Limits to Economic Valuation of Ecosystems: What is best ?

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Abstract: *In practice, monetary valuation of biotic resources by the concept of total economic value (TEV) is a powerful tool for a rational treatment of this fraction of natural capital and for its conservation. Beyond methodological limits to monetarisation with regard to its marginal character there are also moral limits. Adopting the weakest and least controversial assumptions regarding both mankind's dependence on biodiversity and environmental ethics, an optimal valuation tool with procedure is finally outlined. The paper suggests some practical tips for overcoming barriers to limits of valuation of ecosystem systems in developing countries in particular besides some recommendations.*

1 Introduction

While ecologists, environmentalists and the concerned public became aware in the 1960s and 1970s that the world's biodiversity was increasingly under threat by mankind's expansion throughout the globe (early important publications include Myers (1979) and Ehrlich and Ehrlich (1981)), economists were reluctant to participate in the debate for a long time. Clem Tisdell was among the first to realise that ecosystem loss had to be conceived of as a loss of a valuable though complex economic resource and that this resource deserved careful economic treatment, just as any other scarce asset. However, his early writings (Tisdell, 1983, 1989) in this field were addressed to the concerned public rather than to his economic co-professionals in showing that well-intentioned environmentalism was not necessarily conducive to a rational management of biotic resources.

Evidently, the pressure on biodiversity has increased rather than relaxed ever since (Wilson, 1988). After the emergence of ecological economics in the late 1980s it took another few years before biodiversity became a major economic topic. Since about 1994, literature in this field has been surging; important contributions emerged from the Stockholm Beijer Institute's research programme, which resulted in the publication of two outstanding volumes (Perrings *et al.*, 1995, 1995a).

The economic outlook implies that ecosystem, more precisely individuals, populations and species of plants and animals within their physical settings in ecosystems, can be valued in economic terms to a certain degree. It is inherent to economic value that it must be traded against other values and that it cannot be taken for granted (as assumed by some environmentalists) that in case of a conflict biodiversity deserves absolute priority over any competing objective. At least, however, decisions as to whether to conserve or irreversibly forgo biodiversity have to be taken in a rational and considerate format, weighing the pertinent arguments, which are badly lacking and in some parts of the world are virtually absent.

Economic valuation is basically a monetary valuation. In practice, natural capital (Jansson *et al.*, 1994) can be valued either as a consumer good or as an intermediate good for production. Examples of the former include the beauty of a landscape, while as an intermediate good or as an element of infrastructure it may perform various functions, serving the integrity of the biosphere or rendering services such as purifying sludge and so on. Roughly, the suitable methods for economic valuation consist in the former case in eliciting the willingness to pay of consumers by direct or indirect methods, such as contingent valuation (Jakobsson and Dragun, 1996) or the travel cost method, while in the latter case a comparison with technical alternatives capable of at least partially substituting nature's services suggests itself. The question arises, for instance, as to what would be the costs to society if nature hypothetically refused to render its services – purifying sludge, maintaining biochemical cycles, stabilizing the physical and chemical properties of the atmosphere and so on, a question addressed by Costanza *et al.*, (1997a) and

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de Groot (1992).

Environmentalists and philosophers alike argue frequently that economic value is of an ephemeral character, which may be relevant in everyday life but not when taking fundamental decisions about nature or even concerning mankind's future. Partly, they are right, and partly, they are wrong. Non economists ought to accept that monetary valuation is justified and may contribute to a more rational treatment of this scarce resource. On the other hand, economic professionals increasingly become aware that there are things in the world which cannot be measured by the rod of money. This contribution aims at demarcating the limits of economic (i.e. monetary) valuation. It will emerge that although some arguments are so straightforward that it may seem unnecessary to present them to a scholarly audience, it may be worthwhile, none the less, to state them in a coherent, systematic way. Others, though familiar in the philosophical debate, are seldom evoked in an economic context, which may justify their presentation here.

