

Population growth and its implications (Crecimiento poblacional y sus implicaciones)

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Abstract. Human populations have grown at an unprecedented rate over the past three centuries. By 2001, the world population stood at 6.2 billion people. If the current trend of 1.4 % per year persists, the population will double in 51 years. Most of that growth will occur in the less developed countries of Asia, Africa, and Latin America. There is a serious concern that the number of humans in the world and our impact on the environment will overload the life support systems of the earth. The crude birth rate is the number of births in a year divided by the average population. A more accurate measure of growth is the general fertility rate, which takes into account the age structure and fecundity of the population. The crude birth rate minus the crude death rate gives the rate of natural increase. When this rate reaches a level at which people are just replacing themselves, zero population growth is achieved. In the more highly developed countries of the world, growth has slowed and even reversed in recent years so that without immigration from other areas, population would be declining. The change from high birth and death rates that accompanies industrialization is called a demographic transition. Many developing nations have already begun this transition. Death rates have fallen, but birth rates remain high. Some demographers believe that as infant mortality drops and economic development progresses so that people in these countries can be sure of secure future, they will complete the transition to a stable population or a high standard living. While larger populations bring many problems, they also may be a valuable resource of energy, intelligence, and enterprise that will make it possible to overcome resource limitation problems. A social just view argues that a more equitable distribution of wealth might reduce both excess population growth and environmental degradation. We have many more options now for controlling fertility than were available to our ancestors. Some techniques are safer than those available earlier; many are easier and more pleasant to use. Sometimes it takes deep changes in a culture to make family planning programs successful. Among these changes are improved social, educational, and economic status for women; higher values on individual children; accepting responsibility for our own lives; social security and political stability that give people the means and confidence to plan for the future; and knowledge, availability, and use of effective and acceptable means of birth control.

Palabras claves: Crecimiento, poblacion, pobre, rico, tasa

Resumen. La población humana ha crecido a una tasa inprecedente en los últimos tres siglos. Para 2001 la población mundial llegó a 6.2 billones. A una tasa actual de crecimiento de 1.4% anual, la población se duplicaría en 51 años. La mayoría del crecimiento ocurrirá en los países en vía de desarrollo de Asia, África, y Latinoamérica. Hay una preocupación de que la población humana y su impacto negativo sobre el medio ambiente pondrá en peligro la existencia de los sistemas de soporte vital del mundo. La tasa cruda de nacimiento es el número de nacimientos entre el promedio de la población. Una medida más exacta de crecimiento poblacional es la tasa general de fertilidad que toma en cuenta la estructura de la población y la fecundidad poblacional. La diferencia entre la tasa cruda de nacimiento y la mortalidad nos da la tasa natural de incremento. Cuando esta tasa alcanza el nivel al cual la gente solamente reemplaza a sí mismo numéricamente, se obtiene la tasa cero de crecimiento poblacional. En los países avanzados del mundo, el crecimiento ha sido reducido o ha puesto en forma negativa, de tal modo que sin inmigración en estos países, la población estará disminuyendo. El cambio de las tasas altas de nacimiento y mortalidad a las tasas bajas se denomina la transición demográfica. Muchos países desarrollados han empezado esta transición demográfica. La tasa de mortalidad ha bajado en estos países sin que disminuyera la tasa de nacimiento. A medida que la tasa de mortalidad infantil se reduce en estos países y la economía progresa más y trae seguridad económica para la gente, entonces será posible una transición demográfica a una población estable o un estándar de vida más alta. Mientras que las poblaciones grandes traen muchos problemas, también pueden servir como recursos de energía e inteligencia que permiten controlar el problema de la limitación de los recursos. Una idea de la justicia social argumenta que una distribución más equitativa del capital puede reducir tanto el crecimiento excesivo poblacional como problemas ambientales. Hay muchos métodos de control de fertilidad en comparación con antes. Algunas técnicas son más seguras, más fáciles de usar y más placenteras que antes. Se requiere de cambios profundos culturales, como mejoramiento de estatus social, educacional, y económico, valores más altos de los jóvenes, aceptar la responsabilidad en la vida, seguridad social, estabilidad política, el conocimiento, y el uso efectivo de medidas de control de natalidad, para permitir que la gente planea con seguridad hacia el futuro.

