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An Essay Concerning Mankind's Demographic Evolution

While our future appears less and less clear, our past is becoming better and better defined, as Jean-Noël Biraben, Research Director at INED, proves with the patient reconstruction of world population he presents here. The increased precision this article offers throws new light on the history of populations: where population growth was supposed to have been regular, there now appears a succession of accidents, periods of stagnation interrupted by sudden increases.

The author insists upon the provisional character of his estimates, but no new data are likely to reconstitute this disproved regularity.

We could have contented ourselves here with presenting the views of the numerous authors who have attempted to retrace the long demographic history of humanity, or with elaborating upon the most recent and most thorough of these works, that of J. D. Durand, published in 1976 in Philadelphia. Despite the incontestable value of this work, the study of long population curves such as China's, for which Michel Cartier has painstakingly provided the data from the beginning of the Christian Era, or France's, with which we have worked previously, or Italy's, of which J. Beloch has provided the first and authoritative model, has prompted us to further pursue the analysis.

Indeed most authors when describing world population development across the ages conveniently suppose a more or less exponential growth, thus eluding the difficulties and uncertainties underlying the more ancient periods. However the curves for such important regions as China or Europe, each of which has never represented less than one-sixth of humanity, are quite contrary to this hypothesis and within their overall trend of growth reveal great and very irregular fluctuations.

Durand's study, which appears to be particularly well-founded, provides world population estimates for eight time-points from 8000 BC to 1970 AD. However, these eight points are very unequally distributed in time; moreover, six of them refer to the present millenium, precisely the period for which the convenient exponential curve is broken. It is perhaps the same for world population as for regional populations: decreases in one part would then not necessarily be compensated by increases in another, but on the contrary, as has been observable during recent centuries of more reliable statistical data, would show a trend towards covariation, which while being for the most part enigmatic are none the less real.

Mankind can be classified into relatively self-enclosed cultural areas, termed "closed universes" by P. Chaunu (1974). It generally holds that within a particular cultural area, periods of prosperity or recession are accompanied by overall population increase or decrease; however, there is nothing *a priori* to justify the supposition that parallel population developments between two distinct cultural areas, often very distant from one another, are due to anything other than coincidence. This is what we have tried to verify here.

We had neither the means nor the time to go over all the existing documentation in order to obtain new complementary data. We therefore limited ourselves to collating the

published figures for each country; then, taking into consideration what is known about the economic, political and medical history of each country, we drew a curve through these figures and extended it into the past.

These estimates permitted us to calculate aggregate populations for Europe, North Africa and the Near East for any chosen moment in the past. Despite the approximate nature of these figures, they are generally in agreement with those of Durand, except in a few cases where he seems to have relied upon studies either too hastily conducted or made by authors for whom the estimates in question were not the principal objective. The divergences, however, are minor and of no real importance for the overall demographic picture.

One should in fact bear in mind that human population, as is the case for all mammal populations, tends to be concentrated in a few points of the globe: China, India and the European and Mediterranean countries together have always made up between two-thirds and three-quarters of mankind, thus representing the main determinant of its evolution.

Now notwithstanding certain divergences, it appears that certain periods were simultaneously favourable in each of these three regions while others were unfavourable.

Table 1 presents within the same geographic framework a comparison of our results with those of Durand.

In another table giving aggregate figures only, Durand puts forward a world population of between 350 and 450 million for the year 1250, and between 5 and 10 million for the year 8000 BC.

