Journal of Applied Ecology 1997, **34**, 1325–1333

FIFTH BES LECTURE

Population, economics, environment and culture: an introduction to human carrying capacity*

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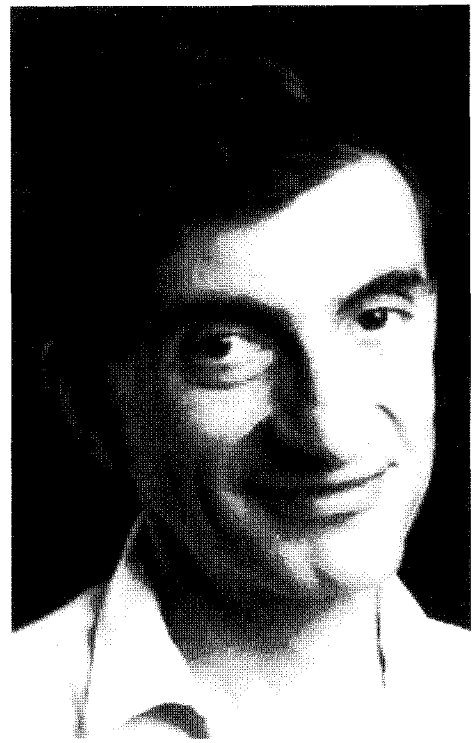

> Ah, what a dusty answer gets the soul
> When hot for certainties in this our life!
> George Meredith, *Modern Love* (1862)

Introduction

The question 'How many people can the Earth support?' is useful, though it is seriously incomplete. It focuses attention on the present and future numbers, qualities, activities and values of humans in their relations with one another and with the Earth. To explain why people are interested in this question, I offer an overview of global human population, economy, environment and culture. I then review some answers to the question, and describe what is involved in answering it. Finally, I suggest some actions that could alleviate some of the problems of population, economy, environment and culture.

Human carrying capacity differs from traditional ecological concepts of carrying capacity. The question of how many people must be enlarged by asking, at the very least: How many with what economics and technologies? At what levels and with what diversity of economic well-being? How many living in what physical, chemical and biological environments? Over what time horizon? With what variability over time, and at what risks? How many with what cultures? What values? And what social, political and legal institutions?

The answers to all these questions must be probabilistic, conditional and dynamic: probabilistic, because humans cannot perfectly predict the future; conditional, because the answers depend on choices yet to be made; and dynamic, because predictions and choices are susceptible to change.

Though demographic forecasting should always be taken with many grains of salt, one plausible range of future population sizes for the year 2050 runs from 7·8 billion to 12·5 billion. Studies of how many people the Earth can support have suggested a zone of limits in the very same range.

Neither panic nor complacency is in order. The Earth's capacity to support people is determined both by natural constraints, which some will emphasize, and by human choices, which others will emphasize. In the coming half century, we and our children are less likely to face absolute limits than difficult trade-offs — trade-offs among population size and economic well-being and environmental quality and dearly held values. Foresight and action now might make some of the coming trade-offs easier.

I hope to offer a perspective to protect you from those who say that rapid population growth is no problem at all, and from those who say that population growth is the only problem. A rounded view of the facts should immunize you against both cornucopians and doomsayers. I give more details of my perspective, and the sources of data not otherwise credited here, in my recent book, *How Many People Can the Earth Support?* (Cohen 1995).

*The text of the Fifth BES Lecture delivered on 18 December 1996 at the University of Durham during the Winter and Annual General Meeting of the British Ecological Society. The text is partially based also on Professor Cohen's introduction to a symposium entitled 'How Many People Can the Earth Support?' held at the annual meeting of the American Association for the Advancement of Science, Baltimore, Maryland, 9 February 1996. This article is © 1997 by Joel E. Cohen.

Past human population

Let's begin with the past. I will touch on changes in population, the economy, the environment and culture.

POPULATION SIZE AND GROWTH

In the last 10 000 years, the number of humans increased about a thousand-fold, from roughly 2–20 million people to nearly 6 billion people in 1997 (Cipolla 1974; Population Reference Bureau 1997). This demographic surge coincided with environmental change (the end of the last ice age) and economic and cultural changes (multiple independent inventions of agriculture and of permanent settlements after the end of the last ice age).

