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Environments

Martin H. Krieger

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on the poor and Pollution," which appeared in  
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"A tree's a tree. How many more [redwoods] do you need to look at? If you've seen one, you've seen them all."

Attributed to Ronald Reagan<sup>1</sup>

A tree is a tree, and when you've seen one redwood, given your knowledge in general about trees, you have a pretty good idea of the characteristics of a redwood. Yet most people believe that when you've seen one, you haven't seen them all. Why is this so? What implications does this have for public policy in a world where resources are not scarce, but do have to be manufactured, where choice is always present, and where the competing uses for resources are becoming clearer and more present? This paper is an attempt to explore some of these issues, while trying to understand the reasons we give, or might give, for preserving certain natural environments.

### The Ecology Movement

In the past year or two a movement concerned with preserving and carefully using our natural environments has grown substantially. The ecology movement, as I shall call it, is coming to have genuine power in governmental decision making, as well as becoming the natural link between certain government agencies and the public to which they are responsible. It should be distinguished from related

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<sup>1</sup>There is no reason to doubt that Reagan said this or something close to it to the Western Wood Products Association in early March 1966. Citations are difficult to find. See, however, Kiefer, 1968, who has a reference to the Sacramento Bee of March 12, 1966. A different version is given on p. 39 of Gentry, 1970. Yet a different version is suggested in the New York Times of September 21, 1966, p. 29.

movements concerned with conservation and the wise use of natural resources. The latter, ascendant in the United States during the first half of this century, was concerned mostly with making sure that resources and environments were used in a fashion that reflected their true worth to man. This resulted in a utilitarian conception of environments and the application of instrumentalities for their partial preservation, such as benefit cost analysis and policies of multiple use on federal lands.

The ecology movement is not overtly committed to such policies. In noting the spoliation of the environment under the conservation movement's policies, the new ecology movement demands much greater concern about what we do to the environment independently of how much it may cost us to do so. The ideology of the ecology movement seeks to make man's environment be valued in and of itself and thereby prevent its being traded-off for the other benefits it offers to man.

It seems likely that the ecology movement will have to become more programmatic and responsive to compromises as it moves into more responsible and bureaucratic positions vis-a-vis governments and administrative agencies. As it now stands, the ecology movement's policies may work against resource conserving strategies likely to provide for the good life in twenty or thirty years.

Richard Meier has said,

The best hope, it seems now, is that the newly evolved ideologies will progress as social movements. A number of the major tenets of the belief system may then be expected to lose their centrality and move to the periphery of collective attention. Believers may thereupon only "satisfice" with respect to these principles; they are ready to consider compromises. (Meier, 1970, p. 30)

What is needed is an approach midway between preservationist and conservationist utilitarian policies. We need to find ways of preserving the experiences we value in natural environments and at the same time have some flexibility in the available alternatives that the movement could advocate.<sup>2</sup>

A new approach is called for because of the success of the economic arguments of the past. We have become more concerned about equity, and with finding "economic" arguments for preserving "untouched" natural environments. Such environments--complexes of land, air and water--have not been manipulated much by mankind in the recent past (hundreds or thousands of years).<sup>3</sup> Traditional resource economics has been concerned not with preservation so much as with deciding the intertemporal use of physical resources that yields a maximum return to man, essentially independent of equity criteria. Also, if we believe that unspoiled and untouched natural environments are unlikely to have substitutes, then this economics is not very useful. In fact, a different orientation towards preservation has been developed which is beginning to be applied in ingenious ways to provide powerful arguments for preservation. At the same time, some ideas about how we experience the environments are becoming better understood, and they suggest that this new economic approach will be in need of some modification even if most of its assumptions are fundamentally sound.

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<sup>2</sup>It may be true that the movement should not become one that offers alternatives. Perhaps "eco-activists should relentlessly pursue their goals, and pursue them with 'confrontation tactics' if necessary." (Dunlap, 1970, p. 20) In that case, a mediating movement will arise of individuals, who will call themselves "rational," which will have to negotiate between the ecology movement and its opponents. These mediating individuals will find the policy discussed here relevant to their concerns. (Morrison, 1971)

<sup>3</sup>Though enough to have rid Europe of forests and create deserts in Africa.

Our inquiry will proceed first by examining what we usually mean by natural environments, rarity, and some of the rationales for preservation. We want to understand the weak points in the usual arguments and their essential character. Then, I want to suggest how our knowledge and sophistication about environments and our differential access to them are likely to lead to levers for policy change that will be effective in preserving natural experiences, yet at the same time offer alternatives in the management of physical resources.

Before going further, one limitation of the analysis should be made explicit. I have restricted my discussion to the level of the nation state, and to the United States in particular. If we were able to take a global view, then it would be my inclination that the rich countries, not only defined by their GNP but also by their concentrations of technical talent, should become the manufactories for the poor, and that environmental questions would be best phrased in terms of the world's resources. If we wanted undisturbed natural experiences it would be best to develop some of them in other countries. But we do not live in one world, and the above proposal is imperialist at worst and unreal at best. Global questions about our environment need to be considered but always in terms of likely controls that exist rather than in terms of desirable states. If we are concerned about the preservation of natural environments, it seems clear that, for the moment, it is most likely that we shall have to preserve them on our own grounds.

Now let us examine a situation where preservation is a very pragmatic policy question.



