exists for side payments to be made. Perhaps half of the world's rainforest is located in Brazil. If Brazil were to cease clearing this forest at its present rate, its future income would be reduced. As all countries consider they would benefit from retaining the Brazilian rainforest, it might be possible to arrange payment. Voluntary payment in the form of private endowments buying tropical forests has already taken place, though it is unlikely that such endowments will be adequately funded to undertake activity of this nature on the scale seen as necessary by many authorities.

The command and control solution would assign permits to each supplier and each user's needs would be carefully vetted. The market approach simply allocates the total quantity of acceptable incremental carbon and leaves the price system to determine which users and uses will be accommodated. Incentives are generated both for users to economise on the substances and for suppliers to provide those which generate least relative harm.

¹²⁰ Tolba M.K., 'Financing Global Environment Problems' Address to Commission on Environment, Document 210/333, United Nations, Paris 1990

Unfortunately it is unlikely that such a pure system will be allowed to operate. In the case of CFC's "political realities" have forced governments as diverse in ideology as those of the UK and the States of Victoria and Tasmania to insist upon certain overarching regulations. In the main these regulations seek accelerated phase out of uses like aerosols, for which substitutes are most readily available. Though such requirements accord broadly with the economic substitutability, political requirements will be much less flexible than those of the marketplace; exceptions within the targeted categories will be necessary, for example in the case of aerosols for certain specialized medical usages, and avoidable administrative and lobbying costs will be incurred.

The experience with Australia's Ozone Protection Act does however provide interesting corroboration of the power of market systems to allocate goods in a cost effective manner. The Act requires a 50 per cent reduction in usage with tradeable permits having been given to those supplying CFCs and halons in proportion to their 1986 usage levels. An accelerated phase out of aerosol usage (about 30 per cent of 1986 demand) was the main mandatory feature and a tax of \$1.06 per kilogram was imposed to cover administration costs. Total usage in 1990 is actually running below target because of some de-stocking (and aerosol usage is down to 500 tonnes or 6 per cent). The price has risen from about \$2.50 per kilogram to \$6 by the third quarter of 1990 and some 40 per cent of the original quota allocation has been traded. Although there are obligations on firms to recycle, these are not policed. Firms have instead taken active steps to conserve and re-use the chemicals internally and devices are being marketed to reduce waste. Dupont has in fact developed a new product in Australia to replace frion 12, the normal gas used in automobile air conditioning.

Possibilities of Adherence to Voluntary Agreements

For the generality of unownable environmental goods, observers drawing from past experience are likely to be sceptical about the prospects for policies which are desirable in an aggregate sense but inimical to each country's interests when examined in isolation. If a country like Australia can only make a one percent contribution to defraying a common problem, action on which would require it to incur costs, to the economic historian the outcome will be lack of lasting agreement. Sticking to an agreement where no sanctions may be imposed and where any benefits achievable will be reaped in any event appears to make little sense where the overwhelming motivation is self-interest.

And yet, powerful though the pursuit of individual self-interest is, it is not people's exclusive motivating force. It is possible to observe a considerable number of actions, ranging from voting in elections through voting for political parties which may not favour the voter's self interest, to voluntary and anonymous charitable donations, all of which are difficult to place within the economist's rubric. In addition to such purely altruistic actions perhaps motivated by self satisfaction are those where esteem is obtained from conduct seen by others as making worthy sacrifices. On an individual level we have already seen actions with regard to CFC's in which people have voluntarily chosen less efficient aerosols out of concern for the environment. Commercial firms also voluntarily undertake expenditures of an environmental preserving nature. This also may in part be more conventionally motivated. Mitsubishi was clearly alarmed by proposed boycotts of its product range advocated by green activists because of the activities of one of its subsidiaries in Indonesian logging.

