

Working Paper

From Malthus to Sustainable Growth

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August 1991



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ABSTRACT

Running parallel to the economic theory of development, from Adam Smith to the present, has been expression of concern, what may be called an ecological preoccupation, about the capacity of the planet to support the increasing human population and to withstand the operations humans were carrying out on it. For Malthus this focussed especially on limits to food supplies, for his successors on limits of other raw materials, most recently on the sensitive dynamics of the planet.

At the start there was no problem of communication between the economic and the ecological side; the same scholars wrote on both and they could be consistent with themselves. But in the past two or three decades the two sides have diverged. It would be too much to say that a debate is going on, for a debate requires that each side answer the points raised by the other, and that does not seem to be happening. How can the conditions for debate be established, and the public understanding and democratic decision making advantages of a debate be secured.

The simple answer is for each of economists and biologists to acknowledge the results of the other in the field of its expertise, and to build its theory around these.

That may ultimately lead to an overall consensus formula for sustainable development. But with the amount of knowledge now at hand and for a considerable time in the future the best we can hope for is incremental steps towards sustainability that are at least in the right direction. Some ten such steps are suggested.

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Nathan Keyfitz

THE CHANGING MEANING OF LIMITS

Limits to the numbers and prosperity of mankind depend on technology, and a limit that seems to crowd mankind into a small space in one epoch can suddenly widen with some innovation, while some other more imminent limit makes its appearance well inside the first. For Malthus the limit on population numbers was food, and he saw availability of food as in all times and ages drawing a line beyond which mankind could not numerically expand. At their own choice peoples could press against that line, or they could stay well inside it. Long before the food limit was reached Malthus foresaw misery, as though within the boundary that surrounds us is a ring of increasing trouble. Like other economists of his time, Malthus did not foresee the technical changes of the 19th and 20th centuries.

As the 19th century advanced it came to be thought that minerals set a limit (for Jevons it was coal), from the viewpoint of economic progress a closer limit than food. But with the advance of technology and observation of the possibilities of substitution the minerals limit has moved far out, so far that it can be disregarded for all minerals except oil. Water is essential, and in particular fresh water is one resource that cannot (yet) be substituted, that is in some parts of the world already making life miserable.

Just as it is desirable to run an engine at a cruising speed that is considerably less than its top speed, so there are many advantages in not pressing against the world population carrying capacity, whatever that may be. In terms of the limits concept, this translates into having mankind's numbers stay well within the boundaries set by the concentric circles of the various kinds of life sustaining resources. Of these reasons the most important is our ignorance of just what we are doing to the terrestrial support systems on which we press; in our ignorance we may unwittingly be bringing some other limiting circle uncomfortably close to us.

The Green Revolution is to be interpreted as a moving outward of the food limit to population. But localities must be differentiated, for some countries and parts of countries have little access to world supplies. We had better think of each area having its set of concentric circles, representing the various limits to which it is subject, and for some the food limit is very close.

¹Expanded version of a chapter submitted for People of Europe: History of European Specificity in a World-Wide Context, Vol. 3, The Environment and Sustainable Growth, to be published (in Italian) by the Istituto Poligrafico dello Stato, Rome.

If we recognize the power of technology, but admit that the devising and application of technology requires capital, then capital sets limits, especially to the population that can prosper. The current shortage of capital in the world brings all the limiting circles closer, i.e. reduces the possible population on the one side, and reduces welfare even if densities are much lower than are possible.

To establish the boundaries set by various essentials for human life that are finite in quantity is a complex matter, as many of those that write about carrying capacity do not sufficiently recognize. The circles that bound us are constantly in motion, with the advances of technology and changes in natural conditions, many of them initiated by human action. The global warming of the next century will probably bring closer the food limit for the world as a whole, and will certainly bring it closer for many localities. In the face of complexities and uncertainties, and without any deeper knowledge than we now possess, it is fortunate that some actions can be clearly specified, some sequences of behavior initiated, that unambiguously push outward the circles limiting population and prosperity, irrespective of what the ultimate total solution of the overall environment problem may turn out to be.

WHAT MALTHUS REALLY SAID

Malthus is not a name beloved in social science. The strongest testimony to his unpopularity is the way he is misquoted, apparently by people who find him so objectionable that they will not read him, and instead of using his words they construct phrases for him that they can easily refute. Thus one reads that "Malthus says that the human population will outgrow its food supplies." Even stronger, in the writing of one of my colleagues:

Malthus foresaw that population growth would eventually outrun the carrying capacity of the earth.

As I read Malthus, he would have said that the statements so attributed to him are self-contradictions--population cannot outrun carrying capacity by definition. What he said in his 1798 Essay² was that population tends to press against carrying capacity (what he called the means of subsistence.) It was the pressure of population that would keep people poor and death rates high. His thesis to this effect was adopted by Darwin,³ but Malthus himself branched off on a different path in the later editions of his Essay, that were wholly different books. I submit that the real Malthus was not the exuberant youth who wrote the first edition, but the scholar who expressed his more mature broodings and empirical observations in the subsequent series. The first Essay was a purely biological model; the later

²A convenient version of the first edition of the Essay: Malthus, Thomas Robert. [1798] 1967. Population: The First Essay. With a foreword by Kenneth E. Boulding. Ann Arbor: University of Michigan Press.

³In his Autobiography Darwin says that on reading Malthus "At last I had got an idea by which to work."

books were genuinely inter-disciplinary, among the few clear examples of that much abused term.

The way that Malthus made his later work interdisciplinary, in fact a genuine biological-social model, was by introducing the notion of preventive checks. He lived in the time of the Enlightenment, and some of its spirit appears in his writing. For instance he strongly favored education of the masses, when many of his countrymen thought that education was a threat to social stability. Malthus saw educated people as more able to exercise childbearing restraint, and dozens of studies in our own day show this--especially with emphasis on the education of women. Above all, Malthus saw people as having choices. None of this reading of Malthus is original with me. To quote one source:

Thomas Robert Malthus was one of the few theorists of population who was aware of the fact that the "natural desire for children" can be modified by human reason, i.e. that such a desire is not natural at all.⁴

I will show various directions in which we have to supersede Malthus, but the dilemma that he posed is going to remain with us for a long time, even though its form will change. A title such as, "Laying the Ghost of Malthus," also due to a colleague of mine, may help to sell books, but a scholar wants to know why it is that despite all that has happened since, the ghost of Malthus still walks abroad.

To appreciate the sheer logical elegance of Malthus' argument, without necessarily accepting his conclusion, we open the original edition of the Essay and read in its first few paragraphs:

Population, when unchecked, increases in a geometrical ratio. Subsistence increases in an arithmetical ratio.... By that law of nature that makes food necessary to the life of man, the effects of these two powers must be kept equal. This implies a strong and constantly operating check on population from the difficulty of subsistence.

Nothing here about mankind outrunning its food supplies, let alone the earth's carrying capacity. That would only be possible if the surplus individuals could exist without food. Malthus may be right or he may be wrong, but he is not a simple-minded fool. He was always aware that his radical ideas would be criticized, and chose his words with the utmost care, and always in anticipation of what his opponents would come up with. One of the fascinating things about his writing is the way that he sets up defenses--outer walls, battlements, moats, traps of all kinds--to make the fortress of his thought impregnable to any logical onslaught, and then subsequently to any refutation by data.

⁴Heinsohn, G. and O. Steiger. 1983. The rationale underlying Malthus's theory of population. Pages 223-232 in Malthus Past and Present, edited by Jacques Dupâquier. London: Academic Press.

Consider for example, the first sentence quoted above, about population increasing in a geometrical ratio. Malthus knew that people would say it does not in fact so increase, and would give his opponent numbers to show growth rates slowing down over time. He covered himself on that by putting in the words 'if unchecked,' so placing his assertion beyond any possibility of contradiction.

I am not trying to persuade the reader that Malthus is right, but only to give him or her respect for his mode of thought and his literary style. Though logically unanswerable, the assertion of the first sentence quoted above is still substantively wrong, since in human populations growth is indeed checked, and that nearly everywhere. I repeat that Darwin, looking for a theory to apply to population in general, seized on this phrase of Malthus, and it remains a fundamental part of biology to the present day, while Malthus turned away from this initial phase of his work. He had no ambition to be a biologist, so as history shows he left it to Darwin writing 60 years later to be the inheritor of the first edition of the Essay. Malthus himself took a turn that would make his theory fit the human capacity for foresight and conscious adaptation.

He did this by his notion of 'preventive checks.' We talk much of the importance of interdisciplinary models for dealing with real problems, rarely recalling that Malthus had one of the first and best more than a century before 'interdisciplinary' became part of our European languages. He saw constant pressure of population against food and other resources, but mankind seeing what is coming limits its progeny.⁵

Malthus thought, and the view held until well after World War II, that food supplies depend on the extent of territory, and once all the good land was taken up an absolute limit to food supplies would have been reached. With the enormous increase in yields resulting from the Green Revolution that view has become untenable. That brings us, as implied above, to what is really wrong with Malthus: he failed to anticipate high-yielding varieties of rice and wheat, along with synthetic fertilizers. But he had good company among students of agriculture. As recently as the 1930s few experts foresaw the enormous increase that lay just ahead in the productivity of land, its yield. As for the returns to labor, writers refused to believe that productivity of agricultural workers could match those in secondary industry. If the phenomenal gains in farm yield, both per worker and per hectare, could not be anticipated even two decades before, we must exonerate Malthus for failing to anticipate them.

⁵In one sense we are all Malthusians. The Catholic Church professes not to be, and yet its celibate priesthood was an effective instrument for holding down population in a time when priests were numerically significant, and when monogamy was the rule. Malthus approved of celibacy, but he did not approve of contraception. Unable to bring himself even to mention it directly, he criticizes the "method described by M. Condorcet" as taking the tension out of life, a French device for making pleasure too easy. It could well be used on the Continent by decadent Europeans, but was not for the morally rugged Englishman. In fact it was more than a century after the death of Malthus before contraception would be publicly mentionable in any country and laws against it taken off the books.

