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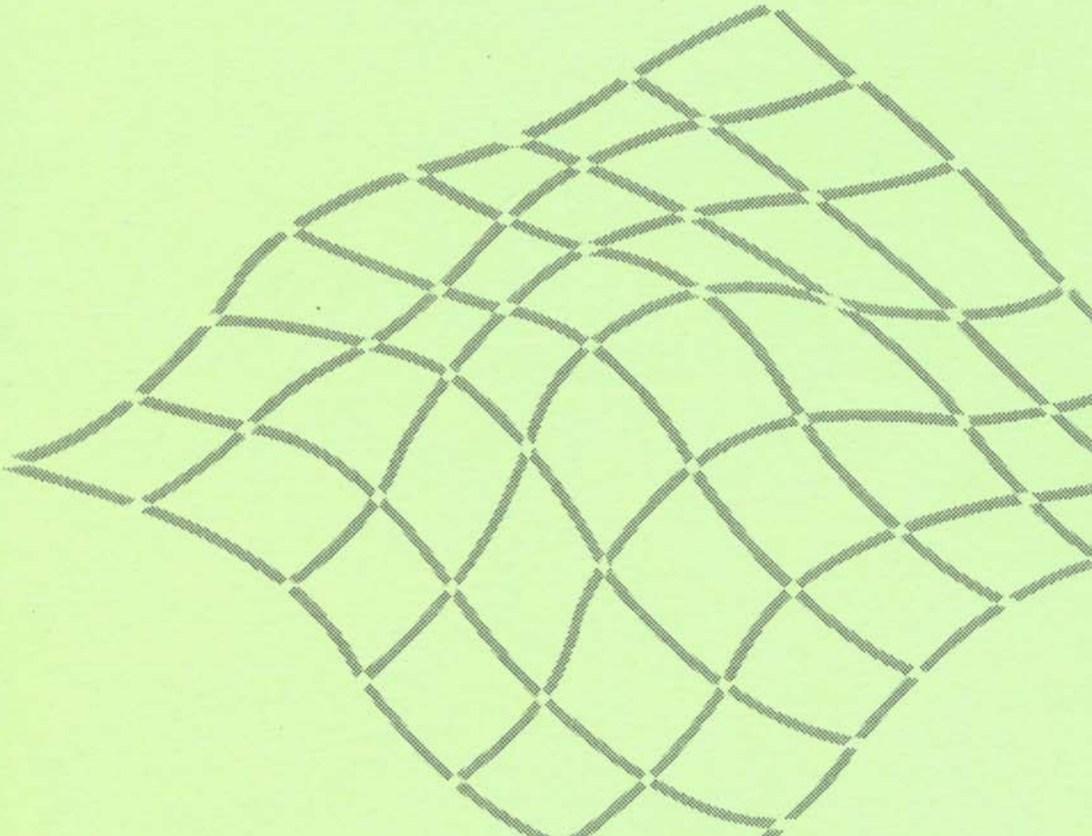

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ENVIRONMENTAL MANAGEMENT WITHOUT ENVIRONMENTAL VALUATION?

by

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ABSTRACT

There is a rising tendency for environmental economics to be viewed as exclusively concerned with valuing everything in monetary terms and there are certainly some among its ranks whose own self-interest leads them to preach that line in public. However, acceptance of the many valid criticisms of monetary valuation and our limited understanding of environmental systems makes this extreme untenable as all economists will admit (if some only in private) and which ecological-economics recognises as a central issue. Yet the danger in characterising the preoccupation of economists with monetary valuation as in some sense wrong assumes this is something which can be excluded from resource allocation decisions. The critics of monetary valuation also tend to believe in an unspecified alternative approach which is often associated with scientifically defined limits and cost-effectiveness. The problem explored in this paper is the extent to which a concern for costs and benefits can be excluded from environmental management and if, as argued, a role for valuation is required how can the critics concerns be taken into account in defining that role.

I Introduction

The concern underlying this paper is to identify principles for environmental policy and more specifically analyze the similarities and contrasts between environmental economics and a broader concept and discipline of environmental management. Advocates of environmental cost-benefit analysis (CBA) are often criticised as if they desired their approach to be used as a 'stand-alone' decision criteria, which would certainly be a blinkered way to proceed. Interestingly, however, the environmental economics literature generally focuses upon the selection of instruments that minimize the overall cost of achieving prescribed environmental objectives (Hahn, 1989). This suggests an uneasiness within the economics profession over setting environmental objectives without regard to socio-political factors. Yet, the rejection of a dominant role for environmental economics leaves unanswered the question of the extent to which the discipline should be allowed to operate within environmental decision-making, and whether the valuation methodology must be thrown out or merely constrained. In any case the likely alternatives require explicit attention.