1.2 The necessity of correct monetary valuation

Let us first consider the benefits of correct monetary evaluation in the field of ecosystem. As Pearce (1993) puts it, it is not the economist's task to value. Rather, he or she finds out how people value. Whether we like it or not, monetary valuation is carried out every day, in many cases implicitly. If, for instance, tropical forests are destroyed, people do so for some purpose such as logging, clearance for agricultural land and so on, which to them appears more valuable than the intact forest, for one reason or another. One may regret these decisions and one may critizise them. From a moral point of view, it can be posited that people ought not to value in this way (although they do), that their valuation is wrong. They should see that the forests possess values superior to any monetary value and agree that it is morally required to forgo the monetary benefits (although they may be considerable) in favour of these superior values. Before engaging in ethical arguments it is worthwhile to notice that the monetary valuation shown in the previous example may be wrong even in purely economic terms without addressing moral points of view.

In practice monetarisation is often carried out in an incorrect or incomplete way from a welfare point of view. The reasons are manifold, all of them involve information deficits, transaction costs and the pattern of property rights. Of course, the error introduced may in principle work in either direction: Accurate monetary valuation as opposed to common practice may save irreplaceable natural assets in disclosing willingness to pay for conservation which would be overlooked otherwise, but it may as well accelerate irreversible natural damage if willingness to pay for nature-adverse projects is fully elicited. However, experience suggests that the first case is far more common. This is due to the fact that nature-adverse activities are in general more readily amenable to market valuation whereas the more subtle monetary values of nature frequently need to be made explicit by special valuation procedures. Therefore, from a conservationist's point of view, a strong case can be made for correct monetary valuation allowing for all pertinent values, as in the concept of TEV (total economic value) (see Moran and Pearce, 1997). It is a matter of speculation what the world would look like if, even properly accounting for the transaction costs involved, monetary valuation was developed to perfection in this field, but there is much evidence that the amount of tropical forest destruction and comparable activities would be substantially reduced.

2 Obvious Limits to Monetarization

Before turning to more delicate questions, some more or less obvious limits to monetary valuation are mentioned which, although straightforward to the economic professional, give rise to various misunderstandings by the public.

2. 1 Marginal valuation and primary value

People frequently ask: how can a monetary value be placed on natural phenomena in themselves such as air, water, ice, soil, warmth, light, natural beauty and so on? In justly assuming that it cannot it is inferred that monetarizing nature – apart from it being or not practically meaningful or morally permissible – is impossible even on logical grounds. Critics are right in that it is meaningless to try to monetarize all water that exists, or in other words, water in itself. They are wrong in concluding that it is therefore meaningless to monetarize natural assets

such as water altogether. They overlook the fact that the same applies to human-made goods such as, say, bread: it is equally meaningless to assess the monetary value of all bread on earth in a specific moment – taking "bread" as short for food in general. Yet food is valued monetarily in everyday life and traded in markets, which helps to allocate this resource in a rational way and to avoid its being spoiled. Monetary valuation is meaningful only if applied to small quantities.

It has to be granted that modern macroeconomic conventions and, more specifically, the principles of national accounting, are operative in misleading the public. People are informed that the value of all real estate in a country amounts to some fantastic sum of Rupees. This is a purely fictitious value.

If non-marginal valuation is futile it follows that fundamental functions of nature, being the prerequisites of our existence on this planet, cannot be valued monetarily. Just like the sun in the previous example, they simply cannot be substituted for something else, provided that we want to stay alive, so it is meaningless to ask in exchange for what we would be prepared to forgo them. Hypothetically, it would be meaningful to monetarize marginal services of the sun. If it decided to send us a little less energy per unit of time we would be able to calculate the extra effort we had to make in monetary terms in order to compensate for this loss. If, however, the sun had the option to shine or not to shine at all, any monetary approach would be meaningless. It transpires that the non-monetarisability of fundamental functions of nature is related to their indivisibility. This, too, is not a surprising conclusion since monetary valuation is meaningful in gradual decisions and unsuited as a guide in once-and-for-all choices.