Most calls by interested parties which appeal to some greater good and appear to be made notwithstanding vested interest contain at least an element of hypocrisy. This is clearly the case in such matters as tariffs and occupational licensing. It is equally the case where neighbours seek suppression of emissions at a factory which was in its location before they arrived. In order to gain support, advocates appeal to a wider audience on the basis that such support will be forthcoming where the target group loses little from the intervention and may indeed see it as creating a precedent for analogous action which it may itself wish to obtain in the future. There is in addition an asymmetry most persuasively demonstrated by Stigler¹²¹ between people's pursuit of self interest as consumers and that pursuit in their roles as income earners. The latter is far more important to any individual than the former. The retreat from the optimum welfare frontier entailed in denial of a particular source of consumption at the lowest cost is likely to be far more acceptable than such a retreat from income earning potential.

Whatever the motivations, willing sacrifices are made by individuals. It is equally clear that nations too will adopt policies which are seemingly irrational given known free-rider opportunities. In some cases this may in part at least motivated by self interest: it could be argued that World Heritage Listing adds to a country's tourist attractions - though it is doubtful that it would do so to the extent of Australia's substantial listings. A nation

121

might, like a private individual, forego obvious income earning activities in one direction for fear of retaliation on the generality of its products. But even this requires an explanation of why the previously willing buyers of those other products would forego opportunities for satisfying their needs at the least cost. South Africa has suffered from lower prices for most of its exports because potential customer nations were willing to deny themselves the most advantageous supply; financial sanctions on South Africa while causing that country to incur additional costs have only been possible because international bankers have willingly accepted somewhat lower profits than they might otherwise have obtained.

In many cases, there can be no other interpretation of a nation's actions in denying itself income than that it is motivated by altruism, in spite of this being combined with the kudos of approval from other nations. Even if apparent altruism on the part of a particular party is mixed with a narrower form of self interest, it nonetheless stems from the self sacrifice of others. In any event it is clear that the self interest which comprises the economist's paradigm is not as robust as the profession sometimes imagines it to be.

The mixture of incentives other than narrow self interest which motivate people in modern societies may well be less potent than those found in tradition directed societies which preceded the modern era. These other considerations may also be less universal within the present company of nations than they were in the close-knit societies that preceded them. They are however clearly potent and sufficiently well observed for the strict application of game theory predictions to be called into question.

The foregoing is not intended to deny the potency of markets based on individual self interest and its power to allocate far more efficiently than any alternative mechanism. For this reason action to prevent or combat cataclysmic externalities, once decided upon, should preferably employ tradeable permits allowing market allocation of the "bads".

This principle has a clear application with regard to reducing ozone depleting emissions to the levels agreed by signatories to the Montreal Convention. Each of the dozen or so chemical entities identified as having a destructive effect on ozone have had that effect quantified. It is not possible to phase out the use of these substances over a number of years but goals of reducing them to one half of 1988 usage levels have generally been adopted and further more ambitious goals will probably follow.

Regulatory Approaches to International Externalities

Much more difficult to arrange is the macro preservation of lands which are thought to be necessary to absorb carbon dioxide and pollutants caused by man's economic activity. The destruction of forests by those wishing to make more productive use of it and of the ozone layer by chlorofluorocarbons, presents, if some scientific projections are correct, the ultimate challenge to prevention of spillover effects.

Tropical forests are the most potent converters of carbon dioxide into oxygen and are largely located within poorer countries. If they must be preserved for the benefit of mankind as a whole, it is unconscionable for the rich nations, who became so partly because they cultivated or built upon their own virgin lands, simply to demand their preservation. Similarly, ozone depleting substances largely derive from the automobiles, refrigerators and air conditioning machinery which are a major feature of high standards of living. Again, it is unreasonable to demand a freeze on production of ozone depleting substances when citizens of poor countries aspiring to higher living standards have per capita consumption levels only a fraction of those of the affluent nations.

The issue of how to arrange for acceptable payments for global externalities generated presents some of the most difficult compensation arrangements imaginable. The ability of a market to develop automatically is as unlikely as in the case of classic public goods like defence. Accordingly governments must determine acceptable levels of outputs for these by-products of production.