The approach of mainstream or neoclassical economics to environmental policy formation can be compared with an alternative concept of environmental management derived from the natural sciences. The two approaches converge in the new field of ecological economics, but this fledgling discipline remains methodologically disunited. A conflict arises because economics is primarily concerned with trade-offs, while the natural science approach to environmental management has been concerned primarily with limits (e.g., sustainable fishing yields, carrying capacity, pollution thresholds). Although, developments in environmental science are moving towards prediction of environmental change and scenario analysis, the core scientific approach referred to in this paper is still more common. A third approach to environmental management is the democratic political model, where environmental targets are determined through public debate, i.e., targets set are social value judgements (see Sagoff 1988, Jacobs 1991). Yet, advocates of the political model often talk in terms such as 'natural capital' and 'carrying capacity' which implies targets are being scientifically derived. Scientific sustainability and democratic choices can easily diverge. In this paper I largely ignore such issues and the political model (see instead Spash 1995).

Even for those who reject a role for environmental economics in the formation of environmental policy objectives there is still a requirement for cost effectiveness because resource wastage creates unnecessary pressure on other systems. This then raises the issue of how far there are substantive methodological differences between the alternative models of environmental management. In the next section this issue is addressed with regard to the economic and scientific approaches, leading to concerns over the implications of cost effectiveness. Then, in order to provide a practical policy focus, two environmental problems are discussed: the enhanced greenhouse effect and land management for conservation and scientific ends. The argument put forward is that benefit estimation is unavoidable even in the standards-based, cost effective approach to environmental issues. Some suggestions for how environmental management might proceed are put forward although I hope this paper will act more as a basis for debate.

II Environmental Economics versus Environmental Management

Concepts of Value and Epistemology

Environmental economics has firm foundations in neoclassical economic theory. As a result the value as defined in economic studies and models is relative, i.e., an object is given value in relation to the scarcity of other objects. Value is described in terms of another object and becomes dependant upon the scarcity of natural resources; value is defined through a process of comparing objects via trade. The refined version of this theory leads through a market process to produce a market value of the traded item (the equilibrium price in supply and demand diagrams). An essential requirement of this explanation of value is the ability and willingness of parties involved in a trade to make comparisons and accept trade-offs, i.e., the loss of one thing or object in exchange for the gain of another. The theoretical outcome of free market trading is an optimal position in which all parties are better off and none worse off (Pareto optimality). This process of reasoning reflects the value of the environment by employing methods such as CBA, where trade-offs are explicitly considered in terms of the resource costs versus the benefits produced by changes in management.

Any wider concept of environmental management must share the concern of economics with providing incentives to achieve a given end, which in turn requires consideration of interactions between human social and economic systems in setting and achieving those ends. However, the foundations of what I refer to here as environmental management are in the natural sciences. Certain absolute values arise from adopting the core natural science methodology because this implies a search for 'the truth'. This may appear as a confusion of fact and value, but values are relevant for two reasons. First, the division between fact and value is blurred because a set of values determines the degree of belief in specific facts in an uncertain world. For example, an empirically testable hypothesis (at least theoretically) is the factual statement that 'the enhanced greenhouse effect will harm future generations', but the acceptance of the fact declines as attitudes move from environmental vanguard to technocentric optimists (Spash 1993). Idso (1984) has complained that scenario development with regards to the enhanced greenhouse effect has been influenced more by the psychological disposition of the protagonists than science, but given that humans are part of the process of scientific discovery the implied objectivity seems impossible. Some may prefer to regard allowing the psychology of the individual to influence 'facts' as unscientific which still leaves open the methodology for the conduct of 'scientific' research. Second, the conception of facts as central to an issue can give a false sense of objectivity to decision-making where the 'facts' are taken to 'speak for themselves'. That is, amongst core natural scientists, there is a belief in an underlying objectivity which can be discovered and which should direct environmental management. Such a foundational truth may also imply social norms because acknowledging boundary conditions can be used to require human behavioral change to avoid passing thresholds. For example, Friends of the Earth Scotland (1995) has recently argued for the concept of 'Environmental Space' which calls for the definition of physical constraints required for the region to be sustainable (based upon input-output type analysis) which then imply limits on individuals (e.g. per capita carbon dioxide emissions allowed).

