

Winrock International Institute for Agricultural Development

**ENVIRONMENTAL AND NATURAL RESOURCE POLICY ISSUES
IN DEVELOPING COUNTRIES**

by
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Environmental and Natural Resource Policy Issues in Developing Countries

Introduction

The central task of the technical assistance wing of the Environmental Policy and Training project (EPAT) is to help developing countries formulate and implement appropriate environmental and natural resource (ENR) policies. This task involves two different kinds of policy analyses. The first is "ENR impact assessments," which pertain to the ENR effects of economic development policies. The second consists of policies that are specifically designed to serve ENR objectives. In the first case, the primary policy objective is economic development, with ENR objectives acting as constraints. In the second case, ENR objectives are primary, constrained by the interests of economic development. In both, a major function of EPAT is to define the complementary and competitive relationships among economic development and ENR objectives and help design policies that create the most complementary and the least competitive relationships as possible. In performing this task, we should understand that, as Gilbert White says, we are dealing with multiple objectives, multiple measures and multiple means.

This paper is divided into three parts: The first describes a general approach to policy analysis that I have found useful. The second discusses ENR policy analysis in developing countries in terms of the differences between less developed countries (LDCs) and developed countries (DCs) and the major ENR problems in LDCs. The last briefly examines the framework and tools of economic analysis and the role of the economist in the field of ENR policy formulation.

Values and Facts¹

Policy formulation addresses the fundamental question: given our values, our resources and the uncertainty of the future, (a) what should we attempt to achieve? and (b) by what processes can it best be achieved? The answer to this two-part question requires a rather mysterious synthesis of two incommensurable kinds of knowledge: the *subjective* knowledge of values, and the *objective* knowledge of facts.

Values define the desirability or worth of a purposive process of action. Facts (including relationships) pertain to the theoretical ability to achieve the purposes of the process in causal terms of logically interrelated, "if...then," sequences. People may agree or disagree about either facts or values. This creates four essentially different kinds of policy dialogue processes and decisions illustrated in figure 1. While one normally thinks of these decisions and processes as occurring among different individuals, they are similar to the internal dialogue a person has when formulating policy for his or her own life.

		Values	
		<u>Agree</u>	<u>Disagree</u>
Facts	<u>Agree</u>	Consensus	Negotiation
	<u>Disagree</u>	Research	Authority

Figure 1. Decision Matrix

Policy formulation considers and synthesizes an enormously large and complex array of values and facts into a long-run program of action. In ENR policy formulation, there is a great deal of uncertainty and debate over facts. For example, is global warming occurring or not? If it is, what is causing it? Given this uncertainty, should we do anything now, or "wait and see?" The difficulty of such factual issues is illustrated by the recent finding (Beardsley 1992) that virtually all of the recent estimated global warming is due to increased nighttime temperatures, that daytime temperatures have not changed. The only plausible theory to date to explain this curious finding is that sulfate pollution is moderating daytime temperature rises, the sulfate particles reflecting sunlight back into space. Thus if this form of smokestack pollution is decreased, global warming may increase!

Another example is the allegedly massive amounts of soil erosion in LDCs. I have looked at this data in some detail, and I believe it has been grossly exaggerated (Seckler 1987; Rogers et al. 1989). The same is true of deforestation. While many fine trees have been cut, the forested area of the world has hardly decreased at all over the past 30 years according to FAO statistics as shown in table 1—and, to my knowledge, these are the only global statistics we have. Harvesting mature forests and letting new trees and underbrush grow locks up carbon and reduces methane production and thus may be a good policy from a global-warming perspective.

As these examples show, one of the major challenges in ENR policy analysis is distinguishing between facts and "factoids" (I believe Norman Mailer coined this valuable word). Factoids look like facts, and they are used in arguments as if they are facts, but are they facts? To many people—unfortunately, especially many professionals in the ENR field—it does not matter whether something is a fact or a factoid so long as it serves its purpose. The recently completed \$500 million study of the effects of acid rain in the United States, for example, has been almost universally ignored because it established fairly well the fact that acid rain does not do much harm. One could say that this was not an "ENR-correct" finding, and many people would rather stay with the factoids concerning acid rain. But such propaganda creates a Gresham's Law effect

in which bad ENR policy analysis drives out good, and it is ultimately counterproductive to ENR objectives.

Table 1. World Land Use

Land Use (Million Hectares) and Compound Rate of Growth							
	World	Developed Countries	Developing Countries	Africa	Latin America	Near East	Far East
Total Land Area							
1974	13073	5486	7587	2329	2018	1192	1959
1989	13076	5489	7587	2329	2018	1192	1959
Agricultural							
1974	1333	645	688	127	127	80	351
1989	1373	652	721	139	149	77	356
Growth	0.20%	0.07%	0.31%	0.60%	1.07%	-0.25%	0.09%
Permanent Crops							
1974	94	23	71	16	26	5	23
1989	103	22	81	17	31	6	27
Growth	0.61%	-0.30%	0.88%	0.41%	1.18%	1.22%	1.08%
Permanent Pasture							
1974	3321	1269	2052	704	542	301	496
1989	3304	1242	2062	698	574	309	480
Growth	-0.03%	-0.14%	0.03%	-0.06%	0.38%	0.18%	-0.22%
Forests and Woodland							
1974	4224	1876	2348	668	1033	99	503
1989	4086	1898	2188	633	955	94	462
Growth	-0.22%	0.08%	-0.47%	-0.36%	-0.52%	-0.35%	-0.57%

Source: FAO Production Yearbook (1990).

But there is even more debate over values, especially between "economic values" and other "environmental values." Milton Friedman, for example, recommends privatizing the national parks (Friedman 1953). In a leaked but widely circulated World Bank memo, another well-known economist contends that polluting industries should be exported to developing countries. Africa, he says in a memorable phrase, "does not have enough air pollution." However, in a subsequent memo (in which he expresses the hope that it too will be leaked) this economist explains that the earlier memo was intended to be ironic, a stimulus to further thought, and not to be taken literally.

Many economists believe that wild animals should be valued in terms of the willingness of people to pay for them. If people are willing to pay more for the pleasure of preserving animals than sportsmen are willing to pay for the pleasure of killing them, they should be preserved—and if not, not. Thus, presumably, if a billionaire sportsman is willing to pay more to kill one of the last white tigers than preservationists are willing to pay to preserve it, the white tiger should be allocated to its highest-valued user: the sportsman. Indeed, many such sportsmen are now hunting endangered species precisely because of their scarcity value.²

Such policy recommendations are derived from a concept of "economic value" that clearly differs from the values other people might want to apply to these cases. While the precise definition of economic value is rather complex, it is sufficient here to note that it depends on the ethical principle of consumer's sovereignty. Under this principle, the value of anything is measured by the amount people are "ready, willing and able to pay for it."³ Most people would agree that this is a reasonable criterion of value for the great majority of goods and services daily exchanged in an economy. But most people also would agree that there are limits to the applicability of consumer's sovereignty as the *sole* criterion of value. This subject is addressed further in the last section.

The problem of value is particularly acute in ENR policy analysis because the essential purpose of the environmental movement is to *change values*. The movement is a kind of secular religion attempting to introduce new ethical principles into policy decisions. For example, many animal rights proponents contend that animals and other living things have rights to life, at least at the species level, and these rights should be protected against economic exploitation, as human rights are, no matter what the economic cost may be. Nor are they willing to submit to a willingness to pay test on this policy issue, any more than they would be in the case of humans.

In a recent discussion of the World Bank memo, for example, I stated my opinion that exporting polluting industries, under appropriate controls, could indeed be beneficial to LDCs. One of my Winrock colleagues responded that this would be an "evil policy." I had not heard this word used in policy dialogue before, but I think it is most appropriate.

It is in this confusing and fascinating context of multiple values and dubious facts that we turn to a brief examination of some of the major features of ENR policy analysis in LDCs.

The Setting of ENR Policy Analysis: Differences Between LDCs and DCs

In discussing differences between these two groups of countries, we of course have to speak in terms of rough averages, stylized facts, or archetypes, with a wide dispersion of individual countries around the center. These differences are most apparent in

- Population Growth
- Poverty
- Growth of GNP
- Technology
- Institutions
- Cultures

Population Growth

LDCs have high rates of population growth, averaging about 2.3% annually, or doubling about every 30 years; DCs have nearly zero growth rates. LDCs also are experiencing massive migration from rural to urban areas. In many countries, the population of rural areas is constant or decreasing, so that all of the population growth is concentrating in a few urban conurbations—Mexico City, at 20 million people and growing, provides a grim paradigm of the future. This creates severe urban problems of air and water pollution, traffic congestion and noise, slums and public health, and the need for diversions of water supplies from agriculture, fisheries and wildlife habitats to urban-industrial uses. On the other hand, it substantially alleviates such ENR problems in rural areas as destroying forests for firewood.

Poverty

Developing countries are poor. Average per capita income in LDCs (adjusted for real purchasing power equivalents) is about \$500 annually, compared to around \$15,000 for DCs. This 30-fold difference in real income has major implications for ENR policy analysis. In terms of the opportunity cost of economic commodities forgone, it means that investment in ENR amenities—such as clean air and water, natural habitats and the like—is roughly 30 times greater in LDCs than in DCs. It also implies that the value of ordinary economic commodities, especially of such basic necessities as food, shelter and clothing, is relatively much higher than the value of ENR amenities. These different relative values are not due to cultural relativism so much as to the law of diminishing marginal utility.

Figure 2 illustrates the hypothetical marginal utility (in ordinal terms) of economic commodities and ENR amenities on the vertical axis and per capita income on the horizontal axis. At low per capita income, the marginal value of commodities greatly exceeds that of amenities. At high per capita income the situation is reversed. Thus people with the *same utility curves* will choose in opposite directions, other things being equal, depending on their income. This explains why environmentalists tend to be in higher income groups than their opponents. This in turn implies that the base of political and economic support for ENR policies is narrower and even more concentrated among income elites in LDCs than in DCs—which, I believe, is correct.

Growth of GNP

While the variation among countries is extremely wide, the average growth rate of GNP in LDCs, around 3% per year in real terms, is about twice that of DCs. Economic growth is the primary source of ENR problems. Prehistoric cavemen (and cavewomen) had a wonderfully natural, if rather uncomfortable and dangerous, environment in which to live. Economic growth also is a primary source of means for solving ENR problems, but this depends on wealth, on growth in per capita income, which is less than 1% per year. Thus roughly speaking, while the growth of ENR problems is about 3% per year, the growth in ability to solve these problems is only about

1% per year. The ENR problems in LDCs, in other words, is growing about twice as fast as the capacity to solve them—at an average annual rate of about 2%, doubling every 35 years, which probably is a conservative estimate.

