Kates, R.W., R. S. Chen, T. E. Downing, J. X. Kasperon, E. Messer, and S. R. Millman, 1988. The Hunger Report: 1988. Alan Shawn Feinstein World Hunger Program, Brown University.

Robert W. Kates
Robert S. Chen
Thomas E. Downing
Jeanne X. Kasperson
Ellen Messer
Sara R. Millman

August 1988

The Alan Shawn Feinstein
WORLD HUNGER PROGRAM

Brown University
Box 1831 • Providence, Rhode Island • 02912 • USA

CONTENTS

TABLES AND FIGURES

Tables

Figures

THE HUNGER REPORT: 1988

No one really knows how many hungry people there are in the world. No one knows the toll of hunger because hunger is difficult to define, because the statistical data are weak or nonexistent, and because efforts to improve data collection and analysis have been limited. But above and beyond these real difficulties, we may not know how many hungry people there are in the world because we may not *want* to know. To know how many hungry there are in a world of plenty is to measure the inadequacy of our economies to sustain all, of our societies to provide for all, and of our common humanity to care for all.

What we do know, we present as a set of indicators of three conditions of hunger that emphasize different causes—*shortage*, *poverty*, and *deprivation*—and that focus on different units of analysis—*regions*, *households*, and *individuals*. We distinguish among conditions of *food shortage* where there is not enough food; *food poverty* where there may be suf-ficient food but some people do not have sufficient means to obtain it; and *food deprivation*, where there may be sufficient food but food may be withheld from individuals, special nutritional needs may not be met, or illness may prevent proper absorption. We combine these indicators with others that tell of the societal response to hunger, of its position on the public agenda, of how immediate needs are being met, and of what is being done to prevent hunger in the future. Together, this broad set of indicators forms a *Hunger Profile*.

This report on the current state of world hunger documents the quantitative indicators that comprise the Hunger Profile. We also summarize recent findings regarding the distribution and causes of world hunger and efforts for its alleviation and prevention. And to place this current "report card" on hunger into perspective, we embed hunger in its history and its future. A preliminary version of this report made its debut at the first annual Hunger Research Briefing and Exchange held at Brown University on April 6-8, 1988. Participants in this meeting were invited to assist in the report's revision.

A PROFILE OF HUNGER

The *Hunger Profile* is very much work in progress, a continuing effort on our part to take the measure of hunger, to mark progress or lack of progress in the struggle to reduce and to prevent hunger, and to do so in ways that are both informative and inclusive. By presenting a profile rather than a single measure of hunger, we indicate that the faces of hunger are varied and many, that the causes of hunger are multiple, and that efforts for alleviating and preventing hunger are fluctuating and uneven. Our profile suggests a new way to categorize the different types of hunger, a way that emphasizes the differential causes of hunger and incorporates recent advances in our theoretical understanding of hunger. And in combining existing measures of hunger developed over long periods by major international institutions with some new indices of our own, we have tried to include

rather than select and to bring together different disciplinary and professional perspectives.[1]

By incorporating a diverse set of indicators, the Hunger Profile also helps to overcome a major difficulty faced by all who study or combat hunger: the varying quality and quantity of data on hunger. Data on food production, consumption, and trade, on malnutrition and hunger-related disease, and on income distribution and poverty are all patchy. Many variables are not consistently measured from country to country or within countries. Definitions, categories, and coverage frequently change substantially over time, often with little or no documentation. Official statistics issued by governments and incorporated into international data sets sometimes bear little relationship to actual conditions. Even such basic demographic indicators as population and infant mortality have never been reliably measured in some countries, or are a decade or two out of date in others. We also note the paucity of data on food poverty worldwide and on self-provisioning in many developing countries. As others have done, we try to fill in gaps and correct the most egregious errors, using a blend of mathematical techniques, informed judgment, and, in a few cases, educated guesses. We document the methods used—and their assumptions and limitations—in some detail in the footnotes. But we emphasize that, given the existing limitations of data on hunger, it is important to examine a broad range of evidence and to compare and contrast the data that are available with a critical eye. When different measures or sources of data agree, we can often be more confident of our interpretations; when they disagree, we must be more cautious in drawing conclusions and supportive of efforts to understand why disagreements exist and to improve data quality. Thus, the Hunger Profile is an evolving tool designed to help improve and sharpen understanding of hunger. In future updates, we anticipate that some of its components may change to meet changes in needs, research questions, and data availability.

Food Shortage

The faces of hunger are varied and many. Those who suffer food-short hunger endure absolute shortage, the scarcity or unavailability of food within a bounded region because of natural disaster, war, or societal disruption. The measures of food shortage are the

1. We are especially grateful to the United Nations Administrative Committee on Coordination's Subcommittee on Nutrition (ACC/SCN), its chairman, A. Horwitz, and its secretary, J. Mason, for making available their report (ACC/SCN, 1987a) and much of the as yet unpublished data on which it is based. The data are drawn from the work of the major United Nations (UN) agencies concerned with nutrition: the Food and Agricultural Organization (FAO), the World Health Organization (WHO), and the United Nations Children's Fund (UNICEF). We also use the work of the UN Population Division (UNPD), the U.S. Department of Agriculture's Economic Research Service (USDA/ERS), the World Bank (WB), and the World Food Programme (WFP). To update current research, we draw heavily on the work of the Hunger and Food Systems Research Exchange, whose member groups regularly exchange research materials. Global population data are taken from the work of the Population Reference Bureau, Inc. (PRB), the UNPD, and the WB. Throughout the report, world populations or global aggregates vary somewhat depending on the recent year employed and are rounded to the nearest 5 million; percentages of the world population are rounded to the nearest whole percentage point.

measures of agronomists, of agricultural economists, of relief givers, and of food importers and exporters.

The largest world region is the world itself. It is often stated that hunger is not caused by absolute scarcity but by inequity in distribution. Indeed this issue, whether inadequate *food availability* or imperfect *food distribution* is the central cause of hunger, is a deeply divisive question among those concerned with hunger. Thus we begin with the question: is there a food shortage at the global scale?

Global

Our answer, as with many of the questions we pose to ourselves, is both *yes* and *no*. If we could take all of the world's vegetative food and the products of range-fed animals and distribute them equally among all the world's people according to recommended caloric standards (WHO, 1973, 1985a), then there is food enough to feed some six billion people or 20% more than the current population of the world (Table 1).[2] Indeed, by this standard there has probably been enough food to feed the world's population since the early 1960s.

But if we modestly improve the diet beyond what is essentially a basic vegetarian diet, to a diet similar to what many South Americans eat today, then there is a real food shortage in the world. For at that standard, there is only food enough to feed about four billion or four-fifths of the current world population. And if we choose a full but healthy diet, one that incorporates the desires most people have for richer and more varied diets, then there is only sufficient food in the world to feed about 2.5 billion people or half of the world

2. Estimates of the primary food supply are based on production data for cereals, roots and tubers, vegetables, fruit, oil seeds, and other crops as reported in the *1985 FAO Production Yearbook* (FAO, 1986). The total tonnage of roots, tubers, vegetables, and fruit has been converted to *grain equivalent* by applying a factor of 0.15 (Blaxter, 1986). The resulting totals were increased by 5% to account for animal and fish products derived from forage or waste. Estimates of food demand are based on annual population estimates provided by the USDA (USDA/ERS, 1985) and an average "basic" diet of 2,350 food calories (kcal) per person per day. The latter figure is based on average caloric needs per kilogram of body weight set by the FAO and the World Health Organization (WHO), average body weights by age reported by the FAO, and the present world age distribution based on UN data. Average caloric needs in the future remain essentially the same. The dietary requirements are converted into grain-equivalent demand by assuming 3,500 food calories per kg of grain and an overall loss of 40% between food production and food consumption (FAO, 1971, 1984; BOSTID, 1978). This includes a 10-15% loss *after* food leaves retail establishments (U.S. Panel on the World Food Supply, 1967).

population.[3] Of course, it is important to note that much more food probably could and would be produced if more people had the ability to purchase it.[4]

National

A similar question may be asked at a national level. Which countries appear to be short of food? Both international and national sources construct estimates of national food sufficiency and these estimates may conflict depending on the types and accuracy of food production and consumption data (Grigg, 1985:18-22).

3. The "improved" diet assumes a 10% increase in the share of food calories provided by animal products. The "full but healthy" diet assumes a 30% increase. This translates into an increased demand for primary foods by assuming an overall efficiency of 1/6 (16.7%) for the conversion of primary food calories into animal products; i.e., 600 kcal of primary foods produce 100 kcal of meat, milk, eggs, or other animal products (Blaxter, 1986, based on data from Miller, 1980). This assumption is high in comparison to observed net efficiencies of breeding populations of farm animals, which range from 3-6% for sheep and beef to 11-12% for pig meat, milk, and eggs (Holmes, 1980), due in part to the utilization of forage and waste products in animal production. The overall effect of the better diets is to increase primary food demand by 50% for the improved diet and 150% for the full-but-healthy diet.

4 But one issue this raises is whether increases in primary food production, intended to meet both desired dietary improvements and the needs of growing populations, can in the long run be sustained in the face of possible limitations in natural resources and growing stresses on the environment.

Table 1. Food Shortage Global and National

Population Potentially Supported by 1985 Primary Food Supply	
Food-Shortage Indicator	Total Population
Basic Diet (principally vegetarian)	**6 billion people** **120% of world population**
Improved Diet (about 15% of calories from animal products)	**4 billion people** **80% of world population**
Full But Healthy Diet (about 35% of calories from animal products)	**2.5 billion people** **50% of world population**
National Populations in Countries with Food Shortages	
Food-Shortage Indicator	Total Population
Dietary Energy Supply Less Than Basic Requirements, 1983-85	**1,485 million people** **30% of world population**
Dietary Energy Supply Less Than Usual Consumption, 1987-88	**465 million people** **9% of world population**
Famines Reported, 1987	**180 million people** **4% of world population**
Wars with Significant Food Disruption, 1987	**425 million people** **9% of world population**

Required Dietary Energy

A first measure is whether total dietary energy supply is sufficient to meet the food-energy needs of all members of a national population if the food were distributed according to need. Here it is possible to use data prepared by the United Nations Food and Agricultural Organization (FAO) for some 112 countries. The most recent available data are for the years 1983-85 (Sivard, 1987; FAO, 1985; ACC/SCN, 1987a). In 1985, 1,485 million people, 30% of the world population, lived in countries where the total dietary energy

supply, including imports, was less than that required for health, growth, and productive work.[5] Of these 46 countries, 29 are located in sub-Saharan Africa, eight in South and Southeast Asia, and six in the Western hemisphere (Figure 1).

5. Dietary energy supplies are estimates of the total food calories available at retail level after allowing for animal feed, seed, storage and marketing losses, and waste. These are usually expressed as calories available per capita and can be compared to a caloric per-capita requirement. The requirement used here is based on 1985 WHO/FAO/UNU estimates of national requirements for child growth, reproduction, and active adult work. These requirements, when expressed as a national average, take into account national differences in the population of age, sex, and gender and of climate and work requirements. The particular set of data used herein is taken from Sivard (1987:46-51).

Another measure of food shortage is to estimate the amount of food needed just to maintain the current *status quo* in food consumption (regardless of actual nutritional requirements). A country-level analysis of data from the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) for 69 countries indicates that, in this current crop year (1987-88), an estimated 465 million people, 9% of the world's population, live in countries where the national aggregates of crops, stocks, and import capacity will fail to meet their most recent average levels of consumption.[6] These 37 countries, shown by the darker standings in Figure 1, are the countries at highest risk for national food shortage in 1988 *unless* they receive food aid.

Famines

The most poignant faces of hunger are the faces of *famine*, the extreme form of food shortage. Famines are the large and persistent food shortages, which by visible impact attract the attention of the media and for many laypeople are synonymous with global hunger. Our eyes are again on the faces of Africa and its "hungry crescent" as hunger continues to plague the continent. Last year, *The New York Times* reported conditions of famine in 16 countries with a combined population of 180 million people or 4% of the world population (Figure 2).[7]

6. The estimate is based on the *World Food Needs and Availabilities* reports for the 1987/88 (July to June) crop year (USDA/ERS, 1987b,c, 1988). The 69 countries covered in these reports account for 38% of the world's population, 54% of the population of developing countries (GNP per capita less than $835), and 92% of the population of developing countries excluding China. Thus, the coverage of the chronically food-deficit, low income countries is reasonably complete. Based on the data updated in the February 1988 report, 465 million people live in countries where food availability from production, stocks, and expected commercial imports (or import capacity based on financial indicators) is expected to be less in 1987/88 than the average consumption of recent years. The "status quo" estimate of consumption is projected from the average per capita food availability of the 4 most recent years that deviate less than 1 standard deviation from the mean of the most recent 8 years. This measure of food shortage differs from the USDA/ERS "additional needs" statistics, which do not include stocks and projected imports.

7. Famines, operationally defined as a widespread absence of food over an extended period of time, are identified in a FAMINDEX developed by Brown University students from reports since 1950 in *The New York Times* (NYT). Reports of famine are usually indexed under "famines" but are also listed under "food" in the *New York Times Index.* The FAMINDEX itself consists of the total estimated population residing in countries in which a famine has been reported during the year of the famine's occurrence. These data are averaged over 7-year periods to smooth annual differences. Since most famines span several years, reports that continue to appear in the NYT are counted for each year of occurrence. The population of a country affected by a famine is used, rather than the actual population directly affected, since the latter is not estimated or reported consistently. However, as a result, if two famines in different countries affect the same number of people, the famine in the larger country will count more in this index than the famine in the smaller country. Thus, the populations referred to in the FAMINDEX are almost always larger than the actual population subject to famine, and the FAMINDEX should therefore be used primarily to compare countries and years, rather than as an actual measure of exposed population. Efforts are under way to validate the FAMINDEX by comparing it with other media, international newspapers of record, and listings by international agencies.

