

## EXECUTIVE SUMMARY

The Population Division of the United Nations has prepared new long-range projections for the world population and eight major world areas for the period 1995-2150. These projections extend the results published in *World Population Prospects: The 1998 Revision*, Volumes I, II and III (United Nations, 1999a, 1999b and 2000) which cover the period 1995-2050. The long-range projections present detailed results for the following major areas: Africa; Asia excluding China and India; Europe; Latin America and the Caribbean; Northern America; Oceania; and for China and India, the only countries considered separately.

The long-range projections include a number of scenarios for the possible future growth of the world population. The three key scenarios are (a) the medium scenario which assumes that fertility in all major areas will stabilize at replacement level (at slightly over 2 children per woman) by 2050 or after; (b) the low scenario which assumes that in all major areas fertility will be lower than the fertility in the medium scenario by about half a child; and (c) the high scenario which assumes that fertility will be higher than in the medium scenario by about half a child. Also considered for illustrative purposes are (d) a constant scenario where fertility is maintained constant over the period 1995-2150 at the level it had in each major area as of 1990-1995; and (e) an instant-replacement scenario in which fertility in each major area is assumed to drop instantly to replacement level in 1995 and remain at that level during 1995-2150. In all these scenarios mortality is assumed to decline steadily during the projection period but, for some scenarios, a variation that incorporates constant mortality over the period 2050-2150 at the level attained in 2050 is also considered for purposes of comparison.

Normally, long-range projections are produced every five years. However, the changes introduced in the *1998 Revision of World Population Prospects* (United Nations, 1999a, 1999b and

2000) have made an early revision of these projections necessary. In recent years a major reassessment of the prospects for fertility decline has taken place. By 1995 only 17 countries in the developing world, with less than 4 per cent of the world population, showed no signs of a fertility reduction. In many of the countries where fertility reductions had begun, the decline was rapid. Furthermore, in countries that were already far advanced in the transition from high to low fertility, fertility did not necessarily stabilize at replacement level. Thus, the number of countries with below-replacement fertility is large and increasing. By 1995, 44 per cent of the world population lived in countries where fertility was at or below replacement level (2.1 children per woman). Forty-nine countries, including China, were in that group, and many of those countries had been experiencing below-replacement fertility for at least a decade or two. In 10 countries, fertility reached levels below 1.5 children per woman and more recent data confirmed that low fertility had persisted. These developments justified the assumption that fertility would remain below replacement level during most of the 1995-2050 period in countries with below-replacement fertility today. The *1998 Revision* incorporated such an assumption in the medium projection, whereas the *1996 Revision* assumed a return to replacement-level fertility in all countries. Such differing assumptions have important implications for the long-term future: whereas the medium scenario of the preceding long-range projections, consistent with the *1996 Revision*, yielded a world population of 10.8 billion in 2150, the medium scenario of the present projections, consistent with the *1998 Revision*, produced a population of 9.7 billion, 1.1 billion lower.

### THE EFFECT OF FERTILITY ON POPULATION SIZE AND GROWTH

The present set of long-range projections permits an assessment of the long-term impact of

different fertility trends. The medium scenario, with a fertility that eventually stabilizes at replacement level (2.05-2.09 children per women), leads to zero population growth in the long run. In contrast, the high scenario produces an ever increasing population because its fertility stabilizes at 2.5-2.6 children per woman, and the low scenario leads to a decreasing population since its fertility stabilizes at 1.5-1.6 children per woman, about half a child below replacement level.

