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**THE WORLD FOOD SITUATION:  
PAST, PRESENT, AND FUTURE**

**Data Summarized by:**

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**June 17, 1975**

## I. THE PAST

### A. Trends in Food Production

During the two decades between 1954 and 1973, food production declined on a global basis only once -- in 1972. During this period world food production rose a total of 69 percent; 65 percent in the developed countries and 75 percent in the developing countries. World food production increased faster than population; the trend rate of increase was 2.3 percent for production and 2.0 percent for population, resulting in an annual increase in world per capita food production of 0.8 percent.<sup>1/</sup> (A breakdown of the 1954-73 trends for developed and developing nations is shown in Table 1.)

These trends show that, on the average, the 3.8 billion people in the world in 1973 had about one-fifth more food to eat per person than did the 2.7 billion people in 1954. But because of sharply different population growth rates, food production per capita rose at an annual trend rate of only 0.4 percent in the developing countries, compared with 1.5 percent in the developed countries. (Figure 1)

Most of the people in the world live in developing countries where most of the world's annual increase in population occurs. Population growth in the developed countries fell from 1.3 percent in 1961 to just under 0.9 percent in 1973. The developed countries were adding only 9.6 million people to the world's annual population increase of 71 million in 1973. In the developing countries, population is now growing more than 2.5 percent annually, compared with 2.0 percent in 1950.<sup>2/</sup> These countries now add almost 48 million in the world's population each year, nearly double their annual additions in the early 1950's and five times the current increment of the developed countries. China and other Asian centrally planned economies add an additional 13.4 million persons per year, and their population growth rate of 1.7 percent is presumed to decline gradually. The developing countries, including Asian centrally planned economies, now account for 86 percent of the world's annual population increase.

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<sup>1/</sup> Much of the information summarized in this paper is drawn directly from the USDA report entitled The World Food Situation and Prospects to 1985, FAER No. 98, December 1974.

<sup>2/</sup> Excludes Asian planned economies.

**TABLE 1**  
**Total and annual increase in food production,**  
**population, and per capita food production, 1954-73**

	<u>Total increase</u> 1954-1973	<u>Annual rate</u> <u>of increase</u>
	percent	
<b>Food production</b>		
World	69	2.8
Developed countries	65	2.7
Developing countries	75	3.0
<b>Population</b>		
World	44	2.0
Developed countries	22	1.0
Developing countries	61	2.5
<b>Per capita food production</b>		
World	17	0.8
Developed countries	33	1.5
Developing countries	8	0.4

Most of the major developed country regions have shown a strong uptrend in per capita food production (Figure 2). During 1954-73, the steepest increases took place in Eastern Europe and the USSR, part of which was recovery from the very low production levels prevailing prior to 1954.<sup>3/</sup> The slowest growth in per capita food production among developed regions occurred in the United States and Canada, where parts of agriculture, especially the grain sector, were being constrained by government policies designed to avoid further accumulations of already large agricultural surpluses, and, in the late 1960's, by low farm prices. In the USSR, Canada and Oceania, variations in weather caused wide year-to-year fluctuations in agricultural production around the 1954-73 upward trend.

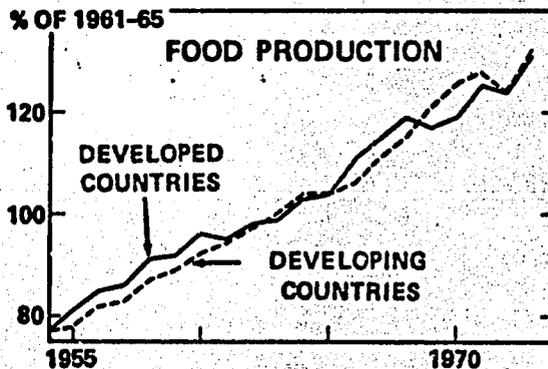
With the exception of Africa, most major developing regions experienced a substantial improvement in per capita food production during the last half of the 1960's, a period associated with the Green Revolution. In Africa,<sup>4/</sup> a general downward trend has been experienced since 1961.