Nonetheless the trend in famines since the end of World War II is clearly downward, reflecting a lessening of the prevalence of famine and a major shift in famine incidence from populous Asia to less-populated Africa. Figure 3 shows the World Hunger Program's FAMINDEX averaged by seven-year periods beginning in 1950. The population residing in countries where famine was reported in *The New York Times* peaked in the period 1957-63 at a yearly average of almost 790 million, then declined to a yearly average of 265 million in 1978-84. This decline has continued over the last three years (1985-87), when the population of famine-plagued countries averaged 170 million.[8]

Food Wars

The faces of famine are often the faces of the victims of *war*. Indeed, the most difficult famines to alleviate or to prevent are those created or exacerbated by violent conflict and war, and one of the last major obstacles to the elimination of famine is the use of hunger as a weapon. "Food wars" include disruption to food supply through destruction of productive resources as in "scorched earth" policies and massacres of peasant farmers; disruption of income and flows of marketed food; blockage or expropriation of civilian food supplies by hostile groups; and all of the above as they affect hunger in refugee populations fleeing hostilities. In 1987, wars, defined as conflicts with more than 1,000 deaths, were fought in 23 countries (Sivard, 1987:28). In 17 of these, with a combined population of 425 million people, significant disruption of food systems has occurred, either as an intentional act of aggression or incidental to the destructiveness of the conflict.[9]

Food Poverty

The faces of the food-poor hungry are the faces of enduring *poverty*. They are often mocked by the general availability of food within their region, but their households are unable to pay for food or have access to the resources needed to feed themselves. Their poverty may take the form of insufficient land, unemployment or low wages, excessive rents or taxes, poor prices for produce or handicrafts, or the failure of customary food-security entitlements. Their numbers swell when food shortages—even shortages in

8. A limitation of any index based on media such as *The New York Times* is that reporting coverage may vary over time. However, it seems likely that the tendency would be towards more complete coverage over time due to the increasing interconnectedness of the modern world and more widespread news reporting. Thus, if anything, the observed downward trend would be *underestimated*, not overestimated.

9. Data on wars are derived from various editions of *World Military and Social Expenditures* authored by Ruth Leger Sivard and now in its 12th edition. She in turn credits William Eckhardt (Research Director, Lentz Peace Research Laboratory, St. Louis, Missouri) who has also assisted us directly in compiling data on food wars. The judgment as to which wars have involved substantial disruption of civilian food systems is our own. In general, we include cases where there is overt diversion or destruction of food supplies or of the potential to produce food, even if, in the case of continuing hostilities, the actions are undocumented during the current year. More difficult are cases where repressive measures and government policy meld together to, in effect, deny or restrict access to productive resources and income as, for example, in the case of forced relocation in South Africa.

distant lands that have greater

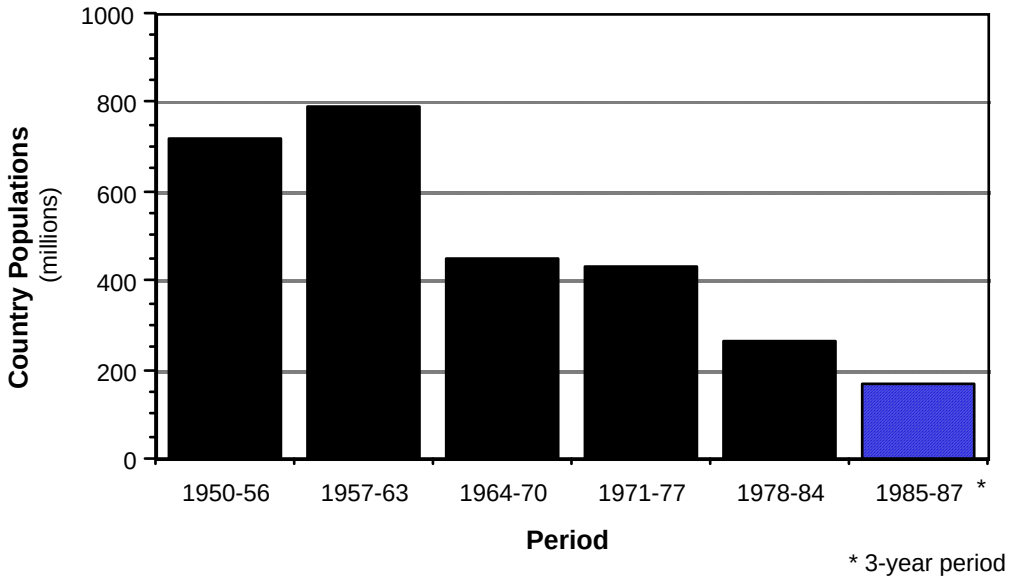


Figure 3. Average population in countries with famine as reported in *The New York Times*, 1950-87.

purchasing power—drive up the prices of whatever food is available or when a natural disaster reduces the productivity of the land they farm. For example, a recent study of central Kenya found that over 10% of the population is chronically food-poor, but during the recent drought of 1984, the proportion rose to 40% (Downing, 1988).[10]

The measures of food poverty are the measures of nutritionists and social scientists concerned with equity and social justice. Calculations of food poverty begin with the FAO data used to measure national food shortages, but they recognize, more realistically, wide discrepancies in access to food. Even countries with supplies greater than basic requirements have substantial numbers of hungry people—people too poor in money to purchase food, too poor in resources to raise food, and too poor in political power to claim food.

Studies estimate this maldistribution by examining income distribution, household expenditures, or household food consumption. Households whose ability to obtain food falls below some threshold of required dietary energy are considered at risk of hunger or undernourished. The thresholds used to calculate the numbers of hungry range from the energy required for sedentary survival, to the requirements for growth and reproduction, to the requirements for various levels of functioning and work. These extremes from near-maintenance to high levels of activity differ by almost a factor of two. Thus it is not

10. Data are drawn from the Central Bureau of Statistics/National Environment Secretariat Survey of Drought Responses conducted in January 1985 in 6 districts of Central and Eastern Provinces of Kenya. Food poverty is measured as the population estimated to have no reliable off-farm income and only able to produce less than two-thirds of their food requirements from on-farm resources (Downing, 1988).

surprising to find that estimates of the population residing in households too poor to obtain the energy they need also differ by a similar factor (Table 2).

The World Bank employed a threshold considered adequate for work and calculated that 730 million people in 87 developing countries (excluding China) lived in households that were too poor to obtain the energy sufficient for work in 1980 (World Bank, 1986). At that time, these 87 countries had a combined population of 2.1 billion. Updating this proportion to the 1985 developing world population and using a low estimate of China's food poverty (70 million), we estimate that 950 million people, or 19% of the world population, were food poor in 1985.[11]

11. The method used by the WB and developed by Reutlinger and Selowsky (1976) allocates the per capita dietary energy supply as estimated by the FAO for 1980 to different income groups, taking into account the share of income that different groups spend on food. The analysis is performed for 87 developing countries, which contained 92% of the developing world's population excluding China. However, for these 87 countries, data on income distribution are available for only 35 countries with 70% of the developing world's population. The estimated shares of income for the remaining countries are extrapolated from the 35. Income is then allotted to the purchase of a per capita energy diet, and those income groups unable to purchase 90% of the estimated required dietary energy are considered to have an energy-deficient diet. Thus, there are three major assumptions: *1)* that income is a good estimator of household food supply; *2)* that the estimates of income distribution, many collected in the early 1970s, provide an adequate measure of income inequity; and *3)* that the WHO/FAO requirements for dietary energy (WHO, 1973) used in the study provide an appropriate threshold of food poverty. We update these estimates by applying the regional share of the population with insufficient calories for an active working life in 1980 in 87 developing countries to the entire 1985 population of developing countries. This further extends the range of the already inadequate estimates of income distribution another five years, i.e., it is implicitly assumed that no change has taken place since the 1970s. To this is added the current Chinese estimate of population below the poverty level, some 70 million (Riskin, 1988). This is a conservative estimate, insofar as relatively recent Chinese statements (Grigg, 1985) and our own discussions with Chinese authorities cite proportions of hungry as 10-11% of the population or over 100 million.

Table 2. Food Poverty Developing Countries

Population in Developing Countries Too Poor to Obtain Dietary Energy

Food-Poverty Indicator	Total Population
Energy Insufficient for Work	**950 million people** **19% of world population**
Energy Insufficient for Minimal Adult Activity and Healthy Child Growth	**585 million people** **12% of world population**

The FAO, in contrast to the World Bank, favors the use of a food-energy threshold for the maintenance of bodily functions and minimal activity for adults and adolescents combined with a desired full-growth requirement for children. Combining these two criteria gives an estimate of 348 million undernourished in 93 developing countries in 1983-85 (ACC/SCN, 1987a). Updating these figures and adjusting similarly for the absence of China, we estimate that 585 million people lived in households too poor to obtain the energy sufficient for minimal activity among adults and for the healthy growth of children in 1985.[12] These food-poor individuals—using both standards of food poverty—live primarily in South Asia and Africa (Figure 4).

Over the last 36 years, the number of food poor in the world has been, by one measure, relatively constant, while the proportion of the food poor in the world has been halved. Using the more stringent measure of food poverty employed by the FAO, Grigg (1985:50) has reconstructed the estimates of numbers and the proportions of the population with

12. The FAO (1985) method also attempts to allocate the per capita dietary energy supply to different groups of households using not only income distribution data but, where available, household survey data on food intake or food expenditure. These are then used to estimate a coefficient of variation for a log-normal distribution around the estimated per capita dietary energy supply. Using the estimated coefficient, the population in households below a required threshold is estimated. In this case, the threshold selected is considerably lower than that chosen by the WB. It is set at 1.2 times the basal metabolism rate for adults and adolescents, a rate sufficient for minimal activity (described by the FAO as a "maintenance" requirement), but not for productive work. Added to this requirement is one for children that will provide the estimated energy required for adequate growth based on actual intakes of healthy children. This method, employed by the FAO in the *Fifth World Food Survey* and in earlier variants, has been updated for the ACC/SCN *First Report on the World Nutrition Situation* (1987a) by using the dietary energy supply estimates for 1983-85. We further extend the data slightly beyond the original 93 countries. The regional proportions of the population falling below the threshold are applied to 1985 regional estimates of population for all the developing countries except China, and half of the estimated Chinese population below the poverty line (35 million) is added to account for China.

dietary energy less than required for sedentary survival and minimal activity at four points in time, and to these we have added a more recent estimate (Figure 5).

In the United States, as in other industrialized nations, hunger results from food poverty and deprivation, and shortage except in wartime is virtually unknown. The most often cited recent estimate for hunger in America is 20 million people, an estimate arrived at by the Physician Task Force on Hunger in America (1985:183-6) based on the number of people whose income falls below the poverty level without food-stamp supplements.[13]

Food Deprivation

The faces of all hungry people are the faces of the *food-deprived*. Theirs is the hunger of individual people who live in regions of food scarcity or reside in food-poor households. But theirs is also the hunger of individuals deprived of nutrition that may be available within the household. Such deprivation may result from intentional abuse or incidental neglect, from self-denial by diet or fast, from disease that hampers food intake, food retention, or nutrient absorption, or from diets that fail to meet the special needs of individuals for growth, reproduction, or micronutrients. The measures of food deprivation are the measures of nutritionists, medical scientists, and public health educators. They report the condition of children, of pregnant women, and of all people lacking essential micro-nutrients.

13. This calculation begins with the 1983 figures on the population below the poverty line, which are based specifically on the ability of an individual to purchase a minimal diet. The estimate of the number of hungry then takes the people in poverty who receive no food stamps (15.5 million), 25% of the remainder to allow for inadequate nutrition even with food stamps (4.95 million), and 10% of the "near-poor" who are in need but ineligible for food stamps or who are eligible but do not receive them (2.4 million). From this total of almost 23 million people, the Task Force cites 20 million as their estimate of the number of hungry, an estimate they still claim to be valid today.

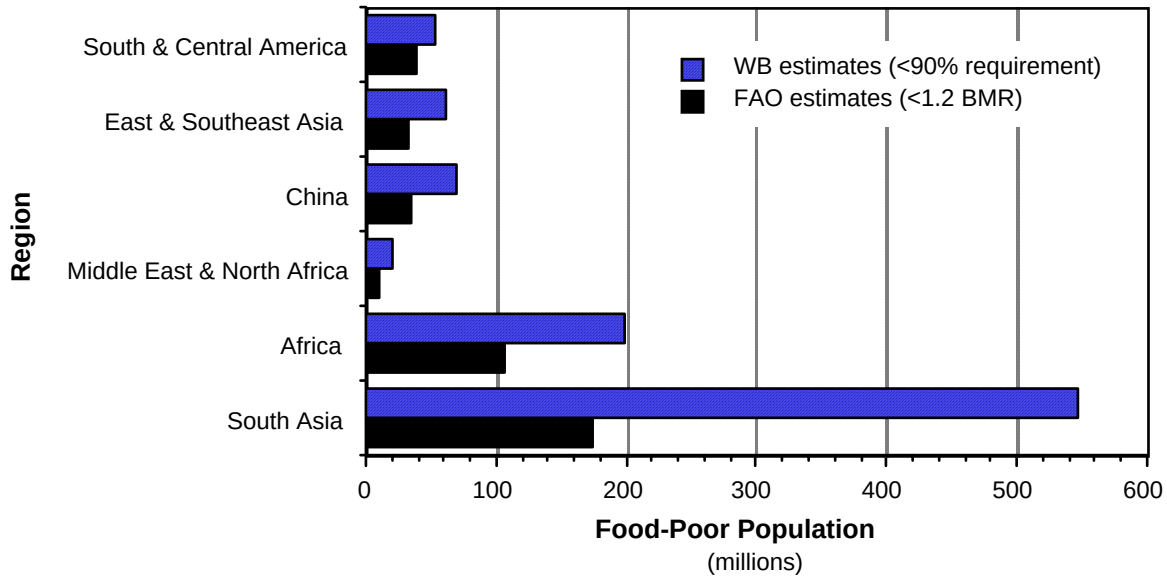


Figure 4. Food-poverty population by region and food-energy requirement, 1985. World Bank food-energy estimates use 90% of estimated dietary requirement (active work) to determine food-income adequacy. FAO uses 1.2 times the Basal Metabolic Rate (BMR) for adults and adolescents (minimal activity) and a more generous requirement for children. Source: World Bank (1986) and ACC/SCN (1987a) with updates by the World Hunger Program.

