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THE ETHICAL FOUNDATIONS OF SUSTAINABLE ECONOMIC DEVELOPMENT

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ABSTRACT

The concept of sustainable economic development is used as a means of exploring the interface between environmental economics, human ecology and ethics. The conventional economic paradigm, illustrated by utilitarian benefit-cost analysis, is modified to allow for the concept of intergenerational equity. A 'constant natural assets' rule is introduced into the benefit-cost calculus, in order to establish the sustainability paradigm. Both efficiency and equity concerns can be encompassed by this modified paradigm. Although the sustainability analysis allows for non-utilitarian values, it is still anthropocentric in its focus. Our conception of the sustainability paradigm does not make allowance for intrinsic values in nature. Such values are part of what we call the bioethics paradigm. This paradigm we criticise on three grounds - it inhibits development and therefore may well be socially costly; it is potentially regressive in its impacts especially in the developing

economy context; and it is redundant, since the modified sustainability approach can yield an acceptable level of environmental quality for current and future generations.

Introduction: Alternative Paradigms for Choosing Between Conservation and Development

'Sustainable development' has become a catch-all phrase for forms of economic development which stress the importance of environmental quality and the conservation of Nature's assets (World Commission on Environment and Development, 1987; Pearce et al., 1989; Turner, 1988). Definitions of sustainable development abound (see the list given by Pearce et al., 1989), but our interest in the concept lies in its catalytic role as a means of exploring the interface between environmental economics, human ecology, and ethics. In this paper we establish the conventional economic paradigm for the evaluation of policies, programs and projects. We take the conventional paradigm to be, illustrated by benefit-cost analysis in which efforts are made to compare gains and losses in utilitarian terms. A subsidiary requirement of benefit-cost procedures is that any given target for policy should be achieved at minimum cost. In turn, the minimum cost requirement favours the use of certain economic instruments which act primarily on prices in the economy.

We then relate the utilitarian benefit-cost paradigm to allow for a concept of intergenerational

equity. We argue that true sustainable development involves compensating the future for damage being done now, and damage done in the past. Conspicuous examples include the storage of radioactive waste, damage to the ozone layer and the prospect of global warming. Compensation requires the passing-on to future generations of a stock of natural assets no smaller than the stock in the possession of current generations. This 'constant natural assets' requirement produces modifications to the cost-benefit paradigm, notably by raising the implicit value of environmental impacts relative to 'development'. In this way, we suggest that a modified benefit-cost rule is capable of accommodating both the traditional efficiency concerns of economists and the intergenerational equity concerns of economists and non-economists.

The economic paradigm, unmodified by the constant natural assets requirement, relate solely to values of human beings. It is utilitarian and anthropocentric. The modified paradigm, allowing for a constraint on the functioning of the economic system set by the requirement to maintain natural assets, relaxes the utilitarian bias. Constant natural assets reflects a

moral imperative to care for the next generation, and this imperative is not readily interpreted in terms of utilitarian gains and losses. As a clear example, maintaining natural assets is wholly consistent with current generations bearing a cost, say X, which generates benefits for future generations of, say, 0.5X. The utilitarian rule would reject this 'trade' because future benefits are less than the current sacrifice. The 'constant natural assets' (CNA) rule could, however, be entirely consistent with the trade taking place. That is, current generations may have to bear higher costs than future gains in order to maintain constant natural assets. The modified paradigm, which we call the sustainability paradigm, thus allows for non-utilitarian values but remains anthropocentric: the 'fairness' in question is fairness between people.

To relax the economic paradigms further involves making allowance for what ethicists would call 'intrinsic' values in nature. These are non-instrumental values - i.e. they do not necessarily provide any function or service to humans in order to be valuable. The values are 'essential', i.e. are in the assets in question rather than of human beings. Expanding the range of relevant values to intrinsic

values results in what we call the bioethics paradigm. The economist's difficulty with intrinsic values is that due allowance for them in practical decision-making produces stultifying rules of behaviour. Evaluating developments, e.g. a proposal to drain a wetland for agricultural use, ceases to be an issue of comparing benefits and costs (the unmodified paradigm), or of debiting the development with the costs of creating alternative environmental assets of equal value (the modified paradigm). Rather it becomes one of maximising the sum of instrumental and intrinsic values, or some variant of this rule. One such variant would be to 'elevate' intrinsic value above instrumental value so that human society has to operate with technologies and products which use only the minimum of resources in order not to deplete intrinsic value more than is absolutely necessary. Such minimum intrinsic depletion rules risk wholly inequitable 'trades', such as conserving intrinsic values now at the expenses of social justice, and even survival if the context is that of poor developing countries.

The essential contrast, then, is between a modified economic paradigm, the sustainability paradigm, which allows for sustainability in the sense

of intergenerational equity, and the bioethics paradigm which expands the objective function to be maximised to instrumental plus intrinsic values. Endless variations of these paradigms occur. The most notable is the 'strong' bioethics view, or 'deep ecology', which appears to raise the 'worth' of intrinsic values above that of instrumental values (Naess, 1973). In our view there is no prospect of relaxing the modified economics paradigm to embrace wholly the bioethics paradigm. However, we argue that by employing a CNA role the incidental effect is to protect the very values that are of concern to the bioethicists. By protecting habitats, ozone layers, water quality etc, we protect the values that the bioethicists believe are in nature. Conservation of species, for example, entails conservation of habitats which in turn entails the avoidance of biogeographical 'islands'.

