

II.

SOME INTRODUCTORY ARTICLES ON ENVIRONMENTAL ETHICS AND SUSTAINABILITY

a) ENVIRONMENTAL ETHICS IN THE WEST: AN OVERVIEW

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'Environmental problems, like all societal problems, require self-understanding for enduring solutions...It is clear that these solutions hinge on the values and attitudes which direct energies towards goal' (Yi-Fu 1973).

Summary

The main interest of environmental ethics, as distinct from any other ethical theory, is in our dealing, relation with and management of the environment and as such is not by any means homogeneous: it follows different attitudes and ideologies inherited from our past. But most ethicists agree with the fact that the fault of the relationship between humans and nature lays on an inherent erroneous set of values.

The article demonstrates that Western Civilisation has created the awareness of its own faults in dealing with the natural world and has started questioning its very concept of progress already around the beginning of the 21st century. It doesn't mean that questions about humanity's role vis-à-vis nature have not been the subject of previous generations. However, the development of a vast body of philosophical research on the subject, under the heading of environmental ethics, is the main contribution that Western Civilisation has offered to a beleaguered world. Aldo Leopold is credited with inventing the concept, when in 1949 he first proposed the adoption of a Land Ethic in his Sand Country Almanac.

Later, the publication *Caring for the Earth: A Strategy for Sustainable Living* (IUCN, UNEP, and WWF 1991) highlighted the notion that environmental ethics should become part of environmental policies. This idea was expanded after the Earth Summit in Rio in 1992 with the creation of an Earth Charter, which defines our duties toward the environment and towards each other, as the only hope to achieve sustainability and peace. The substance of ethics is in actions and not words, which implies that we must often take painful decisions that will test our sense of justice, logic, compassion and love.

Environmental Ethics: What is it?

In all strategies with regard to the environment, a growing ethical concern manifests itself in new laws and regulations. As mentioned previously, Aldo Leopold in his *Sand Country Almanac* (1949) first proposed the adoption of a Land Ethic. Leopold's ethics design was focused on the physical setting and circumstances of North America in the forties. Since then, the concept of land ethics has developed into a vast body of research under the name of environmental ethics. Let's consider what we mean by environmental ethics. As Rolston (1999) explains 'Environmental ethics is theory and practice about appropriate concern for, values in, and duties to the natural world'.

According to all scientific accounts, the planetary condition is dire: destruction of habitat, disappearance of animal species, and in many cases Aboriginal populations, the loss of plant life, desertification, the loss or pollution of waterways. The culprit is ever the same: human action.

Moral philosophy had found a new field of exploration: the responsibility of human action on the natural world. It is not just a matter of understanding the scientific problem and then fixing things with the right technology, but rather one of the understanding and eventual correction of our cosmological vision. The assumption that if only we had better knowledge we would be able to make rational decisions is contradicted by real life. Increasingly our society assumes the characteristics of the risk society, accepted as a price to pay for progress and free choice. The destruction of the environment continues, although the perpetrators are fully informed of the facts. Many illnesses and disasters follow the same pattern: a mixture of necessity, denial, and self-destructive impulses.

The cradle of environmental ethics, as a philosophical field of studies, is Western Civilisation. It has been elicited by the very state of prosperity which industrial societies have achieved. This is one of the reasons why environmental ethics is a relevant topic in North America and Northern Europe, where the industrial revolution began and environmental damage goes hand in hand with economic expansion. An early reaction against industrial progress and commercialism, perceived as triumph of vulgarity and aesthetic debasement of existence, was found among the intellectual class at the end of 19th century (e.g. Ruskin, Lawrence, Morris, Williamson, Cole, Thoreau). The destruction of nature's integrity began to feel like a moral failure, which stained the individual and society."

An ideological path links today's ecological fundamentalists to

socialist, nazi or anarchic affiliations (Bramwell 1989). Western society pursues the highest degree of self-awareness in which we can recycle our guilty complexes. The appeal to preserve nature for itself, is prevalent mainly in societies who do not know scarcity, have a higher degree of education and have been deprived most of all of primitive wilderness. On a full stomach, it is easier to contemplate the beauty of the world and indulge in non-exploitative activities. Conventions, law proposals, publications, exhortations, theories, scientific studies, economical support, find their initial expression in a rich and socially privileged society, and its outlet in political action.

That hot bed of cultural change, the sixties, produced the right intellectual climate for all sorts of alternative life-styles including the environment. Two articles: *The Historic Roots of Ecological Crisis and On Christian Arrogance toward Nature* by Lynn White, which appeared in 1960, blamed Christianity for environmental degradation. White started a sequel of attribution of sins against nature not just to the Church but to the whole western value-system and its very metaphysical foundations, which has been under critical scrutiny by a wave of politically correct pseudo-philosophies ever since. During the same period, *The tragedy of the Commons* by Garrett Hardin, predicted a sinister Hobbesian struggle in a world of diminishing resources.

In 1972, John B. Cobb published a book entitled *Is it too late? A Theology of Ecology*. Since then the debate has enlarged to the point of becoming all encompassing and in 1979 Eugene C.Hargrove first published the authoritative *Journal of Environmental Ethics*, dedicated to the philosophical aspects of environmental problems. The wealth of books and essays about the subject grew to such a point that, in 1990, the International Society for Environmental Ethics (ISEE) was created as an outlet for such an international growth of genuine interest.

The number of publications in the 21 years from 1979 to 1999, is staggering and covers every possible topic. We cite as examples titles such as: *Using and Abusing Nietzsche for Environmental Ethics* (Ralph R.Acampora), *The Vegetarian Savage: Rousseau's Critique of Meat Eating* (D.Bonin Vail), *Intrinsic Value, Quantum Theory and Environmental Ethics* (J.Baird Callicot), *Marxism, Ecology and Technology* (Yol.Jung Hwa) (ISEE 1999).

With the creation in the 1990s of the IUCN Ethics Working Group, environmental ethics became part of environmental policies and '... respect and care for the community of life' became an ethical principle, sometimes referred to as the ethics of sustainability, a very ambiguous term which has sullied the clarity of environmental objectives (IUCN, UNEP and WWF 1991).

The Earth Charter of 2000, is the recognition that environmental ethics have spread beyond a narrow elitism (www.earthcharter.org). The term is now used by teachers and politicians, though not many understand its implications. One of the most interesting features has been the contribution of religion-oriented institutions, with the creation of religious ecumenical networks, following the Assisi gathering of World Religions in 1994 (see II: Links Section). Suffice to say that at this point in time the material collected shows that the recognition of the subject, as a new philosophical theory and as a field of applied ethics, is well established.

Applied Ethics

Holmes Rolston III distinguishes 12 theories of environmental ethics, some with a definitive philosophical pedigree rooted in our humanistic past, some with a new perspective, like ecofeminism (Rolston 1999). (See: *Nature, Value, Duty: Life on Earth with Holmes Rolston, III.* Festschrift, edited by Christopher J. Preston and Wayne Ouderkirk (Dordrecht: Netherlands: Springer, 2007).

Pope John Paul II has proposed the Christian version of Environmental Ethics: :

“Since the ecological crisis is fundamentally a moral issue, it requires that all people respond in solidarity to what is a common threat. Uncontrolled exploitation of the natural environment not only menaces the survival of the human race, it also threatens the natural order in which mankind is meant to receive and to hand on God's gift of life with dignity and freedom. Today responsible men and women are increasingly aware that we must pay attention to what the earth and its atmosphere are telling us: namely, that there is an order in the universe which must be respected, and that the human person, endowed with the capability of choosing freely, has a grave responsibility to preserve this order for the well-being of future generations. “

(To scientists concerned with chemical hazards, 1993)

But the relation of the whole of our human activities with the environment in which they take place is a most ignored fact that commits us to a long series of failures. Because the state of the environment has been examined separately from economic, social and political problems, environmental problems have always been with us. Theoretical imperatives aside, we must come down to the task of solving real problems. The essence of an ethic is in its application and it has to be the moving force of behaviour: actions are the measure of our commitment.

With a baggage of moral tradition built up through centuries, we wade

in a variety of new situations. Solomonic judgments are mediating between conflicting goods, or, more often, between more or less harmful solutions. Facts are subjected to interpretations. The drama of choices will necessarily exclude one or more desirable outcomes. With the democratisation process, every person is becoming an expert in ethical affairs. The public feels that decisions should not be taken by politicians and scientists, without broad consultation. Typical is the case of scientists specialising in genetically modified organisms, disappointed by the constraints imposed on research, debate whether or not people should be allowed to make important decisions on the basis of uninformed emotional beliefs.

‘Behind much of the criticism lies the belief that ethics is in the realm of feeling and emotion; if there can be no objective truth in ethics, it may seem, there can be no scope for reason and argument’ (Singer 1992).

Issues such as genetically modified Rhesus monkeys or overpopulation present challenging thinking. Other issues include medicine, religious beliefs, economics and psychological motivations. Is it right to sacrifice a highly intelligent animal in order to cure our deadly diseases? Many people agree that human suffering comes first, others may feel uncomfortable with the burden of taking ambiguous decisions. They would most probably not want to know, but now the cat is out of the bag. Freedom of information is at the same time a curse and a blessing.