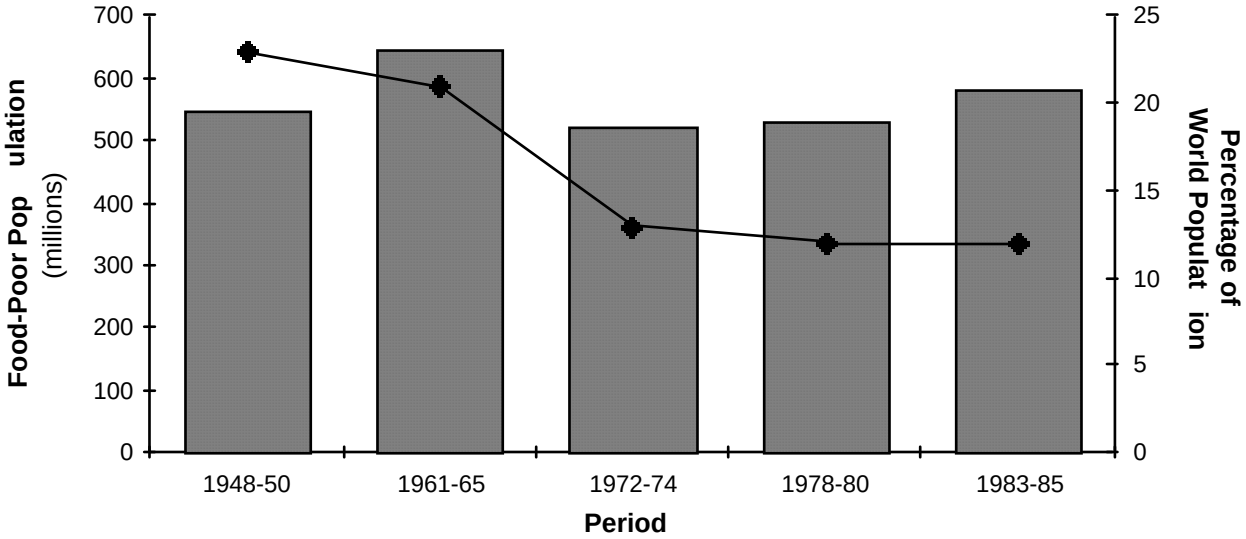


Figure 5. Numbers and proportions of world population in households with dietary energy less than that required for minimal activity, 1949-85. Absolute numbers are shown as columns, and percentages are plotted as a line. Source: Grigg (1985) and ACC/SCN (1987a).

Table 3. Food Deprivation Children, Women, Adults and Children

Children Affected by Food Deprivation

Food-Deprivation Indicator	Total Population
Children Underweight for Age	**165 million children** **29% of the world's children less than 5 years old**
Infants Born Underweight	**20 million infants** **16% of the world's infants**
Diarrheal Related Disease Deaths	**5.0 million children** **1% of the world's children less than 5 years old**
Vitamin A Deficiency Blindness	**3 million children** **< 1% of the world's children less than 10 years old**

Women Affected by Food Deprivation

Food-Deprivation Indicator	Total Population
Iron-Deficiency Anemia	**50 million women** **51% of the world's pregnant women**

Adults and Children Affected by Food Deprivation

Food-Deprivation Indicator	
Iodine Deficiency	**200 million people** **4% of world population**

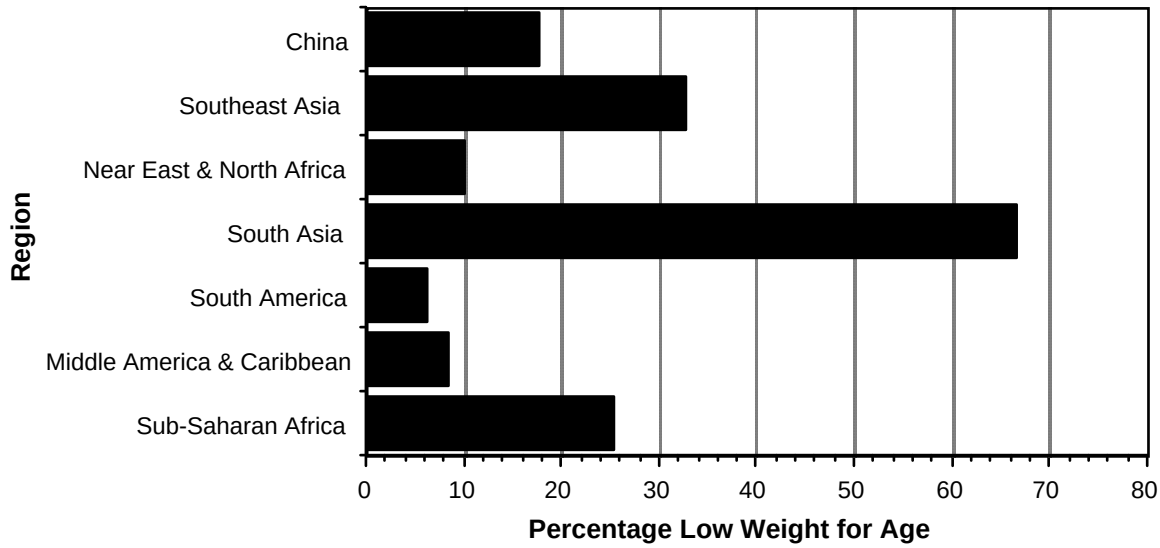


Figure 6. Percentage of children underweight by region, 1984. Based on surveys of children under five years old. Underweight is defined as two or more standard deviations below the mean weight for children of the same age in a healthy, well-nourished population. Source: ACC/SCN (1987a).

Children

Hunger's toll on *children* is experienced in their low birthweights, in the wasting and stunting of their growth, in their diarrheal-related deaths, and, in Asia in particular, in death or blindness caused by Vitamin A deficiency and cretinism and less severe mental/motor impairments caused by iodine deficiency (Table 3). Representative samples of the population in many countries tell us that more than one-fourth of the world's small children are underweight for their age,[14] and one-sixth of the world's infants are born

14. This estimate represents the proportion of children, 0-60 months of age, whose weight falls below the range of normal variation for children of the same age in a healthy, well-nourished population. In some instances this has been defined as weight less than 75% or 80% of the mean and, in some instances, weight at least two standard deviations below the mean for the standard population. Within countries, using representative national samples, the same criterion has been used, but these different cutoffs for underweight may contribute to variation in the estimated prevalence of underweight across countries. Low weight-for-age may result from *wasting* (recent acute undernutrition leading to weight loss, as reflected in low weight for height) or *stunting* (chronic undernutrition over an extended period leading to growth impairment, as reflected in low height-for-age) or both. For underweight by region, see ACC/SCN (1987a); for underweight by age, see WHO (1987); for underweight by rural or urban area, see FAO (1985).

under-weight.[15] A third of all small children who die before the age of five—some five million a year—die because they cannot retain or absorb food and water.[16] As many as 700,000 new cases of eye damage develop each year among pre-school children due to Vitamin A deficiency, of whom perhaps 60% die and 30% remain partially or totally blind.[17] Some 3 million people are estimated to suffer from cretinism, as a consequence of severe iodine deficiency during early fetal development and the first two years of life.[18]

The prevalence of different types and categories of food deprivation varies markedly by region.[19] An extraordinary percentage of children under age five—67%—is underweight in South Asia (Figure 6) relative to Western standards of growth. Controversy continues over the appropriateness of these weight-based standards in judging nutritional adequacy.[20] Relatively high proportions of underweight children are also found in Southeast Asia and in sub-Saharan Africa. China, with a still high 18%, has made considerable progress in recent decades—data for older children (7-10 years old) show increases in height of an inch or more (2.5-3.6 cm) per decade over the three decades 1950-80 (Piazza, 1986:138).

15. Using figures from 1982 surveys (WHO, 1984), updated with birth estimates from 1986, it is estimated that 20.3 million infants had low birthweights of under 2,500 grams out of an estimated 129 million births, or 15.7% (Grant, 1987:116).

16. Total annual deaths of children under five years of age in developing countries are estimated to be 14.1 million, of which 35.7% or 5 million were due to diarrhea (Grant, 1987:111).

17. This estimate by the ACC/SCN (1987b:33) is based on the WHO (1985b) estimate of up to 500,000 new cases of eye damage per year for Asia. Applying this rate worldwide to countries with known Vitamin A deficiencies results in an estimated prevalence of some 700,000 new cases per year among pre-school children. Of these eye-damaged children, it is estimated that 60% die, 25% of the survivors are totally blind, and 50-60% of the survivors are partially blind (IVACG, 1981:8).

18. Some 3.15 million people of all ages are said to suffer from cretinism (ACC/SCN, 1987a:40). No estimates have been offered for the number of children newly afflicted by cretinism in any one year.

19. Data for underweight by region come from the ACC/SCN (1987a:8-31). These data use the criterion of two standard deviations below the mean for 40 countries where representative sample surveys are available. The data are extended to 94 countries by regressing the proportion underweight-for-age on dietary energy supply, infant mortality rates, and other less-significant variables and by using the resulting estimation equation to impute proportions underweight for countries in which it was not measured directly.

20. Certain economists and statisticians have suggested that Western standards for growth—used as the basis for judging nutritional adequacy worldwide—may be inappropriate for some populations. They argue that small size may be adaptive to the lowered dietary energy available, and that South Asians in particular may be more able to limit growth in response to limited diet without adverse effects on health and development. South Asian children therefore may grow less than well nourished, less disease-impaired Western children, but are not "undernourished" by their alternative criterion (see, e.g., Seckler, 1982). Nutritionists respond that growth retardation, as a response to the interactive effects of poor diet and infection, may serve to lower nutritional requirements, but coping with nutrient scarcities does not occur without functional impairment (Martorell, 1987; see also Beaton, 1987, and Scrimshaw, 1987).

The data that record underweight by age provide a consistent clue to one source of child undernourishment, the critical period of weaning from breastfeeding. WHO data on the

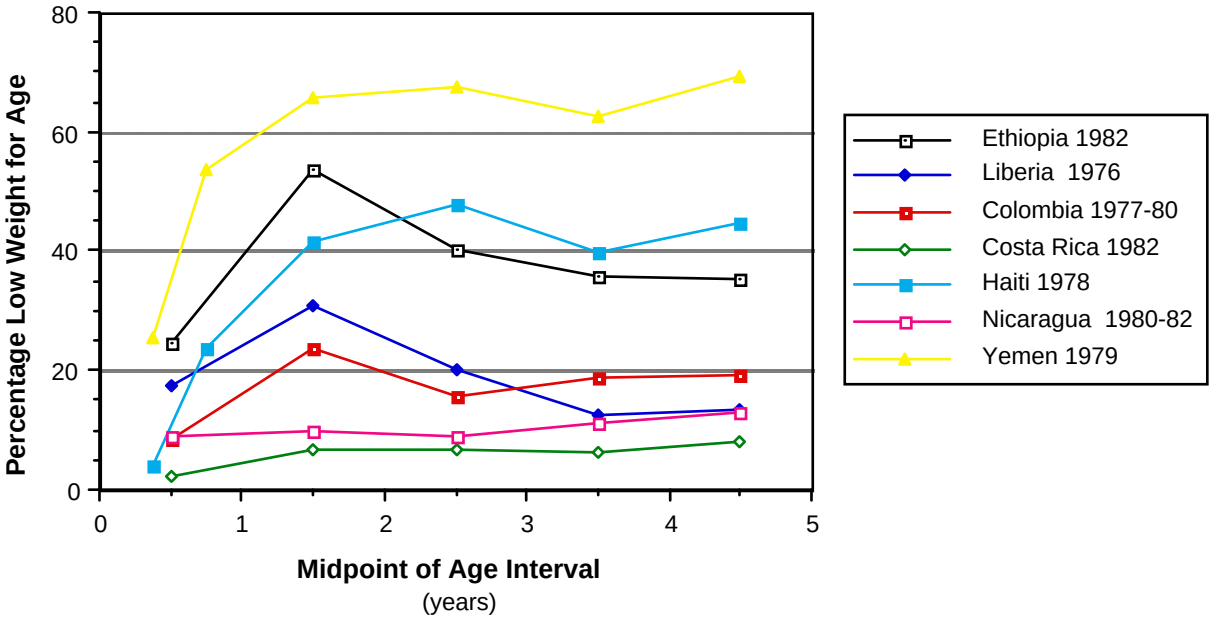


Figure 7. Percentage of children underweight by age. Based on representative country surveys for the given year(s). Source: WHO (1987).

percentage of underweight children by age from many different countries, shown in Figure 7, appear to peak in the midst of the transition from breast milk to other foods.

Still another consistent clue to the source of early childhood wasting and stunting emerges from comparing the frequency of underweight children in cities and the countryside (Figure 8). The literature of development often speaks of the plight of the growing numbers of urban poor in developing countries. But the misery recorded in the measured wasting and stunting of children consistently tells of still greater numbers of hungry in rural areas. The most likely explanation for the still greater prevalence of rural over urban malnutrition lies in the advantages that urban areas hold for child nourishment: *a)* improved access to health care which lessens the impact of diseases that can prevent food absorption and retention, and *b)* less seasonal variation in food supply due to the availability of marketed, and sometimes subsidized food.

Vitamin A deficiency (xeropthalmia) occurs primarily in South and Southeast Asia—especially Bangladesh, India, and Indonesia—with notable additional pockets in Africa, the Near East, and the Americas. Countries with high prevalence of xeropthalmia in 1986-87 are shown in Figure 9 (ACC/SCN, 1987a:35; WHO, 1988:26-27).

