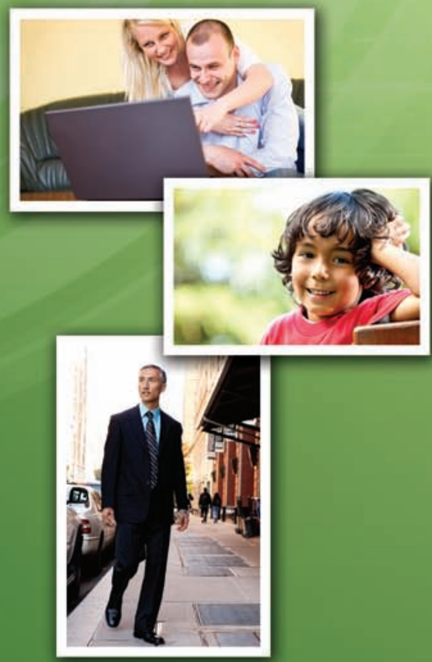
CHAPTER 1

Population Growth and Change



Key Terms

population growth
basic demographic equation
rate of natural increase
rate of population growth
doubling time
carrying capacity
population projections
mathematical methods
component methods
genocide
baby boom

Our aim in Chapter 1 is to place the present world population into a broader historical perspective and then to consider current and future population trends. Only after we have seen where we have been, and how we got to where we are, can we begin to ponder our demographic future.

Measuring Population Growth and Change

Any understanding of the ways in which population processes operate to shape or alter the size or composition of a region's population requires a knowledge of various measures of **population growth** and change.

Population growth is the change in population over time, and can be quantified as the change in the number of individuals in a population per unit time.

The Basic Demographic Equation

The most fundamental characteristic of any population is its size. An area's population may be increased either by a birth within the area or by the migration into the area of a person from another area. Similarly, the population may be decreased either by the death of someone within the area or by the migration of someone from the area out to another area. Thus, the primary population processes are births, deaths, and migration. These basic demographic processes may be combined to produce the following equation:

$$FP = SP + B - D + I - O,$$

where FP = final population, some time interval beyond SP,
SP = starting population,

> The most fundamental characteristic of any population is its size.

B = births during the interval,
D = deaths during the interval,
I = in-migration during the interval, and
O = out-migration during the interval.

It is easy to see why demographers have sometimes referred to it as the "**basic demographic equation**."

> Primary population processes are births, deaths, and migration, which combine to produce the **basic demographic equation.**

The Rate of Natural Increase

For any given population the rate of natural increase (RNI) equals the crude birth rate (CBR) minus the crude death rate (CDR). Thus

$$\text{RNI} = \text{CBR} - \text{CDR}.$$

The crude birth rate is the number of births per 1,000 population in a one year period, or

$$\text{CBR} = (\text{B}/\text{P}) \times 1{,}000,$$

where B = number of births in one year and
P = mid-year population.

In 2011 the crude birth rate for the world was about 20 per thousand and for the United States it was approximately 13 per thousand. The crude birth rate is influenced to some degree by the age and sex structure of a population.

The crude death rate is the number of deaths per 1,000 population in a one year period, or

$$\text{CDR} = (\text{D}/\text{P}) \times 1{,}000,$$

where D = number of deaths in one year and
P = mid-year population.

In 2011 the crude death rate for the world was about 8 and for the United States it was around 8. The crude death rate is considerably more affected by the age structure of the population than is the crude birth rate, so comparisons among countries need to be done with caution. This should be immediately apparent when you consider that the world rate and the rate in the United States are the same.

> **Rate of natural increase** is the crude birth rate minus the crude death rate of a population.

Because the crude birth and death rates are both expressed per 1,000 population, it is obvious that the **rate of natural increase** will also be expressed in units per 1,000 population—births minus deaths. Since the crude birth rate for the world was 20 and the crude death rate was 8, the world's rate of natural increase for 2011 was equal to 20 minus 8, or 12 per thousand. Similarly, for the United States the rates were 13 and 8, respectively, and the rate of natural increase in the United States in 2011 was 13 minus 8, or 5 per thousand. Note that the rate of natural increase is not necessarily the same as the rate of population growth because the effect of migration is not included in the former. For the world, the rate of natural increase equals the rate of population growth because migration to and from the earth is currently nonexistent. For the United States, however, the rate of natural increase is well below the actual rate of population growth because of a sizable annual net immigration (which is the subject of considerable debate today).

> The **rate of population growth** is a measure of the average annual rate of increase for a population.

The Rate of Population Growth

The **rate of population growth** is a measure of the average annual rate of increase for a population. Barring migration, it is possible to convert the rate of natural increase to the natural rate of population growth by simply converting the rate per 1,000 to an annual percentage rate. For the world the rate of natural increase was 12 per thousand, which is equivalent to an annual rate of population growth of 1.2 percent. Keep in mind, however, that most of the time migration must be considered, so the rate of population growth will usually differ from the rate of natural increase. To some extent the relative effects of natural increase and migration are inversely related to the size of the area under consideration. Whereas at the world scale migration plays no part at all in population growth, at the local scale migration may even be more important than natural increase in determining the overall rate of population growth.

In the United States example the rate of natural increase amounts to an annual growth rate of 0.5 percent. Actually, the 2011 rate of population growth for the United States was closer to 1.0 percent. The difference between these two rates results from net immigration. In other words, 50 percent of the growth in the United States, population in 2011 was due to natural increase and 50 percent was due to net immigration.

Doubling Time

The **doubling time** of a population is the number of years that would be required for a population to double in size, assuming that the population continues to grow at a given annual rate. This growth is analogous to the growth of money in a bank savings account. In both cases the "interest" is compounded. Without going into detail, it is possible to closely approximate the doubling time for a population by dividing the annual rate of population growth into the number 70. Thus, for the world, growing at 1.2 percent annually, the time required to double the present population would be 58 years. This assumes, of course, that the 1.2 percent growth rate continues over the entire period. For the United States, growing at 1.0 percent, the doubling time would be around 70 years.

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World Population Growth

This section is concerned with the growth of the human population from prehistoric times to the present. Once we get into the twentieth century the focus shifts from the total world population to regional patterns of growth—mainly to the current division of the world into less developed (mainly poor) and more developed (mainly rich) regions—and to the differences between these regions with respect to population growth. We generally use the terms *less developed* and *more developed* regions with reference to levels of economic development—occasionally less developed countries may also be referred to as Third World countries.

Brief Overview of World Population Growth

In order to understand the current world population situation, as well as future prospects for the world's ever-increasing numbers, it seems worthwhile first to discern how it is that the population reached its current level—a world of 7 billion people growing at an average annual rate of about 1.2 percent. Those figures suggest that each year around 84 million people are added to what many already perceive to be an overcrowded planet. Every four years more people are added to the world's population than currently live in the entire United States. Most geographers and demographers believe that this rate of growth cannot continue indefinitely. As Berelson and Freedman (1974, 3) noted more than three decades ago, "The rate of growth that currently characterizes the human population as a whole is a temporary deviation from the annual growth rates that prevailed during most of man's history and must prevail again in the future." This recent period of rapid population growth is unique in demographic history, both in terms of the rate of population growth and in terms of the absolute size of the world's population. The world's population nearly quadrupled during the twentieth century, from 1.6 billion in

1900 to 6.1 billion in 2000. Population geographers and demographers do not expect that to happen again.

For most of human demographic history, population growth was exceedingly slow; the annual rate of increase probably did not reach 0.1 percent (a doubling time of about 700 years) until sometime in the seventeenth century, after which it began to accelerate. This acceleration was gradual at first, but it became more noticeable after 1750.

Our current knowledge of historical populations remains conjectural. Clever demographic detectives, using whatever clues they can uncover (from archaeological excavations to early church baptismal, marriage, and death records), have pieced together the story of the human population's slow but inexorable expansion in both numbers and occupied territories. Our knowledge of historical population sizes and growth rates remains speculative because censuses and other organized and systematic collections of population data were nearly nonexistent before the middle of the eighteenth century. Earlier censuses had been taken in a few places, but their data were controversial at best. Even today reliable statistics don't exist for perhaps half of the world's population.

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The **carrying capacity** of land is its capacity to sustain a given human population at a given level of technology.

Estimates of population numbers in prehistoric times vary considerably and are generally made on the basis of assumptions about the **carrying capacity** of the land—its capacity to sustain a given human population at a given level of technology—and the distribution of the human population. Cohen (1995a) and others have tried to model human carrying capacity of the earth, but there has generally been little agreement among different approaches, partly because of the complexity of human societies and cultures. Hopfenberg (2003, 109) used food supply data in a logistic model and concluded: "That food supply data adequately fits the logistic model of human population dynamics provides evidence that, consistent with ecological notions typically applied only to nonhuman species, human population increases are a function of increased food availability." This fits well with Cohen (1995b, 35), who earlier observed that "The ability to produce food allowed human numbers to increase greatly and made it possible, eventually, for civilizations to arise."

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Speaking of numbers, this and other books on population are full of them, so let us digress for a minute and talk about them. On May 30, 2013, according to the Census Bureau, the population of the United States was 315,949,324 and the population of the world was 7,088,560,200. What precision! But don't take these numbers, or others like them, too seriously. Most of the above digits mean nothing, though they demonstrate how nice it is to have computers around to generate them. Round them off to 316 million and 7.1 billion and you have lost no accuracy–the accuracy is only apparent to start with. Furthermore, such numbers can be manipulated easily while forgetting that they represent real lives. We encourage you to remember what Cohen (1995b, 20) pointed out, that "Uncertainty does not render statistical numbers worthless; even with uncertainty, statistical numbers are indispensable. They are often far more informative than verbal descriptions or intuitive hunches. But every statistical number should enter your consciousness with a penumbra of doubt." In other words, don't take numbers for granted–look at them carefully, think about how precise they might be, and keep in mind that there may be considerable uncertainty surrounding them. Numbers are necessary for our discussions, but it is also necessary to view them with a touch of suspicion.

Deevey (1960) estimated that the world's population around one million years ago was about 125,000. According to his estimates, this population grew very slowly to approximately 3.34 million 25,000 years ago and to 5.32 million 10,000 years ago. By *A.D.* 1, Deevey and others estimate, the world's population was in the neighborhood of 250–300 million. At that time the average annual rate of increase was probably on the order of 0.05 percent. At that growth rate it would take about 1,400 years for a population to double, compared to a doubling time of about 58 years for today's population.

The world's population did not reach its first billion until sometime around 1820. By then the annual rate of growth had increased tenfold to roughly 0.5 percent. Though all of human history had been required to reach this first billion, only 110 years were required to add the next billion; by 1930 there were 2 billion residents on our planet. In only 45 years this 2 billion doubled to the 1975 population of 4 billion, and by 1987 the world's population had grown to 5.0 billion. Only twelve years later the next billion had been added. As a species, we have certainly demonstrated our capacity for successful reproduction, but it may well be time for us to restrain ourselves before we find a way to destroy our own ecological niche (though not the earth—it could get along quite well without us, as it did for most of its history). As Ornstein and Ehrlich (1989, 45) noted:

> Increasing numbers is a "goal" of all organisms. But never before has there been an "outbreak" of a single species on such a global scale. Unfortunately it is not yet clear how enduring our unprecedented triumph will be, because it has created an unprecedented paradox: our triumphs can destroy us. As people strive to increase their dominance even further, they are now changing the earth into a planet that is inhospitable to civilization.

