Back to Malthus

200-year-old scenario may return to haunt us

by Werner Fornos

Most prophets have been consigned to the trash bin at some point in human history, only to be retrieved, resurrected, and sometimes even beatified. Prophets and visionaries, by definition, cannot be judged during their lifetimes. In the fields of economics and other social sciences, no one has been more discredited than the Reverend Thomas Robert Malthus, who has been more recognized in derision than in serious contemplation.

As the world continues to grow exponentially as the English parson had warned us, the relevance of his thinking becomes as clear as the summer sky. Two hundred years after he first wrote his "anonymous" *Essay on the Principle of Population*, few miracles, it appears, can save the world from careless growth. A careful study of the Rev. Malthus' theories, principles, likely outcomes and possible solutions makes one thing clear: for all their mistiming and misconceptions, Malthus' fears are at our world's threshold again. Now, more than at any other time in history, we must heed his warnings, notwithstanding the dismissive claims of the so-called optimists.

Credible and incontrovertible evidence is presented almost every day that points to a growing imbalance between population growth and the world's resources. There is still hope, and possible room, for yet another technological miracle, but any such breakthrough cannot wipe out fears of a food crisis forever: it can only postpone it for a little longer. There is a limit to available croplands in the world, and statistics indicate a gradual fall in per capita cropland use and food grain output already.

We can no longer rest on our hope for technology to carry us through another crisis. Alongside a search for more efficient ways to feed our billions we also must work to reduce the number of mouths to feed, as Malthus himself recommended. Population stabilization efforts can no longer be ignored as unnecessary preparations or unwarranted panic mongering. A reassessment of Malthus will give us that most essential inspiration to make the world more livable.

***Werner Fornos** is president of the Population Institute, a Washington-based nonprofit public interest group. He is a frequent speaker and writer on "rational and humane solutions to the population problem." Readers may contact Mr.Fornos by e-mail at Popline@Primanet.com.*

Population Concerns in History

Even though the Reverend Malthus made his startling prediction 200 years ago, he was not exactly the first person in history to express concern over excessive population growth. Several ancient epics as well as earliest history texts have references to overpopulation and its adverse effects.

Joel E. Cohen, the respected population scientist, in his introduction to the book, *How Many People Can the Earth Support?* lists references to overpopulation in early Babylonian tablets from circa 1600 B.C. and from Homeric epics. In the Babylonian history of humankind, the gods, alarmed and disturbed by the rapid multiplication of people, ordered: "Let there be a pestilence (upon mankind)." In the Homeric epic of *Cypria* (written 776-580 B.C.), Zeus caused the Ilian war to relieve the earth of the growing pressure of mankind.[1]

In 1758, eight years before the Rev. Malthus was born and 40 years before he wrote his *Essay*, the rector of a Danish parish, the Reverend Otto Diederich Lutken, published an article in the *Danish-Norwegian Economic Magazine* entitled "An enquiry into the proposition that the number of people is the happiness of the realm, or the greater the number of subjects, the more flourishing the state." The article began:

> *Since the circumference of the globe is given and does not expand with the increased number of its inhabitants, and as travel to other planets thought to be inhabitable has not yet been invented; since the earth's fertility cannot be extended beyond a given point, and since human nature will presumably remain unchanged, so that a given number will*

hereafter require the same quantity of the fruits of the earth for their support now, and as their rations cannot be arbitrarily reduced, it follows that the proposition "that the world's inhabitants will be happier, the greater the number" cannot be maintained, for as soon as the number exceeds that which our planet with all its wealth of land and water can support, they must needs starve one another out, not to mention other necessarily attendant inconveniences, to wit, a lack of the other comforts of life, wool, flax, timber, fuel, and so on. But the wise Creator who commanded men in the beginning to be fruitful and multiply, did not intend, since He set limits to their habitants and sustenance, that multiplication should continue without limit.[2]

"In the 20th century [contrary to Malthus' projections] falling fertility in Europe threatened underpopulation."

