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LONGER AND SHORTER VIEWS OF THE MALTHUSIAN PROSPECT*

At the outset of these somewhat opinionated remarks on Malthusian prospects, I want to make clear that I exclude thoughts about malnutrition. While the world incidence and importance of malnutrition is nowadays a topic that absorbs the interest of many people, Malthus knew nothing about it. He had in mind not lack or prospective lack of vitamins and minerals necessary to ward off deficiency diseases, but lack or prospective lack of energy-yielding food in its aggregate, such that people suffering the lack are hungry in the common meaning of the term. He had in mind hunger, emaciation, starvation, and the strife and vice and misery that he believed went hand in hand with hunger, which represents undernutrition rather than malnutrition.

I have asked myself four questions with regard to undernutrition. First, are here hunger situations in the world today, and if so where? Second, have such ituations tended to become more prevalent in the last half a century, when world opulation is estimated to have increased from about 1.7 billion people to over billion—not far from doubling? Third, are such situations likely to begin to ppear more commonly in the years from 1962 to 1984, assuming that recent rates f increase in world population continue in those 22 years? And fourth, what ay we expect of the longer period from 1984 to 2317 A.D.? (It will appear later hy I focus on the date 2317, although you may already have guessed about 1984: eorge Orwell made it notorious.)

I

Are there, then, hunger situations in the world today, and where? Is it a nonstrable fact, as is commonly alleged, that two-thirds of the world's popuon goes to bed hungry every night? Let us consider, with the guidance of the p, how such a conclusion is reached.

This map is the outcome of team research in the United States Department griculture; it was published in October 1961. All the areas covered in black are said to comprise "less-developed" countries where "diets are nutritionally equate, with shortages in proteins, fats, and calories." About two-thirds of vorld's population resides in the black areas and one-third in the white areas, e nothing is said to be wrong with the nutritional status.

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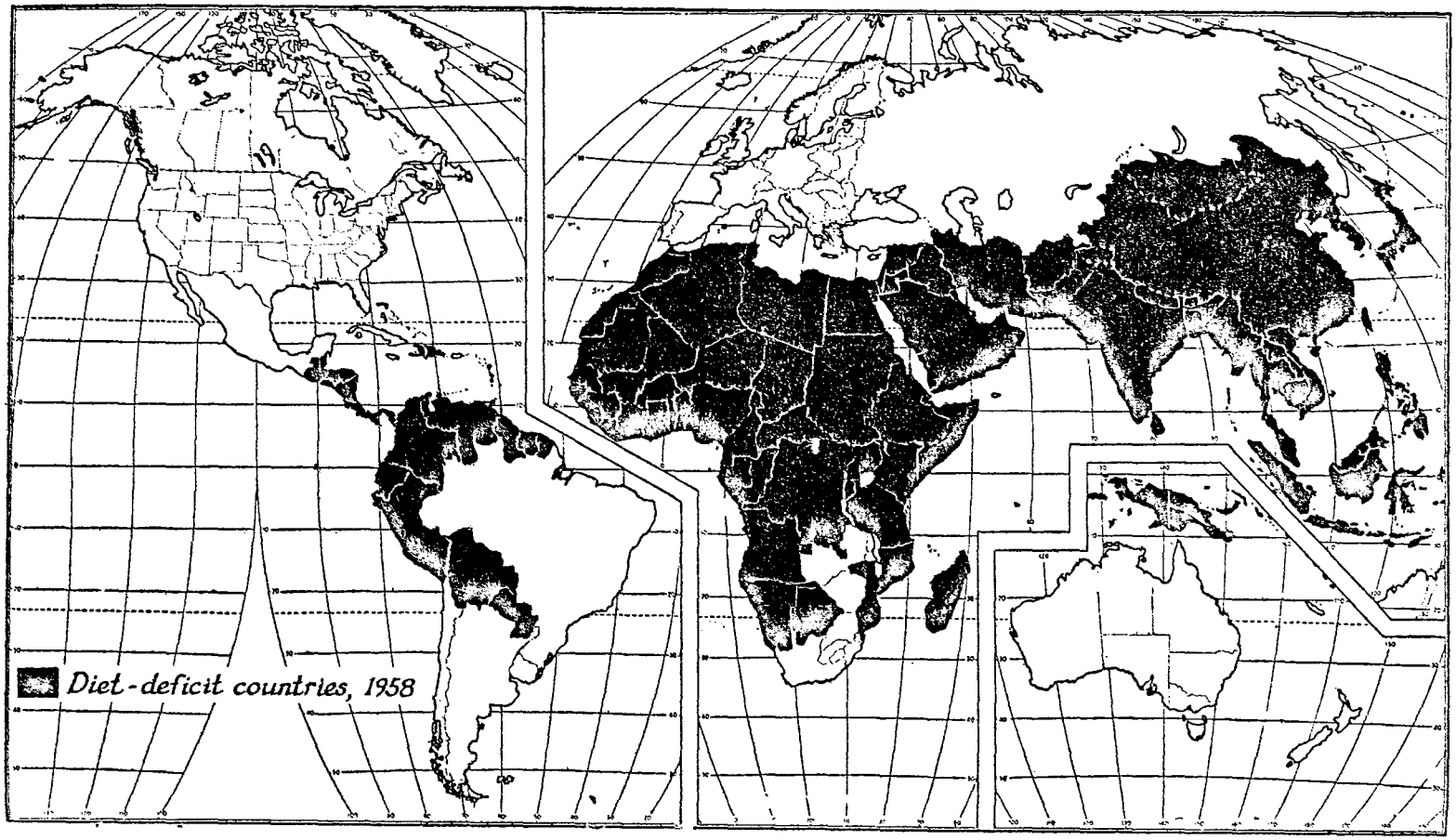
MAP 1.—USDA APPRAISAL OF NATIONS DEFICIT AND NOT DEFICIT IN DIETS, 1958*