Norgaard (1994 pp.66-67) critically explains such a core scientific approach as the acquisition of knowledge whereby individual minds investigate the parts and processes of Nature, which he refers to as an atomistic-mechanistic view. This view is seen to be premised upon unchanging parts and relations allowing knowledge to be regarded as universal over space and time. Variations in natural and social systems are then regarded as due to differences in the proportions of parts and the strength of relations, rather than being an indication of fundamental differences. "Thus, the idea of underlying universal truths could be maintained across diverse environments and cultures" (Norgaard 1994 p.67). This methodology leads in turn to the separation of facts from values and what is termed logical positivism (see Gordon 1991). While the logical positivist approach is flawed (e.g., in rejecting non-empirical knowledge) it still remains dominant in public beliefs and institutional structures. Thus, the 'professional' natural scientist and neoclassical economist participate in public decision-making through this dominant belief pattern, which they then reinforce.

A powerful lobby amongst economists has for some time been eager to treat economics as methodologically scientific with an emphasis upon empiricism to confirm an objective reality, i.e., following logical positivism (e.g., Hutchinson 1938). This view of economics as a science requires a belief in an objective truth and the ability of economists to reveal this truth. In the environmental economics literature this begins to appear in statements and approaches which suggest the 'correct' picture is being presented by the economic analysis. For example, the methodologically scientific idea that the values derived from preferences are universal, stable for an individual and therefore transferable has recently been expounded under the term 'benefit transfers'(see special issue of Water Resources Research 1992 volume 28 no.3). Of course this also has the added advantage of reducing estimation cost (just borrow previous estimates of a similar environmental change). The concept of truth can also be seen in the summing up of various categories of economic value (use, option, existence and bequest values) in the term 'total economic value' which implies that everything of importance is included in the concept (Pearce et al. 1989 p60). An application expressing the all inclusive nature of economic value is presented by Boyce et al. (1992) who claim (as did Pearce et al.) that intrinsic value can be regarded as preference based and included in existence value. Boyce et al. undertake experimental research to empirically validate their hypothesis that intrinsic value can be measured in monetary units.

A danger arises in such extensions of objectivism to the idea of market values because those values begin to be regarded as absolute in the sense of the 'true value' of an object. For example, studies using the contingent valuation method may talk of trying to find the true value of an environmental commodity while the use of experimental economics tries to probe the 'true preferences' of individuals (e.g. Boyce et al. above). The true value here is regarded as the individual's preference-related willingness-to-pay or accept, and is seen to be 'untrue' when distorted by a lack of information, misinformation, free-riding, an unreal pseudo-market, disbelief in the trade-offs being required, property rights, perceived risks and so on. However, even accepting the existence of an underlying objective truth, the economist is handling a slippery fish.

An example of the difficulties faced by economists in searching for the underlying truth is the role of information. When providing information on a particular project in a contingent valuation study the formation of preferences as opposed to their being informed is unclear, especially when the object being valued is unfamiliar to the respondent, e.g., biodiversity (Spash and Hanley 1995). The value given by a person's willingness to pay or willingness to accept compensation is highly contextual. Willis and Benson (1988) provide an example of testing for the role of information in a contingent valuation survey. They found the level of information (i.e., giving detail on ecological functioning) to be positively, but insignificantly, correlated to willingness to pay. They explain this result as follows (p258):

> Presumably an individual's bid will be affected by accurate information only if his perceptions concerning the site in relation to substitutes vary from reality. If, on the contrary, the individual's perceptions are correct,

then no information bias will exist.

The terms 'reality' and 'correct' can be seen as indicative of belief in an objective truth and the extension of that objectivity to individual preferences and so by implication to the pseudo-market value.

Rejecting the ability of economics to discover the truth about environmental values from individual preferences can be compatible with maintaining a belief in the ability of natural sciences to find their own truth. Assuming some areas of study are 'hard' and factual and that this applies to the natural sciences will suffice. David Hume contended that demonstrating the truth of statements about moral or other value judgements is impossible. If this is correct moral and other value judgements cannot be derived from empirical evidence. Thus, scientists can be regarded as dealing solely with factual knowledge so avoiding values; this is the appeal of the core natural science approach to environmental management. Of course an alternative would be to extend the criticism levelled at economics to all knowledge and reject any universal truths, but for present purposes I wish to focus upon the role of hard facts in the process of environmental management.