Deep ecologists will find this stance unacceptable since the moral ground, in their view, rests with those who intend to behave morally, not with those who happen to secure moral outcomes because they pursue other rules of behaviour. We reject this claim to the moral high ground because of our belief that bioethics is consistent with the sacrifice of basic human values, including fundamental rights to exist at an acceptable

standard of living. In short, we argue for the modified economic paradigm as a means of integrating economic efficiency and intergenerational equity. Our further belief is that the resulting 'constant natural assets' rule has two incidental effects: (a) it protects the environments of the poorest communities in the world who depend directly on those environments for fuel, water and food; and (b) it protects the environments of sentient non-humans and non-sentient things.

Benefit-Cost Paradigm

Within the central core of the sustainable development notion is the fact that economic systems are dependent on ecological foundations and ultimately on the maintenance of the global waste assimilation and life-support systems. The way humans manage their economies impacts on the environment and, in the reverse direction, environmental quality impacts on the working of the economy. Neither market-based economies nor planned economies are systems with in-built features that would guarantee sustainability. A vital sustainable economics principle is that natural resources and environments are multifunctional and represent vast storehouses of economic value. To treat

some of these functions and services as if they had zero value (free goods) is seriously to risk over-use and destruction of the whole capital asset. It is therefore vitally important that the environment is valued correctly and that these values are integrated into economic policy.

Three environmental value relationships seem to underlie the policy and ethics adopted in industrialised economies: values expressed via individual preferences; public preference value; and functional physical ecosystem value (see Figure 1). At a fundamental level economic systems are dependent on ecological foundations and ultimately on the maintenance of the global waste assimilation and life-support systems. The long-run survival of human society depends on these functional requirements that are met by a set of social norms. Over time, if sustainability is the accepted policy goal, such norms must be consistent with the natural laws governing ecosystem maintenance.

INSERT FIGURE 1 ABOUT HERE

The individuals in such economic systems are assumed to operate according to their own preferences

within the context of physical requirements and social norms. Some analysts claim that there is a need to emphasise the intuitive environmental ethic which is present in society but which has remained largely dormant. A growing philosophical literature has sought to give rational and theoretical support to this intuitive ethic, as well as attempting to determine the content of the ethic. On the other hand, according to conventional economic theory, the value of all environmental assets is measured by the preferences of individuals for the conservation of those assets.

Total Economic Value

Environmental economists have gone a considerable way towards a taxonomy of economics value as they relate to natural environments (Pearce & Turner, 1979). The terminology is still not fully agreed, but the approach is based on the traditional explanation of how value occurs, ie. it is based on the interaction between a human subject (the valuer) and objects (things to be valued). Individuals have a number of held values which in turn result in objects being given various assigned values.

In order to arrive at a measure of total economic

value, economists begin by distinguishing user values from intrinsic values. In a straight forward sense, user values derive from the actual use of the environment. Slightly more complex, are values expressed through options to use the environment (option values). They are essentially expressions of preference (willingness to pay) for the preservation of an environment against some probability that the individual will make use of it at a later date. Provided the uncertainty concerning future use is an uncertainty relating to the 'supply' of the environment, economic theory indicates that this option value is likely to be positive. A related form of value is bequest value, a willingness to pay to preserve the environment for the benefit of one's children and grandchildren.

Intrinsic values present more problems. They suggest values which are in the real nature of the thing but unassociated with actual use, or even the option to use the thing. Instead such values are taken to be entities that reflect people's preferences, but include concern for, sympathy with, respect for the rights or welfare of non-human beings. Individuals may value the very existence of certain species or whole ecosystems. Total economic value is

then made up of:

actual use value + option value + existence value,

The contexts in which analysts are seeking to determine total economic values often contain the features of irreversibility, uncertainty (particularly in terms of ecosystem functions) and uniqueness. Economic theory indicates a precautionary, or safety margin approach in such circumstances. Preservation/conservation of the natural assets will be relatively more favoured in comparison to development.

A certain amount of progress has been made by economists attempting to determine empirical (monetary) measures of both environmental use values and non-use values. None of the techniques that have been utilised are problem free but enough empirical work has been undertaken to indicate that humans do value the environment positively. Interestingly, non-use values appear to be significantly positive. While the estimates made so far are subject to quite wide error margins, no-one can doubt that the values uncovered are real and important.

The Benefit-Cost Rule

Consider the choice between developing, say, a

wetlands area or preserving it: often a discrete choice problem because many commercial uses of the wetlands would destroy its preservation benefits (Turner, 1990). Then, writing $PV(B_D)$ as the present value [1] of development benefits, $PV(B_P)$ as the present value of preservation benefits, $PV(C_D)$ as the development costs and $PV(C_P)$ as the direct costs of preservation (e.g. policing, maintenance and monitoring costs), the rule we have been using would indicate that we should develop the wetland if:

$$\{PV(B_D) - PV(C_D)\} > \{PV(B_P) - PV(C_P)\}$$

or

$$\{PV(B_D) - PV(C_D) + PV(C_P)\} > 0$$

Dropping the PV notation for convenience, we know that we can also write:

$$B_P = TEV + OP + EXV$$

$$= AUV + OV + EXV$$

where TEV is total economic value, OP is option price, EXV is existence value, AUV is the expected actual use value of the wetlands in its preserved form, and OV is

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[1] The 'present value' refers to a single-valued estimate of the stream of net benefits over time. The means of 'collapsing' the stream of values is through discounting.

the option value preservation. Option price is simply the sum of actual use value and option value.