*Copied from a map in USDA, Economic Research Service, in co-operation with Foreign Agricultural Service, *The World Food Budget, 1962 and 1966* (Foreign Agri-

The diagnostic methodology that lies behind the mapping is laborious and complicated, but I must go into it. National statistics are used, not regional or local. For each nation, one first lists all the energy-yielding foods, with unexplained omission of mothers' milk and alcoholic beverages. Second, the domestic production of each item is ascertained as of the year selected, which for this map was 1958 despite its publication nearly three years later. Third, one adds imports and subtracts exports. Fourth, change of stocks within the year is somehow appraised, and upward change is subtracted or downward change added. In these four steps one has ascertained total domestic utilization of each item. But not all of this is used for food, so that it is necessary, fifth, to subtract seed use; sixth, to subtract industrial use; seventh, to subtract feed use; eighth, to subtract waste. The subtractions from total utilization yield the gross national supply for food. But since gross supplies for food of some items like grain crops are cut down because grains are usually milled and only the inner portion eaten, the ninth step is, after determining extraction rates for each grain, to subtract the weight of the grain removed in milling. One has then reached the total net domestic supply for food, alleged to be at retail level, of each of as many items as there may be.

The tenth step is to convert this total net national supply for food, item by item, and by reference to midyear estimates of population, to net supply per capita per year. Dividing by 365, one reaches net supply of each food per capita per day, at retail level, in each nation; this is the eleventh step.

The next five steps are to convert the poundages of each food per capita per day, by reference to tables of food composition, into calories, grams of fat, grams of total protein, grams of animal protein, and grams of pulse protein, all per capita per day. Then one can add up per capita calories per day from all food items, and the same with grams of fat, of total protein, of animal protein, and of pulse protein.