Geographer Crispin Tickell (1993, 220) noted that "All previous civilizations have collapsed." Though he recognized variations on the general theme, he suggested that each early civilization suffered from a fatal combination of population, resource, and environmental variables that turned unfavorable at some point. Furthermore, Tickell (1993, 220) added that:

> The prime engine of the recent dizzymaking rise in the human population and change generally is the industrial revolution. We have the misfortune to be perhaps the first generation in which the magnitude of the global price to be paid is becoming manifest.

Cohen (1995b, 367) put it this way: "The human population of the Earth now travels in the zone where a substantial fraction of scholars have estimated upper limits on human population size." A look at how the world population has grown may help us better understand where we are today and how many more people are likely to be added to Earth's population in the decades ahead.

Warning!

The study of population is based largely on the collection and analysis of demographic data. These data vary considerably in reliability, so it is necessary to proceed somewhat cautiously, to develop a healthy skepticism about population information and its interpretation. In an informative article, Bouvier (1976, 8–9) suggested the following warnings that you should certainly heed:

- **Warning 1:** Do not use growth rates to indicate changes in birth rates.
- **Warning 2:** Do not use natural increase to indicate population growth, except in those areas where migration is nonexistent.
- **Warning 3:** Do not confuse numerical growth or decline with rates of population growth or decline.
- **Warning 4:** Do not take population figures as gospel truth, especially if they come from areas with less than adequate data-gathering facilities.

Each of these warnings should be considered carefully; errors in demographic thinking often result from a failure to consider one or more of them.

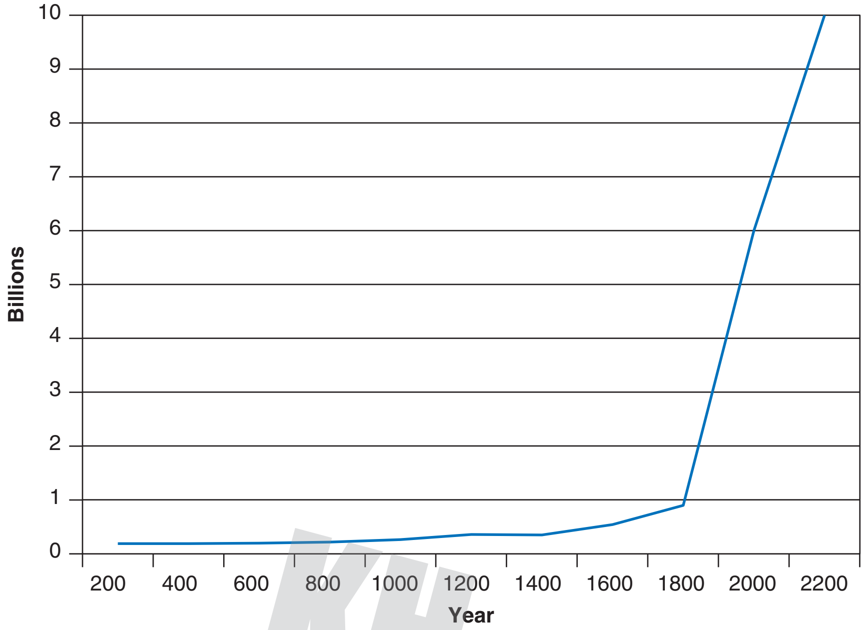

Figure 1–1 Arithmetic Growth of World Population
Source: McEvedy and Jones,1978; United Nations 2011.

Figure 1–1 provides a graphic illustration of human population history. The slow growth that characterized so much of the early history of humankind gives way, first gradually, then much more rapidly, to increased rates of population growth. These changes in growth rates involved alterations of both birth rates and death rates, with an emphasis on the latter; alterations that were in turn linked to sweeping changes in the socioeconomic fabric of societies.

Figure 1–2 shows past population growth on a logarithmic rather than an arithmetic graph, allowing us to focus more on changes in the rates of increase. The contrast with Figure 1–1 is both striking and suggestive. Rather than a single period of population growth, three periods of relatively rapid demographic increase become apparent, each of them followed by a slowing of growth rates. Deevey (1960) argued that each of these periods of accelerated population growth was a response to a revolution in which the

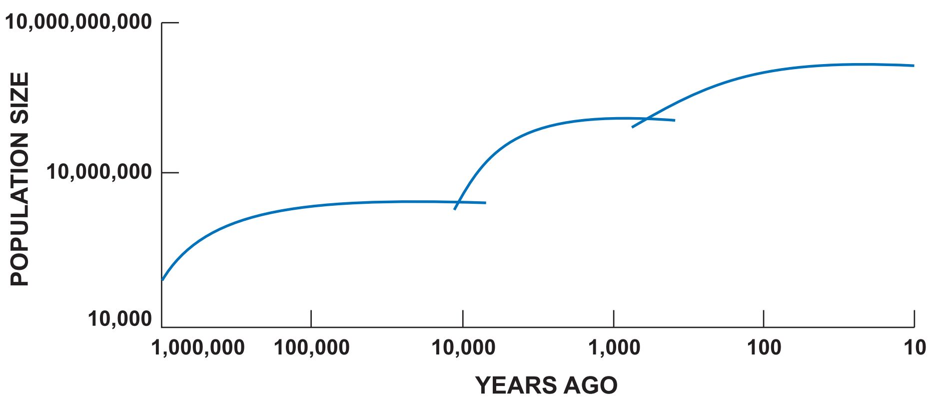

Figure 1–2 Logarithmic Growth Curve for World Population from 1,000,000 Years Ago
Source: Adapted from "The Human Population" by Edward S. Deevey, Jr., *Scientific American.* September 1960.

earth's carrying capacity was dramatically increased. Each of these revolutions in carrying capacity can be viewed as a diffusion process, radiating outward from one or more origins to gradually encompass the inhabited world. The earliest of the three revolutions was the *toolmaking or cultural revolution*; the second was the *agricultural revolution*; and the third was the *scientific-industrial revolution*, which continues today.

The implications of Figures 1–1 and 1–2 for future population growth are dramatically different. Figure 1–1 implies a continuing rapid increase in the size of the world's population (perhaps followed by a catastrophic crash?), whereas Figure 1–2 suggests that the world should experience a tapering off of growth rates as the world population adjusts to the current technological levels and their concomitant limitations on population expansion. Barring another major revolution that would again expand the earth's carrying capacity, Deevey's interpretation of population history implies a slowing of world population growth, one that we are already beginning to see. The world's population growth rate reached a peak sometime in the late 1960s at around 2.1 percent, from which it has dropped gradually to a level of about 1.2 today. Though the direction of change is encouraging, we need to keep in mind that it only represents a change in doubling time from about 33 years to 58 years. Furthermore, given the size and youthfulness of the planet's population, absolute annual population increases (as opposed to the rate of increase) will remain large for many years.

You might wonder, as others have done, how many people have ever lived on our planet. Demographer Carl Haub (2002) estimated an answer. By making a number of "guestimates" about populations, births, and deaths in the past, he concluded that 106,456,367,669 people had been born by 2002. Of those births, about 5.8 percent, 6.125 billion, were still living at the time. By 2008 perhaps another 800 million births had occurred and the total population had passed 6.6 billion. In 2011, it is estimated that 108 billion people have ever lived on earth

The Three Major Periods of Population Growth

As we have already noted, Deevey (1960) proposed that population growth occurred unevenly over time, mainly in conjunction with three major revolutions in human history—the cultural, the agricultural, and the scientific-industrial revolutions. These three major revolutions serve as the basis for subdividing our discussion of population growth into three discrete periods. This is appropriate because each of the revolutions must have opened up new possibilities for population growth, mainly because each one extended the earth's carrying capacity. However, the availability of population *facts* decreases rapidly as we move back in time, hence the following discussion must be approached with a degree of caution.

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The Cultural Revolution and Population Growth

It was the emergence of primates, perhaps as early as 85 million years ago (Gugliotta, 2002), that set the stage for the gradual origin and spread of our own human population. The earliest primates, which probably overlapped the age of dinosaurs, were small (around two pounds) and ate mainly insects and fruit. At some point in time, perhaps eight million years ago, humans diverged from chimpanzees, our closest living relatives. It was a long road from there to where we are today, however, one still full of mysteries, potholes, ruts, and even evolutionary deadends.

The cultural, or tool-making, revolution occurred in prehistoric time. What knowledge exists of events in that era must be drawn primarily from the archaeological record. Seeking into the origin and evolution of the human population continues to occupy the time and energy of many researchers, mainly anthropologists. Periodically, new finds of

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the skeletal remains of early hominids push back the frontiers of our knowledge to yet earlier times. The geographical search for early people has established an African origin.

Several pieces of archaeological evidence have pushed the frontier of hominid history farther back into the dawn of our evolutionary chronology. The earliest hominid on record so far, one similar in many ways to modern chimpanzees, is nearly seven million years old and goes by the name *Sahelanthropus tchadensis*, a name that recognizes its origin in Chad in the Sahel region of Africa. This region is well west of the Great Rift Valley in which most subsequent evidence of hominids have been discovered and suggests that human origins may have been geographically more widespread than has traditionally been appreciated. Around 5.5–5.8 million years ago *Ardipithicus ramidus kadabba* (a new genus) roamed parts of East Africa, as did *Ardipithecus ramidus ramidus* at least 4.4 million years ago. Meave Leakey's (1995) Kanapoi fossils, found not far from Lake Turkana, extended *Australopithicus afarensis* back to about 4.1 million years ago.

Between *Ardipithecus ramidus* and *Australopithecus afarensis*, at an age of 4.2 to 3.9 million years ago, Leakey and Walker (1997) have added a new species, *Australopithe-cus anamensis*, based on further fossil evidence from sites at Kanapoi and Allia Bay.

Previously known skeletal remains uncovered in Africa suggested an age of 2.8 to 3.8 million years for *Australopithecus afarensis*, as exemplified by "Lucy" (Johanson and Edey, 1981) and the "Dikika Baby" (Sloan, 2006), 1.6 to 2.2 million years for *Homo habilis*, and 1.4 to 1.7 million years ago for *Homo erectus*. Bipedalism was probably the earliest characteristic that separated hominids from their nearest relatives, the gorillas and chimpanzees. After that, increasing brain size is one of the primary features that distinguishes each one of the hominid groups from the next. However, as Ornstein and Ehrlich (1989, 37–38) have suggested, ". . . although the human brain appears to have enlarged rapidly (in geological time) in response to the pressures of culture, it does not seem likely that the brain crossed any real physical threshold that suddenly permitted new kinds of cultural activities."