Thus our rule for deciding on development becomes:

$\{B_D - C_D - C^P\} > \{OP + EXV\}$

In terms of *measurability*, it will be clear that development benefits, development costs and preservation costs are likely to be the subject of well-defined monetary estimates. This raises two immediate cautions. First, since OP and EXV are difficult to measure (difficult, not impossible), there is a danger of 'misplaced concreteness'. The things that can be measured might appear to be somehow more important than those which cannot be measured. This is a wise deduction, for the economic values embodied in non-market preferences are just as important as those embodied in market preferences. Second, because something is easy to measure it does not mean that the estimate is correct. It always pays to scrutinise the alleged development benefits. *Ex post* evaluations of development projects frequently show that development benefits are exaggerated at the time of the proposal: there is an in-built benefit 'optimism' on part of planners and developers. This bias, for example, has been present in energy planning with respect to nuclear

power, and in the building of large hydroelectric dams. Another reason for bias is the underestimation of technological progress: as technology advances it tends to displace the technology that is generating the development benefit.

On the conventional economic model, then, values are anthropocentric and utilitarian. However, the logical inclusion of existence values raises the real possibility that the motivation for existence values is non-utilitarian. Thus, if existence values reflect concerns on behalf of nature, they may well be capturing part at least of what the bioethicist is calling intrinsic values. The current state of the art in economic valuation offers no real way of testing this proposition. One major authoritative review has argued that, while valuation techniques can secure reliable estimates of TEV, they cannot separate out the components of TEV (Mitchell and Carson, 1989) . For the moment, we simply speculate that existence values may encompass non-utilitarian values through the normal mode of revealed preference (Brookshire, Eubanks & Sorg [1986]).

The Modified Economic Paradigm: Sustainable Development

Defining sustainable development

Since 'development' is a value word, implying change that is desirable, there is no consensus on its meaning. What constitutes development depends on what social goals are being advocated by the development agency, government, analyst or advisor (Pearce et al., 1989 and Pearce et al., 1990a; Pearce et al., 1990b). We take development to be a vector of desirable social objectives, and elements might include:

- increases in real income per capita
- improvements in health and nutritional status
- education achievement
- access to resources
- a 'fairer' distribution of income
- increases in basic freedoms

The vector components are also readily expanded to include the 'rights' of sentient non-human species.

Correlation between the vector elements, or an agreed system of weights to be applied to the elements, might permit development to be represented by a single 'proxy' indicator, but this is not an issue pursued here.

Sustainable development is then a situation in which the development vector, D, increases

monotonically over time, i.e. dD/dt > 0. However, such a simple definition is not problem-free. For example, use of the term tends to imply the adoption of an infinite time horizon, whereas practical decision-making requires adoption of some finite horizon. Nor does it tell us if dD/dt must be positive for each and every time period (which we might term strong sustainability), or whether only the trend of dD/dt must be positive (weak sustainability). For current purposes, sustainable development is better interpreted in its weak form as saying that dD/dt is generally positive over some selected time horizon.

Subject to the above caveats, we suggest that sustainability be defined as the general requirement that a vector of development characteristics be monotonically increasing over time, where the elements to be included in the vector are open to ethical debate, and where the relevant time horizon for practical decision-making is similarly indeterminate outside of agreement on intergenerational objectives. This level of generality may seem unsatisfactory, but the essential point is that what constitutes development, and the time horizon to be adopted, are both ethically determined. Such an ethical debate can

be illuminated by discussion of the alternative views on both issues, but it cannot be resolved other than by ethical consensus.

The Conditions for Sustainability

Much of the sustainable development literature has confused definitions of sustainable development with the conditions for achieving sustainability. The preceding discussion suggests that the definition, the meaning, of sustainable development, is evident from the phrase itself. We now consider the necessary conditions for achieving sustainable development. These conditions, elaborated below, are not sufficient, however. A sufficient set of conditions is likely to include, for example, institutional requirements for implementing sustainable development policy, and may even require systematic changes in social values (O'Riordan, 1988).

We summarise the necessary conditions as 'constancy of the natural capital stock'. More strictly, the requirement is for non-negative change in the stock of natural resources such as soil and soil quality, ground and surface water and their quality, land biomass, water biomass, and the waste assimilation capacity of receiving environments.

The presumption that sustainability has something to do with non-depreciation of the natural capital stock is explicit in the Brundtland Report (1987). Thus,

> "If needs are to be met on a sustainable basis the Earth's natural resource base must be conserved and enhanced". (World Commission on Environment and Development, 1987, p.57).

It is somewhat more vaguely embraced in the World Conservation Strategy in terms of maintaining 'essential ecological processes and life support systems', 'preserving genetic diversity', ensuring 'sustainable utilisation of species and ecosystems' (IUCN, 1980, Section I). Both sources offer rationales for conserving natural capital in terms of moral obligation and the alleged mutual interdependency of development and natural capital conservation. We offer our own rationale but before doing so we need to ask why the existing capital stock should be preserved, and what conserving the natural capital stock might mean.

