

**Department of Economic and Social Affairs**  
Population Division

# **WORLD POPULATION TO 2300**



United Nations  
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## PREFACE

Every two years the United Nations Department of Economic and Social Affairs' Population Division prepares the official United Nations estimates and projections of world, regional and national population size and growth, and demographic indicators. The results from the most recent set of estimates and projections were published in *World Population Prospects: The 2002 Revision*, a three-volume set issued over the period 2003-2004. The estimates and projections in the *2002 Revision* cover the period 1950-2050.

The United Nations also prepares supplementary world population projections covering a much longer period, referred to as long-range projections. The United Nations previously published long-range projections on six occasions, each being consistent with the population projections of the following revisions of the *World Population Prospects*: 1968, 1978, 1980, 1990, 1996 and 1998. These publications presented long-range projections for the world and its major areas, and since the 1990 set of projections, the long-range time horizon was until 2150.

The Population Division has adopted two major innovations for this new set of long-range population projections based on the *2002 Revision*. For the first time, the long-range projections are made at the national level, that is, for each of the 228 units constituting the world. In addition, the time horizon for the projections is extended to 2300, so as to allow for the eventual stabilization of the population in at least one scenario. In order to address the technical and substantive challenges posed by the preparation of long-range projections at the national level, the Population Division convened two meetings of the Technical Working Group on Long-Range Population Projections at United Nations Headquarters in New York. The purpose of the meetings was to discuss the assumptions, methodology and preliminary results of the national population projections to 2300.

This volume presents the results of the long-range projections, *World Population to 2300*, and includes a detailed analysis. A series of essays on the issue of long-range projections have also been incorporated in this report, enriching the debate on this important topic. Experts from outside the United Nations, many of whom took part in the technical working group meetings, authored these essays.

The United Nations Population Division is grateful to the National Institute on Aging of the United States of America (NIA) whose grant help support this study. Acknowledgement is also due to Rodolfo A. Bulatao, who assisted the Population Division in the preparation of this report. The Population Division extends its appreciation to all the experts for their suggestions and contributions to the preparation of the long-range projections.

This publication, as well as other population information, may also be accessed on the Population Division world wide web site at [www.unpopulation.org](http://www.unpopulation.org). For further information about the long-range projections, please contact the office of Mr. Joseph Chamie, Director, Population Division, United Nations, New York, NY 10017, USA, tel: 212-963-3179 and fax: 212-963-2147.

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#### IV. COMPARING LONG-RANGE GLOBAL POPULATION PROJECTIONS WITH HISTORICAL EXPERIENCE

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In 2003, the Population Division of the United Nations released projections of the world's population from the year 2000 to the year 2300 (United Nations, 2004). The purpose of this note is to compare the projected ratios of population size over intervals of one, two and three centuries with the historically observed ratios of population sizes over intervals of one, two and three centuries during the last two millennia.

In addition to the global population projections, the Population Division projected many demographic details, such as age structure for every existing country for the next three centuries. This note does not attempt to examine these details. Such details could in principle be examined by analogs of the methods used here for the global population projections.

Table 1 shows the Population Division's projections according to five scenarios. This note analyzes the low, medium, high, and constant-fertility scenarios, and ignores the zero-growth scenario.

Table 2 shows 21 estimates of the world's population in years divisible by 100 (excepting year 1) for the last 2,000 years. The estimates for all years except years 100 and 300 came from the United States Census Bureau (2003). For each year in which the United States Census Bureau low estimate differed from the United States Census Bureau high estimate (all years except year 2000), a single estimate was obtained by taking the geometric mean of the low and high estimates. The geometric mean was used here because random variation in population sizes is typically log-normally distributed. The estimate for the year 100 is the geometric mean of the estimates for the years 1 and 200. The estimate for the year 300 is the geometric mean of the estimates for the years

200 and 400. The geometric mean was again used here because it gives the correct estimate at a midpoint in time if population growth is exponential between the earlier and the later date. Both uses of the geometric mean reflect the multiplicative mechanism of population variation and growth.

Table 2 also shows the ratio of the current population to the population one, two, or three centuries earlier. There are 20 ratios for population change over an interval of one century, 19 ratios for population change over two centuries, and 18 ratios for population change over three centuries. The frequency distributions of these historical ratios (approximated as histograms, minima and maxima in table 3) provide a background against which the anticipated future ratios (table 4) of the long-range population projections of the United Nations Population Division can be considered.

For the low scenario, all three projected 100-year ratios, namely 0.90, 0.58 and 0.73, are lower than the smallest 100-year ratio observed in the last 2,000 years. The last two of the three 200-year ratios and the last one of the three 300-year ratios are also lower than the smallest of the observed 200-year and 300-year ratios, respectively. The low-scenario projection is lower than recent historical experience, even for the coming century, and increasingly in future centuries.

All the ratios of the medium scenario fall within the range of historical experience.

For the high scenario, the 200-year ratio of 2100 and the 300-year ratios for 2100 and 2200 are larger than the largest observed ratios for 200 years and 300 years, respectively. The high scenario projection is higher than recent historical experience, especially beyond the next century.