These seventeen steps have to be taken for every country that is to be mapped. But the end result, taken alone, tells nothing about the hunger status or the nutritional status of any country. It is necessary to compare the findings on net domestic supplies of food per capita per day with standards of adequacy. Such standards need to refer to ingestion of food, not merely to its presumptive availability at retail level, which is what the method so far brings forward. Moreover, per capita requirements for food ingestion presumably vary from nation to nation, on account of differences in environmental temperatures, in body weights, in distributions of populations by age and sex, and in normal physical activity. The Department of Agriculture says that national per capita requirements for calorie availability at retail level are 15 per cent higher than requirements for ingestion. Then it sets forth that there is a range in per capita requirement for food at retail level extending from 2,300 calories per day in nations of the Far East and Communist Asia up to 2,710 in Canada and the Soviet Union. Next, the Department says that everywhere in the world an average national person requires 60 grams of total protein at retail level, of which at least 7 grams must be animal protein and the summation of animal and pulse protein must be 17 grams. And finally, the Department says that fat calories are required everywhere to the extent of 15 per cent of total calories.

The official procedure is next, of course, to compare calculated availabilities per capita in each nation with the several standards taken as adequate for each. If the numbers show a nation failing to reach any of the several standards, it is mapped in black. On closer inquiry, one sees that no supporting statistics whatever are given for at least 15 countries so mapped. On still closer inquiry, one perceives that quite a few other countries fall short, not of calories, but of either protein or fat: the implication is that there are not hunger situations in them, but situations of malnourishment. The list of these allegedly nonhungry but presumptively malnourished countries, 15 or 20 of them, many in Africa, is rather long. Even so, the residual list of countries depicted as short of calories—presumptively harboring hunger situations—is longer, and their aggregate population is far larger. It can be reckoned as 58 per cent (1962) of the world population; and of that 58 per cent, around four-fifths can be reckoned as residing in West Pakistan and eastward on the Asiatic continent and in the East Indies.

Probably a good many people are impressed by these findings and inclined to take them as gospel truth, in part perhaps because they bear the stamp of officialdom and so much effort of so many investigators has brought them forward. If anybody is convinced, I think he is gullible. Consider the weaknesses of the methodology. It can never, except by accident, keep us up to date, for food production in almost any country varies from year to year and outputs cannot be known until after the event. In the great majority of these allegedly hungry countries nothing like full quantitative coverage of supplies is at present possible, to say nothing of accurate estimation of output even of major food items. Imagine the guesswork in estimating food supplies of animal origin where there are next to no slaughterhouses. Change in stocks can only be imagined, not known. Neither can quantities used for seed, fed to livestock, used industrially, or wasted. Who knows if there is a gap of 15 per cent between availability at retail level (itself a fantastic concept in nations where most of the food is eaten on farms where it is produced) and consumption in homes? Are population estimates correct? Do we know what extraction rates of grain are? Can error be introduced by imperfect or varying tables of food composition? Who knows with any degree of certainty that an average person in India or Indonesia requires 2,300 calories in order to escape hunger, while one in Bolivia or Peru requires 2,500? The numerical precision implied by such numbers strikes me as no less than absurd, considering especially our total lack of knowledge about differences in normal physical activity as between population groups.

Consider what our document says about India. It says that the average Indian needs 2,300 calories per day but gets only 2,050, thus running 250 calories daily, or something over 10 per cent, short of physiological needs. The implication seems to be that all 450 million Indians are hungry all the time every year. Surely, however, we cannot believe that hunger is or ever was blanketed evenly all over the vast subcontinent of India. It would seem more rational to suppose that at least half of the population would be fully satisfying its physiological calorie requirement. If so, the other half must be about 30 per cent short of calorie physiological requirement. If that were true, we would surely know about it because extreme emaciation, deaths by starvation, and cries for relief would inevitably make headlines even in our provincial newspapers. Haiti, our docu-

ment says, is not merely 10 but 25 per cent short of the calories physiologically needed there. From there we hear, it is true, of political strife and dissatisfaction; but so we do also from Argentina, which our document says has plenty to eat; and from neither do we hear pleas for more food to ward off hunger.

I am left with the conviction that the method described is useless for location and measurement of hunger situations in the world at any given time. In a sense it is quantification gone mad. And, I fear, there is no method at once reliable and feasible to substitute for it. So, about all we have to go on are news reports of food shortage. As of June–August 1962, we can read about those in northeastern Brazil and parts of China. We cannot properly infer of Soviet Russia that there is general calorie shortage there merely because the price of meat has been, they say, raised 30 per cent; for the news report is that peasants find it pays to buy bread so as to feed animals, not that Russians are hungry. Rationing in Cuba does not clearly imply that Cubans are hungry—though probably they are inconvenienced. American gifts of food to Algeria reflect no more than disturbed distribution there.