Two decades before Malthus published his first version of his *Essay*, Adam Smith, in his monumental work, *An Inquiry into the Nature and Causes of the Wealth of Nations,* studied the principles of population in relation to the working of the labor market:

A half-starved (Scottish) Highland woman frequently bears more than twenty children, while a pampered fine lady is often incapable of bearing any, and is generally exhausted by two or three. Barrenness, so frequent among women of fashion, is very rare among those of inferior station.[3]

In another comment that runs close to the Malthusian theory, Smith said:

Every species of animal naturally multiplies in proportion to the means of their subsistence, and no species can ever multiply beyond it. But in civilised society it is only among the inferior ranks of people that the scantiness of subsistence can set limits to the further multiplication of the human species; and it can do so in no other way than by destroying a great part of the children which their fruitful marriages produce.[4]

These simple but profound extrapolations of a universal truth bear close resemblance to the Malthusian theory, yet no one has heard of the Rev. Lutken being hauled over coals for his opinion. Then what made Malthus the singular target of all Utopians?

Anatomy of a Prediction

What makes the Malthusian theory harsh are both the sweeping conclusion and the rather bleak scenario it projects for the late 18th and the early 19th century England — so much so that the word Malthusian has become synonymous with "pessimistic."

The core of his theory was that population grows in geometrical proportions — multiplying at the rates of 1, 2, 4, 8, 16, etc., and doubling every 25 years — while food production can grow only in arithmetic progressions — 1, 2, 3, 4, 5, etc. — and therefore at some point in the future ("in a thousand years") population growth will overwhelm food production. When such a time arrives, the theory concludes, misery and vice will act as checks on population growth, and again bring about a balance between the two.

Malthus based his theory on two postulata, assumptions that are as valid today as they were 200 years ago:

First, that food is necessary for the existence of man. Secondly, that the passion between the sexes is necessary and will remain nearly in its present state.[5]

The weight of the Utopians' criticism was directed at his conjectured rates of growth of population (geometrical) and food production (arithmetical). Malthus extrapolated his theory from real-life experiences of the time, and in 18th century England his projections for food production seemed even generous. He had no way of foreseeing that science would revolutionize agriculture with steam engine, biochemistry and plant genetics.

So, mechanization and the green revolution boosted global food production, especially in the 20th century, and fortunately the world did not see the kind of widespread famine and starvation Malthus expected. Falling fertility in Europe, in fact, threatened to prove contrary to Malthusian projections — the problem of underpopulation. But

the specter of the "Malthusian trap" was never completely removed.

Less than a decade after Malthus's death in 1834, neighboring Ireland faced one of the world's worst famines. Ireland in the 1840s was overpopulated, and depended heavily on its potato harvests. Because of widespread poverty, the potato was the only available cheap, staple food for the Irish. But between 1845 and 1847, Ireland's potato crop failed because of a plant disease, a fungus, resulting in widespread starvation and deaths. As many as 750,000 Irish people are believed to have died in the famine, and 800,000 emigrated to the United States — emigration is another of Malthusian checks on a population explosion.

Similarly, Bengal, then part of British India, and China suffered a series of famines and epidemics over the next 100 years, resulting in millions of deaths. About 9 million Chinese are believed to have died in famines between 1877 and 1879. In 1902, another famine in China resulted in about a million deaths. About 800,000 people died in the famine of 1837 in India.[6] Is it merely a coincidence that China and India, the two countries that have historically suffered the most from famines, also happen to be the two most populous countries in the world? Or were these instances of pestilence, additional Malthusian check on population, at work?