In the industrialized countries, authorities and advocates for child health from 23 countries outside the United States either report the absence of any problems of child malnutrition or only relatively minor problems, including those of aboriginal children (Australia), native children (Canada), disadvantaged and "traveling" children (Ireland), children on

"alternative" diets (Netherlands), and low-income children (Portugal).[21] In the U.S., studies and surveys of low-income communities reveal nutritional measures, infant mortality rates, and even cases of protein-calorie deficiency diseases that are more characteristic of developing countries.[22]

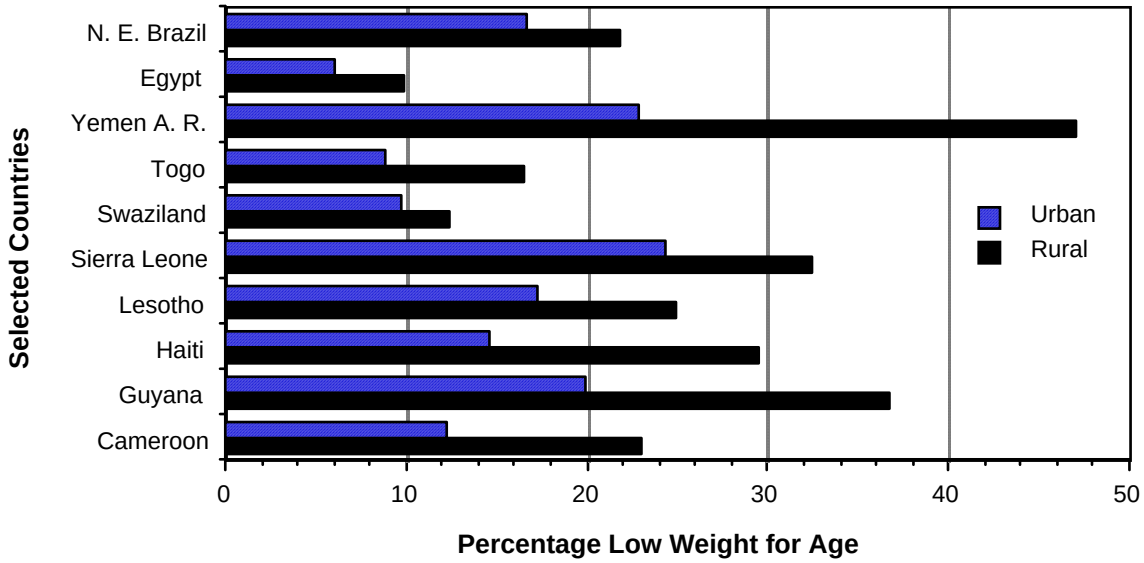


Figure 8. Percentage of children underweight Rural/urban differences. Based on representative samples of children under five years old. Underweight is defined as two or more standard deviations below the mean weight for children of the same age in a healthy, well-nourished population. Source: FAO (1985), Swaziland (1983), and PAHO (1976).

Women

The low birthweights of children are also testimony to the inadequacy of their *mothers'* nutrition before and during pregnancy (WHO, 1984). The special needs of mothers during pregnancy continue during lactation, needs that are strained under conditions of food scarcity and poverty. Anemia caused by iron deficiency and malaria affects all people, but especially women of reproductive age and very young children (Figure 10). About half of the world's pregnant women—and half of all women—have low blood hemoglobin levels

21. Based on a survey in progress (by Dorothy Noyes for the World Hunger Program) of 32 high- and mid-income countries. Replies have been received from authorities or groups in 24 of these countries to date.

22. See, for example, the workshop report *Hunger Surveys in the United States*, University of California, Berkeley (1987).

(ACC/SCN, 1987a:36-38). Severe anemia compromises work performance and health, and even mild deficiency may affect psychological functioning.[23]

Food deprivation based on gender, although widely suspected, is poorly documented. The strongest evidence for it surfaces in the many ethnographic reports of diets and feeding customs that favor males and in the unusually high ratios of males to females in South Asia that contrast with the situation elsewhere in the world (i.e., where females generally outnumber males). A careful study in the Punjab State, which has the highest male/female ratio in India, reported selective deprivation of very young daughters born late in family formation through the preferential giving of both medicine and more nutritious and expensive foods to their brothers (Das Gupta, 1987).

Adults and Children

Iodine deficiency is the other major category of micronutrient deficiency still limiting human potential. Although most prominent in its severe clinical forms—goiter and cretinism—it is increasingly recognized that even less severe iodine deficiency can have damaging effects on mental and motor skills. The term "iodine deficiency disorders" is increasingly used to

23. Estimates exclude China and were made by WHO with reference to over 500 studies on the prevalence of anemia available around 1980. Anemia is defined as hemoglobin concentration below WHO reference values for age, sex, and pregnancy status (DeMaeyer and Adiels-Tegman, 1985; ACC/SCN, 1987a:36-38).

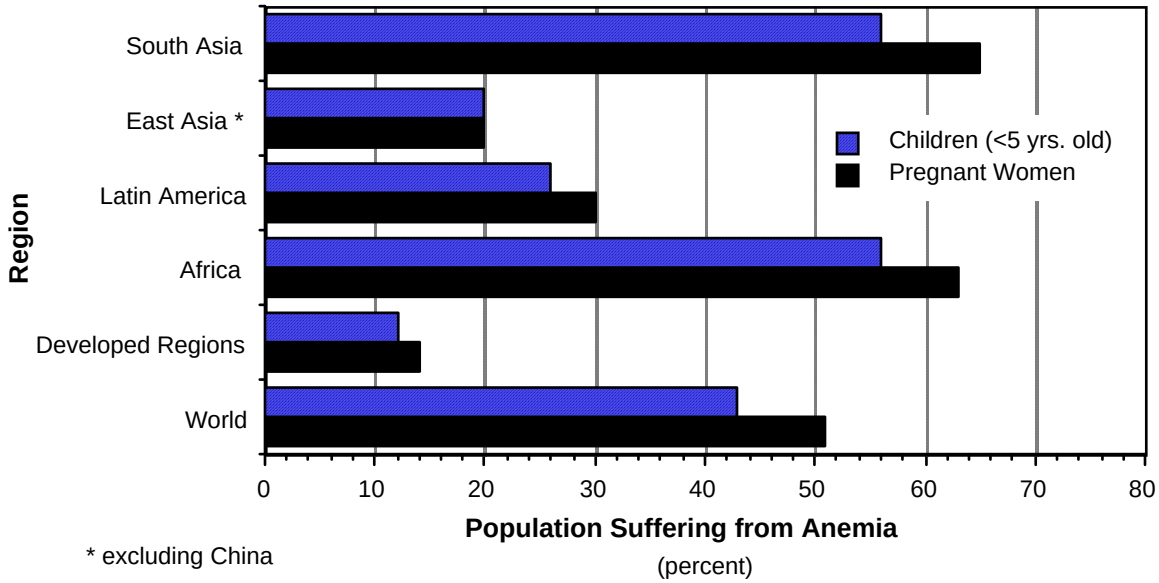


Figure 10. Percentage of anemia in children and pregnant women by region, around 1980. Source: ACC/SCN (1987a) based on DeMaeyer and Adiels-Tegman (1985).

encompass this range of effects. Pregnant women and the very young are the most important targets for interventions to prevent cretinism and less severe forms of neurological damage (ACC/SCN, 1987b).

As many as 200 million people are estimated to suffer from iodine deficiency. This condition occurs all over the world, but is particularly prevalent throughout South and Southeast Asia and to a lesser extent in Africa and Latin America in relatively isolated mountainous and inland regions and in continually flooded terrain (Figure 11). New pockets of iodine deficiency are continually being discovered.

Hunger Attention and Advocacy

Hunger is one of a small set of global problems that includes issues of war, environment, and development. *Public attention* to hunger and *advocacy* of remedial action fluctuate. An examination of references to hunger, famine, and food in a major periodical index revealed that media attention to hunger in 1987 declined by about 40% from the average of the previous five years, falling drastically from the peak level during 1986 (Table 4). Recent improvements in computer data bases draw on a growing set of world media,

particularly news reports, and now permit a much closer monitoring of media attention. An effort to utilize this research resource is now under way.[24]

References to hunger in 1986-87 were at an all-time high in the data on nuclear war and hunger (1949-87) shown in Figure 12.[25] In this series, attention to hunger is surprisingly constant over time except for the surge in periodical attention coincident with recent African famines.

24. NEWS, a data base of the NEXIS Service, covers 34 files of newspapers, wire services, and broadcast transcripts, from the U.S. and international media, most of which date from the late 1970s and early 1980s.

25. The data for Figure 12 are taken from Hopkins (1987:2-6), who used the *Readers' Guide to Periodical Literature* to produce a time series of reports over the period 1949-86. Using a similar methodology, we have updated his work to the end of 1987.

Table 4. Hunger Attention Periodical Reports on Hunger

Attention Given to Hunger in the Periodical Literature	
Hunger Attention Indicator	Percentage Change
Periodical References to Hunger, 1987	**40% decline from 1982-86 average**

Attention to hunger is generally low relative to nuclear war, which shows large fluctuations over the period of study. A recent representative sample of U.S. public opinion found "reducing poverty and hunger in other countries" rated the lowest priority of eight national and international concerns despite the fact that "disease, hunger, and poor health" were perceived by them as the "worst possible problem of the Third World" (Contee, 1987:47-53).

Hunger advocacy takes many forms. It includes activities designed to increase the saliency of hunger as a public issue and efforts to create a constituency for specific programs of hunger alleviation as well as for broad social reform or fundamental change to address the conditions that give rise to hunger.

In 1987, public recognition of efforts to combat hunger expanded. There are now at least five major sets of hunger-related awards, several of which were presented for the first time in 1987. These include: *The Africa Prize for Leadership* of The Hunger Project, The General Foods Corporation *World Food Prize*, the U.S. *Presidential End Hunger Awards*, the *World Hunger Media Awards* of World Hunger Year, and our own Alan Shawn Feinstein *World Hunger Awards.*

The early warnings of potential recurrence of famine in Ethiopia encouraged a variety of advocacy activities, including: efforts to influence international policy, as in The Hunger Project's *Ethiopia: A Call to Action*; the efforts of InterAction and other groups of private voluntary organizations to encourage renewed contributions for aid; and Bob Geldof's well-publicized fact-finding trip to Ethiopia.

Addressing needed institutional reform in medical care, a new Independent International Commission on Health Research for Development was formed in 1987 with the support of private foundations to advocate new approaches to the health problems of developing countries, including those involving interactions between nutrition and disease.

Hunger Alleviation

The most common societal response to hunger is *alleviation*—measures taken to provide food directly to needy people in the form of emergency relief to food-short people; food aid, rations, or subsidies to food-poor people; and supplementary foods to those with special needs.

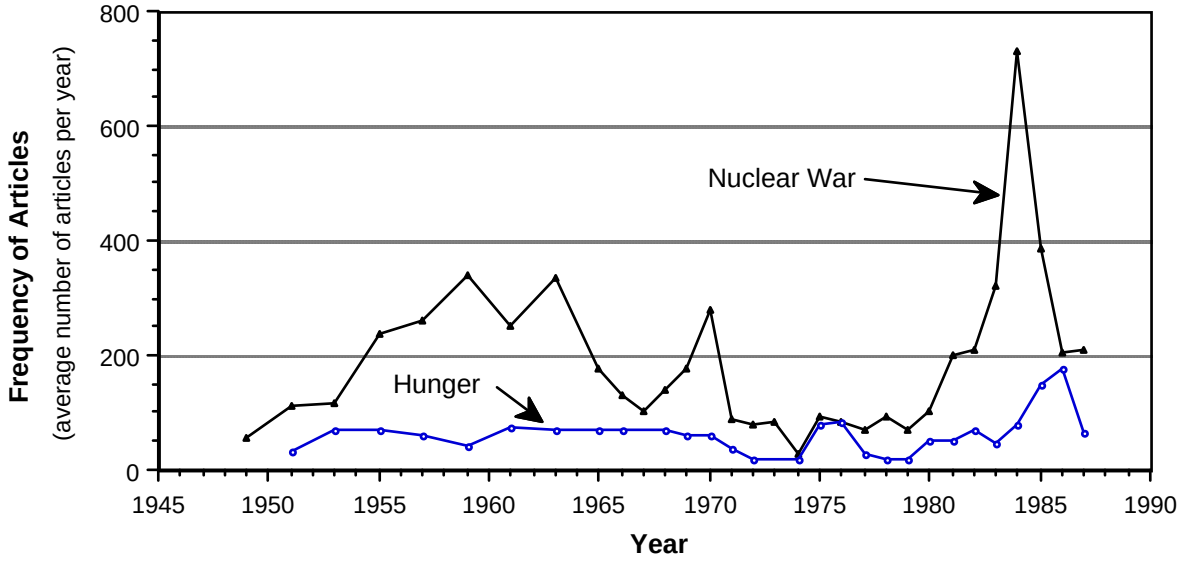


Figure 12. Periodical references to nuclear war and hunger, 1949-87. Based on a search of the *Readers' Guide to Periodical Literature*. Note variations in time periods used to compute average frequency. Source: Updated from Hopkins (1987).

Food Aid

Cereal food aid from July 1986 to June 1987 totalled 12.2 million metric tons (mmt), amounting to 7% of world trade in cereals and 11% of the total imports of developing countries (WFP, 1988). Over one-half (55%) of the food aid went to established food-aid programs and over one-fourth (29%) to "emergency" uses. Half of the aid went to Africa, including 25% to sub-Saharan Africa, and much of the remainder went to other low-income, food-deficit countries. Non-cereal food aid including vegetable oil, dried skim milk, and other commodities totalled 1.0 mmt. The givers of food aid came primarily from Europe and North America, whereas the receivers were clustered in Africa and South Asia where the greatest needs exist (Figure 13).

One measure of the adequacy of current levels of food aid is the gap between the estimated requirements for, and the actual deliveries of, emergency food aid in sub-Saharan Africa during 1987-88. Data from the FAO show that actual deliveries of emergency food aid in 1987-88 have met only 59% of the projected food-aid requirements.[26]

26. An FAO Special Report (FAO, 1988) estimates that food-aid requirements for sub-Saharan Africa total 4.6 million metric tons (mmt), of which 1.977 mmt are considered exceptional requirements. Pledges of food aid are 3.822 mmt for 1987/88 (depending on marketing year), of which 1.163 mmt have been delivered (59% of the estimated exceptional requirements).

Using data from the FAO and the USDA, it is possible to calculate a second measure, the degree to which food aid helped meet estimated minimal dietary energy requirements. In 1986-87, food aid was less than 70% of the worldwide need and only about 40% of the need in sub-Saharan Africa.[27]

It is important to recognize, however, that food aid may in some instances be detrimental to long-term policies of socioeconomic development and growth. Recent studies in Bangladesh, for example, suggest that official figures on foodgrain needs may underestimate local production and consumption and allow ill-advised food and economic policies to proceed (Wennergren and Whitaker, 1986). How food aid is designed and delivered can greatly influence how well it maximizes immediate benefits for the most needy. Recent

27. Of the 12.2 mmt of cereal food aid from July 1986 to June 1987, 10.1 mmt went to low-income, food-deficit countries (less than $835 GNP per capita) and 3.1 mmt to countries in sub-Saharan Africa (FAO data cited in World Food Programme, 1988). The USDA/ERS (1987a) estimated that additional cereal needs, according to nutrition-based requirements, were 17.5 mmt for the entire group of 69 developing countries and 7.9 mmt for sub-Saharan Africa. The latter estimates do not include available stocks or import capacity. Combining the USDA/ERS and FAO data, we estimate that food aid in 1986-87 was less than 70% of the total world need (>17.5 mmt) and 39% of the requirements in sub-Saharan Africa.