Existing and Optimal Capital Stocks

Conserving the natural capital stock is consistent with several situations. The stock in question might be that which exists at the point of time that decisions are being taken - the existing stock, or it might be the stock that should exist. The latter is clearly correct in terms of the application of neoclassical economics principles to resource issues. The optimal steady state stock will be one for which any small increase in the stock will yield benefits just equal to the discounted costs of achieving the increase. Relevant to the cost calculation in this respect is the use to which the land or water resource might be put if it was not used to supply environmental capital. That is, to establish the optimal stock of natural assets it is necessary to engage in a cost-benefit analysis of changes in the stock of assets.

Two observations are in order on the use of optimal rather than existing capital stocks. First, existing stocks would generally be regarded as being below optimal stocks in many developing countries. For some Sahelian countries they are significantly below the optimum in that desertification actually threatens livelihoods (Falloux and Mukendi, 1988). To some extent, therefore, deliberations about what precisely

constitutes an optimum are redundant. Requiring that the existing natural capital stock be constant or increasing is consistent with the idea that one should move to an optimal capital stock, and has particular significance for poorer countries.

The second observation relates to the meaning of 'optimum' in this context. To say that capital stocks 'should' be optimal is tautologous. The interesting feature of optimality is how the benefits of augmenting natural capital are calculated. The critical factor here is, as we noted earlier, that the multifunctionality of natural resources needs to be recognised, including their role as integrated life support systems. Thus, a cost-benefit analysis that compares the 'value' of, say, afforestation with the opportunity cost of land in terms of foregone development values needs more careful execution than might otherwise appear to be the case. How far life-support functions such as contributions to geochemical cycles can be captured by cost-benefit is open to question. In the face of uncertainty and irreversibility conserving what there is could be a sound risk-averse strategy.

There is a powerful case in analytical economics

for thinking in terms of maintaining optimal rather than existing natural capital stocks as the basic condition for sustainability. In practice, and for poor countries dependent upon the natural resource base, optimal stocks will in any event be above the existing stock. In other cases there are rationales in terms of incomplete information (the failure to appreciate and measure multifunctionality), uncertainty and irreversibility for conserving the existing stock.

Conserving the natural capital stock serves goals which would command wide, though maybe not universal, assent. Sustainable development based on this notion is consistent with:

- justice in respect of the socially disadvantaged.
- justice between generations.
- justice to Nature.
- aversion to risk arising from our ignorance about the nature of interactions between environment, economy and society, and from the social and economic damage arising from low margins of resilience to external 'shocks' such as drought and plagues, or to 'stresses' such as soil erosion and agro-chemical residues.

Intragenerational Equity

A constant or rising natural capital stock is likely to serve the goal of intragenerational fairness, i.e. justice to the socially disadvantaged both within any one country and between countries given point in time. The clearest evidence for this exists for poor developing economies in which direct dependence on natural resources is paramount. Examples include: reliance on biomass fuels such as fuelwood, crop residues, and animal waste; reliance on untreated water supplies; dependence on natural fertilisers (organic materials) to maintain soil quality; fodder from natural vegetation for livestock and wildlife meat for protein.

The equity function of natural capital is less obvious for developed economies. Indeed, the contrary view, that the demand for environmental assets is biased towards the rich, tends to define the conventional wisdom. However, the evidence for supposing that there is a higher income responsiveness of demand for environmental goods is distinctly unpersuasive (for a review see Pearce, 1980). Additionally, the physical incidence of pollution - i.e. exposure to air and water pollutants, solid waste

and noise - appears inversely correlated with income (Berry, 1977).

The general result, therefore, is that, as far developing countries are concerned, environmental improvement is likely to be consistent with the goal of intragenerational equity, and very much so in the poorest agriculture-dependent economies. In the latter case the 'environment-poverty trap' prevails: as poverty increases, natural environments are degraded to obtain immediate food supplies. As environments degrade so the prospects for future livelihoods decrease: environmental degradation generates more poverty, thus accelerating the cycle. The provision of natural capital offers one way of breaking into the cycle.

Intergenerational Equity

Although not intended for the purpose, Rawls' theory of justice offers a moral basis for arguing that the next generation should have access to at least the same resource base as the previous generation (Rawls, 1972; Page, 1977). Rawls' 'maximum' strategy suggests that justice is to be equated with a bias in resource allocation to the least advantaged in society. Such a rule could emerge from a constitution drawn up by individuals brought together under a 'veil of

ignorance' about where in society they would be allocated. Risk aversion dictates that the constitution-makers would avoid disadvantaging certain groups for fear that they themselves would be allocated to these groups. The intergenerational variant of the Rawls outcome simply extends the veil of ignorance to the intertemporal context in which each generation is ignorant of the time period to which it will be allocated.