The solution to overpopulation should be, at least technically, easier than to persuade the affluent societies to relinquish their affluence: all that is needed is contraception. But the Indian and Chinese examples teach us that problems of individual choice, unconscious behaviour, economic needs and cultural habits are determinant, just as they are in Western Society.

Our politicians depend on maintaining the levels of wellbeing, which has become the hallmark of 20th Western Civilisation. Sound environmental policies imply economic costs but, above all, a change in life-long acquisition of habits to which years of economic growth have accustomed us. People want smokeless air, pure water, clean, safe energy, beautiful countryside, healthy food, but when there is a price-tag attached to it they often will, like St. Augustine, say ‘...but not yet.’

The creation of an environmental ethic cannot happen out of nowhere, but will reflect the concerns and the tradition of the culture in which it is born. Western values, as we have seen, have always contained intellectual environmental values.

A long tradition of scientific observation, love and reverence for nature goes back to Linnaeus, Leonardo, Goethe, Keats, Turner, Rilke etc.

Moreover, because other cultures have similarly proven a kindred feeling of wonder and inspiration, as demonstrated by cavemen's paintings, Japanese art and Chinese poems, we know that humanity's attachment to nature expresses itself at various historical moments in different modes. The notion that we must consider authoritative regulations to preserve our environment from that side of ourselves which cannot see beyond the satisfaction of some immediate wants, has become common place. Material wealth and power are means to ends: the preservation of higher values, created by humankind. Even utilitarian moral philosophies recognise that nature contributes to human well being, by providing knowledge, contemplation, aesthetic enjoyment, and recreation.

In our highly polymorphic societies with their profound contradictions, the protection of the environment is not an arbitrary optional, but '...is central to the spiritual and cultural interests of human beings' (Allison 1991) not merely a matter of survival. Without this recognition, any material progress is empty and indeed a dangerous two-edged sword.

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ETHICS CANNOT BE SEPARATED FROM ECONOMIC POLICIES

b) EVOLUTIONARY ECONOMICS

THE ECONOMICS OF THE COMING SPACESHIP EARTH

by Kenneth E. Boulding 1966

We are now in the middle of a long process of transition in the nature of the image which man has of himself and his environment. Primitive men, and to a large extent also men of the early civilizations, imagined

themselves to be living on a virtually illimitable plane. There was almost always somewhere beyond the known limits of human habitation, and over a very large part of the time that man has been on earth, there has been something like a frontier. That is, there was always some place else to go when things got too difficult, either by reason of the deterioration of the natural environment or a deterioration of the social structure in places where people happened to live. The image of the frontier is probably one of the oldest images of mankind, and it is not surprising that we find it hard to get rid of.

Gradually, however, man has been accustoming himself to the notion of the spherical earth and a closed sphere of human activity. A few unusual spirits among the ancient Greeks perceived that the earth was a sphere. It was only with the circumnavigations and the geographical explorations of the fifteenth and sixteenth centuries, however, that the fact that the earth was a sphere became at all widely known and accepted. Even in the thirteenth century, the commonest map was Mercator's projection, which visualizes the earth as an illimitable cylinder, essentially a plane wrapped around the globe, and it was not until the Second World War and the development of the air age that the global nature of the planet really entered the popular imagination. Even now we are very far from having made the moral, political, and psychological adjustments which are implied in this transition from the illimitable plane to the closed sphere.

Economists in particular, for the most part, have failed to come to grips with the ultimate consequences of the transition from the open to the closed earth. One hesitates to use the terms "open" and "closed" in this connection, as they have been used with so many different shades of meaning. Nevertheless, it is hard to find equivalents. The open system, indeed, has some similarities to the open system of von Bertalanffy, ¹ in that it implies that some kind of a structure is maintained in the midst of a throughput from inputs to outputs. In a closed system, the outputs of all parts of the system are linked to the inputs of other parts. There are no inputs from outside and no outputs to the outside; indeed, there is no outside at all. Closed systems, in fact, are very rare in human experience, in fact almost by definition unknowable, for if there are genuinely closed systems around us, we have no way of getting information into them or out of them; and hence if they are really closed, we would be quite unaware of their existence. We can only find out about a closed system if we participate in it. Some isolated primitive societies may have approximated to this, but even these had to take inputs from the environment and give outputs to it. All living organisms, including man himself, are open systems. They have to receive inputs in the shape of air, food, water, and give off outputs in the form of effluvia and excrement. Deprivation

of input of air, even for a few minutes, is fatal. Deprivation of the ability to obtain any input or to dispose of any output is fatal in a relatively short time. All human societies have likewise been open systems. They receive inputs from the earth, the atmosphere, and the waters, and they give outputs into these reservoirs; they also produce inputs internally in the shape of babies and outputs in the shape of corpses. Given a capacity to draw upon inputs and to get rid of outputs, an open system of this kind can persist indefinitely.

There are some systems -- such as the biological phenotype, for instance the human body-- which cannot maintain themselves indefinitely by inputs and outputs because of the phenomenon of aging. This process is very little understood. It occurs, evidently, because there are some outputs which cannot be replaced by any known input. There is not the same necessity for aging in organizations and in societies, although an analogous phenomenon may take place. The structure and composition of all organization or society, however, can be maintained by inputs of fresh personnel from birth and education as the existing personnel ages and eventually dies. Here we have an interesting example of a system which seems to maintain itself by the self-generation of inputs, and in this sense is moving towards closure. The input of people (that is, babies) is also all output of people (that is, parents).

Systems may be open or closed in respect to a number of classes of inputs and outputs. Three important classes are matter, energy, and information. The present world economy is open in regard to all three. We can think of the world economy or "econsphere" as a subset of the "world set," which is the set of all objects of possible discourse in the world. We then think of the state of the econosphere at any one moment as being the total capital stock, that is, the set of all objects, people, organizations, and so on, which are interesting from the point of view of the system of exchange. This total stock of capital is clearly an open system in the sense that it has inputs and outputs, inputs being production which adds to the capital stock, outputs being consumption which subtracts from it. From a material point of view, we see objects passing from the noneconomic into the economic set in the process of production, and we similarly see products passing out of the economic set as their value becomes zero. Thus we see the econosphere as a material process involving the discovery and mining of fossil fuels, ores, etc., and at the other end a process by which the effluents of the system are passed out into noneconomic reservoirs -- for instance, the atmosphere and the oceans -- which are not appropriated and do not enter into the exchange system.

From the point of view of the energy system, the econosphere involves inputs of available energy in the form, say, of water power, fossil fuels, or sunlight, which are necessary in order to create the material throughput and to move matter from the noneconomic set into the economic set or even out of it again; and energy itself is given off by the system in a less available form, mostly in the form of heat. These inputs of available energy must come either from the sun (the energy supplied by other stars being assumed to be negligible) or it may come from the earth itself, either through its internal heat or through its energy of rotation or other motions, which generate, for instance, the energy of the tides. Agriculture, a few solar machines, and water power use the current available energy income. In advanced societies this is supplemented very extensively by the use of fossil fuels, which represent as it were a capital stock of stored-up sunshine. Because of this capital stock of energy, we have been able to maintain an energy input into the system, particularly over the last two centuries, much larger than we would have been able to do with existing techniques if we had had to rely on the current input of available energy from the sun or the earth itself. This supplementary input, however, is by its very nature exhaustible.

The inputs and outputs of information are more subtle and harder to trace, but also represent an open system, related to, but not wholly dependent on, the transformations of matter and energy. By far the larger amount of information and knowledge is self-generated by the human society, though a certain amount of information comes into the sociosphere in the form of light from the universe outside. The information that comes from the universe has certainly affected man's image of himself and of his environment, as we can easily visualize if we suppose that we lived on a planet with a total cloud-cover that kept out all information from the exterior universe. It is only in very recent times, of course, that the information coming in from the universe has been captured and coded into the form of a complex image of what the universe is like outside the earth; but even in primitive times, man's perception of the heavenly bodies has always profoundly affected his image of earth and of himself. It is the information generated within the planet, however, and particularly that generated by man himself, which forms by far the larger part of the information system. We can think of the stock of knowledge, or as Teilhard de Chardin called it, the "noosphere," and consider this as an open system, losing knowledge through aging and death and gaining it through birth and education and the ordinary experience of life.

From the human point of view, knowledge or information is by far the most important of the three systems. Matter only acquires significance and only enters the sociosphere or the econosphere insofar as it

becomes an object of human knowledge. We can think of capital, indeed, as frozen knowledge or knowledge imposed on the material world in the form of improbable arrangements. A machine, for instance, originated in the mind of man, and both its construction and its use involve information processes imposed on the material world by man himself. The cumulation of knowledge, that is, the excess of its production over its consumption, is the key to human development of all kinds, especially to economic development. We can see this pre-eminence of knowledge very clearly in the experiences of countries where the material capital has been destroyed by a war, as in Japan and Germany. The knowledge of the people was not destroyed, and it did not take long, therefore, certainly not more than ten years, for most of the material capital to be reestablished again. In a country such as Indonesia, however, where the knowledge did not exist, the material capital did not come into being either. By "knowledge" here I mean, of course, the whole cognitive structure, which includes valuations and motivations as well as images of the factual world.