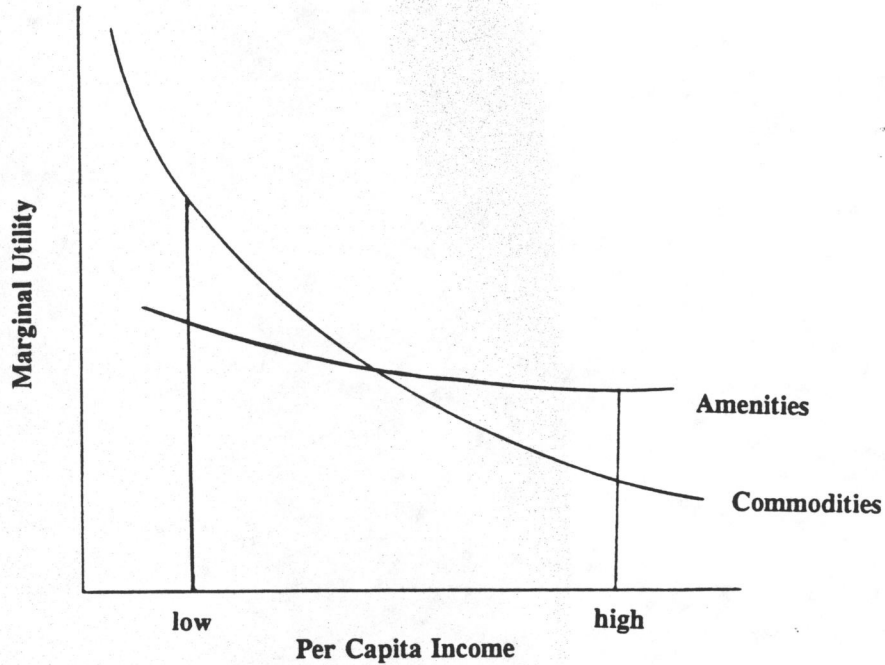


Figure 2. Marginal Value of Commodities and Amenities

Source: Adapted from Barkley and Seckler 1972, 82.

Growth of GNP

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Technology

The technology used for GNP production and consumption generally is more damaging in developing countries. In rural areas, fuel for heat and cooking comes mainly from plant materials, causing deforestation, erosion and loss of soil nutrients. Air pollution from these sources can be quite appalling: it has been estimated that an Indian village woman cooking over a *chula*, a traditional cooking stove, is exposed to the equivalent of smoking 15 packages of cigarettes per day. Vehicles are not controlled for pollution, leaded fuel is still used, municipal and industrial effluents are dumped into streams where they enter domestic water supplies, and so on, quite literally ad nauseam. On the other hand, poor, labor-surplus economies can achieve high levels of recycling. Harvesting garbage bins and dumps for plastic bags, newspapers and even food is a thriving business. The cows in Delhi are the primary "collectors" of garbage with built-in recycling bins!

Institutions

Perhaps of greatest importance in policy implementation, public and private institutions in many developing countries do not work very well. Because of corruption and incompetence in government agencies, many developing countries find it difficult, if not impossible, to collect land taxes and metered charges for electricity consumption, obtain repayment for commercial loans from powerful individuals, protect trees, or keep farmers from stealing irrigation water from their neighbors. Under such conditions, a major effect of licenses, rules and regulations—and even commercial law—is that enforcement agencies are able to generate income and politically connected business interests receive favored economic positions. A license to pollute is more likely to go to the minister's nephew than to the most efficient user. A tax on pollutants is likely to be enforced as a competitive weapon against certain producers while others are permitted to pollute without the tax. For these reasons, we must be cautious about the practical applicability of ENR taxes and subsidies, sales of rights to pollute and other innovative policies that have been employed in DCs.

In recognizing these problems, however, one should not overlook the many fine individuals in both the public and private sectors of LDCs and the government institutions that do perform exceptionally well. The success of "Operation Tiger," and the national parks generally, in India and Nepal are cases in point.

Some economists seem to believe that the solution to poor government is no government. To me, this position simply reflects ignorance about how modern economies work, especially how modern market systems work. Because of "government failure," the market also fails in many developing countries....The solution to poor government is better government.

I believe that we need a new factor of production in economic theory to complement the traditional factors of land, labor and capital. I call this the "cybernetic factor" of communication and control of purposive organizations. This is a much broader area than simply "transaction

costs," although these costs are an important element of the cybernetic factor. Many of the problems of market failure, for example, are reducible to the relative costs and benefits of communication and control. One of the major challenges to EPAT will be to help design policies that can be effectively implemented in the context of LDC institutions and to help these institutions improve communication and control so that they can more effectively formulate and implement policies.

Cultures

An LDC policymaker once told me the problem with most Americans is that they think everyone should do everything just like they do back home in "Two-Bit, Montana." Cultural differences affect both the "what to do?" and the "how to do it?" aspects of ENR policy. These cultural differences make development work fascinating, fun and, to the naive, precarious.

As EPAT teams work in developing countries, we will find different value systems that will fundamentally challenge the kinds of economic analysis that we routinely apply, on the basis of our own cultural values, to ENR problems. Thus, because of both values and political expediency, policymakers in developing countries are generally more interested in the distribution of income, perceived equity and fairness than are U.S. policymakers. If the distribution of income is taken seriously, then methods of contingent valuation, based on estimated willingness to pay, are likely to yield misleading and counterproductive results (Seckler 1966). Moslem countries have strong prohibitions against interest payments. For them discounting is highly suspect, if not evil. Hindus will not kill cattle; thus one of the greatest sources of overgrazing and soil erosion in India is moved beyond the pale of economic policy. Jains will not even kill insects.

Development professionals used to be trained to be sensitive to cultural differences and reminded that, since it is their country, policymakers in LDCs are the boss. But this attitude is unfortunately giving way, especially in donor agencies, to the arrogant attitude that "we know best." This attitude also requires a heroic disregard of facts, given the exceptionally poor performance of the United States in nearly every dimension of economic policy: growth, trade, ENR, poverty, health or whatever.

Major ENR Problems in LDCs

In this section, I list the most important ENR problems and EPAT tasks in developing countries as I see them, in rough order of priority. I should emphasize that this is only my list, that other EPAT team members should add to or subtract from it, and that missions and their counterparts should be solicited as soon as possible for their suggestions about the list. But a short list is

essential: because EPAT cannot do everything in this vast area of ENR policy, we should try to concentrate our forces to do the most important things well. The list as I see it:

1. Reduce the rate of population growth
2. Protect unique natural amenities
3. Reduce urban-industrial congestion
4. Improve energy supply and utilization
5. Improve water quality and availability
6. Encourage biological pest control and reduce excessive fertilizer use

Develop and Support Policies to Reduce the Rate of Population Growth

We need an articulate analysis of the close interrelations among population growth, economic growth and ENR interests. While I do not believe that zero population growth is necessarily the correct objective, I am sure that the 3% to 4% growth rates of many African countries is too high.

One of the fascinating questions in economics is that of the optimal rate of population growth. I agree with Julian Simon that it probably is not zero or negative, but I am certain that it is not as high as that of Kenya, which is close to the maximum natural annual rate of growth of 4%. I am inclined to think it is something like a .5% solution, with perhaps a standard deviation of one half this amount depending on local conditions. Certainly, population policy should be an integral part of EPAT policy analysis. We should not fall into the trap of selecting only certain kinds of policy analyses and reforms, such as price policy or privatization, and miss the essence of the ENR problems we are asked to address. This may lead policymakers into believing that there are "magic bullets" in the way of policy reform that permit them to neglect such fundamental issues as population control.

Protect Unique Natural Amenities

This category includes irreplaceable natural amenities and irreversible processes including wildlife habitats, genetic diversity and scenic wonders. The first law of rational decision making is "preserve your options." Irreplaceable assets and irreversible processes form a unique category of economic phenomena that are among the unsolved problems of economics. In the absence of something better, we should follow the safety first rule. Since much of the demand for these assets is from developed countries, most of the costs should be paid by these countries as additions to, not as substitutes for, economic development assistance—and the two should be combined in integrated programs as much as possible.

Perhaps the most dramatic single example of complementarity I know between economic development and ENR is between properly managed intensive agricultural production systems and preservation of wildlife habitats. In intensive agricultural systems, food production per unit

of land can be ten times that of primitive forms of extensive agricultural production. Thus by concentrating production in the agriculturally most favored areas, the market system will cause more marginal areas to remain out of (or to go out of) agricultural production. The green revolution in India has helped enormously in preserving the magnificent parks and wildlife refuges of that country. The major threat to the wildlife of Africa is precisely the combination of high population growth and extensive agricultural systems that force people to settle in the wild areas in search of food. Africa desperately needs intensive agricultural systems—irrigation, improved seeds, inorganic fertilizers and selective, degradable pesticides—both to feed people and to protect its wildlife resources. But many environmentalists need to be taught to understand the benefits of properly managed intensive agricultural systems.

Reduce Urban-industrial Congestion

Air and water pollution, sewage disposal and treatment, slums, and improved transportation systems are all included in this issue. We need to study the enormous literature on regional science and location theory and analyze the explosive growth of cities like Mexico City, Cairo and Bangkok for the associated costs and benefits. I believe the results of such studies would furnish support for policies that encourage dispersal of urban-industrial growth. Simply relocating government offices from capitals (paid for by privatizing very expensive government land and buildings) would be beneficial and, with modern electronic communications, feasible. Much can be learned by studying the new towns of Europe after forty years of experience.

Improve Energy Supply and Utilization

Under this category falls a wide range of policies governing technological and institutional change—from more energy efficient and less polluting technologies, through development of renewable energy systems, to substitution among energy sources. It also covers a substantial range of complementary relations between economic development and ENR. For example, some developing countries are now following the new requirements of developed countries for standards of new vehicle emissions. The saving on fuel consumption alone would more than pay for the costs of these policies.

Global warming also falls under this category. My own opinion is that not enough is known about the physical facts of the subject for it to be now a direct object of policy analysis. However, as Neva Goodwin has elegantly argued (verbal communication), policies that are needed for other reasons, such as energy conservation and air pollution, are virtually the same as those needed for the threat of global warming. Of course, the benefits of reducing the threat of the latter, which we might get for free, should be added to the benefits of the former.

Improve Water Quality and Availability

Water quality includes safe and convenient domestic water supplies, alleviation of salinity and waterlogging, and destruction of breeding grounds for disease vectors. Water quantity includes irrigation for food security in drought-prone areas, and conflicts over increasingly short supplies of water among agricultural, municipal-industrial and environmental uses. These and related conflicts among regions, provinces and nations are rapidly becoming one of the major natural resource policy problems in the world. As they say in the arid western United States, "Whiskey is for drinking, water is for fighting over."

Encourage Substitution of Biological Control for Pesticides in Agriculture and Reduce Excessive Fertilizer Use

Agricultural research has demonstrated that pesticides have counterproductive effects because they kill natural predators and stimulate rapid adaptation to resistant varieties. Agricultural scientists also have found that it is best not to try to eliminate the pest population as this only encourages rapid evolution of new, resistant varieties. Integrated pest management has become one of the most beneficial products of agricultural research in the past two decades. Indonesia, for example, which used to be one of the heaviest pesticide users, made 50 of the worst and most commonly used pesticides illegal, and rice production has increased.

Fertilizer is a more difficult problem—most developing countries do not use enough. This leads to nutrient mining of soils, low productivity, slash and burn agriculture, and poor land management practices. But where too much is used, fertilizer use obeys the law of diminishing returns. The obverse of the fertilizer production function becomes the pollution function: the more that is applied, the greater the amount that is not utilized by plants and that enters the environment as pollutants. Japan, Europe and parts of the United States are the greatest offenders in this regard. Poor price policies encourage excessive rates of fertilizer use.

I favor taxes on fertilizers and pesticides in DCs with food surpluses to reduce pollution and to induce technological innovations that can later be transferred to LDCs with food shortages. In the meantime, I also favor fertilizer subsidies in many developing countries, such as most of sub-Saharan Africa, to increase food production and reduce pressure on natural amenities.

Of major ENR problems in developing countries, only these six seem to me to be of this order of importance. There may be many other problems that others would want to add to the list, but those that come to my mind are of a lower order. Soil erosion, as noted before, does not seem to me to be a major problem, except in local areas. Nor is deforestation, if one is speaking of the ordinary kinds of trees, with the exception of the natural amenity aspects. My intention, however, is to begin the discussion of problems, not to end it.

