

POPULATION AND DEVELOPMENT WITHIN THE  
ECOSPHERE: ONE VIEW OF THE LITERATURE

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RR-91-14  
August 1991

Reprinted from *Population Index* 57(1):5-22, Spring 1991.

INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS  
Laxenburg, Austria

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Printed by Novographic, Vienna, Austria

# Preface

The literature of contemporary neoclassical economics shows little handicap to development due to population growth, and some incidental advantages. With full employment a larger population means a larger economy, and rapid growth of population means more demand. Everyone seems to benefit from growth--not only does whatever one is making sell better, but one's physical capital (homes for example) is worth more with each increment of population, other things equal. It is no wonder that growth is well regarded, by the public as well as by those analyzing the economy.

All this is in the short run, and within the framework of models that narrowly and exclusively concern development, usually defined as increase of GNP per capita. Under modern conditions technology can increase agricultural yields so readily that the Malthusian threat seems obsolete. And physical capital, required to equip the newcomers to the economy, can be generated by an educated labor force. All that is needed is human capital, which is to say people, educated people.

Here is one more case where propositions that are obvious, even tautological, in one universe of discourse, are downright absurd on their face in a different logical framework. A biologist has a different starting point for his logic, and takes a very much longer view; when he looks at the economy he sees everything we have and use, all human wealth, as made from substances provided by the environment. Human economic activity consists in transforming that environment, and the biologist notes that there is only a limited amount of it to transform. Nothing is destroyed, but many kinds of transformation are one-way only, they are irreversible. Moreover when we transform something to our benefit, we

often incidentally produce unwanted effects that seriously interfere with human life.

Thus the transformation, say of crude oil into fuel into carbon dioxide, that the economist calls production, is called destruction by the biologist. With given technology the amount of it that goes on is proportional to the number of people who are engaged, which is to say the number who have to earn a living, which is to say the number of people. Whether one sees increase of those people as positive or negative for the planet depends on whether one regards what they are doing as production or destruction.

All this is manifest in the literature, of which the hundred or so items referred to in the paper that follows are only a small sample. It goes only the shortest distance to reconciling the economic and biological points of view, but we hope that by juxtaposing the two we have made a small contribution to the work of reconciliation.

Peter E. de Jánosi  
*Director*

# Acknowledgments

I acknowledge comments and stimulus from Ansley J. Coale, Robert Dorfman, Allen C. Kelley, Ronald D. Lee, Karen O. Mason, Samuel H. Preston, Robert Repetto, Ronald Ridker, Pan Yotopoulos and several anonymous referees, and the keying and copy editing of Marilyn Brandl.

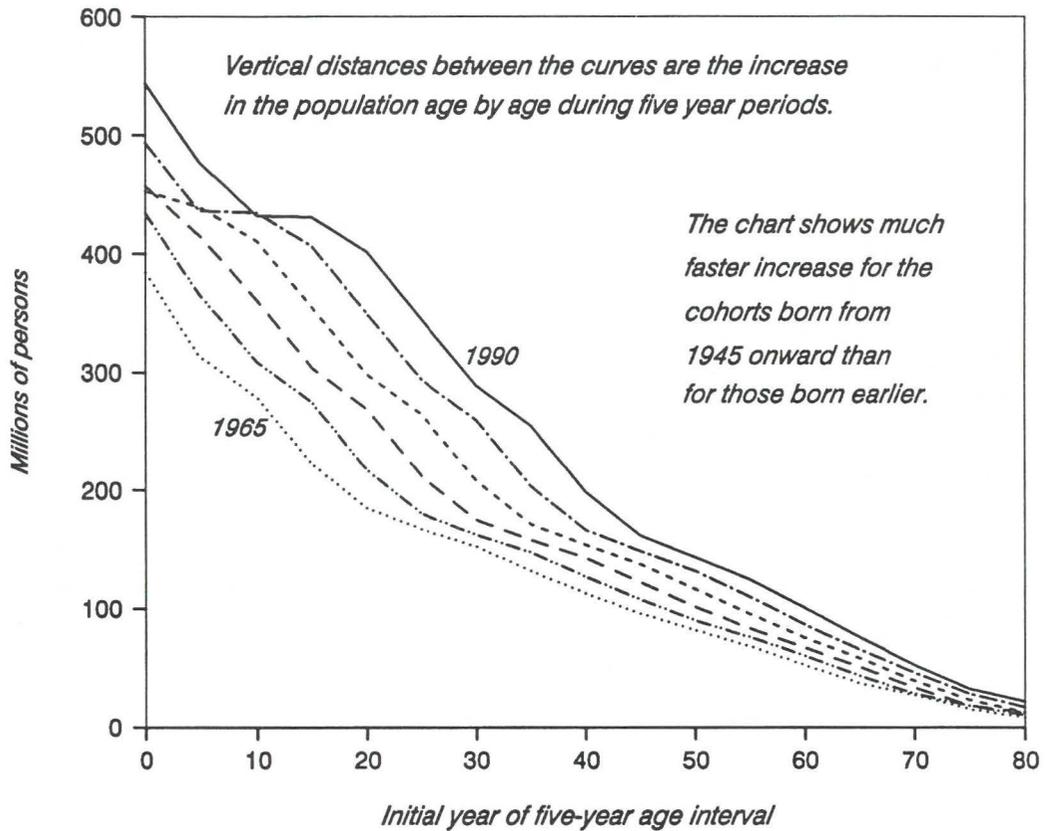


## Abstract

Contemporary academic economists, unlike those of the nineteenth century, find that although population growth and density can have bad effects on development, these will only be severe with wrong economic policies. Technical advance and substitution in free markets avoid major difficulties, for example shortage of materials. But ecologists see the poor cutting trees for firewood, the rich pouring carbon into the atmosphere, and doubt the capacity of the environment to absorb the effects of dense and growing populations and their present technologies. On both sides are distinguished scholars, whose writings cannot here be covered exhaustively, but only enough said for background to the question posed to demographers: Should this central population issue not be on our research agendas?

## ***Age distributions of developing countries***

**1965 to 1990**



**SOURCE:** Nathan Keyfitz and Wilhelm Flieger, "World Population Growth and Aging: Demographic Trends in the Late Twentieth Century." Chicago, Illinois/London, England: University of Chicago Press. 1990.

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# Population and Development within the Ecosphere: One View of the Literature

*--Only the variables put into the  
equation can emerge in the solution.*

The Brundtland Report<sup>1</sup> and the Amsterdam Declaration<sup>2</sup> are two of scores of recent documents and articles expressing a sense of urgency in relation to population as well as to the deterioration of the environment; the current National Academy of Sciences<sup>3</sup> assessment, on the other hand, sees few problems in either population or environment that cannot be solved by sound economic policies. The report<sup>4</sup> of the Special Session of the United Nations on Revitalizing Economic Growth in the Developing Countries contains 38 paragraphs, of which only two mention

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<sup>1</sup> Brundtland, G.H. (Chair). 1987. World commission on environment and development. *Our Common Future*. Oxford, England: Oxford University Press.

<sup>2</sup> Amsterdam Declaration. 1990. *Population and Development Review* 16(1) (March).

<sup>3</sup> National Academy of Sciences. 1971. *Rapid Population Growth: Consequences and Policy Implications*. Baltimore, Maryland: Johns Hopkins University Press.

<sup>4</sup> *Population and Development Review* 16(2):379-84 (June 1990).

population at all, and neither suggests that rapid growth could be a problem. Thus the spectrum of official views on the effect of population is wide. The present survey presents as much of the spectrum as space and the author's knowledge permit. It is concerned with the consequences of population change for development rather than the converse, taking for granted that once development occurs population comes under control--the threat of exponential growth exceeding all bounds gives place to the threat of population decline.

Biologists and many lay writers raise the alarm on what is coming if population continues to increase: exhaustion of soils and mass starvation, deterioration of the ecosphere to the point where the earth is not habitable, or if not that then at the very best declining incomes and loss of amenities. On the other side, academic economics, which also has a lay following, provides optimistic comfort: with modern ingenuity, given scope and stimulus by free markets, all shortages will be overcome, all deterioration repaired. Say Bloom and Freeman,<sup>5</sup> "the empirical evidence shows little relation between the growth of population and income per head or related economic variables." The data, as they interpret it, support a "population neutral" point of view (p. 58). Not population, but artificial constraints on the market, are doing the damage.

The major less-developed countries themselves see population control as a main problem. President Soeharto of Indonesia declares that:

The primary objective of the Indonesian Government's policy is to reduce the rate of population growth....In the 1978 guidelines for state policy, priority was given to national family planning to curb fertility.<sup>6</sup>

The importance of population control is now (after some fluctuations) being stressed by the Chinese leaders even more than by the Indonesian.