The concept of entropy, used in a somewhat loose sense, can be applied to all three of these open systems. In the case of material systems, we can distinguish between entropic processes, which take concentrated materials and diffuse them through the oceans or over the earth's surface or into the atmosphere, and anti-entropic processes, which take diffuse materials and concentrate them. Material entropy can be taken as a measure of the uniformity of the distribution of elements and, more uncertainly, compounds and other structures on the earth's surface. There is, fortunately, no law of increasing material entropy, as there is in the corresponding case of energy, as it is quite possible to concentrate diffused materials if energy inputs are allowed. Thus the processes for fixation of nitrogen from the air, processes for the extraction of magnesium or other elements from the sea, and processes for the desalinization of sea water are anti-entropic in the material sense, though the reduction of material entropy has to be paid for by inputs of energy and also inputs of information, or at least a stock of information in the system. In regard to matter, therefore, a closed system is conceivable, that is, a system in which there is neither increase nor decrease in material entropy. In such a system all outputs from consumption would constantly be recycled to become inputs for production, as for instance, nitrogen in the nitrogen cycle of the natural ecosystem.

In regard to the energy system there is, unfortunately, no escape from the grim Second Law of Thermodynamics; and if there were no energy inputs into the earth, any evolutionary or developmental process would be impossible. The large energy inputs which we have obtained from fossil fuels are strictly temporary. Even the most optimistic

predictions would expect the easily available supply of fossil fuels to be exhausted in a mere matter of centuries at present rates of use. If the rest of the world were to rise to American standards of power consumption, and still more if world population continues to increase, the exhaustion of fossil fuels would be even more rapid. The development of nuclear energy has improved this picture, but has not fundamentally altered it, at least in present technologies, for fissionable material is still relatively scarce. If we should achieve the economic use of energy through fusion, of course, a much larger source of energy materials would be available, which would expand the time horizons of supplementary energy input into an open social system by perhaps tens to hundreds of thousands of years. Failing this, however, the time is not very far distant, historically speaking, when man will once more have to retreat to his current energy input from the sun, even though this could be used much more effectively than in the past with increased knowledge. Up to now, certainly, we have not got very far with the technology of using current solar energy, but the possibility of substantial improvements in the future is certainly high. It may be, indeed, that the biological revolution which is just beginning will produce a solution to this problem, as we develop artificial organisms which are capable of much more efficient transformation of solar energy into easily available forms than any that we now have. As Richard Meier has suggested, we may run our machines in the future with methane-producing algae. 2

The question of whether there is anything corresponding to entropy in the information system is a puzzling one, though of great interest. There are certainly many examples of social systems and cultures which have lost knowledge, especially in transition from one generation to the next, and in which the culture has therefore degenerated. One only has to look at the folk culture of Appalachian migrants to American cities to see a culture which started out as a fairly rich European folk culture in Elizabethan times and which seems to have lost both skills, adaptability, folk tales, songs, and almost everything that goes up to make richness and complexity in a culture, in the course of about ten generations. The American Indians on reservations provide another example of such degradation of the information and knowledge system. On the other hand, over a great part of human history, the growth of knowledge in the earth as a whole seems to have been almost continuous, even though there have been times of relatively slow growth and times of rapid growth. As it is knowledge of certain kinds that produces the growth of knowledge in general, we have here a very subtle and complicated system, and it is hard to put one's finger on the particular elements in a culture which make knowledge grow more or less rapidly, or even which make it decline. One of the great puzzles in this connection, for instance, is

why the take-off into science, which represents an "acceleration," or an increase in the rate of growth of knowledge in European society in the sixteenth century, did not take place in China, which at that time (about 1600) was unquestionably ahead of Europe, and one would think even more ready for the breakthrough. This is perhaps the most crucial question in the theory of social development, yet we must confess that it is very little understood. Perhaps the most significant factor in this connection is the existence of "slack" in the culture, which permits a divergence from established patterns and activity which is not merely devoted to reproducing the existing society but is devoted to changing it. China was perhaps too well-organized and had too little slack in its society to produce the kind of acceleration which we find in the somewhat poorer and less well-organized but more diverse societies of Europe.

The closed earth of the future requires economic principles which are somewhat different from those of the open earth of the past. For the sake of picturesqueness, I am tempted to call the open economy the "cowboy economy," the cowboy being symbolic of the illimitable plains and also associated with reckless, exploitative, romantic, and violent behavior, which is characteristic of open societies. The closed economy of the future might similarly be called the "spaceman" economy, in which the earth has become a single spaceship, without unlimited reservoirs of anything, either for extraction or for pollution, and in which, therefore, man must find his place in a cyclical ecological system which is capable of continuous reproduction of material form even though it cannot escape having inputs of energy. The difference between the two types of economy becomes most apparent in the attitude towards consumption. In the cowboy economy, consumption is regarded as a good thing and production likewise; and the success of the economy is measured by the amount of tile throughput from the "factors of production," a part of which, at any rate, is extracted from the reservoirs of raw materials and noneconomic objects, and another part of which is output into the reservoirs of pollution. If there are infinite reservoirs from which material can be obtained and into which effluvia can be deposited, then the throughput is at least a plausible measure of the success of the economy. The gross national product is a rough measure of this total throughput. It should be possible, however, to distinguish that part of the GNP which is derived from exhaustible and that which is derived from reproducible resources, as well as that part of consumption which represents effluvia and that which represents input into the productive system again. Nobody, as far as I know, has ever attempted to break down the GNP in this way, although it would be an interesting and extremely important exercise, which is unfortunately beyond the scope of this paper.

By contrast, in the spaceman economy, throughput is by no means a desideratum, and is indeed to be regarded as something to be minimized rather than maximized. The essential measure of the success of the economy is not production and consumption at all, but the nature, extent, quality, and complexity of the total capital stock, including in this the state of the human bodies and minds included in the system. In the spaceman economy, what we are primarily concerned with is stock maintenance, and any technological change which results in the maintenance of a given total stock with a lessened throughput (that is, less production and consumption) is clearly a gain. This idea that both production and consumption are bad things rather than good things is very strange to economists, who have been obsessed with the income-flow concepts to the exclusion, almost, of capital-stock concepts.

There are actually some very tricky and unsolved problems involved in the questions as to whether human welfare or well-being is to be regarded as a stock or a flow. Something of both these elements seems actually to be involved in it, and as far as I know there have been practically no studies directed towards identifying these two dimensions of human satisfaction. Is it, for instance, eating that is a good thing, or is it being well fed? Does economic welfare involve having nice clothes, fine houses, good equipment, and so on, or is it to be measured by the depreciation and the wearing out of these things? I am inclined myself to regard the stock concept as most fundamental, that is, to think of being well fed as more important than eating, and to think even of so-called services as essentially involving the restoration of a depleting psychic capital. Thus I have argued that we go to a concert in order to restore a psychic condition which might be called "just having gone to a concert," which, once established, tends to depreciate. When it depreciates beyond a certain point, we go to another concert in order to restore it. If it depreciates rapidly, we go to a lot of concerts; if it depreciates slowly, we go to few. On this view, similarly, we eat primarily to restore bodily homeostasis, that is, to maintain a condition of being well fed, and so on. On this view, there is nothing desirable in consumption at all. The less consumption we can maintain a given state with, the better off we are. If we had clothes that did not wear out, houses that did not depreciate, and even if we could maintain our bodily condition without eating, we would clearly be much better off.

It is this last consideration, perhaps, which makes one pause. Would we, for instance, really want an operation that would enable us to restore all our bodily tissues by intravenous feeding while we slept? Is there not, that is to say, a certain virtue in throughput itself, in activity itself, in production and consumption itself, in raising food and in

eating it? It would certainly be rash to exclude this possibility. Further interesting problems are raised by the demand for variety. We certainly do not want a constant state to be maintained; we want fluctuations in the state. Otherwise there would be no demand for variety in food, for variety in scene, as in travel, for variety in social contact, and so on. The demand for variety can, of course, be costly, and sometimes it seems to be too costly to be tolerated or at least legitimated, as in the case of marital partners, where the maintenance of a homeostatic state in the family is usually regarded as much more desirable than the variety and excessive throughput of the libertine. There are problems here which the economics profession has neglected with astonishing singlemindedness. My own attempts to call attention to some of them, for instance, in two articles, 3 as far as I can judge, produced no response whatever; and economists continue to think and act as if production, consumption, throughput, and the GNP were the sufficient and adequate measure of economic success.