ENR Policy Analysis

We have discussed the setting of ENR policy analysis in terms of differences between LDCs and DCs and the major ENR problems of LDCs. We now turn to the third dimension of the EPAT matrix: the concepts and tools of economics that can help solve these problems. This vast subject can only be outlined in an informal manner here.

I should say at the outset that the basis of this presentation is the so-called neoclassical theory. I consider myself to be as much a neoclassical economist as anything, but I believe there are important unsolved problems in this theory that other schools—such as institutional, social, ecological and structural economics—which are well represented on the EPAT team, are struggling to resolve, and I am happy to join them in this struggle. I do, however, believe that the best way to approach these problems is through the established theory, reforming it where possible, not by attempting to overthrow more than two centuries of work by some of the greatest minds of our civilization.

The foundations of neoclassical policy analysis and project evaluation are the branch of neoclassical economics called welfare theory. Welfare theory was established by Pigou (1946) and refined and extended by many of the best minds in economics (see, e.g., Mishan 1964; and, especially, Little 1957). Welfare economics is both a highly technical and deeply philosophical field of thought of great practical usefulness. In the following sketch, I shall present some of the major features of the theory in a way that, I hope, makes both the scope and limitations of the theory as transparent as possible.

Welfare theory attempts to define when one economic state is better than, or superior to, another state. This problem is addressed by defining first a set of assumptions and then a set of technical conditions for the best possible economic state. Once this state is defined, the assumptions and technical conditions can be compared with reality to see where problems, both real and theoretical, lie. The best economic state is called the Pareto-optimal state (POS) because in this state it is impossible to make anyone better off without making someone worse off—i.e., those who would gain from a change in the optimal economic state could not compensate those who would lose from the change without themselves becoming losers.

Since someone usually loses from a change (whether they deserve to or not) and it is usually impossible to provide compensation, POS has often and rightly been criticized as a defense of the status quo ante. But this criticism is clearly more relevant in the static case, where the pie is fixed, than in the dynamic case where the pie grows. Fortunately, the dynamic case is closer to reality; unfortunately, welfare economics is mainly limited to the static case. Clearly, we need a better dynamic welfare economics, but until we have one, much of value in ENR policy analysis can be obtained from the theory as it is.

Assumptions

In order to evaluate anything, it is necessary to have a criterion of value. The first and most fundamental assumption defines the criterion of value in welfare economics. It is, as noted before, consumer's sovereignty:

1. The value of anything is equal to the amount people are "ready, willing and able to pay" for it in a POS (as explained below).

This criterion is explicitly limited in two important respects:

- 1a. Tastes, social values, ethics and the laws of society are assumed as given.
- 1b. The distribution of income in the economy is assumed to be satisfactory.

Consumer's sovereignty defines the domain of economic value and, therefore, of economic analysis. Anything belonging to (1a) or (1b) are outside of economics per se and properly belong to other fields of study. It may seem curious that the distribution of income is a noneconomic subject, but one of the few things about which all (neoclassical) economists agree is that the distribution of income is a "value judgement" outside of economics (i.e., outside of consumer's sovereignty the only accepted criterion of economic value).

Of course, in terms of set theory, the subset of economic phenomena may intersect with subsets of other, noneconomic, phenomena, such as income distribution; the economist has a legitimate role concerning the economic *aspects* of these intersections. For example, someone may propose a redistribution of income in favor of the poor on egalitarian grounds. The economist has nothing to say about this policy as an economist except in regard to its possible effects on such economic phenomena as savings and growth of GNP. But if someone proposes a redistribution of income in favor of the rich on grounds that it would increase savings and economic growth, the economist's voice would be decisive (although, of course, economists do not speak with one voice because of different theories of economic phenomena). Thus, as Little (1957, 77) says, economists should always use the qualifier "economic" in making recommendations, but

If I say 'this change will increase economic welfare', it is open to anyone to say 'perhaps, but it will not increase political welfare, or welfare in general'....Putting it in always suggests that the economist's conclusion is not the last word.

Hence the qualifier usually is ignored.

Within the domain (quite literally, "turf") of economics established under assumption (1), several other assumptions are employed to simplify the analysis. These assumptions are not fundamental in the sense that "all is lost" without them, as is the case with the first. On the contrary, these assumptions are intended to be relaxed as real problems are encountered to explore the analytic differences between the ideal and the real. Some of the most important of these secondary assumptions are:

2. The institutional and technological structure of the economy is given.
3. The total set of goods in the economy is fixed (and usually with all factors of production fully employed).
4. The present and future is perfectly known.
5. Producers and consumers are perfectly rational.

We shall discuss some of the implications of relaxing these assumptions later, but even with the assumptions taken as given, major problems arise in satisfying the technical conditions for POS. These problems define the subject matter of ENR economics.

Market Failures

It is not necessary to go into the technical conditions for a POS here (see, e.g., Little 1957). The major interest of ENR economics is in those cases where these technical conditions are violated, the cases of "market failure" (just as the major interest of other schools is where the basic assumptions are violated, or rejected). There are, I believe, only two generic cases of market failure under the basic assumptions and conditions of welfare economics because all other cases can be reduced to one or the other or combinations of these generic cases. These are *externalities* and *public goods* (for a more extended discussion along the same lines see Barkley and Seckler 1972).

Externalities

Externalities occur when one person's behavior creates benefits or costs to other people without commensurate compensation: rewards in the case of benefits; penalties in the case of costs. Too much of the activity will be undertaken in the case of external costs, and too little in the case of external benefits. Air pollution from one's fireplace is an example of external cost to one's neighbors. Growing beautiful plants enjoyed by one's neighbors is an example of an external benefit. In all such cases, the externalities should be internalized (in essence, "put a cork in the smoke-stack!") either through regulatory actions or taxes and subsidies.

The subject of externalities is too familiar to warrant much time here. However, there is an interpretation of externalities that will be helpful in understanding the more difficult problems of public goods. Externalities can be interpreted as a break-down in the cybernetic function of the market system. A properly functioning market system provides communication and control among the participants through negative feedback systems (Ashby 1964; Seckler 1980). With negative feedback, the error in the system (the difference between the objective and the actuality) is progressively reduced through successive iterations of the system. Thus if prices are in disequilibrium—too high or too low—in terms of POS, the market usually sets in motion forces that will reduce the error. The problem with externalities is that negative feedback does not exist because the sources and recipients of the costs and benefits are out of communication and control. In fact, in such situations positive feedback can develop, making the problem worse with

each iteration of the system. For example, industries may move to states and countries that do not have pollution controls, growing at the expense of controlled industries.

These problems require an organizational or, more broadly, an institutional solution. One institution, the market, fails to provide negative feedback. Other institutions are needed to provide communication and control, either through the market or by other institutional means, to restore negative feedback. There are many such institutions ranging from legal systems and government regulatory agencies to churches, charities, cooperatives and other nongovernmental organizations. I believe that this cybernetic perspective provides a basis for a "new institutional economics" that could be of considerable value in addressing such problems.

Public goods

Normal economic goods are produced in small units that the consumer can purchase and consume by himself. The minimum size of a public good, however, is so large that no one consumer can use it all. In the extreme case of the "pure public good," as discussed below, even *all* of the potential consumers cannot consume the good. Thus the costs of providing public goods must be shared among many individual consumers, and a market for such goods can only be formed collectively. The effective demand for public goods, in other words, is provided by an institution rather than by individuals. For these reasons, public goods are described as "indivisible," "lumpy," "nonmarginal," or "collective" goods. While public goods may at first seem to be quite rare and queer kinds of things, they are omnipresent and more important than externalities. Indeed, they are the goods on which civilizations depend, although most people are hardly aware of them. Unfortunately, they are exceptionally difficult to produce, maintain and manage. Public goods are most easily perceived in the extreme case of the pure public good.

As noted before, the pure public good exists in such large units that even all of the potential consumers cannot consume all of it. This means that the marginal cost of an additional unit of consumption is zero. Since one of the technical conditions of POS is that price equals marginal cost, the optimal price of a pure public good is zero! Since private firms cannot provide their services for free, they are not able to provide public goods at optimal prices. The pure public good thus is the locus classicus of market failure.

The humble lighthouse is a good example of a pure public good that provides a means of establishing issues relevant to the more abstract public goods in ENR. Once a lighthouse is operating, any number of ships can receive its message at no additional cost; the marginal cost is zero, and the charge for using the lighthouse should be zero. But since businesses cannot incur positive costs and sell at zero prices, the market fails to provide lighthouses optimally.

Associations of shipowners, however, have found it in their interests to build and operate lighthouses. But if other shipowners benefit without paying the costs, they become "free-riders." If there are free-riders, private effective demand is below social demand, and the market will not provide the optimal amount of lighthouses. This free-rider potential also induces members of the association not to pay their dues and become free-riders themselves. Thus even the private cooperative solution may not be sustainable. Of course, the lighthouse association could employ

a gunboat to prevent free-riders from using their lighthouse. But then the economy would be suboptimal because of the benefits foregone of the excluded users and the cybernetic costs of control, the gunboat, would likely make the lighthouse economically unfeasible from both private and social points of view. In this case, the optimal solution can be reached only by government intervention, by imposing local taxes on all lighthouse users to pay the capital and operating costs while providing the short-run services for free.

Similarly, pay television is economically inefficient, however financially expedient it may be. The British have addressed this problem by having an annual tax only on TV receivers, to pay the costs of the BBC, without regard to the number of programs received. (However, this still results in inefficiency by excluding those who will not pay the tax.) Toll roads and admission fees to zoos, museums and the like are economically inefficient up to the point of congestion effects, where users impose positive marginal costs on one another. The same is true of knowledge and the exclusionary effects of patents and privately contracted R & D in universities and even private firms. Even Adam Smith recognized that national defense, the maintenance of law and order, and cultivation of the arts and sciences were public goods that should be supported by the state, without charge to beneficiaries.

Some of the major concerns of the environmental movement have pure public good properties. An example (which I believe was first published in Barkley and Seckler 1972) is "existence demands." One may never expect to see a blue whale, or even go very much out of one's way to see one, but be willing to pay to live in a world where blue whales exist (or more generally, perhaps, to live in a society where killing blue whales is unacceptable behavior). But again, the free-rider problem likely will cause a suboptimal supply of protection for blue whales.

The difference between externalities and public goods can be blurred by the fact that both problems often are involved in the same phenomena. Thus free-riders are recipients of external benefits from public goods. Public goods are especially high generators of external benefits because users *should not* be excluded on economic grounds from the benefits even if they could be excluded. But the ability to become a free-rider, as noted before, tends to destroy institutions involved in the provision of public goods.

Garret Hardin's *Tragedy of the Commons* is concerned with the problem of institutional lag during the evolution of public goods from a state of zero marginal cost to positive marginal costs as users and uses increase. As marginal cost becomes positive, use should be regulated by prices or by legal and administrative means. But people have acquired socially sanctioned rights and entitlements to these resources that make rationing difficult. This leads to overexploitation, such as overgrazing and soil erosion, and a non-POS state for all. The standard economic solution to this problem is to formalize the rights to use the resource, and then to market these rights to the highest bidders. But the institutional-cybernetic problems of how to do this become formidable. There are other institutional forms of rationing—e.g., rotational grazing rights—that might attain the same POS through more socially preferred, and therefore more cybernetically sound, paths.

So far the discussion has remained strictly within the assumptions of POS, with market failure in the form of externalities and public goods occurring because of violation of the technical conditions of POS. But other kinds and combinations of market failure are generated when the assumptions of POS are relaxed.