Introduction

Every second, on average, four or five children are born somewhere on the earth. In that same second, two other people die. This difference between births and deaths means a net gain of nearly 2.5 more humans per second in the world population. This means we are growing at a little less than 9,000 per hour, 214,000 per day, or about 77 million more people per year. By mid-2001, the world population stood at about 6.2 billion, making us the most numerous vertebrate species on the planet. For the families to whom these children are born, this may well be a joyous and long-awaited event. But it is a continuing increase in humans good for the planet in the long run?

Many people worry that overpopulation will cause, or perhaps already is causing resource depletion and environmental degradation that threatens the ecological life-support systems on which we all depend. These fears often lead to demands for immediate, worldwide birth control programs to reduce fertility rates and to eventually stabilize or even shrink the total number of humans.

Others believe that human ingenuity, technology, and enterprise can extend the world carrying capacity and allow us to overcome any problems we encounter. From this perspective, more people may be beneficial rather than disastrous. A larger population means a larger workforce, more geniuses, and more ideas about what to do. Along with every new mouth comes a pair of hands. Proponents of this worldview, many of whom happen to be economists, argue that continued economic and technological growth could both feed the world's billions and enrich everyone enough to end the population explosion voluntarily. Not so, counter many ecologists. Growth is the problem; we must stop both population and economic growth (Acsadi & Nemeskeri, 1970).

Yet another perspective on this subject derives from social justice concerns. From this worldview, there are sufficient resources for everyone. Current shortages are only signs of greed, waste and oppression. The root cause of environmental degradation, in this view, is inequitable distribution of wealth and power rather than population size. Fostering democracy, empowering women and minorities, and improving the standard of living of the world's poorest people are what are really needed. A narrow focus on population growth only fosters racism and an attitude that blames the poor for their problems while ignoring the deeper social and economic forces at work.

Whether the human population will continue to grow at present rates and what that growth would imply for environmental quality and human life are among the most central and pressing questions in environmental science. The number of children a couple decides to have and the methods they use to regulate fertility, however, strongly influenced by culture, religion, politics, economics, as well as basic biological and medical considerations.

Human population history

For most of our history, humans have not been very numerous compared to other species. Studies of hunting and gathering societies suggests that the total world population was probably only a few million people before the invention of agriculture and the domestication of animals around 10,000 years ago. The larger and the more secure food supply made available by the agricultural revolution allowed the human population to grow, reaching perhaps 50 million people by 5,000 B.C. For thousands of years, the number of humans increased very slowly. Archeological evidence and historical descriptions suggest that only about 300 million people living at the time of Christ (Table 1).

Until the Middle Ages, human populations (Ahlburg & Land, 1992) were held in check by diseases, famines, and wars that made life short and uncertain for most people. Furthermore, there is evidence that many early societies

regulated their population sizes through cultural taboos, and practices such as infanticide. Among the most destructive natural population controls were bubonic plagues that periodically swept across Europe between 1,348 and 1,665. During the worst plague years (between 1,348 and 1,350), it is estimated that at least one third of the European population perished. Notice, however, that this did not retard population growth for very long. In 1,650, at the end of the last great plague, there were about 600 million people in the world.

Table 1. World population growth and doubling times (Population Reference Bureau & UN Population Division).

Date	Doubling time (years)	Population (million)
5000 B.C	No data available	50
800 B.C.	4,200	100
200 B.C	600	200
1200 A.D	1,400	400
1700 A.D.	500	800
1900 A.D.	200	1,600
1965 A.D.	65	3,200
2000 A.D.	51	6,100
2050 A.D.	140	9,300 (estimate)

Human population began to increase rapidly after 1,600 A.D. Many factors contributed to this rapid growth. Increased sailing and navigation skills stimulated commerce and communication between nations. Agricultural development, better sources of power, and better health care and hygiene also played a role. We are, at the present, in an exponential or **J** curve pattern of population growth.