It may be said, of course, why worry about all this when the spaceman economy is still a good way off (at least beyond the lifetimes of any now living), so let us eat, drink, spend, extract and pollute, and be as merry as we can, and let posterity worry about the spaceship earth. It is always a little hard to find a convincing answer to the man who says, "What has posterity ever done for me?" and the conservationist has always had to fall back on rather vague ethical principles postulating identity of the individual with some human community or society which extends not only back into the past but forward into the future. Unless the individual identifies with some community of this kind, conservation is obviously "irrational." Why should we not maximize the welfare of this generation at the cost of posterity? "Apres nous, le deluge" has been the motto of not insignificant numbers of human societies. The only answer to this, as far as I can see, is to point out that the welfare of the individual depends on the extent to which he can identify himself with others, and that the most satisfactory individual identity is that which identifies not only with a community in space but also with a community extending over time from the past into the future. If this kind of identity is recognized as desirable, then posterity has a voice, even if it does not have a vote; and in a sense, if its voice can influence votes, it has votes too. This whole problem is linked up with the much larger one of the determinants of the morale, legitimacy, and "nerve" of a society, and there is a great deal of historical evidence to suggest that a society which loses its identity with posterity and which loses its positive image of the future loses also its capacity to deal with present problems, and soon falls apart. 4

Even if we concede that posterity is relevant to our present problems, we still face the question of time-discounting and the closely related

question of uncertainty–discounting. It is a well–known phenomenon that individuals discount the future, even in their own lives. The very existence of a positive rate of interest may be taken as at least strong supporting evidence of this hypothesis. If we discount our own future, it is certainly not unreasonable to discount posterity's future even more, even if we do give posterity a vote. If we discount this at 5 per cent per annum, posterity's vote or dollar halves every fourteen years as we look into the future, and after even a mere hundred years it is pretty small -- only about 1 1/2 cents on the dollar. If we add another 5 per cent for uncertainty, even the vote of our grandchildren reduces almost to insignificance. We can argue, of course, that the ethical thing to do is not to discount the future at all, that time–discounting is mainly the result of myopia and perspective, and hence is an illusion which the moral man should not tolerate. It is a very popular illusion, however, and one that must certainly be taken into consideration in the formulation of policies. It explains, perhaps, why conservationist policies almost have to be sold under some other excuse which seems more urgent, and why, indeed, necessities which are visualized as urgent, such as defense, always seem to hold priority over those which involve the future.

All these considerations add some credence to the point of view which says that we should not worry about the spaceman economy at all, and that we should just go on increasing the GNP and indeed the gross world product, or GWP, in the expectation that the problems of the future can be left to the future, that when scarcities arise, whether this is of raw materials or of pollutable reservoirs, the needs of the then present will determine the solutions of the then present, and there is no use giving ourselves ulcers by worrying about problems that we really do not have to solve. There is even high ethical authority for this point of view in the New Testament, which advocates that we should take no thought for tomorrow and let the dead bury their dead. There has always been something rather refreshing in the view that we should live like the birds, and perhaps posterity is for the birds in more senses than one; so perhaps we should all call it a day and go out and pollute something cheerfully. As an old taker of thought for the morrow, however, I cannot quite accept this solution; and I would argue, furthermore, that tomorrow is not only very close, but in many respects it is already here. The shadow of the future spaceship, indeed, is already falling over our spendthrift merriment. Oddly enough, it seems to be in pollution rather than in exhaustion that the problem is first becoming salient. Los Angeles has run out of air, Lake Erie has become a cesspool, the oceans are getting full of lead and DDT, and the atmosphere may become man's major problem in another generation, at the rate at which we are filling it up with gunk. It is, of course, true that at least on its microscale, things have been

worse at times in the past. The cities of today, with all their foul air and polluted waterways, are probably not as bad as the filthy cities of the petrochemical age. Nevertheless, that fouling of the nest which has been typical of man's activity in the past on a local scale now seems to be extending to the whole world society; and one certainly cannot view with equanimity the present rate of pollution of any of the natural reservoirs, whether the atmosphere, the lakes, or even the oceans.

I would argue strongly also that our obsession with production and consumption to the exclusion of the "state" aspects of human welfare distorts the process of technological change in a most undesirable way. We are all familiar, of course, with the wastes involved in planned obsolescence, in competitive advertising, and in poor quality of consumer goods. These problems may not be so important as the "view with alarm," school indicates, and indeed the evidence at many points is conflicting. New materials especially seem to edge towards the side of improved durability, such as, for instance, neolite soles for footwear, nylon socks, wash and wear shirts, and so on. The case of household equipment and automobiles is a little less clear. Housing and building construction generally almost certainly has declined in durability since the Middle Ages, but this decline also reflects a change in tastes towards flexibility and fashion and a need for novelty, so that it is not easy to assess. What is clear is that no serious attempt has been made to assess the impact over the whole of economic life of changes in durability, that is, in the ratio of capital ill the widest possible sense to income. I suspect that we have underestimated, even in our spendthrift society, the gains from increased durability, and that this might very well be one of the places where the price system needs correction through government-sponsored research and development. The problems which the spaceship earth is going to present, therefore, are not all in the future by any means, and a strong case can be made for paying much more attention to them in the present than we now do.

It may be complained that the considerations I have been putting forth relate only to the very long run, and they do not much concern our immediate problems. There may be some justice in this criticism, and my main excuse is that other writers have dealt adequately with the more immediate problems of deterioration in the quality of the environment. It is true, for instance, that many of the immediate problems of pollution of the atmosphere or of bodies of water arise because of the failure of the price system, and many of them could be solved by corrective taxation. If people had to pay the losses due to the nuisances which they create, a good deal more resources would go into the prevention of nuisances. These arguments involving external economies and diseconomies are familiar to economists, and there is

no need to recapitulate them. The law of torts is quite inadequate to provide for the correction of the price system which is required, simply because where damages are widespread and their incidence on any particular person is small, the ordinary remedies of the civil law are quite inadequate and inappropriate. There needs, therefore, to be special legislation to cover those cases, and though such legislation seems hard to get in practice, mainly because of the widespread and small personal incidence of the injuries, the technical problems involved are not insuperable. If we were to adopt in principle a law for tax penalties for social damages, with an apparatus for making assessments under it, a very large proportion of current pollution and deterioration of the environment would be prevented. There are tricky problems of equity involved, particularly where old established nuisances create a kind of "right by purchase" to perpetuate themselves, but these are problems again which a few rather arbitrary decisions can bring to some kind of solution.

The problems which I have been raising in this paper are of larger scale and perhaps much harder to solve than the more practical and immediate problems of the above paragraph. Our success in dealing with the larger problems, however, is not unrelated to the development of skill in the solution of the more immediate and perhaps less difficult problems. One can hope, therefore, that as a succession of mounting crises, especially in pollution, arouse public opinion and mobilize support for the solution of the immediate problems, a learning process will be set in motion which will eventually lead to an appreciation of and perhaps solutions for the larger ones. My neglect of the immediate problems, therefore, is in no way intended to deny their importance, for unless we at least make a beginning on a process for solving the immediate problems we will not have much chance of solving the larger ones. On the other hand, it may also be true that a long-run vision, as it were, of the deep crisis which faces mankind may predispose people to taking more interest in the immediate problems and to devote more effort for their solution. This may sound like a rather modest optimism, but perhaps a modest optimism is better than no optimism at all.

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c) POLICY ISSUE BRIEFS ON SUSTAINABLE ECONOMICS, ECONOMIC GROWTH AND DEVELOPMENT

by Herman E. Daly
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March 4, 2005

Our traditional economic problems (poverty, overpopulation, unemployment, unjust distribution, environmental degradation) have all been thought to have a common solution—namely an increase in wealth. All problems are easier if we are richer. The way to get richer has been thought to be by economic growth, usually as measured by GDP. We do not here question the first proposition, that richer is better than

poorer, other things equal. But we do question whether what is persuasively labeled

“economic growth” is any longer making us richer. We suspect that physical throughput growth is, at the present margin and in the aggregate, increasing “illth” faster than wealth, thus making us poorer rather than richer. Consequently our traditional economic problems become more difficult with further growth. The correlation between throughput growth and GDP growth is sufficiently strong historically so that in the absence of countervailing policies even GDP growth may be increasing illth faster than wealth.

What we conventionally call “economic growth” in the sense of “growth of the

economy” has ironically become “uneconomic growth” in the literal sense of growth that increases costs by more than it increases benefits. We are speaking here of the North rather than the South, because in many poor countries where the majority lives close to subsistence the benefits of production growth, even if badly distributed and ecologically damaging, justify incurring large costs. But the South is striving with encouragement from the IMF and World Bank to become like the North. One will surely ask, how do we know that growth has become uneconomic for many Northern countries?