<sup>3/</sup> In the USSR, for example, total agricultural production in 1953 was at the same level as in 1913, a result of four decades of revolution, collectivization, and World Wars I and II.

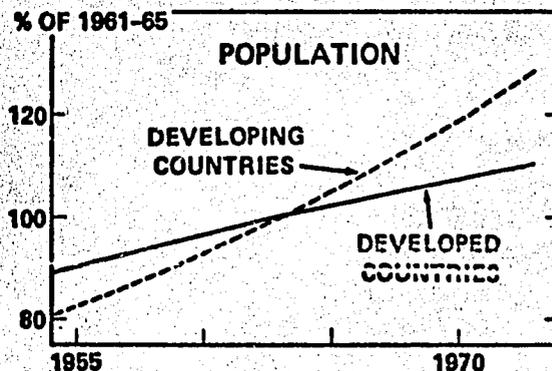
<sup>4/</sup> Many of the estimates of population and food production in Africa, however, are based on very inadequate data and may not be as reliable as those of other regions.

### FOOD PRODUCTION AND POPULATION, DEVELOPED AND DEVELOPING COUNTRIES

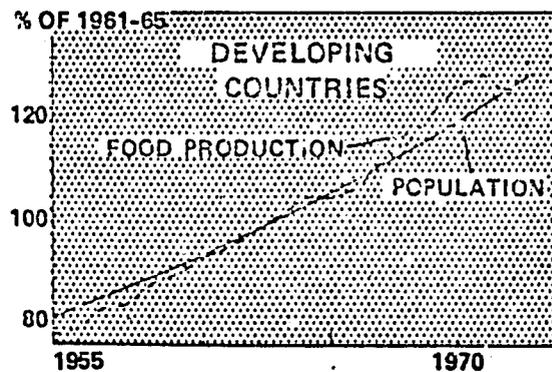
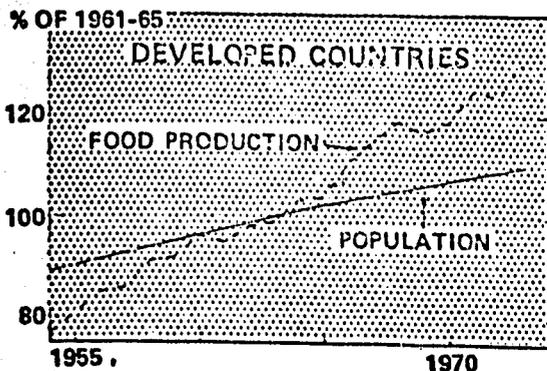
Food production has grown steadily over the past two decades. Growth in the developing countries has roughly paralleled that in the developed countries.



Population has grown much faster in the developing countries.



Peoples of the developed and developing country groups have not fared equally from the roughly equal growth in food production. In the developed countries production has increased much faster than population, boosting production per capita. In the developing countries, population gains have absorbed nearly all of the production increase; production per capita has improved only slightly.