The constant-fertility projection differs from the other scenarios. It is intended as a what-if exer-

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TABLE 1. EVOLUTION OF THE POPULATION OF THE WORLD ACCORDING TO THE DIFFERENT SCENARIOS, 2000-2300

Year	Population (billions)				
	Low	Medium	Zero-growth	High	Constant
2000 .....	6.1	6.1	6.1	6.1	6.1
2050 .....	7.4	8.9	8.9	10.6	12.8
2100 .....	5.5	9.1	9.1	14.0	43.6
2150 .....	3.9	8.5	8.5	16.7	244.4
2200 .....	3.2	8.5	8.3	21.2	1 775.3
2250 .....	2.7	8.8	8.3	27.8	14 783.0
2300 .....	2.3	9.0	8.3	36.4	133 592.0

Source: United Nations, Department of Economic and Social Affairs, Population Division, World Population in 2300 (ESA/P/WP.187).

TABLE 2. HISTORICAL ESTIMATES OF WORLD POPULATION (in millions)

Year	Population			Ratio		
	Lower	Upper	Geometric mean	100 years	200 years	300 years
1	170	400	261			
100			240	0.92		
200	190	256	221	0.92	0.85	
300			209	0.95	0.87	0.80
400	190	206	198	0.95	0.90	0.82
500	190	206	198	1.00	0.95	0.90
600	200	206	203	1.03	1.03	0.97
700	207	210	208	1.03	1.05	1.05
800	220	224	222	1.06	1.09	1.12
900	226	240	233	1.05	1.12	1.15
1000	254	345	296	1.27	1.33	1.42
1100	301	320	310	1.05	1.33	1.40
1200	360	450	402	1.30	1.36	1.73
1300	360	432	394	0.98	1.27	1.33
1400	350	374	362	0.92	0.90	1.17
1500	425	540	479	1.32	1.21	1.19
1600	545	579	562	1.17	1.55	1.42
1700	600	679	638	1.14	1.33	1.76
1800	813	1125	956	1.50	1.70	2.00
1900	1550	1762	1653	1.73	2.59	2.94
2000	6071	6071	6071	3.67	6.35	9.51

Source: For "Lower" and "Upper" columns: United States Census Bureau 2003. Historical estimates of world population. <http://www.census.gov/ipc/www/worldhis.html>, accessed 10-Dec-03. Remaining columns are calculated here.

NOTE: Estimates for years 100 and 300 are geometric means of estimates for prior and following centuries. "Ratio" shows population for the current year divided by the population one, two or three centuries earlier. The ratios for 100 years earlier in the years 100 and 200 (namely, 0.92) are necessarily identical because of the use of the geometric mean; likewise for the years 300 and 400 (ratios 0.95).

TABLE 3. FREQUENCY HISTOGRAMS OF RATIOS IN TABLE 2

Bin	100 years		200 years		300 years	
	Frequency	Cumulative %	Frequency	Cumulative %	Frequency	Cumulative %
0	0	0.0	0	0.0	0	0.0
1	7	35.0	5	26.3	4	22.2
2	12	95.0	12	89.5	12	88.9
4	1	100.0	1	94.7	1	94.4
8	0	100.0	1	100.0	0	94.4
16	0	100.0	0	100.0	1	100.0
minimum ratio	0.92		0.85		0.80	
maximum ratio	3.67		6.35		9.51	

Source: Table 2.

NOTE: Bin 1 counts the number of ratios less than or equal to 1.00; e.g., of the 20 ratios over one century, 7 were less than or equal to 1. Bin 4 counts the number of ratios that exceeded 2.00 (the next lower bin limit) and were less than or equal to 4; for example of the 20 ratios over one century, exactly 1 ratio (namely, 3.67, the ratio of the population in 2000 to that in 1900) exceeded 2 and was less than or equal to 4.

TABLE 4. RATIOS OF PROJECTED POPULATIONS IN YEARS 2100, 2200 AND 2300 TO (ACTUAL OR PROJECTED) POPULATIONS 100, 200 OR 300 YEARS EARLIER, ACCORDING TO THE LOW, MEDIUM, HIGH AND CONSTANT-FERTILITY SCENARIOS (in millions)

		Year		
		2100	2200	2300
Low	Population	5 491	3 165	2 310
	100 years	0.90	0.58	0.73
	200 years	3.32	0.52	0.42
	300 years	5.74	1.92	0.38
Medium	Population	9 064	8 499	8 972
	100 years	1.49	0.94	1.06
	200 years	5.48	1.40	0.99
	300 years	9.48	5.14	1.48
High	Population	14 018	21 236	36 444
	100 years	2.31	1.51	1.72
	200 years	8.48	3.50	2.60
	300 years	14.66	12.85	6.00
Constant-fertility	Population	43 600	1 775 300	133 592 000
	100 years	7.18	40.72	75.25
	200 years	26.38	292.42	3064.04
	300 years	45.59	1 074.24	2 2004.94

Source: Tables 1 and 2.

cise rather than as a realistic possibility. Every projected ratio greatly (and unrealistically) exceeds the largest historically observed ratio for each interval of one, two or three centuries. A continuation of present levels of fertility, in com-

ination with the other assumptions concerning mortality and migration in the long-range projections, would lead to increments of population size far, far greater than any within historical experience.

In conclusion, the medium scenario of these long-range projections calls for changes in population size that fall well within historical experience over the last two millennia. The ratios of population change anticipated in the low scenario and the high scenario fall below and above historical experience, respectively. This conclusion does not argue that either scenario is unrealistic. As table 2 shows, the 100-year ratio for year 2000, namely 3.67, was more than twice the 100-year ratio for the nineteen preceding centuries. The rise of population in the twentieth century was unprecedented. The global fall in fertility since 1965 was also unprecedented. All that can be concluded is that the high and low scenarios fall outside of historical experience. Unpre-

cedented events are not unprecedented in demography.

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