Two thousand years ago, the Earth had roughly one-quarter of a billion people, the population of the United States around 1990. By 1650, the Earth's population doubled to half a billion. When the Old World and the New World began to exchange foods and other resources in a serious way, the time required to double the population dropped from more than 16 centuries (after the inventions of agriculture) to less than two centuries. The human population passed one billion around 1830. The second billion people were added in only one century, by 1930. The next doubling, to four billion, took only 44 years. Until around 1965, the human population grew like an interest-bearing account, in which the rate of interest increased with the balance in the account. Around 1965–70, the global population growth rate reached its all-time peak, then began to fall gradually and erratically. It still remains far above global growth rates ever experienced prior to 1945.

In the lifetime of anyone who is over 40, world population has doubled. Never before the second half of the twentieth century had any person lived through a doubling of world population. In absolute numbers, putting the first billion people on Earth took from the beginning of time to about 1830. Adding the latest billion took 12 years.

The populations of some domestic animals grew even faster than human numbers. For example, the number of chickens more than doubled in the decade prior to 1991, when it reached 17 billion. The 4·3 billion large domestic animals maintained by humans outweigh the human population. Over the last 20 years, domestic animals were fed about 40% of all grain consumed. For every 3 kilos of grain that went into a human mouth, another 2 kilos went into the mouth of a domestic animal. The human species lacks any prior experience with such rapid growth and large numbers of its own or of its domestic species.

In spite of this rapid population growth, by demographic and nutritional standards average human well-being has improved. For the world as a whole, life expectancy at birth rose from 46·4 years in 1950–55 to 64·4 years in 1990–95, an increase of 18 years in the average length of life. The advantage in life expectancy of the more developed regions over the less developed regions fell from 26 years in 1950–55 to 12 years in 1990–95 (United Nations 1995a; pp. 115, 117). In developing regions, the absolute numbers and the fraction of people who were chronically undernourished fell from 941 million around 1970 to 786 million around 1990. In Africa, contrary to the world trend, the absolute number of chronically undernourished increased by two-thirds between 1970 and 1990. Africa also had the highest population growth rates during this period, and still does.

Ecology can shed light on the thousand-fold increase of human abundance during the last 10 000 years. Allometric relations between mammalian body size and population density give insight into whether 2–20 million people or 6 billion people are ecologically unusual numbers of individuals for an animal of human size. When nonhuman animal species are compared, the more a typical adult individual weighs, the smaller the typical number of individuals per unit of land area at any one time. Specifically, if D is population density (number of individuals km^{-2}) and W is the adult body weight (kg), then to a first approximation $D = \mathrm{a}W^{b}$. The values of the parameters a and b and the goodness-of-fit of the allometric relation depend on the group of animal species and the biogeographic region (Fig. 1).

Table 1 gives estimates of a and b for tropical mammals (from Peters & Raelson 1984; p. 505) and computes the expected population density for adult body weights of 50 and 70 kg, weights roughly typical of small and large humans. (Allometric relations for North American species are omitted from Table 1 because, as Fig. 1 shows, the range of weights of North American mammals does not extend to body sizes typical of humans, and because humans or hominids originally evolved in the tropics.) The final columns of Table 1 multiply these population densities times the approximate ice-free land area of the Earth, 133 million km^2, to get estimated total population sizes of average tropical mammals with adult body weights of 50 kg and 70 kg.

For a large carnivore or omnivore of 50–70 kg adult body weight, the expected global population size is 11 million to 13 million individuals. For small plus large carnivores plus omnivores combined, the expected global population size is 17 million to 23 million individuals. These figures agree startlingly well with the estimated preagricultural human population size of 2 million to 20 million, which is derived independently from archaeological finds and observations of the population density of present-day hunter-gatherer groups. For most of human history, until agricultural evolutions started about 10 000 years ago, humans were apparently about as rare or abundant as carnivores and omnivores of comparable weight.