The American Falls: Keeping It Natural

For the last few thousand years the Niagara Falls in northern New York State have been receding. Water going over the Falls insinuates itself into crevices of the rock, freezes and expands in winter, causing cracks in the formation. The formation itself is somewhat problematic in that the hard surface rock covers a somewhat softer substratum. The net effect is that weakness does not result in just small amounts of erosion or small rock-falls, but also in very substantial ones when the foundation rock gives way. About 350,000 cubic yards of rock (talus) are at the base of the American Falls.

Various hydroelectric projects have been constructed over the years. These also have affected the amount of flow over the Falls. It is possible to change the flow over the American Falls now by a factor of two and, consequently, diminish that of the Horseshoe (Canadian) Falls by about 10%.

The net result is that the quality of the Falls, its grandeur, its height, its smoothness of flow, changes over the millenia, and the months.

There is nothing pernicious about nature's way except that our national image of the Falls is not so changing. Our ideal image of a Falls, formed through experiences with small local falls that seem perfect, and images created by artists and even photographers, is not about to change into a dynamic one without some social effort.<sup>4</sup>

So when we go to visit the Falls today, we see rocks and debris at its base, too much or too little water going over the

<sup>4</sup>See Hutch, 1957, plate 1, for a photo of the Falls. Also, pp. 171f. and 206f. for some history of preservation efforts. See the New York Times, 1969: 3/22, p. 1; 5/4, X, p. 9; 8/3, p. 64; 11/26, p. 47; 1970: 7/12, p. 56; 1971: 3/28, p. 103, for more recent details. The Buffalo Evening News 1970: 11/9 and 11/13, and 1971: 2/4, 3/10 and 3/23 and passim provide more details.

edge, and imperfections in the flow. These are not likely to make people feel as if they are having the genuine experience of Niagara Falls. The consequent economic effects on tourism, a multi-million dollar per year industry, could be substantial.

At the instigation of local forces, an American Falls International Board has been formed under the auspices of the International Joint Commission of the United States and Canada. Something like five or six millions of dollars are being spent to investigate, by means of "dewatering" the Falls and building scale models, potential policies for intervention. That such efforts are commissioned suggests that we believe (as a polity) that it is proper and, hopefully, possible to do something about the future evolution of the Falls. A "Fallscape" committee, especially concerned with visual quality, exists. Three strategies, varying in degree of intervention, are being discussed.<sup>5</sup>

(1) The Falls can be converted into a monument. By means of structural strengthening, it is possible to make sure that the Falls does not have rock-falls any more. Also, excess rock from the base can be removed. Such a strategy might cost tens of millions of dollars, a large part of this cost being for the removal of the talus from the base.

(2) The Falls could become an event. Some of the rocks from the base could be removed for convenience and aesthetics. But the rock-falls themselves would not be hindered. Instead, instrumentation could be installed that would predict when a rock-fall would take place. People might then come to the Falls at certain times knowing that they would be in for an interesting and grand

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<sup>5</sup>A final report is due at the end of 1971.

event, part of the cycle of nature. This would be reminiscent of visits to Old Faithful, a geyser that shoots off with some regularity.

(3) We might treat the Falls as a show. The "director" could control the amounts of flow over the Falls, the size of the pool below and the amount of debris, thereby producing a variety of spectacles. Not only might we have son et lumière, but an orchestrated physical mass on which the display takes place.

Which of these is the natural environment? Current practice with respect to Natural Areas administered by the Park Service might suggest that we follow the second procedure and not "perfect" the Falls. But would that be a "Niagara" Falls, the place where Marilyn Monroe meets her fate in the movie of the same name?<sup>6</sup> The answer to this question lies in the ways in which we present our efforts at preservation to the public. If they are seeking a symbolic Falls, then it has to be like its remembered symbol. If they want to see natural phenomena at work, then the Falls should be allowed to fall.

Paradoxically, the public idea of a natural phenomenon often requires great artifice in its creation. The natural phenomena of the Falls today have a lot to do with the various hydroelectric (utilitarian) efforts over the years. The way aesthetic appreciation of the Falls has developed involves rather mundane considerations of the siting of tourist excursions and the views from hotel windows, besides the efforts of artists.

I think that we can meet the needs for the smooth Falls and at the same time not be completely insensitive to natural processes by a procedure in the direction of the third proposal. Niagara Falls

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<sup>6</sup>Though it may be the Horseshoe Falls.

is not virgin territory; the skyscrapers and motels will not disappear. So an aggressive attitude toward the Falls seems appropriate. This does not imply heavy handedness in intervention (the first strategy) but rather a willingness to touch the "sacred" for aesthetic as well as utilitarian purposes.

Analysis of this fairly straightforward policy question is not trivial. Other questions concerning preservation have fuzzier boundaries, less clear costs (direct and indirect), and much more complicated political constellations. So it seems worth our while to examine some of the fundamental concepts that we use in this discussion.

### Natural Environments

What is considered a "natural environment" depends on culture and society. No doubt we might be able to create a definition that is operationally meaningful and socially useable (many would come to the same conclusions using it). But this, of course, says nothing about the applicability of such a definition to different cultures. Its meaning may not correspond to what people ordinarily consider to be "natural environments," if they have such a concept at all. For the moment I will, therefore, restrict myself to the development of the American idea of a natural environment. (Huth, 1957; Nash, 1967)

The history of the idea of the wilderness is a good example of the development of one kind of natural environment. I follow Nash's discussion in the following.

Wilderness may be viewed as a state of mind, an attitude toward a collection of trees, other plants, animals and the land on which they all exist. The idea that a wilderness exists as a product of an intellectual movement is important. It is not discovered in the sense of having some man from a civilization lay his eyes on a piece of territory for the first time. It is the meanings that we attach to such a piece of territory that convert it to a wilderness.