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<sup>5</sup> Bloom, David E., and Richard B. Freeman. 1988. "Economic Development and the Timing and Components of Population Growth." *Journal of Policy Modeling* 10(1):57-81.

<sup>6</sup> *Jakarta Post*, June 1990.

India's leaders think the same, and at one point went to the extreme of compulsory sterilization.

A number of writers<sup>7</sup> have provided valuable summaries and assessments of the literature that bears on our central question. The only addition I can make is to juxtapose in one paper views that arise from different perspectives and are meant for different audiences. I cannot add to either economic or biological knowledge; my purpose is simply to contrast what I read in the two fields.

In the modern academy, knowledge comes packaged in disciplines.<sup>8</sup> Within any discipline the machinery for establishing what is right (refereed professional journals, etc.) works moderately well most of the time; most differences are resolved. But for resolving differences between disciplines the machinery is inadequate. Many questions do not overlap; since biologists have nothing to say about how a change in the discount rate announced by the Federal Reserve Bank will affect the value of the dollar in Tokyo, there is nothing here to resolve. But

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<sup>7</sup> Including Kelley, Allen C. 1988. "Economic Consequences of Population Change in the Third World." *Journal of Economic Literature* 26(4):1,685-728.

McNicoll, Geoffrey. 1984. "Consequences of Rapid Population Growth: An Overview and Assessment." *Population and Development Review* 10(2):177-240.

World Bank. 1984. *World Development Report*. Washington, D.C.: World Bank.

National Research Council. 1986. *Population Growth and Economic Development: Policy Questions*.

Birdsall, Nancy. 1988. "Economic Approaches to Population Growth and Development." In *Handbook of Development Economics*, edited by Hollis B. Chenery and T.N. Srinivasan. Amsterdam: Elsevier.

King, Timothy. 1985. "Population and Development: Back to First Principles." *Population Trends and Public Policy* 7:2-11 (February).

Srinivasan, T.N. 1988. "Population Growth and Economic Development." *Journal of Policy Modeling* 10:1 (Spring).

<sup>8</sup> Easton, David. 1991. *Divided Knowledge: Across Disciplines, Across Cultures*. Sage Publications, in press.

population does spread over economics, biology, sociology, and other disciplines. Separated by different perspectives, each using a language not readily comprehensible to outsiders, each with a body of knowledge too extensive for most of those not brought up to it to master, and offering little premium to the academic who attempts to do so, disciplines do not take irreconcilable conclusions seriously, let alone resolve them.

This throws a problem too difficult for science as now organized to administrators who must make decisions affecting population and environment. They do so by their action in providing budgets or, by default, in not providing them. Whatever they do they have backing from scientists, choosing economists or biologists according to the advice they wish to receive. Used in this way, science does not play its most useful role.

The purpose of this article is to ask colleagues how far demography can make itself the authority in this matter. The lay public thinks that is our assignment, and yet what opinions we express are inconsistent and derive mostly from our participation in some other discipline. But to combine the findings of the several disciplines with new knowledge that we might discover requires modification and extension of our research agendas.

## The Issues Are Not New

Even in the time of the classical economists the issues were by no means new. It takes little searching to find them repeated over and over again through the centuries.<sup>9,10,11</sup> The Greek philosophers thought restraint desirable, in population as in other matters. But for Cicero (44 B.C.) as for other Roman writers who touched on the subject, there could never

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<sup>9</sup> Stangeland, Charles Emil. 1967 [1904]. *Pre-Malthusian Doctrines of Population*. New York: AMS Press.

<sup>10</sup> United Nations. 1973. *Determinants and Consequences of Population Trends*. Especially Chapter 3, Population Theory, pp. 33-63.

<sup>11</sup> Petersen, William. 1972. *Readings in Population*. New York: Macmillan.

be too many Romans--men who would conquer the lands on which they would maintain themselves, and women who would breed soldiers to conquer further lands.

By the time of the Mercantilists sentiment was still emphatically populationist, but now for reasons economic rather than military.<sup>12,13</sup> Jean Bodin<sup>14</sup> put the matter succinctly and equally without qualification: "There is no wealth but men [sic]y"; at the worst they could be put to work making cloth or other goods tradable for gold, and so add to the assets of the sovereign. (Still, even the Mercantilists spoke of the disorder and crime that they saw as resulting from denser population and the growth of cities.)

For 150 years the Malthusian proposition that population tends to outrun its food supply was the basis of the discussion. "Malthus was the father of demography," say Caldwell and Caldwell,<sup>15</sup> and few fields have had so clear a parentage, based on so simple an idea. That proposition was expressed in its least qualified form in the first edition of Malthus's *Essay*.<sup>16</sup> (An easily accessible version comes with an

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<sup>12</sup> Spengler, Joseph. 1942. *French Predecessors of Malthus*. Durham, North Carolina: Duke University Press.

<sup>13</sup> Riley, James C. 1985. *Population Thought in the Age of the Demographic Revolution*. Durham, North Carolina: Carolina Academic Press.

<sup>14</sup> Bodin, Jean. 1962 [1576]. *The Six Books of a Commonwealth*. Facsimile of English translation of *Les six livres de la République*. Cambridge, Massachusetts: Harvard University Press.

<sup>15</sup> Caldwell, Jack and Pat Caldwell. 1986. *Limiting Population Growth and the Ford Foundation Contribution*, p. 4. London: Frances Pinter.

<sup>16</sup> Malthus, Thomas Robert. 1966 [1798]. *First Essay on Population 1798* (A Reprint in Facsimile). London: Macmillan.

insightful introduction by Kenneth Boulding,<sup>17</sup> and a survey of Malthus's thought was presented by Joseph Spengler.<sup>18</sup>)

The Malthusian thesis of the first *Essay* related the drive to reproduce and the need for sustenance. This was the form in which it was adopted by Darwin,<sup>19</sup> but Malthus himself went off on a new path in the later editions of his *Essay*, which were wholly different books. The first *Essay* was a purely biological model; the later books were genuinely interdisciplinary.

The way that Malthus made his later model biological-social was by introducing preventive checks, the idea that people could by their restraint avoid the hardship that seemed inevitable in the first *Essay*. Though regarded as a reactionary by many, 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--the education of women being especially effective.

For Malthus the poverty threatened by too many people exercises an essential discipline. He seems to have regarded the discipline as good for its own sake, and one cannot be quite sure whether he thought that things had to be allowed to get worse before they could become better. (On this Marx was not at all ambivalent: Reform would only mitigate troubles and weaken the resentment that would bring the right solution; socialism would then solve all problems, including that of excess population.) In our own day Srinivasan is concerned about this matter:

It is difficult to say whether an easing of demographic pressures will merely postpone the day of political

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<sup>17</sup> Boulding, Kenneth E., Editor. 1967. *Population: The First Essay* [Malthus, 1798]. Ann Arbor, Michigan: University of Michigan Press.

<sup>18</sup> Spengler, Joseph J. 1945. "Malthus's Total Population Theory: A Restatement and Reappraisal." *Canadian Journal of Economics and Political Science* 16(1):83-110.

<sup>19</sup> In his *Autobiography* Darwin says that on reading Malthus, "At last I had got an idea by which to work."

reckoning or will provide an extended period during which institutions can respond positively.<sup>20</sup>

The harm that population growth can do to the general welfare is shown in an original way by Ricardo<sup>21</sup> in his theory of rent, on a simple model in which with everything else the same additional people will necessitate the use of marginal lands, and the smaller returns that can be earned on these will under competition become the standard returns for all workers, with correspondingly larger amounts going to proprietors. Modern research shows this to be so in practice. "Ronald Lee's<sup>22</sup> estimates for preindustrial England suggest that a 10 percent increase in population depressed real wages by 22 percent and raised rents by 19 percent" (quoted in Preston<sup>23</sup>).

John Stuart Mill<sup>24</sup> introduced the qualification that in secondary manufacturing, increasing returns to scale would be the rule. The diminished food per capita as population grew (successive mouths having the same need, and successive pairs of hands producing less) combined with the cheapening of secondary goods to set an optimum number for

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<sup>20</sup> Srinivasan, T.N. 1987. "Population and Food." In *Population Growth and Economic Development: Issues and Evidence*, edited by D. Gale Johnson and Ronald D. Lee, p. 24. Madison, Wisconsin: University of Wisconsin Press, as quoted in Kelley, *op. cit.*, p. 1,715.

<sup>21</sup> Ricardo, David. 1821. "The Principles of Political Economy and Taxation." In *The Works and Correspondence of David Ricardo, 1951-73*, edited by Piero Sraffa. Cambridge, England: Cambridge University Press.