DATA EXCLUDE COMMUNIST ASIA

FIGURE 1

# FOOD PRODUCTION PER CAPITA

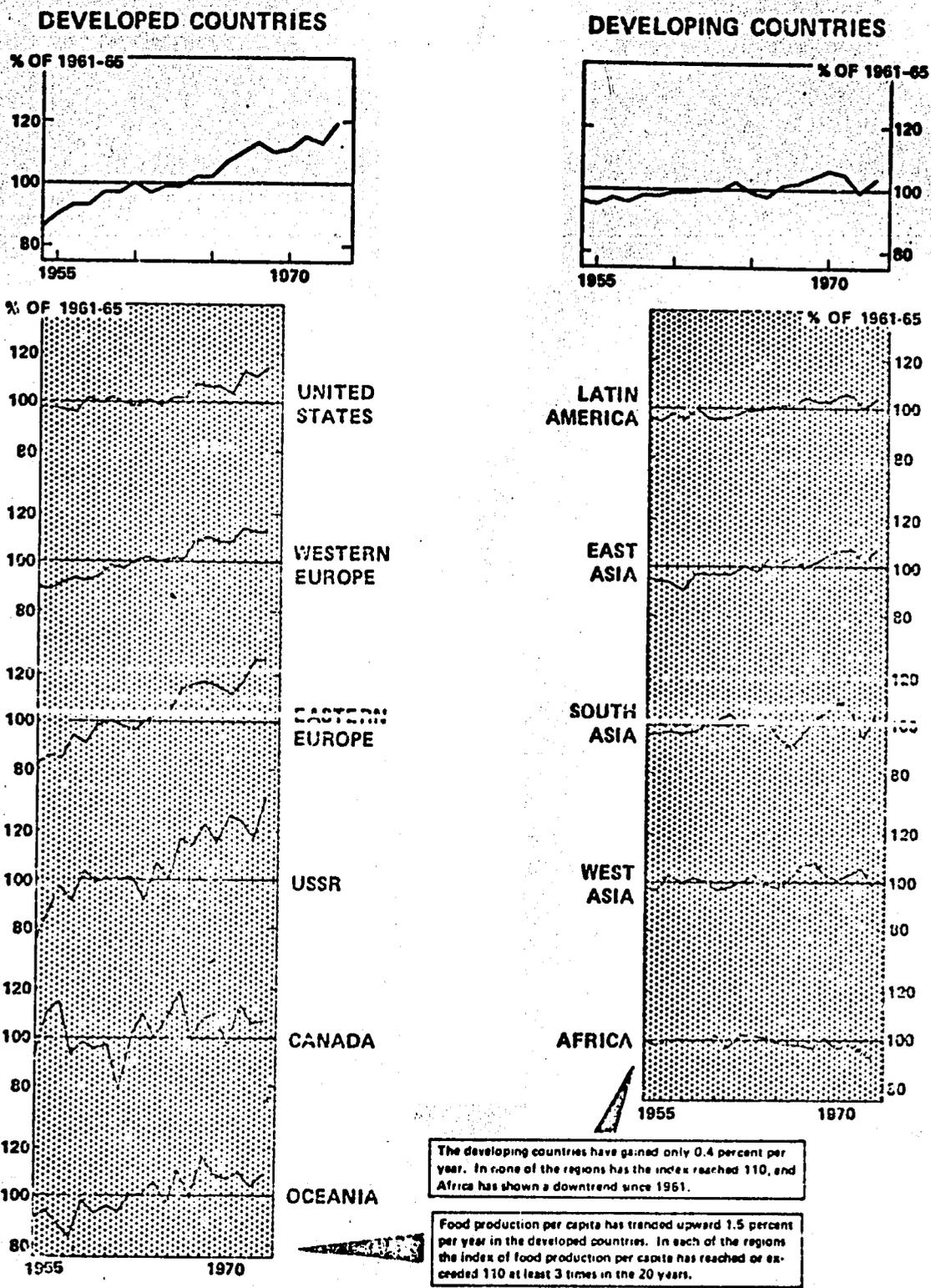


FIGURE 2

The value of food production per capita in the developed countries is more than five times as large as in the developing countries (Figure 3). This difference reflects the higher level of income in developed countries--which permits consumption of higher value food productions such as meat, milk, and eggs--and the much higher level of agricultural productivity per person.

**B. Trends in World Agriculture and Grain Trade**

Trade among the developed countries, both total and agricultural, has increased substantially over the past two decades. In 1955, 45 percent of total world trade and 35 percent of world agricultural trade took place between the developed countries. By 1972, these percentages had increased to 57 and 49.

The developed countries also account for an increasing proportion of total and agricultural exports. They provided 65 percent of total exports and 45 percent of agricultural exports in 1955, and 73 and 61 percent, respectively, in 1972. The developing countries' share of total and agricultural exports fell from 25 and 45 percent in 1955 and to 16 and 28 percent in 1972.

The share of the developed countries in world grain exports has also become larger (Table 2). In 1956-60, the developed countries exported 61 percent of the world's grain exports, and this proportion increased to 83 percent in 1972, in part as a result of the extraordinary imports of the USSR. Over the period, the developing countries' share dropped from 22.8 to 11.3 percent, and that of the centrally planned countries, from 16 to 6 percent.

Thus, over the past two decades and especially during the 1960's, the developing and the planned economies have come to depend more on the developed countries for grain supplies. The developing countries' imports have become progressively larger, and the intermittent imports of the centrally planned economies have also grown.