Yet even though wrong on food, Malthus had a grip on a more general threat, one that is still hanging over us, and that will apply to the end of time irrespective of any miracles of technology. As the food limit is pressed further into the future by technology that in turn is pushed by the market, a succession of other limits come into sight. We are relieved of worry about starvation (with some exceptions to be mentioned later) but what about energy, and beyond that about global warming, or the ozone layer? If not now then very soon we had better start to think of the ecosphere in which all our activities are seated as small in relation to the 10 billion people who will be seeking to live in it by the year 2050. As small even now in relation to the billion or so people who are 'developed', modern, mobile, using the instruments of high technology.

We can argue whether the place of food in the Malthusian scheme is taken by fuels, fresh water, breathable air, or a planet whose essential dynamics are seriously interfered with at our peril, but it cannot be denied that with the pushing back of the Malthusian limit of food other limits have to be faced.

CARRYING CAPACITY

To a farmer nothing is plainer than that his pastures have a certain carrying capacity, a maximum amount of beef or milk they can produce. The farmer brings to bear his considerable knowledge of animal nutrition (probably better than our knowledge of human nutrition) and uses an engineering type of calculation to decide the number of his cows.

Revelle⁶ takes up the population-carrying capacity of the world as a whole, starting with the energy of sunlight, going through its transformation into primary (cereal) food energy, up to its availability for support of populations. His energy conversion process is modeled on that of an Iowa farmer, and he leaves open how the gap between the present 5 billion world population and the 30 billion physical potential can be covered.

The notion of carrying capacity is congenial to natural scientists and an irritation to social scientists. To biologists or agriculturalists used to studying the capacity of pasture lands to maintain livestock, it seems natural to take it as Malthus did that beyond a certain population in a given area growth will bring misery. Those who sponsor this view tend to downplay trade, but even if trade is admitted there must be a certain carrying capacity for the world as a whole, say those who write along this line. Thus a background paper by Kirchner to the 1984 World Development Report starts:

The carrying capacity of a particular region is the maximum population of a given species that can be supported indefinitely, allowing for

⁶Revelle, Roger. 1975. Will the earth's land and water resources be sufficient for future populations? Pages 3-14 in The Population Debate: Dimensions and Perspectives, Volume 2. Papers of the World Population Conference, Bucharest, 1974, 2 Volumes. New York: United Nations.

seasonal and random changes, without any degradation of the natural resource base that would diminish this maximum population in the future. The concept of carrying capacity is familiar to biologists and wildlife managers.... With modifications, it is also an important measure of the ability of regions to support human populations.⁷

The economic viewpoint stands in contrast to this, and one branch of the debate concerns food resources and the effects of MDC extravagance in converting the largest part of its grain calories into meat. D. Gale Johnson⁸ makes the point that curbing this extravagance would be a mistaken policy: if the industrial countries had held down their indirect grain consumption there would have been less produced, reserve stocks would have been smaller, and the institutions required to handle grain exports would not have taken their present shape. In a sense American extravagance in meat consumption results, through the market, in a world reserve against famine.

The argument is unassailable on its terms, but the terms change once the environment is brought in. The loss of soil and of water, the poisoning of streams, etc., are a different and more difficult matter.

THE MODEL BUILDERS

The classical economic tradition of population study, concerned with the limits to land and hence to food supplies, sensing the impossibility of indefinite exponential increase, has now passed to scholars of other disciplines. An early widely read exposition was due to the Meadows and sponsored by the Club of Rome.⁹ It was followed by Mesavoric and Pestel¹⁰ and other writers. A similar spirit animated a later investigation led by Barney.¹¹ International organizations, especially the ILO, came into this, and many models were built for, or in any case applied to, particular countries; among these the BACHUE models are the most often cited. On the other side, Kahn and Wiener¹² attracted attention with a model in which population was no great obstacle to economic growth.

⁷World Bank. 1984. World Development Report 1984. New York: Oxford University Press.

⁸Johnson, D. Gale. 1974. World Food Problems and Prospects. Washington, D.C.: American Enterprise Institute.

⁹Meadows, D.H., D.L. Meadows, J. Randers, and W.W. Behrens III. 1972. The Limits to Growth. New York: Universe Books.

¹⁰Mesavoric, M., and E. Pestel. 1974. Mankind at the Turning Point. New York: E.P. Dutton.

¹¹Barney, G.O. 1980. Global 2000: The Report to the President, Entering the 21st Century. Washington, D.C.: USGPO.

¹²Kahn, Herman, and Anthony J. Wiener. 1967. The Year 2000: A Framework for Speculation on the Next Thirty-Three Years. New York: Macmillan.

The acknowledged antecedent of the Club of Rome model-building was Jay W. Forrester.¹³ Population is central for Forrester. He has feedback loops in which population is respectively controlled by crowding, pollution, food supply, natural resources. Any one of these can bring the exponential population growth to a halt, indeed cause sudden and tragic collapse of population (Chapters 2 and 4). "The Malthusian thesis has been true and is at work at all times" (p. 27).

Forrester explains the suddenness of reaching "crisis level" by the property of an exponential, for instance one that doubles every 50 years (p. 3). "Even though nothing has changed in the underlying law which until then has governed growth...within one lifetime, dormant forces within the world system can exert themselves and take control" (p. 5); "food...has been potentially sufficient throughout all of history," yet suddenly we have a "starvation crisis" (p. 7). Though conditions do not now appear exceptionally bright, yet in comparison with both past and future "we may now be living in a 'golden age'" (p. 11):

There may be no realistic hope of the present underdeveloped countries reaching the standard of living demonstrated by the present industrialized nations.... With four times as many people...their rising...could mean an increase of 10 times in the natural resource and pollution load on the world environment. (p. 12)

DO POPULATION CONTROL AND CONSERVATION OF THE ENVIRONMENT MATTER?

Answers given by eminent scholars to the question whether population matters vary all the way from something like

Yes, but only to the extent that environment damage may lower the growth of the economy by 1 percentage point at most, and since we are not sure even of that the whole subject can safely be subordinated to the installation of proper economic policies¹⁴

to

Yes, to the point where climate and other parts of the terrestrial dynamics drastically alter their functioning, and much of the planet is turned into desert.¹⁵

¹³Forrester, Jay W. 1971. World Dynamics. Cambridge: Wright-Allen Press.

¹⁴A slightly caricatured rendition of the spirit of National Research Council, Working Group on Population Growth and Economic Development, Committee on Population. 1986. Population Growth and Economic Development: Policy Questions. Washington, D.C. National Academy Press.

¹⁵The view expressed by eminent biologists Ehrlich, Paul R. and Anne H. Ehrlich. 1990. The Population Explosion. New York: Simon and Schuster, is representative of the thinking of biologists in general.

On what should be done about it the answers vary correspondingly, from Nothing, or at most very little¹⁶

to

Alter the way of life world wide to styles that are innocuous to the planetary processes,¹⁷ and in addition lower the birth rate to the point where the world population is stabilized at about its present level or even reduced by rigorous birth control.¹⁸

I shall not here make reference to all of the multitude of scholarly writings that carry these extreme messages, or messages intermediate between them, having done so in an earlier paper.¹⁹ Here it is enough to say that the only writers considered in establishing the spectrum of current thought are scholars of established reputation, and the differences among them are sharp.

Given their eminence one can only be surprised at the absence of civility in the style of discussion. Neither side sees the arguments of the other as rational. William Baumol of Princeton speaks of "many hysterical predictions about our environmental future" (back cover of Simon²⁰) and Harold Barnett of "popular press books with their whole array of crisis allegations" (same back cover). Says Simon:

The Limits to Growth²¹ simulation...is not worth detailed discussion or criticism...[it is] public relations hype...[and the Club of Rome] scared many people with these lies.²²

¹⁶Many economists, including Srinivasan, T.N. 1987. Population and food. Page 24 in Population Growth and Economic Development: Issues and Evidence, edited by D. Gale Johnson and Ronald D. Lee. Madison, Wis.: University of Wisconsin Press.

¹⁷My summary statement of Commoner, Barry H. 1971. The Closing Circle: Nature, Man, and Technology. New York: Alfred A. Knopf.

¹⁸Ehrlich and Ehrlich, op. cit.

¹⁹Keyfitz, N. 1991. Population and development within the ecosphere: One view of the literature. Population Index 57(1):5-22 (Spring).

²⁰Simon, Julian L. 1981. The Ultimate Resource. Princeton, NJ: Princeton University Press.

²¹Meadows, et al., op. cit.

²²Simon, op. cit., p. 286.

And the same applies to other work, entirely unrelated to the Club of Rome: Global 2000's²³ conclusions are "almost wholly without merit and the method shoddy." The style of debate, a debate between adherents of different disciplines for the most part, like different religions that pour anathemas on one another, is that neither can fit the other into its own schemes, or discuss it in its own language. The language of economics has evolved in such a way as to provide no place for ecology, and that of ecology can find no way within its vocabulary to express such economic concepts as substitution, price, or effective demand.

But perhaps the matter can be resolved in international conferences, in which scholars and officials sit down together, often specifically to arbitrate such differences? Unfortunately it seems to be a matter of sheer chance which group takes hold in any given meeting, and for the collectivity of such meetings the differences are simply carried over. Thus the Brundtland Report²⁴ put the population and the environment questions at the top of the world's priorities, while on the other hand the United Nations' recent special session²⁵ makes virtually no reference to either population or environment. Given approximately equal numbers of official reports that say "control population as a first priority," and "other things are much more important," they offer little net help to deciding a major question of our time.

We cannot adjudicate the question by noting the eminence or the seriousness of the writers on the two sides. Nor can we count the votes of members of national academies,²⁶ or the writings in reputable scientific journals. On the whole those who urge us to modify our practices both of consumption and reproduction on the grounds that the environment cannot stand what we are now doing to it are biologists, while those who tell us that we can safely continue with impunity, at the worst suffering some loss of income, are economists.