Table 1 **World population in millions (our own figures followed by J. D. Durand's population range)**

	Time of Christ	1000	1500	1750	1900	1970
World total	255 270-330	254 275-345	460 440-540	770 735-805	1633 1650-1710	3637 3600-3700
China	70 70-90	56 50-80	85 100-150	220 190-225	415 400-450	774 750-850
India-Pakistan-Bangladesh	46 50-100	40 50-100	95 75-150	165 160-200	290 285-295	667 660-685
Southwestern Asia	49 25-45	34 20-30	23 20-30	27 25-35	38 40-45	118 105-115
Japan	2 1-2	4 3-8	10 15-20	26 29-30	45 44-45	104 103-
Remainder of Asia	5 8-20	19 10-25	33 15-30	61 35-55	115 110-125	366 410-435
Europe (except U.S.S.R.)	35 30-40	30 30-40	66 60-70	109 120-135	294 295-300	462 420-425
U.S.S.R.	12 5-10	13 6-15	17 10-18	35 30-40	127 130-135	243 243-244
Northern Africa	14 10-15	9 5-10	9 6-12	10 10-15	43 53-55	86 71-73
Remainder of Africa	12 15-30	30 20-40	78 30-60	94 50-80	95 90-120	266 270-290
North America	1 1-2	2 2-3	3 2-3	3 2-3	90 82-83	229 228-229
Central and South America	8 6-15	14 20-50	34 30-60	15 13-18	75 71-78	283 280-295
Oceania	1 1-2	1 1-2	3 1-2	3 2	6 6	19 6

Clearly Durand chose the two cut-off dates for his table because they serve as convenient reference points, and the other dates as a function of their equidistance between the years 1000 and 2000, not because they represent an important moment in man's demographic history. His figures can then be used as reference points only, not as guides; they are too distant from one another and thus can indicate only very crudely the general trend, and not at all eventual periods of population growth or decline. For that, one must either have time-points close enough together to take note of eventual fluctuations, or choose dates that one has reason to suspect of corresponding to a population change. This is why we have summed our curves at two-century intervals up to the year 400, and at one-century intervals thereafter, as well as for the years 1250 (after the Mongolian invasions) and 1340 (prior to the Bubonic Plague). The results thus obtained are reported in Table 2.

Of course none of these figures, even the more recent ones, have any absolute claim to precision. For 1970, as for 1950, the United Nations Demographic Yearbooks are less than totally reliable and the figures vary from one edition to the next. They report the world total as being reliable within a 5% error range, and we consider this to be a realistic approximation for these recent dates. However, a growing margin of error must be allowed for as one goes back in time; perhaps 7 or 8% around 1700, and 10% around 1500. Earlier than that it is difficult to provide a value, given the scarcity of the statistical sources available, these being almost always indirect in nature.

With respect to China, we used figures supplied by Michel Cartier (1971, 1973), making the necessary upward adjustments so that they relate to present Chinese territory. Two remarks must be added at this juncture: in the middle of the first century AD, one notes in the censuses a substantial decrease in the Chinese population. Many possible explanations have been given for this decrease, from natural catastrophes to the disorganization of the responsible registration authorities. One notes for example the drought and concomitant famine in Shantung in 3 BC, in 2 AD the Yellow River broke its dikes and inundated Shantung and Hopei, in 14 AD a great famine claimed many victims while Wang Mang, after usurping power, attempted from the year 9 AD an agrarian reform which caused considerable turmoil. In 22 AD there occurred the revolt of the Crimson Eyebrows put down only in 25-27 AD by Kuang Wu Ti, subsequent founder of the Han dynasty. Following this latter date there were no noteworthy events in Chinese history except for the rapid restoration of its power up to 49 AD. In that year the reconquest of Tarim was interrupted for a period of 25 years; neither the Chinese troops nor the Yüeh-chih undertook military operations between 49 and 73 AD. It seems to us, however, that another factor may have been responsible for the population decrease in question. In this period the first mention of smallpox in China is found in the work of Ko-Hong, a doctor who associated its outbreak with the arrival of the Yüeh-chih cavalrymen in 49 AD. While leaving the last word in this matter to the sinologists, we consider the latter to constitute a possible explanation.

Our second comment refers to the modern-day population of China. If the 1953 census is reliable, we think that the Chinese population of 1970 is nearer to the 825-875 million range than to 774 million, unless of course a drastic drop in the number of births, even faster and greater than occurred in Japan in the 1950s, has been brought about by the campaign in favour of contraception.