If people took on the ecological roles of large trop-

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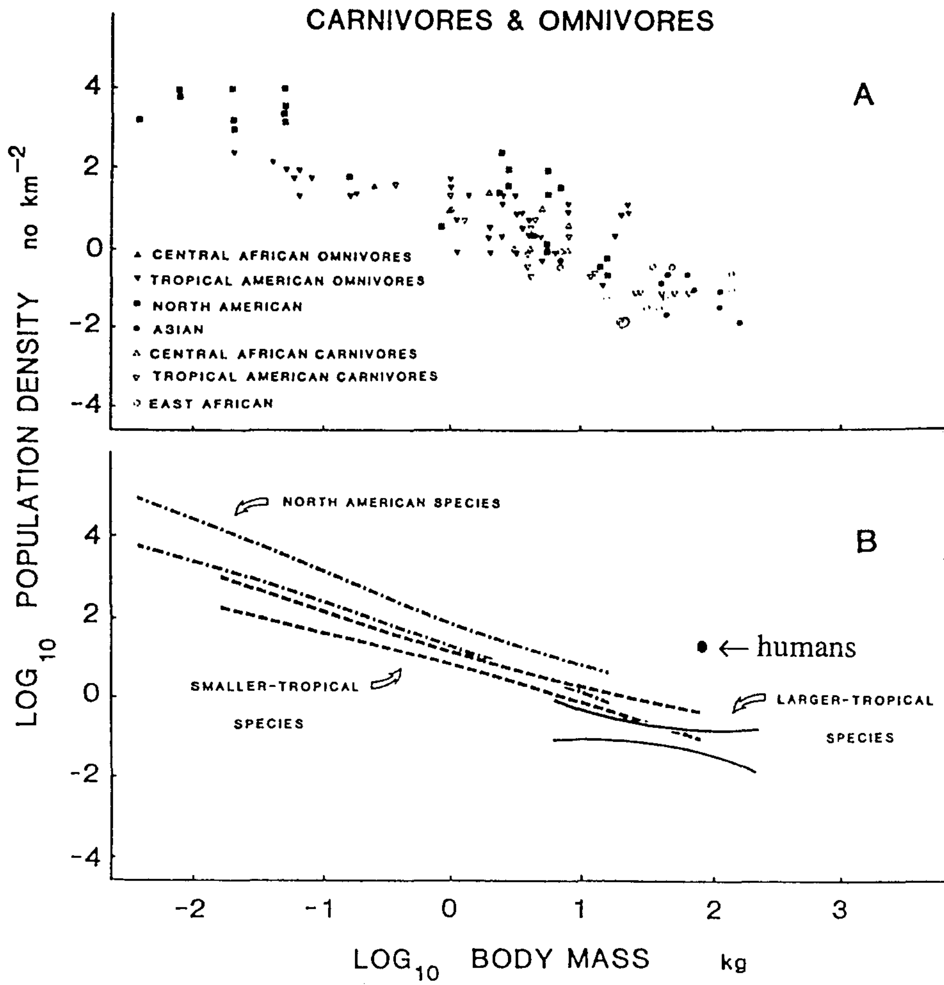

Fig. 1. (a) Association of body size with the population density of carnivores and omnivores; and (b) 95% confidence limits around the mean relationships described in Table 1 (from Peters & Raelson 1984; p. 502). The added dot labelled 'humans' represents a body weight of 70 kg and a population density of 44 persons km^{-2}. Original figure copyrighted © 1984 by The University of Chicago Press; reprinted by permission.

Table 1. Allometric relations for tropical mammals between adult body weight (W, kg) and population density (D, individuals per square kilometre), according to Peters & Raelson (1984; p. 505); estimated population densities $D = aW^b$ for body weights of 50 and 70 kg; and estimated abundance (total population size, number of individuals) for Earth's ice-free land area of $A = 133$ million square kilometres. C = carnivore, H = herbivore, O = omnivore. Peters and Raelson reported that the regressions for C did not differ significantly from regressions for O; regressions for H differed significantly from regressions for C + O; regressions for small tropical mammals (of each type) differed significantly from those for large tropical mammals (of the same type)

Group	a	b	$W = 50$ kg $D = aW^b$	$W = 70$ kg $D = aW^b$	$W = 50$ kg abundance AD (millions)	$W = 70$ kg abundance AD (millions)
Small H	22·4	−0·493	3·26	2·76	433	367
Small C + O	10·3	−0·868	0·35	0·26	46	34
Small O	12·6	−0·606	1·18	0·96	157	128
Small C	12·6	−1·3	0·08	0·05	10	7
Large H	2·45	−0·301	0·75	0·68	100	91
Large C + O	0·62	−0·473	0·10	0·08	13	11
Small + large H	12·9	−0·562	1·43	1·18	190	158
Small + large C + O	9·51	−1·02	0·18	0·12	23	17

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ical herbivores as a result of inventing agriculture, then Table 1 suggests that their global abundance should fall in the range from 91 million to 190 million. Humans had this population size about 2000 years ago.