I repeat that those taking opposite sides are respected scholars,²⁷ and the considerations they raise are often highly technical and by no means easy for the layman to follow. Yet the conclusions call for drastic action, action that can only be responsibly performed by national administrations when they have the support of

²³Barney, *op. cit.*

²⁴Brundtland, G.H. (Chairman). 1987. World commission on environment and development. Our Common Future. Oxford, U.K.: Oxford University Press.

²⁵Report of the Special Session of the United Nations on Revitalizing Economic Growth in the Developing Countries. 1990. Population and Development Review 16(2):379-84 (June).

²⁶My guess is that a vote in the several national academies of the industrial countries would overwhelmingly favor more expenditure on birth control programs, and more serious efforts to change consumption patterns in the interest of conserving the environment. But resolving the question by vote, however eminent the jury of scholars, is not the usual method of science.

²⁷Even though they are far from respectful to one another in their writings.

large constituencies, even of majorities of their electorates. Here is a nightmare for democratic politics: what action to take on vital questions where the experts disagree violently.

Many, including no less than the President of the United States, say that in this situation nothing should be done until more evidence comes up on which the issues can be resolved. We have to wait until we are surer of the facts. But that can be dangerous, especially insofar as the damages under discussion are irreversible. Is mankind to stand there like a hiker in the path of a raging bull, hypnotized so that he cannot move out of the way? This paper will argue that the disagreement of the experts need not transfix the citizen; that the citizen can in fact resolve the question even though the experts cannot. Once one understands that the experts differ because of a defect in the organization of scientific knowledge then one can take the question into one's own hands and provide the necessary information, indeed pressure, to the politicians.

The experts can be bypassed by taking it for granted that they are each right within the framework of their own discipline, and we seek to go beyond their disciplines to find out what is right in a broader framework. To do this we must examine their arguments, accept what each side says that corresponds to the specialized knowledge of its own discipline, but accept nothing beyond that.

THE MORE POPULATION THE BETTER ON ONE ECONOMIC MODEL

Let me give a simplified example of the approach. Think of an economic model in which population is growing, say at rate $100x$ percent per year, and that the growth of productivity, due to greater skill and better tools, is $100y$ percent per year. Suppose also that land is effectively infinite, and physical capital is made by the labor force,²⁸ so no separate provision for land or capital is required in the model. Then income per head will grow at $100y$ percent per year, and total income by $100(x+y)$ percent per year.

There can be no question of the advantage of a large and growing population on this model. Not the smallest advantage is that errors of investment through misjudging which sector is going to grow will be quickly rectified; excessive investment in any sector will be underutilized for only a short time before the population and its buying power catch up. One could go on to list other advantages of growth, for instance the ever increasing demand would ensure full employment for each new generation as it came along. On this model there can never be too

²⁸Perfectly reasonable arguments in this direction have appeared in the work of Kuznets: Kuznets, Simon. 1967. Population and economic growth. Proceedings of the American Philosophical Society 111(3):170-193, and also: Kuznets, Simon. 1975. Population trends and modern economic growth--Notes towards a historical perspective. Pages 425-433 in The Population Debate: Dimensions and Perspectives. Papers of the World Population Conference, Bucharest, 1974, 2 Volumes. New York: United Nations.

many people. For development defined in this sense population growth is not merely neutral; it is strongly favorable.²⁹

UNEMPLOYMENT

But the above model is much simpler than those of economics. Writers typically concede the difficulty in tracking causes and consequences. To Alvin Hansen,³⁰ Simon Kuznets³¹ and others we owe the proposition that the great prosperity and high employment of the 1920s and earlier was due in important part to the relatively rapid growth of population in the Western World, while the depression, and hence the unemployment, of the 1930s was as much as anything due to the low birth rates of that epoch, i.e. the slowing of population growth.

Yet other writers take for granted quite the opposite proposition: that it is rapid population growth that causes unemployment. Thus Pravin Visaria, writing in the Population Bulletin of the United Nations, says that

One of the most serious consequences of the acceleration in population growth is the difficulty of generating adequate employment opportunities for the growing labor force. (page 7)³²

On the testimony of some Third World leaders it was the pressure for creation of jobs, especially for city educated youth, that led to the great amount of borrowing in the 1970s, and hence the debt crisis of today. They see each birth today as a youth with high school or college training twenty years hence, and for whom the means to provide a job are not in sight. The potential political unrest that the situation is causing and likely to cause in the future preoccupies the governing elites in cities from North Africa to Southeast Asia.

The press is full of such attributions of unemployment to too many preceding births and much is said on the resulting social unrest, for instance in the Maghreb:

²⁹Ester Boserup has adduced cases in which population growth has been a stimulant to economic development: Boserup, Ester. 1981. Population and Technological Change. Chicago: University of Chicago Press. What seems to have happened in these cases is that population pressure induced modification of institutions in the direction of private property, an effect that is clearly not universal. Unfortunately Boserup has had followers who generalized the result with no authorization from Boserup's data or their own.

³⁰Hansen, Alvin. 1938. "Economic Profess and Declining Population." Presidential Address to the Economic Association of America.

³¹Kuznets, Simon. 1979. Growth, Population, and Income Distribution: Selected Essays. New York: W.W. Norton and Company.

³²Visaria, Pravin. 1989. Population theory and sustainable development. Population Bulletin of the United Nations 27:1-29.

...ils essaient de convaincre leurs voisins européens, et singulièrement la France, de la nécessité de mettre sur pied, pour le bénéfice de tous, une ambitieuse politique de développement économique....

Moins de chômeurs, c'est aussi moins de mécontents, et, partant, moins d'islamistes puisque c'est aujourd'hui, de l'autre côté de la Méditerranée, la manière dont tous les laissés-pour-compte expriment, faute de mieux, leur ras-le-bol.

Que les intégristes soient finalement réduits au silence par des mesures répressives, comme on le voit en Algérie et en Tunisie, ne résoudra rien au fond. Des millions de désœuvrés continueront de tourner dans leur pays comme lions en cage, enragés de voir se fermer peu à peu devant eux les frontières d'une Europe familière, et prêts à jouer les mercenaires pour n'importe quelle cause.³³

Nor is it only a matter of different writers opposing their favored theories. The same writer can stand on both sides of this particular fence. Thus John R. Hicks³⁴ says that "Overpopulation through shortage of land is one of the great causes of poverty there is in the world", but on the other hand and a few pages later in the same book, "It is not impossible that the slowing-up of population increase may have been one of the things responsible for the exceptional unemployment which occurred during the 1930s."

Intelligent writers can argue such apparent contradictions because they take their basic starting points in different entities. Those who see the positive side of population growth, especially for employment, are thinking of the fact that more people means more demand for goods, and that demand will draw people into the making of the goods that will satisfy it. The effect here is very immediate, a matter of months, or at most a very few years.

On the other hand if one starts at the labor supply end, treating demand as relatively stable, then the growth of population adds all those people to the labor force, and since they start with little money, their needs do not create opportunities. All sorts of things are needed by the increased population, but the effective demand, i.e. money in the hands of those who have the need, is lacking.

For the Third World administrator the place to start is with capital: build the factories, hire the workers and start producing the goods, and the people employed in the factories will have both the needs and the wages and will buy the goods that they are collectively producing. But unfortunately the amount of capital that can be raised by any method within their reach simply does not cope with the huge amount of unemployed youth that is coming into sight.

³³Le Monde, July 12, 1991, p. 1.

³⁴Hicks, John R. 1971. The Social Framework. 4th Edition. Oxford, England: Clarendon Press, pp. 56 and 59.

A part of the reason is the huge disproportion between the kind of physical capital to be bought in the world today, with its limited job-making capacity, and the number of individuals seeking jobs. Scores of millions of dollars of investment in the copper mines of West New Guinea require a few hundreds of well-paid workers.

START WITH THE FINITE ENVIRONMENT

Now let us move over a model at the other extreme, that would start with the finite environment. The environment has been compared to a bank account with a fixed total credit, from which withdrawals can be made, but nothing can be added. What are called the nonrenewable resources--copper, aluminum, etc.--would seem to be fitted by the fixed bank account analogy. Yet strangely enough, this is just the part of the environment that seems to be giving the least trouble; except for oil, all the natural mineral resources are holding out well, and have every prospect of lasting in adequate quantities until in the course of time replacements for them come to be invented. If this were the whole story then the environment would sustain for a long time indeed the exponential growth of both population and affluence with a rate of disturbance of the environment equal to $100(x+y)$ percent. Growth on the economic model would not be hindered by the need to reconcile it with the environmental model.

Unfortunately there are two other chapters bearing on limits, the so-called renewable resources and various phenomena of planetary dynamics.

RENEWABLE RESOURCES

We think of renewable resources as including whatever grows--forests, annual crops, fisheries. These are renewable indeed, but only provided the amount harvested is below a certain critical level. Trees, crops, fish, all wither and die in any case, and up to the point of their natural mortality they can be harvested with impunity. We can think of a critical point in regard to harvesting level, and below that point the resource renews itself. Beyond that, even when it is only slightly exceeded, a cumulative process of decline of the resource occurs. It is cumulative because each year's take diminishes what is available for later years, and increasing demand in subsequent years comes up against declining supplies, so the destruction of the resource is cumulative.

The same thing happens as to an improvident person whose expenditure is just slightly higher than his income. Each year he borrows the difference, but since he has to repay the previous borrowings with interest, if he does not change his style the amount of borrowing will rise steadily. The critical point that he has passed is the amount that can be spent without obligating the future income. Such an argument applies to individuals, to nations, to forests, etc. It applies to soils--taking out more of the nutrients than are being replaced will cause a cumulative running down, just as in the fishery and the forest.