Table 5. Hunger Alleviation Food Aid and Targeted Programs

Food-Aid Deliveries and Donations Compared with Estimated Requirements

Hunger Alleviation Indicator	Percentage of Required Aid
Deliveries of Emergency Food Aid, Sub-Saharan Africa, 1987-88	**59% of projected requirements**
Food-Aid Donations to 69 Developing Countries, 1986-87	**<70% of requirements to meet nutritional needs**
Food-Aid Donations, Sub-Saharan Africa, 1986-87	**<40% of requirements to meet nutritional needs**

Success of Targeted Programs

Hunger Alleviation Indicator	Percentage Treated
Treatment of Diarrhea Cases Using Oral Rehydration Therapy	**12% of diarrhea cases in young children**

papers suggest diverse ways food-aid projects can assist in economic changes in developing countries (Hopkins, 1988) and can contribute to the diverse coping strategies of food-poor women (Katona-Apte, 1986). Overall, recent research suggests that food aid can have a diversity of beneficial effects if properly administered through a variety of programs. Examples include literacy and school feeding programs (U.S. Congress, 1988), different types of food subsidy/food stamp schemes in Sri Lanka (Edirisinghe, 1987), and selected food subsidies in the Philippines (Garcia and Pinstrup-Andersen, 1987).

Targeted Programs

In addressing the special needs of children, public health workers have long recognized that problems of hunger are integrally tied to more comprehensive problems of health and well-being. In particular, the United Nations Children's Fund (UNICEF) has targeted child survival as its key goal and has devised a multipronged assault on the major infant and child killers: malnutrition, major infectious diseases for which immunization is available, and diarrheal diseases. UNICEF's so-called GOBI strategies involve four components: growth monitoring, oral rehydration, breastfeeding, and immunization.

Little information is available on the successful implementation of growth monitoring in relation to hunger-alleviation measures worldwide. Berg (1987) reports that the use of

growth charts serves as a cornerstone for the successful supplementary feeding scheme in Tamil Nadu in India. UNICEF describes widespread use of growth monitoring in Indonesia and a particularly successful program in Thailand (Grant, 1987:78-79).

Table 6. Hunger Prevention Food Production versus Population Growth

Population in Developing Countries with Long-Term Gains in Per Capita Food Production	
Hunger Prevention Indicator	Percentage of Population
Average Increase in Per Capita Food Production > 0.5% Per Year, 1964-85	**73% of total population in developing world**

Five million children die each year from diarrheal disease due to its disruption of their ability to take in and absorb nutrients. Oral Rehydration Therapy (ORT) is a practical and inexpensive treatment for this condition that involves simple solutions of water, sugar, and salts to replenish moisture and electrolytes. UNICEF estimates that, in the mid-1980s, 12% of all cases of diarrhea in young children were treated with ORT (Grant, 1987).[28]

Breastfeeding has been targeted as an objective by UNICEF and child and other advocacy groups since the 1960s in response to studies that suggested that breastfeeding was on the decline throughout the developing world (e.g., Berg, 1973). The actual picture appears to be more complicated—fortunately so for the infants of the world. As of 1987, survey data from representative samples of mothers were available for two different dates in 18 developing countries. Breastfeeding declined in seven countries (but may have recovered somewhat in two), increased in three countries, and stayed practically unchanged in eight countries (Millman, 1986, 1987:12-13).

Hunger Prevention

To *prevent* hunger is to address its causes: the proximate causes of food shortage, poverty, and deprivation and the more complex but fundamental forces of environment, population, agricultural productivity, and human exploitation that combine to create the three conditions of hunger. Over the long run, hunger arises when the growth of food productivity and the system of food security *lag* relative to population growth and the extraction of food surplus by nonfood producers. All of this occurs against a largely unpredictable background of natural and human-induced variations in the resources and hazards of food production.

Thus, some indication of long-run progress in the prevention of hunger can be found in the rates of increase in food production compared with the growth of population, changes in the equity of income distribution, and fluctuations in the resources and hazards of food

28. This includes therapy using pre-mixed salts made according to the WHO/UNICEF formula or home-made sugar and salt solutions.

production. Between 1964 and 1985, for example, food production increased at a rate significantly greater than population growth in countries with 73% of the developing world's population (Figure 14).[29] This important indicator of increase in food production is in per capita terms, thus allowing for the differential increase in population around the world.

The increases were concentrated in Asia and, more specifically, in the two countries with the largest populations, China and India. By contrast, many African countries experienced a net decrease in per capita production, fueled in part by high rates of population growth (Figure 15). Nevertheless, some African nations have achieved promising increases in food pro-duction. In Zimbabwe, for example, a combination of improved technologies, government

29. Based on the FAO index of food production per capita for 1964-66 and 1983-85 reported in *World Resources 1987* (IIED/WRI, 1987). An average increase of 0.5% per year in per capita food production during this period (equivalent to about a 10.5% cumulative increase over the period) is taken as evidence of significant production increase over the rate of population growth.

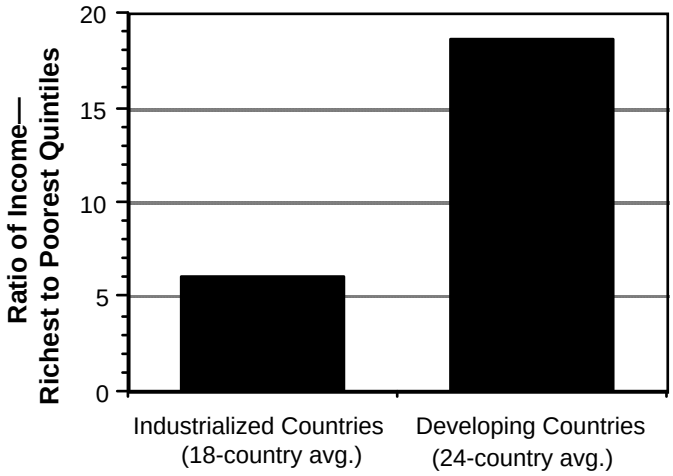


Figure 16. Ratio of income of the richest fifth to the poorest fifth of households, industrialized and developing countries. Based on household income surveys dating back to 1972. Source: World Bank (1987).

policies, credit availability, favorable prices, and marketing opportunities enabled smallholder farmers to triple maize production between 1979 and 1985 (Rohrbach, 1987).

At the same time, inequity in income remains high in developing countries, much greater than in the industrialized countries (Figure 16).[30] Unfortunately, given the rarity of income-distribution data for developing countries, progress in reducing such inequity cannot be reliably measured.

The year 1987 saw a recurrence of drought in Africa and severe drought in parts of India. Recent reports (e.g., Jones *et al.*, 1986; Hansen, 1988) indicate that 1987 was the warmest year on record for the globe as a whole, following on the unusually warm years of 1980, 1981, and 1983. These could be forerunners of the expected "greenhouse" rise in temperature that could cumulate into significant climate change by the middle of the next century. Such change, if it occurs, would have important but still unknown effects on the long-term productivity of the various agricultural regions of the world, enhancing some and diminishing others (Chen and Parry, 1987; Sinha *et al.*, 1988).

30. The *World Development Report: 1987* (World Bank, 1987:252-53) lists a set of income-distribution studies in 42 countries beginning in 1972. The percentages of household income are reported by quintiles of household population. Only five of the studies from the 18 developing countries are from the 1980s, making it very difficult to infer changes over time.

THE HISTORY OF HUNGER

The history of hunger is sparse—the hungry seldom write history. In 1987, an interdisciplinary seminar involving 22 faculty from 10 departments at Brown University examined the history of hunger from four temporal perspectives: ages, millennia, centuries, and decades. Their major findings, now being readied for publication (Newman *et al.*, 1988), help to place current hunger and societal response to it in the larger framework of human history. It also serves as prologue to a consideration of the future of hunger.

The Prevalence of Hunger

As far as we know, there has always been some hunger.[31] But although hunger has always been with us, its prevalence has varied greatly. The history of hunger is marked by fluctuating feasts, diminishing food shortage, and continuing, if not growing, food poverty. Recent times include evidence for *smaller proportions* but *increasing numbers* of hungry people.

Fluctuating Feasts and Famines

The history of hunger for most groups and places is replete with alternating periods of sustained deprivation and relative plenty, interspersed with long periods of almost or barely enough food. To illustrate these fluctuations, we employ an anthropometric measure closely linked to nutrition, *human height*, and more specifically, for most of the period, the height of adult males.[32] Figure 17 shows these fluctuations as represented in burial remains from 12,000 years of human occupation in the Eastern Mediterranean (Angel, 1984), 2,000 years of English burials (Kunitz, 1987), measured heights from 220 years of U.S. native-born males (Fogel, 1984), and 50 years of Shanghai schoolchildren in China (Piazza, 1986).

It is only for the Shanghai schoolchildren's drop in height in 1942 that the cause appears clear—hunger induced by the food shortages and living conditions of wartime occupation. For other declines in height in the past, various episodes of food shortage and disease have been suggested or speculated upon as causes. Whatever the complex of cause, the implication seems clear at all scales of analysis. For most peoples and most places, the diminution of hunger has not been simply upwards and onwards from the cave. Thus the more recent

31. Paleolithic bone remains provide evidence both of cumulative indicators of stress in terms of growth and age-at-death and of episodic indicators of teeth and bone that indicate growth arrest and anemia (Goodman *et al.*, 1984). Correlative evidence for the cause of stress is available in data on natural fluctuations in the availability of plants, animals, and fish—that suggest, at the very least, periods of seasonal hunger—and in simulations of past climates based on mathematical models of climate—that suggest significant climate variations.

32. At the scale of ages and millennia, the data represent reconstructions of height based on bones recovered from burial sites. At the scale of centuries and decades we have actual records of measured heights, mainly from institutionalized populations. To our knowledge, these are the only data that can be compared on the time scales used in this historical analysis.

data—for example, the continuing decline in the proportion of food-poor hungry (Figure 5)—needs to be considered in light of these long-term fluctuations. Progress in diminishing hunger is not guaranteed for the future.

Less Shortage, More Poverty

Over time, the predominant character of hunger shifts from widespread and frequent food shortages to continuing and chronic food poverty. The recurrence of absolute food scarcity over a region diminishes as the productivity of the region's agriculture increases and as its trade expands, making possible the provision of central food storage and the importation of food. The remarkable increase in agricultural productivity begins about 6,000 years ago. Food shortages, the absolute scarcities of food within a region, do occur because of harvest failure, war, loss of hinterlands, or radical shifts in the terms of trade. But over time, they become less frequent and appear only in the direst of circumstances.

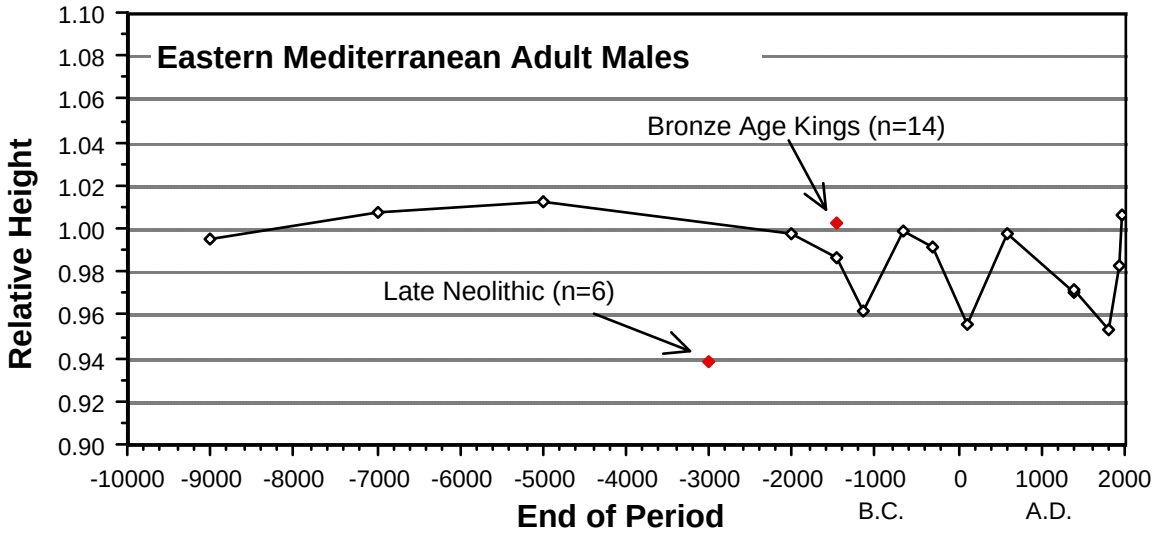
For the industrialized world a watershed occurs about two centuries ago following the eruption of Mt. Tambora in 1816 (Post, 1977). Cool wet weather set in motion by the dust veil of the eruption, combined with a post-Napoleonic War depression, triggered widespread food crises across Europe and North America. But for the first time, European states and cities organized to prevent widespread famine, raising funds and importing food from Russia and the Baltic States. This effort marked the beginning of the end of famine in Europe.[33] Nonetheless, it would take 160 years, interrupted by World Wars I and II, before the last remnants of food poverty were all but eliminated in Europe.

In the developing world, the end of famine due to harvest failure, but not war, is in sight everywhere but in Africa. For example, with the exception of the Bengal famine (caused by a market failure and not a harvest failure), India has managed its food shortages without widespread famine for over 100 years. Yet India still has the largest number of hungry people, victims of an endemic and continuing food poverty.