The Romantic appreciation of nature with its associated enthusiasm for the "strange, remote, solitary and mysterious" (Nash, p. 47), converted territory that was a threatening wild-land into a desirable area capable of producing an invigorating spirit of wilderness. The "appreciation of the wilderness in this form began in cities" (Nash, p. 44) for whose residents the wild-land was a novelty. As a product of massive destruction of this territory for resources (timber, mainly), city residents, whose livelihood did not depend on these resources and who were not overly used to the territory, called for the preservation of wild-lands from destruction. At first, they did not try to keep the most easily available lands (and therefore economically useful) from being used, but noted that Yellowstone and the Adirondacks were rare wonders and of no other utility. They did not think of these areas as wilderness yet, but as untouched lands. Eventually, a battle developed between conservationists and preservationists. The conservationists (Pinchot, for example) were concerned with the wise use of lands, with science and civilization and forestry; while the preservationists (Muir) sourced their argument in art

and wilderness. This latter use of wilderness is the significant one. The preservationists converted wild-land into wilderness -- a good that is indivisible and of value in itself.

This capsule history suggests that wilderness, as we conceive it now, is a product of a political effort to give a special meaning to some biomass organized in a specific way. I suspect that this story is the appropriate model for how all kinds of organized biomass come to have special designations such as natural environments.

But it might be said that we may define natural environments ecosystemically in terms of complexity, energy and entropy flows, etc. (Houston, 1971) Surely that is true. But this is only because of all the spadework that has gone into the development of a consensual public picture of natural environments. What a society takes to be a natural environment, is one.

More seriously, natural environments are likely to be named when there are unnatural ones, and likely to be noted only when they are out-numbered. The old wild-lands that were frightening were plentiful and unvalued. The new wilderness that is a source of re-vitalization is rare and so valued it needs to be preserved.

#### Why Is Something Rare?

We call something rare when there do not exist very many objects or events which are similar to it. It is clear that we must be able to distinguish one object from another in order that it be declared rare, but how this distinction is made is not so trivial.

We make take a realist or idealist view of rarity.

If we are realists, an object is unique within a purview. Given a certain boundary, there exists no other object which is like it. Certainly within the United States the Grand Canyon is unique. Perhaps Niagara Falls is also unique. But there are many other falls throughout the world which are equally impressive if not of identical dimensions.

For idealists, a rare object is one that is archetypal of its species. It is most typical of all the objects which it represents, having the most "perfect" form, and is most central within the species. Natural Areas as designated by the Park Service may have this quality. We frequently preserve archetypal specimens in museums and botanical gardens. They, too, are rare.

Objects are not always rare, either in the past or future. Rather, they come to be designated as rare at one time and may, at some other time, be considered common, everyday, and ignorable. How does this happen? It seems clear that a designation of rareness is a social one in that a collection of people will agree to it. Objects become rare by changing the attitudes of a collection of people towards them. This may come about in a number of ways, but it is necessary that the object in question must somehow be noticed and singled out. Perhaps one individual discovers it and no one else sees it, or everybody may know of it in common experience. In any case, someone must convince the social body that their common experience or what has been discovered by an explorer is something special. The publicist must develop in others the ability to differentiate one object from among a large number of others as well as to value the differentiated characteristic of that object. If he convinces a group of influentials in the society, those who have the

capability of affecting a much larger group's beliefs, then he will have succeeded in his task. Thus it may be important that some form of snob appeal be created in the special object that will be designated as rare.

In order to create the differentiations and the differential valuations of characteristics, information and knowledge are crucial. A physical object can be transformed into an instrument of beauty, pleasure, or pride, and thereby develop sufficient characteristics to be called rare, only by means of changing the knowledge we have of it and its relation to the rest of the world. In this sense knowledge serves an important function in the creation of rare environments, very much as knowledge in society serves an important function in the designation of natural resources.<sup>7</sup> (Firey, 1960)

As a result of the social process of creating a rare object, our usual indicators of rarity become important. Economically, prices rise; physically, the locations of the rare objects become central or at least highly significant in the layout of the environment; and socially, rare objects and their possessors are associated with statuses which are valued and activities which are considered to be good.

Rarity, Uniqueness, and Forgery:  
An Artistic Interlude

The problems encountered when one tries to describe the qualities that make for "real" artistic experiences and genuine works of art are similar to those encountered in describing rare

<sup>7</sup> It may be true that in a more distant time the returns from the additions of knowledge will decline. (Meier, 1969, p. 6) At this time it seems unlikely that the value of knowledge in understanding our environments is very much used, and therefore substantial returns on an investment should be expected for the next few decades.



natural objects. The ideas of replica and forgery will serve to make the point (Kubler, 1962; Harrell, 1966)

Kubler observed that if we examine a time sequence of objects, we may decide that some are prime objects while the rest are replicas. Why should this be so? We may look at properties of objects and note that some serve as a source of the future objects; however, since the future is always sourced in the present, we can say that any one object is a source. So we must distinguish important characteristics, perhaps arbitrarily, and say that these are seminal. Prime objects are the first to exhibit these characteristics in a significant way. (This is reminiscent of the archetypal character of Natural Areas.)