**C. Production Adjustments and Stock Changes**

In the face of the increasing world "food gap" and raising import demands by the planned economies, much attention has been focused on the relatively slow growth of world grain production in the past half decade and on the decline in world grain stocks.

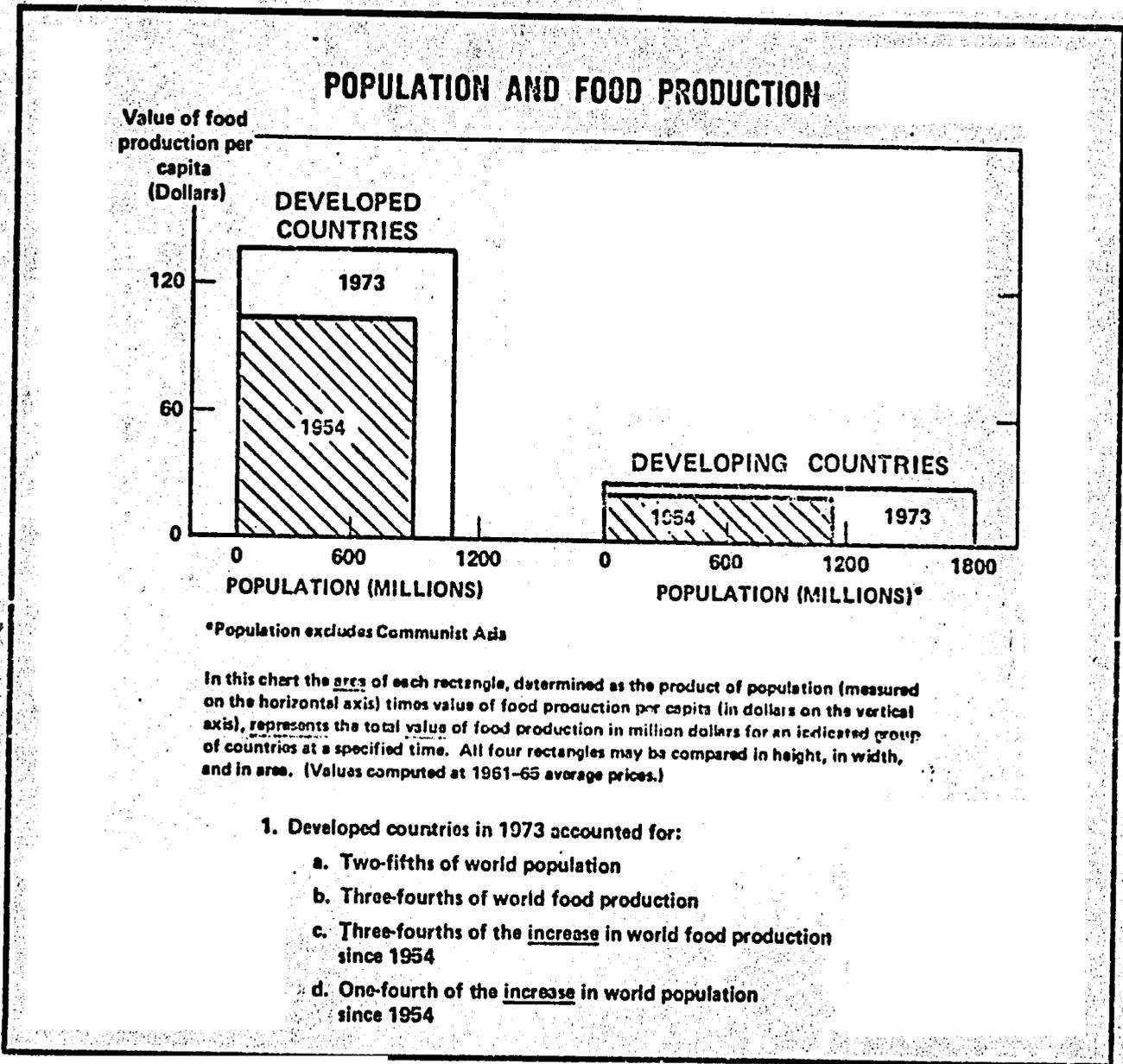


FIGURE 3

Table 2: Matrix of world grain trade

Exporting regions	Importing regions	Developed	Developing	Centrally planned	World
	<i>percent distribution</i>				
<b>Developed</b>					
1956-60		40.6	18.2	2.3	61.3
1961-65		39.2	20.4	11.8	71.4
1966-70		41.7	22.3	8.3	72.3
1971		42.5	23.6	7.2	73.3
1972		44.9	22.8	15.1	82.8
<b>Developing</b>					
1956-60		10.2	11.9	0.7	22.8
1961-65		7.7	9.7	2.5	20.1
1966-70		7.8	7.9	2.0	17.7
1971		8.5	6.1	1.0	15.6
1972		3.9	6.7	0.6	11.3
<b>Centrally planned</b>					
1956-60		3.3	2.0	10.6	15.9
1961-65		2.2	0.8	5.5	8.5
1966-70		1.9	3.0	5.1	10.0
1971		1.2	2.6	7.3	11.1
1972		0.8	1.3	3.7	5.9
<b>World</b>					
1956-60		54.1	32.1	13.6	100
1961-65		49.1	30.9	19.8	100
1966-70		51.4	33.2	15.4	100
1971		52.2	32.3	15.5	100
1972		49.7	30.8	19.4	100

Note: The column headings are importing regions while the table stub on the far left shows the exporting regions. Thus, by reading down one obtains imports by the region listed and by reading across one obtains exports.

Source: United Nations, *Monthly Bulletin of Statistics*, Sept. 1974 and selected issues.

In the 14 years between 1960/61 and 1973/74 annual production of the six major grains (excluding rice) exceeded or equaled annual consumption in 8 years. But in 3 of the past 5 years, annual consumption has exceeded annual production, with the excess over the period totaling 53 million tons.

The USSR had three major grain production shortfalls between 1960 and 1973. Production fell by 33 million tons in 1963, by 31 million tons in 1965, and by 13 million tons in 1972, with the shortfalls contributing significantly to lowered world production in all 3 years. Prior to 1963, the Soviet Union absorbed grain production shortfalls internally by stock drawdowns, reduced human consumption of grains, and slaughter of livestock. But large grain imports were made to partially offset the 1963 and 1965 crop shortfalls, and 1972-73 imports were far more than enough to compensate for the 1972 shortfall.