As to India, we have followed the lead of Ajit Das Gupta (1972), except for periods prior to the 16th century for which he merely noted that the Indian population might

Table 2 **World population estimates, in millions, at various dates (provisional table)**

	Time of																											
	-400	-200	Christ	200	400	500	600	700	800	900	1000	1100	1200	1250	1300	1340	1400	1500	1600	1700	1750	1800	1850	1900	1950	1970		
China	25	45	70	60	25	32	49	44	56	48	56	83	124	112	83	70	74	84	110	150	220	330	435	415	558	774		
India—Pakistan—Bangladesh	30	55	46	45	32	33	37	50	43	38	40	48	69	83	100	107	74	95	145	175	165	180	216	290	431	667		
Southwestern Asia	43	55	49	49	47	43	33	28	32	36	36	32	30	25	23	23	21	27	33	29	29	32	38	75	118			
Japan	1	1	2	2	4	5	5	4	4	4	5	7	9	10	10	9	10	11	25	26	25	30	45	84	104			
Remainder of Asia	3	4	5	5	7	8	11	12	14	16	19	24	31	31	29	29	29	33	42	53	61	68	78	115	245	386		
(exclusive of U.S.S.R.)																												
Europe (exclusive of U.S.S.R.)	23	26	35	42	36	29	22	22	25	28	30	35	49	57	70	74	52	66	87	92	109	145	208	294	392	462		
U.S.S.R.	13	14	12	13	12	11	10	10	11	12	13	15	17	14	16	16	13	17	22	30	35	49	79	127	180	243		
Northern Africa	10	14	14	16	13	11	7	6	9	8	9	8	8	9	8	9	8	9	9	10	10	10	12	43	52	87		
Remainder of Africa	7	9	12	14	18	20	17	15	16	20	30	40	49	60	71	60	78	104	97	94	92	90	95	167	266			
North America	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	2	3	5	25	90	166	228		
Central and South America	5	6	8	8	9	11	12	13	13	13	14	16	20	23	27	29	33	34	10	10	15	19	34	75	164	283		
Oceania	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	2	2	6	13	19		
World total	162	231	255	256	206	206	206	207	224	226	254	301	400	416	432	443	374	460	579	679	770	954	1241	1633	2527	3637		

H. le Bras has carried out a variance analysis of the mean annual growth rates by period and region obtained from this table. His conclusions eliminate the hypothesis of chance fluctuations: there is no difference between regions, but a highly significant deviation is observed between periods.

Source of variance	Sum of squares	Degrees of freedom	S ² (estimate)	F
Between periods	0.0402	24	0.00168	8.3 very highly significant (P 0.001)
Between regions	0.0033	24	0.0003	1.5 not significant
Residual	0.0552	264	0.0002	

have attained 100 million during the periods of prosperity under the Maurya Empire (approximately between 321 and 185 BC), the Gupta Empire (320 to 470 AD), and under the reign of Harsha (612 to 627 AD). We think that this very rounded-off value of 100 million must be further qualified. We feel that for all these periods, one must take into consideration the immense inland areas still inhabited by tribes, which for the most part had a very archaic economic system and certainly very low population densities. We have, therefore, chosen to assign a population of 50 to 60 million to these epochs, a value that remains within the range proposed by Durand. We could, however, have upped our estimate by 10 or 20 million without jeopardizing our results. It is with respect to the ancient Indian population that our results diverge the most from those of Durand, who estimated it at 75 million.

For southwestern Asia within which we included, in addition to the Arabian Peninsula, Palestine, Syria, Irak and Anatolia, Iran and Afghanistan, the only estimates available were either for antiquity or for the 19th and 20th centuries. Between these two extreme time-points, we had to interpolate, trying to allow for the favourable or unfavourable periods of history, admittedly a hazardous procedure, but the only one at our disposal. Fortunately, it is only in antiquity that the Near East has any significant bearing on the total world population.

For Japan we accepted the data supplied to us by Michel Cartier, complemented by some figures furnished by Akira Hayami.