Perhaps our arrogant view of ourselves long colored the way in which we perceived our evolution from ape to hominid to modern people. Like other successful animal species, the line of humans, once separated from the apes five or six million years ago, apparently went through considerable trial and error, made many false starts, and reached a few dead ends. Ian Tattersall (2000) argued convincingly that at least four kinds of hominids lived together within a single landscape in part of what is now northern Kenya about 1.8 million years ago. Though we may never know the degree to which they interacted with each other, Tattersall argues that *Paranthropus boisei*, *Homo rudolfensis*, *Homo habilis*, and *Homo ergaster* (also known as African *Homo erectus*) occupied the same geographical area at the same time. As Tattersall (2000, 61) phrased it, human evolution has not been a simple linear pattern:

> Instead it has been the story of nature's tinkering: of repeated evolutionary experiments. Our biological history has been one of sporadic events rather than gradual accretions. Over the past five million years, new hominid species have regularly emerged, competed, coexisted, colonized new environments and succeeded—or failed. We have only the dimmest of perceptions of how this dramatic history of innovation and interaction unfolded, but it is already evident that our species, far from being the pinnacle of the hominid evolutionary tree, is simply one more of its many terminal twigs.

According to Wenke (1990), two scenarios currently set the stage for debate about the continued search for human origins. One of these scenarios suggests the migration of *Homo* ancestors, most likely *Homo erectus*, out of Africa some 1.5 million years ago, followed by gradual diversification among scattered groups but at the same time a gradual evolution toward *Homo sapiens* among all the groups because of both common genetic inheritances and similar adaptive pressures. The result of this first scenario, as Wenke (1990, 137) described it, was "that they all converged at about 30,000 years ago as one species, *Homo sapiens sapiens*." The other scenario begins in the same way, with the migration of *Homo ancestors* out of Africa some 1.5 million years ago. This scenario differs after the initial migration by suggesting considerably more divergence among groups as they spread out and adapted to different environments. Following the second scenario, according to Wenke (1990, 137), the final result is that "perhaps 140,000 years ago, *Homo sapiens* evolved in one place (probably Africa), and spread across the world, displacing most groups, driving some into extinction, and absorbing a small fraction of the others through intermarriage."

In recent years the latter scenario has received considerable attention, not from archaeological but from genetic evidence. Cann, Stoneking, and Wilson (1987) argued that the maternal lineage of all humans could be traced backed to a single African woman who was alive perhaps 200,000 years ago, a woman now referred to by many as "Mitochondrial Eve." Their data were based on studies of mitochondrial DNA (deoxyribo-nucleic acid), which are only maternally inherited. These DNA then form the basis for a "molecular clock," which in turn can be used to develop a branching tree. As Stringer (1990, 99) has noted, "One attempts to make a molecular clock by comparing genetic differences among various species or varieties within species and expressing their relatedness in a tree . . . then calibrates (or 'dates') the tree by comparing it with another group that diverged from the tree at a known date." Studies since 1987 have tended to confirm the African origin of "Mitochondrial Eve" and have given rise to considerable speculation about what that means for the Neanderthals (Stringer, 1990). Barinaga (1992, 686), citing increasing questions that have been raised about the DNA methodology, noted that ". . . the root of the human tree has been thrown open to question once again." Current criticism is focused primarily on how the mitochondrial DNA have been analyzed and whether or not these data can identify a geographic origin for our species. Excellent summaries of the two opposing views of evolution over the past 200,000 years are Wilson and Cann (1992) and Thorne and Wolpoff (1992). The earliest migration date must be pushed back because of the discovery of fossil remains found in Dmanisi, Republic of Georgia, that date back to 1.75 million years ago and provide clear evidence that *Homo erectus* or something similar had left Africa earlier than 1.5 million years ago.

In a review of these two competing hypotheses about our origin, Tattersall (1997, p. 67) wrote that ". . . my strong preference is for a single and comparatively recent origin for *H. sapiens*, very likely in Africa—the continent that, from the very beginning, has been the engine of mainstream innovation in human evolution. Additionally, Olson (2002, 28) noted that ". . . the genetic evidence available today points to a straightforward conclusion. According to our DNA, every person now alive is descended from a relatively small group of Africans who lived between 100,000 and 200,000 years ago." The oldest fossil of a modern human found so far was discovered in Orno Kifish in Ethiopia, where it lived about 195,000 years ago. Put a different way, Olson (2002, 38) stated that "Everyone alive today is either an African or a descendant of Africans." More recently, Shreeve (2006, 69) wrote that "DNA studies have confirmed this opening chapter of our story over and over: All the variously shaped and shaded people of Earth trace their ancestry to African hunter-gatherers, some 150,000 years ago." He goes on to suggest (2006, 69) that "Perhaps the most wonderful of the stories hidden in our genes is that, when unraveled, the tangled knot of our global genetic diversity today leads us all back to a recent yesterday, together in Africa."

The emergence of anatomically modern humans, *H. Sapiens*, as the *only* surviving members of a long chain of trials and errors occurred recently—probably no more than 25,000 to 28,000 years ago. Before that, we know, for example, that 90,000 to 100,000 years ago in the region that now includes Israel, modern humans lived side-by-side with Neanderthals (whose reputations have been much improved as a result of recent research), though that group seems to have died out without spreading. In 2003 researchers reported some of the oldest known finds of skulls of modern humans. They were approximately 160,000 years old and were found in the proximity of a now-vanished lake in Ethiopia. This evidence puts the fossil evidence in line with the arguments of geneticists—an African origin for *Homo sapiens* between 150,000 and 200,000 years ago.

Despite the find of early modern human fossils in Qafzeh, Israel, that were dated to nearly 100,000 years ago, most evidence today suggests that the successful migration of modern humans out of Africa and around the world began between about 70,000 to 50,000 years ago. As Shreeve (2006, 63) noted, "All non-Africans share markers carried by those first emigrants, who may have numbered just a thousand people." Likely paths were around the north of the Red Sea or across its southern opening (Shreeve, 2006). From there modern humans spread northwestward into Europe, north into what is now Russia, and east through Asia, reaching Australia by around 50,000 years ago. The New World was not populated by modern humans until about 20,000 years ago, or even less, when sea levels were low enough to allow people to cross between Siberia and Alaska.

Between 30,000 and 40,000 years ago modern humans appeared in Europe, where Neanderthals lived already. However, at least according to Tattersall (2000, 61), "Certainly the repeated pattern at archaeological sites is one of short-term replacement, and there is no convincing biological evidence of any intermixing in Europe." In a period of perhaps 10,000 years the Neanderthals disappeared.

Wong (2000), however, identifies some differences of opinion among anthropologists' interpretation of the European confrontation between Neanderthals and modern humans. For example, anthropologist Fred Smith (cited in Wong, 2000, 107) tells us that "The likelihood of gene flow between the groups is also supported by evidence that Neanderthals left their mark on early modern Europeans."

Near the end of 2004 a new skeletal discovery created a stir among anthropologists (Wade, 2004). The discovery was made on the Indonesian island of Flores, about 370 miles east of Bali. The bones were from an adult that would have been around 3.5 feet in height, lived on the island until about 12,000 years ago, and were not pygmy forms of modern people. Rather, they appeared to be downsized versions of *Homo erectus*. This discovery suggests that some of the earliest people to leave Africa may have lived for much longer than has been previously thought. These dwarf humans, assigned the name *Homo floresiensis*, but dubbed Floresians, were still around 20,000 years after Neanderthals disappeared, made stone tools, and lived among giant rats, pygmy elephants, and Komodo dragons. Nicknamed "Hobbit," this small hominid created considerable controversy, with some arguing that it was some kind of dwarf or perhaps a case of microcephaly, but recent testing has ruled out the latter and found in favor of the separate species school.

We are still left with more questions than answers. It seems clearer all the time that the evolution of modern humans was a complex drama that unfolded over a period of some five million years. Trial and error, numerous wrong turns, and dead ends led to the final emergence and dominance of modern humans between 25,000 and 30,000 years ago. Tattersall argues that the final defining characteristic that gave modern humans their edge over the Neanderthals may have been the development of language and an ability to form mental symbols. As he notes (Tattersall, 2000, 62), "We do not know exactly how language might have emerged in one local population of *H. sapiens* . . . . But we do know that a creature armed with symbolic skills is a formidable competitor—and not necessarily an entirely rational one, as the rest of the living world, including *H. neanderthalensis*, has discovered to its cost." Whatever the particular advantages of modern humans were, there is little doubt that McNeill and McNeill (2003, 4) were right when they commented that "What drives history is the human ambition to alter one's condition to match one's hopes."

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Though these debates will undoubtedly continue, perhaps it is more important at this point for us to consider Wenke's (1990, 186) summary comment that ". . . we should also take note of the fact that even though we are physically very much like our ancestors of 12,000 years ago, we are enormously different culturally . . . in a cultural sense we are not at all the same species as the human hunter-gatherers of the late Pleistocene . . . to live a life for which evolution has shaped us—we should probably eat a varied diet, live closely in a small group, and walk a lot."

As fascinating as such studies of early *Homo* and earlier ancestors may be, little is known of the numbers involved, though they were undoubtedly small. As Deevey (1960, 5–6) commented, "For most of the million-year period the number of hominids, including man, was about what would be expected of any large Pleistocene mammal—scarcer than horses, say, but commoner than elephants." Not only were the numbers small, but the rate of growth in these numbers must also have been exceedingly small. The growth of *Homo sapiens sapiens* prior to the agricultural revolution remained extremely slow. Hunting, fishing, and foraging provided an existence, though undoubtedly a precarious one. Life was most likely "nasty, brutish, and short."

Population densities on the eve of the agricultural revolution were low, and populations were vulnerable to environmental changes such as climatic fluctuations. Estimates of population size are subject to wide margins of error and must be accepted with reservation; however, the order of magnitude seems reasonable. According to Deevey (1960), the world's population 10,000 years ago was 5.32 million, though others have suggested that it might have been twice that number. Even if we accept 10 million, we're talking about a small base from which we have grown in a relatively short time.

The Agricultural Revolution

An exact date for the beginning of the agricultural revolution is impossible to set, but it is likely that incipient cultivation and domestication developed sometime around 10,000 B.C. in the Near East. A curious point about the beginning of agriculture revolves around the length of time that modern humans had been around (at least 140,000 years) before agriculture began to take root, so to speak. Why did it take so long, we might wonder? One answer, not completely agreed upon, is the better climate that developed at the end of the last Ice Age. Weatherford (1994, 47) noted, for example, "Around the world, humans seem to have switched from foraging to farming because of the whole set of changes produced by global warming." In writing about agriculture and the warming climate at the end of the last Ice Age, Flannery (2005, 61) argued that "It's hard to avoid the feeling that the hostile ice age climate and its savage transition to the interglacial had, until then stymied this great flowering of creativity and complexity." Furthermore, he noted (2005, 63) that "The long summer that has been the last 8,000 years is without doubt the crucial event in human history."

An exact date for the beginning of the agricultural revolution is impossible to set, but it is likely that incipient cultivation and domestication developed sometime around 10,000 B.C. in the Near East.

