Economic Aspects of Environmental Pollution

JACK L. KNETSCH

The quality of environments, including those of rural and agricultural landscapes, is commanding increasing attention, as well it should for reasons of the legitimate or real values involved—values as real and as valid as those of tomatoes and potatoes. Examples of the concerns include the increasing use of pesticides, abandoned automobiles, the proliferation of trash and refuse, utility poles, abandoned farmsteads, and various types of abandoned and new tourist developments. While we focus much rhetoric on a few more dramatic cases, there are many important, and in a number of ways similar, instances of deterioration of the rural and agricultural environment and of the total environment in which we live.

The concern here is not with an enumeration of the various forms of pollution, nor with allegations of the extent of deterioration. We seem to be getting quite a bit of that. The relative deficiency seems to be the growth of an appreciation for the causes of better or worse environments as we have come to think of them. The reasons, particularly the economic reasons, for environmental degradation are not being taken into account and thereby hinder effective and efficient approaches to the alleged loss of values. Solution or at least betterment would seem far easier when the economic rationale is more fully understood.¹

The chief, and most useful, focus of social science questions is not that of having enough resources for our needs or asking when we shall run out of them. Instead, it is with investigating and improving the social and institutional arrangements by which we mobilize them. This concern centers on the assessment of relative values of resource uses and the analysis of ways in which we utilize the products of these resources. These are the questions involved in environmental quality concerns.

As our dissatisfactions with the present resource arrangements increase, we are finding that our studies and plans have not always provided the needed guidance for dealing with environmental problems. In many instances they have been highly descriptive when the need is increasingly for more analytical efforts and more insightful and imaginative approaches. Parallel to this, the concern has largely been on specific problems in individual resource uses. Such a “commodity” approach has distracted attention from the common causes of many of our environmental concerns.


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and of the consistent strategies that might be available for effective actions.

If research is to make a bigger contribution to our understanding, it seems to me that it needs to concern itself less with these commodities or single uses and more with cutting across resource uses and dealing with the great number of similarities that run through nearly all aspects of environmental pollution. Too often our concern has been with junk yards or industrial waste or utility wires or abandoned tourist courts or billboards along the highways, even though the underlying reasons for the existence of all of these types of pollutants and the way in which values are distorted are very largely common to all.

There should be great benefit in cutting in the other direction, paying far less attention to these single uses as such but concentrating on the mechanisms and institutions by which values accrue, on how both the impetus of origins and growth and the inhibitions to change in these situations and conditions come about, and on how they might be improved. This would appear to be fruitful, even though compartmentalizing and commodity approaches seem to be so revered by a large part of our profession.

**Changing Demand and Supply of Environmental Products**

Many of the characteristics and problems associated with the quality of our environments are closely associated with changing demand-supply relationships for resource-oriented products. As economic and social developments proceed, the values attached to many resource services or outputs change. In early stages of economic development, the concentration is most certainly upon a set of resource products which differ from those attainable and demanded at later stages of development. As quality environments, represented for example by natural areas, are destroyed by urban-industrial expansion or commercial exploitation, the marginal values of remaining natural areas increase. Concurrently, as the output from this process increases, the marginal values of more of this output are likely to decrease.²

As we examine the changing demand and supply situation for what we can think of as quality environments of numerous but undefined sorts, it seems abundantly clear that changes are occurring on both sides. There is little doubt that on the demand side we have been and are witnessing significant shifts and increases. As populations and levels of economic well-being and other aspects of affluence increase, these resource outputs take on increased significance among our wants and preferences. We ap-

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pear to have a greatly increased awareness of these products, not only as desirable in themselves, but also as having important values stemming from what has been termed an option demand—people other than actual visitors place a positive value on national parks, for example.\(^3\)

As economic development continues, it is likely that more and more of the earlier or primary uses of certain resources take on less significance and the amenities associated with our environments take on increasing significance. The fact that this has appeared to be the case in the past and is likely to be even more important in the future seems to lie at the core of our present concern with environmental quality. There may be sensible economic reasons for doing some things in earlier stages of economic development which turn out in later stages to be less reasonable. Certainly some of the charges of natural resource exploitation come into this category. The pace of the increasing relative worth of environmental values to what we might think of as primary products may be altered as our economy advances by any number of things, but its direction is unmistakable.

While the demands for quality environments seem clear enough, at least in direction, the supply side is far more ambiguous. A cursory examination would suggest that the increasing values which we ascribe to better environments is far more due to demand changes than to changes in the supply situation.

The greatly expanded productivity of our economy and advances in technology have in the first instance given us or allowed us increased demands for environmental products. They have also in some cases decreased and in others increased the effective availability of these products and also lowered the opportunity costs of making them available for environmental quality enhancement.\(^4\) Thus, while technology and other forms of progress are detracting from environmental values, as they often do, other types may be working in other directions.