This being so straightforward it is all the more remarkable that it took economists decades of discussions to discover this simple fact. Probably the first unambiguous statement of the impossibility of valuing natural services on grounds of their unsubstitutability in modern ecological economics literature is the work of Gren *et al.* (1994), where fundamental natural functions are granted a primary value, an essentially non-economic, untradable value independent of subjective preferences which normally govern an individual's decisions. Of course, it is disputable which of nature's services are technically substitutable or to what degree some of them are if they are divisible. This is not an economic problem proper but a technical issue, and most answers to this question are biased by optimism or pessimism as to the long-term adequacy of human technology. Meanwhile, the new approach of ecological economics fully accepts the unsubstitutability of natural capital, regarding this resource as a complement to human-made capital (Costanza *et al.*, 1997; Daly, 1994), although one might criticize that this important point – however convincing – is often made in intuitive terms which lack analytical rigour.

If a monetary value was tantamount to expressing the "true" value of the thing being valued for every possible purpose, to every possible human and in every possible instant of time, economic valuation would become paralysed altogether because no person would possess the information required to make right choices under these demands. The economic agent who values a thing by the measuring rod of money is free to restrict her attention to what she considers relevant in her own interest and to abstract from everything else. It is this very element of "modesty" which opens scope for monetary valuation; the only reason we are allowed to value in this way is that we implicitly abstain from identifying our personal valuation with any superior or even absolute value. Monetary valuation is invariably restricted and is thereby conducive to everyday decision making on scarce resources rational and predictable. The inevitable price for this restriction is that every agent valuing monetarily must be prepared to be confronted by the community with other aspects of value which may dominate her valuation, thereby restricting or even curtailing her consumer sovereignty. This aspect is obvious to every considerate person if widely agreed moral issues are involved. We agree that our behaviour cannot be governed by monetary interests if this implies that other person's human rights are thereby violated. But in many other cases this is less obvious and it has to be explained to people in a participatory dialogue that some moral aspects they overlooked hitherto limit their consumer sovereignty. The valuation of biodiversity is a case in point. I am free to state: "if the decision was up to me alone, we would pay up to Rs.100 for the conservation of nature, not more". At the same time we must agree that the decision is not up to me alone and we must be open to ethical arguments which, if convincing, may demand a larger contribution.

2.2 Moral limits to the monetary valuation of ecosystem

Some ecologists tell us that biodiversity on earth is just as essentially a prerequisite for our life as soils, biogeochemical cycles or our symbolic example in the previous section, the sun. Ecological economists (Perrings *et al.*, 1995, 1995a) have adopted this idea. If they are right, moral aspects, although not being absent altogether, are of minor practical importance for it is for sheer (egotistic) self-interest if we conserve biodiversity as a life-support system.

Something is not monetarisable on moral grounds if it possesses intrinsic value instead of or in addition to instrumental value. The question is: what possesses intrinsic value? For no other reason than to present our argument, let us in this section adopt a strongly anthropocentric position: suppose that only man is intrinsically valuable and that nature is valuable only for the purpose of satiating human needs, providing for human pleasures and so on. This implies that nature possesses only instrumental value.

The impossibility of monetarising assets existing in an intergenerational context – of which plant and animal species are only the most prominent examples – is due to our adherence to an individualistic ethics regarding humans. The value judgement underpinning this conclusion is not intrinsic value of the resources concerned but the principle of anthropocentric ethical individualism.