The increase of population and of its demands on the environment result in a different way in the destruction of natural species of plants and animals. Species being in symbiosis with one another the destruction of a forest eliminates more than the trees, but destroys the insects, plants and animals that lived along with the trees.³⁵

PLANETARY DYNAMICS

The ball of earth is represented simply by astronomers and does not look very complicated on geographer's maps, but geophysicists know how complex a machine it is, and how elaborately its many process fit together. The temperate zone summer, with hot growing weather punctuated by heavy rainfall every 5 to 10 days, is perfect for the crops on which the industrial countries depend; the pattern of winds that bring seasonal rains to the tropics is crucial to the billions of people in the LDCs.

As population has increased it has necessarily balanced itself more and more delicately on the processes of each locality. With the denser and denser populations that balance is more and more easily upset. Variation of rainfall in China does the damage we read about because the population has pressed so hard against the ecological niches that the landscape affords. Failure of the monsoon, even partial failure, in India or Africa means starvation for millions. Without any further deterioration of the biosphere, merely because of the growth of population, we can expect more and more serious floods, earthquakes, eruptions of volcanoes--in the sense that the same physical events will affect more people and more property as the years go by. But on top of this the physical events are likely to be more violent as the environment deteriorates on all continents.

That the physical condition does not stand still is due to its elements being interlinked. The cutting of forests affects winds and rainfall, and deserts can result, and the deserts in turn reduce the rainfall. This reciprocal action, not thoroughly understood, means that the most basic planetary processes, on which we all depend, evolve in a different way with the increasing density of population and economies.

And now on top of local effects come some global ones. Superimposed on the southward movement of the Sahara, on the fluctuating desert of the American Southwest, comes a changing composition of the atmosphere, that causes Earth to retain a larger part of the sun's heat. That is something that cannot be locally controlled; because of terrestrial ventilation any local increase of the carbon dioxide in the atmosphere affects climate globally.

Again we express astonishment that the complexity of the atmosphere processes, such that we do not know quite what the effect of warming will be, is used as an argument against doing much about it. One would have thought quite

³⁵Wilson, E.O., Ed. 1988. Biodiversity. Washington, D.C.: National Academy of Sciences/Smithsonian Institution.

the opposite: if we are in the grip of processes that we do not understand, whose consequences we cannot foretell, bringing about changes of whose only property we can be sure is that they will be irreversible by human effort once they occur, then the case for slowing such of our activities as are causing these changes is strong.

How we should react to the complexity of terrestrial processes that are beyond our understanding is a matter that has had far too little attention. Acceptance of the view that because they are complicated and we do not know enough about them we should just go on doing the disruptive things we do, while we wait for scientists to come up with clear answers, would seem the height of irresponsibility. It implies also a degree of arrogance: when we do find out what the trouble is, we will be able readily to fix it. With more sense of responsibility and less arrogance we would say instead that the less we understand of what is going on the stronger the case for reducing our interference with natural processes.

DO WE KNOW ENOUGH TO ACT?

Some economists and politicians have insisted that no one yet knows enough about those limitations for economic policy to take the environmental constraints into account. Much of the discussion has been on points of fact: what will global warming do to agricultural productivity in various regions, is the ozone hole really going to spread, will we be able to get along without those species that are being lost, can we really not find places to dispose of toxic waste?

Indeed uncertainties abound on these and other matters. Yet no one seems to have noticed that every economic question from whether or not to buy a dozen apples in the town market to national policy on money supply has to cope with uncertainties. It is not explained why uncertainties have become such an obstacle to serious thought and action just on this matter of special importance--environment. And on what interests us here especially, the role of population in damaging it.

And even more important, if we do not know what makes the earth-machine work, that is an argument for NOT tampering with it. It is an argument for stopping economic growth until we find out the effects over the long term of what we are doing to it.

HOW TO GET THE DISCUSSION OFF DEAD CENTER

The device I propose for getting the debate off dead center is to ask each side to accept, just for the sake of the argument, the facts and conclusions presented by the other side. To ask, that is, IF the biologists' worst horror stories are true, what WOULD BE the right economic policies? And if the economists' characterization of the merits of markets and the incompetence of governments were correct, what action would biologists recommend to avert catastrophe?

Starting with the supposition that the biologists are right in what concerns the conclusions of their own discipline, and making the extreme assumption that the

present course of economic growth and population increase would turn much of the planet into desert within the next century or two, what change in economic policies should be initiated now? Simply checking economic progress, stopping the clock, freezing haves and have-nots where they are now, will not do. What are the minimum and most likely-to-be-accepted changes in the direction of progress, what limits on the trajectory of the economy and of the population, would deflect spaceship Earth from the disaster (of warming, of desertification, etc.) towards which we will assume it is heading.

Asking economists to forego debate on the findings of the alien discipline, and to accept them for the argument, has as its counterpart asking the biologists to accept the economists' view that the market is the best decider on all such issues, infinitely wiser and more farseeing than government. No one, least of all demographers, would want to go so far as to prescribe how many people can be sustained on the earth and its separate regions, that being intertwined with unforeseeable technical and social changes. But IF those deserts are truly spreading, warming accelerating, etc. THEN one would have to accept the conclusion that the number of increase from the present ought to be as small as can be secured with the widest distribution of family planning instruments and the most vigorous presentation of information on why they ought to be used. As long as there is one woman anywhere who wants to avoid further childbearing and does not have the necessary knowledge or instruments, there is need for family planning programs.

This was exactly US policy until the last decade and it was beginning to work, when the US more or less officially reversed itself, and became preoccupied with supposed ethical issues in the control of population. In particular the use of abortion, pronounced legal by the Supreme Court of the United States, was declared to be unethical when used in the LDCs. Many in the social science community went along with the official change, and found reasons (reasons are always to be found) why the reversal was justified, why population increase did not make all that much difference to development, and why conditions of sustainability no longer had to be taken seriously. Man's inventiveness, human capital, would overcome all difficulties, and the more people the more geniuses who will provide the necessary inventions. (I am not exaggerating; exactly this argument has been seriously put forward by more than one social scientist.³⁶)

The main conclusion of economics that biologists on their side would be asked to accept is the shortsightedness of governments. The myopia of business cannot and will not be corrected by official agencies that are even more myopic. If business is only concerned with the profits of the next few years, governments are only concerned with the next election. That is if they are democracies; if they are dictatorship they do have the power to protect the environment without asking approval of an electorate, but I know of no case of dictatorships taking advantage of the opportunity so presented to them.

³⁶These remarks are provoked by writings of Julian Simon and the pronouncements of the Reagan and Bush administrations.

With luck the conditional acceptance on the part of each discipline of the conclusions of the other could become a habit. Economists and biologists would each find that they can live with the results of the other, a mutual acceptance not to be found today. Neither side could argue for the kind of facile solution that one now hears. Economists would accept the facts and estimates made by biologists, and they on their side would give up the hope that governments would act against the wishes of their constituents, however noble the purpose. Recognizing that the biological-economic-political problem is severe and permanent--that it is going to be with us for all of the remaining tenure of man on Earth--could become part of the basic assumptions of all disciplines.

IF WE CANNOT DEPEND ON GOVERNMENTS, WHAT ACTION IS POSSIBLE?

But if the disaster is truly facing us within the next century, and there are means to avoid it but we cannot push legislators out ahead of their least informed constituents--that way would only lead them and science to electoral failure--then what is to be done? The answer must be more knowledge--creating that is what scholars are expected to do anyhow--AND its diffusion to the public.

Effectively getting knowledge into the minds of the public is frustrating for scholars. We have seen in Europe that a steady 10 percent or so of electors vote for green candidates, and the prospect of increase in this percentage is not imminent. In the hope of increase the greens widen their platform to include matters unrelated to environment, but this dilutes their appeal. Nothing is going to change this quickly, but that need not make us despair.

The results of science do in fact get to be disseminated. The extraordinary change in health practices shown by current statistics of meat consumption, smoking habits, exercise, have all been occurring within a very few decades of the first announcement of the Framingham study results, the articles by Doll in Britain showing the relation of smoking and lung cancer, the US Surgeon-General's Report on smoking, and other analyses. Similarly it must in due course come about with environment questions: a result emerges from the laboratory or the field, it works its way through undergraduate courses, and from there it penetrates downwards via the Sunday Supplements to the literate population, and it penetrates upwards to the legislators.

A SLOW PROCESS, BUT THERE IS NO FASTER

In short the process of change can only be as fast as the creation of knowledge and its diffusion through conventional paths in societies with free flow of information. Our public sensitivity to environmental problems may not be instant and complete, but compare it with the total lack of sensitivity under totalitarian regimes! Or under all regimes before two or three decades back. And in any country the environment can only take its place within a scheme of priorities. It lost its place on the front page with the opening of hostilities in the Persian Gulf, nor has it entirely regained that place now that hostilities have died down. The process

of scholarship and its diffusion goes at its own pace, and sooner or later gets its results accepted even among the most fickle of publics.

No small part of the needed interdisciplinary study is the process of communication in which the relevant biology emerges into the public domain. The first stage after initial discovery often occurs in the classroom, the second stage in the media, the third by word of mouth for those who are neither students nor readers. We do not know enough about the laws of diffusion of scholarly results.

It can well be that politicians are among the last to be reached, or at least the last to be convinced to the point where they see the need for taking action. A democracy involves many contradictions, among which the most prominent is that it requires independence and leadership on the part of its legislators, at the same time as it requires its legislators to do what their constituents want. No one has shown how these two contradictory requirements (both leadership and following the wishes of their voters) can be reconciled, and in our age of opinion polling followership on the part of democratic rulers has become more prominent than leadership.

We have gone through the several stages from the laboratory to individual behavior of the masses in respect of personal health practices (obesity, smoking, exercise), and in respect of family planning in the developed countries, so let no one say that the sequence described is merely visionary.

What will come when the unsustainability of present environmental practices (for example those generating carbon dioxide and those destroying the ozone layer) is widely enough realized are such changes as moving from an income tax to an expenditure tax, with differential rates according to the impact on the environment of various kinds of expenditure. From this point of view it does not matter how much money people earn, or how much they spend on personal services like physician's or psychoanalyst's fees, so taxes on these would be light. As things now stand we not only levy taxes indiscriminately from the point of view of the environment, but actually subsidize many anti-environmental practices. One example of such subsidy is allowing automobiles to be parked gratis on the streets of cities--streets built with public moneys and whose use in this way encourages people to drive motor cars.