The three scenarios result therefore in projections of very different sizes for the world population. By 2150, the population of the world will be 24.8 billion according to the high scenario, 9.7 billion according to the medium scenario and 3.2 billion according to the low scenario. The low and high scenarios illustrate how deviations of about half a child from replacement level, if sustained over the long run, can produce large deviations from the path of the medium scenario which leads to an unchanging population size. Owing to the nature of exponential growth, the deviations expand over time (see table 1 and figure 1). Thus, the differences between the high and low scenarios with respect to the medium scenario are moderate in 2050 (at less than 2 billion each), but in 2150 they amount to 15 billion and 6 billion respectively. Aside from reflecting the uncertainty surrounding the projection of population size over the long-term future, these deviations underscore the importance of attaining replacement-level fertility as soon as possible and sustaining levels very close to it over long periods. Even a deviation of about 0.2-0.3 children per women above the fertility of the medium scenario, if sustained until 2150, would result in a population of 16.2 billion persons instead of the 9.7 yielded by the medium scenario.

Future fertility trends also affect the rate at which population grows. Fertility has both a direct effect on population growth, by determining the number of births women have, and an indirect one, by determining the size of the different generations. In a population with fertility above replacement level, offspring outnumber their parents, sometimes by substantial amounts, and those offspring may in turn have more children than needed to replace the generations of their

own parents even when fertility levels are falling. That is, as fertility falls, the number of births to the relatively large generations of parents is higher for a time than the number of deaths in the population, which are mostly those of the grandparents and great-grandparents of the children in the population, even though fertility may have already reached replacement level. This effect is responsible for producing positive population growth even long after fertility reaches and remains at replacement level. Partly because of this process, the illustrative instant-replacement scenario produces positive growth rates during the whole 1995-2150 period (see table 1). However, after 2070, the rate of population growth in that scenario is very low (below 0.15 per cent per year). Interestingly, the medium scenario produces even lower growth rates after 2070 (see table 1). The fact that fertility in the medium scenario remains below replacement level for the populations of China, Europe and Northern America at least until 2050 and then rises slowly to replacement level is responsible for this difference and contributes to producing a world population in 2150 for the medium scenario that is fairly close to that produced by the instant-replacement scenario (9.7 billion versus 9.3 billion).

In comparison to the medium scenario, where in 2150 the population has a growth rate nearing zero, that of the low scenario will be declining at about 0.9 per cent per year and that of the high scenario will be growing at about the same rate (see table 1). Were those rates of decline and increase to be sustained after 2150, the population of the low scenario would be cut in half every 77 years and that of the high scenario would double every 77 years. This observation suggests that both the low and the high scenarios embody patterns of decline and growth that are unsustainable over the very long run. For that reason, scenarios based on smaller fertility deviations from replacement level have also been prepared. In the low-medium and high-medium scenarios fertility remains within a band of 0.2 children below or 0.3 children above the level in the medium scenario. These intermediate scenarios result in more moderate rates of decline or growth in the long run and in lower reductions or increases of the world population (see

TABLE I. WORLD POPULATION ACCORDING TO VARIOUS PROJECTION SCENARIOS, 1995-2150

Year or period	Projection scenario						
	Instant-replacement	Low	Low-medium	Medium	High-medium	High	Constant
<i>Population (millions)</i>							
1995 .....	5 666	5 666	5 666	5 666	5 666	5 666	5 666
2000 .....	5 962	6 028	6 028	6 055	6 082	6 082	6 113
2025 .....	7 424	7 275	7 275	7 824	8 379	8 379	9 069
2050 .....	8 310	7 343	7 547	8 909	10 409	10 674	14 421
2075 .....	8 663	6 402	7 024	9 319	12 026	13 149	26 048
2100 .....	8 924	5 153	6 324	9 459	13 430	16 178	52 508
2125 .....	9 142	4 074	5 779	9 573	14 735	19 986	113 302
2150 .....	9 349	3 236	5 329	9 746	16 218	24 834	255 846
<i>Growth rates (per year)</i>							
1995-2000 .....	1.02	1.24	1.24	1.33	1.42	1.42	1.52
2020-2025 .....	0.71	0.50	0.50	0.84	1.17	1.17	1.65
2045-2050 .....	0.29	-0.23	-0.07	0.34	0.69	0.87	2.02
2070-2075 .....	0.13	-0.73	-0.39	0.11	0.51	0.83	2.57
2095-2100 .....	0.11	-0.92	-0.40	0.04	0.40	0.83	2.93
2120-2125 .....	0.09	-0.93	-0.34	0.06	0.37	0.86	3.16
2145-2150 .....	0.09	-0.92	-0.32	0.08	0.39	0.87	3.32

Source: Values for 1995-2050 for the low, medium, high and constant scenarios were obtained from *World Population Prospects: The 1998 Revision*, vol. I, *Comprehensive Tables* (United Nations, publication, Sales No. E.99.XIII.9). All other values are the result of the long-range projections.