As the scale of the human subsystem (the economy) expands relative to the fixed

dimensions of the containing and sustaining ecosystem, we necessarily encroach upon that system and must pay the opportunity cost of lost ecosystem services as we enjoy the extra benefit of increased human scale. As rational beings we presumably satisfy our most pressing wants first, so that each increase in scale yields a diminishing marginal benefit. Like-wise, we presumably would sequence our takeovers of the ecosystem so as to sacrifice first the least important natural services. Obviously we have not yet begun to do this because we are just now recognizing that natural services are scarce. This is an important policy challenge for ecological economics. But let us credit ourselves with capacity to learn. Even so, that means that increasing marginal costs and decreasing marginal benefits will accompany increasing human scale. The optimum scale, from the human perspective, occurs when marginal cost equals marginal benefit—hardly an unfamiliar principle to economists! Beyond that point growth becomes uneconomic in the literal sense of costing more than it is worth. It is probably unnecessary to add that these views do not find favor with mainstream economists. The concepts of throughput, of entropy, and even of optimal scale of the macroeconomy are absent in mainstream textbooks. The last is especially odd since in microeconomics the concept of the optimal scale of each micro activity is central. Yet the sum of all micro activities, the macro economy, is not thought to have an optimal scale relative to its sustaining ecosystem. Probably this is because macroeconomists think of the macroeconomy as the Whole, not as a Part of some larger Whole. For them nature is not a containing envelope, but just a sector of the macroeconomy—mines, wells, croplands, pastures, and fisheries. When the Whole grows, in this view, it expands into the Void encroaching on nothing and incurring no opportunity cost. But of course the real economy is a Part and it grows not into the Void, but into the rest of the ecosystem, and really does incur opportunity costs. It is interesting to know empirically if we have reached the optimal scale, but even if we have not, it is obvious that continued growth of a dependent subsystem relative to a finite sustaining total system will inevitably reach such an optimal scale. If we add to the limit of finitude of the total system the additional limits of entropy,

complexity, ecological interdependence, as well as satiability of human needs, then it is clear that the optimal scale will be encountered sooner rather than later.

Additionally, if we expand our anthropocentric view of the optimum scale to a more biocentric view, meaning one that attributes not only instrumental but also intrinsic value to other species, then it is clear that the scale of the human presence will be further limited by the duty to reserve a place in the sun for other species, even beyond what they “pay for” in terms of their instrumental value to us. And of course the whole idea of “sustainability” is that the optimal scale should exist for a very long time, not just a few generations. Clearly a sustainable scale will be smaller than an unsustainable scale. For all these reasons we think that for policy purposes we do not need exact empirical measures of the optimal scale. If one jumps from an airplane it may be nice to have an altimeter, but what one really needs is a parachute.

So what policies constitute a parachute? Briefly, they are policies that limit aggregate throughput, while allowing the market to allocate that limited throughput— assuming the market is competitive and confined to some limited degree of inequality in the distribution of wealth and income. Such policy instruments are evolving now—e.g., cap-and-trade systems for extraction rights, pollution emission rights, fishing rights, etc.

Also ecological tax reform limits throughput by making it more expensive. It shifts the tax base from value added (something we want more of) on to “that to which value is added”, namely the throughput (something we want less of). In differing ways each of the above “parachutes” would limit throughput and expansion of the scale of the economy into the ecosystem, and also provide public revenue, which would permit the abolition of some of our most regressive taxes.

Our policy goal is to limit growth (quantitative increase in throughput), not development (qualitative improvement in design of commodities and institutions). We aim to redefine progress away from growth and toward development.

d) ETHICAL CONSIDERATIONS MUST HAVE FIRM BASIS ON SCIENTIFIC GROUND. THE CONCEPT OF CARRYING CAPACITY IS ONE OF THEM

ETHICAL IMPLICATIONS OF CARRYING CAPACITY by Garrett Hardin (1977)

It should be clear by now that the idea of the commons did not suddenly arise out of nothing in the year 1968. Passing references to the problem occur as far back as Aristotle, and Lloyd certainly saw it clearly in 1833. H. Scott Gordon's work in 1954 saw the beginning of a new concern with the problems presented by this politico-economic system. Yet the fact remains that a widespread recognition of these problems did not develop until after 1968. Why the delay? Two reasons are apparent.

First, a favorable climate of opinion was needed for remarks about the commons to be noticed. This was created in the 1960's by the rapid growth of the environmental movement, which alerted people to the consequences of distributional systems. Second, it was necessary that the properties of the commons be stated in no uncertain terms if people were to consider the matter seriously. It was necessary that the human tragedy of adhering to a commons-type distribution be emphasized. A good, solid fortissimo minor chord had to be sounded. Before 1968 most of the sounds were either mere grace notes or extended passages played pianissimo. The down-playing was for good reason, of course: the clear message of the commons threatened cherished beliefs and practices. Abandoning any traditional practice requires a political upset (though revolution may be too strong a word).

We have seen how the problem of the commons has been evaded in the exploitation of ocean fisheries. Understandably, it is evaded even more in the question of human populations. Both problems require for their rational resolution a clear understanding of the concept of carrying capacity and a willingness to fashion laws that take this concept into account.

Let us first look at the concept as it applies to other animals and plants, to the non-human populations we would like to exploit for our own benefit.

The carrying capacity of a particular area is defined as the maximum number of a species that can be supported indefinitely by a particular habitat, allowing for seasonal and random changes, without degradation of the environment and without diminishing carrying capacity in the future. There is some redundancy in this definition, but redundancy is better than inadequacy. Using deer as an example, the true carrying capacity of a region must allow for the fact that food is harder to get in winter than in summer and scarcer in drought years

than in "normal years." If too many head of deer are allowed in the pasture they may overgraze it to such an extent that the ground is laid bare, producing soil erosion followed by less plant growth in subsequent "years. Always, by eating the grasses that appeal to them, herbivores selectively favor the weed grasses that are not appealing, thus tending to diminish the carrying capacity for themselves and for their progeny in subsequent years.

The concept of carrying capacity is a time-bound, posterity-oriented concept. This is one of the reasons that it threatens the "conventional wisdom" (Galbraith's term) of the present time, which leans heavily on short term economic theory. The theory of discounting, using commercially realistic rates of interest, virtually writes off the future.

[1] The consequences have been well described by Fife and Clark. Devotion to economic discounting in its present form is suicidal. How soon is it so? "In the long run," an economist would say, since disaster is more than five years off. "In the short run," according to biologists, since disaster occurs in much less than the million or so years that is the normal life expectancy of a species. Here we see a standing issue of dispute between economists and biologists, with their different professional biases reckoning time.

Game management methods of maintaining the carrying capacity of a habitat impinge upon ethical theory. Officially, Judeo-Christian ethics is absolutist in form, rich in proscriptions such as "Thou shalt not kill." Can we base game management on such principles? Obviously we cannot. Time after time, in an area where men have eliminated such "varmints" as coyotes and wolves, prey species (e.g., deer) have multiplied far beyond the carrying capacity of their habitat, which they then severely damage thus reducing its carrying capacity in the future.

[2] Taking for granted the legitimacy of human desire to maximize gains from the deer-pasture, is "Thou shalt not kill" a good ethical rule? It depends. If the herd size is less than the carrying capacity we might insist on this rule; but if the herd has grown beyond carrying capacity we should deliberately kill animals, until the size of the herd is brought to a safe level.

For the maximum yield of venison we should keep the herd at that level at which the first derivative of the population function is a maximum; but for safety, allowing for unforeseen random fluctuations, the population level should be kept a bit above the point of fastest population growth.

This analysis was focused wholly on the interests of man, the exploiter of nature. Much the same conclusion is reached if we focus entirely on the species being exploited. Whenever there are too many animals in a habitat the animals themselves show all the signs of misery, if our empathic projections are to be trusted at all. The animals become

skinny and feeble; they succumb easily to diseases. The normal social instincts of the species become ineffectual as starving animals struggle with one another for individual survival.

In a state of nature the unsavory consequences of exceeding the carrying capacity are prevented by natural predation. Putting entirely to one side the exploitative goals of animal husbandry, whenever men maintain a population of animals free of predators they should, if they are humane, pursue a regular program of killing animals so as to keep the herd size below the carrying capacity of the habitat.

We see that the ethics of game management is not an absolutist ethics but a relativistic or situational ethics. [3] The foundation of situational ethics is this: The morality of an act is determined by the state of the system at the time the act is performed. Ecology, a system-based view of the world, demands situational ethics.

Unfortunately, situational (ecological) ethics creates difficult problems for the law. It is difficult to write statute law if we are deprived of the simplicity of flat, unqualified dos and don'ts. Qualifications can be written into law, but it is hard to foresee all the particularities of future situations. Our insufficiently informed efforts leave "loopholes" for rascals to crawl through. When found, loopholes can be plugged, of course; but that takes time. The legislative process is a slow one. Situational ethics seems almost to demand an administrative approach; by statute, administrators can be given the power to make instant, detailed decisions within a legally defined framework. Rules promulgated by an administrative agency are called administrative law. On paper, the system may look fine, but the general public is understandably afraid of it. Administrative law gives power to administrators, who are human and hence fallible. Their decisions may be self-serving. John Adams called for "a government of laws, and not of men." We rightly esteem this as a desirable ideal. The practical question we must face is how far can we safely depart from the ideal under the pressure of ecological necessity? This is the harrowing Quis custodiet problem; [4] it has no easy solutions. [5]

When a well-defined problem is virtually ignored as long as the commons problem was -- more than a hundred years -- we naturally suspect the interference of taboo. This plausible supposition is by its very nature, nearly unprovable. Taboo is a composite thing: [6] there is "the primary taboo, surrounding the thing that must not be discussed; around this is the secondary taboo, a taboo against even acknowledging the existence of the primary taboo."