But is not an expenditure tax regressive? Only if considered in isolation, and the effect is easily corrected. Any regressive effect can be offset by services to those of lower income, or even a universal demogrant or negative income tax. It really does not matter from the point of view of progressiveness whether one charges a graduated income tax, or has a uniform tax applied to all levels of income, and then provides offsets to those of lower income.

And once such a more environmentally benign arrangement becomes general in the MDCs it will be seen and taken up by the LDCs just as surely as they have taken up our refrigeration, our air travel, and our motor cars. That will complete the worldwide change. But it will not happen this year or this decade.

I emphasize that in the initial stages of its diffusion the discovery proceeds by instruction and precept. Some advanced countries will then take it up and show how it works, and others will follow their example. Such a path of change, going by example from rich countries to poorer countries, is exactly what took place in the field of birth control. It is hard to imagine any other route of transfer than a process of diffusion from the more to the less advanced countries. Imagine what the response would have been if we had continued to have 8 children and urged the LDCs to stop at 2!

Thus I am saying that we should assume that biologists and economists are both right, each in their own field. We should then find out what feasible path of discovery and diffusion of knowledge will deal with what seems to me the most pressing question of our time: the destruction of the physical habitat within which mankind and its civilization have to sit.

One element in reaching sustainability, the time when the population-ecology interaction is likely to come into stability, is the control of population growth. We will see that some progress is being made towards stabilization, but not nearly enough.

THE CURRENT POPULATION SCENE

If what the world needs is population stationarity in both the LDCs and the MDCs, to be attained as soon as possible, then the trends are in the right direction, but recent data are not encouraging. On both sides of the North-South divide prospects were better in the 1970s than they are today.

For the world as a whole the annual growth rate had fallen from over 2 percent in the 1950s to 1.7 percent by 1975-80, and most forecasts made around 1980 supposed that the decline would continue, though perhaps at a lower rate. Yet in fact the growth rate remains at 1.7 percent currently, and is expected to continue at that level at least to 1995.³⁷ While the birth rate fell nearly 3 points per thousand over the five year period 1970-75, it has fallen only 1 point per thousand or less each five years since then. Meanwhile the absolute increase has been gently rising, and now stands at over 400,000 persons per five years (Table 1). In the last two years the United Nations has raised its estimate for the year 2000 by more than 100 million.

For the LDCs the fall in the birth rate was 4 1/2 points per thousand per five year period in 1970-75, and since then has been closer to 1 1/2 points per thousand per five years. Some of this slowdown in the rate of decline is due to changing age distribution, but most is due to slower progress in the diffusion of birth control. Foreign aid for population control programs did not continue its acceleration of earlier decades, and that seems important insofar as such programs have a significant effect. The slowdown in decline of birth rates also coincides with a

³⁷United Nations. 1990. World Population Monitoring 1989. New York: United Nations, p. 1.

depressed condition of many of the LDC economies during the 1980s. It is probable that the faltering in economic growth is responsible for slowdown in the pace of decline of births. Whether continued migration to the cities was positive or negative for family planning is hard to say. Certainly crowding in the countryside, with the overflow forced out and into the cities, where prospects of remunerative employment are for the most part not expanding fast enough, was hardly conducive to increased welfare.

TABLE 1. Population, births, and birth rates (CBR per 1000 population), World and Less Developed Countries (LDCs), 1950-2020. (Data from a tape distributed by the United Nations, 1988.)

	World			Less Developed Countries		
	Population	CBR	Births	Population	CBR	Births
1950	2,515,652	37.33	93,902	1,683,796	44.39	74,749
1955	2,751,181	35.59	97,923	1,864,333	42.04	78,371
1960	3,018,878	35.25	106,418	2,073,969	41.86	86,810
1965	3,334,492	33.88	112,966	2,331,658	40.47	94,358
1970	3,693,221	31.65	116,879	2,645,829	37.23	98,510
1975	4,076,165	28.43	115,898	2,981,315	32.89	98,044
1980	4,449,567	27.11	120,610	3,312,899	30.96	102,557
1985	4,836,645	26.03	125,874	3,662,835	29.42	107,753
1990	5,246,209	25.04	131,381	4,036,432	28.08	113,327
1995	5,677,574	23.82	135,234	4,433,531	26.46	117,302
2000	6,121,813	22.25	136,223	4,845,166	24.41	118,261
2005	6,559,174	20.96	137,474	5,253,769	22.72	119,355
2010	6,989,128	19.92	139,230	5,657,929	21.38	120,972
2015	7,414,342	18.78	139,234	6,059,113	19.94	120,837
2020	7,822,193	17.72	138,570	6,445,508	18.61	119,000

With hesitation in the slowdown of birth rates there has come an increase in the number of countries that officially view their rate of growth as too high, says the United Nations.³⁸ "As of 1988, 68 countries (all of them in the developing regions) with 63 percent of the world's population, view their rate of growth as too high." For most of the LDCs the focus of nationalism on increased population has given way to focus on a better life for those present--though Malaysia believes that it can have both.

Supporting this official dissatisfaction with high growth in some countries is the fact that some East Asian countries, among those that have shown the most spectacular economic advances, have exhibited sharp declines in population growth. While the direction of causation is not absolutely clear, yet the association makes

³⁸Ibid., p. 1.

officials ponder, and strengthens the political forces within countries that favor birth control. Officials also are much concerned about unemployment as a source of social instability, especially given the spread of education and the consequent rise of expectations.

That slowdown in the decline in births in the LDCs has been to some extent offset by a further, and not anticipated, fall in births among the MDCs. Forecasts made about 1980 assumed that the very low birth rates then recorded were temporary, and there would be a gradual rise to stationarity. Instead there have been further declines, and even the ultimate rise to stationarity appears less certain. Some of the MDCs, in particular Canada, are planning to make up for fewer births by more immigration. Others are reconciling themselves to a shrinking population.

Any notion that the high birth rates (for instance on the south side of the Mediterranean) can offset low rates elsewhere (say on the north side) had better be dismissed. As Alfred Sauvy has told us, it is not high pressure areas as such that make storms, but differentials, the existence of high and low pressure. And political storms are brewing throughout Europe, most conspicuously in France, as a result of differential demographic pressures and the resultant migration, legal and illegal.

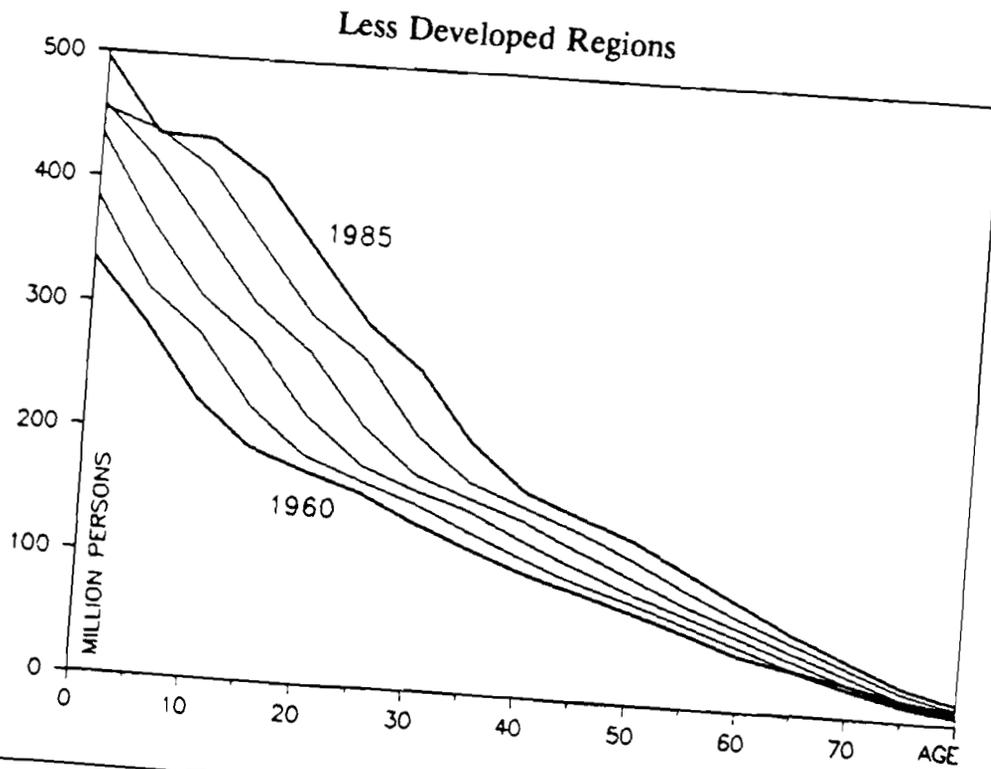
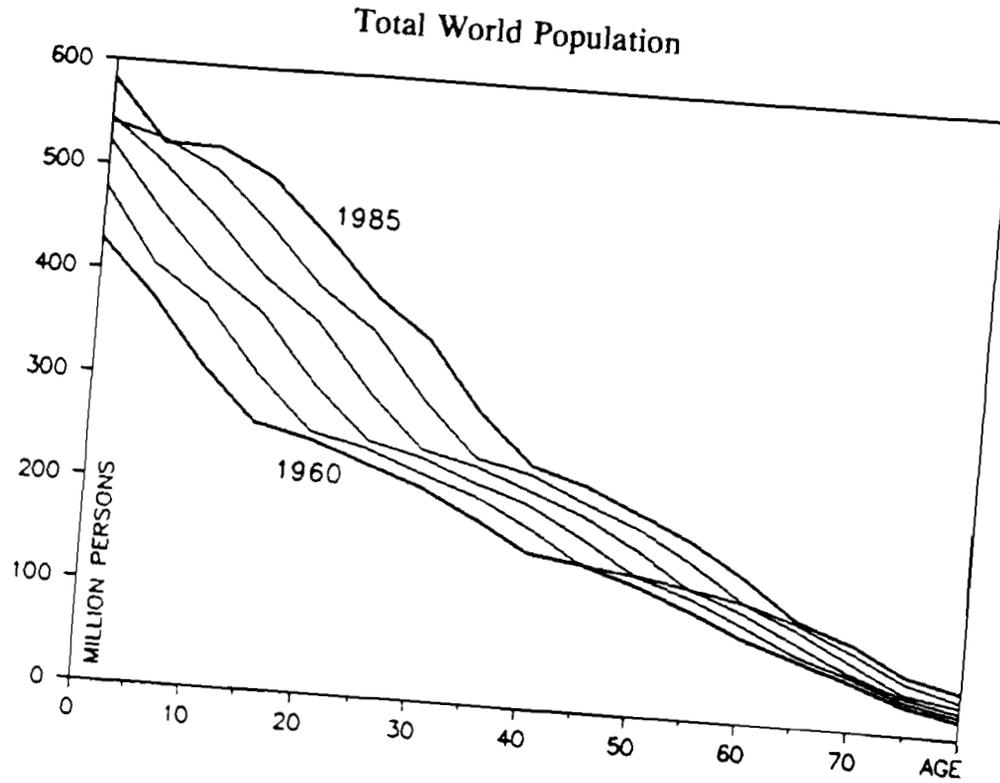
The United Nations points to a particular group, the least developed nations, with a population in 1990 of 425 million, whose rate of increase, 2.68 percent per year, is much above that of the LDCs as a whole, 2.10 percent per year. (1985-90 figures). Not only that, but whereas the LDCs as a whole remained constant in their rate of increase from 1980-85 to 1985-90, the least developed countries rose from 2.44 to 2.68 percent, and the prospect is that they will rise further, to 2.77 percent per year according to the UN projections, during the course of the 1990s.