A reasonable scenario is that around 12,000 years ago hunter-gatherers began to settle along the shore of the eastern Mediterranean, exploiting local plants and animals, making seasonal hunting trips, and gradually becoming more sedentary. Archaeologists have confirmed that by around 8,000 B.C. Jericho (sometimes described as the "world's oldest town") housed several hundred people, and they were definitely agriculturalists. The rimland around the Fertile Crescent was one of the first areas to experience the agricultural changes that would slowly burgeon into a major revolution. As Weatherford (1994, 111) pointed out, "The transition from rural to urban life first occurred in Mesopotamia with the rise of Uruk, Sumer, and other cities in the area between the Tigris and Euphrates rivers, in modern Iraq." As agricultural practices evolved and diffused, people experienced tremendous changes; they were able to turn from the wandering and tenuous life of hunter-gatherers to the more sedentary and secure life of agriculturalists. However, these changes were gradual. As Cipolla (1974, 22) noted:

> It can be stated however, with a fair degree of certainty that the foundations of settled life in the Old World were first laid in South-West Asia between the ninth and the seventh millennium B.C. This seemingly took place where prototypes of the earliest domesticated animals and plants existed in a wild state and where the concentration on particular species as sources of food was stimulated by the ecological changes that marked the transition to Neothermal climate.

Between perhaps 7,000 B.C. and 5,000 B.C. there was some possible domestication of plants in Mesoamerica. Following 5,000 B.C., a slow but consistent domestication continued there (Diamond, 1997).

The introduction of farming allowed greater population densities to exist and probably produced the first food surpluses people had ever known. In turn, a few people were then freed from the fundamental task of providing food. A multitude of inventions and innovations followed, including the development of village settlements, irrigation, metallurgy, and long-distance trade. These inventions and innovations in turn increased people's capacity to satisfy their needs from the environment and further increased the carrying capacity of the land. Trade, and the convergence of trade routes, certainly affected population distribution and the rise of early cities as well. From today's perspective it seems clear that agriculture brought with it both risks and rewards. Hunters and gatherers lived in small groups, worked together, and did not have a well-defined hierarchical structure. As Weatherford (1994, 50) noted, "The division of the world between farmers and foragers created a permanent tension between two types of subsistence with very different needs." Clearly, with the shift to agriculture new skills and ways of thinking appeared, and, as McNeill and McNeill (2003, 6) pointed out, "Economic specialization and exchange created poverty as well as wealth."

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The demographic response to agricultural and related changes was a gradual acceleration in the rate of population growth. As the agricultural revolution diffused to various parts of the earth's inhabited surface, its impact on population growth became increasingly significant. However, as Deevey's interpretation suggested, once the impact of this revolutionary increase in the earth's carrying capacity had completed its diffusion, the rate of population growth slowed again, and the population became stabilized at a new and higher plateau. Geographic variations in population growth rates existed, however. For example, McNeill and McNeill (2003, 37) noted that "In temperate climates, where diseases were less burdensome than in tropical lands, farming village populations clearly grew much faster than hunting bands had previously done." At the same time, settled people were more vulnerable to certain risks, including infectious diseases.

By the beginning of the Christian Era the earth's population was about 250–300 million. Though this population continued to grow, its numerical progress was slow, and the regional distribution of growth was varied. Within the overall pattern of growth, cyclical changes were typical. The rate of population growth was kept in check by food supplies (often interrupted by famines), by wars, and by epidemics of various diseases.

For the most part famines have been localized, and their impact on the death rate depends on both the severity of the famine and the links between the famine-stricken area and other locations. However, famines have occasionally been devastating. Fourteenth century China may have experienced the planet's first great famine (with deaths thought to be in excess of 4 million); they occurred in many regions over the next few centuries, including the great potato famines in Ireland (1845–1849). Since 1900 famines have been worst in China (1921–1923 and 1928–1929), India (1943–1944 and 1965), and Russia (1932–1934, 1941–1944, and 1947), though they have occurred also in Poland, Greece, Africa's Sahel region, Ethiopia, Bangladesh, Somalia, Nigeria, and Kampuchea. With improved transportation linkages, the effects of local crop failures have gradually diminished.

Wars have directly affected population growth rates at various times, but their impact is not always easy to assess. The simple counting of battlefield deaths alone would underestimate the demographic impact of most wars, because wars also disrupt food supplies and act as diffusion agents for numerous diseases. Of war and the latter, Zinsser (1967, 113) commented, "And typhus, with its brothers and sisters—plague, cholera, typhoid, dysentery—has decided more campaigns than Caesar, Hannibal, Napoleon, and all the inspector generals of history." The greatest losses occurred in World War I and World War II.

Epidemics and pandemics have often been devastating in their impact on regional populations. Extreme examples include the Justinian Plague of A.D. 541–544 and the Black Death of A.D. 1346–1348. The latter may have reduced the European population by 25 percent, and local death tolls reached as high as 50 percent. Recovery of the European population after this decimation was slow, and it was further hampered by the One Hundred Years War. By the sixteenth century, however, Europe had regained her lost population and was beginning a gradual acceleration in the rate of population growth, though there were still localized periods of famine, war, and disease. The rapid growth and distribution of AIDS since the 1980s (discussed in Chapter 4) convinced everyone who might have thought otherwise that epidemics and pandemics are still with us.

After 1492 population declined precipitously in the New World as well. Though we will never know for sure, reasonable estimates suggest that more than 50 million people lived in the Americas when Columbus first sailed westward. As journalist Lewis Lord (1997, 70) noted, "The 150 years after Columbus's arrival brought a toll on human life in this hemisphere comparable to all of the world's losses in World War II." Geographer William Denevan (1996) explored estimates of the Native American population in detail. Diamond (1997, 2005) suggested that 95 percent of the Native American population died as a result of diseases introduced by Europeans into the New World. A more recent study by Livi-Bacci (2006) further supports the idea that new world populations were decimated by contact with early European explorers.

The Industrial Revolution

The Industrial Revolution originated in England in the latter half of the eighteenth century, though its roots may be found in earlier times. At its heart, the Industrial Revolution was a shift from animate to inanimate energy sources, from humans and domesticated animals to steam power generated by carbon fuels–charcoal, coal, then later oil and natural gas. Its impact on humans was vast, fairly rapid, and underwent a geographic dispersion that continues to this very day. As McNeill and McNeill (2003, 248) commented, "Industrialization forever altered the nature of work. From the natural rhythm of the days and seasons that governed farm work, people shifted to schedules controlled by the clock." The shift of populations from rural to urban areas began, and the world became noisier, often dirtier, and undoubtedly warmer as well. From England it diffused rapidly into the countries of Western Europe and to the United States. By the beginning of the twentieth century it had reached Russia and Northern Italy. Japan was the first Asian country to

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experience this revolution. As countries industrialized, industry replaced agriculture as the major sector of the economy. The Industrial Revolution continues today, and it has so far only partially diffused to the less developed countries. New inventions and innovations continue to pour forth almost daily.

By about 1750 in England and Wales, and soon thereafter in other countries as they began to industrialize, population growth accelerated. Prior to this time, crude birth and death rates had both tended to be high. In average years there may have been more births than deaths, while in bad years the reverse was likely. Death rates undoubtedly fluctuated more widely than did birth rates. High birth rates were deemed necessary in order to overcome the prevailing high death rates, though birth rates were generally not as high as they might have been because of a variety of social constraints.

During both the cultural and agricultural revolutions people increased their capacity to wrest a living from the earth, but it was not until the scientific-industrial revolution that, for the first time, they began to gain control over death. This control over death rates was a result of many changes, mainly changes that probably at first cut off the high peaks in the cyclical fluctuations of death rates. Better agricultural practices and improved distribution systems cut down on the localized effects of famines. Improved sanitary practices and facilities decreased the deaths from some diseases quite early. Then during the nineteenth century major medical advances accelerated the downward trend in death rates.

The innovations associated with each revolution were not contained in their area of origin but diffused outward, as is well illustrated by the spread of the Neolithic farming cultures of Europe. In 6,000 B.C. farming in Europe was primarily limited to a few sites near the Aegean Sea. During the next 1,000 years it spread northward into the Danubian Basin and by 4,000 B.C. to the North European Plain. An even more rapid diffusion of the industrial-scientific revolution has occurred. These innovations were carried by Europeans as they colonized new areas, and in the current century there are few places that have not been touched by industrialization to some degree.

The speed and direction of diffusion was governed by such things as distance, obstacles, nature of the environmental base, and receptivity of various social structures. One critical point is that the spread of new innovations was uneven. Whenever such innovations were introduced into a society there was a traumatic effect that necessitated new forms of organization, new patterns of leadership, and the acquisition of new skills. Rapid population growth often accompanied the changing socioeconomic conditions.

One further point to be emphasized about Deevey's (1960) interpretation of world population growth is the nature of the population growth curve for each revolution. After each rapid spurt in population growth, the growth rates slackened off—the numbers reached a plateau, and then further additions were slow to be achieved. Each revolution therefore removed, partially at least, some pre-existing constraint upon population growth, but it must also have set into motion forces that eventually brought growth under control. Obviously, these forces are of urgent concern in our present circumstance.

In response to the Industrial Revolution the world's population entered a period of rapid and sustained population growth. During the nineteenth century this growth was concentrated in the more developed countries. By the middle of the twentieth century, however, population growth had subsided in the more developed countries and was accelerating in the less developed countries, setting the demographic stage for the new millennium.

Many would have predicted that the rapid population growth of the twentieth century (from about 1.6 billion in 1900 to 6.1 billion in 2000) would have resulted in a world of extreme poverty and economic deprivation as resource scarcities led to higher prices for basic commodities. Such was not the case, however, and we need to keep this in mind as we look ahead to discussions of population growth and economic well-being, food supplies, and environmental concerns. We also need to keep in mind that the near-quadrupling of the world's population during the twentieth century was made possible in large part by the widespread development and use of fossil fuels.

Though no definitive yardstick is available for measuring such things, economists have suggested that the world's material standard of living increased perhaps nine-fold during the twentieth century—a considerable achievement. On the average people live longer, healthier lives now than they did 100 years ago. Geographically, however, the vast improvements in wealth during the twentieth century accrued mainly to the nations of Europe, the United States, and Japan. We enter the new century with vast differences in wealth among the world's nations—a person's place of birth largely determines his or her economic and demographic destiny.

A person's place of birth largely determines his or her economic and demographic destiny.

The Human Population Today

Jane Jacobs (2004, 168) noted, perceptively, that "The world today is a bewildering mosaic of cultural winners, groups of people sunk into old or recent Dark Ages and downward spirals, groups in the process of climbing out, and remnants of preagrarian cultures, as well as remnants of declined empires."

Today's population situation is unique in the world's history; not only is the current rate of increase still fairly high, but the base population (7 billion) is also the largest ever. The historical record shows that the acceleration of world population growth started with the European countries and the lands that Europeans settled overseas, especially the United States, Canada, and Australia. However, the areas that are growing the fastest today are Africa, Asia, and Latin America. These so-called less developed regions have more than three-fourths of humankind and are responsible for more than 90 percent of the world's population growth. Death rates in these regions' countries have been falling during the last twenty-five years, whereas birth rates have remained twice as high as they are in the more developed nations (Goldstein and Schlag, 1999).