It took all human history to reach 1 billion people in 1,804, but little more than 150 years to reach 3 billion in 1,960. To go from 5 to 6 billion took only 12 years. Another way to look at the population growth is that the number of humans tripled during the twentieth century. Will it do so again in the twenty-first century? If it does, will we overshoot the carrying capacity of our environment and experience a catastrophic dieback? There is evidence that population growth is already slowing, but whether we will reach equilibrium soon enough and at a size that can be sustained over the long run remains a difficult but important question.

Limits to growth: some opposing views

People have widely differing opinions about population and resources. Some believe that population growth is the ultimate cause of poverty and

environmental degradation. Others argue that poverty, environmental degradation, and overpopulation are all merely symptoms of deeper social and economic factors. We will examine some opposing worldviews and their implications.

Malthus idea on population growth

In 1798, the Rev. Thomas Malthus wrote *An essay on the Principle of Population* to refute the views of progressives and optimists, including his father, who inspired by the agrarian principles of the French Revolution to predict a coming utopia. The younger Malthus argued that human populations tend to increase at an exponential or compound rate while food production either remains stable or increases only slowly. The result, he predicted, that human population inevitably outstrip their food supply and eventually collapse into starvation, crime, and misery. According to Malthus, the only ways to stabilize the human populations are "positive checks," such as diseases or famines that kill people, or "preventive checks," including all the factors that prevent human birth. Among the preventative checks, he advocated were "normal restrained," including late marriage and celibacy until a couple can afford to support children. Malthus has influenced many social scientists and biologists. Charles Darwin, for instance, derived his theories about struggle for scarce resources and survival of the fittest after reading Malthus's essay. If Malthus's view of the consequences of the population growth is dismal, the corollary he drew was even bleaker. He believed that most people are too lazy and immoral to regulate birth voluntarily. Consequently, he opposed efforts to feed and assist the poor in England because he feared that more food would simply increase their fertility and thereby perpetuate the problems of starvation and misery. Not surprisingly, Malthus's idea provoked a great social and economic debate. Karl Marx was one of his most vehement critics, claiming that Malthus was a "shameless sycophant of the ruling classes." According to Marx, population growth is a symptom rather than a root cause of poverty, resource depletion, pollution, and other social ills. The real causes of these problems, he believed, exploitation and oppression. Marx argued that workers always provide for their own sustenance given access to means of production and a fair share of the fruits of their labor. According to Marxians, the ways to slow population growth and to alleviate crime, disease, starvation, misery, and environmental degradation is through social justice (Clark, 1990).

Malthus and Marx today

Both Malthus and Marx developed their theories about human population growth in the nineteenth century when understanding of the world, technology,

and society were much different than they are now. Still, the questions they raised are relevant today. While the evils of the racism, classism, and other forms of exploitation that Marx denounced still beset us, it is also true that at some point available resources must limit the numbers of humans that the earth can sustain. Those who agree with Malthus, that we are approaching, or have already surpassed, the carrying capacity of the earth are called neo-Malthusians. In their view we should address the issue of surplus population directly by making birth control our highest priority. An extreme version of this worldview is expressed by Cornell University entomologist David Pimentel, who claims that the "optimum human population" would be about 2 billion, or about the number living in 1,950. He believes this would allow everyone to enjoy a standard of living equal to the average European today. Neo-Marxians, on the other hand, believe that only eliminating poverty and oppression through technological development and social justice will solve population problems. Claims of resource scarcity, they argue, are only an excuse for inequity and exclusion. If distribution of wealth and access to resources were fairer, they believe, there would be plenty for everyone. Perhaps a compromise position between these opposing viewpoints is that population growth, poverty, and environmental degradation are all interrelated. No factor exclusively causes any other, but each influence and, in turn, is influenced by the others.

Can technology make the world more habitable?