It is widely agreed by modern economists and philosophers that within the subset of unpredictable choices the present generation has the duty to bequeath to future humans as broad as possible a scope of opportunities. We have no moral right to limit future choices without need. It would be unfair to future generations to do so. But the principles of intergenerational fairness are to a certain extent symmetrical: future generations cannot demand everything from us. It would be equally unfair to commit the present generation to conserve species if this was extremely costly and at the same time rendered services of only questionable importance to futurity. This point is particularly important if the sacrifice imposed on the present generation is in itself not monetarisable, specifically if it involves infringements on human rights or even loss of human life. The question is often raised (and answered negatively) whether biodiversity must be conserved even if this implies starvation of poor people, as for instance, rural human populations in the vicinity of the last refuges for African gorillas. Although the practical answer is in every case that biodiversity must be conserved and starvation of humans must at the same time be avoided by intragenerational transfer of knowledge and resources from rich countries, the question addresses a profound problem. The distribution of welfare between generations (just as the distribution within a generation) is essentially a moral problem; decisions have to be based on ethical, not on economic (i.e. efficiency-related) arguments. All this implies that if biodiversity is relevant to the welfare of future generations, its value cannot be fully expressed in monetary terms.

2.3 Biocentrism

One would not need the winding arguments above if one simply stated that ture itself possessed a right to be conserved. In modern environmental ethics it is vividly debated whether or not sentient animals, all animals or all animals and plants have intrinsic value or whether even abstract entities such as ecosystems or species or non-living materials have to be respected on the same grounds.

In contrast, biocentrism holds that nature has moral standing and that humans owe duties to her (not only to other humans profiting from her). It is, however, often overlooked that there are different variants of biocentrism with strongly differing consequences. Biocentric individualism (BI) attributes intrinsic value to individuals of animals and plants. The sufficient reason for this is, following Taylor (1986), that although being unable to think rationally (such as animals) or even being inconscious (such as plants) they possess a “good”. Unlike, for instance, in the case of stones, it is always meaningful to state that a plant is well off or less well off, that her teleological ends (which stones do not possess) are fostered well or less well.

As opposed to BI, biocentric holism (BH) is not concerned about individuals. Its adherents argue, in a somewhat more abstract way, that ecosytems, all life on earth and particularly species (although the latter being categories invented by man) have intrinsic value. They would not object to selling or buying individual animals and

plants (or even humans, as one might anxiously ask) because they are exchangeable. However, a species is not exchangeable because it adds to the richness and beauty of the biosphere.

It is impossible in this contribution to assess more fully the philosophical implications of both variants of biocentrism which is done in a growing literature (Attfield and Belsey, 1994; Callicott, 1989; Hargrove, 1989; Norton, 1991; Rolston, 1988). Their economic consequences differ strongly: BI draws extremely narrow limits to monetarisation of individuals, which in practice would imply that our everyday contact with animals and plants (including those we need for our nutrition) would have to be governed by moral aspects in every detail. It is doubtful that man is psychologically fit to meet this challenge. But BI does not object to a (even man-induced) reduction in the number of species on earth because it is only concerned with individuals. On the other hand, BH permits us to treat individuals just as we are accustomed to do, including their monetary valuation, but forbids categorically any man-induced reduction in the number of species. Other interesting questions can only be briefly mentioned:

• Sometimes, biocentrism is generalised to physiocentrism, which states that everything in nature, including non-living beings is intrinsically valuable. Here, we remember Kant's ambiguity: how about beings which are unable to argue rationally but are at the same time unsubstitutable by even the most advanced hypothetical man-made technology? According to him, the sun is not a person and cannot therefore deserve human conduct led by duties (if it happened to care about our conduct anyhow). At the same time, it allows for no substitute and therefore possesses dignity.

• Even the most radical biocentric position is expressed by humans. It is alleged that, in a way, every ethical outlook must therefore be structurally anthropocentric. This conflicts with the view predominant in antiquity that man does not value himself but rather discovers values which ontologically exist in nature, as held by Rolston (1988).