One other feature of the present condition has not been sufficiently emphasized. That is the suddenness of the expansion of population that has taken place since World War II. That does not appear in aggregate numbers such as those of Table 1, but does come out in the age distributions, that reveal the increase of successive cohorts.

The charts show this clearly by the vertical distances between the curves, representing increase in successive five year time periods. The left side of each chart shows the younger cohorts, while the right side shows the older ones; the division seems to be those born about the year 1950. The vertical distances to the left of the cohorts born about 1950 is anything up to three times that to the right. One does not even need statistics to observe the phenomenon, but can see it on the youthfulness of the people on the streets of the large cities of the Third World.³⁹

³⁹A more refined calculation of the intercohort increase is presented in: Keyfitz, N. 1990. The profile of intercohort increase. *Mathematical Population Studies* 2(2):105-117.

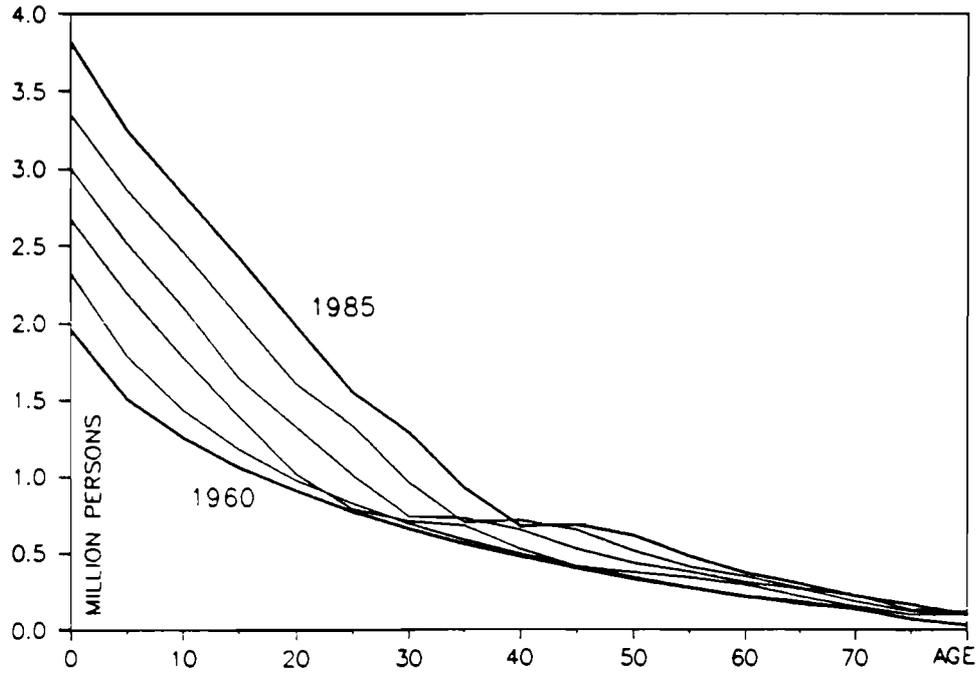
Age distributions, 1960-1985⁴⁰



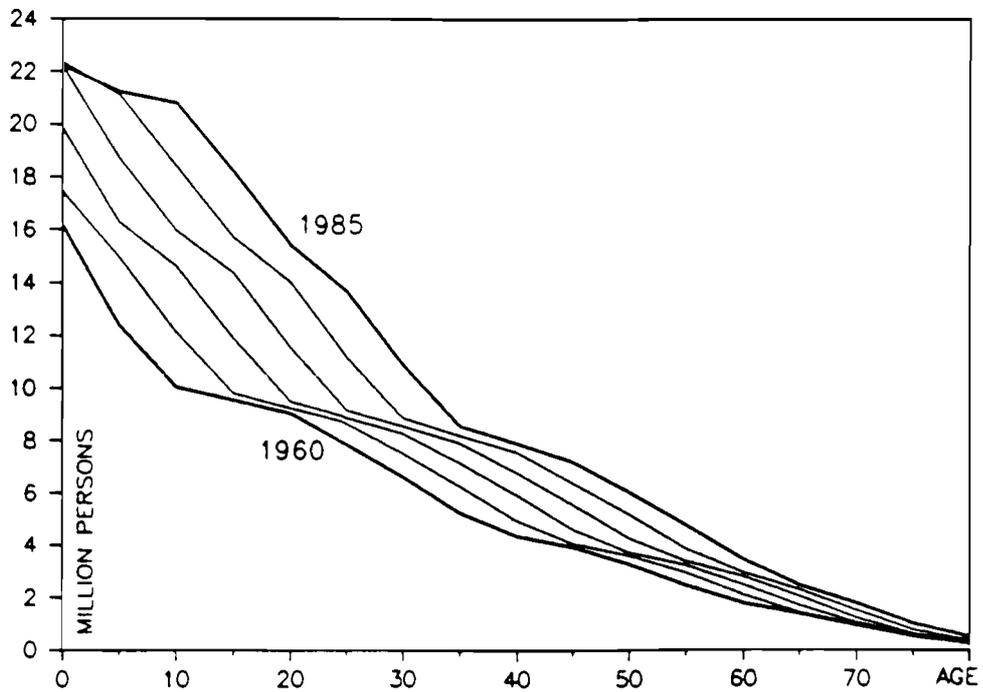
⁴⁰Keyfitz, N. and W. Flieger. 1990. *World Population Growth and Aging*. Chicago: The University of Chicago Press, pp. 105 and 107.

Age distributions, 1960-1985⁴¹

Algeria



Indonesia



⁴¹Ibid., pp. 115 and 218.

HISTORICAL EVOLUTION OF THE RELATIONS OF NORTH AND SOUTH: COLONIAL HISTORY AFFECTS LIMITS FOR THE LDCS

We cannot understand the dissatisfaction of the Third World, and hence its instability, i.e. the political unsustainability of the present condition, without glancing back at its history.

Most of the present LDCs have been through a colonial experience, in which they were directly ruled or indirectly influenced by a colonial power, for a longer or shorter time. Indonesia was subject to foreign rule over a part or a whole of its present territory for most of 3 centuries; Burma for less than one century. China was never quite part of a colonial empire, but it endured European and Japanese control of its affairs during a good part of the 19th century. Egypt was a British "possession" though less tightly ruled than was India. Thailand was always nominally free, though observing the size of the British Embassy building in Bangkok makes one ponder what all those British officials might have been doing there.

In the 19th century certain raw materials were needed in Europe, and extraction of these financed the colonial epoch. The metropolitan powers in their most expanded phase took advantage of steam transport, telegraphic communication and military fire-power to make distant lands politically safe for their purposes, sometimes coopting their traditional rulers, sometimes replacing them. We need not try here to evaluate the net benefit or harm of the opening up of the colonies on the one side, against the destruction of their artisan manufactures to provide outlets for the secondary products of the colonial rulers; we are still too close to the period to hope for agreement between the descendants of the colonizers and the colonized.

The formerly self-contained tropical economies became raw material exporters, and this on the one hand increased incomes, but any benefit to the colonies of this increase was offset by the vagaries of markets to which the whole world became subject. Worse, after the colonial officials switched off their ceiling fans for the last time about 1950 and went back home they did not return to homeland economies that were standing still. Having lost their stake in the tropics they could put their laboratories wholeheartedly into the creation of alternatives to colonial products. They saw to it that the ex-colonies were able to take over very little of the financial advantages that their masters had been enjoying, as synthetics and other innovations undercut the prices of their exports. And when they took over banks and other financial institutions they discovered that there was little tangible behind the facade of the building--that the business had consisted largely in contacts that fell away with the advent of independence.

Thus once the colonial masters departed much of the surplus they had been skimming simply disappeared. Faced with the adverse terms of trade prevailing after the War, the LDCs had to borrow for development in the 1960s and 1970s, building import-replacing industries with the proceeds. Plentiful capital in the world--at the time they borrowed--ensured moderate interest rates.