The Irish, Chinese and Bengal famines have often been attributed to mistaken government policies and social structures and it has been claimed that they have nothing to do with the Malthusian theory. Malthus was influenced by the socio-economic theories of Adam Smith and others, and in fact, his *Essay* was in response to several such theories. His concepts of population growth versus available "room and nourishment" on Earth, and his subscription to Smith's principles on the demand and supply of labor — all these point to the fact that his theory was not divorced from the socio-economic aspects of population growth.[7]

Of Time and Scale

Malthus began his career as a demographer with deep pessimism about "the future improvement of society" when he first wrote his *Essay* in 1798. In subsequent editions, he progressed to cautious optimism. In that sense, he even made allowances for scientific advances, and yet-unknown "checks" on population. Unlike the so-called neo-Malthusians of the 20th century, Malthus did not set a date for the Apocalypse to befall the Earth. In a major disservice to his campaign, his followers in this century trivialized his theories by wagering on the advent of Doomsday. While the 18th century English parson, even if he had no way seeing the future advances, conceded the infinite possibilities of the vast realm of science and social behavior, his modern-day followers have been extremely short-sighted in their projections and warning.

Paul Ehrlich, the respected Stanford University biologist, who will be remembered as one of the pioneers in spreading awareness of population-resources balance, was also among the first to assume the role of a neo-Nostradamus. His various books, beginning in the 1960s' with *The Population Bomb*, succeeded in bringing population concerns to the forefront of international debates. But his credibility suffered with his prediction of widespread famines in ten years. Such short-term predictions of doom also discredited other Ehrlich contemporaries, including William and Paul Paddock (father and son) who wrote a book entitled *Famine – 1975…* in 1967!

"Unlike the so-called neo-Malthusians of the 20th century, Malthus did not set a date for the Apocalypse."

Paul Ehrlich almost forfeited his position as a leading environmentalist when he lost a wager on metal prices with Julian Simon, an advocate of the "more the merrier" philosophy.

It can be argued that just as the Industrial Revolution proved Malthus wrong, the Green Revolution in Mexico and India in the 1970s upset Ehrlich's calculations. But contemporary prophets simply must refrain from predicting that Doomsday is nigh. Such exercises only result in robbing the environmental concerns of all their seriousness.

That the absolute predictions of Ehrlich and the Paddocks did not come true in the 1970s doesn't mean the fears of Malthus are gone forever. Today, more than ever in the past, the Malthusian trap is staring us straight in the face. Malthus reached his famous ratio on population growth and food

production on the basis of the newly independent colonies of North America, where population was doubling every 25 years, but food production was only adding one more proportion over the base year. The world's population today will not double in 25 years — because as the population base grows larger it will take longer for the population to double — but the growth rate is as alarming as Malthus feared.

"…the main Malthusian checks to population growth are also in evidence in Africa where millions are killed in wars, carnage, and in famines caused by floods and drought."

It took the world population a hundred years to move from 1 billion in 1830 to 2 billion in 1930, but only 30 years to reach the third billion in 1960; 15 years to reach the fourth billion in 1975, and 12 years to reach 5 billion in 1987. It is expected to reach 6 billion sometime in 1999. Thus, even at this huge size, world population is set to double in less than 40 years — from 3 billion in 1960 to 6 billion in 1999.[8]

There are at least 74 countries, 40 of them in Africa, whose populations are doubling within 30 years or less.[9] Not coincidentally, these countries also happen to be the ones struggling the most to feed their millions.[10] Every year more than 80 million people are added to the world's population. About 98 percent of the annual increase occurs in poor developing countries in Asia and Africa whose capacity to meet the basic needs of their peoples is far from adequate.[11]

As I pointed out in my recent testimony before the Foreign Operations Subcommittee of the U.S. House of Representatives Committee on Appropriations, the enormous momentum in population growth set off by the entry of nearly three billion people — a number equal to the entire population of the world as recently as 1960 — into their reproductive years in the next generation will have the largest impact on future population growth.[12]

Eighty percent of the world lives in less developed countries. The share of the more developed world is expected to fall from the present 20 percent to 16 percent in 2020. Europe and, to a lesser extent, North America, may have turned into Adam Smith's "pampered fine lady" and slowed down population growth in economic prosperity, but Africa has become a shocking laboratory to prove the Malthusian theory.