On the basis of general reasoning and in the absence of news reports, I would suspect that in almost every part of the world, including the United States, some people must have gone hungry, some of them voluntarily, this summer or part of it. Yet probably there are, outside of northeastern Brazil and China, isolated local communities where there is true food shortage, places where local harvests of last autumn were short and the new crop is not yet garnered—so-called preharvest hunger. Bad weather, or pest invasions, or warfare, or inept governmental interferences with land ownership, prices, or external or internal trade may have caused those situations, and not, I think, circumstances that can properly be characterized as Malthusian pressure of population on food resources. But there seems to be little evidence in the newspapers that these situations of general food shortage involve large numbers of people, or very severely, or for very long. Even the Chinese and Brazilian situations may fade from our attention with the advent of new crops in a couple of months, though this we cannot know now. As it probably always has been in almost any summer, the world food situation is spotty, with general shortage here and there, sufficiency to assuage hunger the common rule. Next year or the year after there may be shortages in quite different places. The fact is that hunger situations flit about erratically from year to year, and in a given region are sporadic or episodic, not chronic or persistent. But Malthus, I think, had visions of chronic or long-lasting hunger situations.

II

So far as I know, the past half a century has never been carefully studied with a view to determining whether hunger situations in the world have tended to become less or more prevalent, affecting a larger or a smaller fraction of the world's population. What one would want to study is ingestion of food, region by region or nation by nation. That is impossible: we cannot measure the trend of per capita ingestion even in the United States, where the historical statistics of consumption are the best in the world. Nevertheless, if we could measure the change in per capita food ingestion in terms of calories between two periods of

relative peace, say 1908–12 and 1958–62, I have the impression that two principal conclusions would emerge. The first is that a smaller fraction of the world population experienced hunger in the recent than in the earlier period, in the face of an increase in world population of well over a billion people. The second is that in most, possibly all, parts of the world the average level of per capita calorie ingestion has somewhat declined, as the result of a lowering of human food-energy requirement due to substitution of mechanical for human labor in industry, mining, fishing, lumbering, and farming—not as a result of pressure of population on resources.

In support of the conclusion that hunger situations in times of peace have become less prevalent, I would consider first the phenomenon of increasing urbanization. City populations in times of peace or absence of social disturbances appear to have been consistently secure with respect to inflow of food, and their number has become a progressively larger fraction of world, regional, and national populations. There is evidence that they have not been forced, except in times of war and revolution, to spend an increasing fraction of their incomes on food. An expanding network of communication and transport, by telegraph, telephone, radio, ship, rail, road, and air, has tended to make the necessary inflow of food in peacetime more certain and cheaper. Governments exert themselves to keep the channels of inflow open, for food riots in cities endanger the ruling faction, and I think that governments tend to be more sensitive to public distress than they were earlier.

On the farms the security of basic food supply depends less on assurance of inflow, more upon the vagaries of weather in the form of drought, flood, frost, wind, hail, and upon impacts of insect infestations, epidemics of livestock disease, and so on. I think we may take it for granted that the huge number of peasant farmers in the world take good care to provide themselves with food before they market surpluses; force is required to extract from them more than will leave them with customary subsistence. But some natural afflictions of peacetime have been locally so severe that the peasants themselves could not produce enough food to cover their full requirements for the year: they may well have gone hungry at least part of the year, whereas city people have been in position to shift easily to unaccustomed sources of supply. The Chinese, recently hard pressed for food in some places, import grain from Canada—but I suspect for distribution in cities rather than in the country. In any event, it seems to me that these local farm deficits involving hunger situations must have tended to become less prevalent in the course of half a century, partly because the widening net of transport makes relief more feasible, partly because governments assume and are able to assume greater responsibilities for relief, but partly also because many developments in agriculture have made for lesser farm vulnerability to the vagaries of weather, pest infestations, and livestock epidemics. I mention only a few: the development of varieties of grain resistant to rust or drought, of varieties maturing earlier to escape frost or having stiffer straw to minimize lodging; advances in techninques of dry farming; contour plowing; the mechanization that permits more timely plowing, cultivation, and harvesting; the choice of superior crop combinations and rotations; the expansion of flood controls; the invention of pesticides and of herbicides that suppress weeds; inocu-