A taboo may be sustained in part for good tactical reasons: breaking it may open up a nest of problems not yet ripe for productive discussion. We may speculate--we can hardly know--that the long avoidance of

the commons problem was due to a subconscious awareness of the intractable Quis custodiet problem, which would have been activated by any attempt to depart from the system of the commons.

Moreover, the theory on which the commons problem is based rests on the concept of carrying capacity, which so far we have assumed is static. This is a justifiable assumption when we are speaking of a deer pasture in the wild, a habitat we propose to leave wild for esthetic reasons. But when we talk about cattle pastures, fish culture in fresh water ponds, and oyster culture in estuaries, we are talking about areas in which it is possible to increase the carrying capacity by technological intervention. Much of what we have called progress in the last two centuries has resulted from increasing the carrying capacity of the earth by technological means. Agricultural productivity, for instance, has increased by more than an order of magnitude since the time of Malthus, whose theory clearly assumed a static carrying capacity. Malthus' historical failure has understandably made many intelligent people very skeptical of any theory founded on the idea of a static carrying capacity.

Thus has it come about that many of the decisions made at the present time (insofar as they are explicitly rational) are based on balancing today's demand against tomorrow's supply, a type of bookkeeping that is frowned upon by certified public accountants. For the past two centuries we've gotten away with this practice because Science and Technology have generated miracles. But can such progress continue without end? The chorus of those who say it must come to an end grows ever larger. [7,8] Whom shall we believe: the Technological Optimists, or the Limits Lobby? If we are wrong, which way of being wrong is more dangerous? What is the proper policy for the true conservative? [9]

The concept of carrying capacity calls for the conservative, balanced equation type of thinking that has led to the triumphs of thermodynamics [10] and modern chemistry. But applied to human problems connected with exploiting the environment the concept of carrying capacity has been perceived as a threatening one. As regards populations of non-human animals and plants, we are just now beginning to grapple with the implications of carrying capacity. When it comes to humanity itself, it is doubtful if we yet have the courage to systematically examine all possibilities, as the following report by Nicholas Wade, from Science (1974) makes clear.

The famine that struck the six Sahelian zone countries of West Africa last year is thought to have killed some 100,000 people and left 7 million others dependent on foreigners' food handouts. The same or

worse may happen again this year. The essence of the tragedy is that the famine was caused not by dry weather or some putative climatic change but, primarily, by man himself. Could not Western skills, applied in time, have saved the primitive nomads and slash-and-burn farmers from destroying their own land? Western intervention in the Sahel, Western science and technology, and the best intentioned efforts of donor agencies and governments over the last several decades, have in fact made a principal contribution to the destruction.

"One of the basic factors in the situation is overpopulation, both human and bovine, brought about by the application of modern science," says a former Food and Agricultural Organization (FAO) sociologist. According to a recent in-house report on the Sahel prepared by the Agency for International Development (AID), "To a large extent the deterioration of the subsistence base is directly attributable to the fact that man's interventions in the delicately balanced ecological zones bordering desert areas have usually been narrowly conceived and poorly implemented." "Too many of our projects have been singularly unproductive and . . . we have tediously reintroduced projects which ought never to have been attempted in the first place," says Michael M. Horowitz, a State University of New York anthropologist who has studied the nomad peoples of Niger. And, to quote the AID report again, "It must be recognized that assistance agencies have ignored the principles [of effective resource management], and the consequence of indiscriminate support has produced negative results or, on occasion, disaster."

The symptoms of distress in the Sahel are easier to perceive than the underlying causes of the disaster. The six countries concerned -- Senegal, Mauritania, Mali, Upper Volta, Niger, and Chad -- are former French colonies that stretch along the southern edge of the Sahara desert. [See Figure 13.1.] The land is mostly semidesert that enjoys only 4 months of rainfall a year. But the grasses are sufficient to support the herds of cattle tended by the nomads, and in the southern regions millet and sorghum are grown, together with cash crops such as peanuts and cotton. By 1970, just before the collapse, the fragile steppe and savannah ecology of the six countries was supporting some 24 million people and about the same number of animals. This burden amounted to roughly a third more people and twice as many animals as the land was carrying 40 years ago. The agent of collapse was a drought -- the third of such severity this century -- which began in 1968 and cannot yet be said to have ended. The grasslands started turning to desert, the rivers dwindled to a trickle, and by 1972, the fifth year of the drought, people, cattle, and crops began to die. "Our country is already half desert and our arable lands left are extremely reduced," the director of Chad's water

and forestry resources told the FAO. By last year, Lake Chad had in places receded 15 miles from its former shorelines and split into three smaller lakes. The ancient cultural center of Timbuktu, a port fed by an inlet of the Niger river, was completely cut off and boats lay in the caked mud of its harbor. The nomads, forced to sell the surviving cattle that afforded their only means of subsistence, were reduced to the status of aimless refugees in camps around the major cities. Probably 5 million cattle perished, the staple grain crops produced low harvests, and nearly a third of the population faced a severe food shortage which, but for a massive infusion of relief supplies from the United States and other donors, would have ended in widespread famine.

Drought has clearly been the precipitating cause of the ecological breakdown in the Sahel, but attempts to blame the desiccation of the land wholly on the dry weather, or a supposed southward movement of the Sahara desert, do not quite hold water. A global weather change may indeed have squeezed the Sahel's usual rain belts southward, as climatologists such as H. H. Lamb argue, or, as others believe, the drought may be no more than an extreme expression of the Sahel's notoriously variable climate. The Sahara desert may indeed appear to be advancing downward into the Sahel—at the rate of 30 miles a year, according to a widely quoted estimate (which works out at 18 feet per hour). But the primary cause of the desertification is man. and the desert in the Sahel is not so much a natural expansion of the Sahara but is being formed in situ under the impact of human activity. "The desertification is man caused, exacerbated by many years of lower rainfall," says Edward C. Fei, head of AID's Special Task Force on Sahelian Planning. According to the French hydrologist Marcel Roche, "The phenomenon of desertification, if it exists at all, is perhaps due to the process of human and animal occupation, certainly not to climatic changes."

Perhaps the most graphic proof of man's part in the desertification of the Sahel has come from a curiously shaped green pentagon discovered in a NASA satellite photograph by Norman H. MacLeod, an ergonomist in American University, Washington, D.C. MacLeod found on a visit to the site of the pentagon that the difference between it and the surrounding desert was nothing more than a barbed wire fence. Within was a 250,000-acre ranch, divided into five sectors with the cattle allowed to graze one sector a year. Although the ranch was started only 5 years ago, at the same time as the drought began, the simple protection afforded the land was enough to make the difference between pasture and desert.

The physical destruction of the Sahel was not an overnight process. Its beginning can be traced to the French colonization of the late 19th century, when the Sahelian peoples lost with their political power the

control over their range and wells which was vital to the proper management of their resources.

The Sahel -- a term derived from the Arabic word for border--was once one of the most important areas of Africa. In the middle ages it was the home of the legendary trading empires of Ghana, Mali, and Songhai.

The key to the Sahelian way of life was a remarkably efficient adaptation to the semidesert environment. Although the nomads' life-style may seem enviably free to those who dwell in cities, there is nothing random about their migrations. The dry season finds them as far south as they can go without venturing within the range of the tsetse fly. Between the nomads and the sedentary farmers who also inhabit this area there is a symbiotic arrangement: The nomads' cattle graze the stubble of the crops and at the same time manure the fields. In exchange for manure the nomads receive millet from the farmers. With the first rains, the grass springs up and the herds move northward. The rains also move north and the cattle follow behind in search of new grass. According to Lloyd Clyburn of AID, "The migration continues as long as the grass ahead looks greener than that at hand, until the northern edge of the Sahelian rain belt is reached. When that grass is eaten off, the return to the south begins. This time the cattle are grazing a crop of grass that grew up behind them on their way north, and they are drinking standing water remaining from the rainy season." Back in their dry-season range the cattle find a crop of mature grass that will carry them for 8 or 9 months to the next growing season.

The traditional migration routes followed by the herds, and the amount of time a herd of given size might spend at a particular well, were governed by rules worked out by tribal chiefs. In this way overpasturage was avoided. The timing of the movement of animals was carefully calculated so as to provide feed and water with the least danger from disease and conflict with other tribal groups.