<sup>22</sup> Lee, Ronald D. 1980. "A Historical Perspective on Economic Aspects of the Population Explosion: The Case of Pre-Industrial England." In *Population and Economic Change in Developing Countries*, edited by Richard E. Easterlin, pp. 517-56. Chicago, Illinois: University of Chicago Press.

<sup>23</sup> Preston, Samuel H. 1988. "Are the Economic Consequences of Population Growth a Sound Basis for Population Policy?" *Population Bulletin of the United Nations*, p. 3.

<sup>24</sup> Mill, John Stuart. 1965 [1848]. *Principles of Political Economy, with Some of Their Applications to Social Philosophy*. Edited by J.M. Robson. In 2 volumes. Toronto: University of Toronto Press.

population, a concept that Sauvy<sup>25</sup> makes central to analysis of the effect of population on welfare, notwithstanding its static character. But the advantage of size of market could be obtained by international trade, so there was no need for any country to push its population to the point where scarce foodstuffs brought down the general standard of living. In fact, small countries could well have an advantage, especially if they are culturally homogeneous, a point taken up by Kuznets.<sup>26</sup>

"The proper framework of social institutions...is an indispensable prerequisite for economic growth....The distinctive advantage of small nations lies in this determinant of economic growth--not in technology of production." Here and elsewhere we are in debt to Kuznets for stressing the institutional framework.

The economist who railed most violently against Malthus was Karl Marx, in various places using arguments that he could not have meant seriously: "If Malthus is right the world was already overpopulated when there was one person on it."<sup>27</sup> In population, as in other matters, the Peoples' Republic of China was for a time loyally Marxist. "Population is not a problem under socialism," declared the head of the Chinese delegation at Bucharest in 1974. But as an example of ideological flexibility, just a few years later in 1983: "We continue to lay special stress on population control...late marriage and one child per couple," said Prime Minister Zhao Ziyang.<sup>28</sup>

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<sup>25</sup> Sauvy, Alfred. 1963. *Théorie générale de la population*. In 2 volumes. Vol. 1, pp. 50-4, and throughout. Paris: Presses Universitaires de France.

<sup>26</sup> Kuznets, Simon. 1960. "Economic Growth of Small Nations." In *Economic Consequences of the Size of Nations*, edited by E.A.G. Robinson, p. 32. London: Macmillan.

<sup>27</sup> Quoted in Meek, R.L. 1953. *Marx and Engels on Malthus*, p. 59. London: Lawrence and Wishart.

<sup>28</sup> Quoted in Demeny, Paul. 1985. "Bucharest, Mexico City, and Beyond." *European Journal of Population* 1(2/3).

## Post-World War II Development

In the 1960s the Harod-Domar<sup>29</sup> model of the period before the War was applied to the less-developed countries (LDCs). It assumed unlimited labor and disregarded land, and so in effect made capital *the* source of wealth. Twentieth-century classics are Arthur Lewis<sup>30</sup> and Gunnar Myrdal,<sup>31</sup> the former mainline economics, the latter more alert to social variables, both taking the classical view of the handicap constituted by a dense and growing population. Also somewhat old but still widely read is the work of Benjamin Higgins,<sup>32</sup> which gives special attention to Indonesia. None of these books challenges the Malthus-Ricardo-Mill view that population growth beyond some moderate density (already passed in most of the LDCs) is a clear drawback for individual welfare and for the economy as a whole. They all put population control in the forefront of the measures needed for development. As Frank Notestein expressed it for social scientists in general:

The problems of economic development would be greatly simplified if the rate of population growth could be cut by a drastic reduction of fertility in the less developed countries.<sup>33</sup>

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<sup>29</sup> Domar, Evsey D. 1957. *Essays in the Theory of Economic Growth*. New York: Oxford University Press.

<sup>30</sup> Lewis, W. Arthur. 1955. *The Theory of Economic Growth*. London: Allen and Unwin.

<sup>31</sup> Myrdal, Gunnar. 1968. *Asian Drama: An Inquiry into the Poverty of Nations*. New York: Twentieth Century Fund.

<sup>32</sup> Higgins, Benjamin H., and Jean D. Higgins. 1979. *Economic Development of a Small Planet*. New York: Norton.

<sup>33</sup> Notestein, Frank. 1975. "Population Policy and Development: A Summary View." In *The Population Debate: Dimensions and Perspectives*, Papers of the World Population Conference, Bucharest, 1974. In 2 volumes. Pp. 538-42. New York: United Nations.

## Capital Shortage

The book that took technical advance into account, and contributed some relatively solid numbers, was Coale and Hoover.<sup>34</sup> After showing that India was likely to be able to produce the food it needed for several decades ahead, they focused on its limited capacity for capital accumulation. To oversimplify their argument, any increment of population would require tools and other capital at least equal to what its predecessors had used if it was to have the same livelihood, and this would require capital even before capital was used for the innovation in which development consists. "It is precisely in having more resources available for fruitful investment that we have found the principal economic advantage of reduced fertility." As empirical support, Coale<sup>35</sup> shows that although the cross-sectional correlation between per capita income increase and population increase is low, the correlation between per capita income increase and fertility, and between per capita income increase and percent under 15 years of age, is very high.

The methodology introduced by Coale and Hoover was to calculate the pace of development in India and Mexico on various assumptions of the rate of population growth. They assumed that population growth has a negative effect on savings rates, and this assumption has had its critics. It is not easy to estimate how income will move with more people and how with fewer people in the context of the particular territory, and others would do it with different models, yet the methodological principle stands: Only by estimates for a particular territory can the question of too many people or not enough be answered. Any theory that shows there are always too many people, or never enough, disqualifies itself by proving too much.

The Coale and Hoover argument held the field for most of 20 years. It was explained in every population textbook and was the

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<sup>34</sup> Coale, Ansley J., and Edgar M. Hoover. 1958. *Population Growth and Economic Development in Low-Income Countries*, p. 328. Princeton, New Jersey: Princeton University Press.

<sup>35</sup> Coale, Ansley J. 1986. "Population Trends and Economic Development." In *World Population and U.S. Policy: The Choices Ahead*, edited by Jane Menken. New York: W.W. Norton for the American Assembly.

rationale for large population programs by the United States and other countries. Lloyd Reynolds<sup>36</sup> is one economist of many who reflect it: "The lower the rate of labor force increase, the smaller the development effort needed to shift the economy's center of gravity." But now, says Preston:

Capital/labor ratios, like natural resources, have left the center stage of the debate...growth of capital stock has played a far smaller role in economic growth than had previously been believed.<sup>37</sup>

What took the place of physical capital on center stage was human capital.<sup>38</sup>

Indifference to conventional capital is not to be found in the administrative circles of Brasilia or Jakarta. The view prevailing in those places is closer to the Harod-Domar model than to the turn from physical capital to human capital. There is no question that over the long pull people are wealth, as the mercantilists said, and as Schultz added, educated people are very great wealth indeed, but in the shorter run there are foreign debts to repay, capital goods to buy, and people for whom jobs have to be created.

### Is the Birth Rate a Policy Variable?

In much of the post-World War II period it was accepted by the more-developed country (MDC) governments that population control was

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<sup>36</sup> Reynolds, Lloyd. 1969. *Economics*. 3rd edition, p. 776. New Haven, Connecticut: Yale University Press.

<sup>37</sup> Preston, *op. cit.*, p. 2.

<sup>38</sup> Schultz, Theodore W. 1961. "Education and Economic Growth." In *Social Forces Influencing American Education*, edited by N.B. Henry. Chicago, Illinois: National Society for the Study of Education. Also Schultz, T.W., Editor. 1962. "Investment in Human Beings." *Journal of Political Economy*. Supplement 70(5), Part II.

indispensable, and the main discussion was whether birth control programs could actually have an effect in the desired lowering of the birth rate. Writers followed Notestein<sup>39</sup> in subscribing to a demographic transition, in which the birth rate inevitably falls after mortality has fallen and development has reached a certain stage. Perlman<sup>40</sup> would categorize this as the Iron Law of Wages/neo-Malthusian approach: "Economic progress leads to demographic response (not the other way around)." He contrasts this with Kuznets's<sup>41</sup> emphasis on the advantages of population growth to economic development.

Notestein's demographic transition was taken so seriously by some, especially in the LDCs, that they asserted that there was little need for sponsored programs of birth control, whose contraceptive instruments would come to be used only after development was well under way and not before. Needed, therefore, was large-scale capital aid rather than population programs. As Indira Gandhi said, "Development is the best contraceptive," and "Are not poverty and need the greatest polluters?"<sup>42</sup> phrases that have been rallying cries ever since.