Instances of quality-deteriorating extractive processes and unattractive commercial exploitation of roadsides and open spaces are only instances of the many types of environmental pollution associated with our development and growth. However, the improved character of many landscapes, with increased contrasts and better textures brought about by pastoral agriculture, refuse collection and disposal, and sewage treatment plants, are other instances associated with these changes.

Developmental changes are also adding to our ability to satisfy many demands for resource products involving environmental preservation and improvement, as, for example, through our efforts to establish and make extensive use of a national park system. And, importantly, we are increas-

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\(^4\) Krutilla, *op. cit.*
ingly reducing the opportunity costs of diverting many kinds of resources to environmental and amenity uses, through the increasing substitutability of other raw material resources for industrial or commercial uses. We need to take seriously the notion that increasingly technology is making resources more and more a matter of atoms, molecules, and energy, which can be manipulated in more and more ways to provide the basic inputs to a modern industrial society. A recent illustration of this possibility is the Tennessee Valley Authority's decision to install two large nuclear generators as part of their thermal system, in spite of the fact that TVA has long been known as having one of the most efficient thermal generating systems in the world, due in large part to the exploitation of nearby strip mines.

Market Solutions and Other Coordinating Mechanisms

As our demands for environment-related outputs change, the values of many resource products consequently also change. However, it is not always clear that the guides offered are very effective in bringing about the changes in resource use called for. Environmental quality values are very real, but we seem poorly prepared to introduce these values into the social and economic calculus in ways which are at all effective in resolving the conflicts of divergent interest.

Most differences involving conflicting demands for resources and for most goods and services are resolved in the private marketplace, where users actively bid against each other for limited supplies. The market forces, in an economy composed of individual consumers and producers supplying large numbers of goods and services, establish prices for each commodity and for each factor of production. By taking account of complex interrelationships between consumers' preferences (which may have infinite variability), of the technical conditions of production, and of the willingness of suppliers to supply productive factors, this system makes the best use of the available factors of production and best satisfies the wide range of desires and preferences of individuals within the limited amount of resources available.

Because of the harnessing of individual initiative and the ordering of divergent tastes and demands of individuals, the market-price system is a very efficient one and accomplishes an enormous amount of decentralized calculation and decision making that would be immensely burdensome under any alternative. Moreover, it permits individuals a wide range of choice in consumption and opportunities to achieve profits, and generally conforms to many widely held goals of society.

For the production and distribution of most goods and services, the price system works extremely well. In cases of production or consumption

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involving effects on environmental quality, however, market-price signals may fail to communicate the desired ends properly. The best allocation of resources may not in such cases occur with the response of private resource owners to market prices.

While we take rightful pride in our vast production of goods and services from our stock of resources, and such progress has real values, it may also impose serious offsetting losses in other values. Many of these values which are lost or decrease are just as meaningful and of the same kind as those expressed in market prices, of which we are so fond. Many of the values which we are concerned with in environmental problems involve values which are not adequately registered in the market and consequently are outside the normal economic calculus. The national income accounts are not capable of measuring the values of many environmental products and values in the same metric as gross national product. For example, coal produced by a strip mine is valued in the market, and its production is subject to the incentives and restraints registered by its market price and market costs of production, whereas the change in the value of the landscape receives no consideration by the resource owner.

The reasons for many of our environmental quality concerns are largely technical reasons of market failure. These include the problems of external or side effects, indivisibilities, and important nonmarket demands for products of resource use. In a great many of these cases, marginal social values may diverge greatly from the use determining marginal private values. The marginal social cost of environmental deterioration is simply no longer zero.

A good bit of our difficulty is that we are not evolving ways in which all of the relevant values enter into the politico-economic system. The demands and values associated with environmental amenities change, but our institutions, mainly the market, seem to lag in bringing about the improvements.

While there are deficiencies in our market solutions and other coordinating mechanisms whereby the production and distribution of goods and services is not necessarily working out to the greatest advantage, there are also important instances in which public intervention and less reliance on market solutions have produced uneconomic development and resource depletion. Instances of uneconomic development might include a great many urban developments and highway programs. Important instances of resource depletion would include many free public outdoor recreation areas. In many ways these instances of public intervention have pro-

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6 Krutilla, op. cit.
7 Herfindahl and Kneese, op. cit.
duced less economic development than more reliance upon market indicators would have produced. This is not necessarily to argue for the private provision of these services but rather to call attention to the important role which market indicators might play in their provision.

In addition to our more or less reliance on the private market, we have also tended to deal with environmental problems in terms of zoning controls and other institutions of a nonmarket type. These too have been far less than fully adequate. In good measure, the inadequacy is directly attributable to the lack of concern for and reconciliation of economic values in their application. There are good economic reasons for many things to occur, and until these are better understood, solutions, whether they be market-type solutions or others as represented by zoning laws, are in danger of being far less effective than they might otherwise be.