In 1997, with 5·8 billion people on 133 million km^2

of ice-free land, the human population density is nearly 44 people km^{-2}. When the data point for humans is plotted on the scatterplot for carnivores and omnivores (Fig. 1) or that for herbivores (not shown), it is clear that contemporary humans are far more abundant than expected from the abundance and body sizes of nonhuman mammals.

ECONOMIC GROWTH AND GROWING ECONOMIC DISPARITIES

Human influence on the planet has increased faster than the human population. One imperfect index of economic activity is the use of energy. In 1860, the average person used annually nearly one megawatt-hour of inanimate energy. A megawatt-hour is enough energy to fuel a lawyer or a teacher for 1 year, so you may think of each megawatt-hour as a full-time personal slave in energetic form. By 1991, the average person on Earth used the energy equivalent of about 19 full-time slaves. As the human population grew nearly 5-fold from 1860 to 1991 while inanimate energy use per person grew 19-fold, the total energetic impact of humans on the Earth increased from 1 billion megawatt-hours per year to 95 billion, in 130 years.

The association between population growth and energy consumption per person is not automatic. For example, between 1971 and 1991, commercial energy consumption per person fell 4% in the US and 17% in Denmark (World Resources Institute 1994; p. 335). In the same period, commercial energy consumption per dollar of gross national product fell 27% in the US and 41% in Denmark; total commercial energy consumption rose 17% in the US but fell 14% in Denmark. Depending on human choices, economic values can be achieved with increasing energy efficiency.

In the aggregate production of material wealth, the half century since 1945 has been a golden era of technological and economic wonders. For example, in constant prices with the price in 1990 set equal to 100, total food commodity prices fell from 196 in 1975 to 85 in 1992. The price of petroleum fell from 113 in 1975 to 76 in 1992. The price of a basket of 33 nonfuel commodities fell from 159 in 1975 to 86 in 1992. However, timber prices increased, from 62 in 1975 to 112 in 1992.

For many economists, the declining prices mean that human welfare is improving. Many participants in efficient market economies might agree. But global market prices, while useful for coordinating economic activity, are not universally reliable signals of changes in human well-being, for at least three good reasons.

First, global prices do not reflect the depletion of unowned stocks, such as marine fisheries, the ozone layer in the stratosphere, or water in internationally shared rivers and aquifers.

Secondly, prices need not reflect all environmental and social costs unless laws and practices bring these costs into the costs of production. Environmental and social costs may arise from extracting natural resources or from disposing of unwanted products, and may be felt locally or globally, immediately or in the future. For example, in a local community, if a coal mine leaves behind an open pit or unfilled shafts, the price of coal does not reflect toxic effects of the mining, local erosion, or increased run-off. If the pit or mine is abandoned when the vein runs out, the price of coal does not reflect the cost of the collapse of the mining community left behind. Countries differ widely in how much they require environmental costs to be included in the costs of production.

Likewise, market prices need not reflect future consequences of unwanted products such as spent nuclear fuels, carbon dioxide from power generation, solid wastes from discarded packaging and consumer goods, or asbestos, chlorofluorocarbons, and persistent pesticides. Assessing the costs varies in difficulty from a relatively easy case like nontoxic solid waste, with a well-developed market in some countries, to a relatively hard case, like chlorofluorocarbon disposal, apparently with no present market.

It is an empirical question whether the fall in many commodity prices could be partly explained by an increasing proportion of production or disposal in parts of the world where the external costs of resource extraction and waste disposal are left out of the costs of production. Economists and ecologists need to collaborate in estimating these external consequences more quantitatively, using economic and other yardsticks.

A third reason that prices are not always indicators of human well-being is that markets respond to effective demand, not to human need. Food commodity prices have dropped by half while three-quarters of a billion people in developing countries chronically do not eat enough calories to grow normally and walk around because the bottom billion are so poor that they cannot exercise effective demand in world commodity markets. They have no money to buy food, so they cannot drive up its price. The extremely poor are economically invisible.