The continent, now home to 750 million people, has been growing at the staggering annual rate of 2.6 percent. Most African countries have total fertility rates of six children or more per woman. True to the other end of the Malthusian equation, Africa is also the least self-sufficient in food production. The continent is largely covered with deserts and has little arable land. Most African countries, beaten at the marketplace, look up to food aid from rich Western countries.

Misery and pestilence, the main Malthusian checks to population growth, are also in evidence in Africa where millions are killed in wars, carnage, and in famines caused by floods and drought. Thousands of African lives are also claimed every year by diseases such as AIDS, the worst pestilence of the modern age, and by Ebola virus and Dengue fever.[13]

Feeding the Millions

Driven to Utopian optimism by the phenomenal success of science in multiplying global food production, critics have been quick to trash Malthusian predictions as shortsighted scare mongering. Ignorant as he was of the scientific miracle in store for the world, Malthus allowed room for such a scenario in his limited assessment:

> *No limits whatever are placed to the productions of the earth; they may increase for ever and be greater than any assignable quantity; yet still the power of population being a power of a superior order, the increase of the human species can only be kept commensurate to the increase of the means of subsistence by the constant operation of the strong law of necessity acting as a check upon the greater power*.[14]

So far, the world's food production has managed to keep pace with population growth and

may do so for some years to come. There are signs everywhere, however, that the "fruits of the earth" cannot be taken to be infinite. We of the 20th-21st centuries have already seen the near-saturation of the technological miracle that helped boost food production. While another technological revolution to improve the world's resource reserves may not yet be ruled out, to place all hopes in that invisible cornucopia would be foolhardy.

The Green Revolution of the 1960s and 1970s, driven by the development of better varieties of food grains and more efficient use of croplands, gave rise to euphoric complacency. However, according to agricultural scientists and policy experts, the growth has apparently hit a plateau. Lester R. Brown of the Worldwatch Institute warns us that 200 years after Malthus wrote his *Essay*, "the race between food and people is still a matter of concern in many national capitals."[15]

"…humankind's dogged effort to extend its turf invariably comes into conflicts with Nature and other species."

From 1950 to 1990, the world's grain farmers raised the productivity of their land by an unprecedented 2.1 per cent a year, but since 1990 the rise has slowed markedly. Rice production, which grew at the rate of 2.1 percent annually between 1960 and 1990, has dropped to 1 percent since 1990; wheat yields dropped from 2.6 percent annual growth to 1 percent, and corn productivity fell from 2.6 percent to 1.7 percent. During the same period, world population has been growing at the annual rate of 1.5 percent.[16] Could it be that the Malthusian specter is revisiting us, revalidating fears of population growth over-whelming food production?

"The slower rise in world grainland productivity during the 1990s may mark the transition from a half-century dominated by food surpluses to a future that will be dominated by food scarcity," Brown warns.[17]

A 70-day supply of grain in carryover stocks is considered desirable for a minimum level of food security. However, since 1996, it has been hovering around a 50- to 55-day supply.

Even as the world's farmers race to feed the billions, large stretches of farmland are lost to soil erosion, salinization and other forms of degradation. The Global Land Assessment of Soil Degradation (Glasod) estimates that of the nearly 8 billion acres which are under pasture, 21 percent are degraded, while of the 3.7 billion acres in cropland, 38 percent are degraded to various degrees. The degradation of cropland is most extensive in Africa, affecting 65 percent of the cropland area, compared with 51 percent in Latin America and 38 percent in Asia.[18]

Farming in most of the developed world depends heavily on irrigation, but water has become one of the scarcest commodities of the modern world. According to recent reports, 1.5 billion people — nearly one-quarter of the world population — lack an adequate supply of drinking water. As many as 39 countries are expected to suffer severe water deficiency by 2050. Not surprisingly, 35 of these countries are set to double their populations by that year.[19]