Between 1950 and 1987 the world's population doubled from around 2.5 billion to over 5 billion, an increase of over 2.5 billion people in less than forty years. The Cold War ignored growing populations and changing geographic concentrations of people. During those years population growth had been unequally distributed geographically; more than 85 percent of that growth occurred in the less developed countries. In most of the more developed countries today, fertility hovers near or below replacement level (the United States is the major exception), so that an even higher percentage of population growth in coming decades will occur in the less developed countries, those least able to absorb additional people. By the year 2008, 85.4 percent of the world's population resided in the less developed countries; nearly half of them were residents of either China or India (the world's second "demographic billionaire"). It is easy to see why, then, we can expect international migration to flourish in the decades ahead as globalization of the economy brings together capital, which is heavily concentrated in the rich countries, and young people, who are heavily concentrated in the poor ones.

Still another comparison between the more developed and less developed countries can be made by considering the differing age structures of their populations. A country that has a rapidly growing population has a large proportion of its residents in the younger age groups. In the rapidly growing areas of the world—Africa, Asia, and Latin America—high proportions (typically 30–45 percent) of the population are under 15 years of age, whereas in North America, Europe, and Australia and New Zealand there are significantly lower proportions of young people (20 percent or less). A population with a large proportion of old people will have different needs and requirements than a population with a great many young people. Though we don't know exactly what the earth's carrying capacity for humans actually is today, many would argue that we may be approaching it soon. Some would even suggest that we've already passed it.

However, overpopulation is an elusive concept. Though it may seem to you that parts of the world are indeed overpopulated, that doesn't mean either that everyone would agree with you or that, by virtue of some regions being overpopulated, that the world is also overpopulated. If we could define an optimum population, then it would be easier to define overpopulation. It would be any population greater than the optimum. But there is no agreed upon definition of optimum population. Optimum for whom, we might ask, and for what? We might try to relate the optimum population in turn to carrying capacity, but as we've seen already, the carrying capacity of the world has been regularly altered by changes in technology that have allowed us to produce more food, the essential need that we humans have. We will revisit these ideas in more detail in Chapter 9, though we will never resolve the issue to everyone's satisfaction.

Population Projections

So far we have viewed the present population situation mainly in the perspective of the past, but what does the future hold in store for the world's population? One answer to that question, based on a set of assumptions about the dynamics of a population over some time period, is the **population projection**. Young (1968, ix) cautioned us long ago, however, to remember that:

A **population projection** is made on the basis of the population at some date and assumptions about births, deaths, and migration between that date and some future date.

> The projection of a future population from a present growth rate is a hazardous undertaking at best. These rates contain many variables and are sensitive to small changes in these variables. Furthermore, since population growth is cumulative, very slight changes in present rates can make enormous differences when projected 100, 200, or more years into the future.

Always remember that we cannot predict the future, and those who try are doomed to failure. As only one example, in 1949 *Popular Mechanics* predicted that "Computers in the future may weigh no more than 1.5 tons."

Demographers are careful to differentiate between projections and predictions. The *projection* for the size of a population at some future date is based on a set of *assumptions* about the demographic processes that will affect population growth over the time period. The simplest assumption is that the future rate of population growth will be the same as that of today. However, for most situations this is unrealistic. Typically, the projection is broken down into separate projections for the birth rate, death rate, and migration. These may then be combined into a single projection for the future population. What the projection shows is that, *if* the assumptions hold true for births, deaths, and migration, *then* the projection will be accurate. Demographers should not be held responsible if the assumptions are not fulfilled, you see. Often a projection may alter people's reproductive behavior and set into motion events that will assure that the projection will be off the mark. Usually more than one projection is made and quite often a series of projections is made, using different assumptions about future birth, death, and migration rates.

Population Projections: A Brief Overview

First, we should distinguish among the following three commonly encountered terms: projection, forecast, and prediction. A population projection is made on the basis of the population at some date and assumptions about births, deaths, and migration between that date and some future date. As Gibson (1977, 7) noted, "Population projections are 'correct' by definition (except for computational errors) because they indicate the population that would result if the base data (starting) population is correct and if the underlying assumptions about future change should turn out to be correct." The usefulness of projections, then, depends on what assumptions have been made and how well they accord with the actual events.

Demographers prefer to avoid the term *prediction* altogether because it suggests that only one projection has been made and it is considered as an ultimate truth, as occurring with a high degree of certainty. Past projections have often fallen so wide from their marks that the most demographers will venture today is to choose one of a series of projections as a forecast, and that usually only for short distances into the future, and then only reluctantly.

Two broad classes of population projections exist: mathematical and component. **Mathematical methods** are easier to understand and to apply, but **component methods** are preferable for most projections, especially for those beyond the short term, which is usually taken to be five years or less. Whereas mathematical methods employ some mathematical formula to a base population using an assumed rate of growth over the projection interval, component models separately project births, deaths, and migration, then combine the "components" into an overall population projection. These latter projections, of course, are also done mathematically, and the terminology sometimes confuses people. For demographers and population geographers there is no escape from mathematics.

Mathematical methods employ some mathematical formula to a base population using an assumed rate of growth over the projection interval.

Component models separately project births, deaths, and migration, then combine the "components" into an overall population projection.

Within each class of projections different models exist, so a wide range of projection models can be called upon. The model that should be used, of course, depends upon several factors, such as the size of the area for which projections are being made, the assumptions that can or should be made, the types of data that are available, and the length of the projection interval. With respect to scale, for example, national projections require different considerations than do projections for local areas. Understanding and projecting migration is, perhaps, more critical for local area projections than is the projecting of births and deaths. Conversely, projecting immigration at the national level may be much easier than projecting births mainly because immigration is controlled, at least to some extent, by the national government. Also, data for local areas are not always available in sufficient detail for employing component models, thus making mathematical models more attractive, especially for short-term projections.

Population Projections: World and Major Regions

Despite the difficulties, population projections are deemed essential and useful. They can stimulate our thinking about the consequences of population trends, for example. We need to keep in mind, however, what a United Nations study stated:

> What will population trends be like beyond 2050? No one really knows. Any demographic projections, if they go 100, 200, or 300 years into the future, are little more than guesses. Societies change considerably over hundreds of years—as one can readily see if one looks back at where the world was in 1900, or 1800, or 1700. Demographic behavior over such long time spans, like behavior in many spheres of life, is largely unpredictable (United Nations, 2004, 3).

The United Nations' world and regional population projections for the 1950–2050 period are shown in Table 1–1. Among the basic assumptions that the United Nations used to make these projections are the following:

1. At least a minimal degree of social order and control will be maintained.
2. Efforts at maintaining or improving the quality of life will continue and will not be totally frustrated.
3. Regional vital rates will move differently in terms of time, but eventually everywhere mortality and fertility will fall slightly below the lowest levels now observed.

As Table 1–1 shows, the potential for population growth is considerably higher in the less developed areas of the world than in the more developed ones.

Table 1–1 Population of the World, Major Development Groups and Major Areas, 1950, 1975, 2010 and 2050 According to Different Variants

	Population (millions)			Population in 2050 (millions)			
Major area	**1950**	**1975**	**2010**	**Low**	**Medium**	**High**	**Constant**
World	2 535	4 076	6 895	8 112	9 306	10 614	10 943
More developed regions	814	1 048	1 235	1 158	1 311	1 478	1 252
Less developed regions	1 722	3 028	5 659	6 955	7 994	9 136	9 691
Least developed countries	200	358	832	1 517	1 726	1 952	2 434
Other less developed countries	1 521	2 670	4 827	5 437	6 267	7 184	7 257
Africa	224	416	1 022	1 932	2 191	2 470	2 997
Asia	1 411	2 394	4 164	4 458	5 142	5 898	5 908
Europe	548	676	738	632	719	814	672
Latin America and the Caribbean	168	325	590	646	751	869	863
Northern America	172	243	344	396	447	501	444
Oceania	13	21	36	49	55	62	60

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2011). World Population Prospects: The 2010 Revision. Highlights. New York: United Nations.

After getting close to 7 billion in 2010, the world's population is projected to increase by nearly 30 percent over the next 50 years, to a population of slightly over 9 billion according to the medium variant of the United Nation's updated projections. Generally, the future course of fertility is more difficult to project than that for mortality.

Population Projections: The United States

For comparative purposes it is useful to look at what has happened to official population projections for the United States. These projections are extremely important because they serve as the basis for many other projections, including the country's projections of the demand for housing, educational facilities, hospitals, and a myriad of other needs.

Population projections for the United States in the 2000–2100 period are shown in Table 1–2. Though these projections were published in early 2000, they do not include the 2000 census figures, which showed a population about 6 million larger than the 2000 figure used for projections. As a result, these projections are assuredly on the low side. The assumptions underlying the different variants in Table 1–2 are discussed in Hollmann, Mulder, and Kallan (2000). The middle series is considered the "most likely" variant, though with the usual caveat. In a commentary in *Time* magazine, Stengel (2006) wrote about the growing population of the United States as it passed the 300 million mark. He went on to celebrate the nation's growth and pointed out that it would only take about 40 more years to reach 400 million. He wrote that (2006, 8) "In America, we have always done Big well–big cars, big screens, Big Macs; we're the supersize nation. But now we are being challenged to trade Big for Smart." He didn't even mention the possibility of trading Big for Smaller. Even if we were to build "greener" buildings, squeeze more miles per gallon out of cars, and put solar panels on Wal-Marts, another 100 million Americans will further burden Earth's environment.

Given discussions in the United States about immigration rates, it is of particular interest to note the final column of the projections in Table 1–2 because they assume no

Table 1–2 Population Projections for the United States

	Middle Series	Lowest Series	Highest Series	Zero International Migration Series
2000	275,306	274,853	275,816	273,818
2005	287,716	284,000	292,339	280,859
2010	299,862	291,413	310,910	287,710
2015	312,268	297,977	331,636	294,741
2020	324,927	303,664	354,642	301,636
2025	337,815	308,229	380,397	307,923
2030	351,070	311,656	409,604	313,219
2035	364,319	313,819	441,618	317,534
2040	377,350	314,673	475,949	321,167
2045	390,398	314,484	512,904	324,449
2050	403,687	313,546	552,757	327,641
2055	417,478	312,160	595,885	330,991
2060	432,011	310,533	642,752	334,724
2065	447,416	308,716	693,790	338,999
2070	463,639	306,589	749,257	343,815
2075	480,504	303,970	809,243	349,032
2080	497,830	300,747	873,794	354,471
2085	515,529	296,923	943,062	360,026
2090	533,605	292,584	1,017,344	365,689
2095	552,086	287,826	1,097,007	371,492
2100	570,954	282,706	1,182,390	377,444

Source: U.S. Census Bureau. www.census.gov/population/projections/nation/summary/np-t1.pdf. (Feb. 14, 2000)

immigration. As a result, we see that the difference between the middle series variant and the zero immigration variant is about 76 million people by 2050 and more than 193 million by 2100. No matter how we view it, the United States will have a much larger population in the future if current high rates of immigration are sustained, which seems likely. Tables 1–3 and 1–4 show how different age and race groups will be affected by population change.