Option demands

Relaxing assumption (4), perfect knowledge, creates option demands. People may be willing to pay to preserve their option to enjoy a good in the future even though they may not have a high expectation of doing so. For example, the present existence value of a snail-darter may be zero, but one may be willing to pay for the option of changing one's mind later. Option demands, together with existence demands, provide much of the rationale for preservation of genetic diversity. Option demands are thus like insurance policies. They usually also have public good properties, since once the option is obtained everyone can have it at no additional cost.

Merit and demerit goods

Some goods should be provided or withheld irrespective of consumer's sovereignty (relaxing the fundamental assumption [1]). Thus in the United States, people are legally required to send children to school whether they want to or not; and people cannot legally consume certain kinds of drugs no matter how much they are willing to pay. This type of merit and demerit good exempts tastes or preferences (1a) from the criterion of value.

Another important type of merit good relates to the distribution of income (1b). It may be decided that people should have basic food, shelter and education. For someone willing to pay to help poor people through private charities, poverty relief is a good like any other good because it satisfies consumer's sovereignty either by fulfilling charitable inclinations or through the hope that one will be rewarded later, either here, say through reduced crime, or in the hereafter. But one also may rationally refuse to donate to charity and yet vote to aid the poor by a general tax, partly to avoid the free-rider problem. In this case, a free-rider would be willing to pay to help the poor but does not in the hope that others will do it instead. But many people do not want to help the poor. Then one may vote for a tax to help the poor on grounds that it is a moral imperative of society, whether others like it or not.

Similarly, one may feel that poor people should be able to visit congested zoos, museums and parks without the income rationing imposed by admission fees.⁴ Rationing can be imposed, for example, by queues, which tend to be more income-neutral devices. Thus the visible queues in socialist countries have vanished as prices have increased. They have been replaced by invisible queues of those who cannot afford to pay, as in capitalist countries.

Discounting

It is hard for many people to believe that if 30 years from now a tree is worth \$100 one would be willing to pay only \$3.34 for it today. The reason is that \$3.34 invested today at 12% will

be worth \$100 in 30 years. Many people believe that discounting incorrectly favors the present over the future, promoting rapid use of assets or underinvestment in long-term assets.

But if trees in fact are going to be increasingly in short supply over the next 30 years, their prices will increase. If their prices increase at the same rate as the discount rate (12%), then the present value of the tree 30 years from now will be the same as it is today. If tree prices are expected to increase by more than the discount rate, investors will rationally save trees for the future. I do not believe that the discount rate can be attacked on these grounds, as a form of market failure.

But the problem is much deeper than this. First, since we do not have perfect knowledge, we may underestimate the future value of trees and other items that require a long time to replace. There is a great deal of risk, uncertainty and potential loss due to mistakes in this regard. It is better to be conservative under such conditions by assuming high rates of appreciation close to or above the discount rate of such assets.⁵ Second, it should be emphasized, most of these cases have been considered within the domain of economics, of consumer's sovereignty. Even in merit/demerit goods, the economic aspect of the problem is the willingness of someone to pay to encourage or discourage consumption by other persons. Once we leave this domain of consumer's sovereignty, we enter the intersection of economic values and other values represented by political economy, the subject of the concluding section.

Perhaps this section can be summarized by saying that the market system is one of many instruments for achieving personal and social values. It is a wonderfully effective and efficient cybernetic institution in many cases. Indeed, one of its virtues is that it is indifferent to what some economists call "distortions." One can adjust prices to meet social objectives in any way one wishes, and the market will obediently carry these orders out to the most minute sectors of the economy. But the market can fail. It is not a value in itself, much less is it some kind of a god to which we must appeal for judgments of value.

The Role of the Economist in ENR Policy Analysis

Joan Robinson has aptly described economics as a "kit of tools" to help in decision making. I believe that economics has progressed to the point where it can reasonably be said that it is impossible to make intelligent decisions in the field of public policy without drawing on this kit of tools. Some of the more important tools, often used in combination, are benefit-cost analysis, cost-effectiveness analysis, simulations, operations research, contingent valuations, input-output analysis, macroeconomic models and decision theory. Perhaps even more important than the specific tools, however, is the framework of economic analysis itself. One can almost always distinguish economists from others in a policy discussion by their implicit reference to the framework of thought based on the fundamental principles of marginal analysis and opportunity cost. Once one has these concepts and their implications firmly in mind, one thinks like an

economist—and I believe that in most areas of policy analysis this is indeed a better way of thinking.

The power of this analytic framework and the associated kit of tools has created a demand for economists in virtually every field of policy analysis (sometimes just to argue with other economists) to the extent that economics has been described as the "imperial science." As an economist, I am naturally sympathetic to these developments; but I have two primary reservations relating to facts and values.

First, there are some "unsolved problems of economics"⁶ on the factual side, some of which I have attempted to describe elsewhere (Seckler 1991). These are of great importance in certain kinds of policy analysis. Two of the major unsolved problems are true uncertainty (as contrasted with risk), and nonmarginal phenomena, or "regime switches." I contend that in addressing these problems we need a different, a "strategic," framework of analysis to supplement the essentially "tactical" framework used in standard economic analysis. I do not pretend to know how to solve these problems. But I strongly believe that no solution is better than a false solution and that when we encounter such problems in policy analysis we should clearly inform policymakers that *we do not know* the answer.

My second reservation concerns values: the propensity to use economic value as the sole criterion of value in policy analysis. In a sense, this is a much easier conceptual problem than the first because every sophisticated economist knows that *economists cannot make policy recommendations*; we can only provide policy *advice* to policymakers on the strictly economic aspects of policy decisions. This is because every policy decision involves evaluation on the basis of economic values combined with other, noneconomic values which the policymaker alone can synthesize into a final decision. It is indeed one of the major tasks of policymakers to decide the degree to which economic value is to play a role in any particular case.

Thus while I agree that the policy recommendations of Friedman and Summers in the introduction represent valid *conclusions* in economic theory in the strict sense that consumers' sovereignty would be optimized under the assumptions and conditions of POS, I believe that as policy *recommendations* they carry no more force than the opinions of the man in the street. (These conclusions may, of course, also be invalid under different assumptions.)

The general methodology of cost-effectiveness analysis provides the appropriate framework for policy analysis since it incorporates both the scope and limitations of economics in a manner that policymakers can readily comprehend. Assume, for example, that one does a standard benefit-cost analysis of a particular policy, staying strictly within the domain of economic value and reasonably well known facts. This analysis results in a benefit-cost ratio (or equivalent internal rate of return or net present value) of, say, 0.80. Many economists would say that the policy should be rejected on grounds that it is not economically feasible. But I regard the benefit-cost ratio (or its equivalents) as the beginning, not the end of policy dialogue. Perhaps the policy creates other desirable effects. Then one can say that 80% of the economic costs of the policy are paid for by its economic benefits. If the other desirable effects of the policy are worth more

than 20% of the costs, in terms of subjective evaluations, then it should be accepted—and if not, not. Similarly, a policy with a high benefit-cost ratio may be rejected on grounds of undesirable noneconomic effects—as is sometimes the case with environmental impact assessments.

This approach is reflected in mathematical optimization techniques where decision-makers are asked to assign relative weights to the objectives and then the system as a whole is optimized. This is often called the "objective function," although it is the most subjective thing in economics. My own position is that the concepts behind these weights are too complex to be assigned numbers, at least the ordinary kind of numbers, and optimization in such cases is best left to the subjective judgments of policymakers.⁷

Perhaps I can best summarize my position on these issues by referring to what I like to call the "Olde English School of Political Economy." This school was probably founded by Alfred Marshall. It includes his two great students, Keynes and Pigou, along with such other luminaries as Hayek, Robbins and Robertson.⁸ Keynes thought economists should be regarded rather like dentists, performing a useful but rather modest function in life. Robbins denied that economics has anything of interest to say about the "really important things in life." Pigou (1946) emphasized that economics can only be concerned with values that properly can be brought into relation with the "measuring rod of money" (or, as Little [1957]) says, exchanged for money). Hayek said that an economist who is only an economist is a nuisance, if not a positive menace. But the last word should be given to Sir Dennis Robertson, from his Presidential Address to the Royal Economic Society in 1929, aptly entitled *On Sticking to One's Last*.

You will see that my ambitions for my profession are not quite so exalted as my predecessor's. I do not want the economist to mount the pulpit or expect him to handle the keys of Heaven or Hell. I want him to be rather brave and rather persistent in hammering in those results achieved within his own domain about which he feels reasonably confident, not too readily reduced to silence by the plea that this, that or the other is ruled out of court by custom, or justice, or the temper of the age. But in the last resort I want him, too, to be rather humble—humbler than some of his great predecessors were disposed to be—content to bow to the judgment of the prophets or even the men of affairs if he is convinced that his case has been properly understood and fairly weighed. In fine, I like to think of him as a sort of Good Dog Tray rather than as a Priest forever after the Order of Melchizedek.

ENDNOTES

1. This discussion on decision strategies is adapted from Landau 1986.
2. Shortly after this sentence was written, an article appeared in the *Washington Post* (Feb. 9, 1992) reporting on expeditions to hunt endangered species, allegedly guided by an employee of the Smithsonian Institution!
3. As discussed later, the precise definition of economic value is the exercise of consumer's sovereignty in a Pareto-optimal state of the economy. The assumptions and technical conditions for such a state, together with a brilliant analysis of the implications, are in Little (1957).
4. Milton Friedman and others contend that if you want to change the distribution of income it is best to do it through lump-sum transfers to the poor, for example through a negative income tax, rather than subsidies and taxes on specific goods. It can be shown that lump-sum transfers are more efficient in terms of the opportunity cost of consumer' sovereignty. But this rather misses the point. One may be satisfied with the distribution of income in general but not with the allocation of merit and demerit goods in particular. If so, it is likely more cost-effective to have specific taxes and subsidies.
5. For nearly two hundred years, the real interest rate on government bonds issued by western nations has been around 3%. There is a famous article by Frank R. Ramsey (which I have not been able to find) showing the long-run equilibrium discount rate should equal the real rate of growth of the economy—which in fact has been around 3% per year over the past two hundred years. If this were not so, the factor share of capital in the economy would explode and the economy would collapse. For example, if the real growth rate of the economy were 3% per year and the real discount rate were 12%, then the share of capital would grow by 9% a year, doubling every two years. Perhaps even the present administration of the United States would consider this excessive. In any case, such an imbalance in factor share would likely result in a Keynesian depression (which it has). The practice of basing the discount rate on capital markets is erroneous because lenders assume that most of the interest will be paid for by inflation. Yet in economic evaluation, inflation is not taken into account in projections of costs and benefits. If it were, the real discount rate, adjusted as discussed in the text, would be much less. In sum, I believe that the discount rate used in economic evaluations should be set at the expected rate of growth of the economy over the period of the investment.
6. I am indebted to Theodore W. Schultz for this phrase in his comments on the paper cited in the sentence.
7. My conjecture is that if the correct kinds of weights were discovered they would be of a weird sort, like those produced in the mathematics of quantum theory, as Penrose (1989) so elegantly explains. This could be an interesting area of collaborative inquiry among mathematicians and experimental economists (see the interesting review in Shogren and Nowell 1990). Keynes'

(1973, 2d ed.) theory of probability rests on some of these odd concepts, which might be tested (see the discussion in Seckler 1991).

8. I am grateful to Neva Goodwin for including Marshall in this list (also see Goodwin 1991 for an excellent discussion of Marshall and other issues in this paper).

