

Now We Are Six ... Billion

THE WORLD WILL have 6 billion people for the first time in history on Tuesday, according to the statistical agencies of the United Nations. Never mind that the population clock maintained by the U.S. Bureau of the Census passed 6 billion people in July, 1999. Why do the Bureau of the Census and United Nations disagree by three months? Is either one right?

Roughly 20 percent of the world's people have not been counted since 1990. Nobody knows precisely how many people have not been counted, because they have not been counted. The likely error in any estimate of the world's population is probably at least 120 million. The estimate of 6 billion on Oct. 12 could be too high or too low by roughly the population of Japan.

All that can be said with honesty is that, sometime last year, this year, or next year, we will have 6 billion people. That milestone, whenever its exact date, is a good occasion to look back on the most extraordinary century in human demographic history and to look forward to the next.

At the beginning of the 20th Century, there were 1.6 or 1.7 billion people on Earth, and large parts of the Earth had never been counted. The population passed 2 billion around 1927, 3 billion in 1960, 4 billion around 1974, 5 billion around 1987, and 6 billion one of these days. Think about that.

It took from the beginning of time until 1927 to put the first 2 billion people on the planet. We added the most recent 2 billion in just 25 years. Never before the second half of the 20th Century had any human being lived through a doubling of the Earth's population. Now, anyone 39 years old or older has seen the number of people double in his or her lifetime.

Less visible than this colossal increase, but just as important, are two other demographic milestones that were little noticed when they were passed. Between 1965 and 1970, the population growth rate of the world reached its all-time peak of 2 percent per year and began to decline. It has now fallen to 1.3 percent per year. Between 1985 and 1990, the absolute annual increase in population reached its all-time peak of perhaps 86 million people and began to decline. It has now fallen to 77 million or 78 million additional people per year. While population growth is now slower than at its peak, it still vastly exceeds the estimated 10 million people who were added to the population each year at the beginning of the 20th Century.

For the first time in history, human reproduction is coming under human control. Currently 44 percent of people live in countries where fertility is below the level required to replace the population in the long run. As much as any achievement of civilization, this is one to be proud of, and to build on. While more than half of all couples in developing countries now use contraception, hundreds of millions more do not because of poverty, lack of education, and lack of access. In the opulent United States, an estimated 57 percent of all conceptions are not intended.

Human impact on the Earth rose even faster than human numbers in the 20th Century. Emissions of carbon into the atmosphere from human activities grew from a half billion tons to 7.3 billion tons per year, raising the carbon dioxide concentration in the atmosphere by about 20 percent. Today's level is higher than at any time in the last 150,000 years. Emissions of nitrogen from the combustion of fossil fuels grew 20-fold, to 25 million tons per year. World water withdrawals from all renewable freshwater sources grew eight-fold, to roughly 4,000 cubic kilometers per year currently. Humans now withdraw annually roughly a quarter to half of all available renewable freshwater. Humans also altered the habitats and populations of many other species, raising widespread concerns about extinctions. No one knows whether people can continue to transform car-



AP Photo

A thoroughfare in the Indian city of Delhi — population 10 million and counting.

bon, nitrogen, water and other living species at present rates without severe damage to the environmental processes and systems that support human and all other life.

What about the future? Barring global catastrophes, most demographers expect that by the middle of the next century the world's population will be larger, growing more slowly, more elderly and more urban than it is now. Putting precise numbers on any of these predictions is chance. For example, in 1998 the UN estimated world population in 2050 at 8.9 billion, nearly three billion people more than we have now. Just a few years ago, the UN's best guess for 2050 was a billion larger.

The future will be strongly influenced by human choices. Here are four choices about population, economics, environment and culture that can make the next century a better century.

First, we can help make every human conception a wanted conception, every birth a wanted birth. We can help the 56 percent of the world's people who live in countries with continuing high fertility to achieve

family sizes at or below replacement levels of fertility. We can do it by educating girls and boys and by providing health services, including reproductive health and family planning services, to every man, woman and adolescent. Research shows that healthy, educated parents generally choose to have fewer, healthier, better-educated children.

Second, we can organize our economic production efficiently. Until now, economic production has been a linear process: We extract some resource from nature, industry transforms it, consumers use it, and we throw what's left away. In the 20th Century, the global economy is so big that this mental picture is obsolete: There is no longer any "away" to throw things away to. Industrial ecology presents a new organization of economic production. The byproducts of one economic activity become the inputs and resources of another. Instead of linear, independent production processes, the economy becomes a network of industries and consumptive activities feeding other productive activities, just as a food web in ecology links all species in a network of feeding and recycling.

Third, we can create a more conscious, forward-looking relationship with our physical, chemical and biological environments. An Earth wired with sensors will make it possible to monitor the impact and consequences of our own activities. Existing worldwide networks of weather stations, tide gauges and seismic sensors are early steps toward instrumenting the Earth. To understand the earth's history and future and our place in it, we need to install more instruments in the atmosphere, continents and oceans at all depths and elevations. In biology, we do not understand the functions provided by most species and ecosystems on earth, and we cannot replace the genetic information produced by the last 4 billion years of evolution. We can stop throwing out living parts of the Earth before we read the instruction manual.

Fourth, no one can anticipate the challenges humans will face one-quarter, one-half or one century from now. But we can ensure that future generations are healthy, educated and supplied with the social and material means to respond to whatever challenges come their way. Universal education would im-

prove individual lives and provide society with a reserve of competence to face surprising challenges. It would have favorable effects on fertility, economic productivity and enterprise, environmental understanding and preservation, and human capacities to innovate and to adapt. There are 1.25 billion children in the world today between 6 and 16 years old. Using information technology, we could probably educate all of them better than we do now at a global average cost of \$500 per child per year. That would cost less than 2 percent of the gross world product of about \$32 trillion. As much as any other single line of action, universal basic and secondary education would enhance our chances of a sustainable future.

If the challenges of population, economics, the environment and culture are serious, how can we afford not to educate all the children?



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