In summary, selecting an appropriate growth rate for projecting a population requires numerous considerations. We must look not only at past trends and current patterns, but also try to look at ways in which these trends may be altered in the future. Our projections can be no better than the assumptions upon which they are based. In addition, studying projections forces us to confront different scenarios about the consequences of different growth patterns and the possibility of designing policies to affect those patterns (Lee, 2000).

Small Area Population Projections

Though national population projections are of considerable importance, they are not the only ones that are of interest. Political units, from states to counties and cities, need to know something about their demographic futures, as do local school districts, highway

Table 1–3 Projected Population of the United States, by Age and Sex: 2000 to 2050 (In thousands except as indicated. As of July 1. Resident population.)

Population or percent, sex, and age	2000	2010	2020	2030	2040	2050
Population Total						
Total	282,125	308,936	335,805	363,584	391,946	419,854
0–4	19,218	21,426	22,932	24,272	26,299	28,080
5–19	61,331	61,810	65,955	70,832	75,326	81,067
20–44	104,075	104,444	108,632	114,747	121,659	130,897
45–64	62,440	81,012	83,653	82,280	88,611	93,104
65–84	30,794	34,120	47,363	61,850	64,640	65,844
85+	4,267	6,123	7,269	9,603	15,409	20,861
Male						
Total	138,411	151,815	165,093	178,563	192,405	206,477
0–4	9,831	10,947	11,716	12,399	13,437	14,348
5–19	31,454	31,622	33,704	36,199	38,496	41,435
20–44	52,294	52,732	54,966	58,000	61,450	66,152
45–64	30,381	39,502	40,966	40,622	43,961	46,214
65–84	13,212	15,069	21,337	28,003	29,488	30,579
85+	1,240	1,942	2,403	3,340	5,573	7,749
Female						
Total	143,713	157,121	170,711	185,022	199,540	213,377
0–4	9,387	10,479	11,216	11,873	12,863	13,732
5–19	29,877	30,187	32,251	34,633	36,831	39,632
20–44	51,781	51,711	53,666	56,747	60,209	64,745
45–64	32,059	41,510	42,687	41,658	44,650	46,891
65–84	17,582	19,051	26,026	33,848	35,152	35,265
85+	3,028	4,182	4,866	6,263	9,836	13,112
Percent of Total						
Total						
Total	100.0	100.0	100.0	100.0	100.0	100.0
0–4	6.8	6.9	6.8	6.7	6.7	6.7
5–19	21.7	20.0	19.6	19.5	19.2	19.3
20–44	36.9	33.8	32.3	31.6	31.0	31.2
45–64	22.1	26.2	24.9	22.6	22.6	22.2
65–84	10.9	11.0	14.1	17.0	16.5	15.7
85+	1.5	2.0	2.2	2.6	3.9	5.0

Male						
Total	100.0	100.0	100.0	100.0	100.0	100.0
0–4	7.1	7.2	7.1	6.9	7.0	6.9
5–19	22.7	20.8	20.4	20.3	20.0	20.1
20–44	37.8	34.7	33.3	32.5	31.9	32.0
45–64	21.9	26.0	24.8	22.7	22.8	22.4
65–84	9.5	9.9	12.9	15.7	15.3	14.8
85+	0.9	1.3	1.5	1.9	2.9	3.8
Female						
Total	100.0	100.0	100.0	100.0	100.0	100.0
0–4	6.5	6.7	6.6	6.4	6.4	6.4
5–19	20.8	19.2	18.9	18.7	18.5	18.6
20–44	36.0	32.9	31.4	30.7	30.2	30.3
45–64	22.3	26.4	25.0	22.5	22.4	22.0
65–84	12.2	12.1	15.2	18.3	17.6	16.5
85+	2.1	2.7	2.9	3.4	4.9	6.1

Source: U.S. Census Bureau, 2004, "U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin," <http://www.census.gov/ipc/www/usinterimproj/>Internet Release Date: March 18, 2004.

Table 1–4 Projected Population of the United States, by Race and Hispanic Origin: 2000 to 2050 (In thousands except as indicated. As of July 1. Resident population.)

Population or percent and race or Hispanic origin	2000	2010	2020	2030	2040	2050
Population Total	**282,125**	**308,936**	**335,805**	**363,584**	**391,946**	**419,854**
White alone	228,548	244,995	260,629	275,731	289,690	302,626
Black alone	35,818	40,454	45,365	50,442	55,876	61,361
Asian alone	10,684	14,241	17,988	22,580	27,992	33,430
All other races 1/	7,075	9,246	11,822	14,831	18,388	22,437
Hispanic (of any race)	35,622	47,756	59,756	73,055	87,585	102,560
White alone, not Hispanic	195,729	201,112	205,936	209,176	210,331	210,283
Percent of Total						
Population Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
White alone	81.0	79.3	77.6	75.8	73.9	72.1
Black alone	12.7	13.1	13.5	13.9	14.3	14.6
Asian Alone	3.8	4.6	5.4	6.2	7.1	8.0
All other races 1/	2.5	3.0	3.5	4.1	4.7	5.3
Hispanic (of any race)	12.6	15.5	17.8	20.1	22.3	24.4
White alone, not Hispanic	69.4	65.1	61.3	57.5	53.7	50.1

1/ Includes American Indian and Alaska native alone, native Hawaiian and other Pacific islander alone, and two or more races.

Source: U.S. Census Bureau, 2004, "U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin," <http://www.census.gov/ipc/www/usinterimproj/> Internet Release Date: March 18, 2004.

> Small area population projections are more difficult to make because local variations in fertility, mortality, and migration may be much wider than those at the national scale.

planners, and urban and regional planning departments. In addition, numerous private corporations are interested in the changing demographics of local areas, so that they can better gauge local and regional changes in demand, marketing strategies, and even changing tastes and preferences. Thus the need for small area, that is, subnational, population projections exists and is growing.

At the same time, as you might expect, small area population projections are more difficult to make because local variations in fertility, mortality, and migration may be much wider than those at the national scale. Especially difficult to project are migration rates for local areas, because changes in an area's socioeconomic characteristics may quickly alter current migration patterns. For example, no one looking at the changes that had occurred in the Asian population in Long Beach, California, during the 1970s would have projected that that city and neighboring Lakewood would have a population of more than 20,000 Cambodians by 2000. At best, small area projections are a tricky business, and changing migration patterns are the major culprit.

The United States Bureau of the Census often publishes state population projections (Table 1–5 is one example). But even there the assumptions that must be made are difficult to choose. Consequently, different projections result primarily from different assumptions about migration patterns. However, the Bureau wisely chooses not to do population projections for areas smaller than states, leaving that task to state and local agencies and to private firms such as Donnelley Marketing Information Systems.

Culture, Population Growth, and Planning

The United Nations designated 1974 as World Population Year and in August of that year convened the World Population Conference in Bucharest, Romania. The purpose of that conference was to focus world attention on problems associated with population growth. At the time it was the largest international population meeting ever held and had representatives from 136 governments around the world.

Though most governments recognized the existence of population problems in their own countries, as well as throughout the world, there was much disagreement and debate about the reasons for the problems and the types of solutions that should be implemented. A number of countries participating in the conference felt that the reason for high birth rates was the lack of social and economic development, so that the emphasis should not be put on population and family planning programs but rather on development. One of the frequently heard slogans at Bucharest was "Take care of the people, and the population will take care of itself." A different position, however, was taken by a number of other countries, including the Western European nations, the United States, and Canada, which felt that reductions in population growth rates would make a substantial contribution to the process of economic development and that what was needed first was a decrease in population growth to induce development.

A more lucid explanation of this relationship between population-family planning and development was expressed by Nortman and Hoffstater (1975, 3):

> Whatever the stance on the political stage, the most ardent family planning advocates recognize that contraception "alone" will not produce housing, schools, or steel mills; and among the staunchest supporters of the "new economic order," many appreciate the demographic value of legitimated and government-subsidized family planning services.

At least three different positions on the population problem can be identified. One position is that population growth is a crisis issue and the problem is so grave that catastrophe is near unless dramatic actions are followed in order to reduce the growth. A second position is held by those who feel that population growth will intensify and multiply other

Table 1–5 Population Projections for Colorado, 2000–2020

	Census 2000				Projection 2020				2000–2020 Change	
	Number			Percent	Number			Percent	Total	
Age Group	Total	Male	Female	Total	Total	Male	Female	Total	Number	Percent
Total	4,301,261	2,165,983	2,135,278	100.0	5,278,867	2,673,752	2,605,115	100.0	977,606	22.7
0–4	297,505	152,353	145,152	6.9	387,617	198,926	188,691	7.3	90,112	30.3
5–9	308,428	158,119	150,309	7.2	374,214	192,310	181,904	7.1	65,786	21.3
10–14	311,497	160,118	151,379	7.2	354,829	182,246	172,583	6.7	43,332	13.9
15–19	307,238	159,971	147,267	7.1	356,206	185,673	170,533	6.7	48,968	15.9
20–24	306,238	162,619	143,619	7.1	348,671	183,260	165,411	6.6	42,433	13.9
25–29	331,795	175,593	156,202	7.7	366,054	191,208	174,846	6.9	34,259	10.3
30–34	332,232	172,898	159,334	7.7	375,798	195,906	179,892	7.1	43,566	13.1
35–39	366,092	185,712	180,380	8.5	362,533	187,561	174,972	6.9	-3,559	-1.0
40–44	370,731	186,634	184,097	8.6	337,217	175,414	161,803	6.4	-33,514	-9.0
45–49	334,855	167,899	166,956	7.8	332,145	172,597	159,548	6.3	-2,710	-0.8
50–54	279,270	140,452	138,818	6.5	314,505	161,697	152,808	6.0	35,235	12.6
55–59	194,722	96,345	98,377	4.5	317,178	160,418	156,760	6.0	122,456	62.9
60–64	144,585	70,739	73,846	3.4	300,997	149,732	151,265	5.7	156,412	108.2
65–69	121,222	57,663	63,559	2.8	253,427	123,143	130,284	4.8	132,205	109.1
70–74	105,088	47,250	57,838	2.4	197,011	93,439	103,572	3.7	91,923	87.5
75–79	85,922	36,043	49,879	2.0	124,550	55,128	69,422	2.4	38,628	45.0
80–84	55,625	21,422	34,203	1.3	81,141	33,357	47,784	1.5	25,516	45.9
85+	48,216	14,153	34,063	1.1	94,774	31,737	63,037	1.8	46,558	96.6
Under 18	1,100,795	565,710	535,085	25.6	1,327,467	682,912	644,555	25.1	226,672	20.6
5–17	803,290	413,357	389,933	18.7	939,850	483,986	455,864	17.8	136,560	17.0
18–24	430,111	227,470	202,641	10.0	494,070	259,503	234,567	9.4	63,959	14.9
25–44	1,400,850	720,837	680,013	32.6	1,441,602	750,089	691,513	27.3	40,752	2.9
45–64	953,432	475,435	477,997	22.2	1,264,825	644,444	620,381	24.0	311,393	32.7
65+	416,073	176,531	239,542	9.7	750,903	336,804	414,099	14.2	334,830	80.5