The growing urbanization of the world also results in the diversion of agricultural land into such uses as housing, industrial and recreational sites. The World Resources Institute estimates that since World War II, nearly 3 billion acres — equivalent to the combined area of China and India — have been impaired as a consequence of human activity.[20]

With the shrinking of farmland, people resort to extreme, environmentally dangerous steps to sustain farming. Thousands of square miles of forests have been burnt in desperate attempts to gain croplands in several parts of the world. More than 19,000 square miles of Amazon rain forests have been burning for over two months, destroying several animal and plant species. Fires set off by firewood-seekers in Indonesia earlier this year caused severe air pollution throughout Southeast Asia. According to estimates, year after year the world is losing some 28 million acres of forest, more than two-thirds of which is converted to unsustainable agricultural purposes.[21]

"Half of the forests that once covered the earth are gone, and deforestation has been accelerating in the last 30 years," says a recent Worldwatch report. "Each year, at least another 39 million acres of natural forest are razed — an area the size of

Washington State," the report says.[22]

As the demand for food presses against the available cropland, humankind's dogged effort to extend its turf invariably comes into conflicts with Nature and other species. Pushed to the limits of croplands, the human species turns to the world's oceans to supplement nourishment. As giant trawlers scrape the ocean floor to increase fish output, the marine ecosystem is gradually and irredeemably destroyed. Most of the world's fish species are either over-exploited or exploited near their replacement levels.

According to the World Conservation Union's first comprehensive Red List, published recently, 12.5 percent of the world's 270,000 known species of plants are found at risk of extinction. In the United States, 29 percent of the 16,108 plant species are on the imperiled list. Many of these plants are essential in producing life-saving drugs. For example, 75 percent of the yew family, which produces the anti-cancer drug taxol, is threatened with extinction, according to the Union.[23]

As the world struggles to feed, clothe and shelter the growing millions, the delicate balance among animals, plants, natural resources and the atmosphere is severely disturbed. A now-familiar strain of the call for sustainable development in consonance with the earth's carrying capacity can be read in Malthus's revised *Essay,* where he suggests efforts to balance population with "provisions" of sustenance.

Checks to Population Growth — Malthusian and Modern

Explaining the delicate balance between population and resources and its consequences, Malthus wrote:

> *Through the animal and vegetable kingdoms, nature has scattered the seeds of life abroad with the most profuse and liberal hand. She has been comparatively sparing in the room and the nourishment necessary to rear them. The germs of existence contained in this spot of earth, with ample food and ample room to expand in, would fill millions of worlds in the course of a few thousand years. Necessity, that imperious all pervading law of nature, restrains them within the prescribed bounds. The race of plants and the race of animals shrink under this great restrictive law. And the race of man cannot, by any efforts of reason, escape from it. Among plants and animals its effects are waste of seed, sickness, and premature death. Among mankind, misery and vice. The former, misery, is an absolutely necessary consequence of it. Vice is a highly probable consequence, and we therefore see it abundantly prevail, but it ought not, perhaps, to be called an absolutely necessary consequence*.[24]

Malthus suggests an oscillatory effect between population growth and the welfare level of society: population grows beyond sustenance; famine, diseases and high mortality, especially among children, ensue, thus reducing population growth, even as surviving members of society toil harder to produce more food to meet the demand. The suggestion that disease and starvation will check population explosion may sound out-of tune with the medical advancements of this age, but starvation and diseases continue to haunt millions of people all over the world.

"As the world struggles to feed, clothe and shelter the growing millions, the delicate balance between animals, plants, and natural resources and the atmosphere is severely disturbed."