Still, why are there so few prime objects? True, by definition, prime objects exhibit characteristics in a strong way and this must eliminate a lot of others. But why should we not have artists who are constantly making up new objects, each so original that it would be prime. Not all artists are geniuses, it might be said. But this is just a restatement that most objects do not exhibit the characteristics in strong forms. We might also say that if there are no followers, there will not be leaders. That, too, is true, but does not get at why some eras are filled with prime works, and others are not.

Kubler suggests that invention, especially if too frequent, leads to chaos which is frightening. Replication is more calm and only leads to dullness. So we would rather repair, replicate what we have done, rather than innovate and discard the past. We are (perhaps justifiably) afraid of what will be the prime objects of the future. We prefer natural environments to synthesized ones

because we know how to manage the natural ones and know what their effects are already. Plastic trees are frightening.

What about replicas of prime objects that are claimed to be prime forgeries? Something is a forgery if its provenance has been faked. Why should this bother us? (Lessing, 1965) If the object provides us with the same kind of experience as we might have with the original, except that we would know that the replica is a forgery, then we are snobbish to demand the original. But we do not like to be called snobs. Rather, we say that our opinion of the work, the quality of our experience of a single event, depends on its context. History, social position, and ideological view affect how we experience the single event. We may conclude that our appreciation of something is only partly a product of the thing itself.

Art replicas and forgeries exist in a historical framework. So do the prime and genuine objects. And so do natural environments.

#### Environments Are Creatable and Created

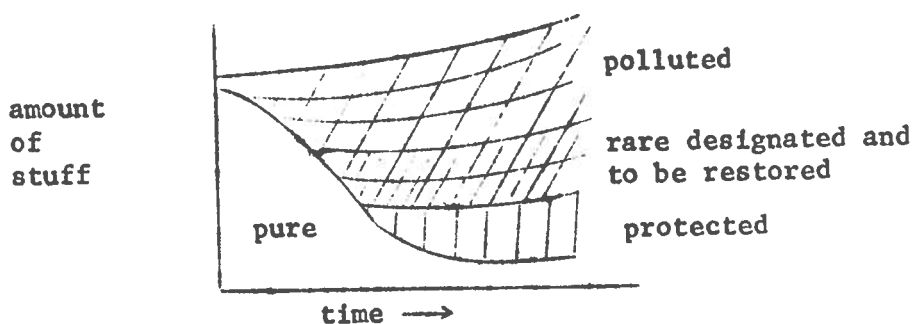
To recapitulate, objects are rare because men decide that they are and, through social action, convince others of their beliefs. Designation, differentiation, signification and contextualization are the mechanisms through which rarity is created. The last two are especially important, for the meaning that an environment has and its relationship to other things in the society are crucial to its being called rare. That a rare environment is irreproducible or of unchanging character is a usually necessary preliminary to our desire to preserve it. Physical and knowledge technologies determine how reproducible an object is, for we may make a copy of the original or we may transfer to another object the significance attached to the

original. (This may be more possible for natural environments than artistic objects since the qualities of replicas and forgeries are not so well characterized.) Insofar as we are incapable of doing either of these, we may desire to preserve the original environment.

When we consider the clientele for rare environments, accessibility by means of transportation and communication becomes important. If there is no means of transportation to a rare environment, then it is not likely that we will care about it. An alternative to transportation is some form of communication, either verbal or pictorial, that serves as a simulation for being where the environment is. It seems clear that mere pictures without the potential of an actual visit, however, are insufficient, for photographs of an environment are meant to be evocative of an original experience.

It is possible to suggest a prototypical history of how an environment comes to be called rare and subsequently preserved. We want to show how men intervene in specific ways to alter social perceptions of natural experiences. We abstract from histories of wildernesses and museums.

I shall be concerned with environments which, at first, are considered to be part of a fairly homogeneous class. For environments which we consider truly unique, such as the Grand Canyon, similar arguments might be made if we were to take the collection of closest like environments as part of the stock. Reference to the diagram below should aid in the explanation that follows.



Say that we have a stock of some environment which over a period of time is being used and polluted. By polluted, I mean dirtied as a result of acts which made it unclean in a ritual sense. Since there is a substantial amount of the environment available, man's use of the environment, at first, will have little effect on his perception of its rareness. As time goes on, however, it will be noted by someone that there is a lot less of an environment available now than there was many years before. Suddenly, what was once vast quantities of environment starts looking less plentiful. It seems more special, for it is distinguishable from the polluted environments around it. At that point, it is likely that there will be a movement to designate some fraction of the stock as rare and protectable. There will also be a movement to restore parts of the environment that had been polluted. Interventions will be made to convert the polluted environment to a simulation of the original one.

This analysis is as useful for paintings in museums and stamps in collections as for trees in parks.

Art museums are places where rare objects are preserved in order to enhance the quality of experience available to people. Originally, they were developed to help artists by showing their works, thereby rationalizing the artist's relationships with his patron clients. Eventually, these galleries came to be sources of the orthodoxy, thus restricting the possibly acceptable types of art. (Haskell, 1968)

We may view the creation of museums and their continued development not as a simple product of the increased rareness of works of art, per se, for the rareness of a work of art is actually, in part, the result of museums. The stock of art must be viewed in terms of public and private consumption. If it is believed that the public ought to have access to artistic experience, then putting art in private collections uses up the art as far as the public is concerned. An ideology that encourages

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the development of means of public consumption of art -- e.g., building museums in order to be saved either after a life of sin (Andrew Carnegie) or from taxes -- rescues and cleanses these objects.

A similar history is to be found in the creation of some national parks to enable a larger public to enjoy a certain experience.