The extension or adoption of the scientific belief system by economics has led to the environment being treated atomistically and defined in terms of goods and services with an underlying value which economists can discover. Rejecting this methodology for economics results in an appeal to constraints upon economic systems. For example, denying the ability of economists to value changes in the climatic controls of the earth suggests limiting the extent of human impact upon those controls. In this approach absolute constraints are found and imposed upon us by the operation of natural systems, e.g., thresholds. This must deny the ability of humans to make trade-offs. Environmental management under the core scientific approach therefore regards the world as constituting systems which require analysis to find their operating conditions.

Environmental Control of Systems

The range of intervention measures suggested by environmentalists varies widely and denies the simple exclusion of socio-economic factors from environmental decision-making. Allowing an area to be left to Nature as a wilderness perhaps typifies the concern for banning human actions from spreading to every aspect of every ecosystem. This, however, raises the difficulty of defining a wilderness area. There can be few, if any, wilderness areas if this is defined in terms of an area being outside of human influence. For example, the species roaming across the Scottish Highlands (e.g. red deer, sheep, goats) are the result of human actions, and the long-range transportation of air pollutants (e.g., acid deposition) has changed Scottish ecosystems in fundamental ways. Thus, to set up a wilderness area here requires human action to manage the environment towards some concept of an 'undisturbed' system, which seems counter-intuitive to the desired wilderness concept. In the United States large areas may be only distantly impacted by human action but decisions over the definition of wilderness still result in human action to try and influence the outcome, e.g., the controversy over the reintroduction of wolves in Yellowstone National Park. Thus, the requirement for human action or inaction is a part of the process of even wilderness designation, and this implies a conception of objectives and environmental management.

As the range of intervention measures moves away from the wilderness area the role of management becomes less defining inaction and more deciding upon action. Protected areas and sites often require extensive management to avoid what is seen as undesirable change, e.g., invasion by non-native species. Recreation use of sites places the emphasis firmly on human management for human ends, but can be viewed in terms of multiple use management. The use of land for farming has also moved partially in the direction of multiple use and consideration of conservation (e.g., environmentally sensitive areas in the U.K.), although this conflicts with intensive chemical monoculture. At the opposite end of the spectrum from the wilderness area is the urban-industrial environment, where a human designed and managed system is dominant. The role of human intervention and economics in the control of systems is readily accepted at this end of the spectrum. As we move from wilderness concept to the built environment the objectives for management change from being natural science based to economic, from constraints to trade-offs.

The concern over the role of economics in environmental management can therefore be regarded as rotating around the degree to which the systems are under human control. This might be viewed as the contrast between mankind as steward in command of Nature versus mankind as a component of the environment with minimal control of the whole system. The implication being that 'mankind as a component' must have far greater concern for constraints which maintain the integrity of the system. The two issues here are (i) whether control can be achieved and (ii) how control can be achieved? In the view of mankind as steward, and also in the economic model, the answer to the first question is assumed affirmative and attention is then focused entirely upon the second. Under the scientific environmental management approach the first question has no *a priori* answer.

Economics has conceptualised the control of systems as the achievement of a stable equilibrium since Marshall's work became the dominant paradigm a hundred years ago. Uncertainty, ignorance, non-linearities and chaotic systems all argue away from this type of characterisation of the ability humans have to achieve systems control. Put simply, there may be aspects of the environment over which we have influence but which we are unable to direct or unaware we influence. The type of management and decision processes required under these circumstances are diametrically different from those under complete information and stable, resilient equilibrating systems.

The ability to control environmental systems will depend upon their characteristics. Following Lange (1970) the control of systems can be regarded as falling into seven aspects: speed, precision, reliability, stability, sensitivity, cost efficiency, and control range. Speed refers to how quickly disturbances can be eliminated so as to maintain equilibrium, although moving too fast can create stress. Precision is the ability of the manager to achieve a desired output pattern. Reliability describes the conditions under which management systems fail. Stability involves the conditions under which the manager will dampen or magnify a disturbance. Sensitivity is the response to a small deviation in control mechanisms. Cost efficiency is the ability to maintain control systems within a set cost boundary. Related to this is the range of disturbances under which cost efficiency can be maintained.