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Winrock International Institute for Agricultural Development

**ENVIRONMENTAL AND NATURAL RESOURCE POLICY ISSUES
IN DEVELOPING COUNTRIES**

by
David Seckler

Environmental Policy and Training Project

**Center for Economic Policy Studies
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Environmental and Natural Resource Policy Issues in Developing Countries

Introduction

The central task of the technical assistance wing of the Environmental Policy and Training project (EPAT) is to help developing countries formulate and implement appropriate environmental and natural resource (ENR) policies. This task involves two different kinds of policy analyses. The first is "ENR impact assessments," which pertain to the ENR effects of economic development policies. The second consists of policies that are specifically designed to serve ENR objectives. In the first case, the primary policy objective is economic development, with ENR objectives acting as constraints. In the second case, ENR objectives are primary, constrained by the interests of economic development. In both, a major function of EPAT is to define the complementary and competitive relationships among economic development and ENR objectives and help design policies that create the most complementary and the least competitive relationships as possible. In performing this task, we should understand that, as Gilbert White says, we are dealing with multiple objectives, multiple measures and multiple means.

This paper is divided into three parts: The first describes a general approach to policy analysis that I have found useful. The second discusses ENR policy analysis in developing countries in terms of the differences between less developed countries (LDCs) and developed countries (DCs) and the major ENR problems in LDCs. The last briefly examines the framework and tools of economic analysis and the role of the economist in the field of ENR policy formulation.

Values and Facts¹

Policy formulation addresses the fundamental question: given our values, our resources and the uncertainty of the future, (a) what should we attempt to achieve? and (b) by what processes can it best be achieved? The answer to this two-part question requires a rather mysterious synthesis of two incommensurable kinds of knowledge: the *subjective* knowledge of values, and the *objective* knowledge of facts.

Values define the desirability or worth of a purposive process of action. Facts (including relationships) pertain to the theoretical ability to achieve the purposes of the process in causal terms of logically interrelated, "if...then," sequences. People may agree or disagree about either facts or values. This creates four essentially different kinds of policy dialogue processes and decisions illustrated in figure 1. While one normally thinks of these decisions and processes as occurring among different individuals, they are similar to the internal dialogue a person has when formulating policy for his or her own life.

		Values	
		<u>Agree</u>	<u>Disagree</u>
Facts	<u>Agree</u>	Consensus	Negotiation
	<u>Disagree</u>	Research	Authority

Figure 1. Decision Matrix

Policy formulation considers and synthesizes an enormously large and complex array of values and facts into a long-run program of action. In ENR policy formulation, there is a great deal of uncertainty and debate over facts. For example, is global warming occurring or not? If it is, what is causing it? Given this uncertainty, should we do anything now, or "wait and see?" The difficulty of such factual issues is illustrated by the recent finding (Beardsley 1992) that virtually all of the recent estimated global warming is due to increased nighttime temperatures, that daytime temperatures have not changed. The only plausible theory to date to explain this curious finding is that sulfate pollution is moderating daytime temperature rises, the sulfate particles reflecting sunlight back into space. Thus if this form of smokestack pollution is decreased, global warming may increase!

Another example is the allegedly massive amounts of soil erosion in LDCs. I have looked at this data in some detail, and I believe it has been grossly exaggerated (Seckler 1987; Rogers et al. 1989). The same is true of deforestation. While many fine trees have been cut, the forested area of the world has hardly decreased at all over the past 30 years according to FAO statistics as shown in table 1—and, to my knowledge, these are the only global statistics we have. Harvesting mature forests and letting new trees and underbrush grow locks up carbon and reduces methane production and thus may be a good policy from a global-warming perspective.

As these examples show, one of the major challenges in ENR policy analysis is distinguishing between facts and "factoids" (I believe Norman Mailer coined this valuable word). Factoids look like facts, and they are used in arguments as if they are facts, but are they facts? To many people—unfortunately, especially many professionals in the ENR field—it does not matter whether something is a fact or a factoid so long as it serves its purpose. The recently completed \$500 million study of the effects of acid rain in the United States, for example, has been almost universally ignored because it established fairly well the fact that acid rain does not do much harm. One could say that this was not an "ENR-correct" finding, and many people would rather stay with the factoids concerning acid rain. But such propaganda creates a Gresham's Law effect

in which bad ENR policy analysis drives out good, and it is ultimately counterproductive to ENR objectives.

Table 1. World Land Use

Land Use (Million Hectares) and Compound Rate of Growth							
	World	Developed Countries	Developing Countries	Africa	Latin America	Near East	Far East
Total Land Area							
1974	13073	5486	7587	2329	2018	1192	1959
1989	13076	5489	7587	2329	2018	1192	1959
Growth	0.20%	0.07%	0.31%	0.60%	1.07%	-0.25%	0.09%
Agricultural							
1974	1333	645	688	127	127	80	351
1989	1373	652	721	139	149	77	356
Growth	0.20%	0.07%	0.31%	0.60%	1.07%	-0.25%	0.09%
Permanent Crops							
1974	94	23	71	16	26	5	23
1989	103	22	81	17	31	6	27
Growth	0.61%	-0.30%	0.88%	0.41%	1.18%	1.22%	1.08%
Permanent Pasture							
1974	3321	1269	2052	704	542	301	496
1989	3304	1242	2062	698	574	309	480
Growth	-0.03%	-0.14%	0.03%	-0.06%	0.38%	0.18%	-0.22%
Forests and Woodland							
1974	4224	1876	2348	668	1033	99	503
1989	4086	1898	2188	633	955	94	462
Growth	-0.22%	0.08%	-0.47%	-0.36%	-0.52%	-0.35%	-0.57%

Source: FAC Production Yearbook (1990).

But there is even more debate over values, especially between "economic values" and other "environmental values." Milton Friedman, for example, recommends privatizing the national parks (Friedman 1953). In a leaked but widely circulated World Bank memo, another well-known economist contends that polluting industries should be exported to developing countries. Africa, he says in a memorable phrase, "does not have enough air pollution." However, in a subsequent memo (in which he expresses the hope that it too will be leaked) this economist explains that the earlier memo was intended to be ironic, a stimulus to further thought, and not to be taken literally.

Many economists believe that wild animals should be valued in terms of the willingness of people to pay for them. If people are willing to pay more for the pleasure of preserving animals than sportsmen are willing to pay for the pleasure of killing them, they should be preserved—and if not, not. Thus, presumably, if a billionaire sportsman is willing to pay more to kill one of the last white tigers than preservationists are willing to pay to preserve it, the white tiger should be allocated to its highest-valued user: the sportsman. Indeed, many such sportsmen are now hunting endangered species precisely because of their scarcity value.²

Such policy recommendations are derived from a concept of "economic value" that clearly differs from the values other people might want to apply to these cases. While the precise definition of economic value is rather complex, it is sufficient here to note that it depends on the ethical principle of consumer's sovereignty. Under this principle, the value of anything is measured by the amount people are "ready, willing and able to pay for it."³ Most people would agree that this is a reasonable criterion of value for the great majority of goods and services daily exchanged in an economy. But most people also would agree that there are limits to the applicability of consumer's sovereignty as the *sole* criterion of value. This subject is addressed further in the last section.

The problem of value is particularly acute in ENR policy analysis because the essential purpose of the environmental movement is to *change values*. The movement is a kind of secular religion attempting to introduce new ethical principles into policy decisions. For example, many animal rights proponents contend that animals and other living things have rights to life, at least at the species level, and these rights should be protected against economic exploitation, as human rights are, no matter what the economic cost may be. Nor are they willing to submit to a willingness to pay test on this policy issue, any more than they would be in the case of humans.

In a recent discussion of the World Bank memo, for example, I stated my opinion that exporting polluting industries, under appropriate controls, could indeed be beneficial to LDCs. One of my Winrock colleagues responded that this would be an "evil policy." I had not heard this word used in policy dialogue before, but I think it is most appropriate.

It is in this confusing and fascinating context of multiple values and dubious facts that we turn to a brief examination of some of the major features of ENR policy analysis in LDCs.

The Setting of ENR Policy Analysis: Differences Between LDCs and DCs

In discussing differences between these two groups of countries, we of course have to speak in terms of rough averages, stylized facts, or archetypes, with a wide dispersion of individual countries around the center. These differences are most apparent in

- Population Growth
- Poverty
- Growth of GNP
- Technology
- Institutions
- Cultures

Population Growth

LDCs have high rates of population growth, averaging about 2.3% annually, or doubling about every 30 years; DCs have nearly zero growth rates. LDCs also are experiencing massive migration from rural to urban areas. In many countries, the population of rural areas is constant or decreasing, so that all of the population growth is concentrating in a few urban conurbations—Mexico City, at 20 million people and growing, provides a grim paradigm of the future. This creates severe urban problems of air and water pollution, traffic congestion and noise, slums and public health, and the need for diversions of water supplies from agriculture, fisheries and wildlife habitats to urban-industrial uses. On the other hand, it substantially alleviates such ENR problems in rural areas as destroying forests for firewood.

Poverty

Developing countries are poor. Average per capita income in LDCs (adjusted for real purchasing power equivalents) is about \$500 annually, compared to around \$15,000 for DCs. This 30-fold difference in real income has major implications for ENR policy analysis. In terms of the opportunity cost of economic commodities forgone, it means that investment in ENR amenities—such as clean air and water, natural habitats and the like—is roughly 30 times greater in LDCs than in DCs. It also implies that the value of ordinary economic commodities, especially of such basic necessities as food, shelter and clothing, is relatively much higher than the value of ENR amenities. These different relative values are not due to cultural relativism so much as to the law of diminishing marginal utility.

Figure 2 illustrates the hypothetical marginal utility (in ordinal terms) of economic commodities and ENR amenities on the vertical axis and per capita income on the horizontal axis. At low per capita income, the marginal value of commodities greatly exceeds that of amenities. At high per capita income the situation is reversed. Thus people with the *same utility curves* will choose in opposite directions, other things being equal, depending on their income. This explains why environmentalists tend to be in higher income groups than their opponents. This in turn implies that the base of political and economic support for ENR policies is narrower and even more concentrated among income elites in LDCs than in DCs—which, I believe, is correct.

Growth of GNP

While the variation among countries is extremely wide, the average growth rate of GNP in LDCs, around 3% per year in real terms, is about twice that of DCs. Economic growth is the primary source of ENR problems. Prehistoric cavemen (and cavewomen) had a wonderfully natural, if rather uncomfortable and dangerous, environment in which to live. Economic growth also is a primary source of means for solving ENR problems, but this depends on wealth, on growth in per capita income, which is less than 1% per year. Thus roughly speaking, while the growth of ENR problems is about 3% per year, the growth in ability to solve these problems is only about

1% per year. The ENR problems in LDCs, in other words, is growing about twice as fast as the capacity to solve them—at an average annual rate of about 2%, doubling every 35 years, which probably is a conservative estimate.