NOTE: Values for 1995 are estimates rather than projections and are therefore the same for all scenarios. Projected numbers for the world are the sum of the projected numbers for the eight major world areas based on the assumptions for each scenario.

Figure 1. World population according to five projection scenarios, 1950-2150

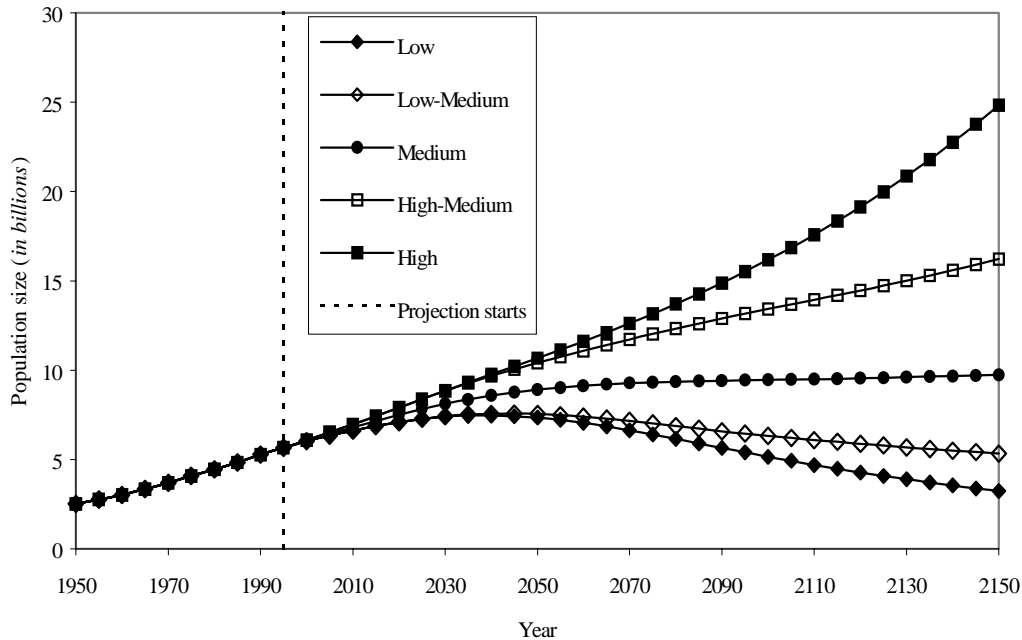


table 1 and figure 1). The path that fertility will actually follow in the future will very likely be bound by these scenarios if sustainability is to be maintained.

#### THE EFFECT OF MORTALITY ON POPULATION SIZE AND GROWTH

Population growth is also affected by changes in mortality. Under constant fertility conditions, reductions in the risks of dying contribute to increased population growth. When fertility is falling, the effects of declining mortality on population growth counterbalance those of declining fertility. The main long-range projection scenarios prepared by the Population Division assume that mortality declines steadily after 2050, albeit at a slow pace. Thus, the expectation of life at birth for women increases from 79 years in 2050 to 88 years in 2150. For men the increase is from 74 years to 83 years over the same period.

To explore the impact that the assumed changes in mortality would have on population growth, scenarios were prepared that incorporated constant mortality risks as of 2050. As expected, constant mortality reduces population growth in all scenarios and results in smaller populations in 2150. The largest impact in relative terms is on the declining population of the low scenario where constant mortality would cut population size in 2150 by 15 per cent, resulting in a population of 2.8 billion instead of the 3.2 billion that the low scenario yields. For the medium and high scenarios the reductions are of the order of 10 to 11 per cent. In 2150, constant mortality would produce populations of 8.6 billion and 22.4 billion instead of the medium and high scenario populations of 9.7 billion and 24.8 billion respectively.