Interpreted this way there would appear to be no particular reason for focussing on natural capital as the instrument for achieving intergenerational equity. It might apply more to man-made capital or to some composite of both types of capital. There are some reasons for supposing that natural capital is more important, however. First, natural capital may qualify as a Rawlsian 'primary good' - a good with the characteristic that any rational being would always prefer more of it to less. The life support functions of the natural environment would seem to fit this category since less of them would remove the very capability of choosing and having preferences. The ability to make a choice would, on this argument, have a higher ethical status than the rights and wrongs of

making a particular choice. Moreover, natural capital differs from man-made capital in a crucial respect. Man-made capital is virtually always capable of symmetric variation - it can be increased or decreased at will. Natural capital is subject to irreversibilities in that it can be decreased but often not increased if previous decrements lead to extinction.

The primary good and irreversibility features of natural capital thus suggest that natural and man-made capital are substitutes only to a limited extent.

Sustainable Development and the Benefit-Cost Paradigm

We are now in a position to consider how the idea of sustainability can be incorporated into cost-benefit analysis. Benefit-cost analysis (BCA) embodies intuitive rationality utilitarian in that any course of action is judged acceptable if it confers a net advantage, i.e. if 'benefits' outweigh 'costs'. What constitutes a gain or loss depends on the objective function chosen. Most BCA operates with a function based on economic efficiency, i.e. on the basis that a benefit is anything whereby more is preferred to less, and a cost is anything whereby less is preferred to more. But this is only one objective function. It is

widely used because economic efficiency is embodied in the very structure of the welfare economics developed over the last century. In principle, however, any other objective function can be chosen, or, more profitably, a set of objectives can be chosen. Common parlance has it that BCA using more than one objective is termed 'extended' BCA. Such terminology is neutral if the idea is to compare multi-objective CBA with the 'norm', i.e. CBA based on economic efficiency alone. It is misleading terminology if it is meant to imply that the basic structure of BCA is somehow overturned by the inclusion of other objectives. Indeed, integrating the sustainability objective into BCA can be shown to leave the basic structure of BCA intact, but the resulting modifications to the basic theorems are of interest, and, we suggest, of importance.

Sustainability can be introduced into the benefit-cost models through the idea of compensating offsets. Since the aim is to maintain a 'constant natural environment', any set of policies, projects or programmes which damages the environment needs to be offset by a specific investment which restores natural or other environments to an 'equal value'. The requirement is not that each project or activity should

be obliged to restore the environment to its original state - that would be stultifying. Instead, by analysing an overall portfolio of investments it should be possible to detect the cumulative environmental impact and then identify offsetting environmental improvements. This use of offsetting projects defines the modified benefit-cost approach. Notice that the modified benefit cost rule becomes the instrument for achieving constant environmental assets. In turn, constant environmental assets afford protection for future generations, the poor of current generations who depend directly on natural assets, and the inhabitants of the spatial areas containing the natural capital. Moreover, the benefits relevant to this rule include the existence values earlier identified as the means whereby individuals reveal their concern for intrinsic values in the sense of the bioethicists. By these means, we argue, the modified benefit-cost rule achieves:

(a) a comprehensive capture of anthropocentric values and

(b) the potential for capturing part at least of the intrinsic values identified by bioethicists.

Figure 2 summarises the main ideas of sustainable development and their linkages to different value

systems.

INSERT FIGURE 2 ABOUT HERE

Bioethical Values

The debate about the need for and content of a new environmental ethic highlighted supplementary and alternative measures of value (Turner, 1988). It has been claimed that individuals have public preferences as well as private preferences and related assigned values. Public preferences are said to involve opinions and beliefs about what ought to be the case rather than individual desires or wants. They are the basis of social norms and legislation. It is still argued that all value is found in human loci, but it is not restricted to satisfactions of felt preferences of human individuals. Individuals may also hold "considered preferences" related to the public, group or community interest. For example, that the current generation has a generalised obligation to maintain a stable flow of resources into the future (an inheritance of environmental and conventional goods and services) in order to ensure continuing human life, rather than just meeting individual requirements.

More radically, some environmentalists believe that nature has inherent value which exists whether or not humans are around to sense and experience it. The "new naturalistic" ethical positions encompass this notion of inherent value in nature and go on to extend the moral reference class to non-human nature (both animate and inanimate) see Figure 3.

INSERT FIGURE 3 ABOUT HERE

An on-going debate has evolved among philosophers and environmentalists about the theoretical basis for "new naturalistic" ethics, as well as the content of the ethics. The extension of the moral reference class beyond human beings in the current generation opens up a multitude of complex questions. The notion of environmental value (particularly the distinction between instrumental and intrinsic value in nature) has become one focal point in the wider debate. The more radical ethical positions (ethics "of the environment") involve an acceptance of the idea that non-human nature (both conscious and non-conscious) be capable of being inherently valuable (i.e. both possess intrinsic value (Regan, 1981).

We have argued that an ethic "for the use of the

environment", which restricts rights to humans and recognises primarily only instrumental value in nature, can in any case offer sufficient environmental safeguards. More progress may be made if analysts turned their attention to the individualist basis of utilitarianism and conventional economics. Adopting a more collectivist approach would allow the recognition of "generalised obligations" (Norton, 1987) - obligations of the current generation to maintain a set of opportunities (our CNA rule) into the indefinite future, in order to ensure an adequate standard of human welfare, rather than just meeting individual requirements.