lations of livestock. Certainly even the peasant farmers of less-developed countries have a larger arsenal of weapons against natural afflictions than they had half a century ago. Probably there has been also a general tendency among farmers toward local specialization of production on the sort of crops that thrive best under given circumstances of climate.

The view that hunger situations, as between relatively peaceful periods separated by half a century, have become less prevalent implies, of course, a vast increase in annual world food output. It has been achieved partly by way of expansion of sown acreage, partly by way of enhanced yields per sown acre and per productive farm animal. I shall not attempt to describe how or where acreages sown to foodstuffs and feedstuffs have expanded, or what techniques have been developed to enlarge output per sown acre or per farm animal. Clearly, in view of urbanization, there must have been increase of food output per person engaged in food production—generally, I believe, but presumably less so in most of the Orient than in other major segments of the world; and this seems to have occurred in spite of increase in densities per square mile of food producers at least in many less-developed regions.

In the absence of two major wars in the past half a century, one might reasonably guess that suppression of hunger situations, and indeed more widespread achievement of more palatable and varied diets, would have become more evident than they have. Great wars, involving as they do profound disturbances of transport and diversion of labor, power, and materials from farms without anything like offsetting checks to population increase, are bound to reduce farm food output, disturb its distribution, and thus both create hunger situations and intensify them if coupled with natural calamities. Both acreages and yields per acre tend to fall. It takes time for recovery to occur. I suppose that of the past 50 years at least half can be characterized as years of decline and subsequent reconstruction in world food production, with no more than half representing years of peaceful development. If the causal relation has run, as I believe, from human propensity for warfare to hunger situations and not from hunger situations to propensity for warfare, it seems reasonable to believe that we have not in the past half a century encountered a population problem in the usual Malthusian sense.

III

The time has come to speculate about the short-run future, up to the Orwellian year 1984.

There is no aspect more important with respect to hunger situations up to 1984 than advent or absence of devastating widespread war. The crystal ball into which I stare tells me, if dimly, that it will not happen in the next 22 years. We who have power enough do not want it, and if I understand the Russians, they will continue to find the risk too big to take. They seek political dominance cheaply, without retaliatory damage to themselves. Nobody else has, or probably will have in two decades, the power to start a major war. Bickerings and frontier engagements no doubt will persist here and there, along with short-lived revolutions—but nothing resembling the destruction and the economically and agriculturally disruptive wars of 1914–18 and 1939–45.

The crystal ball points to a huge increase in world population. If the annual

rate of increase of the 1950's should continue, a rate of 1.6 per cent annually, the world population of 1984 would approximate 4.4 billion people, an increase of 1.3 billion, or around 40 per cent—a far larger increase both in absolute numbers and percentagewise than has ever before occurred in only two and a fraction decades. This projected population increase seems to distress a good many people, though not, apparently, our younger national generation.

In the absence of widespread warfare, the crystal ball tells me that the trends developed over many years past are likely to persist. Urbanization will continue, along with expansion of the network of communication and transport. More land will come under cultivation (there is a vast amount of well-watered land still unsettled in the tropics); there will be relatively more of the highly productive irrigated acreage, though I doubt if much of it will be moistened by desalted sea water; there will be more double cropping of existing acreage; more swamps will be drained. Yields per acre will continue to rise as more fertilizer is mined, manufactured, and applied; as weeds and livestock diseases are increasingly well-controlled; as soil management becomes increasingly well understood; as superior seed, more productive crop combinations, and more economical feed mixtures are invented for productive livestock. The ratio of food producers to nonproducers will continue to fall, and this will be facilitated by mechanization of an increasing fraction of the world's farms. Governments are not likely knowingly to hamper the adoption of improved techniques on farms, even if some of them bungle the matter now and again. Specialization, division of labor, will proceed both on farms and elsewhere.