There are two aspects to the consideration of cost efficiency here. Cost refers to the cost of a particular control system, which is the concern when cost effectiveness is under consideration. However, cost also refers to the damages due to deviations from the target of control. Both these cost categories require valuation and therefore assessment of environmental impacts. In the former case there is a tendency to believe that the cost of a particular control system are easier to calculate, perhaps because they are regarded as more market orientated values. Yet, the definition of economic costs is wide and includes all externalities and opportunity costs (e.g., pollution associated with the systems). The range of damage costs is more obviously all encompassing and therefore more clearly seen to raise the problematic issues surrounding the use of CBA in the assessment of non-market values. In fact the problems commonly associated with benefit estimation pervade both cost categories in contrast to the view that the former are less controversial and more 'objective'.

In the next two sections these points are developed further and the extent to which environmental valuation pervades a wider concept of environmental management is explored. This is achieved by considering two case studies to provide a policy focus for the problems environmental decision-making faces. One case study is chosen at the global level, the enhanced greenhouse effect, and one at the regional or local level, land use planning for conservation.

III Global Environmental Policy: the Enhanced Greenhouse Effect

In discussions of appropriate policy in the face of human ability to change climatic conditions all the most difficult issues of management arise: complexity, uncertainty, and disparate spatial and temporal impacts. The issue is complex with numerous significant linkages across other systems compounded by the global scale; thus the standard approach of simplifying assumptions such as *ceteris paribus* become unacceptable if our models are to be meaningful. A related problem is the uncertainty arising from human actions both in the influence of climatic systems and the results of changing climatic systems. Complexity and uncertainty are regarded as scientific while a somewhat neglected aspect of greenhouse gas control, but one which is central to the expression of concern, is the status given to future generations and geographically distant peoples in the policy decision. In order to tackle the policy question of what action to take, all these aspects of the problem must be considered; strict adherence to the environmental economic approach can be contrasted with environmental management.

Under environmental economics all pollution problems are in general simplified to the determination and achievement of the optimal level of pollution reduction. The appropriate question society must ask is: "How much is society prepared and willing to pay for greenhouse gas reduction?" The contentious issue becomes the size of the welfare benefits to humans from those reductions. In this approach to controlling greenhouse gases, environmental economics employs the techniques of CBA; some examples are Nordhaus (1991), Cline (1992) and Fankhauser (1995). An explicit recognition of the trade-offs required when making pollution control decisions is central to the methodology. The costs of control in the case of the enhanced greenhouse effect will relate to control of the source emissions (e.g., chloroflurocarbon production) and the expansion of sinks for greenhouse gases such as forests to absorb carbon dioxide. On the other side the benefits of control are the avoided damages which, at least in theory, are to be measured in marginal units, i.e., the effect of an increment in a gas in terms of the damages caused. Thus, in principle, the analyst would need to know, for example, the extent to which the release of one more tonne of carbon dioxide might lead to increased sea level rise and so flooding in Bangladesh resulting in the cost of relocating people, and simultaneously drought and starvation elsewhere. Even this is a gross simplification of the problem because there are many gases contributing to climate change, raising issues of synergism, and there are globally diverse impacts occurring simultaneously. Yet, this consequentialist approach requires that scenarios are made explicit.

An obvious difficulty with the consequentialist approach combined with marginal analysis is in establishing such refined cause-effect relationships; this is compounded by the time and scale of impacts. In addition, the treatment of potential loss of life and species raises contentious aspects of monetary valuation. The uncertainty surrounding future events might be reduced to the estimation of risk but this neglects the wider nature of our missing knowledge about future states of the world and the dangers of the enhanced greenhouse effect. There is also the question of whether future damages should count in the utilitarian calculus as much as present damages. These are just some of the issues confounding the assessment of the benefits of greenhouse gas control (for others see Daily et al. 1991; Ayres and Walters 1991; Spash 1994a, 1994b).

An alternative approach is to try and avoid the explicit detailed analysis of the benefits and instead concentrate upon the costs. Thus, an environmental management approach would determine the capacity of systems to assimilate greenhouse gases by looking at the relationship between sources and sinks. This information would be used to estimate the thresholds beyond which systems become stressed and how that stress might materialise. As in environmental economics, this approach is fundamentally consequentialist, but here marginal analysis is avoided and, at least in theory, value judgements are excluded. The contentious issue then becomes the cost of control to those thresholds.

Environmental management is therefore characterised here as being in favour of cost effectiveness, i.e., cost effective control of source and sink functions. This is done in the belief that estimation of monetary benefits is susceptible to manipulation and makes unacceptable ethical assumptions, but scientists can present decision-makers with 'facts' leaving control debates to the political process (see for example Sagoff 1988). Greenhouse gas control will then be decided by negotiations between power groups within society. However, the extent to which this political decision-making process can free itself from the problems which confronted the environmental cost-benefit approach is unclear.

