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PREFACE

One of the themes of IIASA's research is the global transition, the paths the world might follow over the next century to reach a system that will provide for the needs of about ten billion persons in a sustainable, equitable, and resilient way. This short paper offers striking confirmation of the extent to which current generations are important actors in this transition. It is the product of a collaboration between Jesse Ausubel, who works in the Resources and Environment (REN) Area on issues related to global climatic change, and Michael Stoto, statistician and demographer working with the Risk Group and the System and Decision Sciences (SDS) Area.

ABSTRACT

Attitudes toward societal planning horizons may assume that there is relatively little overlap between the population of today and the population of the future. To test this assumption a rough calculation is made of how many people who are alive today will be alive 50 years hence. The calculation is made on the basis of 3 age cohorts for a sample of 10 countries from 6 demographic categories. While the result is uncertain because of changing mortality, poor data, etc., the authors believe it is reasonably robust. About forty percent of those alive today will be alive in 50 years. This proportion includes 550 million people 15 or older. These results suggest that long planning horizons are rational from the point of view of the self-interest of the existing population. Further research into societal planning horizons would be useful.

A NOTE ON THE POPULATION 50 YEARS HENCE

Jesse Ausubel and Michael Stoto

INTRODUCTION

In discussions of long-term environmental issues, such as carbon dioxide and global climatic change, reference is often made to the improbability of substantial societal action to protect populations of the future. Most government and business planning decisions are oriented toward the next quarter or the next year, not towards half a century from now, when many experts contend dramatic climatic shifts will be taking place. Indeed, "long-range" planning rarely extends more than five years ahead. Of course, there are significant exceptions. In forestry it has long been customary to adopt relatively distant planning horizons. Many public works, whether roads, dams, or monuments are also conceived well beyond the needs of today. Nevertheless, it is a commonly held view that for many long-term issues preventive or anticipatory actions are unlikely compared to adaptive or *ex post* reactions.

Implicit in this view may be an assumption that the population of today is quite distinct from the population of the future. As an exercise to test how remote the future is, let us make a rough calculation of how many people alive today will be alive fifty years from now. How many people alive today might experience, for example, life on a warmer earth?

THE CALCULATION

The method used to make the calculation is simple, intended to give answers correct to one or two significant figures. The estimates derived should be regarded as convenient reference points, not as state-of-the-art demographic projections.

We make the calculation on the basis of population figures for six categories of countries chosen by Keyfitz (1979) that have broadly similar characteristics. Within these categories, we select individual countries which represent a large share of the population. The ten selected countries total over 60% of the global population. In five of the six categories, the population of countries selected represents more than half the category total; for Western Europe and Japan it is about one-third, but countries in this category are reasonably homogeneous with respect to their demography.

For each country we begin with the population in age groups 0-14, 15-29, and 30-44, taken from the United Nations *Demographic Yearbook 1978* for the latest available year, which ranges between 1970 and 1978. The population 45 years and over is ignored, because this age group will contribute a negligible number of 50 year survivors. The use of three age cohorts is sufficient to convey roughly the effect of the differences in initial age structure from category to category. Age cohort figures were available for eight of the ten countries; for Nigeria estimates were made on the basis of the age distribution of Ghana, while the figures for China are based on those of the Republic of Korea.

In order to estimate the fraction of the 1975 population that will survive 50 years, we used the latest life-table survival rates for females from the United Nations *Demographic Yearbook 1974*. Some of these mortality figures (India, USSR) date back to the 1950s. For simplicity, we chose survival probabilities to represent central points of the three age cohorts analyzed here: from age 10 to age 60, 25 to 75, and 35 to 85.

These calculations lead to an overall survival fraction for each of the selected countries. For each category, we apply the survival fraction from the selected country (or countries) to the category total. We then sum the category survivals to provide a rough estimate of the global population who were alive in 1975 who should be alive in 2025.