Technological optimists argue that Malthus was wrong in his prediction of famine and disaster 200 years ago because he failed to account for scientific progress. Indeed, food supplies have increased faster than population growth since Malthus's time. There have been terrible famines in the past two centuries, but they were caused more by politics and economics than lack of resources or sheer population size. Whether this progress will continue remains to be seen, but technological advances have increased human carrying capacity more than twice in our history. The burst of growth of which we are a part, was stimulated by the scientific and industrial revolutions. Progress in agricultural productivity, engineering, information technology, commerce, medicine, sanitation, and other achievements of modern life have made it possible to support approximately 1,000 times as many people as per unit area as was possible 10,000 years ago. Much of our growth in the past 300 years has been based on the availability of easily acquired natural resources, especially cheap, abundant fossil fuels. Whether we can develop alternative, renewable energy resources in time to avert disaster when current fossil fuels run out is a matter of great concern.

Can more people be beneficial?

There can be benefits as well as disadvantages in larger populations. More people mean larger markets, more workers, and efficiencies of scale in mass production of goods. Greater numbers also provide more intelligence and enterprise to overcome problems such as underdevelopment, pollution, and resource limitations. Human ingenuity and intelligence can create new resources through substitution of new materials, and new ways of doing things for the old materials and old ways. For instance, utility companies are finding it cheaper and more environmentally sound to finance insulation and energy-efficient appliances for their customers rather than build new power plants. The effect of saving energy that was formerly wasted is comparable to creating a new fuel supply. Economist Julian Simon was one of the most outspoken champions of this view of human history. People, he argued, are the "ultimate resource" and there is no evidence that pollution, crime, unemployment, crowding, the loss of species, or any other resource limitations will worsen with population growth. This outlook is shared by leaders of many developing countries who insist that instead of being obsessed with population growth, we should focus on inordinate consumption of the world's resources by the people in richer countries. What constitutes a resource and which resources might limit further human population growth must be discussed seriously (<http://www.census.gov/ftp/pub/ipc/www/world.html>).

Human demography

Demography is derived from the Greek word *demos* (people) and *graphos* (to write or to measure). It encompasses vital statistics about people, such as births, deaths, and where they live, as well as how they live. On October 12, 1999, The United Nations officially declared that the human population had reached 6 billions. The US Census Bureau, however, had put the date for this landmark 3 months earlier on July 19th. Even in this age of information technology and communication, counting the number of people in the world is like shooting at a moving target. Some countries have never even taken a census, and those that have done many not be accurate. Governments may overstate or understate their populations to make their countries appear larger and more important or smaller and more stable than they really are. Individuals, especially if they are homeless, refugees, or illegal aliens, may not want to be counted or identified. We really live in 2 demographic worlds. One of these worlds is poor, young, and growing rapidly. It is occupied by the vast majority of the people who live in the less developed countries of Africa, Asia, and Latin America. These countries represent 80% of the world population but more than 90% of the projected growth. In countries like Uganda, and Nigeria, the average age is less than 15, the current doubling time is

only 23 years, and the average person can expect fewer than 30 years of reasonably good health. Some countries in the developing world experienced amazing growth rates and are expected to reach extraordinary population sizes by the middle of the twenty first century. Table 2 shows the 10 largest countries in the world, arranged by their projected size in 2,050.

Table 2. Projected population sizes of 10 largest countries by 2,050 (Population Reference Bureau, 2001).

Most populations in 2,000		Most populations in 2,050	
Country	Population (millions)	Country	Population (million)
China	1,200	India	1,600
India	1,000	China	1,300
USA	281	USA	403
Indonesia	212	Indonesia	312
Brazil	170	Nigeria	304
Pakistan	151	Pakistan	285
Russia	145	Brazil	244
Bangladesh	128	Bangladesh	211
Japan	127	Ethiopia	188
Nigeria	123	Congo	182

Note that while China reached 1.26 billion people in 2,001, India also passed 1 billion and is expected to have the largest population in a few decades because its population control programs have been less successful than China's. Nigeria which had only 33 million residents in 1,950, is forecast to have more than 300 million in 2,050. Ethiopia, with about 18 million people 50 years ago, is likely to grow at least 10 fold over a century. In many of these countries, rapid population growth is a serious problem. Overall, the population of less developed countries is projected to rise from 5 billion in 2,001 to 8.2 billion in 2,050. Just six countries (India, China, Pakistan, Nigeria, Bangladesh and Indonesia) account for almost half this growth (<http://www.census.gov/ftp/pub/ipc/www/idbsum.html>).