Work investigating the condition of population in the world and just how much difference birth control programs make is due to Berelson,<sup>43</sup> of which an account is given in Ross and Mauldin.<sup>44</sup> A

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<sup>39</sup> Notestein, Frank. 1945. "Population: The Long View." In *Food for the World*, edited by T.W. Schultz. Norman Wait Harris Memorial Fund Lectures.

<sup>40</sup> Perlman, Mark. 1981. "Population and Economic Change in Developing Countries: A Review Article." *Journal of Economic Literature* 19:74-82 (March).

<sup>41</sup> Kuznets, Simon. 1960. "Population Change and Aggregate Output." *Demographic and Economic Change in Developing Countries*, pp. 324-40. Princeton, New Jersey: Princeton University Press for the National Bureau of Economic Research.

<sup>42</sup> Quoted in United Nations. 1972. *Environment Stockholm*, p. 18. Geneva: United Nations.

<sup>43</sup> Berelson, Bernard. 1975. *The Great Debate on Population Policy: An Instructive Entertainment*. New York: Population Council.

<sup>44</sup> Ross, John A., and W. Parker Mauldin. 1988. *Berelson on Population*. New York: Springer Verlag.

careful case study is provided by Freedman, Takeshita, et al.<sup>45</sup> on the decline of fertility in Taiwan. Briefly interpreted, all these studies showed that if there is no economic or cultural incentive to population control, then sponsored programs providing contraceptives will do little (see also Sauvy<sup>46</sup>); if there is full sophistication, programs are obviously unnecessary. Many countries and groups within countries now fall between these two conditions, and in them the fall of the birth rate is indeed speeded by the availability of information and the instruments of contraception. Hermalin,<sup>47</sup> reviewing eight studies, finds strong effects of programs in all. Siew-Ean-Khoo<sup>48</sup> finds 48 percent of the fall in fertility attributable to program effects in Hong Kong, 64 percent in Malaysia.

Especially relevant here is the coherence of the traditional family, in particular its provision of old-age security. Few would disagree with Leibenstein<sup>49</sup> in attributing the high fertility of traditional societies to the need of parents to secure their old age. Owning children is like any other kind of family saving, perhaps better than owning a bank account or a house. (Much less often mentioned is the converse--that in industrial societies, which have government and commercial pension systems, the birth rate is low because children are not needed for old-age security.)

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<sup>45</sup> Freedman, R., J. Takeshita, et al. 1969. *Family Planning in Taiwan: An Experiment in Social Change*. Princeton, New Jersey: Princeton University Press.

<sup>46</sup> Sauvy, *op. cit.*, Vol. 2, p. 225.

<sup>47</sup> Hermalin, Albert I. 1982. "Issues in the Comparative Analysis of Techniques for Evaluating Family Planning Programs." In *Evaluation of the Impact of Family Planning Programmes on Fertility: Sources of Variance*, pp. 29-40. New York: United Nations.

<sup>48</sup> Siew-Ean-Khoo. 1978. *Effects of Program Contraception on Fertility: A Comparison of Three Asian Countries*. Paper 54. Honolulu, Hawaii: East-West Population Institute.

<sup>49</sup> Leibenstein, Harvey. 1957. *Economic Backwardness and Economic Growth*. New York: John Wiley and Sons.

Notestein<sup>50</sup> some time ago referred to meaningless debate between advocates of economic development, social change, and family planning: "All three are required, and no one is a substitute for another." This theme also runs through the writings of Philip Hauser<sup>51</sup> and Donald Bogue.<sup>52</sup>

### Bucharest and Mexico City

The view that population control is important for development, on which most MDC demographers at the time agreed, encountered opposition through the 1970s in many of the LDCs. The World Population Plan of Action of 1971, dominated by the LDCs, had started in this contrary vein: "Of all things in the world, people are the most precious. Mankind's future can be made indefinitely bright."<sup>53</sup> The opposition between the MDCs (the United States in particular) and the LDCs came to a head in 1974 in Bucharest.<sup>54</sup> It was mostly through the influence of the LDCs that the final act of the Conference included the statement that "the basis for an effective solution of population problems is, above all, socioeconomic transformation."<sup>55</sup>

Much has happened since the Bucharest Conference. Some of the MDCs started to ask whether family planning was important for economic growth, whether a larger population, either in particular countries or in the world as a whole, would be such a severe handicap to development. This fitted with a strong pro-birth, antiabortion

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<sup>50</sup> Notestein, 1975, *op. cit.*

<sup>51</sup> Hauser, Philip M., Editor. 1963. *The Population Dilemma*. New York: The American Assembly.

<sup>52</sup> Bogue, Donald J., Editor. 1967. *Sociological Contributions to Family Planning Research*. Chicago, Illinois: University of Chicago Press.

<sup>53</sup> Demeny, *op. cit.*, p. 132.

<sup>54</sup> *Ibid.*

<sup>55</sup> *World Population Plan of Action*, Bucharest, August 1974, paragraph A.I.

movement in U.S. politics, especially in the years since 1980. By the time of the Mexico City Conference in 1984,<sup>56</sup> the protagonists had changed sides from 1974: The LDCs, beginning to experience some of the seemingly intractable problems of development, insisted on the importance of population aid programs, while the United States expressed uncertainty on the need for them, tending to stress the immorality of abortion and speaking against coercion and in favor of the right of couples to have as many children or as few as they wanted.

The American Assembly sums up the reversal in the United States in its current report:

Since 1981, the United States has retreated from the strong leadership role on world population it exercised in the two previous decades. The ideological debate has destroyed a bipartisan consensus...[yet] no administration can be regarded as serious about the environment unless it is serious about global population growth.<sup>57</sup>

## The Importance of People

Julian Simon<sup>58</sup> provides the most unqualified populationist argument since Jean Bodin:<sup>59</sup> Countries can benefit from indefinite numbers of people; the more people, the more production.

Underlying all this in its contemporary expression is a profound if implicit faith in human ingenuity. Technology spurred by the free market can liberate production from the land, find substitute materials,

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<sup>56</sup> Demeny, *op. cit.*

<sup>57</sup> Mathews, Jessica Tuchman, Editor. 1991. *Preserving the Global Environment: The Challenge of Shared Leadership*, p. 327. New York: W.W. Norton.

<sup>58</sup> Simon, Julian L. 1982. "A Scheme to Promote World Economic Development with Migration." In *Research in Population Economics*, edited by J.L. Simon and P.H. Lindert, Volume 4. Greenwich, Connecticut: JAI Press.

<sup>59</sup> Bodin, *op. cit.*

and overcome damage to the ecological base. For most neoclassical economists, technology is exogenous, but Julian Simon thinks it is driven by population; if that were so the inhabitants of squatter colonies in Mexico City or hungry cattle herders in the Sahel would be very creative. Especially if the economy shifts towards tertiary industries that require little of either land or capital, then with labor as the sole productive agent both population and the economy can expand indefinitely. Writers (e.g., Herman et al.<sup>60</sup>) speak of dematerialization of the economy; both the inputs and the outputs of production diminish in weight and volume. And Malthus's bugbear of food limits is postponed to far in the future in the otherwise ecologically oriented FAO study of carrying capacity (Higgins et al.<sup>61</sup>). Avery<sup>62</sup> is even more optimistic, citing triticale and other discoveries.

For Kuznets<sup>63</sup> population growth brings new labor force into cities in early industrialization and also increases demand. He shows the association of economic growth with population growth and its urban concentration, which in the early days provided both the masses of workers and the mass market for their product. He comments<sup>64</sup> on the

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<sup>60</sup> Herman, Robert, Siamak A. Ardekani, and Jesse H. Ausubel. 1989. "Dematerialization." In *Technology and Environment*, edited by Jesse H. Ausubel and Hedy E. Sladovich. Washington, D.C.: National Academy Press.

<sup>61</sup> Higgins, G.M., et al. 1982. *Potential Population Supporting Capacities of Lands in the Developing World*. Rome: Food and Agriculture Organization.

<sup>62</sup> Avery, Dennis. 1985. "U.S. Farm Dilemma: The Global Bad News is Wrong." *Science* 230:408-12.

<sup>63</sup> Kuznets, Simon. 1966. *Modern Economic Growth, Rate, Structure and Spread*. New Haven, Connecticut: Yale University Press. Also Kuznets, Simon. 1967. "Population and Economic Growth." *Proceedings of the American Philosophical Society* 111(3):170-93.

<sup>64</sup> Kuznets, Simon. 1975. "Population Trends and Modern Economic Growth--Notes Towards a Historical Perspective." In *The Population Debate: Dimensions and Perspectives*, Papers of the World Population Conference, Bucharest, 1974. In 2 volumes. Pp. 425-33. New York: United Nations.

desirability of reducing fertility to accord with contemporary low mortality, but expresses no fear of population increase.