India's 1965 and 1966 shortfalls in cereal production coincided with the 1965 Soviet shortfall and contributed to the high export levels in those years and the rapid drawdown in world stocks in 1966-67. China also increased grain imports in the mid-1960's.

Concern about an approaching world food shortage in the mid-1960's stimulated expanded grain production in the grain exporting countries, rapid development of fertilizer production capacity, and a heavy drive to expand production in some developing countries with Green Revolution technology.

These efforts produced dramatic results. Combined with recovery in the USSR and China, large increases in world grain production took place in 1966-68, and production exceeded consumption in those years. Stocks reached a peak of 191 million tons at the beginning of the 1969/70 marketing year. In response to this, the major grain exporting countries began to cut back grain production, especially wheat. Between 1968 and 1970, the combined wheat area of the United States, Canada, Australia and Argentina fell from over 50 million to 33 million hectares and production fell from over 80 million to less than 60 million tons. Had these four countries maintained the wheat area they had in 1967 or 1968, they would have produced over 90 million tons more wheat than actually was produced from 1968 through 1972.

Reduced wheat area in the major grain exporting countries helps to explain why world wheat area stagnated after 1967. This has contributed to the impression that limitations on land availability or production capability have hampered food production growth.

Thus, in the late 1960's and early 1970's, the grain exporting countries and Japan were adjusting their domestic agricultural policies to curtail production of food grains--wheat in the United States, Canada, and Australia, and rice in Japan--and to reduce their stocks of these grains. These adjustment policies were effective. Stocks were reduced and some of the area in food grains was transferred to coarse grains.