The trends favorable to enhanced food output look to be world-wide. Yet nothing indicates that adaptations and innovations in farming, and in storage and processing, will proceed at the same pace among all nations or all geographical regions; some will lead and others lag, and I venture no guesses. Nor is there clear certainty in the closed economy of the world that food output will keep pace with or outpace the projected growth of population. A conclusion on that point seems to me a matter purely of opinion. Nevertheless I advance the opinion that, in the absence of widespread warfare, hunger situations in the world will continue to become less prevalent, and also that in many, though not all, parts people will have increasingly varied and palatable diets, in the face of the projected addition of more than a billion mouths to the world population. It is well to remember that a billion mouths are accompanied by a billion pairs of hands and a billion brains. The shorter run to 1984, in brief, does not look to me as if it supports Malthusian fears.

IV

My reason for choosing the period between the years 1984 and 2317 for considering the longer view of the Malthusian prospect is simply this. If world population should continue in that period to grow at the rate of the 1950's, 1.6 per cent per annum, arithmetic says that by the year 2317, three and a half centuries from now, the average density of human population over the whole land area of the world would be about 15,000 per square mile. There would be some 863 billion people in the world. A population density of 15,000 per square mile is only some 15 per cent less than the present density of the City and County of

San Francisco, a compact and heavily built-up place. I take it that this is an impossible density of population for a completely closed economy, as San Francisco is not and no nation is, but I suppose the earth will continue to be, space ships notwithstanding. A density of 15,000 per square mile of land surface in a closed economy implies availability per person of a strip of land 70 feet long by 27 feet wide. That seems rather small to provide food and other support for a person, even with allowance for forthcoming miracles of science.

This is the sort of calculation dear to the hearts of Malthusian pessimists. In the longer prospect, if population continues to grow at the recent rate, there will not be land surface enough to support people in bare subsistence, to say nothing of the comforts of a high and rising level of living, including occasional privacy and travel. There will be hunger situations in plenty. I have no quarrel with the conclusion provided it is properly stated as a long-term point of view, as often it is not. More than a few writers perceive calamity just around the corner unless population growth begins to be checked right away. I hold the opinion that the corner is at least several decades distant, but that a corner will have to be turned sometime in the next 350 years. The current rate of world population growth must sometime before 2317 fall to a creeping rate or to no rate of increase at all.

The crystal ball is notably foggy in the matter of elucidating when that inevitable change will come. About all it suggests to me is that turndown of the current rate of growth may become perceptible considerably nearer to the year 1984—or 1962—than to the year 2317. It is even more foggy in the matter of elucidating whether the eventual inevitable decline in rate of population growth will come by way of enhanced death rates or by way of reduced birth rates, or by some mixture of the two. Writers harboring humanitarian motives do not want enhanced death rates to be the effective agent: they inveigh against nuclear or bacteriological or conventional warfare, and hope for no emergence of a new form of pestilence, perhaps due to a new virus. Euthanasia seems not to have much support, infanticide none. Rather, the humanitarian writers are fully in favor of reduced birth rates. They plead not only for more and more persuasion for popular use of contraceptives, but also for formal adoption of national policies toward population limitation. I sometimes wonder what devices governments in decades following 1984 might use beyond permitting or facilitating access to contraceptive information and devices, and beyond even subsidized voluntary abortion, all of which leave to parents a choice as to size of family. Perhaps a heavy tax on the fourth and later children? Perhaps compulsory deferment of the age of marriage coupled with severe penalties on illegitimacy? Perhaps compulsory sterilization of male or female parent once three children have survived? Perhaps compulsory abortion after the third birth? Perhaps generous subsidies to childless couples? Current mores might have to change.

I may as well end with these questions. There is little to sum up. It amounts to reiterating that in the shorter view, and despite continuation of the population explosion, shrinkage rather than expansion of hunger situations in the world seems to me in reasonable prospect. In the longer view, that can hardly be the prospect failing a decline in rate of population growth. Whether or not that decline can be engineered in comfort, only time can tell.