More than 20 million adults worldwide are infected with AIDS, which has led to an increase in mortality in Africa — to more than one-and-a-half times the world average — and brought down life expectancy to 50 years or less in several African countries. Infant and maternal mortality rates continue to be high in several parts of the world.[25]

Recent reports have also indicated a return of infectious and parasitic diseases such as malaria, tuberculosis, cholera, dengue fever and Ebola. More than 17 million people have died from these diseases since 1995, accounting for more than one-fourth of all deaths. About 97 percent of these deaths occur in low-income countries that also have high fertility rates.[26]

On a more humane level, Malthus also prescribes other checks on population which are within the control of the people — the very ideas promoted by the modern-day demographers and sociologists:

> *…a foresight of the difficulties attending the rearing of family acts as a preventive check and the actual distresses of some of the lower classes, by which they are disabled from giving proper food and attention to their children, acts as a positive check to the natural increase of population.*[27]

In the revised edition of the *Essay*, Malthus was less pessimistic about the future happiness of society and added one more possible check to population: delayed marriage, which he termed "moral restraint."

> *It is clearly the duty of each individual not to marry till he has a prospect of supporting his children; but it is at the same time to be wished that he should retain undiminished his desire of marriage, in order that he may exert himself to realize this prospect, and be stimulated to make provision for the support of greater numbers*.[28]

Of course, modern contraception was inconceivable in Malthus's time; nor could one expect the parson to recommend abortion. So within the constraints of the time the best solution he could find was delayed marriage and childbearing, which continue to be among the prime strategies of population stabilization advocates today. Several international studies have revealed that delayed marriage has helped many countries slow down their population growths.

In an apparent rejoinder to Adam Smith's theory on labor, Malthus wrote, "…we must explain to (the poor) the true nature of their situation and show them that the withholding of the supplies of labour is the only possible way of really raising its price, and that they themselves, being the possessors of this commodity, have alone the power to do this."[29] The modern Western conglomerates' race to cash in on the cheap labor of China and other Third World countries cannot be better explained.

In an unintended forerunner to the 1994 Cairo Programme of Action on Population and Development, Malthus wrote: "…it is not the duty of man simply to propagate his species, but to propagate virtue and happiness; …If he has not a tolerably fair prospect of doing this, he is by no means called upon to leave descendants."[30]

As Dr. Nafis Sadik, executive director of the United Nations Population Fund (UNFPA), asserted, the Cairo Programme of Action contained "highly specific goals and recommendations in the mutually reinforcing area of infant mortality, education and reproductive health and family planning, but its effects will be far wider-ranging than that. The Programme of Action has the potential to change the world."[30]

More is not the Merrier

Malthus's detractors, bent on proving his theory wrong, claim that the earth's resources, even at present levels, can sustain 11 billion or 15 billion people — more than double the current population. They claim that the recoverable stocks of various metals and minerals in the earth can sustain us for thousands of years to come. But the signs of the times show more strain on the resources than comfort.

"…it is not the duty of man simply to propagate his species, but to propagate virtue and happiness…"
— Thomas Robert Malthus

Emboldened by Paul Ehrlich's failed wager with the late Julian Simon on metal prices in the 1980s, the cornucopians say science, that ultimate provider of hope, can devise technologies to recover mineral wealth from the core of the earth. An improved method of fast extraction and exploitation of natural resources (oil and other minerals) may increase the current output levels, but it does not mean the resources are infinite. Ironically, it might well mean the faster depletion of resources. For, when all is said and done, the bottom line is that resources are limited.

Using the classical hare-tortoise race as a metaphor, Malthus suggested trying to "raise the quantity of provisions" even while working to slow

down population growth — which is the essence of modern-day sustainable development.[31]

It would be a foolish stretch of reason to believe that the earth can support 15 billion people or even more. The truth is staring at us right now from every corner of the world: countries are struggling to support even the current global population of nearly 6 billion. Eighty-six countries are currently classified as low-income food-deficient by the U.N. Food and Agricultural Organization. As many as 1.3 billion people — more than the combined population of Europe and North America — live in absolute poverty on the equivalent of one dollar or less per day. More than 840 million people are under-nourished today, and even with all possible improvements in food production, there will still be at least 680 million under-nourished people in the world in 2010.[32]

While it may be easy for some of the critics from rich European or American nations to shed tears over falling fertility rates in Europe and discount the fears of overpopulation and its impact, it will be worthwhile to heed the cries of those poor overpopulated countries that suffer the painful, first-hand consequences of overpopulation. Their illiterate, impoverished millions, their overcrowded cities and parched farmlands can be transformed only by a concerted global conviction and effort.