(*Continued*)

Demographic Indicator	2000	2020	Change
Median Age	34.3	36.0	1.7
Male	33.2	35.2	2.0
Female	35.4	36.9	1.5
Dependency Ratio (1)	61.7	72.8	11.1
Youth (2)	46.0	48.2	2.2
Old Age (3)	15.6	24.6	8.9

Demographic Indicator	2000	2020	Change
Child-Woman Ratio (4)	30.6	37.7	7.1
Sex Ratio (5)	101.4	102.6	1.2
Under 18	105.7	106.0	0.2
18–64	104.6	107.0	2.3
65–84	79.0	86.9	7.9
85+	41.5	50.3	8.8

(1) Dependency Ratio = (Age under 20 + Age 65 and over) / (Age 20–64) × 100

(2) Youth dependency ratio = Age under 20 / Age 20–64 × 100

(3) Old age dependency ratio = Age 65 and over / Age 20–64 × 100

(4) Child-Women ratio = Age under 5 / Female 15–44 × 100

(5) Sex Ratio = Male / Female × 100

Source: U.S. Census Bureau, Population Division, Interim State Population Projections, 2005 Internet Release Date: April 21, 2005 social problems, but that although population is important, it is not everything. A third position is held by those who feel that population is a nonproblem, or even a false problem, with the real problem being development or redistribution of income and power. A small but growing concern among demographers and others is with population decline, which has already begun in many European nations and a few others as well. An unexpected consequence of modernization has been the decline of birth rates to below replacement level. In summary, the very nature of the population problem and the consequences of population growth are under closer scrutiny and examination today than at any time in the past (Hardin, 1999).

The Laissez-Faire Point of View

The general argument stated by those in favor of some form of population control is that individual fertility decisions do not add up to what is socially optimal, or even desirable, hence such decisions cannot be left to individual families. Thus, parents intending to have children may impose a significant part of the cost and responsibility for those children on people other than themselves. These parents are therefore likely to have "too many" children.

On the other hand, however, there are those in favor of a laissez-faire solution. They feel that it is a question of individual choice, because it is the individual who bears the cost and receives the benefits of his own action. In general, the laissez-faire argument regarding population control is essentially the same as the laissez-faire argument in economics. Under proper functioning of the free market, without controls, the prices, both monetary and nonmonetary, that people pay for things reflect the real cost of production; and the prices that they receive reflect the real value of what they produce. Thus, when an individual makes an economic decision he or she bears all the costs and receives all the benefits. If the costs are less than the benefits, a positive decision is made; if the costs are greater than the benefits, a negative decision is made.

Laissez-faire population exponents feel that those best able to determine the costs and benefits of children are those who are contemplating having them. They are the ones who must assume the financial and social responsibility for that child and they are the ones who will benefit from that child. There are some, however, who believe that the costs and benefits for the family are not the same as the costs and benefits derived by the society for each additional child. For the individual family the ideal number of children may be five or six, whereas the ideal family size for the society may be only two.

Laissez-faire population exponents feel that those best able to determine the costs and benefits of children are those who are contemplating having them.

The Question of Cultural Genocide

Somewhat akin to the laissez-faire population exponents are those who feel that population control is a device proposed by more economically developed countries to control the less economically developed countries. Since the former group of countries is primarily the white non-poor nations and the latter group is the non-white poor nations, many believe that population control is a form of "genocide."

"**Genocide**" is a controversial concept with manifold emotional overtones. The United Nations Genocide Convention defined genocide as any of the following acts committed with intent to destroy, in whole, or in part, a national, ethnic, racial, or religious group:

Genocide is the deliberate and systematic destruction of an ethnic, racial, religious, or national group.

- killing members of the group;
- causing serious bodily or mental harm to members of the group;
- deliberately inflicting on the group conditions to bring about its physical destruction in whole or in part;
- imposing measures intended to *prevent births* within the group;
- forcibly transferring children of the group to another group.

The above definition was adopted unanimously by the General Assembly of the United Nations. According to the definition, mass sterilization of a compulsory nature would be considered genocide. Item (D) of the definition, "imposing measures intended to prevent births within the group," is either directly or indirectly related to the family planning programs espoused by the United States and other more developed countries. The important question thus becomes: Do family planning programs, as espoused by predominantly white, wealthy nations represent conscious, deliberate efforts to curtail nonwhite fertility, or do they reflect a genuine concern for the well-being and health of the rest of the world?

In an analysis of population control Darden concluded that, in his opinion:

> The poor and nonwhite should oppose any program which involves institutional limitation of population growth. Why? Because there is no guarantee that relative poverty would decline if the poor and nonwhites accepted such a fertility program. There might be fewer poor people in absolute numbers, but the gap between rich and poor would either get wider or remain constant. . . . In brief, institutionalized, coercive limitation of population growth is a policy aimed directly or indirectly at the poor and nonwhite and is therefore unacceptable as a solution to the problems of hunger, and other social ills in the United States and the world (Darden, 1975, 51).

Genocide is not just a thing of the past, no matter how much human rights are trampled in its path. In 2004 the United States officially recognized genocide in the Darfur region of the Sudan, even as it did little to stop it. Though humanitarian aid was sent to the region, the killing continues. We are constantly reminded of "man's inhumanity to man."

The Ethics of Population Control

As previously mentioned, there are those who believe that any form of coercive population control is unethical. However, a significant number of people feel that in order to solve the population problem and limit population growth it will be necessary to induce people to limit the size of their families. They feel that the hazards of excessive population growth pose such critical dangers to the future of the species, the ecosystem, individual liberty and welfare, and the structure of social life, that there must be a reexamination and ultimately a revision of the traditional value assigned to unlimited procreation and to the increase in population size.

Callahan (1971, 2) outlined some general ethical guidelines for governmental action and presented them in a "rank order of preferences" from the most preferable to the least preferable. They are listed here and are still very much worth thinking about. The government has an obligation to do everything in its power to protect, enhance, and implement freedom of choice in family planning. This means the first requirement is to establish effective voluntary family planning programs.

If it turns out that voluntary family planning programs do not curb excessive population growth, then the government has the right to go "beyond family planning." Callahan felt, however, that before governments take this second step they must justify the introduction of these new programs by showing that voluntary methods have been adequately and fairly tried. Callahan believed that the voluntary programs had not yet failed because they had not been tried in any massive and systematic way.

When the government has to choose among possible programs which go "beyond family planning," it has an obligation to first try those programs which, comparatively, are the least coercive. In other words, positive incentive programs and manipulation of social structures should be resorted to before "negative" incentive programs and involuntary fertility controls are applied. According to Callahan, if it appears that some degree of coercion is required, that policy or program should be chosen which:

- entails the least amount of coercion;
- limits the coercion to the fewest possible cases;
- is not problem-specific;
- allows the most room for dissent of conscience;
- limits the coercion to the narrowest possible range of human rights;
- least threatens human dignity;
- least establishes precedents for other forms of coercion;
- is most quickly reversible if conditions change.

In summary, the ethical considerations associated with population control are complex. Population policies, though they must take into account the interests and needs of particular regions and population groups, should have as their ultimate aim the best interests of the entire human species. Any plan to reduce world population growth to (some would argue even below) zero will have to carefully consider at least the following: economic development (including variations on the "Western model") and its role in reducing family size, the empowerment of women and gender equity, and the extension of family planning services to provide safe and efficient means of preventing unwanted births.

Population Dynamics and the World of Business

Demographic considerations and their spatial or geographic components play an important role in today's business world. Understanding these issues is of vital importance to business executives, who are increasingly turning to demographic experts for answers to a variety of problems. As one writer noted, business executives need to ". . . understand population changes and their impact on basic corporate decisions such as labor supply, location of facilities, the changing nature of markets, and the age makeup of consumer groups" (Hyatt, 1979, 1). *American Demographics* a now discontinued magazine presented succinct looks at the relationship between demographic trends and everything from where to market products to where to retire. Some of the material from *American Demographics* has since been incorporated into another publication called *Advertising Age.*

Marketing

Marketing relies heavily on demographic statistics and their spatial or geographic aspects. Market segmentation and differentiation now play a key role in marketing strategies. According to Francese and Renaghan (1991, 50), ". . . many markets have become too complicated and too unforgiving to rely on just one or two demographic variables." A variety of variables such as race, ethnicity, income, education, and age, have a symbiotic relationship and together form the basis of "database marketing." In order for marketers to succeed in the future they will have to understand the multi-dimensional demographic profiles of their market segment; in the United States multiculturalism itself is becoming a concern for marketing specialists, with growing Latino and Asian populations appealing to many product manufacturers and distributors. Additionally, the aging baby boom is a market segment that will be important in marketing.

The formation of households is an important variable to consider by planners for such utilities as gas, electric, and telephone; population gains and losses certainly shape the demand for power. Changing fertility rates and divorce rates, as well as the increase in the number of late marriages, have a tremendous impact on household formation and thus are important variables when predicting consumer demand for utilities.

African American buying power is expected to reach 1.1 trillion dollars by 2015. Latino buying power was 1 trillion dollars and Asian buying power was 540 billion dollars in 2010 (Humphreys, 2010). The gay market is by and large an affluent one. Average annual income for a gay household was $61,000 compared to $51,914 for the general US population. Gay buying power in the US was projected in 2010 to be 743 billion dollars (Witeck-Combs et al., 2010). Women influence 85% of all consumer purchases and account for 7 trillion dollars in spending. African immigrants are estimated to have 50 billion dollars in buying power (New American Dimensions, 2009). Race and ethnic groups as well as many gay communities reside in geographically distinct regions and locations of the US. This fact has obvious implications for the importance of the geographical analysis of markets.

Business Forecasting

Business people are always interested in the future. They are concerned about next week's sales, next year's profits, future changes in interest rates, and five-year capital investment schemes. Their natural tendency, however, has been to focus on the next fiscal quarter, instead of the next quarter-century. Short-term symptoms always seem to overshadow long-run causes. Worries about short-term problems tend to obscure the longer run, but, equally important, they obscure changes in population variables. For example, a home builder is usually concerned with changes in interest rates, but a shift in the divorce rate or a shift in migration patterns could be equally as important to that industry. Builders have only recently begun to appreciate the impact of the "**Baby Boom**," and the boomers have yet to have their impact on Medicare and Social Security, though it is now beginning.

Baby boom is the period following World War II from 1946–1964 characterized by a rapid increase in fertility rates and in the absolute number of births in the U.S., Canada, Australia, and New Zealand.

The impact of population change on business forecasting has recently taken on added importance. In a study on changing demographics and the future of business, James Hyatt observed that ". . . while only a few years ago the attention was on worldwide population growth rates, analysts are beginning to understand that for the United States a much more complex set of population shifts are at work. Fast, slow, and no growth are all occurring at the same time in different parts of the country" (Hyatt, 1979, 5). This important geographic dimension of population change is now receiving more attention from business forecasters.