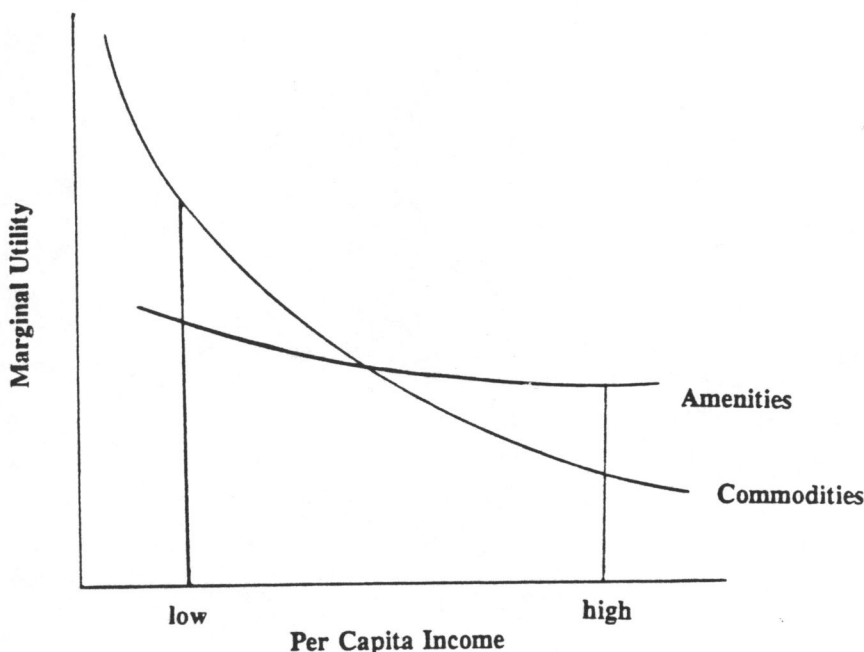


Figure 2. Marginal Value of Commodities and Amenities

Source: Adapted from Barkley and Seckler 1972, 82.

Growth of GNP

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Technology

The technology used for GNP production and consumption generally is more damaging in developing countries. In rural areas, fuel for heat and cooking comes mainly from plant materials, causing deforestation, erosion and loss of soil nutrients. Air pollution from these sources can be quite appalling: it has been estimated that an Indian village woman cooking over a *chula*, a traditional cooking stove, is exposed to the equivalent of smoking 15 packages of cigarettes per day. Vehicles are not controlled for pollution, leaded fuel is still used, municipal and industrial effluents are dumped into streams where they enter domestic water supplies, and so on, quite literally ad nauseam. On the other hand, poor, labor-surplus economies can achieve high levels of recycling. Harvesting garbage bins and dumps for plastic bags, newspapers and even food is a thriving business. The cows in Delhi are the primary "collectors" of garbage with built-in recycling bins!

Institutions

Perhaps of greatest importance in policy implementation, public and private institutions in many developing countries do not work very well. Because of corruption and incompetence in government agencies, many developing countries find it difficult, if not impossible, to collect land taxes and metered charges for electricity consumption, obtain repayment for commercial loans from powerful individuals, protect trees, or keep farmers from stealing irrigation water from their neighbors. Under such conditions, a major effect of licenses, rules and regulations—and even commercial law—is that enforcement agencies are able to generate income and politically connected business interests receive favored economic positions. A license to pollute is more likely to go to the minister's nephew than to the most efficient user. A tax on pollutants is likely to be enforced as a competitive weapon against certain producers while others are permitted to pollute without the tax. For these reasons, we must be cautious about the practical applicability of ENR taxes and subsidies, sales of rights to pollute and other innovative policies that have been employed in DCs.

In recognizing these problems, however, one should not overlook the many fine individuals in both the public and private sectors of LDCs and the government institutions that do perform exceptionally well. The success of "Operation Tiger," and the national parks generally, in India and Nepal are cases in point.

Some economists seem to believe that the solution to poor government is no government. To me, this position simply reflects ignorance about how modern economies work, especially how modern market systems work. Because of "government failure," the market also fails in many developing countries....The solution to poor government is better government.

I believe that we need a new factor of production in economic theory to complement the traditional factors of land, labor and capital. I call this the "cybernetic factor" of communication and control of purposive organizations. This is a much broader area than simply "transaction

costs," although these costs are an important element of the cybernetic factor. Many of the problems of market failure, for example, are reducible to the relative costs and benefits of communication and control. One of the major challenges to EPAT will be to help design policies that can be effectively implemented in the context of LDC institutions and to help these institutions improve communication and control so that they can more effectively formulate and implement policies.

Cultures

An LDC policymaker once told me the problem with most Americans is that they think everyone should do everything just like they do back home in "Two-Bit, Montana." Cultural differences affect both the "what to do?" and the "how to do it?" aspects of ENR policy. These cultural differences make development work fascinating, fun and, to the naive, precarious.

As EPAT teams work in developing countries, we will find different value systems that will fundamentally challenge the kinds of economic analysis that we routinely apply, on the basis of our own cultural values, to ENR problems. Thus, because of both values and political expediency, policymakers in developing countries are generally more interested in the distribution of income, perceived equity and fairness than are U.S. policymakers. If the distribution of income is taken seriously, then methods of contingent valuation, based on estimated willingness to pay, are likely to yield misleading and counterproductive results (Seckler 1966). Moslem countries have strong prohibitions against interest payments. For them discounting is highly suspect, if not evil. Hindus will not kill cattle; thus one of the greatest sources of overgrazing and soil erosion in India is moved beyond the pale of economic policy. Jains will not even kill insects.

Development professionals used to be trained to be sensitive to cultural differences and reminded that, since it is their country, policymakers in LDCs are the boss. But this attitude is unfortunately giving way, especially in donor agencies, to the arrogant attitude that "we know best." This attitude also requires a heroic disregard of facts, given the exceptionally poor performance of the United States in nearly every dimension of economic policy: growth, trade, ENR, poverty, health or whatever.

Major ENR Problems in LDCs

In this section, I list the most important ENR problems and EPAT tasks in developing countries as I see them, in rough order of priority. I should emphasize that this is only my list, that other EPAT team members should add to or subtract from it, and that missions and their counterparts should be solicited as soon as possible for their suggestions about the list. But a short list is

essential: because EPAT cannot do everything in this vast area of ENR policy, we should try to concentrate our forces to do the most important things well. The list as I see it:

1. Reduce the rate of population growth
2. Protect unique natural amenities
3. Reduce urban-industrial congestion
4. Improve energy supply and utilization
5. Improve water quality and availability
6. Encourage biological pest control and reduce excessive fertilizer use

Develop and Support Policies to Reduce the Rate of Population Growth

We need an articulate analysis of the close interrelations among population growth, economic growth and ENR interests. While I do not believe that zero population growth is necessarily the correct objective, I am sure that the 3% to 4% growth rates of many African countries is too high.

One of the fascinating questions in economics is that of the optimal rate of population growth. I agree with Julian Simon that it probably is not zero or negative, but I am certain that it is not as high as that of Kenya, which is close to the maximum natural annual rate of growth of 4%. I am inclined to think it is something like a .5% solution, with perhaps a standard deviation of one half this amount depending on local conditions. Certainly, population policy should be an integral part of EPAT policy analysis. We should not fall into the trap of selecting only certain kinds of policy analyses and reforms, such as price policy or privatization, and miss the essence of the ENR problems we are asked to address. This may lead policymakers into believing that there are "magic bullets" in the way of policy reform that permit them to neglect such fundamental issues as population control.

Protect Unique Natural Amenities

This category includes irreplaceable natural amenities and irreversible processes including wildlife habitats, genetic diversity and scenic wonders. The first law of rational decision making is "preserve your options." Irreplaceable assets and irreversible processes form a unique category of economic phenomena that are among the unsolved problems of economics. In the absence of something better, we should follow the safety first rule. Since much of the demand for these assets is from developed countries, most of the costs should be paid by these countries as additions to, not as substitutes for, economic development assistance—and the two should be combined in integrated programs as much as possible.

Perhaps the most dramatic single example of complementarity I know between economic development and ENR is between properly managed intensive agricultural production systems and preservation of wildlife habitats. In intensive agricultural systems, food production per unit

of land can be ten times that of primitive forms of extensive agricultural production. Thus by concentrating production in the agriculturally most favored areas, the market system will cause more marginal areas to remain out of (or to go out of) agricultural production. The green revolution in India has helped enormously in preserving the magnificent parks and wildlife refuges of that country. The major threat to the wildlife of Africa is precisely the combination of high population growth and extensive agricultural systems that force people to settle in the wild areas in search of food. Africa desperately needs intensive agricultural systems—irrigation, improved seeds, inorganic fertilizers and selective, degradable pesticides—both to feed people and to protect its wildlife resources. But many environmentalists need to be taught to understand the benefits of properly managed intensive agricultural systems.

Reduce Urban-industrial Congestion

Air and water pollution, sewage disposal and treatment, slums, and improved transportation systems are all included in this issue. We need to study the enormous literature on regional science and location theory and analyze the explosive growth of cities like Mexico City, Cairo and Bangkok for the associated costs and benefits. I believe the results of such studies would furnish support for policies that encourage dispersal of urban-industrial growth. Simply relocating government offices from capitals (paid for by privatizing very expensive government land and buildings) would be beneficial and, with modern electronic communications, feasible. Much can be learned by studying the new towns of Europe after forty years of experience.

Improve Energy Supply and Utilization

Under this category falls a wide range of policies governing technological and institutional change—from more energy efficient and less polluting technologies, through development of renewable energy systems, to substitution among energy sources. It also covers a substantial range of complementary relations between economic development and ENR. For example, some developing countries are now following the new requirements of developed countries for standards of new vehicle emissions. The saving on fuel consumption alone would more than pay for the costs of these policies.

Global warming also falls under this category. My own opinion is that not enough is known about the physical facts of the subject for it to be now a direct object of policy analysis. However, as Neva Goodwin has elegantly argued (verbal communication), policies that are needed for other reasons, such as energy conservation and air pollution, are virtually the same as those needed for the threat of global warming. Of course, the benefits of reducing the threat of the latter, which we might get for free, should be added to the benefits of the former.

Improve Water Quality and Availability

Water quality includes safe and convenient domestic water supplies, alleviation of salinity and waterlogging, and destruction of breeding grounds for disease vectors. Water quantity includes irrigation for food security in drought-prone areas, and conflicts over increasingly short supplies of water among agricultural, municipal-industrial and environmental uses. These and related conflicts among regions, provinces and nations are rapidly becoming one of the major natural resource policy problems in the world. As they say in the arid western United States, "Whiskey is for drinking, water is for fighting over."

Encourage Substitution of Biological Control for Pesticides in Agriculture and Reduce Excessive Fertilizer Use

Agricultural research has demonstrated that pesticides have counterproductive effects because they kill natural predators and stimulate rapid adaptation to resistant varieties. Agricultural scientists also have found that it is best not to try to eliminate the pest population as this only encourages rapid evolution of new, resistant varieties. Integrated pest management has become one of the most beneficial products of agricultural research in the past two decades. Indonesia, for example, which used to be one of the heaviest pesticide users, made 50 of the worst and most commonly used pesticides illegal, and rice production has increased.

Fertilizer is a more difficult problem—most developing countries do not use enough. This leads to nutrient mining of soils, low productivity, slash and burn agriculture, and poor land management practices. But where too much is used, fertilizer use obeys the law of diminishing returns. The obverse of the fertilizer production function becomes the pollution function: the more that is applied, the greater the amount that is not utilized by plants and that enters the environment as pollutants. Japan, Europe and parts of the United States are the greatest offenders in this regard. Poor price policies encourage excessive rates of fertilizer use.

I favor taxes on fertilizers and pesticides in DCs with food surpluses to reduce pollution and to induce technological innovations that can later be transferred to LDCs with food shortages. In the meantime, I also favor fertilizer subsidies in many developing countries, such as most of sub-Saharan Africa, to increase food production and reduce pressure on natural amenities.

Of major ENR problems in developing countries, only these six seem to me to be of this order of importance. There may be many other problems that others would want to add to the list, but those that come to my mind are of a lower order. Soil erosion, as noted before, does not seem to me to be a major problem, except in local areas. Nor is deforestation, if one is speaking of the ordinary kinds of trees, with the exception of the natural amenity aspects. My intention, however, is to begin the discussion of problems, not to end it.