The rest of Asia for which we have very little data prior to the 19th century (except for Korea and Tonkin, provided by Cartier, and Thailand around 1700) remains a problem for the middle and end of the Middle Ages when several countries enjoyed very flourishing civilizations: Cambodia, Champa, Indonesia, Sri Lanka, etc.

For Europe, we drew our data essentially from the third edition of the *Histoire Générale de la Population Mondiale* (M. Reinhard *et al.*, 1968) as well as from certain works of CICRED (e.g. Italy, Poland) and some country-specific publications (e.g. Great Britain, The Netherlands, Austria, Hungary). We constructed a curve for each country from the beginning of the Christian Era and then summed them for each of our previously decided upon dates. During antiquity the population decrease must have begun either in 168 AD with the Antonine Plague or shortly thereafter. This decrease accelerated in 251 AD with the first invasions and especially in 276, 375 and 407–412 AD when the heavy influx of barbarians definitively jeopardized the economy. The end of the fifth century and the beginning of the sixth showed some signs of recovery but the so-called Justinian's plague of 542–543 AD and the probable appearance of smallpox in 562 resulted in further depopulation. The population then stagnated for a while and its subsequent recovery was slowed by the insecurity related to the Slavic invasions in the east and the raids of the Saracens, and later the Normans and the Hungarians in the west. The increase thereafter was rapid, although interrupted by the Mongolian invasions of 1242–1243 and the Bubonic Plague (or Black Death) which resulted in a century-long 25% population decrease. The end of the 16th century, the beginning of the 17th and the 20th centuries were marked by considerable slow-downs. M. K. Bennet in his work *The World's Food* (1954) puts forth much more substantial fluctuations for the population of Europe: he thinks that the population went from 67 million around 200 AD to 27 million in 700, 73 million in 1300 and only 45 million in 1400.

For the U.S.S.R. we have some indicators from as far back as the 13th century (Mongolian censuses) and the data are relatively abundant from the 17th century up to the

present. We chose to separate and then total the results for five regions: the Baltic countries, the remainder of European Russia, Siberia, Central Asia and Caucasus.

North Africa has certainly known periods of prosperity in antiquity notably in Egypt and in the Maghrib. But, as is the case for the Near East we have no data for the period from antiquity up to modern times. In the Maghrib we have supposed a rapid resurgence in the rate of population growth during the prosperous period of the Zayrid dynasty which began in 946 AD with a decisive victory of the sedentary population over the nomadic, and which comes to an end only with the ravages of the Bani Hillal invasions during the second half of the 11th and the beginning of the 12th centuries.