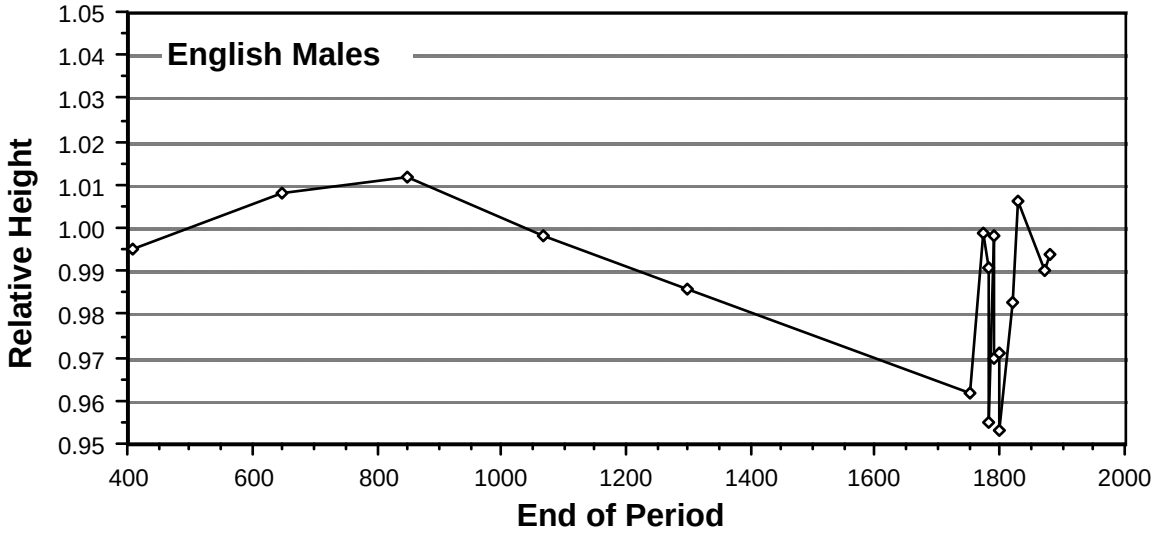
Rates Down, Numbers Up

Over the last three and a half decades, as shown in Figure 5, the proportion of hungry people in the world has diminished by almost half, from 23% to 12% using the FAO data set and

33. Two catastrophic famines during this period, in Ireland in the 1840s and in the Ukraine in the 1930s, do not diminish this conclusion. Rather, they show the overwhelming influence of political and economic factors when appropriate relief measures are not applied (e.g., Ireland) or where food deprivation is used as a weapon (e.g., the Ukraine).

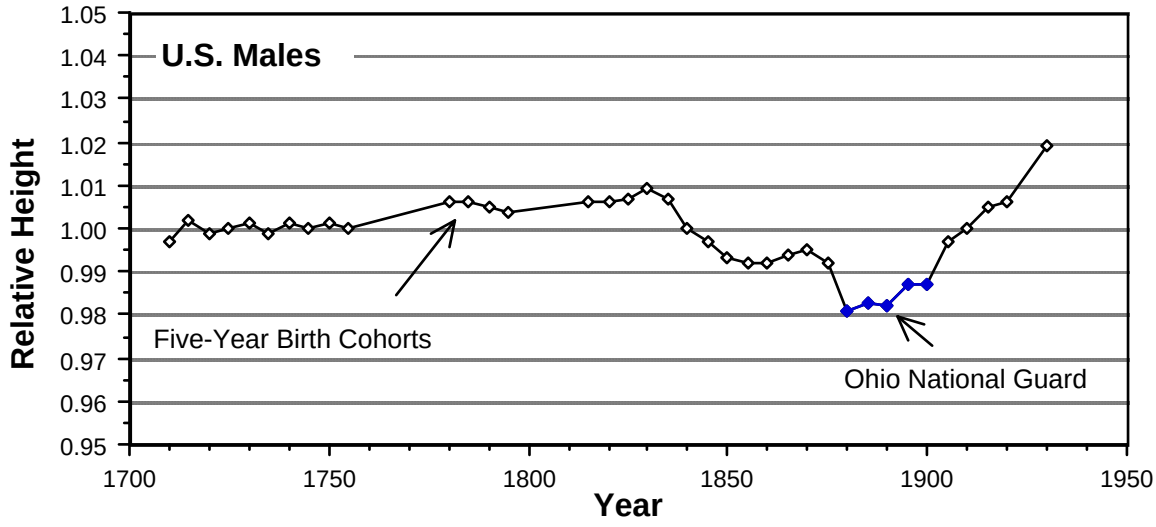


a) Ages. Source: Angel (1984).

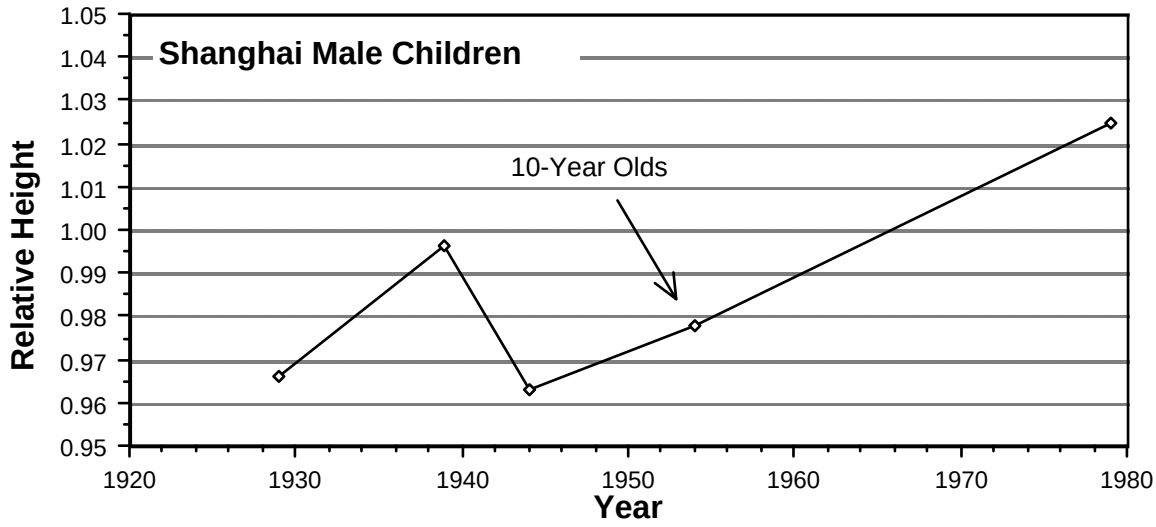


b) Millennia. Source: Kunitz (1987).

Figure 17. Fluctuations in human height over ages, millennia, centuries, and decades. Data for Eastern Mediterranean and English males are reconstructions of height based on correlations between leg bones (from burial remains) and height. Data on U.S. males and Shanghai male children are based on measurements of institutional populations.



c) Centuries. Source: Fogel (1984).



d) Decades. Source: Piazza (1986).

Figure 17 (continued)

estimation method. Nonetheless there are probably as many hungry people today in the world as ever before. How recent is this paradox that the glass of progress is *half empty* or *half full*, depending on the eyes of the beholder? We cannot tell, but this latest round of declining proportions and rising rates is tied to the rapid expansion of population in Africa, Asia, and Latin America in this century, at growth rates that are probably unique in human history. As this rapid growth slows, the number of hungry may begin to diminish.

The Scale and Complexity of Food Entitlement

Over time the scale and complexity of food entitlement change. The hunter-gatherers of the past obtained food found within the limits of a day's walk, a hunting trip, or a seasonal migration; the consumers of the present now readily obtain food collected from around the globe. The nature of entitlement changes from access to natural resources and the dependencies of kinship to a complex set of resources, gifts, and exchanges and growing responsibility for strangers a world away.

Food Availability: From Local to Global

From single sites, people who forage for food traverse the area of a day's walk, and in their seasonal rounds they cover areas of hundreds of square kilometers. Early farming communities drew the bulk of their food supplies from smaller areas. For example, Uruk, one of the earliest city states, probably grew most of its sustenance within 20 kilometers of the city walls. Two millennia later, Greece and Rome derived much of their sustenance from overseas colonies across the Aegean, Adriatic, and Mediterranean Seas. With the collapse of these great empires, food hinterlands shrank, only to enlarge again in most industrialized countries. Reliance on external food sources has increased with the diversification of diets to include products such as cane sugar that are transported across great distances. Today we can speak of the global food supply and calculate its sufficiency (Table 1). This historic enlargement of scale in food availability has led to diminished episodes of food scarcity, but it may also have undermined local food security and made very large numbers of people vulnerable to rare, but extremely serious, failures of "entitlement."

Entitlement: From Resources to Exchange

Food *entitlement* takes three basic forms: *1)* access to resources to collect or to produce food, *2)* the exchange of resources (property, money, labor power) for food, and *3)* the receipt of gifts or grants of food or the resources to procure food (Sen, 1982). The simplest form of food entitlement for human beings is natural entitlement—their own labor employed to extract edible plants and animals from nature and to distribute the collected food to dependent members. As population increased, became sedentary, and engaged in agriculture, natural resources, including the most productive lands, water, and grazing, became less available and more valued. Thus they became objects of appropriation and

investment.[34] By 4,000 years ago, the city-states of Mesopotamia began to leave us thousands of clay tablets that record these increasingly complex transactions and relationships.

The basic triumvirate of entitlement has not changed over time. What changes is the mix: from a primary emphasis on household self-provision, to the status of slave, servant, or serf whose labor is appropriated in return for minimal entitlement, to market exchange of labor and production, and most recently, to the development of extensive safety nets of food security. But the current form of welfare—one that attempts to place a minimal subsistence threshold beneath all households—has been in place for clan members for ages, was available to citizens in Greece and Rome millennia ago, and was extended to most inhabitants of European states two centuries ago. And as the mix of entitlement changes, so does the moral counterpart to entitlement, the sense of responsibility for others.

Moral Responsibility: From Kin to Kind

The expansion of the scale and complexity of entitlement is paralleled by the extension of social relationships and moral responsibilities. Moral responsibility may originate in the evolved biological dependencies of human parents and children. But culture soon blends with biology, and altruism shifts from reproductive necessity to moral imperative. Over time, there is a significant expansion of responsibility, marked, however, by many starts and retreats. From the biological responsibility of the family, the *right* to entitlement expands to loosely linked families, to those with common language, religion, or ethnicity, to citizens, to servants, and now slowly beyond the nation state to all the world's peoples.

Changing Causal Structure

The prevention of hunger requires addressing its underlying causes, but the structure of cause changes over time. Hunger appears when environmental change or deterioration limits what can be produced, when agricultural productivity declines or slows, when population numbers grow too quickly relative to food production, and when those in power appropriate too great a share of agricultural production. These underlying causes endure, but the mix of proximate causes appears to change in important ways. Over time, natural variability as a cause of hunger diminishes, and other forms of entitlement failure increase. Hunger used or created in the course of warfare persists, even as the scale and technology of warfare change. And as absolute scarcity diminishes, the enlargement of scale, so important to the reduction of scarcity, continues to make places marginal and renders possible rare, but enormous, food shortages.

34. Territorial claims to land and water have become identified with extended family clans, clan alliances, and early urban states. Human labor from slaves, captives, and various dependent and subservient persons were appropriated or purchased with surplus grain, its monetary equivalent, or both and were invested in agricultural infrastructure and production as well as in non-agricultural production. The hierarchical division of society expanded—and with it the types of food entitlement: access to productive resources, the sale of labor power, exchanges, and gifts.

Less Nature, More Entitlement Failure

For foragers dependent solely on natural resources, the dominant cause of hunger was natural variability in the flow of such resources and to a lesser degree, human-induced change in resource availability and in access to such resources. As surpluses developed, societies became more complex and stratified, entitlement relationships increased in type and number, and the opportunities for hunger to occur through entitlement failure increased as well. As the direct linkage of people to their subsistence disappeared and they lost control over adequate productive resources, then the variability in entitlement—shifting commodity prices, wages, employment opportunities, and terms of trade—replaced the variability of nature. Today, for the food-poor, it is the daily inadequacy of food entitlement and the threat of its further decline that make them so vulnerable to hunger.

Continuing Warfare: Sieges, Long Marches, Guerilla War

Hunger as a weapon is at least as old as the first siege of a city. Laying waste the fields of an adversary, diverting the irrigation water needed for production, and raiding livestock were also common. Armies have long "lived off the land," a euphemism for the hunger and desolation they leave in their path. With improvement in the technology of war and the enlargement of scale of the hinterland from which food supplies were drawn, sieges expanded into blockades. The destruction of food-producing resources by bombs and shells has been further expanded upon with incendiaries, napalm, chemical defoliants, and perhaps biological agents. Older techniques of battle mesh with the new in places like Afghanistan, Ethiopia, Mozambique, Nicaragua, and the Sudan, where the destruction or interdiction of food supplies becomes a weapon of guerillas and counterinsurgents alike and serves to create hungry civilian populations. Indeed, at this point in time, one of the most important obstacles to ending famine is the continued use of hunger as a weapon of war (Figure 2).

Marginal Peoples, Marginal Places

Another constant in the history of hunger is the maintenance of marginal peoples and marginal places that puts large numbers of people at continuous risk of hunger. Over time the nature of marginality changes and the places of marginal livelihoods shift, but the principles remain the same. The economies of empires or corporations seem well served by trying to obtain labor at the lowest cost of minimal subsistence.[35] Also, in expanding political and economic systems, there are surely large fluctuations in the need for labor to staff armed forces, provide corvees for public works, or meet seasonal labor demands in agriculture. Reserves of such labor can be maintained at lowest cost by slavery or captivity, tied by serfdom or indenture, or purchased in a buyer's market of agricultural dispossession, reserve unemployment, or poorhouse welfare.

35. The minimal requirements for subsistence seem to have been well known in antiquity as recorded in the "ration" lists for slaves and servants in Mesopotamia and Egypt.

Places, too, become reservoirs for such minimum maintenance as seen in areas that export large numbers of laborers as migrants—or to use the current euphemism, "guestworkers"—while providing for needed domestic reproduction at low levels of subsistence and high inputs of family and female labor.[36] Ironically, the very enlargement of scale that, in the short term, permits the reduction of occasional food scarcity in isolated places may also reduce the long-term viability of such places.