As the world's average economic well-being rose, economic disparities between the rich and the poor increased. In 1960, the richest countries with 20% of world population earned 70·2% of global income, while the poorest countries with 20% of world population earned 2·3% of global income. Thus, the ratio of income per person between the top fifth and the bottom fifth was 30:1 in 1960. In 1970, that ratio was 32:1; in 1980, 45:1; and in 1991, 60:1. In constant dollars, the absolute gap between the top fifth and the bottom fifth roughly doubled during this period.

While the global number and the global fraction of chronically undernourished people fell over recent decades, the share of global income earned by the poorest 20% of people fell even faster. Even if there is no global shortage of food relative to effective demand, and even if global food prices are steady or falling, a global pattern of local hunger in parts of Africa, south Asia and Latin America is a serious problem.

ENVIRONMENTAL IMPACT AND VULNERABILITY

Humankind has become a geological force in the control of fresh water. All human-made water reservoirs and dams have a capacity of at least 10 000 cubic kilometers (Chao 1995). This volume is roughly five times the stock of water in all the world's rivers.

In the minds of many, human action is linked to an unprecedented litany of environmental problems. Demeny's (1991) grim list includes loss of topsoil, desertification, deforestation, toxic poisoning of drinking water, oceanic pollution, shrinking wetlands, overgrazing, species loss, loss of wilderness areas, shortage of firewood, siltation in rivers and estuaries, encroachment on arable land, dropping water tables, erosion of the ozone layer, global warming, rising sea levels, consumption of mineral resources, nuclear wastes and acid rain. Demeny complained that ecologists rarely provide enough information to quantify the relative importance of these problems in specific locales. More information is needed to evaluate the trade-offs among these problems. For example, what are the trade-offs among burying municipal wastes (soil and groundwater contamination), incinerating them (air pollution), dumping them offshore (marine contamination), and reducing them at the source (changes in manufacturing and packaging technology, consumer expectations and habits, laws and prices)?

Environmental vulnerability increases as humans make contact with the viruses and other pathogens of previously remote forests and grasslands. The number of people who live in coastal cities rapidly approaches one billion. Vulnerability to a rise in sea levels rises with the tide of urbanization.

CULTURAL IMPLOSION

In recent decades, migrations from rural to urban regions and between countries, business travel, tourism, radio, television, telephone, fax, Internet, cassettes, newspapers and magazines – all have shrunk the world stage, bringing cultures into contact and sometimes into conflict.

In 1800, roughly one in 50 people lived in cities; by 1995, almost one in two did. In 1950, the world had one city with more than 10 million people (New York). In 1994, the world had 14 cities with more than 10 million people. Of those 14 large cities, only four were in the rich countries (in decreasing order, Tokyo, New York, Los Angeles, Osaka); the remaining 10 were in developing countries (in decreasing order, Sao Paulo, Mexico City, Shanghai, Bombay, Beijing, Calcutta, Seoul, Jakarta, Buenos Aires, Tianjin) (United Nations 1995c; p. 4). In every continent, in giant cities and city-systems, people increasingly come into direct contact who vary in culture, language, religion, values, ethnicity and race, and who share the same space for social, political and economic activities. The resulting frictions are evident in all parts of the world.

Between 1970 and 1990, the number of women who are economically active (that is, working for pay or looking for paying work) rose from 37 per 100 men to 62 per 100 men (United Nations 1995b), while the world's population growth rate fell for the first time in modern history. Because of these changes in the roles of women, the number of economically active people rose much faster than the number of people who are of working age. Problems of employment are influenced as much by economic and cultural factors as by sheer population growth.

At the International Conference on Population and Development in Cairo in 1994, many delegates strongly advocated empowering women through education, paid jobs, credit, property rights, contraception, and political power. But in many cultures, empowering women in these ways conflicts directly with the goal of maintaining 'full respect for the various religious and ethical values and cultural backgrounds,' a goal often repeated in the final document of the Cairo conference. Cultural conflicts over women's and men's status, roles and rights will not go away soon.

In summary, concerns about how many people the Earth can support involve not only population but also economics, the environment and culture.

The present

As of 1997, the world has about 5·8 billion people. At current birth rates, the worldwide average number of children born to a woman during her lifetime (the total fertility rate) is around 3·0. The population would double in 47 years if it continued to grow at its present 1·5% per year, though that is not likely.