Ambivalence in modern economics is shown by two quotations (from J. R. Hicks<sup>65</sup>) within a few pages of each other: "Overpopulation through shortage of land is one of the great causes of the poverty there is in the world." Hicks speaks of overpopulation as a "terrible possibility." On the other hand: "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." The last assertion--that slowing population causes unemployment as discussed below--would hardly appeal to the intuition of third-world administrators, and yet the arguments of Keynes,<sup>66</sup> Hansen,<sup>67</sup> and Kuznets<sup>68</sup> all support it.

## Institutions for Orderly Exploitation of Resources

Suitable institutions for the use of natural resources became a preoccupation in the late 1960s. Those that are accessible to all are cared for by none, as Garrett Hardin<sup>69</sup> told us in a simple and influential article. His expression "tragedy of the commons" has become a part of the language, used, for example, by Ronald Lee<sup>70</sup> in the title

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<sup>65</sup> Hicks, J.R. 1971. *The Social Framework*. 4th edition, pp. 56, 59. Oxford, England: Clarendon Press.

<sup>66</sup> Keynes, John Maynard. 1936. *The General Theory of Employment, Interest and Money*. London: Macmillan.

<sup>67</sup> Hansen, Alvin. 1938. "Economic Progress and Declining Population." Presidential Address to the American Economic Association.

<sup>68</sup> Kuznets, Simon. 1979. *Growth, Population and Income Distribution: Selected Essays*. New York: Norton and Co.

<sup>69</sup> Hardin, Garrett. 1968. "The Tragedy of the Commons." *Science* 116:1,243-8.

<sup>70</sup> Lee, Ronald D. 1989. "The Second Tragedy of the Commons." Unpublished manuscript. Graduate Group in Demography, University of California at Berkeley.

of a recent article that finds in protection of the environment an argument for limiting population stronger than those of development economics.

The essence of a commons is that the one who exploits it secures the benefit, while at least some of the cost is external, i.e., it falls on others. Population increase hastens the destruction of any commons--the grazing field of a village, or a nation's forests, or the ocean fisheries. If crowding brings into people's vision the greater effectiveness of private ownership of land and they set up a system of land tenure, thus internalizing the externality, then their crowding will have brought major benefit. Individual tenure will provide incentives to economizing and to innovative methods of production.<sup>71</sup> If all commons could be appropriated and all externalities internalized, including those costs on later generations, most of the problems mentioned in this survey would disappear.

The positive effects of population on institutions is represented in the current literature by Ester Boserup,<sup>72</sup> in a tradition that goes back to Durkheim and ultimately to Adam Smith. Durkheim devoted the first of his major works<sup>73</sup> to the way that people protect themselves against the pressure of population by seeking a niche, i.e., a specialized function in which they will be sheltered from the storms of competition.

The need to set up suitable international institutions rather than leave them to emerge spontaneously from population growth or other natural cause has recently been set forth by William Clark.<sup>74</sup>

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<sup>71</sup> National Academy of Sciences. 1986. *Population and Development*. Washington, D.C.: National Academy Press.

<sup>72</sup> Boserup, Ester. 1981. *Population and Technological Change: A Study of Long Terms*. Chicago, Illinois: University of Chicago Press. Also Boserup, Ester. 1987. "Population and Technology in Pre-Industrial Europe." *Population and Development Review* 13(4):691-701.

<sup>73</sup> Durkheim, Emile. 1978 [1893]. *De la division du travail social* [On the Social Division of Labor]. 10th edition. Paris: Presses Universitaires de France.

<sup>74</sup> Clark, William C. 1989. "The Politics of Planetary Management." *Environment* 31.

## Limiting Factors: 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 by D. H. and D. L. Meadows was sponsored by the Club of Rome.<sup>75</sup> It was followed by Mesavoric and Pestel<sup>76</sup> and other writers. A similar spirit animated a later investigation led by Barney.<sup>77</sup> 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 Wiener<sup>78</sup> attracted attention with a model in which population was no great obstacle to economic growth.

The acknowledged antecedent of the Club of Rome model-building was Jay W. Forrester.<sup>79</sup> Population is central for Forrester. He has feedback loops in which population is controlled respectively by crowding, pollution, food supply, and natural resources. Any one of these can bring the exponential population growth to a halt, and can 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

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<sup>75</sup> Meadows, D.H., D.L. Meadows, J. Randers, and W.W. Behrens III. 1972. *The Limits to Growth*. New York: Universe Books.

<sup>76</sup> Mesavoric, M., and E. Pestel. 1974. *Mankind at the Turning Point*. New York: E.P. Dutton.

<sup>77</sup> Barney, G.O. 1980. *Global 2000: The Report to the President, Entering the 21st Century*. Washington, D.C.: U.S. Government Printing Office.

<sup>78</sup> Kahn, Herman, and Anthony J. Wiener. 1967. *The Year 2000: A Framework for Speculation on the Next Thirty-Three Years*. New York: Macmillan.

<sup>79</sup> Forrester, Jay W. 1971. *World Dynamics*. Cambridge, England: Wright-Allen Press.

(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). Although conditions do not now appear exceptionally bright, 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)

To go one step further back, the originator of such simulation was Guy Orcutt,<sup>80</sup> who did his first work when computers had barely become available. Perhaps we have now come to the end of an era; we know what such models can do, which is not trifling, but on the other hand we know, from seeing the diverse results that they produce, how susceptible they are to the assumptions on which they are constructed. Says McNicoll,<sup>81</sup> "The age of dinosaurs among population-development models may be coming to an end." Arthur and McNicoll<sup>82</sup> and

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<sup>80</sup> Orcutt, G.H., M. Greenberger, J. Korbel, and A.M. Rivlin. 1961. *Microanalysis of Socioeconomic Systems: A Simulation Study*. New York: Harper and Row.

<sup>81</sup> McNicoll, Geoffrey. 1981. "Notes on Population Development Modelling and Policy Formation." In *Population and Development Modelling*, Proceedings of the UN/UNFPA Expert Group Meeting, Geneva, 24-28 September 1979, pp. 93-6. New York: United Nations.

<sup>82</sup> Arthur, Brian W., and Geoffrey McNicoll. 1975. "Large Scale Simulation Models in Population and Development: What Use to Planners." *Population and Development Review* 1:251-65.

McNicoll<sup>83</sup> have useful reviews of such models. Warren Sanderson<sup>84</sup> discusses seven economic-demographic models in some detail.

Although all such work is subject to many questions, long after its techniques and specific results are forgotten the Club of Rome will be remembered for calling public attention to neglected aspects of economic growth and for being in the vanguard of what is now a worldwide ecological movement. It certainly deserves a better evaluation than Julian Simon's:

The *Limits to Growth* simulation...is not worth detailed discussion or criticism....[It is] public relations hype...[and the Club of Rome] scared many people with these lies.<sup>85</sup>

## Carrying Capacity

A more restrained analysis is made by Revelle.<sup>86</sup> He 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 the question of 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

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<sup>83</sup> McNicoll, 1984, *op. cit.*

<sup>84</sup> Sanderson, Warren. 1980. *Economic-Demographic Simulation Models: A Review of Their Usefulness for Policy Analysis*. RR-80-14. Laxenburg, Austria: International Institute for Applied Systems Analysis.

<sup>85</sup> Simon, Julian L. 1981. *The Ultimate Resource*, p. 286. Princeton, New Jersey: Princeton University Press.

<sup>86</sup> Revelle, Roger. 1975. *Will the Earth's Land and Water Resources be Sufficient for Future Populations?* Volume 2, pp. 3-14. Bucharest: United Nations.

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* begins:

The *carrying capacity* of a particular region is the maximum population of a given species that can be supported indefinitely, allowing for 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.<sup>87</sup>

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 Johnson<sup>88</sup> 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.

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<sup>87</sup> World Bank. 1984. *World Development Report 1984*. New York: Oxford University Press.

<sup>88</sup> Johnson, D. Gale. 1974. *World Food Problems and Prospects*. Washington, D.C.: American Enterprise Institute.

## Resources

Barnett and Morse<sup>89</sup> provide an ambitious treatment that shows little need for husbanding resources. For them, the uniformity of energy and matter are such that anything can be turned into nearly anything else, and they support their view with extensive data. The persistent fall in real (i.e., relative) prices of nearly all raw materials is before the eyes of all of us. It is very much evident to the many LDCs that export raw materials. Oil is the big exception, and even for oil the shortage is by no means imminent.