#### THE CHANGING GEOGRAPHICAL DISTRIBUTION OF THE POPULATION

Today, the different major areas of the world are at different stages of the transition from high to low mortality and fertility. Consequently, their growth paths differ considerably over the projection period. According to all scenarios, Africa experiences the highest rates of population growth

and Europe experiences the lowest, followed by China and Northern America in increasing order. Different rates of growth result in a redistribution of the population by major area. In all projection scenarios the fastest growing area, Africa, increases its share of the world population, whereas Europe and China, which experience the lowest growth, see their shares reduced (see table 2). According to the medium scenario, the number of inhabitants in Africa increases from 697 million in 1995 to 2.3 billion in 2150, and their share of the world population doubles, expanding from 12 per cent to 24 per cent. For Europe, the population declines from 728 million in 1995 to 517 million in 2150 and its share of the world population falls from 13 per cent to 5 per cent. In the case of China, although the population increases from 1.2 billion to nearly 1.4 billion between 1995 and 2150, its share of the world population declines from 22 per cent to 14 per cent. Other areas experience less marked changes over the projection period.

As a result of these trends, the world of 2150 is likely to be one in which China and India together will account for about a third of the world population; the rest of Asia and Africa each will account for nearly a quarter of the world population; Latin America and the Caribbean will comprise nearly a tenth; and so will Europe and Northern America taken together. In terms of population size, by 2150 the most populous major area will continue to be Asia (even excluding China and India), but Africa will be the second most populous area, followed by India, China, and Latin America and the Caribbean (see figure 2).