Before presenting the results, the several sources of bias, error, and uncertainty should be mentioned. First, survival rates are not constant, and the ones we use probably introduce a downward bias. For example, rates of survival in India are higher now than they were in the 1950s, and life expectancy will likely continue to lengthen. While the 50 year survival rates of someone alive in 1975 may be higher than the estimates employed for some countries, it is also possible that the rates will stabilize or even decline. A second likely source of downward bias is the selection of survival probabilities for ages 10, 25, and 35, because median age in the larger, younger groups is somewhat lower. In contrast, use of survival figures for women, with their generally lower mortality, leads to an upward bias. There is an inconsistency between the 1975 population estimates and the age cohort statistics which come from several years; the error here could go either way, depending on whether the cohort figures used were for a population larger or smaller than the 1975 level. The selection of representative countries and categories can also be a source of error. Finally, the demographic data on which we base our calculations may themselves contain error.

Several of these problems could be controlled through further analysis. Ideally, one might approach the matter through an integral like

$$\int_0^\infty p(x)\,(l(x + 50)/l(x))\,dx$$

where $p(x)$ is the population aged x and $l(x)$ is the life table survivorship to age x. One could use data on five-year age intervals and some approximate integral formula to evaluate the overall quantity. In practice, such data would be available for only a few countries. For these countries the results of the integral formulation could be compared with the results of the more abridged calculation we have made. The comparison might indicate a bias in our approach.

However, inadequacies of data and uncertainty associated with changing mortality would remain. Thus, more exhaustive analysis may not be warranted. Indeed, this exercise may be a good example of where a quick calculation can be useful. While more thorough and consistent estimates are possible, we do not think that they would qualitatively change the results.

RESULTS

Table 1 summarizes the results of the calculation. Let us look at the figures for the first demographic category, the United States and countries of British settlement, as an example. In 1975, the population of the US was estimated to be 213 million. 51 million were between ages 0 and 14. 85 out of 97 females age 10 are expected to live to age 60, so we estimate that 44 million people from the youngest age cohort will survive 50 years. There were 57 million Americans between 15 and 29, and 61 out of 97 females age 25 are expected to live to age 75, so 35 million are projected to survive in this group. Of the population between the ages of 30 and 44, 11 million are projected to survive 50 years. In total, 90 million, or 42% of the the 1975 US population of 213 million, are projected to be alive in the year 2025. The survival fraction of 42% for the US is applied to the demographic category, so 117 million of the 278 million estimated 1975 population of the US and countries of British settlement are projected to survive 50 years.

The survival fractions for the six demographic categories range from 35% in the poor less developed countries to 49% in the higher income developing countries. The first figure is due primarily to the high mortality and relatively flat age structure exhibited by the data used for China. The second figure results from a combination of the relatively low mortality rate and high proportion of children under 15 in Brazil and Mexico. The category of oil exporters also has a low survival fraction. This is due to the fact that Nigeria and Indonesia constitute two-thirds of the category population and represent the category in our calculation. It is interesting that the high income countries have more favorable life tables, but because their population is older the 50 year survival fraction seems not to vary among countries as much as one might guess.

Table 1. Estimated population 50 years hence.
(all population figures in millions)

Country and Category	Population (est. 1975)	Population age 0-14 (year)	Fraction surviving 10-60 (year)	Projected survivors from age group	Population age 15-29 (year)	Fraction surviving 25-75 (year)	Projected survivors from age group	Population age 30-44 (year)	Fraction surviving 35-85 (year)	Projected survivors from age group	Total projected survivors	Category survival fraction	Projected survivors 15+ (fraction)
United States	213	51 (1978)	85/97 (1972)	44	57 (1978)	61/97 (1972)	35	38 (1978)	30/96 (1972)	11	90		
United States and countries of British settlement	278										117	.42	60 (.21)
France	53	11 (1978)	88/98 (1972)	9	12 (1978)	66/97 (1972)	8	8 (1978)	31/96 (1972)	2	19		
Japan	110	25 (1977)	85/97 (1965)	21	25 (1977)	57/96 (1965)	14	25 (1977)	19/95 (1965)	5	40		
Western Europe and Japan	463										168	.36	82 (.17)
USSR	254	67 (1973)	81/94 (1958-59)	57	59 (1973)	58/93 (1958-59)	36	54 (1973)	27/91 (1958-59)	16	109		
Socialist countries of Eastern Europe, including the USSR	354										164	.46	72 (.20)
Indonesia	139	50 (1971)	76/94[a] (1972)	40	27 (1971)	41/93[a] (1972)	11	20 (1971)	14/71[b] (1946-49)	4	55		
Nigeria	63	30[c] (1970)	30/65 (1965-66)	14	16[c] (1970)	10/58 (1965-66)	3	10[c] (1970)	-	-	17		
Oil Exporters	294										104	.35	26 (.08)
Brazil	106	46 (1977)	67/88 (1960-70)	35	30 (1977)	39/86 (1960-70)	13	16 (1977)	12/83[d] (1960/70)	2	50		
Mexico	59	30 (1978)	69/87 (1970)	23	16 (1978)	42/87 (1970)	7	8 (1978)	18/84 (1970)	1	31		
Developing countries of more than $400 GNP per capita in 1972	321										157	.49	44 (.13)
China	895	313[e] (1975)	75/93[f] (1970)	252	255[e] (1975)	46/91[f] (1970)	128	153[e] (1975)	13/85[f] (1970)	23	403		
India	625	253 (1977)	29/74 (1951-60)	99	165 (1977)	11/69 (1951-60)	26	105 (1977)	3/61 (1951-60)	5	130		
Less developed countries of less than $400 GNP per capita in 1972	2249										788	.35	269 (.11)
Countries sampled	2517										944		
World	3996										1498	.37	553 (.13)