Among the economists who early on took the exhaustion of resources seriously and stressed the implications for intergenerational equity was Stanley Jevons,<sup>90</sup> with his worry about whether England could maintain its large population (then about 25 million, much of it employed in industry) when it ran out of the coal needed by industry. Since that particular concern turned out to be misplaced, he gets little credit. Repetto<sup>91</sup> and others demonstrate the robustness of supply of most minerals. Thus there seem to be good reasons why the need to control population is no longer argued from the limits of mineral resources, notwithstanding that they are called "nonrenewable." But certain other resources, especially water and soil, forests, and fisheries, come under increasing pressure, and contrary to what the words imply, these "renewable" resources are the ones of which we are more likely to run short. Though the world's forests are in principle renewable, in fact

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<sup>89</sup> Barnett, Harold, and C. Morse. 1963. *Scarcity and Growth: The Economics of Natural Resource Availability*. Baltimore, Maryland: Johns Hopkins University Press.

<sup>90</sup> Jevons, William Stanley. 1909. *The Coal Question: An Inquiry Concerning the Progress of the Nations and the Probable Exhaustion of Our Coal-Mines*. London: Macmillan.

<sup>91</sup> Repetto, Robert. 1986. *World Enough and Time: Successful Strategies for Resource Management*. New Haven, Connecticut: Yale University Press.

they are being destroyed.<sup>92</sup> A quick history of economic thought on the subject is provided by Dasgupta and Heal:

To nineteenth-century man, it would therefore have seemed unthinkable that one could explain the dynamics of an economy, or analyze the processes of production and exchange, without giving special attention to the role of natural resources.

The economic theorists of the twentieth century have, however, proceeded on the basis of just such an omission, at least until recently: in the works that have exercised a dominant influence on the evolution of economic theory in the last half century--Hicks's *Value and Capital*, Samuelson's *Foundations of Economic Analysis* and the developments of the Arrow-Debreu model--there are few explicit references to natural resources.

The wheel has now turned full circle: in the last quarter of the twentieth century, no general text on economics will be complete without a reference to resource depletion.<sup>93</sup>

This forecast has not so far been validated.

## Damage Resulting from Growth

A clear example of the non-sustainability of short-run solutions is the use of chemical pesticides, which often are more effective on the pest's predators than on the pest itself, and so result in increasing the pest they aim to control. Examples abound, first pointed out by American

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<sup>92</sup> Repetto, Robert. 1988. *Forest for the Trees? Government Policies and the Misuse of Forest Resources*. Washington, D.C.: World Resources Institute.

<sup>93</sup> Dasgupta, P.S., and G.M. Heal. 1979. *Economic Theory and Exhaustible Resources*. Cambridge, England: Cambridge University Press.

authors, among whom the pioneer was Rachel Carson;<sup>94</sup> Perring and Mellanby<sup>95</sup> are among her many successors. The relatively short time interval between the alarm raised by writers and biologists and the banning of pesticides most dangerous to humans and least useful in controlling pests gives some hope for democratic political systems--they are responsive to the findings of scientists when these speak with one voice.

Ecologists stress the growth of population as not the least of the forces that drive the use of pesticides, such as synthetic fertilizers and weed-killers. Having built up population on the food output that these chemical means permit, we cannot entirely stop their use, but only try to moderate their worst effects. Biologists are now learning how they may be effectively used in combination with biological controls.

In a different way biologists explain the extinction of species as a result of human population growth. Growth causes more land to be cultivated, more cultivated land to be taken over by urban municipalities, and more trees to be cut down and forest species displaced. Animal and plant species come and go in the normal course of evolution, but never has the disappearance of species been as rapid as today. Writers in Elliott<sup>96</sup> emphasize the disappearances caused by human activities and the way that such activities simplify ecological systems and make the web of life less stable. Detail is provided in Ehrlich and Ehrlich.<sup>97</sup> Kenneth Arrow<sup>98,99</sup> has a piece of

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<sup>94</sup> Carson, Rachel. 1987 [1962]. *Silent Spring*. 25th anniversary edition. Boston, Massachusetts: Houghton Mifflin.

<sup>95</sup> Perring, F.H., and K. Mellanby, Editors. 1978. *Ecological Effects of Pesticides*. London: Academic Press.

<sup>96</sup> Elliott, D.K., Editor. 1986. *Dynamics of Extinction*. New York: John Wiley and Sons.

<sup>97</sup> Ehrlich, Paul R., and Anne H. Ehrlich. 1983. *Extinction: The Causes and Consequences of the Disappearance of Species*. New York: Ballantine.

<sup>98</sup> Arrow, Kenneth J. 1984. *Individual Choice under Certainty and Uncertainty*. Cambridge, Massachusetts: Harvard University Press.

mathematics that clarifies irreversible decisions, of which development actions that cause species to become extinct are the prime example. The conclusion is that ignorance of whether the species in question could be of use at some later time should lead to less development than would be optimum without this consideration. Though in principle the actors in the market could allow for this, one doubts that in practice they give it much attention.

The reason is that commercial considerations push for short-term gains. In Herman Daly's example,

If a whaler, for example, can make a profit of 15 percent per year by exterminating whales over 10 years and then investing the proceeds in another activity, what economic incentive is there to make a profit of only 10 per cent per year by harvesting the whales sustainably?<sup>100</sup>

And if the whaler has been financed at 12 percent he can only choose between exterminating the whales and bankruptcy. If this market unconcern for the future applies where the use of the species is already well known, how much more does it apply in Arrow's case where the future use is contingent.

### **Can Technology Reconcile Economy and Ecology and Also Provide for Economic Growth?**

One key to reconciling the economic and the ecological approach is technology, on which there is a large literature. Some write the phrase "transfer of technology" as equivalent to "economic development." A

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<sup>99</sup> Arrow, Kenneth J., and A.C. Fisher. 1974. "Environmental Preservation, Uncertainty and Irreversibility." *Quarterly Journal of Economics* 88.

<sup>100</sup> Goodland, Robert, and Herman Daly. 1990. "The Missing Tools." In *Planet Under Stress*, edited by Constance Mungall and Digby J. McLaren, p. 274. Toronto: Oxford University Press.

summary is given in Johnston and Sasson,<sup>101</sup> whose chapter on Biotechnologies and Food Systems is especially relevant to population; changing from chemical controls to genetics could solve many problems. Finding or making food plant species that thrive on seawater would bring North African and other coastal arid lands back into production. This, like other standard references,<sup>102</sup> mostly covers the positive side of technology; the disadvantages and side effects are more difficult to discover. Lester Brown<sup>103</sup> shows that food is less plentiful than has been thought, and that shifts to non-animal shortenings, margarine, soya-based meat substitutes, non-dairy whipped toppings, and coffee whiteners in effect increase carrying capacity in the FAO sense. It was Schumacher<sup>104</sup> and Barry Commoner<sup>105</sup> who gave the alarm on the negative aspects. For them, the present direction of technology may well solve every problem, but in doing so it creates new problems that can be even more difficult; we therefore need to reverse direction and to seek softer and simpler technologies.

Clearly technology is the cause of many present problems, and it is also the best hope for solving them. Population also is the cause of problems, and its control provides the means of mitigating them. How then can responsibility for present difficulties be allocated; how much is due to population and how much to technology? When two factors operate for good or for bad, sharing the credit or the blame presents a difficult problem of imputation.

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<sup>101</sup> Johnson, A., and A. Sasson. 1986. *New Technologies and Development*. Paris: UNESCO.

<sup>102</sup> *Encyclopedia of Science and Technology* (1982), of which the most recent annual update is the *Yearbook of Science and Technology* (1989).

<sup>103</sup> Brown, Lester R. 1975. "World Population and Food Supplies: Looking Ahead." In *Papers Prepared for the Bucharest Conference*, Volume 2, pp. 15-24. New York: United Nations.

<sup>104</sup> Schumacher, E.M. 1973. *Small is Beautiful*. London: Blond and Briggs.

<sup>105</sup> Commoner, Barry H. 1971. *The Closing Circle: Nature, Man, and Technology*. New York: Alfred A. Knopf.

Commoner as well as Ehrlich and Ehrlich<sup>106</sup> express the imputation of environmental damage to technology and to population with the formula  $E = PIT$ , where E is the environment, P the population, I average income, and T some measure of the harshness of the technology used. One school will hold constant technology and income, and blame population for all problems; another will hold constant population and allocate the blame to technology or to income. It is fairer to take it that these three factors of "production" are all operative; if they work independently the simple decomposition on readily available data gives the answer. Ehrlich and Commoner disagree on the interpretation of the numbers that come out in this way, but more important, the whole decomposition is rejected by those who see the factors as interrelated. In particular, high incomes are mostly the result of advanced technologies. And it is argued by the National Academy of Sciences,<sup>107</sup> Kuznets, Boserup, Preston, and others cited earlier that dense population can itself improve institutions and technology and so raise income. Those who find such relationships oversophisticated and the evidence for them inconclusive will come back to the direct and simple decomposition of Ehrlich and Commoner.