Ideal approaches for ozone depleting substances would be to establish a base of globally permitted outputs and then determine the levels of allowable emissions either

- by reference to existing usages say in each country; or
- by reference to population levels.

The former has the advantage of minimising the impact of collective decision making on the income generation process. The latter however starts from the the basis that all people have an equal right to live and, as the ozone depleting substances were an unknown in the bequests which previous generations might have made, equally conferring the rights to use them is unlikely to disturb previous (conscious) decisions.

The application of market processes would make it essential that trading be permitted in the materials, within nations, between nations (or preferably between firms and individuals of different nations) and between substances the value of which would be negatively weighted in accordance with their ozone depleting characteristics. A market in these substances, a market which might be tapered towards reducing permissible levels of outputs, would allow the substances to be used so that value from the disbenefits they generate is minimised.

Such a market would remove the necessity for arbitrary bans on certain usages or certain varieties of CFC's; the price mechanism would squeeze out those offering more destruction per dollar. It could be policed in a variety of ways including chemical tracers on each source to guard against unauthorized production. The potency of financial sanctions in forcing reform in South Africa demonstrates that such measures are workable against renegade governments just as the unorganised use of trade sanctions in medieval Europe marked well enough to prevent governments from disturbing peaceful trade.

If buyers are free to search out supplies and their owners free to dispose of them at the best price we have the ideal circumstances for efficient trade to take place.

Similar principles are applicable to combatting global warming should a scientific consensus emerge that such a phenomena is indeed likely. And before jumping in to the massive transfers of income any action would require we must have a reasonable degree of certainty - it was after all, only a decade or so when the scientific community was predicting global cooling. Moreover, it would be considerably more difficult to arrange equitable transfers to prevent global warming. Higher levels of carbon dioxide increase plant growth and warmer climates would improve the value of much of the earth's landmass. Australia, along with Canada and most of the Soviet Union would gain on balance. The losers would be certain low lying countries.

Again, means of devising permits to carbon dioxide emissions are feasible. The number of different points of emission are however such that monitoring would be far more complex.

Resolving this problem continues to confound resolution of the contentious issue of the degree to which hydrocarbons are contributing to acid rain deposits among the affluent northern hemisphere countries.

Sustainable Development

Although previous concerns about the abilities of the ecosystem to continue providing for mankind's increasing demands have proven to be unfounded, enhanced credibility to such present concerns is offered by the amplification of those demands. The phrase sustainable development has come to epitomise both the environmental concerns themselves and the prescriptions for broaching them.

Capital Bequests

In his address to the Australian Mining Industry Council (3 May 1990), the Minister for Primary Industries and Energy Mr Kerin argued, "Sustainable Development simply means incorporating legitimate environmental values into a larger process". At its most basic, sustainable development requires that preceding generations leave their successors capital and other similar assets so that they start their lives in no worse a position than that which the bequeathing generation inherited.

If that bequest must be subdivided so that the successor generation is left as equally well endowed as the bequeather with both capital skills and natural resources separately defined, this requirement is likely to be difficult to fulfil. Except insofar as matter is virtually indestructible, a smaller quantity of non replaceable resources, especially minerals, is certain to be passed on. It is also likely that if populations increase, successive generations will require more land for housing, roads and workplaces even if improved technology and the application of capital allows higher levels of productivity per unit of natural resource.

Where questions of inter-generational equity are involved, we clearly cannot seek agreement of future generations to contemporary decisions. If the standard by which previous generations actions are judged is one which allows some substitution of naturally endowed for man-made capital then they have fulfilled their obligations handsomely. This conclusion would be reinforced if the notion of capital were to be extended to include knowledge. By any such judgement the custody which previous generations have maintained over the earth's resources has been immensely to the benefit of succeeding generations. Indeed, when we contrast our present affluence with the conditions of our forebears we would have to acknowledge that inter-generational equity would be better

met had previous generations not sacrificed as much of their consumption for savings on which their descendants' present standards of living are founded.