Conclusion

The issue of development versus conservation poses some of the most complex problems for modern environmental ethics. In this paper we have contrasted three broad paradigms for the decision-making process:

- the benefit cost approach. Rooted in utilitarianism, this approach evaluates the problem from the standpoint of economic efficiency. It does not, in its basic form anyway, consider other social objectives such as equity,

duty or moral obligation. The benefit-cost approach is deliberately anthropocentric, but it does not exclude judgements on behalf of other species, the 'stewardship' motive. The phenomenon of 'existence value' identified and measured by environmental economists may well capture such values.

- the modified benefit cost approach which is derived from the concept of sustainable development. Sustainability requires, we argue, a commitment to the conservation of natural capital stocks. Benefit-cost is modified through the idea of offsetting or compensating investments designed to compensate for cumulative damage done by investments which pass the orthodox benefit-cost test. In the current context, our interest in this rule lies in its role as a means of securing non-utilitarian values, include inter-generational equity, concern for the disadvantaged in current society, sentient non-humans and non-sentient things. The protective nature of the rule is an incidental effect of its primary purpose - economic efficiency and intergenerational equity.

- the bioethical standpoint which argues either for some broad equality between anthropocentric

values and 'intrinsic' values, or for 'higher moral ground' for intrinsic values. Intrinsic values in this context are 'in' beings and objects, rather than 'of' human beings. We argue against the bioethical standpoint on three grounds:

(i) it is stultifying of development and therefore has high social costs in terms of development benefits forgone;

(ii) it is conducive to social injustice by defying development benefits to the poorest members of the community, now and in the future;

(iii) it is redundant in that the modified sustainability approach generates many of the benefits alleged to accrue from the concern for intrinsic values.

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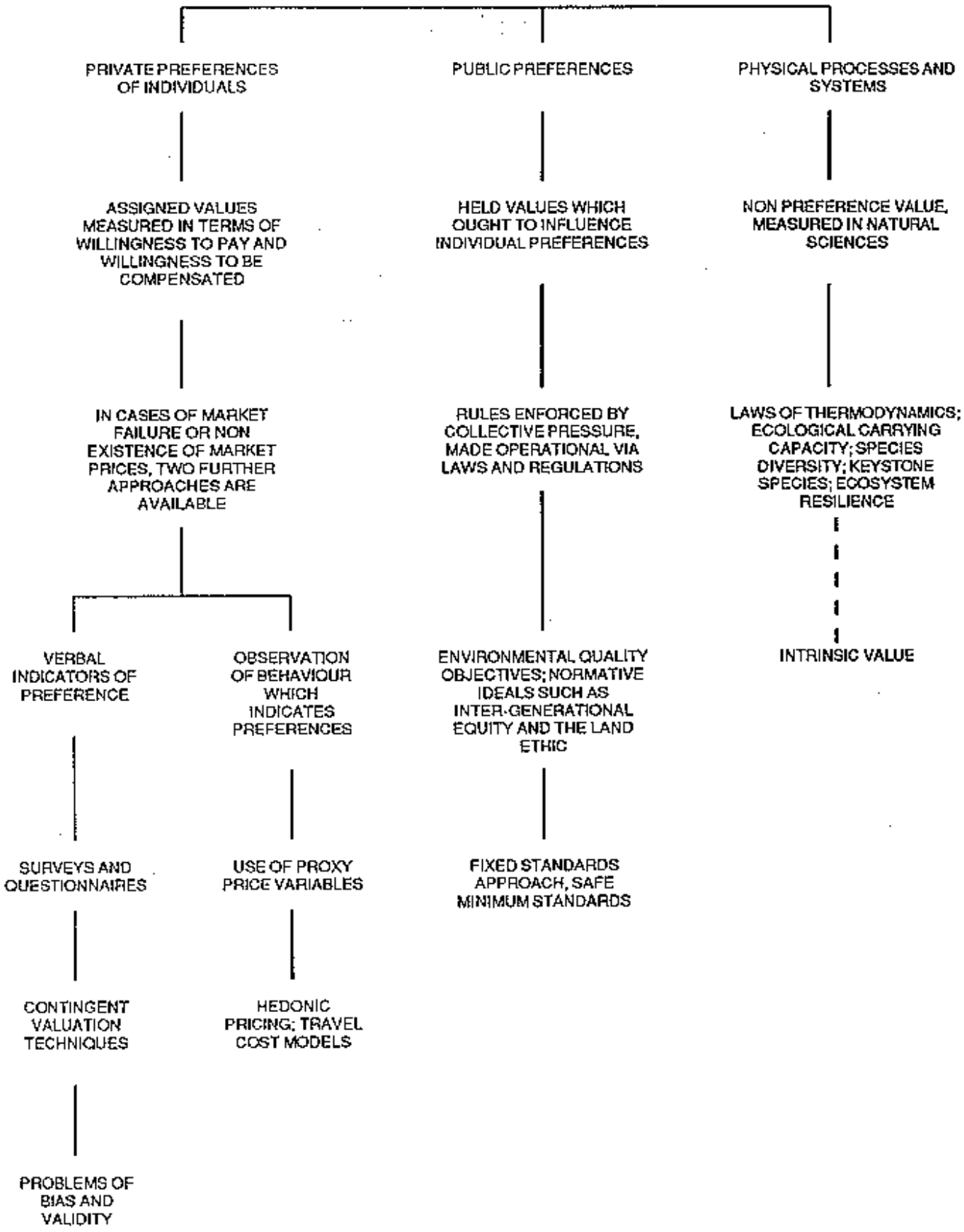
FIG. 1 ENVIRONMENTAL VALUES



Source: D.W. Pearce and R.K. Turner, Economics of Natural Resources and the Environment, Harvester Wheatsheaf, Hemel Hempstead, 1990.