## II. THE PRESENT\*

The current world food situation is both reasonably favorable and perilous. It is favorable in that (a) the severe crisis situation of late last year has apparently been avoided and (b) the current outlook for the production of major grain crops is favorable. The situation is perilous in that the world's level of grain reserves is below last year's alarmingly low levels. Thus the world, and especially the developing nations are very dependent on continued favorable weather.

As of mid-May the FAO "Early Warning System for Food Shortages" did not include any countries under the headings of "Serious Food Shortages" or "Ranger of Food Shortages". "Food Shortages" were listed for seven countries: Bangladesh, Burundi, Ethiopia, Haiti, India, Mozambique and Somalia. "Uncertain Crops" were listed for : Algeria, Burundi, Iraq, Jordan, Morocco and Syria.<sup>5/</sup> There is some question whether India should be included in the "shortage" list; it reportedly had good winter crops. And most of Bangladesh's import needs are scheduled to be met. Drought in North Africa and portions of the Near East is largely responsible for inclusion of countries from that region.

Early indications suggest that world production of grains in 1975 (excluding rice) may be 8% above last year's low levels.<sup>6/</sup> Current indications continue favorable for wheat and coarse grains, though much of the increase would be in North America. The outlook for rice is uncertain; much depends on the summer monsoon.<sup>7/</sup> Should favorable crops materialize as hoped, some recovery in stock levels should be possible -- perhaps as much as 25 million tons by the end of the 1975/76 crop year.<sup>8/</sup>

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\*The author of this section has benefited from discussions with: Pat Houston of the North American Regional FAO Office and with Bill Gasser of the Economic Research Service, USDA.

<sup>5/</sup>Food Crops and Shortages. FAO, No. 5, May 30, 1975 ("Restricted; not for publication"). Another "confidential evaluation" reported in The New York Times (June 3) also lists shortages in Yemen, Tanzania, Rwanda, and Malawi and a danger of a shortage in Sri Lanka.

<sup>6/</sup> "The World Food Situation - February 1975", FAO Council, March 1975, p.8. A similar increase was subsequently projected in the "World Grain Situation: Outlook for 1975/76," USDA, Foreign Agriculture Circular April 16, 1975, p.6.

<sup>7/</sup> "Food Outlook Quarterly," FAO, May 16, 1975.

<sup>8/</sup> "World Grain Situation," op. est., p.6.

A build-up in stocks is, as suggested above, urgently needed. Recent and prospective world cereals carryover levels, were estimated as follows in February 1975: 9/

<u>Crop Year</u>	<u>Closing Stocks</u> - million metric tons-	<u>Proportion of Total Supplies, Available</u> -percent-
1969/70	201	26
1970/71	167	19
1971/72	183	22
1972/73	134	14
1973/74	116	13
1974/75 (prelim.)	97	11

A subsequent USDA breakdown was as follows: 10/

<u>Crop Year</u>	<u>World Stock</u>		<u>Total</u>
	<u>Wheat &amp; Flour</u>	<u>Feedgrains</u>	
	- million metric tons -		
1972/73	50.9	56.3	107.2
1973/74	56.3	53.7	100.0
1974/75 (est.)	48.5	41.4	89.9
1975/76 (proj.)	59.5	55.2	114.7

The closing stocks at the end of 1974/75 will on this basis be the lowest in at least the last 15 years, and perhaps longer. 11/ It is evident, therefore, why the world might be said to be walking on the razor's edge over the remainder of the year.

Weather will be the big factor, but not the only one. The availability of fertilizers and other inputs will be another important variable. While fertilizer supplies currently are more ample and prices lower than they have been over the past year, prices are still above levels of a few years ago. These higher prices and some associated supply problems may have led to some weakening in demand in certain less developed areas. It may be necessary to stimulate demand for fertilizer in the future. The supply of pesticides is expected to be scarce in 1975, but insecticides may become more plentiful. 12/

9/ "The World Food Situation," op.est., p. 6. Excludes China and the USSR.

10/ "World Grain Situation," op.est., pp. 4,5.

11/ Comparative stock levels back to 1960/61 are provided in The World Food Situation and Prospects to 1985, USDA, ERS, FAER No. 98, December 1974, p. 22.

12/ "The World Food Situation ..." op.est., p. 8.