• If biocentric holism is taken seriously man is inferior to nature in the hierarchy of values. Although one might welcome the view that man agreed to behave more modestly and to express more respect for nature, one would be intrigued if this meant that his hitherto inalienable human rights were also cheapened in the hierarchy of values. It is easy to construct holistic systems in which a human individual is not intrinsically valuable, let alone our experiences with various political systems of this kind during the twentieth century.

• Finally, no biocentric holist has been able to date to say why nature is intrinsically valuable. The fundamental reason for this belief being interpersonally incommunicable it is in a liberal society imperative to consider biocentrism as a personal conviction (not unlike religion) which deserves to be respected but cannot demand adoption by others against their will. This is strikingly different from anthropocentric positions, which are the foundation of civilisation as opposed to the "Hobbesian jungle": I must treat other humans as ends in themselves because I expect the same from them regarding my own person.

3. Policy Tips for Overcoming Barriers to Valuation of Ecosystem

Having listing out major of drawbacks of economic valuation of ecosystem and in order to appropriately assess ecosystem for better environmental policy alternatives and the decisions that follows, it is essential to formulate a policy framework for better valuation of ecosystem in view of growing recognition of the importance of ecosystem services. The following are the practical tips in this direction.

i. Value should Measure Trade Offs:

The policy maker should use economic valuation as a way to quantity the trade off in a policy choice in environmental decision making as when possible.

ii. Economic and Ecological Models to be linked:

Economists already produce estimates of value for environmental decision making. However, the strength of their analysis depends in large part on how well the underlying ecology of an ecosystem in understood and measured. Ecologist are challenged because ecosystems are complem, dynamic variable, interconnected, and nonlinear, and because our understanding of the services they provide and how they are affected by human actions are imperfect and difficult to quantity.

In an analysis it is important to ensure that the ecosystem is well understood and also that the study is designed so that output from ecological models can be used as input to the economic models, so that the two can be linked effectively.

iii. Consider Multiple Ways of Ecosystems

Many economists use the Total Economic Valuation (TEV) framework to incorporate the multiple ways that individuals or groups could value an ecosystem – most of which have no market or commercial basis. Following are the important elements of the framework include:

- Use and Nonuse Value: Although different TEV framework are used to assess value, most of them include both "use" and "nonuse" value. Use values can be further divided into consumptive uses (goods, water supply) and non consumptive uses (recreation, habitat support, flood control.)
- Willingness to Pay and Willingness to Accept: If the quality of a freshwater river is improved to enhance its quality, the economic measure of the value of such an improvement would be his willingness to pay. Similarly, if the river water is worsened, the economic measure would be willingness to accept.

iv. Incorporating Judgment and Uncertainly:

Perhaps the most important choice in any ecosystem valuation study is how the initial question is framed. Uncertainty can arise at many steps in an analysis. For ecosystem valuation, one of the biggest source of uncertainty is the lack of probabilistic information about the likely magnitude of some variables. Other source of uncertainty arise from models or parameters used. Economic factors can introduce uncertainty as well.

Although uncertainty and judgment are inevitable, they are not debilitating to ecosystem valuation and do not undermine the validity of the analysis. It is only necessary to provide a clear explanation of how judgment are made how uncertainty are accounted for.

3.1 Overarching Recommendations

When faced with environmental policy decisions that seek to balance human activity and conservation, the process of valuing ecosystem services can inform the policy debate and lead to better decision making. This paper makes the following recommendations for how policymaker should conduct ecosystem valuation :

- Seek to evaluate trade off – where possible, value should be measured in a way that makes analysis of trade offs possible. If the benefits and costs associated with the changes in an ecosystem service must be evaluated as well.
- Frame the valuation appropriately – measure changes in ecosystem services, rather than the value of an entire ecosystem.
- Delineate all source of value from the ecosystem and determine whether they are captured in the valuaton.
- Quantify ecological impacts where possible. Go beyond a simple listing and qualitative description of affected ecosystem services.
- Make sure that economic and ecological models are appropriately linked; the output from ecological modeling must be input to economic analysis.
- Seek to value the goods and services most important to a particular policy decision.
- Base economic valuation of ecosystem changes on the total economic value framework. Include both use and nonuse values
- Consider all relevant impacts and stakeholders in the scope of the valuation.
- Scrutinize any extrapolation made across space, time and scale to avoid errors.
- Economic Steps in the ecosystem strategy and action plan (see figure 1), which includes:

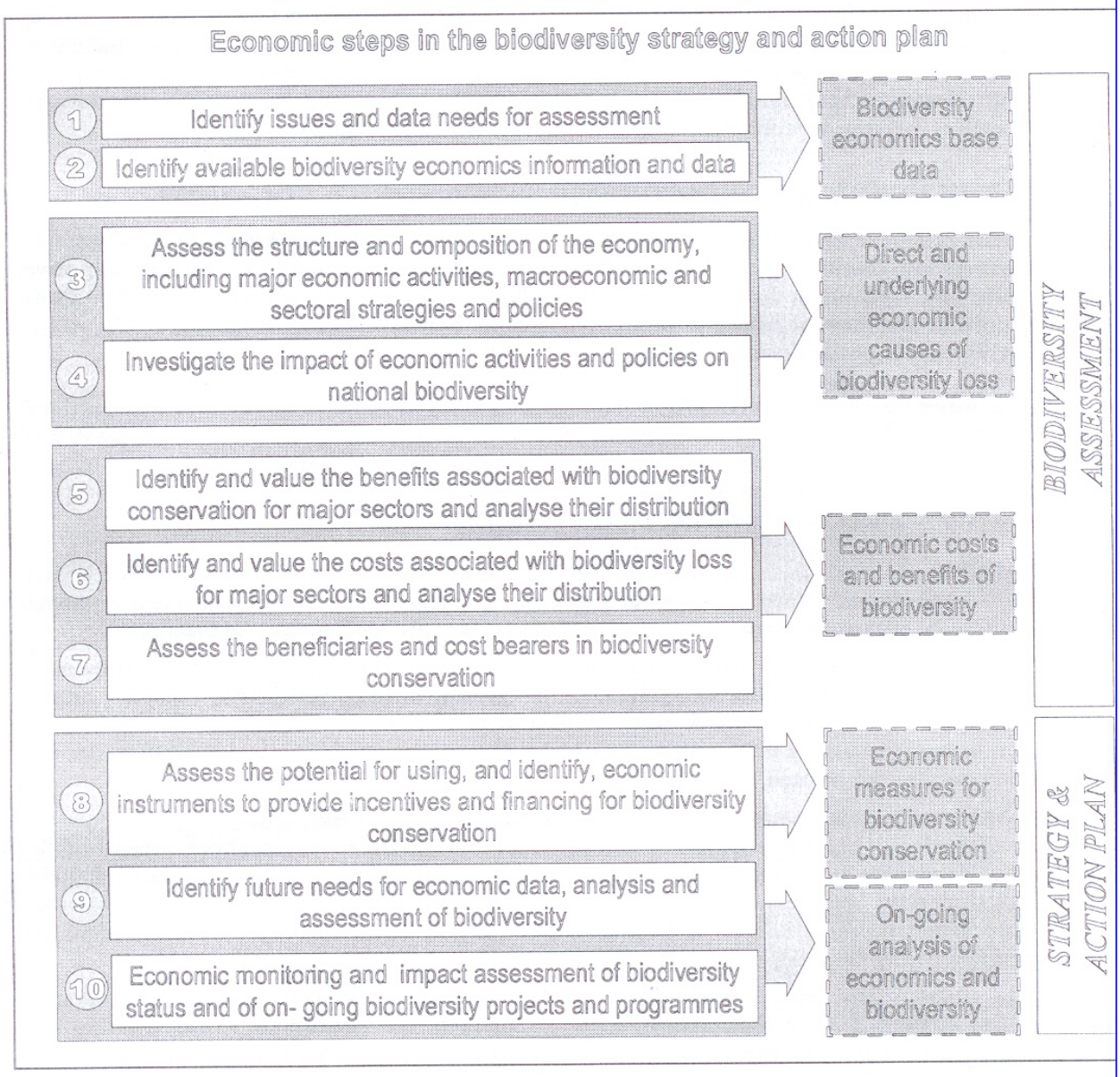
Economic steps in the biodiversity strategy and action plan
1 Identify issues and data needs for assessment
2 Identify available biodiversity economics information and data
Biodiversity economics base data
3 Assess the structure and composition of the economy, including major economic activities, macroeconomic and sectoral strategies and policies
4 Investigate the impact of economic activities and policies on national biodiversity
Direct and underlying economic causes of biodiversity loss
5 Identify and value the benefits associated with biodiversity conservation for major sectors and analyse their distribution
6 Identify and value the costs associated with biodiversity loss for major sectors and analyse their distribution
7 Assess the beneficiaries and cost bearers in biodiversity conservation
Economic costs and benefits of biodiversity
BIODIVERSITY ASSESSMENT
8 Assess the potential for using, and identify, economic instruments to provide incentives and financing for biodiversity conservation
9 Identify future needs for economic data, analysis and assessment of biodiversity
10 Economic monitoring and impact assessment of biodiversity status and of on- going biodiversity projects and programmes
Economic measures for biodiversity conservation
On-going analysis of economics and biodiversity
STRATEGY & ACTION PLAN