These global summaries disguise two different worlds, the rich and the poor. The average number of children per woman ranges from almost 5·6 in Africa and 3·4 in the developing countries as a whole, down to 1·6 in the wealthy countries.

In 1995, the 1·2 billion people in the world's richest countries enjoyed an average annual income of $19 300 – a truly astounding achievement. The remaining 4·5 billion averaged roughly $1000 per year. The poorest 2 billion people lived on average incomes of $400 a year, or a dollar a day.

Roughly one in three people on Earth are infected with the bacillus of tuberculosis. Roughly half the people on Earth have no place to go to the toilet. A

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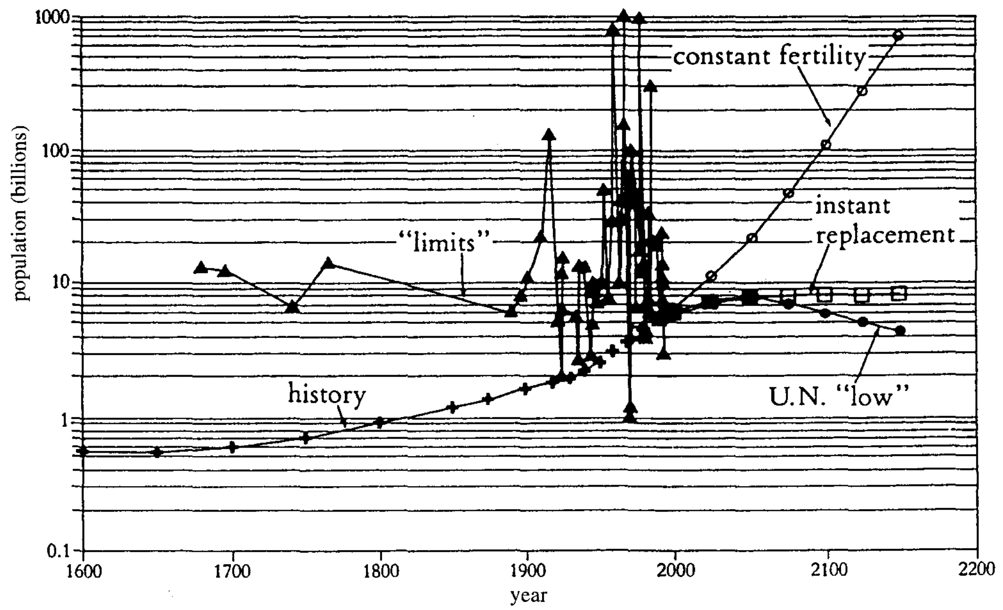

Fig. 2. Human population size 1600–1990, three United Nations (1992) scenarios of future population growth 1990–2150 and estimates of the Earth's maximum human population ('limits') by year of publication 1679–1994. The constant-fertility projection assumes that fertility in each region of the world remains at its level in 1990; in this scenario, the global average total fertility rate rises from 3.3 children per woman in 1990 to 5.7 children per woman in 2150 as the faster-growing regions become a larger share of world population. The instant-replacement projection assumes that the total fertility rate dropped to 2.06 children per woman in 1990 and remains at that level. The low-fertility projection assumes that the total fertility rate gradually moves to 1.7 children per woman everywhere. By the year 2050, according to these three projections, the world's population would number 21.2 billion, 7.7 billion and 7.8 billion. The plotted estimates of the Earth's maximum human population are the highest given when an author stated a range. Source: Cohen (1995, p. 368). © 1995 by Joel E. Cohen.

billion adults are illiterate, and two-thirds of those are women.

Possible futures

The future of the human population, like the futures of its economies, environments and cultures, is highly unpredictable. The United Nations regularly works out the demographic consequences of assumptions that it considers plausible, and publishes projections in a range from high to low. A high projection published in 1992 assumed that worldwide average fertility would fall to 2·5 children per woman in the 21st century. In this scenario, the population would grow to 12·5 billion in 55 years, within the lifetime of some of our children. The 1992 low projection of the UN assumed that worldwide average fertility would fall to 1·7 children per woman. According to this scenario, population would peak at 7·8 billion in 2050 before beginning to decline.

Neither projection is as extreme as the actual high and low possibilities. At the high end, the average woman in the less-developed countries in 1997, excluding China, bears about four children in a lifetime at present fertility rates; that region includes 3·4 billion people. At the low end, the average woman in Italy and Spain and Hong Kong has about 1·2 children. There is much more uncertainty about the demographic future than conventional projections suggest.