The other demographic world is made up of the richer countries of North America, Western Europe, Japan, Australia, and New Zealand. This world is Wealthy, old, and mostly shrinking. Italy, Germany, Hungary, and Japan, for example, all have negative growth rates. The average age in these countries is now 40, and life expectancy of their residents is expected to exceed 90 by 2,050. With many couples choosing to have either one or no children, the populations of these countries are expected to decline significantly over the next century. Japan,

which has 126 million residents, now, is expected to shrink to about 100 million by 2,050. Europe, which now makes up about 12% of the world population, will constitute less than 7% in 50 years, if current trends continue. Even the US and Canada would have nearly stable population if immigration were stopped.

It isn't only wealthy countries that have declining populations. Russia, for instance, is now declining by nearly one million people per year as death rates have soared and birth rates have plummeted. A collapsing economy, hyperinflation, crime, corruption, and despair have demoralized the population. Horrific population levels left from the Soviet era, coupled with poor nutrition and health care, have resulted in high levels of genetic abnormalities, infertility, and infant mortality. Abortions are twice as common as live birth, and the average number of children per woman is now 1.3, one of the lowest in the world. Death rates, especially among adult men, have risen dramatically. According to some medical experts, four out of five Russian men are drunk when they die, and male life expectancy dropped from 68 years in 1,990 to 58 years in 2,000. After having been the fourth largest country in the world in 1,950, Russia is expected to have a smaller population than Vietnam, The Philippines, or the Democratic Republic of Congo by 2,050. The situation is even worse in many African countries, where AIDS and other communicable diseases are killing people at a terrible rate. In Zimbabwe, Botswana, Zambia, and Namibia, for example, up to 36% of the adult population have AIDS or are HIV positive. Health officials predict that more than two thirds of the 15 year-olds now living in Botswana will die of AIDS before age 50. Many of these countries are soon expected to have declining populations. Overall, however, because of high fertility rates, Africa is expected to grow by at least 1.5 billion people over the next century. Considering the human population distribution around the world, the high densities supported by fertile river valleys of the Nile, Ganges, Yellow, Yangtze, and Rhine Rivers and the well-watered coastal plains of India, China, and Europe. Historic factors, such as technology diffusion and geopolitical power, also play a role in the geographic distribution.

Fertility and birth rates

Fecundity is the physical ability to reproduce, while fertility describes the actual production of offspring. Those without children may be fecund but not fertile. The most accessible demographic statistics of fertility is usually the crude birth rate, the number of births in a year per thousand persons. It is statistically "crude" in the sense that it is not adjusted for population characteristics such as the number of women in reproductive age. The total fertility rate is the number of children born to an average woman in a population during her entire reproductive life. Upper class women in seventeenth and eighteenth century England, whose

babies were given to wet nurses immediately after birth and who were expected to produce as many children as possible, often had twenty five or thirty pregnancies. The highest recorded total fertility rates for working class people is among some Anabaptist agricultural groups in North America who have averaged up to 12 children per woman. In most tribal or traditional societies, food shortages, health problems, and cultural practices limit total fertility to about six or seven children per woman even without modern methods of birth control. Zero population growth (ZPG) occurs when births plus immigration in a population just equal death plus emigration. It takes several generations of replacement level fertility (where people just replace themselves) to reach ZPG. When infant mortality rates are high, the replacement level may be a five or more child per couple. In the more highly developed countries, however, this rate is usually about 2.1 children per couple because some people are infertile, have children who do not survive, choose not to have children ([http://biology.uoregon.edu/Biology www/BSL/D-demo2.html](http://biology.uoregon.edu/Biology/www/BSL/D-demo2.html)).