Figure No. 1

4. Summary and Conclusion

This contribution accepts monetary valuation of individuals, species, ecosystems and the whole of nature to the largest extent possible. Unlike, for instance, Gowdy (1997), who, following Sagoff (1994), is much more sceptical as to the justification of individualistic valuation in this field, and without ignoring his good arguments, it is held here that there is room for monetary valuation as defined by Kant in mankind's relation to nature. Furthermore, it is agreed that accurate and complete monetary valuation, corrected for omissions and distortions of all kind, as summarised by the concept of TEV (total economic value), is a powerful tool for rational conduct of man with regard to nature. It is true that there are interesting open questions, as addressed by Spash (1997). Nevertheless, in practice, this concept in combination with redistribution between rich and poor societies (which are urgently due independently from the problems discussed here) would stop the spoiling of biodiversity in the shortest possible time and on a worldwide scale. Thus far, this contribution follows the neoclassical tradition, adapted to modern problems.

There are technical and logical limits to the monetarisation of natural assets which are rightly evoked by modern ecological economists. They invariably involve the indivisibility, unsubstitutability and complementarity of fundamental elements, systems or functions of nature which entail the inapplicability of marginal valuation and consequently of monetarisation.

There are "primary values" in nature. Furthermore, there are moral limits to monetarisation which are ignored by many neoclassical economists. As long as the application of TEV and the acceptance of primary values provide sufficiently for the conservation of nature, these moral limits need not be operative in leading our conduct, rather they exist in latent form (comparable to constraints in optimisation exercises which are not binding with, therefore, Lagrange multipliers amounting to zero in specific cases but which may become important if circumstances change). If, however, in case TEV suggests not to conserve biodiversity on economic grounds but rather to allow irreversible losses, as for instance the extinction of a species, moral considerations become operative.

Despite their intellectual values which command respect even from the part of non-adherents, the variants of biocentric ethics are at present of little help in setting up moral limits committing all members of human society because biocentrism must be regarded as a private, voluntary conviction. One may espouse these ideas but one may as well refuse to do so. This may change in the long run with the evolution of ethics, but at present, there is no duty to accept intrinsic values in nature. Therefore, biocentrism cannot be a general idea preventing society (i.e. everybody) from trespassing against moral limits to the monetary valuation of nature.

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