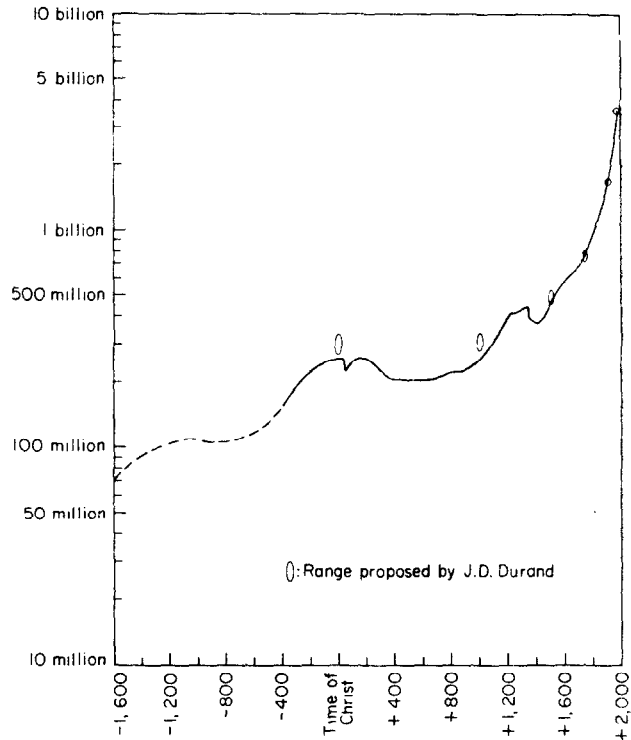
The remainder of Africa presents immense problems since, apart from a few specific points in time, its population is not known before the 20th century. We tried to define its population development in relation to our knowledge of its economic and political history. In the seventh and eighth centuries the interruption of trade with North Africa and the decline of the Nubian and Ethiopian kingdoms probably resulted in a certain depopulation. The ninth and 10th centuries, which witnessed a growth in commercial ties among Muslim countries and the zenith of the Ghanaian Empire and the Zimbabwe civilization in southeast Africa must have been marked by a population increase followed by a decline concomitant with the collapse of the Ghanaian Empire at the end of the 11th century. Likewise, the prosperity of the empires of Mali and Ethiopia, and the Yoruba civilization, and the territorial expansions of the Bantus in the 13th century and up to the beginning of the 14th, followed by (from 1330 in the case of Ethiopia) chaotic and incessant wars must have been accompanied by a rapid population growth followed by a decline. Yet another rise seems to manifest itself during the height of the Songhai Empire and the Benin civilization up to the end of the 16th century and the beginning of the 17th. From this epoch onwards a few urban censuses in Upper Niger (Timbuktu, Gao, etc.) make it possible to evaluate the depopulation in West Africa following the collapse of the Songhai Empire in 1591. Despite the rapid adoption of maize and manioc which constituted an important nutritional progress, slavery and tribal struggles which devastated Black Africa during more than two and a half centuries, followed by the shock of the colonial conquests in the second half of the 19th century must have led to a population decline which in certain regions extended up to 1920 or even 1945.

For America we have data from the 16th century onwards. The population estimate at the moment of the Spanish conquest has incited bitter controversy; we think, as Durand, that it must be in the vicinity of 40 million. For the year 1000, however, our estimate, in taking into consideration the collapse of the Mexican Upper Plateaux civilization during the ninth and 10th centuries and of the Maya civilization during the seventh, eighth and ninth centuries, is slightly below the lower limit of the range proposed by Durand. As of 1520 for the more highly civilized regions we allowed 13 million inhabitants for Mexico, 12 for the Inca Empire, only 3.5 for the Mayas once again in the midst of a period of decline, and 2 for the Chibcha Valleys of Colombia. Though the pre-Colombian evolution of the Maya population is hardly measurable it can be surmised in the case of Mexico, and even after allowing for possible errors and exaggerations the evolution of the population of Teotlapán from the 10th to 18th centuries (M. Reinhard *et al.*, 1968) reveals much more considerable fluctuations than we dare to imagine.

Finally, for Oceania we simply supposed a population growth in the 11th and 12th centuries due to the settlement of Polynesia and New Zealand which up to that point had been uninhabited.

Turning now to the world total we note that within the limits of the approximations we had to make it can be said that human population has very likely undergone more or less rapid phases of growth and decline. Prior to the present phase of rapid population growth the outbreak of the Plague in the middle of the 14th century and a diversity of other difficulties had brought on a strong decrease lasting nearly a century. The previously observed high, around 1340, was succeeded by a low comparable to that of the fifth and seventh centuries, itself preceded by a high during the first two centuries of the Christian Era. Still further in the past we surmise a low around the seventh century BC and a high around the 10th century BC, etc. (cf. Figure 1).

Figure 1. World population estimates since 1600 BC.