Mortality and death rates

A traveler to a foreign country once asked a local resident "what is the death rate around here?" "the same as anywhere," was the reply, "about one per person. In demographics, however, crude death rate (or crude mortality rate) are expressed in terms of the number of deaths per thousand persons in any given year. Countries in Africa where health care and sanitation are limited may have mortality rates of 20 or more per 1,000 people. The number of deaths in a population is sensitive to the age structure of the population. Rapidly growing, developing countries such as Belize or Costa Rica have lower crude death rate (4 per 1,000) than do the more developed, slowly growing countries, such as Denmark, (12 per 1,000). This is because there are proportionally more youths and fewer elderly people in a rapidly growing country than in a more slowly growing one (Umpleby, 1990; WHO, 1992, <Http://www.pop.org/>).

Population growth rates

Crude death rate subtracted from crude birth rate gives the natural increase of a population. We distinguish natural increase from the total growth rate, which include immigration and emigration, as well as births and deaths. Both of these growth rates are usually expressed as a percent (number per hundred people) rather than per thousand. A useful rule of thumb is that if you divide 70 by the annual percentage growth, you will get the approximate doubling time in years. Afghanistan, for example, which is growing 5.3% per year, is doubling its population every 13 years. The US and Canada, which have natural increase

rates of 0.8 per year are doubling in 87.5 years. Actually, because of immigration, US total growth is considerably faster than natural increase. Spain and the UK, with natural increase rates of 0.1%, are doubling in about 700 years. Most countries in Eastern Europe have negative growth rates and declining populations. The fastest decline currently is Latvia, which at -1.1% per year will lose half its population in 64 years. The world growth rate is now 1.4%, which means that the population will double in about 50 years, if this current rate persists (<http://www.mhhe.com/global>, <http://www.mhhe.com/global>).

Life span and life expectancy

Life span is the oldest age to which is known to survive. Although there are many claims in ancient literature of kings living for 1,000 years or more, the oldest age that can be certified by written records was that of Jeane Luise Calment of Arles, France, who was 122 years old at her death in 1997. The aging process is still a medical mystery, but it appears that cells in our bodies have a limited ability to repair damage and produce new components. At some point they simply wear out, and we fall victim to disease, degeneration, accidents, or senility. Life expectancy is the average age that a newborn infant can expect to attain in any given society. For most human history, we believe that life expectancy in most societies has been between 35 and 40 years. This does not mean that no one lived past age 40, but rather so many deaths at earlier ages (mostly early childhood) balanced out those who managed to live longer. Declining mortality, not rising fertility, is the primary cause of most population growth in the past 30 years (Wilson, 1992). Crude death rates began falling in Western Europe during the late 1700s. Most of this advance in survivorship came long before the advent of modern medicine and is due primarily to better food and better sanitation.

The twentieth century has seen a global transformation in human health unmatched in history. This revolution can be seen in the dramatic increases in life expectancy in most places (Tuckwell & Koziol, 1992; Scott, 1994). Worldwide, the average life expectancy has risen from about 40 to 65.5 years over the past century. Table 3 shows gains in some selected countries. Globally, the number of people over 60 years old is expected to triple, increasing from 600 million today to nearly 2 billion in 2,050. The oldest old (over 80 years) is projected to grow five fold to about 400 million in that same period. The greatest progress in life expectancy has been in developing countries. Take the case of Chile, for example. In 1,900, the average Chilean man could expect to live only 29 years. By 1998, although Chile had an annual per capita income less than \$4,000 (US), the average life expectancy for both men and women had more than doubled and was very close to that of countries with 10 times its income level (Young, 1994).

Longer lives were due primarily to better nutrition, improved sanitation, clean water, and education rather than miracle drugs or high tech medicine. While the gains were not as great as already industrialized countries, residents of the USA, Italy, Japan, for example, now live about half again as long as they did at the beginning of the century. There is a good correlation between annual income and life expectancy up to about \$4,000 (US) per person. Beyond that level, which is generally enough for adequate food, shelter, and sanitation for most people, life expectancy level out at about 75 years for men and 80 years for women.

Table 3. Life expectancy at birth in selected countries around the world (World Health Organization, World Health Report, 1999).