#### Reasons for Preservation

That something is rare does not imply that we need to preserve it. The property associated with the distinguished "rare" quality must be valued. We may discern arguments for preservation in terms of luxuries not needed for survival, necessities that are so needed, and merits which would be good.

We build temples or other monuments to our society (often by means of preservation) and believe that they represent important investments towards social unity and coherence. If a forest symbolizes the frontier for a society and that frontier is meaningful in the society's history, then there may be good reasons for preserving it. Another reason, still not necessary for survival, is that we may preserve something now so that it may be used in the future. A reason not often given, but still true, is that we preserve things because there is nothing much worth doing with them. It may turn out that it will cost us very little to preserve something that no one seems to have particular reason for despoiling, so we expend some small effort in trying to keep it untouched.

We preserve natural environments for necessary reasons also. Environments may provide ecological samples that will be useful to future generations as samples both genetic and biological. It may turn out that the preservation of an environment is ecosystemically necessary and that our destruction of it will also destroy, as a product of a series of interactions, some highly valued aspects of

our lives. Finally, it may be necessary to preserve environments so that the economic development of the adjacent areas may go along in a desired fashion.

There are some meritorious reasons for preservation. It may be felt by the society that it is good to preserve natural environments. It is good for people to be exposed to nature. We may believe that the beauty around us is worth having, and the amenity involved as the product of preservation is important.

Criteria Sets for Preservation

Whatever argument we may use for preservation, we need some criteria for deciding what to preserve. Given that something is rare and we believe it worth preserving, we may decide to use economic, rarity, ecological, or socio-historical reasons for preservation. I want to look at each of these in turn.

There are a large number of economic reasons for preservation, and I shall discuss three of them. I shall not say much about leaving criteria up to the free-market, if that exists, and making preservation purely responsive to current prices unaffected by concerted public action. However, I do want to discuss two other possibilities: one, most forcefully argued by Krutilla and his colleagues, concerning the application of cost-benefit analyses to preservation, and another concerning how we should value the future in imputing present value to future benefits.

The work of Krutilla and his colleagues is an ingenious application of economics which rescues environments from current use by arguing for their future utility. (Krutilla, 1967)

His argument goes something like the following. Nature is irreproducible in comparison to the materials one can get from it. As Barnett and Chandler have shown, sufficient substitutions have taken place over time to let us believe that the idea of a shortage of natural resources is not a useful one. (Barnett, 1963) It also seems likely that the value of nature and natural experiences will rise in the future while its supply seems to be constant. Because of the comparatively easy substitutability of the materials we get from natural environments, the opportunity cost of refraining from exploitation of an environment is small compared to the cost of producing it. Finally, there is an option demand for environments. This means that there is a demand (at a certain price) that would be exercised in the future for the environment. If a substantial fraction of the supply of the environment is destroyed now, that demand could not be fulfilled at a reasonable price then. So we are willing to pay to preserve that option. (Wiesbrod, 1964; Krutilla, 1967) Our problem is not the intertemporal use of natural environments, as it is for natural resources, but the preservation of options to use environments or the reduction of uncertainty about their future availability. (Cicchetti, 1970)

Fisher has applied optimal investment theory, including a possibility of restoring environments to a quasi-natural state, to the problem of preservation as formulated by Krutilla. (Fisher, n.d.) And Krutilla and his colleagues have applied an analysis similar to Fisher's to the preservation of Hell's Canyon. (Krutilla, 1970; Cicchetti, 1970)

Robinson has criticized Krutilla's argument from the following perspectives. (Robinson, 1969) He suggests that the amenity that is

so valued by Krutilla is not necessarily so valuable. More importantly, he argues that the experiences of nature are reproducible. He also points out that the arguments for public intervention into such environments depend on their collective consumption aspects. These are not so clear, since it is well known that the users of rare natural environments tend to be a small fraction of the population and are those who are better off socially and economically. (Harry, 1969) He also suggests that refraining from current use may not have a small cost. The financing of the preservation effort must reflect the differential intensity of use by different client populations. Robinson's critique has much to recommend itself, but I suspect that it is insufficiently programmatic, especially for an active ecology movement, and also does not appreciate the "non-economic" sources of the limitations of Krutilla's analysis.

It seems to me that the limitations in Krutilla's argument relate centrally to the question of the rate of reversion of the spoiled environments into restored ones and the nature of the supply of the environments. Krutilla et al. are sensitive to the possibility that the reversion rate may well be amenable to technological intervention:

Perhaps more significantly, however, is the need to investigate more fully the presumption of asymmetric implications of technological progress for the value of attributes of the natural environment when used as intermediate goods compared with their retention as assets supplying final consumption services. Irreproducibility, it might be argued, is not synonymous with irreplaceability. If reasonably good substitutes can be found, by reliance on product development, the arguments for the presumption of differential effects of technological progress are weakened; or if not weakened, the value which is selected for  $r_y$  [reversion rate] Section III, at least would not remain unaffected. This problem doubtless merits additional attention, although a reconnaissance effort awaits completion before a strategy of research can be suggested. (Krutilla, 1970, p. 66)



The supply of natural environments is quite sensitive not only to technological capabilities in terms of the manipulation of biological processes, but also in terms of the manipulation of information and significance by methods such as advertising. It may be possible to increase the supply of environments dramatically by highlighting, in ways not uncommon to the differentiation of groups of equivalent toothpastes, significant and rare parts of what are commonly thought to be uninteresting environments.