By the later 1980s, after they were heavily committed to the loans and had no means of liquidating them, demand for capital increased in the world at the same time as saving diminished; interest rates rose everywhere, so that as the debts were rolled over the LDC obligations increased without their receiving any new funding.

Meanwhile economic understanding around the world increased, at least to the point where most of the LDCs abandoned their ruinous efforts at import replacement. They invited foreign direct investment and reduced tariffs and administrative hindrances as they went for a much sounder export oriented economy. But the same world wide capital shortage that kept increasing their indebtedness reappeared in the limited capacity of the multi-national concerns to set up plants, and coincided with more intense competition among LDC countries for these plants.

The last blow to the LDCs is a movement towards protection in the MDCs, pushed by their own unemployment. They are discovering that free trade may well raise the total national income, but that it at the same time shifts income from workers in factories to owners. Any workers who are obdurate can be brought to heel by a threat to move the manufacturing process offshore. And even if the workers are perfectly docile, they suddenly become too expensive. First World factories may (or may not) be more efficient than Third World factories in making the same products, but the ratio of productivity is rarely adequate to maintain the differential in wages. And many doubt the long run ability of the First World to make up for the departure of factories by stepping up the sale of services.

Thus we have an example of historical irony, in that the liberal policies preached by the industrial countries, first to great resistance of the LDCs, are now more or less adopted by them, but circumstances have changed, and the LDCs find that the expected capital does not flow, nor do the expected MDC markets open up. The MDCs have themselves departed from the saving and the free trade that they were once inculcating.

Those of us in the First World ought to keep the colonial and post-colonial history in mind, for it is certainly in the minds of the Third World when it complains of being a helpless plaything of international markets. Without an appreciation of that point of view we cannot carry on a dialogue.

Such history has to do with sustainability in a political and also in an ecological sense. The political instability stems from the rapid population growth and its extraordinary age distribution, with many young people highly educated in comparison with their elders. Quite different is the ecological instability. Desperate for want of foreign exchange, countries that lack oil but have forests--Brazil, Malaysia, and others--cut and sell their trees at bargain prices. That is a process that will necessarily come to a stop within a decade or two when the forests are gone, and prudent restraint would bring it to a stop earlier.

Not usually spoken of in connection with sustainability is the inequality generated in the Third World as it follows the path of development to which

internal and external forces constrain it. Inequality is not the main focus of books on development, and yet if it continues and nourishes fundamentalist religious movements as occurred in Iran, and as is occurring at the time of this writing in Algeria,⁴² it could bring development sharply to a stop.

INEQUALITY

Those who see the social side as equally important with the technical and economic sides of development would want to take up such matters as the distribution of the gains of development among income groups, not the most popular subject in development economics. Jim MacNeill⁴³ and Pan Yotopoulos⁴⁴ among many others raise questions on distribution. The latter has a simple explanation of how it is that rising average income can actually cause an increase in poverty, even starvation.

If the average income goes up through gains at the top, while the bottom income groups remain unchanged, and there is a shift from cereals to meat in the diet of those benefitting from this progress, that will raise the market price of cereals (the famous food-feed competition) and rice or bread will become too expensive for the poor to afford with their unchanged incomes. Amartya Sen's⁴⁵ explanation of famine is consistent with this--he found that in Bengal in 1943 there was only a trifling decrease in the crop, but there was a serious increase of unemployment owing to the disruptions of war. He speaks of the loss of entitlements rather than the shortage of food as the cause of the famine.

Why the gross inequality in sharing the gains of development? One part of the answer is given by Ricardo, who at least in this aspect was thoroughly Malthusian.⁴⁶ Growing population that pushes towards marginal lands (and marginal occupations) lowers the returns to labor everywhere, and raises the returns to land and by extension the returns to capital.⁴⁷ The distributional effect does not happen in the same way for contemporary LDCs as it does for the purely

⁴²Barely suppressed by a curfew and military force, followed in detail in Le Monde of June, 1991.

⁴³MacNeill, Jim. 1989. Strategies for sustainable economic development. Scientific American 261(3) (September).

⁴⁴Personal correspondence, 1991.

⁴⁵Sen, Amartya. 1981. Poverty and Famines: An Essay on Entitlement and Deprivation. Oxford: Clarendon Press.

⁴⁶My reading of Keynes's and other biographies of Malthus suggests that many of Ricardo's ideas were developed in the course of their numerous evenings together, even though it is the disagreements between them that are more often referred to by subsequent commentators.

⁴⁷This last was Marx's contribution, who also in this was Malthusian, however vigorously he denied it, arguing that socialism would provide all necessary subsistence!

agricultural societies that Ricardo had in mind, but the mechanism is found in all ages. It is discussed by economists (for instance Todaro) under the heading of dualism, that is accentuated by rapid population growth.

Accentuated but not entirely created by population. Economists believe, and so do I, that sound economic policies would not only make for faster average growth, but sound policies would allocate more of the gains at the bottom. The point is especially stressed by Michael Todaro,⁴⁸ but in one form or another every economist who goes into the matter finds the same thing. Governments set the price of grain low, which impoverishes the peasantry in favor of the city, but without relieving city poverty because of the influx of ever more immigrants. Why, then, do Third World countries so persistently follow policies that every economist tells them are wrong both for growth and for distribution?

The answer to that last question lies only partly within economics. When the same bad policies are persistently followed by countries on opposite sides of the world they cannot be simple mistakes. So underlying the economics is a further question: how is it that in the jostling to partake of the gains of incipient development those who are already better off can systematically invent and implement policies that enable them to appropriate so large a part of each successive increment of income? What is the relation of those wrong policies to the present difficulties of the Third World? And most particularly what is the connection between those wrong policies and the unrest that is so widespread, held down by the armed strength of the forces of order?

Wrong policies are even more damaging than economists say, because not only do they slow growth, and distort distribution, but they are indirectly responsible for at least some of the damage to the environment. With a more even distribution of income there would be fewer automobiles and more bicycles in Cairo and Mexico City. That the price of gasoline is set well below what the country could earn by exporting the oil in effect adds to the income of the better off. What Alfred Sauvy says of water applies to many other subsidized commodities as well:

the price charged for water...is often less than its cost price; many people consider this "more social." In this way the bath of the most well-to-do person is paid for in fiscal terms by a household that does not even have running water.⁴⁹

Where electricity is similarly subsidized people can have air conditioning in climates that are perfectly congenial without it, and to run the airconditioners to so low a temperature that they have to wear sweaters. Subsidized electricity is a mistake of course, but why is the mistake not rectified the moment it is pointed out? And why

⁴⁸Todaro, Michael P. 1989. Economic Development in the Third World. Fourth Edition. New York and London: Longman.

⁴⁹Sauvy, Alfred. 1973. Croissance Zero (Zero Growth). Calmann-Lévy, p. 173.

are so many of the "mistakes" of such a character that they support a middle class style of life?

That question leads in the direction of the study of culture. Economics is proud of being value-free--it does not tell people what they should want, but only how to obtain as nearly as possible whatever it is that they in fact do want. This writer⁵⁰ showed to what a degree the arbitrary consumption choices of the middle classes around the world, subject to personal whim, the play of fashion, the promptings of the media, put an intolerable burden on the world's resources. The main point of that article remains applicable, even though now it is not so much nonrenewable resources (aside from oil) that concern us, but the disappearance of species, the loss of soils, global warming and other disturbances of the planetary dynamics.

DILEMMAS AND CONTRADICTIONS OF CURRENT POLICIES

The truly poor and disadvantaged present a dilemma to those formulating aid policy. They are the most in need of aid for humanitarian reasons, and yet they are not the countries or the citizens in them that will use aid most effectively for development. It is the countries among the LDCs that are effectively controlling their population and growing economically that are in a position to use injections of capital for the creation of infrastructure that will attract private investment, and this is the fastest track of economic growth. The problem is how to divide aid budgets between those countries that need help most, and those that will put it to the use that will most quickly take them out of the condition of aid recipients. The question is even more agonizing when we think that aid to the poorest countries helps further to increase their population, while aid to the already better-off encourages population control.

This problem of allocation between humanitarian aid and development aid is far from the only paradox in the development predicament of the present. To repair damage to the environment that they cause in the course of their development, the MDCs try to impose environmental constraints on the whole world, including the LDCs, that they could never have afforded when they were LDCs. The LDC elites ask the foreign investor to trust his capital with them, but on their side they have so little confidence in their own countries that they send a good part of their savings abroad. The Cold War was severely castigated as a wasteful arms race that diverted funds from development, but now that it is over, help to the LDCs in grants and loans has diminished rather than increased. LDCs complain of poverty imposed on them, but they find the money to buy arms and to engage in wars. The MDCs want international debts serviced, but they set up trade barriers that block the imports of textiles and other goods that are the only possible means of payment on the scale required.

At one time it was thought that foreign aid from America, Europe and Japan would quickly lead the rest of the world to self-sustaining growth. The paradoxes

⁵⁰Keyfitz, N. 1976. World resources and the world middle class. Scientific American 235(1):28-35.

above referred to help us to understand why the process is so much more difficult and time-consuming than had been thought, why after three United Nations Development Decades we have still such a long way to go.

DOES ECONOMIC GROWTH ABSORB OR DOES IT ACCENTUATE THE NEGATIVE EFFECTS OF POPULATION GROWTH?

I shall move back from social sustainability to environmental sustainability by citing a statement by a respected economist-demographer:

Obviously, there is no population problem that a sustained economic growth of, say, 5 percent per year could not solve.⁵¹

Yet from the ecological point of view the 5 percent economic growth (as growth is now defined by increase of national income per capita) does not subtract from the population growth problem but rather adds to it. Only if the economic growth was measured in some way that allowed for the running down of the environment does the statement become true, but such a measurement of sustainable development could not have been meant because no one yet knows how to do it.

ACCOUNTING SYSTEMS AND SUSTAINABILITY

We note that sustainability,⁵² that came into widespread currency following the Brundtland report, must furnish the basis of all proper accounting. The books of the sawmill must allow for the replacement of its building and machinery before profit is calculated. The running down of its machinery, either physically through use or notionally through obsolescence, is a real cost to the owners, and not to be disregarded if the calculated profit is to be a genuine one that the owners are justifying in withdrawing.