Let us assume some percentage reduction in carbon dioxide is scientifically and/or politically agreed upon, say 30%. The next step would be to employ environmental economics to determine the cost effective control method, i.e., how control should be achieved. One option is to control source emissions but this will affect the value of products associated with greenhouse gases. The emissions prior to control are a bi-product of the production process which results in outputs of importance to humans. For example, carbon dioxide is emitted during fossil fuel combustion which occurs in the production of plastics and transportation services. The control of carbon dioxide relates to these uses. The cost of the control process requires assessment of the welfare impacts associated with these products, and that means monetary valuation of products to see how control affects social costs. A 30% reduction in carbon dioxide might require large taxes on petrol so reducing car use which is associated with many negative externalities such as tropospheric ozone; the reduction of these externalities must be accounted for as a reduction in control costs, i.e., a benefit of the control decision. In this way the benefits associated with tropospheric ozone control become part of the cost effective calculus. Alternatively, control might require the reduction of methane with one of the sources being wetlands. If wetlands are 'managed' to reduce methane emissions this implies associated impacts upon related goods and services; the 'products' of interest to humans in this case include recreation, wildlife conservation and biodiversity. These 'products' are of the same type as the class of environmental benefits which cost effectiveness is apparently supposed to avoid putting into monetary terms, because management here requires a political decision based upon scientific 'fact'.

Similarly, if control is to involve the expansion of sinks their valuation will become part of the cost effectiveness procedure. The value of sinks, in the utilitarian framework, again relates to the impact upon human use. For example, increasing the area of forest plantations to help carbon dioxide absorption will be associated with choices affecting tree species which can conflict with or benefit recreation, timber production, and biodiversity. The costs of control relate to the value of these uses. The creation of beneficial side effects lowers control costs but requires the exact same benefit estimation as was necessary under the cost-benefit approach.

Thus, cost effective greenhouse gas control requires estimating the extent to which sources and/or sinks are to be managed. So, for the 30% reduction in carbon dioxide to be achieved efficiently, society needs to know how far to increase forestry versus reducing fossil fuel use. Part of the information requirement will be for the value of forest recreation to be compared with the value of fossil fuel use in transportation. Similarly, when considering cost efficient responses to sea-level rise the options included migration and sea defences. Costs of the options include cultural, aesthetic and environmental values of the sort environmentalists are loath to see reflected as purely monetary. The cost of reducing carbon dioxide by one tonne will be measured in part by the welfare losses and gains in related activities. There is then no distinction between cost effectiveness analysis and CBA in terms of the methodological criticisms of monetary benefit estimation. In fact, cost effectiveness is properly regarded as a restricted or constrained CBA.

IV Local Environmental Policy: Land Use

At the opposite extreme to the enhance greenhouse effect is the set of decisions made by national and regional government agencies concerning the economic development of land. The recognition that development must be constrained if conservation of ecosystems and species is to be achieved has led to various approaches in different countries. In this section the experience of Great Britain is briefly discussed with respect to the class of land designated as Sites of Special Scientific Interest (SSSIs); as of 1991 there were 5,671 such sites covering 1,778,474 hectares. Threats to sites of high conservation value in Great Britain arise from urban-industrial development where planning legislation is relevant (except for statutory undertakers such as the military), and rural development which bypasses planning requirements. Concern has been raised over the latter because of the cost of preventing a class of actions by landowners which are officially designated as potentially damaging operations (Spash and Simpson 1993, 1994).

Potentially damaging operations are allowed in the majority of cases with only slight modification. This might be regarded as a violation of the designation of land as protected for environmental reasons but the need to cooperate with the landowners is seen as essential. More seriously-damaging actions can be delayed in order to try and negotiate a management agreement, with side-payments for potential loss of development benefits foregone, or the conservation agency concerned could make a compulsory purchase, but rarely has done (two cases in ten years). The management agreement requires the definition of objectives for conservation, and the imposition of restrictions.