Thus, on balance, the food situation will likely continue to be difficult through the remainder of 1975 and into early 1976 -- or at least until it is possible to rebuild stocks to safer levels.

A further reading on the food situation will be provided later this week when the U.S. Department releases its quarterly report on the "World Agricultural Situation".<sup>13/</sup> The general assessment is not expected to be greatly different from that presented here. The report, however, will provide more current details on important matters such as expected stock carryover levels.

As the crop season continues, closer attention will have to be given to the distribution of the crop between developed and developing countries. A good crop in the developed nations, while clearly important to the LDC's, is not as important as a good crop in the LDC's themselves.

The big concern of a number of food specialists moreover, is that the public will lose sight of the peril of the present situation and become complacent. Dale Hathaway of the Ford Foundation provides an anecdote when he states that "We're right back where we were in '74 at about this time except that stocks are lower than ever." <sup>14/</sup>

<sup>13/</sup> Release of a press summary is expected Thursday afternoon, June 19. It may be a day or two thereafter before the full report is available.

<sup>14/</sup> Boyce Rensberger, "Food Experts See Several Countries in Greater Peril of Hunger and Possible Starvation Than Last Year", The New York Times, June 3, 1975.

### III. THE FUTURE

Long term analysis of the world food situation are undertaken regularly by the USDA and the FAO. This work is usually done on a country and commodity basis, as well as a world supply, demand, and trade basis. Neither the FAO nor the USDA have published projections of the world food situation beyond 1985.

An Iowa State University report, World Food Production, Demand, and Trade, includes projections for 1985 and 2000. This report uses the early 1960's as a base period, however, and excludes full consideration of the Green Revolution. A recent University of California report, A Hungry World: The Challenge of Agriculture, (July, 1974) provides projections to 1985 which are based on USDA and FAO data.

The various projections differ somewhat due to differences in country coverage and differences in assumptions about (a) income changes, (b) population growth, (c) use of modern technology, and (d) agricultural policies.

#### A. Projections of Grain Production to 1985

ISU: The ISU study projects huge grain surpluses in developed countries and a large deficit in developing countries (Table 3). The study does not reflect much of the technological advance associated with the Green Revolution, by virtue of an early base period. There is considerable expansion in area cultivated during the base period, but irrigation and other investments are limited.

The constant base prices assumed in the ISU projections are not high enough to provide much incentive for developing country farmers to increase production. Large concessionary grain deliveries to developing countries, together with tariff and other measures to support developed country prices, were assumed. Thus, high farm prices are projected to exist in developed countries, and this causes the accumulation of an unmanageable grain surplus of 171 million tons.

Meanwhile, deficits of 114 million to 118 million tons of grain are projected for developing countries.

FAO: The FAO commodity projections are for a later base period than are the ISU projections. They thus reflect more recent trends that include the effects of the first years of the Green Revolution. The FAO projections inject some of the current food crisis constraints, including the bad weather and poor crop yields of 1972, the incipient fertilizer shortage, and the energy crisis but not high product prices.

Table 3 - Comparison of cereal projections to 1985<sup>1</sup>

Item	FAO base (1969-71)	FAO 1985	USA base (1969-71)	USDA-I 1985	USDA-II 1985	USDA-III 1985	USDA-IV 1985	ISU 1985
<i>million metric tons</i>								
<b>World</b>								
Demand	1,207	1,725	1,062.6	1,548.5	1,618.7	1,501.8	1,643.9	1,145.5
Production	1,239	NS	1,081.8	1,550.4	1,620.6	1,503.6	1,645.7	1,187.3 (L)
Balance <sup>2</sup>	+32	NS	19.2	1.9	1.9	1.9	1.9	1,191.7 (H)
<b>Developing countries</b>								41.8 (L)
Demand	590	929	466.6	691.2	726.2	678.6	743.5	46.2 (H)
Production	585	853	443.1	632.4	648.7	626.2	721.0	
Balance	-5	-76	-23.5	-58.8	-77.5	-52.4	-22.5	
<b>Developing market economies</b>								
Demand	386	629	299.7	479.4	512.6	466.7	529.1	524.7
Production	370	544	279.2	424.7	441.0	418.7	513.3	411.0 (H)
Balance	-16	-85	-20.5	-54.7	-71.6	-48.0	-15.8	406.6 (L)
<b>Asian centrally planned countries<sup>3</sup></b>								-113.7 (H)
Demand	204	300	166.9	211.8	213.6	211.9	214.4	-118.1 (L)
Production	215	309	163.9	207.7	207.7	207.7	207.7	
Balance	+11	+9	-3.0	-4.1	-5.9	-4.2	-6.7	
<b>Developed countries<sup>4</sup></b>								
Demand	617	796	596.0	857.3	892.5	823.2	900.4	403.4
Production	654	NS	638.7	918.0	971.9	877.4	924.7	574.0
Balance	+37	NS	42.7	60.7	79.4	54.2	24.3	170.6