Fig. 2 SUSTAINABILITY PARADIGM

INTERDISCIPLINARY LINKING CONCEPTS AND THEMES

SUSTAINABLE ECONOMIC DEVELOPMENT PERSPECTIVE; BALANCE TO BE STRUCK BETWEEN RESOURCE CONSERVATION, SUSTAINABLE UTILISATION AND ECONOMIC DEVELOPMENT

→ ENVIRONMENTAL IDEOLOGIES: (ecocentrism versus technocentrism).

EFFICIENCY AND EQUITY WITHIN AND BETWEEN GENERATIONS;
EFFICIENCY AND EQUITY OBJECTIVES ARE SECURED BY ACTUAL COMPENSATION;
REJECTION OF POTENTIAL WELFARE CONCEPT.

→ ECONOMICS AND ETHICS: PARETO WELFARE, UTILITARIANISM, INTRAGENERATIONAL EQUITY, CONTRACTUALISM, INTERGENERATIONAL EQUITY, BIO-ETHICS.

ACTUAL COMPENSATION IS OPERATIONALIZED VIA THREE TYPES OF CAPITAL TRANSFER IN ORDER TO PASS ON A PORTFOLIO OF PRODUCTIVE OPPORTUNITIES OF EQUAL OR GREATER VALUE TO THE NEXT GENERATION:

→ ENVIRONMENTAL SCIENCE, CIRCULAR ECONOMY THERMODYNAMICS AND ENTROPY;

'CRITICAL' NATURAL CAPITAL + OTHER NATURAL CAPITAL + MAN-MADE CAPITAL

K_N^C < VERY LIMITED SUBSTITUTION > K_N < GREATER SUBSTITUTION > K_M

→ ECOSYSTEM RESILIENCE AND THE LACK OF AN "EXISTENCE THEOREM" IN ECONOMICS: CRITICAL ECOSYSTEMS AND BIOSPHERE FUNCTIONS.

$KN^C + K_N + K_M$ = TOTAL CAPITAL STOCK

GNP - ΔK_N = SUSTAINABLE INCOME FLOW

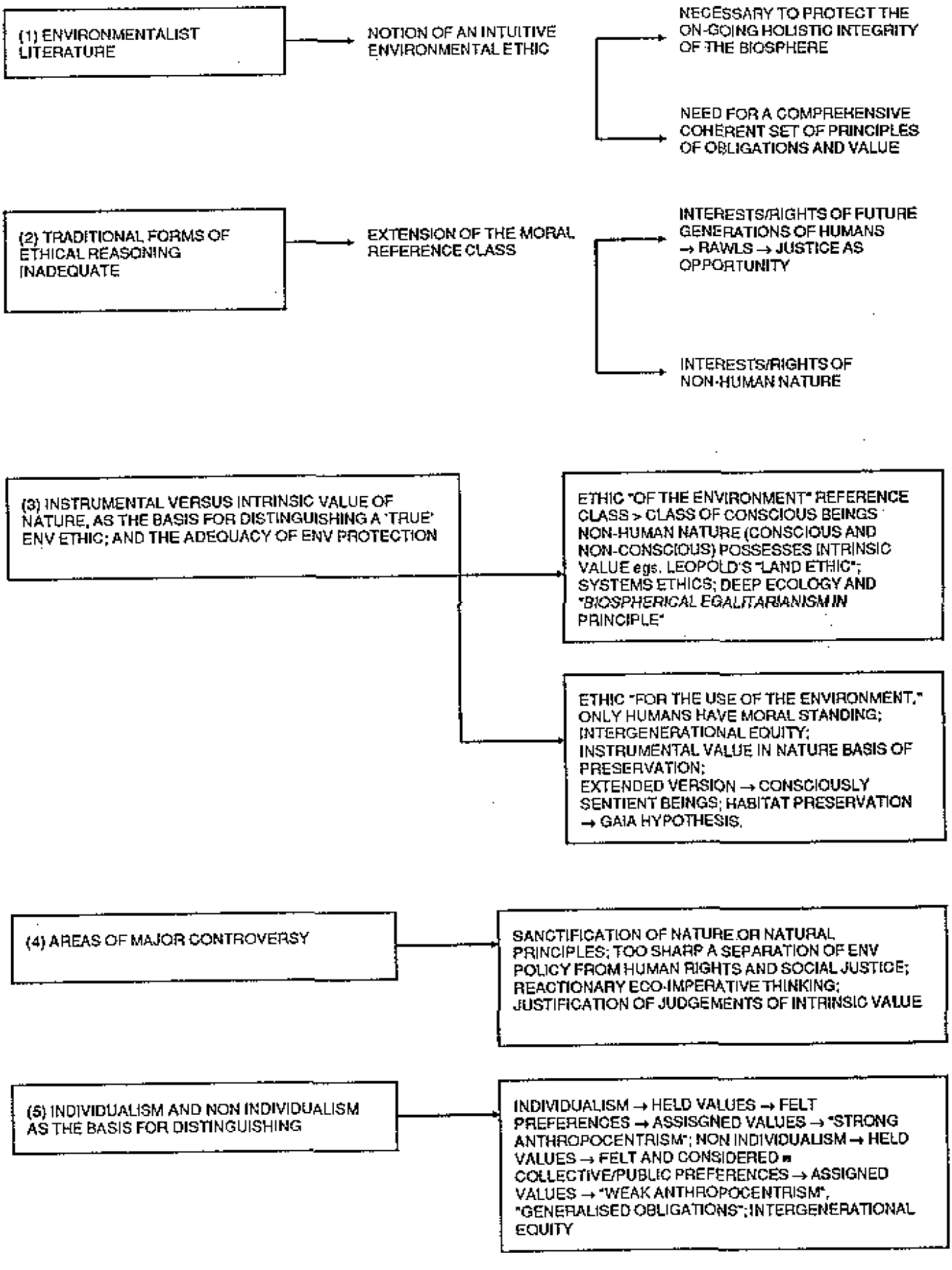
→ NATIONAL INCOME AND NATIONAL RESOURCE ACCOUNTING.