How many people can the Earth support?

One source of uncertainty that most demographers overlook is this: can the Earth support the billions of additional people that the UN projects for 2050? Can the Earth continue to support the nearly 6 billion people it has now, at present levels or better? How many people can the Earth support? In 1679, Antoni van Leeuwenhoek estimated not more than 13·4 billion. In 1994, five authors independently published estimates ranging from fewer than 3 billion up to 44 billion. Between 1679 and 1994, at least 60 additional estimates were published. Figure 2 plots the estimates as a function of the year in which the estimate was published.

These 65 estimates of the Earth's maximum population range widely, from less than one billion to more than 1000 billion. There is neither an increasing nor a decreasing trend in these estimates. The scatter has increased with time, contrary to what one might expect from estimates of a constant of nature. One conclusion is immediate: many of the published answers cannot be nearly right – or there is no single right answer.

Why there is no single right answer becomes clear when the methods used to obtained these estimates are examined carefully (Cohen 1995). One commonly used method assumes that a single factor, usually food, constrains population size (e.g. Brown & Kane 1994). (That populations often grow fastest in countries with the least food and slowest in the countries where food is most abundant does not seem to deter those who assume that food limits population growth.) An estimate of the maximum possible annual global food production is divided by an estimate of the minimum possible annual food requirement per person to find the maximum possible number of minimal shares that the food supply could be divided into, and this number is taken as the maximum number of people the Earth could support.

The maximum possible food production depends not only on environmental constraints like soil, rainfall, terrain and the length of the growing season, but also on human choices, individual and collective: which cultivars are chosen, the technology of cultivation, credit available to farmers, farmer education, infrastructure to produce and transport farm inputs (including irrigation capacity and hybrid seed development), infrastructure to transport, store and process farm outputs, economic demand for food from other sectors of the economy, and international politics and markets that affect trade in inputs and outputs. Culture defines what is food: where a Hindu may see a sacred cow, an American may see a hamburger on hooves; where an American may see a cuddly pet, a Chinese may see a square meal. If edibility alone determined what is food, cockroaches would be in great demand.

The minimum food requirement depends not only on physiological requirements (about 2000 kilocalories per person per day, averaged over most national populations) but on cultural and economic standards of what is acceptable and desirable. Not everyone who has a choice will accept a vegetarian diet with no more than the minimal calories and nutrients required for normal growth. Americans, who derive as much as a quarter of their calories from animal products, require that three or four times the minimal plant calories be grown, for use both as human food and as animal fodder.

The initial assumption that food is the single factor that limits population would be challenged by the other single-factor enthusiasts who advance instead land, energy, fresh water, biologically accessible nitrogen, phosphorus, light, soil, space, diseases, waste disposal, nonfuel minerals, forests, biological diversity, or climatic change as the single limiting factor. The assumption would also be challenged by those who recognize the interactions of natural constraints and the possibility of human adaptations to constraints.

Many authors of maximum population estimates recognized the difficulty of finding a single answer by giving a low estimate and a high estimate. The middle value, or median, of the high estimates is 12 billion. The median of the low estimates is 7·7 billion. This range of low to high medians, from 7·7 to 12 billion, is very close to the low and high UN projections for 2050: from 7·8 billion to 12·5 billion.

Recent population history has rapidly approached the level of many estimated limits, and the UN projections of future population lie at similar levels (Fig. 2). Of course, a historical survey of estimated limits is no proof that limits really lie in this range. It is merely a warning signal that the human population has now entered, and rapidly moves deeper into, a zone where limits on how many people the Earth can support have been anticipated and may be encountered.

How many people the Earth can support depends both on natural constraints, which are not fully understood, and on human choices. Many of these choices are unconscious decisions made by millions and billions of people in their daily lives (turn off the light when you leave the room, or leave it on? wash hands before eating, or don't bother? pick up litter in the school yard, or add to it?). The cumulative results of what may be unconscious individual actions amount to major human choices: consume more or less fossil fuel; spread or prevent infectious diseases; degrade or beautify the environment.