We may use our ability to change the knowledge states of the population by means of education and advertising, as well as our ability to change the accessibility of certain places to others, to create new "rare" natural environments for people. It seems likely that environments that are especially rare, or created as especially rare, could be very far away, since people would pay more to see them. Thus it may be possible to satisfy a large variety of customers for rare environments by means of selective advertising. Methods used would include pictures and descriptions, and it is likely to be as costly as the introduction of a new toothpaste. We might end up with the following kind of situation: 1) Those who are demanding to go to "truly" natural environments might be encouraged to get on a plane and go to Africa or the moon, where a national park offering such an environment is maintained for which they pay substantial sums to enter. 2) For those for whom the rare natural environment has something to do with State parks or perhaps with small National parks, we would charge less but these parks would be more accessible and more developed so that a greater number of people may use them. 3) Finally, for those who wish to have an environment that is just some trees, some woods, and some grass, there might be a very small

park; access would be very high and differentiability and rareness might well be enhanced much beyond commonly thought possible by sophisticated methods of landscape gardening.<sup>8</sup>

It seems to me that the demand for rare environments is a learned one, as Krutilla suggests also. It seems likely that conscious public choice can manipulate this learning so that the environments which people learn to use and want reflect environments that are likely to be available at low cost to the rest of the society. There is no lack of merit to natural environments, but this merit is not canonical.

In any cost-benefit analysis that tries to include future values, the rate at which we discount the future is crucial to the analysis. If the preference schedules of different clientele correlate well with different discount rates, then the choice of the discount rate certainly represents the preferences of one group more than another. For example, if the rich were willing to forego benefits for some time, and thereby discount the future at a low rate, the preservation alternatives might seem more attractive than if the cost-benefit analyses were being done by those whose discount rate was much higher. Baumol suggests (though it is only a hunch) that

. . .by and large, the future can be left to take care of itself. There is no need to lower artificially the social rate of discount in order to increase further the prospective wealth of future generations. . . . However, this does not mean that the future should in every respect be left at the mercy of the free market. . . . Investment in the preservation of such items then seems perfectly proper, but for this purpose the appropriate instrument would appear to be

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<sup>8</sup>I do not find this proposal entirely satisfying. The segregating characteristics of it should not be supported by public expenditures. Originally city parks were set up in part so that various classes would mingle together. (Huth, 1957, p. 68)

a set of selective subsidies rather than a low general discount rate that encourages indiscriminately all sorts of investment programs whether or not they are relevant." (Baumol, 1968, p. 801)

Baumol is saying that the process of preservation of environments may not always be fruitfully analyzed in terms of cost-benefit analyses, since we are preserving things in very special cases and each choice is not a utilitarian choice in any simple sense, but represents, in fact, a balancing of all other cost to the society of having no preserved environments. Preservation is often a gross change in policy and utilitarian analyses cannot easily compare choices where value may be drastically altered.

We may decide to preserve things just because they are rare, and then we need to know which things are rarer than others. Leopold has tried to do this for a set of natural environments. (Leopold, 1969) He listed a large number of attributes for each environment and then gave weights to each attribute as follows. For any single attribute we see how many environments share that attribute, and to each of them you give  $\frac{1}{n}$  units, where  $n$  is the number of environments that share an attribute. One then adds all the weights for the environments, and the environment with the largest weight is the most rare. It is clear that if an environment has attributes which are unique it will get one unit of weight for each attribute and so its total weight will just equal the number of attributes. If all the environments are about the same, then each of them will have roughly the same weight which will equal the number of attributes divided by the number of environments. The procedure is sensitive to how differentiated we wish to make our attributes and to the attributes we choose. But it is straightforward and usable, as Leopold has shown.

It seems to me that there are two major difficulties with this approach. The first, and more important, is that the accessibility of environments to their clientele needs to be taken into account in deciding on what to preserve. An environment which is essentially inaccessible and quite rare may not be as worthy of preservation as one which is fairly common but quite accessible.<sup>9</sup> The other reservation that I have is that it is likely that the proper quantity that Leopold should use would be the amount of information possessed by each environment. Rather than taking  $\frac{1}{n}$ , he would take its logarithm to the base two.

An ecological orientation suggests that we preserve environments that contribute to our stability and survival as an eco-system. It is quite difficult to define what survival means, however. If we mean the continued existence of man, in a situation which is quite similar to the one he lives in nowadays, then survival is likely to be a very difficult task as we use part of our environment for the maintenance of life and as new technologies come to the fore. If we mean the maintenance of a healthy and rich culture then ecology can only partially guide us in the choices, since the high technology that we possess has changed the contours of risk in the natural world substantially. (Starr, 1969) It may turn out that our complex political and social organizations serve to develop sufficient plateaus on the surfaces of survival and stability, so that we are saved from the catastrophic tricks of our own technology.

We might hope that if we were to divide up environments in some suitable taxonomy we would find that a few of them would stand

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<sup>9</sup> Olmstead, Jr. suggested that California parks be placed at the location of unique resources, which turns out to be (given the values of the decision maker) in the North. A substantial fraction of the population currently is in the South.

out from all the rest. Rather than search for rareness in a procedure looking at specific attributes, we might hope that a process of dividing and splitting of the spoils might work. But what will be the taxonomic criteria?

Another possibility is to search for epitomizing images of cultural, historical, and social significance in which national experience has taken place and on which the political and social legitimacy of the present depends. We preserve the physical artifacts of these since the meaning of our present society depends significantly on them. In this sense, forests are preserved to recall a frontier, and historic homes are preserved to recall the individuals who inhabited them. Of course, there is a problem here, since there is no simple way of ordering the significance of epitomizing images. It seems likely that one might be able to search the consciousness of a large number of people and come up with enough of these images, but this would be a substantial effort.