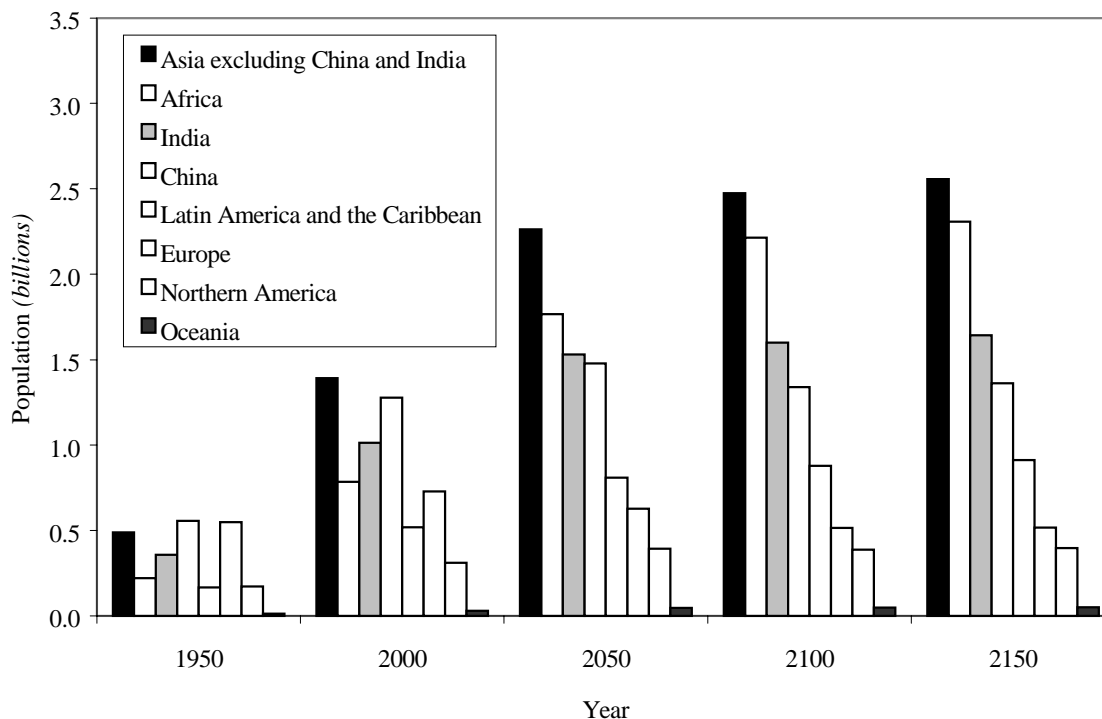
#### THE UNAVOIDABLE GREYING OF THE POPULATION

In a growing population, children outnumber their parents and younger age groups comprise rising proportions of the population. When fertility declines, the number of children starts to fall and, if fertility reductions are sustained, younger age groups account for a decreasing proportion of the population over time. The declining proportion of children is counterbalanced by a rising proportion of adults, at first concentrated largely in the middle age range and later impacting

TABLE 2. WORLD POPULATION BY MAJOR AREA, MEDIUM SCENARIO, 1995-2050

Year	Major area								
	Total	Africa	Europe	Latin America and the Caribbean	Northern America	Oceania	Asia excluding China and India	China	India
<i>Population (millions)</i>									
1995 .....	5 666	697	728	480	297	28	1 282	1 221	934
2000 .....	6 055	784	729	519	310	30	1 391	1 278	1 014
2025 .....	7 824	1 298	702	697	364	40	1 912	1 480	1 330
2050 .....	8 909	1 766	628	809	392	46	2 262	1 478	1 529
2075 .....	9 319	2 077	549	857	390	48	2 423	1 386	1 589
2100 .....	9 459	2 215	515	877	388	49	2 476	1 340	1 600
2125 .....	9 573	2 264	508	894	390	50	2 512	1 338	1 617
2150 .....	9 746	2 308	517	912	398	51	2 558	1 361	1 642
<i>Percentage</i>									
1995 .....	100	12	13	8	5	1	23	22	16
2000 .....	100	12	13	8	5	1	23	22	16
2025 .....	100	13	12	9	5	1	23	21	17
2050 .....	100	17	9	9	5	1	24	19	17
2075 .....	100	20	7	9	4	1	25	17	17
2100 .....	100	22	6	9	4	1	26	15	17
2125 .....	100	23	5	9	4	1	26	14	17
2150 .....	100	24	5	9	4	1	26	14	17

Figure 2. Population size of major world areas, medium scenario, 1950-2150



mostly the upper age range (see figure 3). Consequently, reductions in fertility result in population ageing, a process whereby the proportions of children and younger persons decline and those of middle-aged and older adults rise. Given that, with the exception of the constant scenario, all other scenarios assume a decline of fertility for most areas during the 1995-2050 period, they all result in a considerable ageing of the population.

Consideration of the changing numbers of persons in the different age groups will help to illustrate the extent of population ageing over the projection period. According to the medium scenario, the world population increases by 4 billion persons between 1995 and 2150, yet the number of children (0 to 14 years of age) declines slightly (from 1.8 billion in 1995 to 1.7 billion in 2150). Over the same period, the number of persons aged 15 to 59 years rises by 1.7 billion but that of persons aged 60 years or more increases by 2.4 billion. In terms of the distribution by age, these changes imply that the proportion of children declines from 31 per cent in 1995 to 18 per cent in 2150, whereas the proportion of persons aged 60

or over triples, passing from 10 per cent in 1995 to 30 per cent in 2150 (see table 3). The proportion of the population aged 15 to 59 changes moderately, dropping from 59 per cent in 1995 to 52 per cent in 2150, but the nature of the economically dependent population changes drastically. By 2150, instead of involving mostly children who depend on their parents for support, this portion of the population will include mostly elderly persons whose support may have to depend either directly or indirectly on younger generations unless the period of economically productive life is effectively extended and provisions are taken to ensure that sound mechanisms for the funding of old-age pensions are in place.