John Rawls 'veil of ignorance' construct provides a means of testing this. Imagine in Clint Eastwood's words, that you only have one life and you have to give it your best shot but that one has the option of being born into a time of one's choice. Imagine further, that being so born, one would start with no particular privileges of health and wealth than one has in the age that he or she was born into.

Surely in such a situation few would opt to be born into an earlier era when life styles, income levels, health care, longevity and so on were all unambiguously inferior to the standards of today. Moreover, notwithstanding risk aversion, large numbers of people would be likely to opt for being born into generations of the future, confidently predicting that we ourselves are doing sufficient to further enrich the living conditions for our progeny.

Not only have previous generations been munificent to ourselves but, if intergenerational equity means anything, we would be forced to the view that their own privations were excessive - that they should have saved less seed corn.

Values Assigned to Goods

Clearly the values mankind assigns to particular natural goods changes over time and between cultures. Though western culture may have always envisaged man's custody over nature as one of stewardship, dominant has been the notion that natural resources are there to be used. Abraham Lincoln's misdemeanour in chopping down his father's apple tree was one of destroying a valuable income producing asset, not one of showing inadequate consideration for a living entity. William Gladstone is said to have cut down trees for relaxation, a relaxation which was doubtless reinforced by what he saw as the correctness of demonstrating man's mastery over other living things.

It is of course true that there have been cycles in western history where environmentalism has achieved major importance - though probably none of these was as strong as that we are witnessing in the final decade of this century. It is also true that many societies, among them the Aboriginal Australians, have placed great store on respect for the land.

However such respect is likely to have been formed as a result of fragility of the land which they inhabited and its importance to their existence relative to other inputs.

The value which we place on goods is at least in part dependent upon their scarcity and the degree to which our needs for other goods have been satisfied. Such features exhibit a high degree of income elasticity. Acid rain, oil spills, even urban pollution are matters which occupy our attention only because more pressing issues have been reduced in severity. The preferred nature of these can moreover be considerably undermined by other exigencies. Even less than fifty years ago several millions of tons of shipping were being sunk each year, over a quarter of it comprising oil tankers, without any concerns being registered about oil slicks.

Our forebears would doubtless be somewhat bemused by our placing the present apparent priority on these matters. In their own day they were overshadowed by the struggle for survival and to obtain as luxuries the commonplace goods we today regard as essentials. The other issues of the time were just too commanding and crowded out the less immediate and direct concerns caused by such matters as pollution of the oceans - a pollution which it might be noted, has had a trivial enduring impact.

The change in values that we assign to things falling within the framework of environmental goods plagues the calculation of what we might regard as economic welfare. Many writers¹²² point out that a perverse action can yield a measured increase in income. Thus GNP registers an increase if health care expenditures are augmented as a result of pollution. In medical parlance this would be termed iatrogenic - the treatment of the symptoms (inadequate income) results in damage to the patient. But unlike in medical malpractice, the difficulty in identifying the perpetrator of the harm together with the difficulties which the victims often have in joining together to seek compensation considerably reduces the prospects of checks and balances being developed to ensure an efficient outcome.

Moreover national income measurements have long since abandoned attempts to determine net national income because of the difficulties in estimating the true depreciation of capital; the relevance of such measures is however not denied nor should we deny the appropriateness of measures which incorporate the depreciation of natural

¹²² see for example Pearce D, Merkandya A and Barbier EB. "Blueprint for a Green Economy" Earthscan Publications, London 1989

resources. In the case of capital or for that matter natural resources in which ownership is vested, we can quite safely assume that, as long as the good yields a future income stream, its owners will take actions to ensure the appropriate trade-off between conserving its future capacity to generate that income and the earning of a current income from it. And if the capital asset is run down the presumption is that its owners - who are in the best position to judge the value of its future uses - have decided that society will place a low value on its future income stream.