Country	Around 1910		1998	
	Males	Females	Males	Females
Australia	56	60	75	81
Chile	29	33	72	78
Italy	46	47	75	81
Japan	43	43	77	83
New Zealand	60	63	74	80
Norway	56	59	75	81
USA	49	53	73	80

Russia is the striking exception to this pattern. With a GNP per person near \$5,000 (US), Russian life expectancy is only 58 years for men and 71 for women. Russian men now live about 14 years less, on average, than they did before the break up of the USSR. As mentioned earlier, disastrous economy, alcoholism, poor nutrition, and substandard medical care all contribute to this decline.

Large discrepancies in how benefits of modernization and social investment are distributed within countries are revealed in differential longevity of various groups. The greatest life expectancy reported anywhere in the USA is for women in Stearns County, Minnesota, who live to an average age of 86. By contrast, Native American men on Pine Ridge, Indiana Reservation in neighboring South Dakota, live on average, only to age 45. Only a few countries in Africa have a lower life expectancy. Mainly prosperous German Catholic farmers populate Stearns County. The pine Ridge reservation is the poorest area in America with an unemployment rate near 75% and high rates of poverty, alcoholism, drug use, and cultural alienation. Similarly, African American men in Washington, D.C., live on average, only 57.9 years, or less than in Lesotho or Swaziland.

Some demographers believe that life expectancy is approaching a plateau, while others predict that advances in biology and medicine might make it

possible to live 150 years or more. If our average age at death approaches 100 years, as some expect, society will be profoundly affected. In 1970 the median age in the USA was 30. By 2100 the median age could be over 60. If workers continue to retire at 65, half of the population could be unemployed, and retired might be facing 35 or 40 years of retirement. We may need to find new ways to structure and finance our lives.

Both rapidly growing countries and slowly growing countries can have a problem with their dependency ratio, i.e., the number of nonworking compared to working individuals in a population. In Mexico, for example, each working person supports a high number of children. In the USA, by contrast, a declining working population is now supporting an ever-larger number of retired people and there are dire predictions that social security system will soon be bankrupt. This changing age structure and shifting dependency ratio are occurring worldwide. By 2050, The UN predicts there will be two older persons for child in the world.

Humans are highly mobile, so emigration and immigration play a larger role in human population dynamics than they do in those of many species. Currently, about 800,000 people immigrate legally to the USA each year, but many more illegally. Western Europe receives about 1 million applications each year for asylum for economic chaos and wars in former socialist states and the Middle East. The UN High Commission on Refugees estimated in 1997 that at least 38 million refugees left their countries for political or economical reasons, while another 30 million fled their homes but remained displaced persons in their own countries. The more developed regions are expected to gain about 2 million immigrants annually for the next 50 years. Without migration, the population of the wealthiest countries would already be declining and would be more than 126 million less than the current 1.2 billion by 2050. The 2000 census showed that 35 million USA residents (12.5% of the total population) classify themselves as Hispanic or Latino. They now constitute the largest the USA minority. Immigration is a controversial issue in many countries. They often perform heavy, dangerous, or disagreeable work, paid low wages, and gain substandard housing, poor working conditions, and few rights. Some countries encourage, or even force, internal mass migration as part of a geopolitical demographic policy. In the 1970s, Indonesia embarked on an ambitious "transmigration" plan to move 65 million people from the overcrowded islands of Java and Bali to relatively unpopulated regions of Sumatra, Borneo, and New Guinea.

Population growth: opposing factors

A number of social and economic pressures affect decisions about family size, which in turn affects the population at large. Factors that increase people's

desires to have babies are called pronatalist pressures. Raising a family may be the most enjoyable and rewarding part of many people's life. Children can be a source of pleasure, pride and comfort. They may be the only source of support for elderly parents in countries without a social security system. Society also has a need to replace members who die or become incapacitated. This need often is codified in cultural or religious values that encourage bearing and raising children.

In more highly developed countries, many pressures tend to reduce fertility. High education and personal freedom for women often result in decisions to limit childbearing. When women have opportunities to earn a salary, they are less likely to stay at home and have many children. Not only the challenge and variety of a career attractive to many women, but the money that they can earn outside their home becomes an important part of the family budget. Thus, education and socioeconomic status are usually inversely related to fertility in richer countries (Pritchett, 1994; MacKellar, 1994).