**Competitive Waste and Externalities**

Many of the problems involved in the present concern involve some sort of failure of the market mechanism to bring about desired results by its failure to take fully into account all of the values relevant to resource decisions. It is generally agreed that the price system does not bring about maximum efficiency when important external effects exist. A chief difficulty is that not all of the costs nor all of the benefits fall directly on parties responsible for decisions.

An illustration is a government publication giving advice to prospective motel operators, which, after urging striking design and vibrant colors, states: "There are so many signs that yours must be unusual to get results." This advice is, of course, very reasonable in terms of both the adviser and the advised. But it well illustrates the problem involved in the failure of the cost, in environmental pollution and loss of amenities, of erecting these many distinctive signs, to be fully borne by those bringing them about. Everyone—that is, the public at large—certainly is involved in the loss of values stemming from the erection of these many, indeed competitive, signs.

A further instance occurs with the desire to preserve historic or architecturally pleasing buildings in preference to more commercially remunerative structures. Here, again, values are in fact involved beyond those concerning the property owner. Certainly everyone is a little poorer when, for example, buildings of some architectural or historic significance are demolished. And yet, the fact that everyone but the owner is a little poorer does not enter into the calculation of the rents which could be received from a newer building, however displeasing it might be. If firms and individuals are not obliged to take such side effects into account, they will for the most part neglect them in their decisions, treating them as free goods when in fact they are anything but free.

A good deal of our difficulty stems from the existence of a large number
of externalities or side effects in the case of environmental quality values. Price signals which tell a firm how much it should produce or how to carry on its production may not be adequate in the presence of significant external effects and nonmarket demands.

The extensive literature on these problems is in general being neglected in most discussions about environmental pollution. While an understanding of external effects and nonmarket demands is no assurance of just and efficient solutions, it is more than a beginning to such solutions and is a prerequisite of satisfactory improvement.

**Irreversibility of Supply Curves**

There are very good economic reasons for many of our desired changes not to take place. In addition, but related to the problem of externalities and other forms of competitive waste, is our built-in assumption of the complete reversibility of supply functions. Our proposals and predictions of outcomes are often heavily dependent upon such assumptions. We have been very prone to assume, in dealing with a large number of economic problems, that resource combinations could be put together and taken apart with equal ease. This is not likely to be really the case and not likely to be the case for a good many important instances involving environmental values. We seem, perhaps unwittingly, to have been content to make a good number of resource commitments involving significant environmental effects on the assumption of the complete reversibility of supply functions.

Examination of the economics of the firm has demonstrated that its supply curve may indeed not be reversible owing to the fixity of assets brought about by the divergence between salvage values and acquisition values of important classes of resources. Asset fixity and capitalization of values in complementary assets play a part in our failure to bring about various forms of desired changes in such things as abandoned tourist courts and farmsteads and other instances where the present commitment to a resource pattern is detrimental to environmental values.

Unique areas offer another prime instance in which the supply curve is certainly anything but reversible. Once many ecological communities are disturbed, for example, they may be effectively destroyed for all time. If Grand Canyon were materially altered, it is unlikely that as a practical matter it could ever be restored. While these may be perhaps more dramatic examples, we have in the area of environmental effects a large number of instances which may be essentially similar in nature.

Another related reason for the supply function of environmental prod-

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ucts not to be completely reversible may also exist. As the demand and supply situation for these products changes as we think it does, the aggregate values may become large enough for important classes of them to be such that while we may be willing to sacrifice sufficient goods and services—that is, pay the costs—to preserve their supply, a still larger sacrifice may be required to restore a supply once it has been interrupted or destroyed.

**Economic Causes and Directions of Solutions**

The continued search for better ways to handle these problems will yield far more to analytical investigation than to doctrinaire prescription. Rather than a contribution to a harangue on the situation, economics seems to have far more to say on questions pertaining to the reasons for environmental pollution and the directions of workable solutions.

A common reaction to means for dealing with many aspects of what we include under the rubric of environmental quality is some form of prohibition. While common, it is by no means clear that it is the best. Means to improvement may vary. Payment from gainers to losers represents one form. Internalizing the costs and gains within a single economic unit or through a system of charges represents others. Still other ways include systems of standards and resource use controls.

The goal is not to rid ourselves of all external effects or all environmental pollution. It is economically relevant only to consider altering the scale or intensity. Improvement would appear to be in the direction of a coordinating system that better accounts for the range of values and costs incurred or associated with production and consumption, and a closer alignment of those bearing the costs with the beneficiaries. While measurement problems may loom large in some cases, the mechanism for resolution seems most significant at this point. In constructing such improvements, we need to consider the incidence of costs and gains, as well as economic efficiency. It may, for example, be just as efficient for the public to pay polluters not to pollute as it is to charge them for the right to pollute. Efficiency is served by either method, but the policy prescription differs with equity considerations and the way in which we interpret property rights.

An important aim would seem to be here to make private decisions concerning resource use conform more closely to social values. After all, the rules of the game that we set up in large measure determine the outcome.

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