Hence it comes as a shock to find that it is not customary to count into the cost structure the forest that is being cut down to provide logs for the sawmill. Typically the owners of the sawmill are not required to buy the forest, but only to buy a license to cut what they need in it. If society set the same value on the trees that it does on the plant and machinery it would indeed add to the cost of the lumber produced the cost of replacing those trees. Does our accounting treatment that assesses the forest at a small fraction of what its market value would be tell something about our attitude to nature? Perhaps it does, but perhaps also replacing virgin forest is too time consuming, but in that case it would be a matter of growing the equivalent value in trees. And going one step further, the flooding caused by logging in the Himalayas, the destruction of species in the Amazon, the loss of soil

⁵¹Demeny, Paul. 1989. Limits to growth. Page 232 in Population and Resources in Western Intellectual Traditions, edited by Michael S. Teitelbaum and Jay M. Winter. Cambridge: Cambridge University Press.

⁵²Brundtland, op. cit.

in Borneo, ought all to be counted into the cost of the lumber if we are as concerned about sustainability in the face of changes in the biosphere as we are about sustainability in the face of running down of plant and machinery. Without such reckoning we are living off capital, and the market ensures that what we are doing will soon come to a stop.

This same inadequacy of accounting systems applies to virtually every respect in which the biosphere is exploited. The running down of soils is not counted into the cost of grain, the depletion of the fisheries into the cost of the fish on our tables, the warming of the atmosphere with all the changes of climate entailed into the cost of travel by motor car.

It would be disingenuous to express surprise that our accounting systems do not embrace these costs, for their estimation is beyond the reach of present scientific knowledge. We cannot estimate costs that lie far in the future without being able to make quantitative forecasts of the consequences of our actions for the distant future. If we later learn how to grow crops without soils then the washing away of soils is not a real cost today.

I raise these matters to show that sustainability is not a readily measurable concept. We should not be reassured by the ease of measuring depreciation of plant and equipment.

ECONOMIC GROWTH CAN BE SELF-NULLIFYING

Insofar as the economic product consists of heavy cars and airconditioning and 200-mile drives to the beach on summer weekends then more of it has taken place already than the ecosphere can stand over a long period. Any kind of growth that is in its very nature not extendable even in the distant future to the whole of mankind cannot ultimately be sustainable.

This is aside from the fact that much of what we do is self-nullifying even for ourselves and in the immediate present. Last May (1991) the papers were full of the supertanker that burned and sank off the Riviera and threatened to make its beaches unusable for vacationers. Think of the frustration of those holidayers--they get to the beach at much cost and trouble, and then they find signs put up by the local health authorities forbidding them to enter the water. Yet they could not have the gasoline for their motor cars without occasional spillages on the ocean. The incident symbolizes the self-contradictory character of our pattern of expenditure: in order that people might drive to the beach, we transport masses of oil over the seven seas, with consequent spillages that leave those same people horrified when they arrive at the beach and find their trip there pointless.

SOME INCREMENTAL CHANGES IN THE RIGHT DIRECTION ARE THE BEST WE CAN HOPE FOR IN THE PRESENT STATE OF KNOWLEDGE

I repeat that we have no way of defining sustainable development operationally in the present state of knowledge, but we can certainly come closer to its attainment

than is now being done. We do not know the answer to the preservation of the environment, but we know many pieces of the answer. They do not fall into any neat theoretical scheme, being a matter of pragmatic incrementalism, not to be scorned pending the discovery of something better. Following are ten of the more obvious pieces of the ultimate answer:

A. Pricing that allows for social and ecological costs. The forests as a resource are not a free good to be consumed as on the frontier, but a good of great value to the nation and to the world; the trees as a part of the cost of household furniture could be internalized through suitable taxes. The value of oil includes at least its alternative use for petrochemicals, and its price should reflect this value.

B. Cost recovery. On some matters we know the costs exactly, yet we charge them to taxpayers rather than to users. If people are given something of value free or below cost they will use it wastefully. The streets cost the community their initial laying and maintenance; if they are paid for by the community then they will be used wastefully--there will be more driving and parking on them than if those who use them pay the full cost. The case for underpricing education surely does not apply to underpricing roads.

C. Using less. Sound pricing plus public information will help push towards achievement of the same results with less materials, but we can go beyond pricing and impose standards. Motor car manufacturers can be required to turn out products that average more than so many kilometers per liter. The notion of engineering efficiency is important; even more important is the neglected notion of use efficiency. A two-ton automobile may have high engineering efficiency; its use efficiency is low if a one-ton model will allow the passengers to get where they are going as fast, as safely, and as comfortably.

D. Provision of information. The desertification in the 1930s in the United States was checked by changed methods of agriculture--ploughing along contours rather than up and down the hills. For forestry, agriculture, layout of towns, efficiency of automobiles, research is needed to establish standards, which would be provided as free information, not necessarily written into law. In the oil shortage of 1973 Americans were asked to tolerate rooms as cool as 68° F in winter and as warm as 78° F in summer and most followed the recommendation.

E. Cycling. Sustainability would be provided if all materials were cycled in the course of economic activities. That is impossible--the laws of thermodynamics do not allow us to retrieve the carbohydrate and oxygen after we burn wood or oil. But we can go much further than we now do. Compost can be made out of garbage, turning a nuisance into an economic value. Cycling glass, aluminum cans, automobiles, provide a benefit to the community but at market prices the recycler does not capture enough of the benefit to justify the cost of his operation. Rules requiring that the cost of recycling be paid at the time of original purchase of a bottled soft drink or an automobile would conserve materials and keep the streets tidy too.

F. Small scale technology. It is not by accident that most of the efficient technologies of production are large scale; large scale centralized production, appropriate to the cost of labor in developed countries, is subsidized in many indirect ways in the LDCs. We cannot expect new methods for village industry to emerge from the laboratories of Dupont or Mitsubishi. Yet in the glory days of Swiss watchmaking many of the components were produced in peasant cottages. Pottery, metal items, food processing, all now go on in villages, but usually with technologies less efficient than they need to be. Research can in some instances make village technologies that will pay proper wages and still be able to compete. The hope would be to retain some of the good minds of the village that now leave for the cities.

G. Cultural development of the village. If we want to check the flight to the cities the villages have to have jobs plus something else. A start has been made with schools and roads, but schools give young people the desire to leave the village and the transportation system enables them to do so. One has to go further and include local banking, health facilities, mail, libraries, television, telephone, theater. Making the village attractive enough to retain its good minds, especially some of those with entrepreneurial bent, should be a primary objective.

H. Doing things differently. Burning wood or cowdung for cooking was sustainable for an India of 100 million people; it is ecologically extravagant for an India of 860 million. I have seen a solar cooker made with aluminum foil on a papier-mache base at a cost of \$10 for materials that in the dry season and in sunlight produces the same result. A bicycle gets one a short distance as well as an automobile does. Many countries subsidize gasoline where they should be subsidizing bicycles.

I. Rehabilitation. Much of the damage to the environment can be reversed. Forests have been destroyed; they can be replanted. Rivers have been polluted with chemical waste; they can be cleaned up--as proven in the Thames and the Rhine. Coal can be substituted by natural gas, that puts fewer pollutants into the air. Automobiles can be fitted, or retrofitted, with equipment that makes them burn more cleanly.

J. Population control. Given the present population size, density and rate of growth in the LDCs, family planning cannot but move the national and the world economy in the direction of sustainability.

SUMMARY

Malthus wrote much that we now know to be wrong, but on one important matter he was right: that there are limits to the growth of the human population. His failings were mostly in not anticipating the enormous technical progress that has occurred between his time and ours, especially in agriculture, and his puritanical insistence on the need for sexual restraint--no making childbearing restraint easy with contraceptives. Childbearing restraint without contraceptives is especially uncongenial to the age of instant satisfaction in which we live.

Our age replaces the food limits envisaged by Malthus with other limits of the environment as we place on Earth the burden of more billions of people, and more trillions of dollars worth of economic activity. The food limit is readily understood and calculated⁵³ but the limit set by the requirement of sustainability is undoubtedly much smaller, as well as much more difficult to calculate. It requires technical knowledge that is not in anyone's possession, as well as social and economic knowledge of how people are going to want to live in the future. About 1.1 billion people driving automobiles and eating meat to their pleasure, plus 4 billion living restricted lives, is more than the planet can stand without some drastic changes in technology and in consumer tastes. The damage to the planet is already visible to far-seeing scientists, especially biologists, and one can expect it to become increasingly apparent to the public.

The hope must be that the improved knowledge of what is going on will diffuse through the educated publics of the advanced countries, and will act on their consumption patterns, and that the new styles they set will diffuse through the layers of society, first in the industrial countries, then through the remainder of the world population. The diffusion of birth control shows exactly the pattern, and more recently the abandonment of smoking is following the same path of diffusion. We can see following these the decline of meat-eating, the use of lighter automobiles and of bicycles, and other changes that will make the level of income and its growth more nearly sustainable. We can hope that over a series of iterations there will ultimately come a level of population that the globe can tolerate indefinitely, and a pattern of consumption that the entire world will be able to share more or less equally.

Not much more than this can be said about limits, given our ignorance of how quickly tastes will change, as well as ignorance of just what damage we are now inflicting on our fragile planet. The longer the change in our practices is delayed, the smaller the population that will ultimately be able to live on the planet, and the less comfortable life will be for them. Notwithstanding our inability to answer the big questions concerning sustainability, we can at least name some measures of change that are in the right direction.

All this makes it a race between awareness and intelligence on the one side and desertification, destruction of species and atmospheric warming on the other. The race has begun, and in the present phase mankind is falling behind, but the ultimate winner is not yet known.

⁵³An estimate of 45 billion adequately fed people is to be found in Revelle, *op. cit.*