Malthusian prophecy may not come true in this century or the next, but if we don't act now to stabilize population growth along the lines proposed at the 1994 International Conference on Population and Development it will be difficult to rule out that doomsday in future. It will be in the world's interest to prove Malthus wrong. And Malthus would have welcomed it, as he suggested in the preface to his "Anonymous" first *Essay*:

> *If he (the author) should succeed in drawing the attention of more able men to what he conceives to be the principal difficulty in the way to the improvement of society and should, in consequence, see this difficulty removed, even in theory, he will gladly retract his present opinions and rejoice in a conviction of his error*.[33] **TSC**

SELECTED REFERENCES

An Essay on the Principle of Population by Thomas Robert Malthus, edited by Philip Appleman, W. W. Norton and Company, New York, 1976

Full House: Reassessing the Earth's Population Carrying Capacity, The Worldwatch Environmental Alert Series, by Lester R. Brown and Hal Kane, W. W. Norton and Company, New York, 1994

State of the World, 1998, Lester Brown and others, Worldwatch Institute, Washington, DC, 1998

Vital Signs 1997: The Environmental Trends That are Shaping Our Future, Lester R. Brown and others, Worldwatch Institute, Washington, DC, 1997

World Population Data Sheet, 1997, Washington, D.C.: Population Reference Bureau, 1997

State of the World Population, 1997, United Nations Population Fund, 1997

Resource Conservation, Population and Sustainable Development, Washington: *Toward the 21st Century*, The Population Institute, 1997

"Food Security Depends on Family Planners," *Popline*, Population Institute, Washington DC. January-February 1997,

The 1997 World Population Overview, Washington: *Toward the 21st Century*, The Population Institute, 1998.

Population in the 21st Century: UNFPA and Agenda 21, United Nations Population Fund, New York, 1997

Population & Sustainable Development: Five Years After Rio, United Nations Population Fund, New York, 1997

World Resources: A Guide to the Global Environment – The Urban Environment 1996-97, A joint publication by The World Resources Institute, The United Nations Environment Programme, The United Nations Development Programme, and The World Bank, Oxford University Press, New York, 1997

Human Development Report 1997, United Nations Development Programme (UNDP), Oxford University Press, New York, 1997

The Population Bomb, Paul R. Ehrlich

The Most Overpopulated Nation, Paul R. and Anne H. Ehrlich

How Many People Can the Earth Support? Joel E. Cohen, W. W. Norton and Company, New York, 1995

Critical Masses: The Global Population Challenge, George D. Moffett, Viking, 1994

Last Oasis: Facing Water Scarcity, Sandra Postel, The Worldwatch Environmental Alert Series, W.W. Norton & Company, New York

The State of World Population, 1997, New York: United Nations Population Fund, 1997

World Population Prospects: The 1996 Revision, United Nations Population Division, New York, 1997

"Future Population May Overwhelm Food Supply," *Popline,* The Population Institute, November-December 1997.

"Developing World's Quality of Urban Life is Declining,"

Popline, The Population Institute, November-December 1997

"Urbanization spurs Return of Diseases," *Popline,* The Population Institute, September-October 1997

"Population Surpassing Cropland Productivity," *Popline,* The Population Institute, September-October 1997

"1 in 8 Plants in Global Study Threatened," *The Washington Post,* April 8, 1998, A1; "One in every 8 Plant Species is Imperiled, a Survey Finds," *The New York Times,* April 9, 1998, A1

NOTES

[1] Joel E. Cohen, *How Many People Can the Earth Support? W. W. Norton and Company, New York, 1995, p.5.*

[2] ibid., p.7.