By virtue of what one writer has called "the essential ecological rationality of the nomadic pastoral regime," the herders made probably the best possible use of the land. The settled part of the population, the farmers, had an equally capable understanding of their environment. They knew to let the land lie fallow for long periods -- up to 20 years -- before recropping, and they developed an extraordinary number of varieties of their main staples, millet and sorghum, each adapted to different growing seasons and situations. Within the limits of their environment and technology, the peoples of the Sahel have, over the past centuries, demonstrated what University of London anthropologist Nicholas David calls "an impressive record

of innovation . . . which is quite at variance with the common negative criticism of the African as unduly conservative." In fact, when the Sahelian peoples have been conservative and resisted changes advocated by Western experts, it has often been with reason.

It could be absurd to blame the collapse of this intricate social and ecological system solely on Western interference, and yet rather few Western interventions in the Sahel, when considered over the long term, have worked in the inhabitants' favor. Those who have studied the farmers' and herders' traditional methods, says an FAO report on the Sahel, believe that the destructive practices that are now frequent are due to the cumulative effects of "over-population, deterioration of the climatic conditions and, above all, the impact of the Western economic and social system."

Western intervention has made itself felt in many ways, some inadvertent, some deliberate. Introduction of a cash economy had profound effects on the traditional system. The French colonial division of the Sahel into separate states has faced the nomad tribes with national governments which have tried to settle them, tax them, and reduce their freedom of movement by preventing passage across state boundaries. Curiously, however, it has been the West's deliberate attempts to do good that seem to have caused the most harm. The West in this case means the French, up until 1960, when the Sahelian countries were granted independence, and the French, Americans, and others thereafter. The French should probably not be held particularly to blame; they were only following conventional wisdom, and there is little reason to believe that other donor countries would have handled the situation very differently.

The salient impact is of course the increase in human and animal population that followed the application of Western medicine. The people of the Sahel are increasing at a rate of 2.5 percent a year, one of the highest rates of population increase in the world. If the nomads could have been persuaded to kill more of their cattle for market, the animal population might have been kept within bounds. Not foreseen was the fact that cattle are the nomads' only means for saving, and it in fact makes good sense -- on an individual basis -- for a nomad to keep as many cattle on the hoof as he can.

As a result herd numbers increased hand over fist in the decade following independence, aided by 7 years of unusually heavy rains. According to the FAO, the number of cattle grew from about 18 to 25 million between 1960 and 1971. The optimum number, according to the World Bank, is 15 million.

While the herders were overtaxing the pastures, the farmers were doing the same to the arable land. Population increase led to more

and more people trying to farm the land. An even sharper pressure was the introduction by the French of cash crops to earn foreign exchange. With the best lands given up to the cultivation of cotton and peanuts, people had to bring the more marginal lands into use to grow their own food crops. In many cases these ecologically fragile zones could not take the strain of intensive agriculture. The usual process is that the fallow periods of 15 to 20 years are reduced to five or even one. Fertility declines, slowly at first, and then in a vicious spiral. Poor crops leave the soil exposed to sun and wind. The soil starts to lose its structure. The rain, when it falls, is not absorbed but runs off uselessly in gulleys. Desertification has begun. "Let us be under no illusion," President Leopold Sedar Senghor of Senegal told a symposium on the African drought held in London last year, "the process of desertification had been precipitated since the conquest of Senegal [by the French], since the introduction of growing peanuts without either fallow or crop rotation."

What cash crops have done for the Sahelian farmland, deep borehole wells have done for the pasture. A thousand feet or more beneath the Sahel lie vast reservoirs of water that can be tapped by deep wells. Thousands of these boreholes, costing up to \$200,000 apiece, have been drilled across the Sahel by well-intentioned donors. The effect of the boreholes was simply to make pasture instead of water the limiting factor on cattle numbers, so that the inevitable population collapse, when it came, was all the more ferocious. "Few sights were more appalling at the height of the drought last summer," according to environmental writer Claire Sterling in a recent article in *The Atlantic*, "than the thousands upon thousands of dead and dying cows clustered around Sahelian boreholes. Indescribably emaciated, the dying would stagger away from the water with bloated bellies and struggle to fight free of the churned mud at the water's edge until they keeled over.... Enormous herds, converging upon the new boreholes from hundreds of miles away, so ravaged the surrounding land by trampling and overgrazing that each borehole quickly became the center of its own little desert forty or fifty miles square."

Overgrazing of the Sahelian pasturelands was a consequence of too many cattle having too little place to go. As the farmers spreading out from the towns took more land under cultivation, they tended to squeeze the nomads and their herds into a smaller strip of space. Moreover, the nomads' ability to manage their own resources was slowly slipping away. Government interference reduced their freedom of movement, and the boreholes threw into chaos the traditional system of pasture use based on agreements among tribal chieftains. With all the old safeguards in abeyance, the cattle numbers began to chew up the ecology across the whole face of the Sahel. First the

perennial grasses went. These usually grow up to 6 feet tall and put down roots as deep. If the plant is heavily grazed, its roots make a shallower penetration and, in dry periods, may fail to strike water. The perennial grasses are replaced by coarse annual grasses, but these, under heavy grazing and trampling, give way to leguminous plants that dry up quickly and cannot hold the soil together. Pulverized by the castles' hooves, the earth is eroded by the wind, and the finer particles collect and are washed by rains to the bottom of slopes where they dry out into an impermeable cement.

Desertification has been hastened by the heavy cutting of trees for firewood. Trees recycle nutrients from deep in the soil and hold the soil together. Slash-and-burn techniques--the only practical method available to the poor farmer for clearing land--are the cause of numerous fires which, according to a World Bank estimate, kill off 50 percent of the range grass each year.

Under these abuses, the Sahel by the end of the 1960's was gripped by a massive land sickness which left it without the resilience to resist the drought. A whole vast area which might with appropriate management have become a breadbasket providing beef for half of Africa instead became a basket case needing more than \$100 million worth of imported food just to survive.

The future prospects for the Sahel and its people are not very bright. Sahelian governments and the various donors have not reached any kind of agreement on long-term strategy for rehabilitation. Some donors--AID excepted--are still digging boreholes. Most of the development projects now under consideration were drawn up before the drought struck and are based on the unlikely assumption that when the rains return everything can go on as before. (A recent meeting of American climatologists concluded that planners should assume drought conditions in 2 years out of every 3.)

Much of the development money for the Sahel will have to come from the United States and France, but there seems to be little coordination or exchange of ideas between the two countries. Nor is there any general agreement on how the Sahel can be restored to self-sufficiency. Optimists, such as William W. Seifert of MIT, who heads a \$1million long-term development study for AID, believe that the Sahel could support its present human population provided that cattle numbers were reduced by a half or more. Unfortunately, there is no way, short of a major social upheaval, that the nomads will consent to reduce their herds. Projects involving controlled grazing, such as in the Ekrafane ranch, are impractical because there is not enough land to go around. AID plans to open up the lands to the south of the Sahel by clearing them of tsetse fly, but this would benefit only 10 percent of the population. Others are not so hopeful. "I don't think there is

much optimism that significant improvements can be expected in the short term. All you can do is to try to increase their margin for survival and hope that something turns up," says an agricultural specialist conversant with both the AID and MIT development plans.

"Neither the leverage of modern science and technology," concludes an in-house AID report on the Sahel, "nor the talents and resources of large numbers of individuals and institutions currently being applied to relevant problems has occasioned more than minor progress in combatting the natural resource problems and exploiting the undeveloped potential." Which is another way of saying that Western ideas for developing the Sahel have not proved to be a spectacular success. Its ecological fragility and the vagaries of its climate make the Sahel a special case. But there are many other areas in the world where unchecked populations are overloading environments of limited resilience. The Sahel may have come to grief so soon only because mistakes made there show up quickly. Other Western development strategies, such as the Green Revolution, are, one may hope, more soundly based in ecological and social realities. If not, the message of the Sahel is that the penalty for error is the same Malthusian check which it is the purpose of development to avoid, except that the crash is from a greater height. [11]

A curious feature of this excellent report is that nowhere does it specifically point out that the tragedy in the Sahel is precisely the tragedy of the commons, though the detailed account could hardly be improved upon as an illustrative example. The omission is especially curious because the report was published in *Science*, the journal in which "The Tragedy of the Commons" was published six years earlier.

The significance of Wade's report did not escape bioethicist Van Rensselaer Potter, who wrote in a letter to the editor: [12]

"The report on the Sahelian drought by Nicholas Wade . . . is a dramatic illustration of "the tragedy of the commons" as described by Hardin.

When I first read Hardin's article, I wondered if the users of the early English commons weren't prevented from committing the fatal error of overgrazing by a kind of "bioethics" enforced by the moral pressure of their neighbors. Indeed, the commons system operated successfully in England for several hundred years. Now we read that, before the colonial era in the Sahel, "overpasturage was avoided" by rules worked out by tribal chiefs. When deep wells were drilled to obtain water "the boreholes threw into chaos the traditional system of pasture use based on agreements among tribal chieftains." Thus, we see the tragedy of the commons not as a defect in the concept of a "commons" but as a result of the disastrous transition period between the loss of an effective bioethic and its replacement by a new bioethic

that could once again bring biological realities and human values into a viable balance. [13]

The distinction between the old way of treating common property in the Sahel and the new way can be seen in terms of the political responsibility table given in Chapter 9 (Table 9.1). In the old days, the Sahelian environment was managed approximately according to the system of Case II, using informal sanctions ("an effective bioethic," in Potter's words). Then, as a result of intervention by well-meaning men of the European culture, part of the environment -- the grazing land -- was changed to Case III management, with the usual tragic results. Mind-boggling photographs of the earth from space played an important role in bringing home this tragedy. There is no necessary logical connection between a mere photograph and the idea of conservation; but, as Marshall McLuhan has said, "The media is the message" and in our visually oriented society a striking photograph can become the symbol of an idea or a program.