Big Systems, Big Mistakes

The enlargement of scale can also place extraordinarily large numbers of people at peril from hunger at the same time.[37] Such a phenomenon is evident in the creation of famine when elaborate food distribution systems break down by reason of market disruption, administrative failure, or wartime conditions. The last 50 years provide ample examples of each. Mass starvation returned to Western Europe after a hiatus of a hundred years during World War II. Three million or more Bengalis died in 1942 from the failure of the grain market to distribute rice adequately, compounded by a localized natural disaster and wartime decisions to favor urban Calcutta. And the greatest famine of this century, and perhaps of all times in terms of numbers, led to the deaths of an estimated 15 million or more people in China during the years 1959-61. These were the years marked by the Great Leap Forward, which attempted to change radically the nature of the Chinese command economy and to redirect the productive forces of society to localized subsistence.

THE FUTURE OF HUNGER

Nevertheless, despite the long-term persistence of hunger, this is a remarkable time, in which, as we contemplate the future of hunger, we can see that its diminution, and perhaps even its demise, may be *attainable*.

The demise of hunger may be attainable because humanity passed the first threshold of theoretical food sufficiency in the 1960s and is approaching a second threshold of improved diet sufficiency. But the world is still a long way from a third threshold of a full but healthy diet. Projections of world food demand, under alternative assumptions of both diet and population growth, indicate that nearly three times the present level of food

36. But places seem to suffer in a way different from people. Lacking the mobility of people, places become marginalized by shifts in centers and peripheries, accompanied by changes in transport, technologies, or environmental deterioration. The dry areas of Sahelian-Saharan Africa—once prosperous crossroads of caravan trade—the rustbelts of modern industrial societies, the busts following the boom exploitations of crop, lumber, or minerals—all are witness to the creation of marginal places.

37. In studies of ecology, natural resource management, health, and natural disaster, there is a well-recorded phenomenon in which the frequency of hazardous events diminishes over time, but their magnitude and catastrophic potential increases (Holling, 1986).

production might be required for an improved diet and almost five times for a full, but healthy, diet, some 60 years from now (Figure 18).[38]

The demise of hunger may be attainable because for perhaps the first time in human history it is possible to contemplate the end of food scarcity, famine, and mass starvation. With the exception of its intentional creation or perpetuation as a weapon of war or genocide, a combination of effective famine early-warning systems, national and global emergency food

38. Basic assumptions are as listed in notes *3* and *4* above. Projections are based on long-range, medium-variant population projections developed by the UN (United Nations Secretariat, 1982).

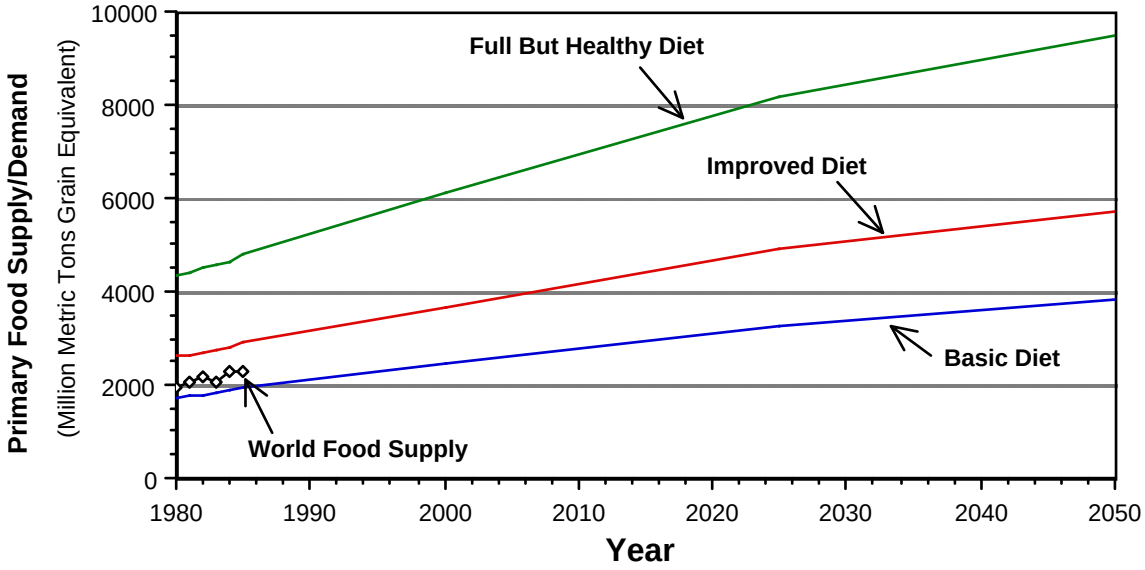


Figure 18. Projections of primary food demand for the world, 1985-2050. The "basic" diet assumes that all primary food production is consumed directly by humans at FAO/WHO/UNU recommended caloric levels, whereas the "improved" and "full but healthy" diets assume that 10% and 30% of food calories, respectively, come from animal products derived from primary foods.

reserves, and improved experience with distribution and food-for-work programs has brought the end of famine well within sight. Despite the continuing African famine experience, famine is already rare and becoming even rarer. Our FAMINDEX, a continuing series using *New York Times* reports of famines since 1950, shows a decline in the population living in countries with reported famine since the peak period in 1957-63 (Figure 3).

The demise of hunger may be attainable because we know that the end of food poverty does not require the end of *all* poverty. The evidence is recorded in the increasing heights of the Chinese people—an inch taller per decade over each of the last three decades—in the falling infant mortality statistics of the state of Kerala in India, and in the rising life expectancies in Sri Lanka: all places where hunger has receded dramatically in recent times, even though their extremely low incomes have grown slowly at best.

The demise of hunger may be attainable because there has been a decreasing trend in measures of food poverty. The proportion of the world that is *food poor* has probably diminished by half over the last three decades, although the rate of decrease has slowed dramatically in recent years.

The demise of hunger may also be attainable because major international efforts have now begun to intervene on behalf of the food-deprived—through child-survival programs that reduce the likelihood of malnourishment among children, Vitamin A interventions that

identify and correct dietary deficiencies leading to xeropthalmia, and programs to control endemic goitre, cretinism, and other iodine-deficiency disorders.

But the demise of hunger, although it may be attainable, is much too slow and is surely not guaranteed. Even as the *proportion* of hungry in the world has decreased, the *number* of hungry people has not—and is still rising. If the current rate of progress in diminishing the proportion of hungry in the world—about one percentage point every five years—continues, and if population grows as most demographers expect, then the absolute number of hungry people in the world will still rise until the year 2000, and only then begin to decline.[39] It would take until the year 2050, 60 years hence, to reduce the proportion of hungry people in the world to 3%, assuming continuing progress at the current rate. In the meantime, half of the world's women who carry the seeds of our future may be anemic, a third of the world's children may be wasted or stunted in body and mind, and perhaps a fifth of the world's people can never be sure of their daily bread, chapati, tortilla, ugali, or rice bowl.

The demise of hunger is much too slow because many have a stake in hunger, albeit unwittingly. An increasingly interdependent world has spawned a *hunger industry*. It is a diverse industry that includes warriors of all persuasions who use hunger as a weapon, rich people in both rich and poor countries whose comparative advantage is cheap labor, and farmers and agribusiness people who market grains to the hungry. It also includes a vast network of professional organizations that work to end hunger—the UN agencies, the relief organizations, the organizers of rock concerts, and even us university people. From this welter of good and mean intentions, it is no surprise that the prescriptions for hunger's demise vary so widely even as the desire to end hunger becomes more universal.

Hunger is one of the set of seemingly intractable issues in which those concerned with the issues appear to diverge sharply both in their analyses and in their policy prescriptions: one sector addressing the problem incrementally, activity by activity; one sector addressing the greater context, calling for fundamental social change as a prerequisite for problem solution. And within each approach, there is a diversity of views as to which activities are efficacious—or for which fundamental changes are required. These divergences are *not* simply manifestations of reformist or radical analysis or style, although these are surely evident, but arise from deeply held concern, which in one case is expressed by a desire to "light a candle rather than curse the darkness," and in the other by great frustration over the enormous human loss incurred by the long wait for hunger's final demise.

39. The proportion of hungry in the developing world declined from 34% to 29% from 1948-50 to 1961-65, to 20% by 1972-74, and to 17% in 1978-80, according to Grigg (1985:50). However, data reported by ACC/SCN (1987a) suggest that the proportion for the developing world was 16% in 1983-85, or only about a 1% decline in 5 years. We assume that this rate of progress continues indefinitely and apply it to long-range UN population projections (medium variant) for the developing world (United Nations Secretariat, 1982).

We suggest that it is possible to seek a common *middle ground,* to accept that a significant fraction of the world's hunger, as much as a half, can be readily attacked by using the *better* and the *best* of current capabilities and programs, if these are applied appropriately to the varied contexts of hunger in the world. We are now undertaking such a study and will report on it in our next update to the Hunger Report. But at the same time, it is clear that further progress will require fundamental change in structures, institutions, and values. And it is progress in this direction that will make the demise of hunger not only attainable, but also practical.

REFERENCES

ACC/SCN (Administrative Committee on Coordination/Subcommittee on Nutrition). 1987a. *First Report on the World Nutrition Situation*. Rome: ACC/SCN, Food and Agriculture Organization, November.

ACC/SCN (Administrative Committee on Coordination/Subcommittee on Nutrition). 1987b. *A Global Strategy for the Prevention and Control of Iodine Deficiency Disorders: Proposal for a Ten-Year Programme of Support to Countries. Report of the l3th session, ACC Subcommittee on Nutrition, Washington DC, 2-6 March 1987*. Coc. SCN87/IODA. Rome: FAO.

Angel, J. Lawrence. 1984. Health as a crucial factor in the changes from hunting to developed farming in the Eastern Mediterranean. In *Paleopathology at the Origins of Agriculture*, M.N. Cohen and G.J. Armelagos, Eds. New York: Academic Press, pp. 51-73.

Beaton, George. 1987. "Small but healthy?" Are we asking the right question? Paper presented at the 86th Annual Meeting of the American Anthropological Association, 20 November, Chicago IL.

Berg, Alan. 1973. *The Nutrition Factor*. Washington DC: Brookings.

Berg, Alan. 1987. *Malnutrition. What Can Be Done? Lessons From World Bank Experience*. Baltimore MD: Johns Hopkins.

Blaxter, K. 1986. *People, Food and Resources*. Cambridge: Cambridge University.

BOSTID (Board on Science and Technology for International Development). 1978. *Postharvest Food Losses in Developing Countries*. Washington DC: National Academy of Sciences.

Chen, Robert S., and Martin L. Parry, Eds. 1987. *Climate Impacts and Public Policy*. Nairobi, Kenya: United Nations Environment Programme and Laxenburg, Austria: International Institute for Applied Systems Analysis.

Contee, Christin E. 1987. *What Americans Think: Views on Development and U.S.-Third World Relations: A Public Opinion Project of InterAction and the Overseas Development Council*. New York: InterAction.

Das Gupta, Monica. 1987. Selective discrimination against female children in rural Punjab, India. *Population and Development Review* **13**(1):77-100.

DeMaeyer, E.M. 1986. Xeropthalmia and blindness of nutritional origin. In *Children in the Tropics*. Paris: International Children's Center.

DeMaeyer, E.M., and M. Adiels-Tegman. 1985. The prevalence of anaemia in the world. *World Health Statistics Quarterly* **38**:302-16.

Downing, Thomas E. 1988. Climatic Variability and Household Food Security in Six Districts of Central and Eastern Kenya. Ph.D. Dissertation, Clark University, Worcester MA.

Edirisinghe, Neville. 1987. *The Food Stamp Scheme in Sri Lanka: Costs, Benefits, and Options for Modification*. International Food Policy Research Institute Research Report No. 58. Washington DC: IFPRI.

FAO (Food and Agriculture Organization of the United Nations). 1971. *Food Balance Sheets, 1964-66 Average*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 1984. *Food Balance Sheets, 1979-81 Average*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 1985. *The Fifth World Food Survey*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 1986. *1985 FAO Production Yearbook, Vol. 39*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 1987. *Food Outlook. Statistical Supplement*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 1988. *Food Supply Situation and Crop Prospects in Sub-Saharan Africa. Special Report*. Rome: FAO.

Fogel, Robert W. 1984. *Nutrition and the Decline in Mortality Since 1700: Some Preliminary Findings*. Working Paper No. 1402. Cambridge MA: National Bureau of Economic Research, Inc.

Garcia, Marito, and Per Pinstrup-Andersen. 1987. *The Pilot Food Price Subsidy Scheme in the Philippines: Its Impact on Income, Food Consumption, and Nutritional Status*. International Food Policy Research Institute Research Report No. 61. Washington DC: IFPRI.

Glantz, Michael H. 1987. Drought in Africa. *Scientific American* **256**(6):34-40.

Goodman, Alan H., Debra L. Martin, George J. Armelagos, and George Clark. 1984. Indications of stress from bone and teeth. In *Paleopathology at the Origins of Agriculture*, M.N. Cohen and G.J. Armelagos, Eds. New York: Academic Press, pp. 13-49.

Grant, James. 1987. *The State of the World's Children 1987*. Oxford: Oxford University Press.

Grigg, David. 1985. *The World Food Problem 1950-1980*. Oxford: Basil Blackwell.

Hansen, James. 1988.

Holling, C.S. 1986. The resilience of terrestrial ecosystems: Local surprise and global change. In *Sustainable Development of the Biosphere*, W.C. Clark and R.E. Munn, Eds. Cambridge: Cambridge University Press, pp. 292-317.

Holmes, W. 1980. Secondary production from land. In *Food Chains and Human Nutrition*, K. Blaxter, Ed. London: Applied Science, pp. 109-34.

Hopkins, Raymond. 1987. Interests and regimes: The subjective dimension of international politics. Paper presented at the Annual Meeting of the American Political Science Association, 3-6 September, Chicago IL.

Hopkins, Raymond. 1988. The politics of adjustment: The African case. *Food Policy* **13**(1):47-55.

IIED/WRI (International Institute for Environment and Development, and World Resources Institute). 1987. *World Resources 1987*. New York: Basic Books.

IVACG (International Vitamin A Consultative Group). 1981. The Symptoms and Signs of Vitamin A Deficiency and Their Relationship to Applied Nutrition. IVACG.

Jones, P.D., Wigley, T.M.L., and Wright, P.B. 1986. Global temperature variations between 1861 and 1984. *Nature* **322**:430-34.

Katona-Apte, Judit. 1986. Women and food aid. *Food Policy* **11**:216-22.