Finally, it might be suggested that preservation should only be used, or could sometimes be used, to serve the interests of social justice. Rather than preserve things for what they are or for the natural experiences they provide, we preserve them because they are monuments to people who deserve commemoration, or as means of distributing wealth differentially to certain individuals. Rather than buy forests and preserve them, perhaps we are to preserve slums and suitably reward their inhabitants.

The problem with all of these criteria is that none is very good. Each represents the best interest of certain groups and not of others, and none is likely to find consensual use. I suspect that, in the end, a large amount of jockeying and bargaining will take place

in deciding which environments need preservation. The argument may take place on the level of the suitability of criteria.

But if we are concerned with increasing the number of alternatives and making it possible for us to appreciate a larger variety of experiences, then it seems to me that a certain strategy for preservation is likely to be more fruitful than some others. We first need to do a job of dividing and deciding which environments need to be intervened with right now and those for which we might wait.

#### Priorities for Environmental Preservation

Not every problem in environmental quality is urgent. Nor need we improve every undesirable condition that exists. We need to classify environmental situations so that we can choose from among the possible improvements we might make.

1. There are conditions about which we must do something soon or we will lose a super-special thing. These pertain especially to rare environments, environments we wish to preserve for their special beauty or their uniqueness. We might allocate a fixed amount of money every year to such super-urgent problems. Niagara Falls might be one of these and might cost a few cents per family to keep it in good repair. Wilderness and monument maintenance cost about ten dollars a year per family, ignoring opportunity costs.
2. Then there are situations which are stably poor. In these, the conditions are rotten, but are not getting worse too fast; we might be able to handle the problem in ten years without too much loss. We may defer action

to the future. The losses to the society due to the delayed improvement of these facilities need to be carefully computed. For example, the eutrophied Lake Erie might be such a project. There are losses due to unusable fishing and recreational facilities. It might cost \$1000/family, locally, to clean up the Lake. Perhaps our environmental dollar should be spent elsewhere.

3. There are also situations where things are rapidly changing and getting much worse and where a small injection of environmental improvement and amelioration would be able to cause dramatic changes in a trend. Smog control devices have probably raised the cost of driving by only two or three percent, yet their contribution to the relative improvement of the environment in certain areas (e.g. Los Angeles) has been substantial. Fifty dollars a year per family is a rough estimate of the current cost to the car owner.
4. Then there may be problems which need large infusions of money to stop a change. These problems are especially irksome. The response here may be to change the system enough so that we can avoid such costs. The costs of such change, one time costs we hope, may be much smaller than the long term costs of such problems, though this need not be the case. The development of new industrial methods that are "clean" is a case in point.

This is not an all inclusive or especially inventive classification of problems, but I have devised it to suggest that many of the "urgent" problems are not so urgent.<sup>10</sup>

Rare environments pose special problems and may need a point of view different from other environmental quality programs.

A poor nation will not destroy very much of its special environments. It is too impotent to do so. It may certainly perform minor miracles of destruction with a tyranny of small decisions. But, I suspect, these are reversible more easily than the errors of the rich.

The middle nations of the industrialized world have wreaked havoc on the environment in their efforts to gain some degree of wealth. It is interesting that they are willing to tell the poor world that they should not do so when this may be a very fast way of developing (the nuclear non-proliferation treaty has been seen in this perspective).

The rich nations (of which the United States and some European countries are probably the only representatives) can afford to have environments that are rare and consciously preserved. They can be compared to the temples of old as the monuments of our time. This perspective, something of a relic of the past, strikes me as being good.

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<sup>10</sup>We can, in fact, classify the above set of four types of problems in terms of a costing problem related to the discount rate. Problems of the first type have zero or negative discount rate. In any case, we may not wish to argue their value utilitarianly -- the bits of environment saved are intrinsically worth saving. The prices assigned for saving them do not reflect their long term value. For the second case of stably poor environments, the discount rate is small and positive. Problems of the third type can be said to have a very high discount rate, while for the fourth type the discount rate is even higher.



However, we do not get a way of deciding how much we should spend on "temple building" from such a criterion. I think that we shall have to decide on our temples in almost a religious way. The amount we need to spend for temple building in a rich society is a small proportion of our wealth (very different from the churches of the medieval times). So let us use no more than pin money (\$500 million per year?) for our temples. We use "pin money" for the poor.

Politically, we have a complicated situation. There are many small groups in the society for whom certain environments are highly significant. The problem of each group is to somehow get its piece of turf, preferably uncut, or unrenewed, or untouched. It seems likely that the ultimate determinant of which environments get preserved will be a process of political trade-off, where some environments are preserved for some groups and other environments for others. Natural environments are likely to become seen in the continuum with a large number of other environments which are especially valued by some sub-group of the society. In this sense environmental issues will become continuous with a number of other special interests and will no longer be seen as a part of a whole earth movement. The power of the intellectuals, in the media, and even in union bureaucracies, with their upper middle class personal preferences for nature, suggests that special interest groups that advocate for the poor will have to be wary of their own staffs.

Another problem is how we can consider the side effects of environmental quality programs and their interrelation with other goals (e.g. income redistribution) in deciding on which projects we should pursue.