[a]Survival statistics from West Malaysia.
[b]Survival statistics from the Philippines.
[c]Estimated on the basis of age distribution in Ghana.
[d]Survival 35-80.
[e]Estimated on the basis of age distribution of the Republic of Korea.
[f]Survival statistics from the Republic of Korea.

The estimates for China have been made by analogy with the Republic of Korea. As a test of the sensitivity of the result to the assumption of similarity in the demographic characteristics of these two countries, we made an alternate estimate equating the age distribution of China with that of India, that is, with a larger share of population in the youngest age group. The survival statistics remained those for the Republic of Korea. The result is an increase in the survival fraction for China from 45% to 48% and for the category from 35% to 37%.

In total, it seems reasonable to expect that about one and a half of the roughly four billion people alive in 1975 will be alive in 2025. This is about 37%; use of the alternate age distribution for China raises the survival rate above 38%.

As a rule of thumb for the next few years, we would propose using forty percent for the fraction of the population currently alive who will be alive 50 years hence. We choose this primarily because it is a round number which does not suggest excessive accuracy and secondarily because it reflects some adjustment for the downward biases mentioned above.

Forty percent seems quite a high proportion in relation to the attitudes to which we referred at the beginning. Because of their youth, many of these projected survivors have no influence on policy yet. Thus, we also make an estimate of the projected survivors now 15 and older. This may give a sense of the number of people alive today who will be alive 50 years hence and who might at present, or soon, be consciously concerned about the state of the future world. We choose 15 and older primarily for convenience. However, 15 seems reasonable as a starting age when one considers the quite extensive participation of secondary school students in environmental movements or the responsibilities in agriculture which young adults often hold. Our estimate of the projected survivors now 15 and older is roughly 550 million, or about fifteen percent of the population alive today.

Another way to look at the situation is to consider the proportion of the future population that is already alive. Taking a range of six to eight billion for global population in 50 years time (Keyfitz, 1981), the proportion of that population which is alive now is about twenty to twenty-five percent.

DISCUSSION

The results arrived at in this note may be of most interest as an opening to more general consideration of societal planning horizons. The estimates we have made suggest that a 50-year planning horizon is quite rational from the point of view of the self-interest of the existing population. It is noteworthy that such an argument can be made without reference to the children yet to be born of those currently alive. Justification for long planning horizons is often based on the idea that, while much of the current population will not be alive in 50 years, they will have children who will be alive. Of course, there are also rational arguments for short planning horizons. For example, decisions which do not entail significant irreversibilities should not call for far horizons. If there are pervasive and debilitating uncertainties about the future, long-range perspectives may also be senseless.

It would be possible to extend consideration of societal planning horizons on the basis of the approach here. For example, one could explore further the shape of the survival function by calculating the fraction of projected survivors over periods of 40 and 60 years. Then, it would be interesting to compare the demographic findings with opinion poll data and economic and cultural ideas about appropriate planning horizons for families, firms, and government.

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