SSSIs are selected and designated on scientific grounds as a representative stock which is to be protected absolutely. This follows the more general criteria of ecological designation for protected areas on the basis of rarity and representativeness (Smith and Theberge 1986). In theory the agency has no choice but to accept all sites which pass the scientific criteria by which sites are evaluated as being SSSIs. The stock is then seen as a safe minimum standard, a threshold beyond which development must be restricted from venturing. Thus the agency responsible (until 1991) for this designation process could state their belief that the current level of notification and designation and the protection of individual sites should be seen as a minimum environmental safety standard for nature conservation, and therefore any damaging operations would take society below that minimum standard (Nature Conservancy Council 1990 section 4.17). Furthermore the agency stated (section 4.40):

> Many sites, notified as SSSIs or not, such as ancient woodland or ancient meadows, are considered to be irreplaceable and incapable of re-creation in any meaningful way. In such cases the site should act as a constraint on a project development at any cost.

A similar position of absolute constraints has been argued for by English Nature (1992, 1994) and the Council for the Protection of Rural England (Jacobs 1993) with regards to a range of environmental assets and their features.

However, the process of negotiating with land owners places the conservation agency in an awkward position where supposed environmental management objectives become negotiable for monetary resources, given the agencies budget constraint. In practice the agency was, and its descendants are, forced to trade the protection of various aspects of environmental conservation so reducing the minimum stock. Flora, fauna, and animals are far from being regarded as absolute constraints on various forms of action regardless of the benefits to be derived from developing the ecosystems upon which they depend. If this were the case there would be no potentially damaging operations and management agreements would be for increasing conservation values rather than preventing destructive actions.

The decision process can be thought of in the following general terms (see Spash and Simpson 1993, 1994). The agency may have a preference for say biodiversity and uniqueness which allows it to rank all sites according to conservation value. Thus, deciding what is a SSSI requires some decision criterion, but this is seen as scientific rather than economic, i.e., the efficiency goal is of little or no relevance. However, the decision is being forced into an economic framework because of the need to maximise conservation value subject to a budget constraint. That is, the agency has a limited amount of resources to use for the protection and maintenance of SSSIs; internally the agency has other goals and externally it must compete with other government departments. Thus, when faced with, say, the option of designating a new site versus improving the integrity of old ones the cost will become an integral part of the decision. The opportunity cost to land-owners of lost development will then require actual compensation paid for lost production (note how this contrasts with the Hicks-Kaldor criterion which only requires potential compensation and assumes redistributive payments would be made on other grounds such as distributive justice). The landowner is in a strong position if the land can be withheld, potentially damaging operations threatened and/or the potential loss of earnings exaggerate (i.e., an asymmetry of information exists). Thus, the agency is now confronted by the landowners ability to extract rent and must spread its limited budget to protect and designated in a fundamentally utilitarian fashion. That is, scientists or other experts in the conservation agency are forced to form consequentialist preferences over sites so as to decide upon where the funds go.

V Environment and Human Control: Learning Lessons

There are several conclusions to be drawn from the brief look at the two case studies. Environmental economics is often regarded as unacceptable because of the way it seems to suggest that the optimal control of pollution can be determined via an environmental CBA. Environmental CBA is then contrast with the cost effectiveness approach, which is more acceptable because of the presumption that difficulties raised by benefit assessment can be avoided, and optimality is a theoretical irrelevance. However, cost effectiveness still requires benefit assessment although the range may be restricted by the fact that one level of the decision process has already been undertaken. That is, the extent of control is decided and then the appropriate type of control is assessed. While optimization is indeed normally practically unhelpful and misleadingly objective, determination of the extent of control is still fraught with difficulty in terms of scientific assessment, uncertainty, complexity and in the construction of an acceptable political process.

Craig et al. (1993) and Spash and Simpson (1993) both show how intrinsic value principles may be at the heart of environmental legislation but that the application of policy demonstrates a utilitarian or more generally consequentialist philosophy. The link of intrinsic value principles with scientific objectivism is an interesting possible explanation for the motivation behind supposedly 'fact' based decisions, e.g., designation of protected areas. However, conservation agencies constrained by financial budgets must chose between preservation options. As a result planning proposals are approved which indicate the trade-off between preservation and development; examples include the Cardiff Bay barrage (Hanley et al., 1991), Gwenlais Valley SSSI (Dunn, 1994) and peat extraction on Thorne Moors SSSI (Pearce, 1992).

The economic argument implies there is an opportunity cost to any action and this is the relevant value upon which to concentrate when making decisions. That is, if the loss of material wealth is accepted this is the trade-off made and reflects the preferences of those involved. Unfortunately at the extreme where individuals express what can only be described as infinite values the language of trade-offs becomes meaningless. At this point reflection turns to other ways of describing human preferences and concerns for justice, rights, compassion and freedoms are more easily understood reflections of what the economic model refers to as infinite valuations, and tends to regard as 'irrational' anomalies.