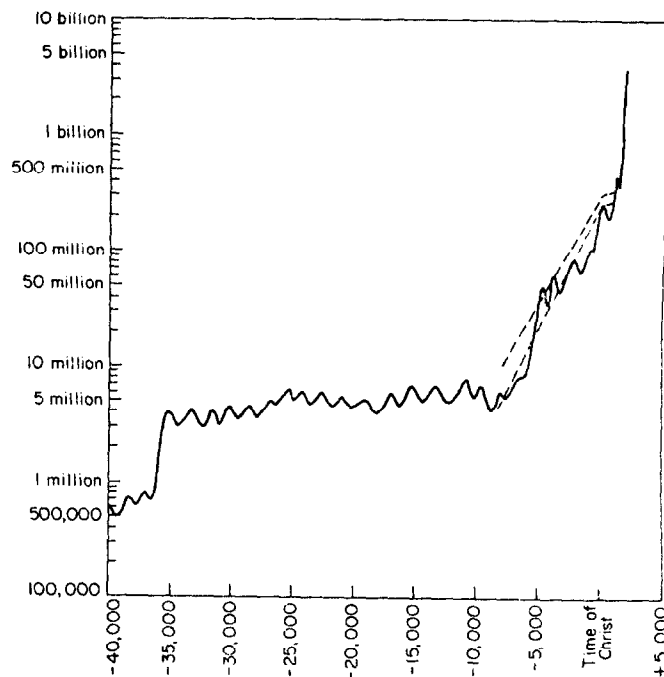


The decreases are generally in the order of 10 to 20% with respect to the preceding high and the duration of the rather irregular cycles so formed (except for the last one which was much shorter) is about 8 to 12 centuries. It follows that extrapolating the trend of just a few centuries can in no way serve as a guide to future world population; calculated on the basis of the fourth and third centuries BC such an extrapolation would have forecast a population of 20 billion for the year 2000. On the basis of the third and fourth centuries AD however it would have yielded a decline to 35 million for the same date!

If we go further back in time it seems that more or less regular fluctuations of this magnitude existed even in prehistoric times and that some of them were of even greater magnitude. In France, for example, remains of the Neolithic period have been observed, in well-prospected areas the size of a department, to be 20 to 30 times more abundant

(for a comparable time period) than those of the immediately preceding Tardenoisian culture. This is subject to caution of course—Tardenoisian men might have carved numerous objects out of wood and other non-fossilizable substances—but it is quite in keeping with our knowledge of the economy of the Tardenoisian hunters/fishermen and that of Neolithic populations. Thus, during the sixth millenium the cultural complex, slowly developed by successive contributions and for the sake of convenience termed Neolithic, extended itself from the Near East to Egypt, Anatolia and the Balkans, Caucasus and Iran, Central Asia, North China, the Indus Valley and Yemen, while in, Central America the first agrarian cultures were beginning to develop. This millenium then probably witnessed a very substantial increase in world population, greatly exceeding present-day fluctuations. Prior to the Neolithic period, during different phases of the Upper Paleolithic the world population perhaps fluctuated between 5 and 8 million inhabitants, ending somewhere between 9800 and 8800 BC as a result of a severe climatic change which led, at least in the present temperate zones of the northern Hemisphere, to an abrupt cultural and demographic reverse. A similar evolution had perhaps been unfolding earlier at the dawning of the cultures of the Upper Paleolithic period between 30,000 and 35,000 BC amid the ruins of the Mousterian epoch, such ruins having been brought on by the glacial advance (cf. Figure 2).

Figure 2. Tentative description of the evolution of world population since 40,000 BC. (The broken curves represent the range proposed by J. D. Durand.)



By way of summary we have outlined rather crudely, in graphic form, what may have been the numerical development of humanity: periods of large and abrupt increases corresponding to cultural changes, separated by periods of slower growth marked by light oscillations reflecting the conquest of new territories and changes in technology or social organization. During the lower and middle Paleolithic ages, the large increases were

probably less abrupt and due to changes both in technology and species, which by way of oversimplification has resulted in some such cultures being classified as those of Pithecanthropoid man, others as Neanderthal man or *Homo sapiens*; the lighter oscillations however, were more due to climatic fluctuations (E. Le Roy-Ladurie, 1967) or territorial expansions. Cultural changes today are much more decisive, and if it is permitted within this retrospective essay to make forecasts, the next decline could have a voluntary character with which it has never before been invested.

Adapted from: Biraben, J. N. (1979). L'évolution du nombre des hommes. *Population*, pp. 13-29 (where the bibliography is to be found).