BENEFIT-COST APPROACH (MODIFIED) VALUATION OF THE CAPITAL STOCK: TOTAL ECONOMIC VALUE = USE + OPTION + EXISTENCE; CONSUMER SURPLUS, EQUIVALENT AND COMPENSATING VARIATIONS, WILLINGNESS-TO-PAY AND WILLINGNESS-TO-ACCEPT COMPENSATION; VALUATION METHODS AND TECHNIQUES; TRAVEL COST, HEDONIC PRICING, CONTINGENT VALUATION ETC.

MANAGEMENT OF THE MULTIFUNCTIONAL NATURAL CAPITAL STOCK TO ENSURE SUSTAINABLE FLOW OF INCOME.

→ ENVIRONMENTAL VALUE RELATIONSHIPS: INSTRUMENTAL VERSUS INTRINSIC VALUE; UNCERTAINTY, IRREVERSIBILITY AND SUSTAINABILITY CONSTRAINTS, SAFE MINIMUM STANDARDS; SHADOW PROJECT APPROACH (COMPENSATING OFFSETS).

FIG. 3 ENVIRONMENTAL ETHICS



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BOOKS

Edward B Barbier,
Economics, Natural-Resource Scarcity and Development: Conventional and Alternative Views. Earthscan Publications Limited, London, 1989. (£29.95)

The history of environmental and resource economics is reviewd, then using insights provided by environmentalism, ecology and thermodynamics, Barbier begins the construction of a new economic approach to the use of natural resources and particularly to the problem of environmental degradation. With examples from the global greenhouse effect, Amazonian deforestation and upland degradation on Java, Barbier develops a major theoretical advance and shows how it can be applied. This book breaks new ground in the search for an economics of sustainable developement.

David W Pearce, Edward B Barbier and Anil Markandya,
Sustainable Development: Economics and Environment in the Third World, Edward Elgar Publishing Limited, London 1989 [in press].
** Enquiries/orders to Edward Elgar Publishing Ltd Gower Publishing Group, Gower House, Croft Road, Aldershot, Hants GU11 3HR.
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The authors attempt to give some structure to the concept of sustainable development and to illustrate ways in which environmental economics can be applied to the developing world. Beginning with an overview of the sustainable development concept, the authors indicate its implications for discounting and economic appraisal. Core studies on natural resource management are drawn from Indonesia, Sudan, Botswana, Nepal and the Amazon.

David W Pearce, Anil Markandya and Edward B Barbier
Blueprint for a Green Economy, Earthscan, September 1989, £6.95 (Second Printing)

This book by the London Environmental Economics Centre was prepared as a report for the Department of Environment, as a follow up to the UK government's response to the Brundtland Report. Here it stated that: '...the UK fully intends to continue building on this approach (environmental improvement) and further to develop policies consistent with the concept of sustainable development.'
The book attempts to assist that process.

Gordon R. Conway and Edward B. Barbier
After the Green Revolution:
Sustainable Agriculture for Development
Earthscan, London 1990 (available in April)

The Green Revolution has been successful in greatly improving agricultural productivity in many parts of the developing world. But these successes may be limited to specific favourable agro-ecological and economic conditions. This book discusses how more sustainable and equitable forms of agricultural development need to be promoted. The key is developing appropriate techniques and participatory approaches at the local level, advocating complementary policy reforms at the national level and working within the constraints imposed by the international economic system.

David W. Pearce and R. Kerry Turner
** Economics of Natural Resources and the Environment, Harvester-Wheatsheaf, London and Johns Hopkins University Press, Baltimore, 1989.

This is a major textbook covering the elements of environmental economics in theory and practice. It is aimed at undergraduates and inlcudes chapters on sustainable development, environmental ethics, pollution taxes and permits, environmental policy in the West and East, recycling, and optimal resource use.

Copies of the above publications (except those marked with **) are available from:

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The London Environmental Economics Centre (LEEC) is now known as the Environmental Economics Programme, at the International Institute for Environment and Development. The former name dates from 1987 when the Centre was established by IIED and the Economics Department of University College, London.

Today, all environmental economics staff and research projects are based at IIED where the Programme has become a core area of Institute activity.

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