Most European countries now have birth rates below replacement rates, and Italy, Russia, Australia, Germany, Greece, and Spain are experiencing negative rates of natural population increase. Asia, Japan, Singapore, and Taiwan are also facing a "child shock" as fertility rates have fallen well below the replacement level of 2.1 children per couple. This "birth death" may seriously erode the powers of Western democracies in world affairs. The Europe and North America accounted for 22% of the world population in 1950. By the 1980s, this number had fallen to 15%, and by the year 2030, Europe and North America probably will make up only 9% of the world population. On the other hand, since Europeans and North Americans consume so many more resources per capita than most other people in the world, a reduction in the population of these countries will do more to spare the environment than would a reduction in a population almost anywhere else.

A typical pattern of falling death rates and birth rates due to improved living conditions usually accompanies economic development. This is called the Demographic transition from high birth and death rates to lower rates. Some demographers claim that a demographic transition already is in progress in most developing nations. Problems in taking censuses and the normal lag between falling death and birth rates may hide this for a time, but the world population should stabilize sometime in the next century. Some countries have had remarkable success in population control. In Thailand, Indonesia, Colombia, and Iran, for instance, total fertility dropped by more than half in 20 years. Morocco, Dominican Republic, Jamaica, Peru, and Mexico all have seen fertility rates fall between 30 and 40% in a single generation. Some factors such as growing prosperity, technology, historic pattern, and modern communication contribute to stabilizing populations.

Some economists believe that the poorest countries appear to be caught in a “demographic trap” that prevents them from escaping from the middle phase of the demographic transition. Many people argue that the only way to break out of the demographic trap is to immediately and drastically reduce population growth by whatever means are necessary.

Another view is the social justice (a fair share of social benefits for everyone) is the real key to successful demographic transitions. The world has enough resources for everyone, but inequitable social and economic systems cause maldistribution of those resources. Hunger, poverty, violence, environmental degradations, and overpopulation are symptoms of a lack of social justice rather than a lack of resources. An important part of this view is that many of the rich countries are, or were, colonial powers, while the poor, rapidly growing countries were colonized. The wealth that paid for progress and security for developed countries was often extracted from colonies, which now suffer from exhausted resources, exploding populations, and chaotic political systems. Some of the world’s poorest countries such as India, Ethiopia, Mozambique, and Haiti had rich resources and adequate food supplies before they were impoverished by colonialism.

In addition to considering the rights of fellow humans, we should also consider those of other species. Rather than ask what is the maximum number of humans that the world can support, perhaps we should think about the needs of other creatures. As we convert natural landscapes into agricultural or industrial areas, species are crowded out that may have just as much right to exist as we do. Perhaps we should seek the optimum number of people at which we can provide a fair and descent life all humans while causing the minimum impact on nonhuman neighbors.

Conclusion and the future of Human population

How many people will be in the world in a century from now? Most demographers believe that world population will stabilize sometime during the next century. The total number of humans when we reach that equilibrium, is likely to be somewhere around 8 to 10 billion people, depending on the success of the family planning programs and the multitude of other factors affecting human populations. Some believe that the human population will grow up to 23 billion people. Which of these scenarios will we follow? To accomplish a stabilization or reduction of human population will require substantial changes from the business as usual. An encouraging sign is that worldwide contraceptive use has increased sharply in recent years. About half of the world’s married couples used some family planning techniques in 1999, compared to only 10% 30 years earlier, but

another 300 million couples say they want but do not have access to family planning. Contraceptive use varies widely by region, with high levels in Latin America and East Asia but relatively low use in much of Africa. The World Health Organization estimates that nearly 1 million conceptions occur daily around the world as a result of some 100 million sex acts. At least half of those conceptions are unplanned or unwanted. Still birth rates already have begun to fall in East Asia and Latin America. Similar progress is expected in South Asia in a few years. Only Africa will probably continue to grow in twenty first century.

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