### Development Literature for Particular Countries and Areas

The richest part of the development literature is found in the monographs on specific areas, of which there are hundreds--for instance Shaw<sup>108</sup> and Kelley et al.,<sup>109</sup> both dealing with the Middle East. Mauritius is an instructive case because it is a small territory, which up

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<sup>106</sup> Ehrlich, Paul R., and Anne H. Ehrlich. 1990. *The Population Explosion*. New York: Simon and Schuster.

<sup>107</sup> National Academy of Sciences, 1986, *op. cit.*

<sup>108</sup> Shaw, R. Paul. 1983. *Mobilizing Human Resources in the Arab World*. Boston, Massachusetts: Routledge and Kegan Paul.

<sup>109</sup> Kelley, A.C., et al. 1982. *Population and Development in Rural Egypt*. Duke Press Policy Studies. Durham, North Carolina: Duke University Press.

until the 1960s was miserably poor, almost wholly dependent on exports of sugar to a buyer's market, and with a rapidly increasing population. Since that time its economy has diversified, its exports have greatly increased, and its population growth has been checked. Wolfgang Lutz of IIASA is undertaking a major study to find out how the turnaround was accomplished.

The World Bank is a particularly valuable source of data, not only in its annual *World Development Reports* but in the series of country monographs, usually written by distinguished scholars on the basis of actual examination. These are issued by reputable publishers, including Johns Hopkins and Oxford, and are an unsubstitutable contribution to the development literature.

It cannot be stressed too often that most of the general theory proves too much, showing either that more people are always an advantage for welfare or that they are never an advantage, so study of particular areas is the right way to go. Of course theory is needed. The Coale and Hoover work uses theory to forecast the future of India and Mexico on various scenarios supposing more and less population. If such long-term forecasting is impossible, then we had better admit that we can never know whether population increase is advantageous or not.

## Unbalanced Underdevelopment

Case studies of particular areas show innumerable instances of disequilibrium--in food, in population, and in rising wages that price countries out of manufactures. The most obvious source is population growth; Frank and McNicoll<sup>110</sup> study Kenyan rural institutions in the face of averages of five or more children per woman surviving to adulthood. They show that the rural inheritance system cannot last many generations with the division of holdings that is occurring.

The standard general literature discusses policies that will keep GNP rising uniformly year after year, as far as possible in a semi-automatic process. Opposed to this history-free approach are

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<sup>110</sup> Frank, Odile, and Geoffrey McNicoll. 1987. "An Interpretation of Fertility and Population Policy in Kenya." *Population and Development Review* 13:209-43.

Hirschman,<sup>111</sup> Rosenstein-Rodan,<sup>112</sup> and others who see imbalances everywhere and propose that advantage be taken of them, or even that they be deliberately created.

For Leibenstein<sup>113</sup> population is endogenous, determined within the model. A great shock is necessary to get development moving (technical progress, infusion of capital), and when it does get going population growth will fall. Until it gets going, rational parents thinking of their old age give little attention to population programs that would persuade them to limit their families.

Various equilibria of population and its surroundings existed in past times. Before he had efficient stone tools man was in equilibrium with other primates who shared the limited food supplies; after agriculture and urbanization he painfully came into equilibrium with bacteria, as McNeil<sup>114</sup> shows. At each point a preceding balance was disturbed by some (in itself desirable) innovation. Currently it is the initial steps, or partial development, that unbalance societies and urgently demand further steps in development. Partial development includes mass education, urbanization, some very rich people, and many as poor as ever, with population still growing and the poor watching with envy the rich in their own country and abroad. As Sauvy<sup>115</sup> says, "Le propre du déséquilibre est de créer le mouvement." There is no question that movement is occurring, but are the conditions such that it is movement toward welfare or movement toward disaster?

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<sup>111</sup> Hirschman, Albert O. 1958. *The Strategy of Economic Development*. New Haven, Connecticut: Yale University Press.

<sup>112</sup> Rosenstein-Rodan, P.N. 1964. *Capital Formation and Economic Development*. Cambridge, Massachusetts: MIT Press.

<sup>113</sup> Leibenstein, *op. cit.*

<sup>114</sup> McNeil, William H. 1976. *Plagues and Peoples*. Garden City, New York: Anchor Press.

<sup>115</sup> Sauvy, *op. cit.*, Vol. 1, p. 4.

## Unemployment and Rapid Population Growth

Much of the concern of the LDCs has revolved around employment, with increase of GNP often thought of as a means to this rather than an end in itself. For whatever reason, they do not accept the explanation of unemployment (for instance in Beckerman's<sup>116</sup> book) as due simply to rigidities and remediable by removing those rigidities. Rather they incurred huge debts in the 1970s and 1980s to purchase capital intended to employ their urban citizens, who are now coming out of schools and colleges in the thousands. With the closing off of further loans, at least from the private banks of the United States and Germany, they turned to inflationary financing of employment. Thus population growth and the need to employ urban youth if civil order is to be maintained has been one of the incentives to indebtedness and inflation. Of course these maladies have other causes as well, among which are such mistaken policies as farm and food subsidies.<sup>117</sup> Somewhat extended chains of reasoning are required to justify Lester Brown's<sup>118</sup> assertion of the connections between population growth and various social and economic problems, connections more roundabout than those that appear in conventional economics. My ecumenical view is that any chain of causation that is not self-contradictory probably exists somewhere, and these are all operating together, but most are minor effects that are swamped by larger effects; the problem is to find which are the minor and which the major. It is not easy to force data to speak unambiguously and pick out for us the practically important chains of causation.

In the creation of the disequilibrium represented by the employment problem, education has a part to play. Increasing population, an increasing fraction of which has college training and

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<sup>116</sup> Beckerman, Wilfred, Editor. 1986. *Wage Rigidity and Unemployment*. London: Duckworth.

<sup>117</sup> As Robert Dorfman points out to me in personal correspondence.

<sup>118</sup> Brown, Lester R. 1976. *Twenty-Two Dimensions of the Population Problem*. Washington, D.C.: Worldwatch Institute.

corresponding expectations as described by Dore,<sup>119</sup> is a chief worry of many regimes in the LDCs. Up to the time of World War II cities were small, population growth was kept down by high mortality, education was for the few, and the people lived out their lives doing manual work in the countryside. They came to the city only when jobs were created by investment of capital, as in Arthur Lewis's famous interpretation of Adam Smith.<sup>120</sup> That description does not well cover the partial development to be seen in the LDCs today; the flow to the cities comes long before the jobs to employ it exist.

## Sustainable Development

In recent years the continuing debate seems to have become centered on the word "sustainable." Can population and income both continue growing forever? The question is of course the old Malthusian one, with the modification that today's economy is very different from the one Malthus knew. The answer for population still has to be no; for the economy it may now be yes, depending on the form that growth takes.

Gunnar Myrdal saw limits to what the environment can stand:

Population increase is the key factor in the environmental problem. Natural resources have to be considered in relation to the population which is to be provided for.<sup>121</sup>

And recently Ronald Lee, accepting the plentiful evidence that population growth does not damage the economy, also located the population problem in the harm done to the environment:

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<sup>119</sup> Dore, Ronald P. 1976. *The Diploma Disease: Education, Qualification and Development*. London: Allen and Unwin.

<sup>120</sup> Lewis, W. Arthur. 1954. "Economic Development with Unlimited Supplies of Labor." *Manchester School* 22:139-91 (May).

<sup>121</sup> Myrdal, Gunnar. 1972. *Against the Stream*, p. 211. New York: Vintage Books.

Of course many potential consequences of population growth would not be caught in the net of economic statistics, which mainly reflect the goods and services passing through markets. The most serious consequences of population growth may well be those afflicting nonmarket resources, particularly environmental resources and amenities.<sup>122</sup>

An increasing minority of economists in good standing are preoccupied with environmental matters and have produced important work on some of the hidden costs of growth. One of the earliest and most emphatic was E. J. Mishan.<sup>123</sup> Writing on this aspect are Herman Daly<sup>124</sup> and Bartelmus,<sup>125</sup> along with a Mexican anthropologist, Arizpe.<sup>126</sup> Valuable contributions are collected in Dorfman and Dorfman.<sup>127</sup> After the World Bank encountered a storm of criticism on certain of its projects, which included a special issue of the British journal *Ecology*,<sup>128</sup> it made substantial changes in its aid policies.

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<sup>122</sup> Lee, 1989, *op. cit.*

<sup>123</sup> Mishan, E.J. 1969. *Growth: The Price We Pay*. London: Staples Press.

<sup>124</sup> Daly, Herman E., and John Cobb. 1989. *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future*. Boston, Massachusetts: Beacon Press.