ENR Policy Analysis

We have discussed the setting of ENR policy analysis in terms of differences between LDCs and DCs and the major ENR problems of LDCs. We now turn to the third dimension of the EPAT matrix: the concepts and tools of economics that can help solve these problems. This vast subject can only be outlined in an informal manner here.

I should say at the outset that the basis of this presentation is the so-called neoclassical theory. I consider myself to be as much a neoclassical economist as anything, but I believe there are important unsolved problems in this theory that other schools—such as institutional, social, ecological and structural economics—which are well represented on the EPAT team, are struggling to resolve, and I am happy to join them in this struggle. I do, however, believe that the best way to approach these problems is through the established theory, reforming it where possible, not by attempting to overthrow more than two centuries of work by some of the greatest minds of our civilization.

The foundations of neoclassical policy analysis and project evaluation are the branch of neoclassical economics called welfare theory. Welfare theory was established by Pigou (1946) and refined and extended by many of the best minds in economics (see, e.g., Mishan 1964; and, especially, Little 1957). Welfare economics is both a highly technical and deeply philosophical field of thought of great practical usefulness. In the following sketch, I shall present some of the major features of the theory in a way that, I hope, makes both the scope and limitations of the theory as transparent as possible.

Welfare theory attempts to define when one economic state is better than, or superior to, another state. This problem is addressed by defining first a set of assumptions and then a set of technical conditions for the best possible economic state. Once this state is defined, the assumptions and technical conditions can be compared with reality to see where problems, both real and theoretical, lie. The best economic state is called the Pareto-optimal state (POS) because in this state it is impossible to make anyone better off without making someone worse off—i.e., those who would gain from a change in the optimal economic state could not compensate those who would lose from the change without themselves becoming losers.

Since someone usually loses from a change (whether they deserve to or not) and it is usually impossible to provide compensation, POS has often and rightly been criticized as a defense of the status quo ante. But this criticism is clearly more relevant in the static case, where the pie is fixed, than in the dynamic case where the pie grows. Fortunately, the dynamic case is closer to reality; unfortunately, welfare economics is mainly limited to the static case. Clearly, we need a better dynamic welfare economics, but until we have one, much of value in ENR policy analysis can be obtained from the theory as it is.

Assumptions

In order to evaluate anything, it is necessary to have a criterion of value. The first and most fundamental assumption defines the criterion of value in welfare economics. It is, as noted before, consumer's sovereignty:

1. The value of anything is equal to the amount people are "ready, willing and able to pay" for it in a POS (as explained below).

This criterion is explicitly limited in two important respects:

- 1a. Tastes, social values, ethics and the laws of society are assumed as given.
- 1b. The distribution of income in the economy is assumed to be satisfactory.

Consumer's sovereignty defines the domain of economic value and, therefore, of economic analysis. Anything belonging to (1a) or (1b) are outside of economics per se and properly belong to other fields of study. It may seem curious that the distribution of income is a noneconomic subject, but one of the few things about which all (neoclassical) economists agree is that the distribution of income is a "value judgement" outside of economics (i.e., outside of consumer's sovereignty the only accepted criterion of economic value).

Of course, in terms of set theory, the subset of economic phenomena may intersect with subsets of other, noneconomic, phenomena, such as income distribution; the economist has a legitimate role concerning the economic *aspects* of these intersections. For example, someone may propose a redistribution of income in favor of the poor on egalitarian grounds. The economist has nothing to say about this policy as an economist except in regard to its possible effects on such economic phenomena as savings and growth of GNP. But if someone proposes a redistribution of income in favor of the rich on grounds that it would increase savings and economic growth, the economist's voice would be decisive (although, of course, economists do not speak with one voice because of different theories of economic phenomena). Thus, as Little (1957, 77) says, economists should always use the qualifier "economic" in making recommendations, but

If I say 'this change will increase economic welfare', it is open to anyone to say 'perhaps, but it will not increase political welfare, or welfare in general'....Putting it in always suggests that the economist's conclusion is not the last word.

Hence the qualifier usually is ignored.

Within the domain (quite literally, "turf") of economics established under assumption (1), several other assumptions are employed to simplify the analysis. These assumptions are not fundamental in the sense that "all is lost" without them, as is the case with the first. On the contrary, these assumptions are intended to be relaxed as real problems are encountered to explore the analytic differences between the ideal and the real. Some of the most important of these secondary assumptions are:

2. The institutional and technological structure of the economy is given.
3. The total set of goods in the economy is fixed (and usually with all factors of production fully employed).
4. The present and future is perfectly known.
5. Producers and consumers are perfectly rational.

We shall discuss some of the implications of relaxing these assumptions later, but even with the assumptions taken as given, major problems arise in satisfying the technical conditions for POS. These problems define the subject matter of ENR economics.

Market Failures

It is not necessary to go into the technical conditions for a POS here (see, e.g., Little 1957). The major interest of ENR economics is in those cases where these technical conditions are violated, the cases of "market failure" (just as the major interest of other schools is where the basic assumptions are violated, or rejected). There are, I believe, only two generic cases of market failure under the basic assumptions and conditions of welfare economics because all other cases can be reduced to one or the other or combinations of these generic cases. These are *externalities* and *public goods* (for a more extended discussion along the same lines see Barkley and Seckler 1972).

Externalities

Externalities occur when one person's behavior creates benefits or costs to other people without commensurate compensation: rewards in the case of benefits; penalties in the case of costs. Too much of the activity will be undertaken in the case of external costs, and too little in the case of external benefits. Air pollution from one's fireplace is an example of external cost to one's neighbors. Growing beautiful plants enjoyed by one's neighbors is an example of an external benefit. In all such cases, the externalities should be internalized (in essence, "put a cork in the smoke-stack!") either through regulatory actions or taxes and subsidies.

The subject of externalities is too familiar to warrant much time here. However, there is an interpretation of externalities that will be helpful in understanding the more difficult problems of public goods. Externalities can be interpreted as a break-down in the cybernetic function of the market system. A properly functioning market system provides communication and control among the participants through negative feedback systems (Ashby 1964; Seckler 1980). With negative feedback, the error in the system (the difference between the objective and the actuality) is progressively reduced through successive iterations of the system. Thus if prices are in disequilibrium—too high or too low—in terms of POS, the market usually sets in motion forces that will reduce the error. The problem with externalities is that negative feedback does not exist because the sources and recipients of the costs and benefits are out of communication and control. In fact, in such situations positive feedback can develop, making the problem worse with

each iteration of the system. For example, industries may move to states and countries that do not have pollution controls, growing at the expense of controlled industries.

These problems require an organizational or, more broadly, an institutional solution. One institution, the market, fails to provide negative feedback. Other institutions are needed to provide communication and control, either through the market or by other institutional means, to restore negative feedback. There are many such institutions ranging from legal systems and government regulatory agencies to churches, charities, cooperatives and other nongovernmental organizations. I believe that this cybernetic perspective provides a basis for a "new institutional economics" that could be of considerable value in addressing such problems.

Public goods

Normal economic goods are produced in small units that the consumer can purchase and consume by himself. The minimum size of a public good, however, is so large that no one consumer can use it all. In the extreme case of the "pure public good," as discussed below, even *all* of the potential consumers cannot consume the good. Thus the costs of providing public goods must be shared among many individual consumers, and a market for such goods can only be formed collectively. The effective demand for public goods, in other words, is provided by an institution rather than by individuals. For these reasons, public goods are described as "indivisible," "lumpy," "nonmarginal," or "collective" goods. While public goods may at first seem to be quite rare and queer kinds of things, they are omnipresent and more important than externalities. Indeed, they are the goods on which civilizations depend, although most people are hardly aware of them. Unfortunately, they are exceptionally difficult to produce, maintain and manage. Public goods are most easily perceived in the extreme case of the pure public good.

As noted before, the pure public good exists in such large units that even all of the potential consumers cannot consume all of it. This means that the marginal cost of an additional unit of consumption is zero. Since one of the technical conditions of POS is that price equals marginal cost, the optimal price of a pure public good is zero! Since private firms cannot provide their services for free, they are not able to provide public goods at optimal prices. The pure public good thus is the locus classicus of market failure.

The humble lighthouse is a good example of a pure public good that provides a means of establishing issues relevant to the more abstract public goods in ENR. Once a lighthouse is operating, any number of ships can receive its message at no additional cost; the marginal cost is zero, and the charge for using the lighthouse should be zero. But since businesses cannot incur positive costs and sell at zero prices, the market fails to provide lighthouses optimally.

Associations of shipowners, however, have found it in their interests to build and operate lighthouses. But if other shipowners benefit without paying the costs, they become "free-riders." If there are free-riders, private effective demand is below social demand, and the market will not provide the optimal amount of lighthouses. This free-rider potential also induces members of the association not to pay their dues and become free-riders themselves. Thus even the private cooperative solution may not be sustainable. Of course, the lighthouse association could employ

a gunboat to prevent free-riders from using their lighthouse. But then the economy would be suboptimal because of the benefits foregone of the excluded users and the cybernetic costs of control, the gunboat, would likely make the lighthouse economically unfeasible from both private and social points of view. In this case, the optimal solution can be reached only by government intervention, by imposing local taxes on all lighthouse users to pay the capital and operating costs while providing the short-run services for free.

Similarly, pay television is economically inefficient, however financially expedient it may be. The British have addressed this problem by having an annual tax only on TV receivers, to pay the costs of the BBC, without regard to the number of programs received. (However, this still results in inefficiency by excluding those who will not pay the tax.) Toll roads and admission fees to zoos, museums and the like are economically inefficient up to the point of congestion effects, where users impose positive marginal costs on one another. The same is true of knowledge and the exclusionary effects of patents and privately contracted R & D in universities and even private firms. Even Adam Smith recognized that national defense, the maintenance of law and order, and cultivation of the arts and sciences were public goods that should be supported by the state, without charge to beneficiaries.

Some of the major concerns of the environmental movement have pure public good properties. An example (which I believe was first published in Barkley and Seckler 1972) is "existence demands." One may never expect to see a blue whale, or even go very much out of one's way to see one, but be willing to pay to live in a world where blue whales exist (or more generally, perhaps, to live in a society where killing blue whales is unacceptable behavior). But again, the free-rider problem likely will cause a suboptimal supply of protection for blue whales.

The difference between externalities and public goods can be blurred by the fact that both problems often are involved in the same phenomena. Thus free-riders are recipients of external benefits from public goods. Public goods are especially high generators of external benefits because users *should not* be excluded on economic grounds from the benefits even if they could be excluded. But the ability to become a free-rider, as noted before, tends to destroy institutions involved in the provision of public goods.

Garret Hardin's *Tragedy of the Commons* is concerned with the problem of institutional lag during the evolution of public goods from a state of zero marginal cost to positive marginal costs as users and uses increase. As marginal cost becomes positive, use should be regulated by prices or by legal and administrative means. But people have acquired socially sanctioned rights and entitlements to these resources that make rationing difficult. This leads to overexploitation, such as overgrazing and soil erosion, and a non-POS state for all. The standard economic solution to this problem is to formalize the rights to use the resource, and then to market these rights to the highest bidders. But the institutional-cybernetic problems of how to do this become formidable. There are other institutional forms of rationing—e.g., rotational grazing rights—that might attain the same POS through more socially preferred, and therefore more cybernetically sound, paths.

So far the discussion has remained strictly within the assumptions of POS, with market failure in the form of externalities and public goods occurring because of violation of the technical conditions of POS. But other kinds and combinations of market failure are generated when the assumptions of POS are relaxed.