We might rank projects in terms of the net benefits to the group we wish to benefit. Stephen Marglin has suggested how we might explicitly include income redistribution goals in cost-benefit calculations of environmental programs. (Marglin, 1962, 1967) If we wish to take into account efficiency concerns, we could minimize costs minus benefit with a constraint of redistribution. This turns out not to be so simple, since pricing some commodities at zero dollars, a seemingly best way of going the redistribution, may not be politically desirable or feasible. As Clawson and Knetch have pointed out, we have to be sure that in making some prices low, there are not others that are prohibitively high and do not permit the persons who are to benefit to gain access to the low priced goods. (Clawson, 1966) In any case, Marglin shows that the degree of redistribution will depend on how we might spend the money in alternative activities (marginal opportunity cost). This has a nice symmetry with the point of view articulated by Allen Kneese that the level of pollution that we tolerate or is "optimal" is that at which the marginal benefits of increasing pollution are balanced by the marginal costs of abatement measures. (Kneese, 1968)

In doing these calculations of cost and benefit, we shall have to look at the relative value of ten years of recreated and preserved clean lake (if we can clean up the lake now) versus ten years of uneducated man (if we wait ten years for a manpower training program). We shall have to include, as costs, some of the unexpected consequences of programs suggested earlier in this essay.

Another possible measure of priorities would be a measure of the success of certain environmental programs, not in their reduction in the incidence of pollutants on different physical areas,

but in their incidence on different sub-groups of the society. Such a disaggregation would avoid problems related to the low visibility of poor people. If ten percent of the population is poor, and this sub-group received a major amount of the pollution, the mean level of pollution may be very low. If this ten percent is not spacially agglomerated, it will not be noticed in physical surveys, and we may have serious problems in our midst without being able to detect them. Certain acts of preservation will benefit different clienteles very differently.

#### An Ethical Question

After all is argued, I still feel quite uncomfortable with what I have said here. I have tried to show that the utilitarian and manipulative rationality inherited from the conservationist movement and currently embodied in economic analysis and modes of argument, can be used to get some control on the question of preservation and rarity. By manipulating attitudes, we have levers for intervention into what is ordinarily considered fixed and uncontrollable. But to what end?

Our abilities in manipulating preferences and values in a deliberate way tend to lead to systems that make no sense. For example, the electrical utility encourages its customers to use more electricity, and they proceed to do so. As a result, we have power shortages.<sup>11</sup> Similarly, I would expect that if we try to meet option demand by allocating resources now to preserve environments for future users, their preference schedules will be altered by this action, and there will be larger shortages.

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<sup>11</sup>I realize that the argument is not so simple. Bad planning and difficulties with nuclear power plant start-ups are significant contributors to the current problems. But these difficulties are only small parts of the system.

And I fear that my own proposals might also get out of hand.

My own purpose in proposing interventions is to deal with a different aim than the value of natural experiences. I take this as a given. My ethical postulate is sourced in a concern over equitable lives among people.

I believe that this ethical concern, the asking of the question of what is good, and by implication, what will be the ethical consequences of an intervention, is one of the avenues for our controlling our ability to manipulate, trade-off, and control. I would want to source my ethics in a humanistic frame, and the ultimate of preserving trees has no place in it.

Were I to take this ethic truly seriously, I could not argue about schemes that would alter the manipulations that we might do. I would argue that the ecology movement is wrong and not answer their question about what we are going to do about the earth. I would be worried about what we shall do about men.

### Conclusion

With some invention, a transformation of our attitude towards preservation will be taking place in the not-so-distant future. We shall have to admit the value of symbolic and social meanings that environments have and not only their economic utility. We shall want to emphasize their historical significance as well as the future users that will be involved with them.

At the same time, we want to realize that there are things which we may not want to trade at all except in the sense of letting someone else have his turf also. As environments become more differentiated, presumably smaller amounts of them will have greater significance, and it may be possible for more groups to have theirs.

It is likely that we shall want to apply our technology to the creation of artificial environments. It may be possible to create displaced environments in space and time that are evocative of other ones. Another possibility is that by the simulation and stimulation of remembrance through the rewriting of history, environments will come to have new meaning. Finally, we will want to create proxy environments by means of substitution and simulation. In order to create substitutes, we want to endow new objects with meaning by means of advertising and, by social practice, give this meaning a social quality. Sophistication about differentiation will become terribly important in order to appreciate the substitute environments. We may simulate the environment by means long available to "Walt Disney" -- photographs, recordings, models, and perhaps even manipulations in the brain. (Schickel, 1968) The experiences of natural environments may be actually more controllable than we might imagine.<sup>12</sup> More pragmatically, artificial prairies and wildernesses have been created, and there is no reason to believe that these artificial environments need be unsatisfactory for those who experience them.

Rare environments are relative, creatable, dependent on our knowledge, and a function of policy and not only tradition. It seems likely that economic arguments will not be sufficient to preserve or suggest how we can create new environments. Rather, conscious choice about what matters, and then investment and effort to create significant experience and environments, will become a policy choice available to us.

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<sup>12</sup>The growing field of inquiry of environmental psychology promises to develop useful knowledge on the nature of these experiences. See Craik, 1970, for a recent review.

So, what's wrong with plastic trees? My guess is that there is very little wrong with them if one's turf is Astroturf,<sup>13</sup> or a city block. Much more can be done with plastic trees and the like to give most people a feeling of natural experience. It is just that we will have to realize that the way in which we experience nature is not so natural but a product of social life -- which more and more is seen to be open to responsible interventions.

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<sup>13</sup>Unfortunately, it seems that Astroturf is not so safe for sports as grass.

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