Environmental management appeals to constraints which seem to imply non-utilitarian values or at least goals outside of efficiency. If the constraints are a refusal to make trade-offs between say more material wealth and lower environmental quality then the underlying preference function can be described as lexicographic (see Spash and Hanley 1995). Under these circumstances compensation has no role to play because no amount of material wealth can compensate for the loss of environmental quality. The focus is then upon limiting activities which reduce environmental quality to the extent that they no longer occur.

Now, given this underlying concern for how the economic methodology approaches environmental valuation, cost effectiveness can be seen more clearly as only a constrained CBA. The appeals to trade-offs is an essential part of cost effectiveness and thus is accepted in the characterisation of environmental management as described in this paper. Furthermore, the appeal to facts based upon empiricism creates a false sense of freedom from moral and other value judgements. The overall requirement is for a political consensus upon environmental action, and this requires being fully aware of the political economy of decision-making. Scientific facts may help create a consensus more easily in the unmanaged environment such as wilderness areas, but still imply constraints upon action and value judgements. Economic values may lead to a consensus more easily in the human built environment but still are bound within the constraints of a physical environment and a limited perspective given by the dominant paradigm's consequentialist philosophy.

In the exploration of where environmental economics fits into the overall management picture a key issue is the extent of human control over environmental systems. Mankind is seen as dominant over natural systems so that individual preferences are central to how economic decisions are made. These economic decisions feed into natural systems and influence their direction. The extent to which the flow of influence is two way determines how far humans are seen to be in control of their own destiny. This underlies the old characterisation of policy positions with regard to the environment ranging from pessimist to optimist, as found in Lecomber (1979) for example. Environmentalists as 'ecodoomsters' with pessimistic predictions describes a belief in the dominance of Nature over humanity, and is clearly seen via negative feedbacks in Meadows et al. (1972, 1992). Technocentric optimists see man as supplanting the role formerly held by God and so placing themselves in control of Nature. A newer interpretation of the human condition is to avoid both extremes and see the interrelationship of humanity and environment. For example, Norgaard (1994) has argued in favour of coevolutionary development which implies an indeterminate circularity of cause and effect.

The current movement away from the optimist-pessimist dichotomy implies some acceptance of this middle path. Thus, environmental management can be taken as humans managing to survive within an environmental system of which they are an integral part. This 'management' can reject the technocentric view of survival 'without' Nature, and the ecocentric view of survival 'without' human influence of Nature. If environmental management is characterised in this manner the policy decisions required today appear to be unable to free themselves from environmental economics, even if the idea seems a good one. However, the economic paradigm required is fundamentally different from neoclassical optimisation of resilient, equilibrating systems and its characterisation of the 'rational' individual in an exclusively utilitarian world.

VI CONCLUSIONS

The issues which come to the fore in discussing the role of economics in environmental management include the level and types of decisions which are regarded as within its province. The extent to which economics should play a role in environmental decision making is undetermined. Effectively the argument is over the extent to which scientific and political constraints should operate over the goal of efficiency rather than the rejection of environmental economics for an alternative methodology. Those preferring the cost effective approach emphasise a greater reliance on non-efficiency criteria but must realise this still means accepting a role for environmental valuation and the need to tackle the problems it poses. Cost effectiveness as a limited CBA uses all the same tools and suffers the same problems. Thus, environmental management, by requiring cost effectiveness, accepts the valuation methodology of environmental economics. In addition, the enforcement of constraints implies opportunity costs due to the boundaries they create and must therefore face the economic and political consequences they imply.

However, the acceptance of the need for constraints requires a process where by those constraints are determined and enforced. As shown in the land use section of this paper actual compensation is in practice required to create and maintain a consensus for action, especially where cooperation is essential to successful environmental management. Determination of constraints as discussed in this paper can be viewed as scientifically based so as to control economic processes. However, the appeal to scientific facts to set the constraints is naive in its belief that fact-value choices can be so easily separated. Similarly, the appeal to optimal economic solutions is misleading because these are unachievable neoclassical ideals giving a false sense of scientific objectivity. The recognition of human inability to control environmental systems and the subjectivity of 'factual' constraints implies a new methodology which emphasises choice of a path leading to potential scenarios rather than the selection of a specific equilibrium solution. A wider concept of environmental management requires disciplines which attempt to unify scientists and economists while acting through institutions which recognise the role of both in creating a consensus in developing dynamic approaches to environmental policy.

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