Option demands

Relaxing assumption (4), perfect knowledge, creates option demands. People may be willing to pay to preserve their option to enjoy a good in the future even though they may not have a high expectation of doing so. For example, the present existence value of a snail-darter may be zero, but one may be willing to pay for the option of changing one's mind later. Option demands, together with existence demands, provide much of the rationale for preservation of genetic diversity. Option demands are thus like insurance policies. They usually also have public good properties, since once the option is obtained everyone can have it at no additional cost.

Merit and demerit goods

Some goods should be provided or withheld irrespective of consumer's sovereignty (relaxing the fundamental assumption [1]). Thus in the United States, people are legally required to send children to school whether they want to or not; and people cannot legally consume certain kinds of drugs no matter how much they are willing to pay. This type of merit and demerit good exempts tastes or preferences (1a) from the criterion of value.

Another important type of merit good relates to the distribution of income (1b). It may be decided that people should have basic food, shelter and education. For someone willing to pay to help poor people through private charities, poverty relief is a good like any other good because it satisfies consumer's sovereignty either by fulfilling charitable inclinations or through the hope that one will be rewarded later, either here, say through reduced crime, or in the hereafter. But one also may rationally refuse to donate to charity and yet vote to aid the poor by a general tax, partly to avoid the free-rider problem. In this case, a free-rider would be willing to pay to help the poor but does not in the hope that others will do it instead. But many people do not want to help the poor. Then one may vote for a tax to help the poor on grounds that it is a moral imperative of society, whether others like it or not.

Similarly, one may feel that poor people should be able to visit congested zoos, museums and parks without the income rationing imposed by admission fees.⁴ Rationing can be imposed, for example, by queues, which tend to be more income-neutral devices. Thus the visible queues in socialist countries have vanished as prices have increased. They have been replaced by invisible queues of those who cannot afford to pay, as in capitalist countries.

Discounting

It is hard for many people to believe that if 30 years from now a tree is worth \$100 one would be willing to pay only \$3.34 for it today. The reason is that \$3.34 invested today at 12% will

be worth \$100 in 30 years. Many people believe that discounting incorrectly favors the present over the future, promoting rapid use of assets or underinvestment in long-term assets.

But if trees in fact are going to be increasingly in short supply over the next 30 years, their prices will increase. If their prices increase at the same rate as the discount rate (12%), then the present value of the tree 30 years from now will be the same as it is today. If tree prices are expected to increase by more than the discount rate, investors will rationally save trees for the future. I do not believe that the discount rate can be attacked on these grounds, as a form of market failure.

But the problem is much deeper than this. First, since we do not have perfect knowledge, we may underestimate the future value of trees and other items that require a long time to replace. There is a great deal of risk, uncertainty and potential loss due to mistakes in this regard. It is better to be conservative under such conditions by assuming high rates of appreciation close to or above the discount rate of such assets.⁵ Second, it should be emphasized, most of these cases have been considered within the domain of economics, of consumer's sovereignty. Even in merit/demerit goods, the economic aspect of the problem is the willingness of someone to pay to encourage or discourage consumption by other persons. Once we leave this domain of consumer's sovereignty, we enter the intersection of economic values and other values represented by political economy, the subject of the concluding section.

Perhaps this section can be summarized by saying that the market system is one of many instruments for achieving personal and social values. It is a wonderfully effective and efficient cybernetic institution in many cases. Indeed, one of its virtues is that it is indifferent to what some economists call "distortions." One can adjust prices to meet social objectives in any way one wishes, and the market will obediently carry these orders out to the most minute sectors of the economy. But the market can fail. It is not a value in itself, much less is it some kind of a god to which we must appeal for judgments of value.

The Role of the Economist in ENR Policy Analysis

Joan Robinson has aptly described economics as a "kit of tools" to help in decision making. I believe that economics has progressed to the point where it can reasonably be said that it is impossible to make intelligent decisions in the field of public policy without drawing on this kit of tools. Some of the more important tools, often used in combination, are benefit-cost analysis, cost-effectiveness analysis, simulations, operations research, contingent valuations, input-output analysis, macroeconomic models and decision theory. Perhaps even more important than the specific tools, however, is the framework of economic analysis itself. One can almost always distinguish economists from others in a policy discussion by their implicit reference to the framework of thought based on the fundamental principles of marginal analysis and opportunity cost. Once one has these concepts and their implications firmly in mind, one thinks like an

economist—and I believe that in most areas of policy analysis this is indeed a better way of thinking.

The power of this analytic framework and the associated kit of tools has created a demand for economists in virtually every field of policy analysis (sometimes just to argue with other economists) to the extent that economics has been described as the "imperial science." As an economist, I am naturally sympathetic to these developments; but I have two primary reservations relating to facts and values.

First, there are some "unsolved problems of economics"⁶ on the factual side, some of which I have attempted to describe elsewhere (Seckler 1991). These are of great importance in certain kinds of policy analysis. Two of the major unsolved problems are true uncertainty (as contrasted with risk), and nonmarginal phenomena, or "regime switches." I contend that in addressing these problems we need a different, a "strategic," framework of analysis to supplement the essentially "tactical" framework used in standard economic analysis. I do not pretend to know how to solve these problems. But I strongly believe that no solution is better than a false solution and that when we encounter such problems in policy analysis we should clearly inform policymakers that *we do not know* the answer.

My second reservation concerns values: the propensity to use economic value as the sole criterion of value in policy analysis. In a sense, this is a much easier conceptual problem than the first because every sophisticated economist knows that *economists cannot make policy recommendations*; we can only provide policy *advice* to policymakers on the strictly economic aspects of policy decisions. This is because every policy decision involves evaluation on the basis of economic values combined with other, noneconomic values which the policymaker alone can synthesize into a final decision. It is indeed one of the major tasks of policymakers to decide the degree to which economic value is to play a role in any particular case.

Thus while I agree that the policy recommendations of Friedman and Summers in the introduction represent valid *conclusions* in economic theory in the strict sense that consumers' sovereignty would be optimized under the assumptions and conditions of POS, I believe that as policy *recommendations* they carry no more force than the opinions of the man in the street. (These conclusions may, of course, also be invalid under different assumptions.)

The general methodology of cost-effectiveness analysis provides the appropriate framework for policy analysis since it incorporates both the scope and limitations of economics in a manner that policymakers can readily comprehend. Assume, for example, that one does a standard benefit-cost analysis of a particular policy, staying strictly within the domain of economic value and reasonably well known facts. This analysis results in a benefit-cost ratio (or equivalent internal rate of return or net present value) of, say, 0.80. Many economists would say that the policy should be rejected on grounds that it is not economically feasible. But I regard the benefit-cost ratio (or its equivalents) as the beginning, not the end of policy dialogue. Perhaps the policy creates other desirable effects. Then one can say that 80% of the economic costs of the policy are paid for by its economic benefits. If the other desirable effects of the policy are worth more

than 20% of the costs, in terms of subjective evaluations, then it should be accepted—and if not, not. Similarly, a policy with a high benefit-cost ratio may be rejected on grounds of undesirable noneconomic effects—as is sometimes the case with environmental impact assessments.

This approach is reflected in mathematical optimization techniques where decision-makers are asked to assign relative weights to the objectives and then the system as a whole is optimized. This is often called the "objective function," although it is the most subjective thing in economics. My own position is that the concepts behind these weights are too complex to be assigned numbers, at least the ordinary kind of numbers, and optimization in such cases is best left to the subjective judgments of policymakers.⁷

Perhaps I can best summarize my position on these issues by referring to what I like to call the "Olde English School of Political Economy." This school was probably founded by Alfred Marshall. It includes his two great students, Keynes and Pigou, along with such other luminaries as Hayek, Robbins and Robertson.⁸ Keynes thought economists should be regarded rather like dentists, performing a useful but rather modest function in life. Robbins denied that economics has anything of interest to say about the "really important things in life." Pigou (1946) emphasized that economics can only be concerned with values that properly can be brought into relation with the "measuring rod of money" (or, as Little [1957]) says, exchanged for money). Hayek said that an economist who is only an economist is a nuisance, if not a positive menace. But the last word should be given to Sir Dennis Robertson, from his Presidential Address to the Royal Economic Society in 1929, aptly entitled *On Sticking to One's Last*.

You will see that my ambitions for my profession are not quite so exalted as my predecessor's. I do not want the economist to mount the pulpit or expect him to handle the keys of Heaven or Hell. I want him to be rather brave and rather persistent in hammering in those results achieved within his own domain about which he feels reasonably confident, not too readily reduced to silence by the plea that this, that or the other is ruled out of court by custom, or justice, or the temper of the age. But in the last resort I want him, too, to be rather humble—humbler than some of his great predecessors were disposed to be—content to bow to the judgment of the prophets or even the men of affairs if he is convinced that his case has been properly understood and fairly weighed. In fine, I like to think of him as a sort of Good Dog Tray rather than as a Priest forever after the Order of Melchizedek.

ENDNOTES

1. This discussion on decision strategies is adapted from Landau 1986.
2. Shortly after this sentence was written, an article appeared in the *Washington Post* (Feb. 9, 1992) reporting on expeditions to hunt endangered species, allegedly guided by an employee of the Smithsonian Institution!
3. As discussed later, the precise definition of economic value is the exercise of consumer's sovereignty in a Pareto-optimal state of the economy. The assumptions and technical conditions for such a state, together with a brilliant analysis of the implications, are in Little (1957).
4. Milton Friedman and others contend that if you want to change the distribution of income it is best to do it through lump-sum transfers to the poor, for example through a negative income tax, rather than subsidies and taxes on specific goods. It can be shown that lump-sum transfers are more efficient in terms of the opportunity cost of consumer's sovereignty. But this rather misses the point. One may be satisfied with the distribution of income in general but not with the allocation of merit and demerit goods in particular. If so, it is likely more cost-effective to have specific taxes and subsidies.
5. For nearly two hundred years, the real interest rate on government bonds issued by western nations has been around 3%. There is a famous article by Frank R. Ramsey (which I have not been able to find) showing the long-run equilibrium discount rate should equal the real rate of growth of the economy—which in fact has been around 3% per year over the past two hundred years. If this were not so, the factor share of capital in the economy would explode and the economy would collapse. For example, if the real growth rate of the economy were 3% per year and the real discount rate were 12%, then the share of capital would grow by 9% a year, doubling every two years. Perhaps even the present administration of the United States would consider this excessive. In any case, such an imbalance in factor share would likely result in a Keynesian depression (which it has). The practice of basing the discount rate on capital markets is erroneous because lenders assume that most of the interest will be paid for by inflation. Yet in economic evaluation, inflation is not taken into account in projections of costs and benefits. If it were, the real discount rate, adjusted as discussed in the text, would be much less. In sum, I believe that the discount rate used in economic evaluations should be set at the expected rate of growth of the economy over the period of the investment.
6. I am indebted to Theodore W. Schultz for this phrase in his comments on the paper cited in the sentence.
7. My conjecture is that if the correct kinds of weights were discovered they would be of a weird sort, like those produced in the mathematics of quantum theory, as Penrose (1989) so elegantly explains. This could be an interesting area of collaborative inquiry among mathematicians and experimental economists (see the interesting review in Shogren and Nowell 1990). Keynes'

(1973, 2d ed.) theory of probability rests on some of these odd concepts, which might be tested (see the discussion in Seckler 1991).

8. I am grateful to Neva Goodwin for including Marshall in this list (also see Goodwin 1991 for an excellent discussion of Marshall and other issues in this paper).

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