[3] Philip Appleman, ed., *An Essay on the principle of Population, Thomas Robert Malthus, A Norton Critical Edition,* W. W. Norton and Company, New York, 1976, p.6.

[4] ibid., p.6.

[5] ibid., pp.19,20.

[6] World Book Encyclopedia, references under "Ireland, Famine."

[7] Appleman, pp.24,36 (Malthus' *Essay*, Chapters II, V.

[8] U.S. Census Bureau, International Population Center (www.census.gov/ipc/www), Population Reference Bureau's World Population Data Sheet (www.prb.org), UN Population Division's World Population Prospects, 1996 revision.

[9] ibid.

[10] UN Food and Agricultural Organization's list of low-income, food-deficient countries, 1996.

[11] U.S. Census Bureau, etc.

[12] Testimony of Werner Fornos, president of the Population Institute, before the Foreign Operations Subcommittee of the U.S. House of Representatives Committee on Appropriations, Washington, DC, March 31, 1998.

[13] "Urbanization Spurs Return of Diseases," *Popline*, The Population Institute, September-October 1997.

[14] Appleman, p.23, Malthus' *Essay*, Chapter II.

[15] Lester R. Brown and others, *State of the World, 1998*, A Worldwatch Institute Report, W. W. Norton and Company, New York, 1998, Chapter 5" "Struggling to Raise Cropland Productivity, p.78.

[16] ibid., p.88, "Population Surpassing Cropland Productivity," *Popline*, The Population Institute, September-October 1997.

[17] ibid., p.91, "Future Population May Overwhelm Food Supply," *Popline*, November-December 1997.

[18] International Food Policy Research Institute, Washington, DC, Discussion Paper 14, p.5. Also see Scherr S.J. and Jadav S., *Land Degradation in the Developing World: Implications for Food, Agriculture and the Environment to 2020,* quoted in "Food Scarcity for a Growing World Population," Novartis Foundation for Sustainable Development, 1998.

[19] Population Action International: sustaining Water, Easing Scarcity, quoted in *The Washington Post*, "What On Earth?" January 10, 1998, p.A16.

[20] World Resources Institute, *World Resources 1992-93*, Oxford University Press, New York, 1992, p.111.

[21] Lester Brown and others, *Vital Signs, 1997*, W. W. Norton and Company, New York, 1997, p.96.

[22] Janet N. Abramovitz, *Taking a Stand: Cultivating a New Relationship with the World's Forests*, Worldwatch Paper 140, Worldwatch Institute, 1998.

[23] "1 in 8 Plants in Global Study Threatened," *The Washington Post*, April 8, 1998, p.A1; "One in Every 8 Plant Species is Imperiled, a Survey Finds," *The New York Times,* April 9, 1998, p.A1.

[24] Appleman, etc., Malthus' *Essay*, Chapter I, p.20.

[25] World Health Organization and Population Reference Bureau's World Population Data Sheet, 1997, *The 1997 World Population Overview,* Washington: *Toward the 21st Century,* The Population Institute, 1998.

[26] Jay Olshansky and others, *Infectious Diseases — New and Ancient Threat to World Health,* Population Reference Bureau Bulletin, 1997.

[27] Appleman, etc., Malthus' *Essay*, Chapter IV, pp.33-34.

[28] ibid., Malthus' *Essay,* 1803 Revised Edition, Chapter I, p.132.

[29] ibid., Chapter IX, p.136.

[30] Nafis Sadik, executive director, UNFPA: Closing remarks at the International Conference on Population and Development, Cairo, 1994.

[31] op.cit., Appleman, etc., p.133.

[32] UN Food and Agricultural Organization, *Food, Agriculture and Food Security: The Global Dimension,* (World Food Summit Document WFS 96/Tech 1) Rome, 1996.

[33] Appleman, etc., Preface to Malthus' *Essay on the Principle of Population 1798 edition, p.16.*