Personal and collective choices affect: the average level and the distribution of material well-being; technology; political institutions governing individual liberty, conflicts and change (compare the break-up of Czechoslovakia with the break-up of Yugoslavia to see the impact of politics on the resources subsequently available for human well-being); economic arrangements regarding markets, trade, regulation and externalities; family size and structure, migration, care of the young and elderly, and other demographic arrangements; physical, chemical and biological environments (do we want a world of humans and wheat only?); variability or stability; risk or robustness; the time horizon (5 years ahead or 50 or 500); and values, tastes and fashions.

I emphasize the importance of values. How many people the Earth can support depends in part on what people want from life. Values determine how parents trade-off the number of children against the quality of children, how parents balance parents' freedom to reproduce and children's freedom to eat. Many choices that appear to be economic depend heavily on individual and cultural values. Should industrial economies seek now to develop renewable energy sources, or should they keep burning fossil fuels and leave the transition to future generations? Should women (and, by symmetry, should men) work outside their homes? Should economic analyses continue to discount future income and costs, or should they strive to even the balance between the people now living and their unborn descendants? How many people the Earth can support depends in part on how many will wear cotton and how many polyester; on how many will eat beef and how many bean sprouts; on how many will want parks and how many will want parking lots; on how many will want Jaguars with a capital J and how many will want jaguars with a small j. These choices change with time and circumstance, and so will how many people the Earth can support.

Implications for action

What could be done now to ease future trade-offs in making these choices? The 'bigger pie' school says: develop more technology. The 'fewer forks' school says: slow or stop population growth and reduce wants per person. The 'better manners' school says: improve the terms under which people interact (for example, by defining property rights to open-access resources; by removing economic irrationalities; by reducing inequities and organized violence; and by improving governance). There is much value in all these approaches. None is sufficient by itself. Even in combination they will not eliminate the need to make choices among competing values.

One affordable plan of action that would support all three approaches would be to assure an education of good quality to every child in the world between the ages of 6 and 16 (Colclough & Lewin 1993). Such a level of education, in addition to the intrinsic benefits of linking everyone to local and world cultures, would increase the capacity of every region to use available technology and to develop technology appropriate for its own circumstances; would raise the age of marriage, lower fertility before and within marriage, and improve the health of households; would reduce inequities between males and females and improve the effectiveness of citizens.

Lack of certainty about future constraints and choices does not justify lack of action now. Whenever I ride in a car, I put on my seatbelt though I do not expect to be involved in a crash. I carry life insurance for my family though I do not expect to die tomorrow. It is not necessary to be able to project the future with precision to recognize that more than 100 million women of child-bearing age are estimated to lack desired access to means of fertility control; that 130 million girls and boys officially eligible for primary schooling in developing countries are out of school (Colclough & Lewin 1993; p. 1); that three-quarters of a billion people, more or less, were hungry yesterday, are hungry today, and will be hungry tomorrow; that humans leave their mark on the land, sea, air and other species with which we share the planet; and that, while life is better today for many people than it was in the past, there are also many people for whom life is more miserable than the available means require. We need no projections to identify problems that require action today.

Pyramid of population, economy, environment, culture

Many of the current statistics and future projections quoted here will change. But one message will remain useful, I believe. Population problems are not purely demographic. They also involve economics, the environment, and culture (including politics, law, and values).

Population, economy, environment and culture may be envisioned as the corners of a symmetrical tetrahedron or pyramid. This image is my mental prophylaxis against omitting important dimensions when I listen to discussions of population problems. Each major dimension interacts with all three of the others. The symmetry of the pyramid means that culture or the environment or the economy could be placed on top without changing the message.

This pyramidal image is too simple in an important respect. Reality has not just a single pyramid, but thousands or millions of such pyramids, scattered over the globe, wherever humans live. Many of these local pyramids interact strongly over great distances, through worldwide financial and economic integration, through our shared commons of atmosphere and oceans and living species, and through global exchanges of people, microbes and cultural symbols. Population problems vary from place to place, but are globally interlinked.

The real issue with population is not just numbers of people, although numbers matter and statistics give us quantitative insight and prevent us from making fools of ourselves. The real crux of the population question is the quality of people's lives: the ability of people to participate in what it means to be really human, to work, play and die with dignity, to have some sense that one's own life has a meaning and is connected with other people's lives. That, to me, is the essence of the population problem.

Acknowledgements

This work was supported by US National Science Foundation grant BSR92–07293 and the hospitality of Mr and Mrs William T. Golden.

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Received 18 July 1997