Kunitz, Stephen J. 1987. Making a long story short: A note on men's height and mortality in England from the first through the nineteenth centuries. *Medical History* **31**:269-80.

Martorell, Reynaldo. 1987. Body size, adaptation, and function. Paper presented at the 86th Annual Meeting of the American Anthropological Association, 20 November, Chicago IL.

Miller, D.S. 1980. Man's demand for energy. In *Food Chains and Human Nutrition*, K. Blaxter, Ed. London: Applied Science, pp. 23-45.

Millman, Sara. 1986. Breastfeeding trends in a dozen developing countries. *International Family Planning Perspectives* **12**(3):91-5.

Millman, Sara. 1987. Breastfeeding in eighteen developing countries. Final Report to Family Health International.

Newman, Lucile F., William Crossgrove, Robert W. Kates, Robley Matthews, and Sara Millman, Eds. 1988 (forthcoming). *Hunger in History: Food Shortage, Poverty, and Deprivation.* New York: Blackwell.

PAHO (Pan American Health Organization). 1976. *The National Food and Nutrition Survey of Guyana*. PAHO Scientific Publication No. 323. Geneva: The World Health Organization.

Physician Task Force on Hunger in America. 1985. *Hunger in America: The Growing Epidemic*. Middletown CT: Wesleyan University Press.

Piazza, Alan. 1986. *Food Consumption and Nutritional Status in the PRC.* Boulder: Westview Press.

PRB (Population Reference Bureau). 1988. *1988 World Population Data Sheet*. Washington DC: Population Reference Bureau, Inc.

Post, John D. 1977. *The Last Great Subsistence Crisis in the Western World*. Baltimore: Johns Hopkins.

Reutlinger, Shlomo, and Marcelo Selowsky. 1976. *Malnutrition and Poverty: Magnitude and Policy Options*. World Bank Staff Occasional Paper No. 23. Baltimore MD: Johns Hopkins University Press.

Riskin, Carl. 1988 (forthcoming). Hunger and poverty in China since 1949. In *Hunger in History: Food Shortage, Poverty, and Deprivation*, L.F. Newman *et al.*, Eds. New York: Blackwell.

Rohrbach, David D. 1988. The Growth of Smallholder Maize Production in Zimbabwe: Causes and Implications for Food Security. Ph.D. Dissertation, Michigan State University, East Lansing MI.

Scrimshaw, Nevin. 1987. Biological adaptation in the maintenance of nutrition and health. Paper presented at the 86th Annual Meeting of the American Anthropological Association, 20 November, Chicago IL.

Seckler, David. 1982. Small but healthy: A basic hypothesis in the theory, measurement, and policy of malnutrition. In *Newer Concepts in Nutrition and Their Implications for Policy*, P.V. Sukhatme, Ed. Pune, India: Maharashtra Association for the Cultivation of Science, pp. 127-37.

Sen, Amartya. 1982. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Clarendon.

Sinha, S.K., N.H. Rao, and M.S. Swaminathan. 1988. Food security in the changing global climate. Paper presented at the World Conference on The Changing Atmosphere: Implications for Global Security, 27-30 June, Toronto, Canada.

Sivard, Ruth Leger. 1987. *World Military and Social Expenditures 1987-88.* 12th Edition. Washington DC: World Priorities.

Swaziland (Government of Swaziland/Centers for Disease Control/United States Agency for International Development). 1983. *Swaziland National Nutrition Status Survey, 1983: Full Report.* Doc. No. GPO-86-635-664. Washington DC: U.S. Government Printing Office.

United Nations Secretariat. 1982. Long-range global population projections, as assessed in 1980. *Population Bulletin of the United Nations* **14-1982**:17-30.

USDA/ERS (United States Department of Agriculture/Economic Research Service). 1985. *World Indices of Agricultural and Food Production, 1975-84*. Statistical Bulletin No. 730, Doc. No. 1985-460-941:20096-ERS. Washington DC: U.S. Government Printing Office.

USDA/ERS (United States Department of Agriculture/Economic Research Service). 1987a. *World Food Needs and Availabilities, 1986-87: Spring Update*. Doc. No. 1987-180917/60275. Washington DC: U.S. Government Printing Office.

USDA/ERS (United States Department of Agriculture/Economic Research Service). 1987b. *World Food Needs and Availabilities, 1987-88*. Doc. No. 1987-180-917/60496. Washington DC: U.S. Government Printing Office.

USDA/ERS (United States Department of Agriculture/Economic Research Service). 1987b. *World Food Needs and Availabilities, 1987-88: Fall Update*. Doc. No. 1987-201-064/60708. Washington DC: U.S. Government Printing Office.

USDA/ERS (United States Department of Agriculture/Economic Research Service). 1988. *World Food Needs and Availabilities, 1987-88: Winter Update*. Doc. No. 1988-201-089:80070/ERS. Washington DC: U.S. Government Printing Office.

United States Panel on the World Food Supply. 1967. *The World Food Problem: A Report of the President's Science Advisory Committee. Volume II, Report of the Panel on the World Food Supply*. Doc. No. 1967 O-263-888. Washington DC: U.S. Government Printing Office.

U.S. Congress (United States Congress Select Committee on Hunger). 1988. Alleviating world hunger: Literacy and school feeding programs. *Abstract. 1988 Hunger Research Briefing and Exchange*, Alan Shawn Feinstein World Hunger Program, Brown University, and InterAction, 6-8 April, Providence RI.

University of California, Berkeley. 1987. *Hunger Surveys in the United States. Workshop Report*, 5-7 February, University of California, Berkeley, Berkeley CA.

Wennergren, E. Boyd, and Morris D. Whitaker. 1986. Foodgrain sufficiency in Bangladesh: A reappraisal and policy implications. *Journal of Developing Areas* **21**:1-14.

World Bank. 1986. *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. Washington DC: The World Bank.

World Bank. 1987. *World Development Report 1987*. New York: Oxford University Press for The World Bank.

WFP (World Food Programme). 1988. *Review of Food Aid Policies and Programmes*. Rome: WFP.

WHO (World Health Organization). 1973. *Energy and Protein Requirements. Report of a Joint FAO/WHO Ad Hoc Expert Committee*. WHO Technical Report Series No. 522. Geneva: WHO.

WHO (World Health Organization). 1984. The incidence of low birth-weight: An update. *WHO Weekly Epidemiological Record* **59**(27):202-12.

WHO (World Health Organization). 1985a. *Energy and Protein Requirements. Report of a Joint FAO/WHO/UNU Expert Consultation*. WHO Technical Report Series No. 724. Geneva: WHO.

WHO (World Health Organization). 1985b. *Prevention and Control of Vitamin A Deficiency and Nutritional Blindness. Proposal for a Ten-Year Programme of Support to Countries*. Doc. Nut/84.5 Rev.1. Geneva: WHO.

WHO (World Health Organization). 1987. *Nutrition: Global Surveillance through Anthropometric Measurements*. Reprinted from *WHO Weekly Epidemiological Record*, 1987, Part I, (7):37-38; Part II, (8):45-50; Part III, (9):57-59; Part IV, (10):64-66; Part V, (ll):71-73; Part VI, (12):78-80.

WHO (World Health Organization). 1988. A health and nutrition atlas: Food for thought. *World Health* **1988**(May).

APPENDIX

Country-Level Data

Region Country	Food Short[a]	Famine Rept. Food War[b]	Food Aid[c]	Food Prod. Growth[d]	Rate of Natural Increase (%)[e]
Northern Africa					
Algeria			R		3.2
Egypt			R		2.8
Libya				H	3.1
Morocco			R		2.6
Sudan	FU	FW	R		2.8
Tunisia			R		2.2
W. Sahara					2.5
Western Africa					
Benin	F		R	H	3.0
Burkina Faso	F		R		2.8
Cape Verde			R		2.6
Cote d'Ivoire				H	3.1
Gambia	F		R		2.1
Ghana	F		R		3.1
Guinea	FU		R		2.4
Guinea-Bissau			R		2.4
Liberia	U		R		3.1
Mali	F	F	RD		2.9
Mauritania	FU		R		3.0
Niger	FU	F	R		2.9
Nigeria	F				2.9
Senegal	F		R		2.6
Sierra Leone	FU		R		1.8
Togo	FU		R		3.3
Eastern Africa					
Burundi	FU		R		2.9
Comoros			R		3.4
Djibouti			R		2.5
Ethiopia	FU	FW	R		3.0
Kenya	F		RD		4.1
Madagascar	U		R		2.8
Malawi	U	F	R		3.2
Mauritius			R		1.2
Mozambique	FU	FW	R		2.6
Reunion					1.8
Rwanda	FU		R	H	3.7
Seychelles			R		1.9
Somalia	FU	F	R		3.1
Tanzania		F	RD		3.6
Uganda	F	FW	R		3.4
Zambia	F	F	R		3.7
Zimbawbwe	F	F	RD		3.5

[a] F=FAO estimate, U=USDA estimate. See caption to Figure 1.

[b] F=Famine report, W=Food War. See caption to Figure 2.

[c] R=Receiver, D=Donor. See caption to Figure 13.

[d] H=High growth (>0.5%/year). Developing countries only. See caption to Figure 14.

[e] See caption to Figure 15.

Region Country	Food Short[a]	Famine Rept. Food War[b]	Food Aid[c]	Food Prod. Growth[d]	Rate of Natural Increase (%)[e]
Middle Africa					
Angola	FU	FW	RD		2.6
Cameroon	FU		R		2.6
Cen. Afr. Rep.	FU		R		2.5
Chad	FU	FW	R		2.0
Congo	FU		RD		3.4
Equat. Guinea	FU		R		1.9
Gabon					1.6
Sao Tome & Principe			R		2.7
Zaire	FU		R		3.0
Southern Africa					
Botswana	F	F	R		3.4
Lesotho	U		RD		2.6
Namibia	F				2.8
South Africa		W			2.3
Swaziland		F	R	H	3.1
Western Asia					
Bahrain					2.8
Cyprus				H	1.1
Gaza			R		4.1
Iraq					3.5
Israel					1.6
Jordan			R		3.6
Kuwait					2.9
Lebanon	U	FW	R	H	2.0
Oman					3.3
Qatar					2.7
Saudi Arabia				H	3.3
Syria			R	H	3.8
Turkey			R		2.2
United Arab Emirates					2.6
Yemen, North	FU		R		3.3
Yemen, South	F		R		3.3
Southern Asia					
Afghanistan	FU	W	R		2.4
Bangladesh	FU		R		2.7
Bhutan			R		2.0
India	F		RD	H	2.0
Iran			R	H	3.2
Maldives			R		3.7
Nepal	FU		R		2.5
Pakistan	F		R	H	2.9
Sri Lanka	U	W	R	H	1.8

Southeast Asia					
Brunei					2.7
Burma				H	2.1
East Timor					2.2
Indonesia		W	R	H	1.7
Kampuchea	FU	W	R		2.3
Laos	FU		R	H	2.5
Malaysia				H	2.4
Philippines		W	R	H	2.8
Singapore				H	1.0
Thailand			R	H	2.1
Vietnam	FU		R	H	2.6

Region Country	Food Short[a]	Famine Rept. Food War[b]	Food Aid[c]	Food Prod. Growth[d]	Rate of Natural Increase (%)[e]
East Asia					
China			RD	H	1.4
Hong Kong					0.8
Japan			D		0.5
Korea, North				H	2.5
Korea, South				H	1.3
Macao					1.7
Mongolia					2.6
Taiwan					1.1
North America					
Canada			D		0.7
United States			D		0.7
Central America					
Belize					3.0
Costa Rica			R	H	2.9
El Salvador	FU	W	R		2.8
Guatemala		W	R	H	3.2
Honduras	F		R		3.1
Mexico			R		2.4
Nicaragua		W	R		3.5
Panama			R		2.2
Caribbean					
Antigua & Barbuda					1.0
Bahamas					1.9
Barbados					0.8
Cuba			R	H	1.0
Dominica					1.6
Dominican Rep.			R	H	2.4
Grenada					1.9
Guadeloupe					1.3
Haiti	FU		R		2.8
Jamaica			R	H	1.7
Martinique					1.2
Neth. Antilles					1.4
Puerto Rico					1.2
St. Kitts-Nevis			R		1.4
St. Lucia			R		2.2
St. Vincent & Gren.			R		2.0
Trinidad & Tobago					2.2
Tropical South America					
Bolivia	FU		R		2.6
Brazil			R	H	2.0
Colombia			R	H	2.1
Ecuador	F		R		2.8
Guyana			R		2.0
Paraguay			R		2.9
Peru	F	W	R		2.5
Suriname				H	2.1
Venezuela					2.4

[a] F=FAO estimate, U=USDA estimate. See caption to Figure 1.

[b] F=Famine report, W=Food War. See caption to Figure 2.

[c] R=Receiver, D=Donor. See caption to Figure 13.

[d] H=High growth (>0.5%/year). Developing countries only. See caption to Figure 14.

[e] See caption to Figure 15.

Region Country	Food Short[a]	Famine Rept. Food War[b]	Food Aid[c]	Food Prod. Growth[d]	Rate of Natural Increase (%)[e]
Temperate South America					
Argentina			D		1.5
Chile			R		1.6
Uruguay					0.8
Northern Europe					
Denmark			D		-0.1
Finland			D		0.3
Iceland			D		0.9
Ireland					0.8
Norway			D		0.2
Sweden			D		0.1
United Kingdom			D		0.2
Western Europe					
Austria			D		0.0
Belgium			D		0.1
France			D		0.4
Germany, West			D		-0.1
Luxembourg			D		0.1
Netherlands			D		0.4
Switzerland			D		0.3
Eastern Europe					
Bulgaria					0.2
Czechoslovakia					0.2
Germany, East					0.0
Hungary					-0.2
Poland					0.7
Romania					0.5
Southern Europe					
Albania					2.1
Greece			D		0.2
Italy			D		0.0
Malta					0.7
Portugal					0.3
Spain			D		0.4
Yugoslavia					0.6
USSR			D		1.0
Oceania					
Australia			D		0.8
Fiji			R		2.3
Fr. Polynesia					2.4
New Caledonia					1.8
New Zealand					0.8
Papua-New Guinea	F				2.4
Solomon Islands			R		3.6
Vanatu			R		3.3
Western Samoa					2.9