In 1965, shortly before his death, while he was the U.S. Ambassador to the United Nations, Adlai Stevenson made a most memorable statement:

"We travel together, passengers on a little spaceship, dependent on its vulnerable reserves of air and soil; all committed for our safety to its security and peace; preserved from annihilation only by the care, the work and, I will say, the love we give our fragile craft."

The "we" of this statement is presumably all of the earth's inhabitants. It became a cliché of environmental activism to place Stevenson's statement alongside a blow-up of a NASA photograph of the earth as seen from space. The message implicit in this justification was evidently something of this sort: "This little blue ball, this unity, this Earth must surely be treated as a unity." What the activists did not realize was that they were calling for treating the earth as a commons -- with all the perils that implies.

The atmosphere and the seas are certainly global commons, but (as we have seen) global methods for managing them have not yet been devised. As regards environmental problems generally, Raymond Dasmann has remarked that "Those of us in international organizations are likely to assume a globalist viewpoint." Dasmann, who is himself a member of such an organization, then goes on to point out that "only a few environmental problems are really global in nature." When one realizes this, one is apt to ask rather interesting questions about the motivation of people who insist on treating nonglobal questions globally.

Faint beginnings of a shift in public attitude could be detected

following the reproduction of the NASA photograph that showed the green hexagon in west Africa referred to in Wade's article. The resolution of this photograph from space was not very good, but its meaning was clear. The green part was restricted to the area protected (as private property) from uncontrolled grazing, while the dead-looking area around it was an unmanaged commons. Follow-up ground surveys verified this interpretation and noted the effect of environmental degradation on the grazers, the cattle. As William Forster Lloyd had cogently asked in 1833: "Why are the cattle on a common so puny and stunted? Why is the common itself so bare-worn, and cropped so differently from the adjoining inclosures?" For more than three centuries intellectual and emotional fashions have increasingly veered toward the global outlook. Our thoughts have been significantly molded by John Donne's "No man is an island . . ." and Karl Marx's ". . . to each according to his needs." The thoughts engendered by these banners are generous thoughts, whereas speaking of local responsibility for local environments seems to many to be a miserly and selfish way of looking at the world's problems. There are a thousand to praise generosity for every one who has a kind word to say for selfishness. Yet biology clearly tells us that survival requires a respect for carrying capacity, and points to the utility of territorial behavior in protecting the environment and insuring the survival of populations. Surely posterity matters. Surely there's something to be said for selfishness.

Altruism versus selfishness: It is all too easy to polarize the argument, to maintain the univalence of facts. But the facts are ambivalent, as wise men have recognized for millennia. A Talmudic saying puts the matter rather well:

If I am not for myself, who will be for me?
If I am for myself only, what am I?
If not now -- when?

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7. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, and William W. Behrens III, 1972. *The Limits to Growth*. New York: Universe Books.

8. Mihajlo Mesarovic and Eduard Pestel, 1974. *Mankind at the Turning Point*. New York: Dutton. Unlike the "first report to the Club of Rome" (note 7 above), the "second report" does not aggregate the world's natural resources but seeks to deal with them on a regional basis. In going from facts to implications, however, this second report is not always consistent. See Garrett Hardin, 1975. "Will humanity learn from nature?" *Sierra Club Bulletin*, 60 (8):41-43.

9. It is one of the ironies of history that those who are generally labeled as economic "conservatives" at the present time are people who believe in limitless growth and hence see no need for what scientists regard as truly conservative thinking, that is, thinking in which the variables are conserved, and in which equations balance. For a particularly emotional defense of the conventional wisdom see Melvin J. Grayson and Thomas R. Shepard, Jr., 1973. *The Disaster Lobby: Prophets of Ecological Doom and Other Absurdities*. Chicago: Follett.

A book with a similar message, by the editor of the English journal *Nature*, is more sophisticated but scarcely better: John Maddox, 1972. *The Doomsday Syndrome*. New York: McGraw-Hill. For the most intellectual criticism of the limits to growth thesis see H. S. D. Cole, Christopher Freeman, Marie Jahoda and K. L. R. Pavitt, 1973. *Models of Doom: A Critique of The Limits to Growth*. New York: Universe Books. This, the American edition of the "Sussex Report", has the merit of including a postscript by the Meadows, et al. that throws much light on the nature of the controversy.

10. Nicholas Georgescu-Roegen, 1971. *The Entropy Law and the Economic Process*. Cambridge, Mass.: Harvard University Press. This is the only book published to date that sets economic theory on a firm foundation of thermodynamics, thus bringing together economics and ecology. (Etymologically, this is as it should be, since both words use the Greek root *oikos*, home. Both are concerned with the management

of the "home," which classical economics sees almost entirely as made up of men only, with other organisms and the physical environment playing the role of "givers" -- to which little attention is given. In the perspective of ecology, however, all organisms, as well as nonliving elements of the environment, are viewed as coexisting and interacting variables in this earthly home of ours.)

11. Nicholas Wade, 1974. "Sahelian drought: no victory for Western aid." *Science*, 185:234-237. Copyright 1974 by the American Association for the Advancement of Science.

12. Van Rensselaer Potter, 1974. "The tragedy of the Sahel commons." *Science*, 185:183. Copyright 1974 by the American Association for the Advancement of Science.

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.....AND THE ECOLOGICAL FOOTPRINT CONCEPT

d) OUR ECOLOGICAL FOOTPRINT
(from: © 2003-2007 Global Footprint Network
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Last Updated: 10/17/2006)

The Ecological Footprint is a resource management tool that measures how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes under prevailing technology.

In order to live, we consume what nature offers. Every action impacts the planet's ecosystems. This is of little concern as long as human use of resources does not exceed what the Earth can renew. But are we taking more?

Today, humanity's Ecological Footprint is over 23% larger than what the planet can regenerate. In other words, it now takes more than one year and two months for the Earth to regenerate what we use in a single year. We maintain this overshoot by liquidating the planet's ecological resources. This is a vastly underestimated threat and one that is not adequately addressed.

By measuring the Ecological Footprint of a population (an individual, a city, a nation, or all of humanity) we can assess our overshoot, which helps us manage our ecological assets more carefully. Ecological

Footprints enable people to take personal and collective actions in support of a world where humanity lives within the means of one planet.

The Challenge and the Goal: Sustainability

Sustainability is a simple idea. It is based on the recognition that when resources are consumed faster than they are produced or renewed, the resource is depleted and eventually used up. In a sustainable world, society's demand on nature is in balance with nature's capacity to meet that demand.

When humanity's ecological resource demands exceed what nature can continually supply, we move into what is termed ecological overshoot. According to a report by the World Resources Institute, the United Nations Environment Programme, the United Nations Development Programme, and the World Bank, *World Resources 2000–2001, People and Ecosystems: The Fraying Web of Life*, in addition to the growing depletion of non-renewable resources such as minerals, ores and petroleum, it is increasingly evident that renewable resources, and the ecological services they provide, are at even greater risk. Examples include collapsing fisheries, carbon-induced climate change, species extinction, deforestation, and the loss of groundwater in much of the world.

We depend on these ecological assets to survive. Their depletion systematically undermines the well being of people. Livelihoods disappear, resource conflicts emerge, land becomes barren, and resources become increasingly costly or unavailable. This depletion is exacerbated by the growth in human population as well as by changing lifestyles that are placing more demand on natural resources.

Our Approach to Sustainability: Resource Accounting

Keeping track of the compound effect of humanity's consumption of natural resources and generation of waste is one key to achieving sustainability.

As long as our governments and business leaders do not know how much of nature's capacity we use or how resource use compares to existing stocks, overshoot may go undetected – increasing the ecological deficit and reducing nature's capacity to meet society's needs.

The Ecological Footprint is a resource accounting tool used to address underlying sustainability questions. It measures the extent to which humanity is using nature's resources faster than they can regenerate. It illustrates who uses how much of which ecological resources, with

populations defined either geographically or socially. And, it shows to what extent humans dominate the biosphere at the expense of wild species.

The Ecological Footprint clarifies the relationship of resource use to equity by explicitly tying individuals' and groups' activities to ecological demands. These connections help decision makers more accurately and equitably shape policy in support of social and environmental justice.

Continued overshoot is not inevitable. The Ecological Footprint provides a systematic resource accounting tool that can help us plan for a world in which we all live well, within the means of our one planet.