Many of the present and future problems and opportunities to be faced by business have their roots in the most striking demographic phenomena of twentieth-century America: the unique high fertility period that followed the Second World War, the so-called "baby boom." During the baby boom period, between 1946 and 1964, there were nearly 80 million births in the United States, 50 percent more than during the preceding fifteen years. The baby boom or "bulge" has far-reaching effects in housing, employment, retail sales, education, and many other areas of concern to the business community. According to Hyatt (1979, 5), "Business managers would be well advised to keep in mind the location of that bulge from year to year, just as they pay attention to other economic indicators."

During the baby boom period, between 1946 and 1964, there were nearly 80 million births in the United States, 50 percent more than during the preceding fifteen years.

The first baby boomers began to turn 60 in 2006, and as Waldrop (1991, 24) suggested earlier, "It will begin a population explosion among affluent, maturing householders. And it will turn the 1990s into peak years for consumer spending." These baby boomers entering midlife brought about changes in a variety of business services. For example, the 1990s saw a rise in consumer demand for bifocal eyeglasses as those midlife boomers underwent inevitable changes due to the aging process. Visual and hearing impairments increase significantly after age forty-five. Increasing attention was paid to health concerns and boomers, in order to stay fit, had to be more selective about food choices. Talk of ice cream and Twinkies gradually gave way to conversations about cholesterol, monounsaturated fats, and triglycerides. This brought about a rise in consumption of food items like fish, poultry, low-fat milk, whole grain cereals and fresh fruits and vegetables. The boomers are also relatively affluent, and in recent years they have been pouring money into mutual funds and other investments, a major factor in the strong stock market performance during the 1990s, despite an economy that was struggling for the most part.

Although much of the attention of the business community has been focused on the young, there has been an increasing awareness of the aged and the aging of America (Soldo and Agree, 1988). Indeed, adults over age 65 now outnumber teenagers and have become one of the fastest-growing population groups in the country. In 1900 only 3.1 million people in the United States were 65 years of age and older, but by 1985 that figure reached 28.5 million and projections for the year 2030 are that there will be 64.6 million. In 1985, one in nine Americans or 11.7 percent of the population was at least 65 years old, but by 2010, because of the maturation of the baby boomers, one in seven Americans will be at least 65 years old (Hooyman and Kiyak, 1988, 22).

As baby boomers become "senior" boomers, ". . . public policy questions how we will support the needs of a growing older population and how we will structure policies to assure a fair and equitable distribution of resources for all age groups" will have to be assured (Bouvier and DeVita, 1991, 27). Government bureaucracies, charged with planning the provision of services for the elderly, will be faced with a variety of decisions with both political and social consequences (Laws, 1991, 32). Some of these problems will be further complicated by the changing ethnic and racial composition of the United States.

Not only will there be more older Americans, but because of their relatively high disposable incomes, they will present a growing market for the business community. England (1987, 8) points out that "Americans over age 65 are the second-richest age group in U.S. society. Only those Americans in the next-oldest age bracket, from 55 to 64, are better off." The aged have assets nearly twice that of the median for the nation. "The spending power of the mature market may be one of the best-kept secrets left in the age of demographic scrutiny," suggests Lazer (1985, 23).

Zero Population Growth and Business

To most entrepreneurs "growth" is a magic elixir; they are naturally attracted to growth, they love growth—be it in profits, sales, or incomes. Investors usually look for firms with solid growth records. Also, to most business managers a growing gross national product (GNP) means a stronger economy with more consumer spending, more employment, and more sales and services. There is, therefore, understandable trepidation among those with businesses when they contemplate the prospects of a slowing, or even cessation, of population growth. They fear reduced demand, which in turn means less profit, smaller dividends, more unemployment, and general economic uncertainty (even though effective demand depends not just on numbers but also on affluence, the ability to pay).

The impact of population growth on the economy of the United States is assumed to be positive because it has continued for so long. Economic theorists have, however, found it difficult to find a direct correlation between population growth and economic well-being in highly industrialized nations. During parts of the nineteenth century population growth was high, yet per capita income growth was modest. On the other hand, in the twentieth century population growth slowed down while the GNP remained high. Among the three economic superpowers—Japan, the United States, and the European Union—only the United States has a significant rate of population growth, and a lack of growth does not seem to have diminished the affluence of its competitors. Nonetheless, concern remains about the connection between economic growth and prosperity, especially as fertility continues to decline and populations grow older. In support of this concern Longman (2004, 41) noted, ". . . for better or for worse, population growth is still the prime driver of economic growth. Increase in population causes new houses to be built, new cars to be manufactured, and new law offices to be built."

After following similar demographic paths for many decades, trends in Western Europe and the United States began to diverge around 1980. Up until then fertility had been getting lower in each region, but after 1980 fertility declines continued in Western Europe whereas fertility began a gradual upward trend in the United States. The increase in American fertility was a result of both more births among native-born citizens and more immigration. Many immigrants have come from higher fertility societies, and their fertility in the United States has continued at a higher level than for the American-born population. This has been especially noticeable for the Latino population and for some Southeastern Asian groups as well. One result of the fertility divergence between Western Europe and the United States is its effect on the age distributions of the two populations; by 2050 the average age in the former is predicted to be around 53 and for the latter around 36. In turn, then, Western Europe's aging population will be more of a burden, whereas America's younger population is likely to be more innovative.

Labor Force

The composition and quality of the labor force are important variables for personnel managers to consider. During the next few decades the nature of the labor force will be considerably different from what it has been in the past. There will be more workers and they will need to be better educated. There will be more minorities in the labor force as well as more females, mothers of young children, and older workers over age 55. Many of these changes in the United States will be direct results of the baby boom.

> Among the most important demographic variables in determining the size of the work force is the age structure of the population.

The supply of workers available for businesses will be the result of two separate trends in the labor force. First is the size of the working age population, and second is the labor force participation rate. Among the most important demographic variables in determining the size of the work force is the age structure of the population. The bulge in the young working force cohort is now progressing through the population, so the number of young people entering the work force will be declining, though earlier projections are going to be off because of rising immigration and higher fertility in places such as California.

At the other end of the work force age spectrum, among those over 55 years of age, important changes will take place. Changing attitudes about retirement could have far-reaching impacts on the corporate world. Can business easily absorb those older workers who decide to continue their careers? Will companies find it harder to promote young workers if retirement ages advance? Will older workers continue to be productive? These are all important questions to personnel managers and are underlain by demographic changes in society. During the 1990s corporate downsizing resulted in the elimination of many jobs held by these workers, leaving them floundering to compete for lower-paying jobs with few or no benefits.

> Illegal immigration alone has become a critical issue among average Americans, yet politicians and corporate executives do their best to ignore it.

Labor migration in the future promises to be at least as important as population growth, and it will affect the populations of numerous sending and receiving nations. As Wallerstein (1999, 17) observed, "We shall nonetheless see a rise in the real rate of migration, legal and illegal—in part because the cost of real barriers is too high, in part because of the extensive collusion of employers who wish to utilize such migrant labor." Illegal immigration alone has become a critical issue among average Americans, yet politicians and corporate executives do their best to ignore it. As Bartlett and Steele (2004, 58) discovered, "For corporate America, employing illegal aliens at wages so low few citizens could afford to take the jobs is great for profits and stockholders . . . companies are rarely, if ever, punished for it." This issue can only attract more attention in the years to come.

In 2010 there were an estimated 10.8 million undocumented immigrants living in the United States (Hoefer, Rytina and Baker, 2011). Even though it is illegal to hire an undocumented immigrant, most of these millions are working in the US. It is jobs that attract them. Congress, never quick to solve real problems, is struggling to create new legislation that would deal with the problems of undocumented immigration, but at the time we are writing this it doesn't look promising. From building walls to seal off our southern border to giving amnesty to all who have entered undocumented, opinions and emotions run the gamut. There is much sound and fury, but so far little light.

The Education Roller Coaster

The nation's education system, perhaps more than any other social institution, has been greatly affected by fertility variations. The impact of the postwar baby boom children on the schools was dramatic, costly, and painful. In the late 1950s and 1960s school enrollments soared. The elementary-school-age population (5–13 years) grew from 23 million in 1950 to 37 million in 1970, for example. Secondary schools faced similar problems by the early 1960s, and the high school population doubled in size between 1950 and 1975 (Bouvier, 1980, 21). High school enrollments rose 14 percent in 1957 alone, and a critical shortage in classrooms was evident. Administrators projected a need for an additional 750,000 teachers in three years. This demand caused a rapid increase in school budgets.

Changing Enrollment Trends

School planners were totally unprepared for this rapid increase in enrollments. By the time colleges had geared up to graduate enough teachers and massive building programs had produced enough elementary and secondary classrooms, the crest of the baby boom wave was about to leave the K-12 school ages.

The mid-1960s saw enrollments in colleges and universities skyrocket. This increase was a result of both the sheer numbers of baby boomers and the increased proportion of young people going to college. In the 1950s only about 10 percent of those between ages 25–29 had completed at least four years of college. That proportion increased to 16 percent by 1970 and 23 percent by 1980. Between 1957 and 1975 college enrollments increased from 3 million to 11 million, creating a growth industry of its own. The baby boom generation thus became the most highly educated generation in American history (Bouvier and DeVita, 1991, 14).

The major change in school enrollment in the 1970s and 1980s has been a significant increase in nursery and preschool attendance. The percentage enrolled in nursery schools, pre-kindergarten or kindergarten programs, or child-care centers with an "educational" curriculum, increased from 11 percent in 1965 to 38 percent in 1988 (Bianchi, 1990, 30). In 2005 that percent increased to 74.

Another school turnaround occurred. After years of stable or declining enrollments, the school-age population was projected to increase by about 8 percent during the decade of the 1990s. This increase was the result of the baby boom's children filling the elementary and secondary schools across the country (Bouvier and De Vita, 1991, 15); it was also very different from one region to another.

Geography Variations

In order to understand these educational trends and their demographic causes, it is necessary to look beyond national statistics and to understand regional or more local circumstances. The geographic distribution of the population, as well as spatial differences in vital rates, presents a complicated picture. For example, the decline in births was not uniform across the United States in the 1960s and early 1970s. In some areas the peak in births was attained in 1957, whereas in other areas it was not reached until 1960 (Reinhardt, 1979, 10). Also, the decline in births within states was not uniform, and there were significant differences between metropolitan and nonmetropolitan areas.

These geographic differences, as well as other changes in population distribution, mean that some areas have had dramatic declines in the school-age population, whereas others have still been growing. Many rural areas and urban regions losing population have experienced dramatic declines, but many newly developing suburbs have enrollment increases, as do some inner-city areas. Nursery school attendance is more common in the Northeast than other U.S. regions, and among children who live outside the central cities of metropolitan areas (Bianchi, 1990, 30).

Migration has also had a significant impact on school-age populations. Increases can be seen throughout much of the Sunbelt and the West, with declines in the Midwest and the Northeast. An analysis of college-age students also points out significant spatial differences, with many Sunbelt and Western states being net importers of college students. Changes in demographic factors can have a significant impact on school planning policy decisions and should be incorporated into the decision-making process at all levels.