Assessment of the Threats to Sustainable Development

In the case of the production of 'bads' like pollution and using up natural resources, the obstacle to allowing supply and demand to run its course is the lack of ownership and hence individual responsibility so necessary to the bringing about of the correct solution.

The case for dispassionately examining actions to combat the market failure of these externalities is severely weakened by the rhetorical claims and urgings of those championing the cause of intervention.

Thus, Zarsky¹²³ puts the issues for Australia as first the need to reduce foreign debt, restore external balance etc and secondly "... to reverse the deterioration of our national and global environment. Land degradation, loss of species, increased cancer rates and climate change are only a few of the symptoms of widespread ecological distress. Our health and livelihood, as well as that of future generations hang in the balance" (P1).

Whilst restoring external balance is an unexceptional goal (though one subject to controversy in the so-called Pitchford debate), the symptoms of widespread ecological distress she selects are at best ill chosen. Land degradation is not taking place; on balance Australian land, like that of most developed economies is steadily becoming more productive due to agricultural practices. Counterfactual examples can always be found but output per hectare, per unit of labour, per unit of total factor input or by any major input which one cares to identify, has steadily increased since European settlement. That increase has, if anything, been greater in recent decades.

¹²³ Zarsky L "Sustainable Development: Challenges for Australia" Commission for the Future, February 1990

Zarsky's second claim is that Australia has lost species. Known loss is said to be 100 plant species and eighteen mammals. Although any such loss is to be regretted, and is probably ninefold the rate experienced prior to modern man assuming domination over the earth, it must be kept in perspective. There are some five million separate animal and plant species world wide. Probably 99 per cent of all species which once inhabited the earth are now extinct and man can be blamed for only a minute proportion of this. In the main, loss of species in Australia is incidental to European settlement. It is a result of the introduction of exotic species which outcompeted indigenous species. Given Australia's previous isolation, to lose only 18 species of mammal in 200 years of settled cultivation, remembering that the equally isolated Hawaii Islands have lost over 300 during the same period, might be claimed an acceptable outcome.

Zarsky's third claim that cancer rates are increasing is spurious. Mortality from cancers, once adjustments are made for ageing, has steadily decreased. Two exceptions are the somewhat self-inflicted cancers of the lung (clearly attributable to smoking) and, in Australia, skin cancers largely attributable to leisure preferences. Only 2 per cent of the incidences of cancers are attributable to pollution and less than one per cent to industrial products.¹²⁴

Finally, there is climate change. Greenhouse is however a discovery of the past fifteen years; even ten years ago, the scientific consensus was anticipating a second iceage, or more sinisterly, cold caused by carbon dioxide emissions blocking sunlight. Moreover even if man is having the effect to which some suggest the evidence points, the outcome may be equivocal. Higher levels of carbon dioxide mean faster plant growth and greater precipitation especially in some of the more arid areas; adverse effects include rising sea levels which inundate low lying land, though this can be countered by dyke building.

Although those crying wolf have in the past always been shown to be wrong, there is no certainty that doom laden forecasts of man's impact on the global environment will always prove to be unfounded. Many would agree that the severity and perhaps irreversibility of such environmental change rules out normal procedures of innocent until proven guilty. Be that as it may the earth has proven to be remarkably resilient to man's activity in the past. Doomsday predictions have been overturned by the force of nature itself. Even

¹²⁴ Standardised for age, non respiratory cancers in females are declining while those for males are constant. See Doll R and Peto R "The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the US Today" Journal of National Cancer Institute Vol 66 p1192

major localised disasters like oil spillages have had no long term effect and the recovery of Prince Edward Sound from the Exxon Valdes spill is again demonstrating this. Some have suggested a Gaia principle in operation under which man's activities on the entire mass of the earth and its biosphere remain trivial and will automatically be corrected. However we cannot dismiss the possibility that this process could take longer than man would find it possible to survive - at least survive in our present comfort.

Table 1	20
Table 2	21
Table 3	89
Table 4	90
Table 5	113
Table 6	117
Table 7	125
Table 7	133
Table 8	135
Table 9	147