<sup>125</sup> Bartelmus, Peter. 1986. *Environment and Development*. Boston, Massachusetts: Allen and Unwin.

<sup>126</sup> Arizpe, Lourdes. 1989. *On the Cultural and Social Sustainability of Economic Development Models*. Paper presented at 25th Anniversary Symposium "The Next Decade: Interdependence in a Multipolar and Two-Track World Economy." Paris: OECD Development Centre.

<sup>127</sup> Dorfman, Robert, and Nancy S. Dorfman. 1977. *Economics of the Environment: Selected Readings*. New York: Norton.

<sup>128</sup> *Ecology*. 1986. Special Issue on Environment.

Average income can increase indefinitely provided the shift to services that we see prominently today continues rapidly enough. No environmental limits prevent more medical services per capita, more education per capita, more and better restaurants, or more and better opera. In fact this is the way a series of writers, as far back as Colin Clark and Fouristié, saw that the economy would inevitably move from primary to secondary to tertiary. Primary is based essentially on land, and the population limit is sharp; secondary is more flexible, but it still requires materials and energy; tertiary is the most flexible of all, requiring little outside of skill and effort.

The trouble for sustainable growth is that the economy does not move that way fast enough. As they become richer people do want more services, but they also want more houses, more automobiles, and more air travel. Taking all increments to their incomes in the form of services would not suit the present developed countries, and it would certainly not suit the less developed until they were well past where the developed countries now are. Economic policies that would push consumption in a sustainable direction can indeed be devised, but so far the path that consumption will take seems to be determined by its own laws.

Will not good economic and ecological regulations and sound tax systems direct the economy into an environmentally viable trajectory? They would, but people do not vote for good rules that cause departures from the consumption pattern they want. Thus it is difficult to legislate sound policies in a democracy, and for other reasons they are even less likely to be imposed in a dictatorship. If we have one piece of empirically backed knowledge, it is that bad policies are widespread and persistent. Social science has to take account of them.

### **Other Effects of Large and Growing Population**

The case against rapid population growth has been made on grounds that have nothing to do with either economic growth or environment. Intuition suggests that population pressures lead to war, and the eminent group recently sponsored by the American Assembly declared in its final report:

In many developing countries, population pressures on the land threaten national security as people migrate in search of sustenance, aggravating territorial disputes and often creating violent conflict.<sup>129</sup>

Choucri<sup>130</sup> concludes from her data that "the direct link between density and violent behavior has been found to be weak," but on the other hand "density does appear to have a substantial impact on international violence through a complex causal chain."

If international wars are not immediately attributable to population growth, internal rebellions are so attributable, according to a number of studies. The well-known dynastic cycle in China is commonly associated by scholars with population: Population growth leads to a gradual fall in income per head, until eventually the surplus over bare subsistence is insufficient to provide for the ruling class and its military instruments of control, and after a period of brigandage and local warlords a new dynasty seizes power. Usher studies the historical data and finds that it confirms a simple logic:

In a society of farmers, rulers, and bandits, population growth simultaneously impoverishes farmers and reduces the ruler's surplus....Society evolves into a despotic stationary state or into a dynastic cycle, depending on whether poverty among farmers chokes off population growth before the surplus shrinks to the point where rulers turn to banditry.<sup>131</sup>

The disappearance of the surplus not only deprives the rulers of luxury, but more important it deprives them of the armed forces that can maintain order through the empire. The mechanism in question has

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<sup>129</sup> Mathews, *op. cit.*

<sup>130</sup> Choucri, Nazli. 1974. *Population Dynamics and International Violence*, p. 60. Lexington, Massachusetts: Lexington Books.

<sup>131</sup> Usher, Dan. 1989. "The Dynastic Cycle and the Stationary State." *American Economic Review* 79(5):1,031-44.

some resemblance to Nelson's<sup>132</sup> low-level trap models of the persistence of underdevelopment, as Usher points out. To me it resembles the theory of Ibn Khaldun, derived from his experience in the Middle East and North Africa, except that Ibn Khaldun gave special attention to the incapacity of later generations of rulers in each cycle.

So much for China. Jack Goldstone shows with data for Britain, tracing rebellions over several centuries, that rebellions were almost invariably preceded by a rise in the price of grain, which was due to increased population in a stationary agriculture.

Beyond that, and more peaceful, a long tradition of research and writing is based on the comparison of individuals born in large and those born in small families. Children born to couples having only one or two come out better in many kinds of tests. A recent book by Blake<sup>133</sup> presents the classical case and adds new evidence.

And even if none of these assertions were true in a causal sense (though all are based on perfectly valid correlations), there would be a case for birth control if people want to use it. That in fact is what the NAS report ends up with as the chief argument for providing contraceptive information and supplies: Every couple has a right to as few or as many children as it wishes. That sounds fair enough, until one meets up with the parallel assertion that every child has the right to adequate nutrition. Suppose the world is made in such a way that these two rights cannot both exist once density goes above a certain point? Such incompatibilities of moral principles are not usually acknowledged in official documents.

## Envoi

The conclusion of most academic economists from their current theoretical work and the data adduced in its support is that population

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<sup>132</sup> Nelson, Richard R. 1956. "A Theory of the Low-Level Equilibrium Trap in Underdeveloped Economies." *American Economic Review* 46:894-908 (December).

<sup>133</sup> Blake, Judith. 1989. *Family Size and Achievement*. Berkeley, California: University of California Press.

growth does not greatly handicap economic development. Without opposing that result, one has to point out that the argument does not take into account the impact of humans on the biosphere, which is equivalent to saying that the conclusion applies in an infinite world. It is the finiteness of the ecosphere in all its dimensions to which biologists draw attention.

For various reasons this finiteness is only now coming to be important. Only now are we having to recognize the ozone layer, carbon dioxide in the atmosphere, extinction of species, waste, and desertification. In the past, populations were small enough, incomes low enough, and technologies innocuous enough that the effect of humans on the ecosphere could be neglected, i.e., the ecosphere was effectively infinite. One unfortunate effect of this transition to a finite world is that data drawn from the past tell little about the world of the twenty-first century, when present trends will make that finiteness more and more felt.

Like every other branch of social science, ours is confounded by the central place of interpretation in human affairs. The great obstacle to explanation and forecasting is that so much depends on how people look at their situations. If they can anticipate prospective crowding and its discomforts, and accordingly limit their numbers as Malthus urged, that gives rise to one demographic condition; if they see themselves as needing children for support in their individual old age, or collectively as warriors, that leads to something different. Examples of the former have been turned up by anthropologists among preliterate, including the hunters and gatherers of the Kalahari Desert.<sup>134</sup> The !Kung have as simple a culture as exists anywhere, with no writing, no state, and certainly no economic development, but their reproductive behavior is such as not to disturb their leisurely lives (they work only two or three days a week); certainly the stability of their relation to their environment depends on having few children. The !Kung are not the only (or necessarily the best) example of preindustrial population control. Wulf

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<sup>134</sup> Howell, Nancy. 1979. *Demography of the Dobe !Kung*. New York: Academic Press.

Schiefenhövel<sup>135</sup> describes clearly deliberate control among the Eipo of Irian Jaya, and Napoleon Chagnon<sup>136</sup> the same among the Yanomamö of the Amazon. The French peasantry of the nineteenth century are well known for birth control without equipment. At the other extreme are rural Kenyans and Pakistani hill tribes, with their very large families and rapid increase.

Thus two tribes, similar in physical environment and social structure, can differ in fertility and other practices because they interpret their situations differently. We do not like to think of those subjective understandings, for as such they are beyond the reach of science. We take it as a matter of faith that subjective elements are controlled by objective conditions, but the relation of the subjective interpretation to the surrounding world is often ambiguous. That is what makes possible the several disciplines of social science. The !Kung and a hill tribe in Pakistan, economists and biologists, look at population differently. Some put one set of variables into their models, others use other variables. Scholars as well as the people they study have their different ways of interpreting the world!

Perhaps Perlman<sup>137</sup> had something of this in mind when he wrote: "If we use antinatalist programs, we do so for reasons other than those simply offered by what we as economists now know."

A truly interdisciplinary treatment would systematically integrate those other reasons.

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<sup>135</sup> Schiefenhövel, Wulf. 1984. "Preferential Female Infanticide and Other Mechanisms Regulating Population Size Among the Eipo." In *Population and Biology*, edited by Nathan Keyfitz, pp. 169-92. Liège: Ordina Editions.

<sup>136</sup> Chagnon, Napoleon A. 1977. *Yanomamö: The Fierce People*. 2nd edition. New York: Holt, Rinehart and Winston.

<sup>137</sup> *Ibid.*, p. 81.