Lastly, another major change brought about by the long-term ageing of the population is a very marked increase in the number and proportion of the population of the very old (those aged 80 years or over). According to the medium scenario, by 2150 there will be nearly one billion persons in that age group, 15 times the number in 1995. As a proportion of the population, those aged 80 or over will also become prominent, comprising

**Figure 3. Percentage of world population by age group, medium scenario, 1950-2150**

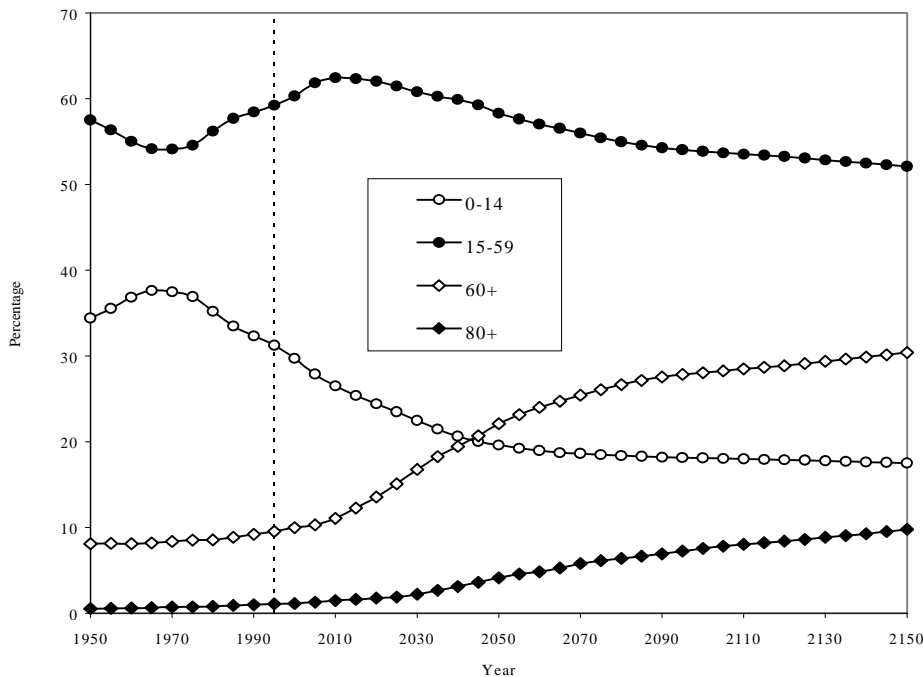


TABLE 3. AGE DISTRIBUTION OF THE WORLD POPULATION, MEDIUM SCENARIO,  
SELECTED AGE GROUPS, 1995-2150

<i>Year</i>	<i>Total</i>	<i>Age group</i>			
		<i>0-14</i>	<i>15-59</i>	<i>60+</i>	<i>80+</i>
<i>Population (millions)</i>					
1995.....	5 666	1 768	3 354	544	62
2000.....	6 055	1 800	3 650	605	70
2025.....	7 824	1 836	4 807	1 180	149
2050.....	8 909	1 747	5 193	1 970	370
2075.....	9 319	1 724	5 166	2 428	572
2100.....	9 459	1 713	5 092	2 654	717
2125.....	9 573	1 707	5 078	2 788	824
2150.....	9 746	1 706	5 075	2 964	956
<i>Percentage</i>					
1995.....	100	31	59	10	1
2000.....	100	30	60	10	1
2025.....	100	23	61	15	2
2050.....	100	20	58	22	4
2075.....	100	19	55	26	6
2100.....	100	18	54	28	8
2125.....	100	18	53	29	9
2150.....	100	18	52	30	10

10 per cent of the population in 2150 instead of 1 per cent as they do today. These changes suggest that the society of the future will have to value more the contributions of its older members so as to ensure that they remain active and engaged for most of their lengthy life spans. If the world population evolves as projected in the medium

scenario, society will have some time to adapt to the expected changes, especially as savings can be accrued because of the slow growth and eventual reduction in the number of children. However, in historical terms, the time available is short and successful adaptation requires that we embark early on the path of societal change.