<sup>1</sup>The data for FAO and USDA are not comparable because FAO carries rice as paddy, USDA carries rice as milled. <sup>2</sup>Imbalances for USDA between demand and production in base are due to stock buildup, timing of shipments, and missing data on a number of small importers. Projected equilibrium does not allow for building or reducing stocks. <sup>3</sup>FAO Asian centrally planned includes the People's Republic of China and other Asian centrally planned countries (North Korea, North Vietnam, etc.), while USDA includes only the People's Republic of China. <sup>4</sup>Includes the USSR and Eastern Europe.

Note: Detail may not sum to total because of rounding.

NS = not shown.

The FAO projections stress the growing dilemma of grain surpluses in developed countries and rising deficits in many developing countries, particularly South and Southeast Asia. A net deficit of 85 million tons of grain is projected for the developing market economies by 1985, due in part to both a larger population and a higher rate of economic growth (more people eating more food per person). The deficit increases to 100 million tons if the major developing country exporters are excluded.

USDA: The USDA projections for wheat, coarse grains, and rice integrate the supply and demand estimates into a single framework allowing for their simultaneous projection. Four alternative sets of assumptions are used.

Alternative I assumes that economic growth has been temporarily slowed, but resumes strong expansion in the late 1970's and early 1980's. However, under this alternative, continued high internal prices limit expansion of world trade.

Alternative II is a high world import demand situation. Under this alternative, income grows at a faster rate in both the developing and developed countries than under alternative I. In addition, there is progress toward removing barriers to trade in the developed world, and the centrally planned economies increase their efforts to improve diets.

Alternative III is a low demand situation that assumes economic stagnation would continue in the late 1970's and recovery does not occur until the 1980's.

Alternative IV reduces the developing countries' import needs by assuming that they increase their investments in food production by embarking on a policy of increasing the bundle of inputs used to produce food.

The USDA projections published in this report confirm some of the results obtained from USDA analyses made prior to the current energy crisis. They indicate that productive capacity in world grain production over the next decade will permit continued improvement in per capita consumption of food in the developing world. Under alternative I, per capita cereal consumption is expected to increase from 187 kilograms in 1970 to 195 kilograms in 1985. The per capita increases in projected consumption under all alternatives assume the availability of either sufficient foreign exchange to finance the rise in imports generated by the higher income levels or the access to concessional supplies.

These projections also tend to confirm some of the earlier results with respect to the world meat economy. Contrary to the trends in the last two decades, real prices of meat are expected to show only modest rises relative to real grain prices. The higher input costs of grain for feed could slow the rate of expansion of meat production and trade, as compared with conditions assumed in the earlier analyses, unless mitigated by efficiencies in production and marketing of meat.

Long-term growth in world food and feed grain demand is projected under all alternatives considered. Consumption of wheat and rice would grow less rapidly than that of coarse grains because of faster growth in feed demand generated by expanding livestock and poultry production. The analysis also suggests that the developed and centrally planned countries--grain importing as well as grain exporting countries--will continue to supply the developing importing countries with grain, and the developed importing countries will increase their feed grain imports. Very little growth in total demand for wheat is expected in the developed countries. However, per capita demand for wheat in Japan will continue to grow as wheat is substituted for rice. Demand for wheat in the European Community will also continue to grow as more wheat is fed. Rice demand is expected to increase but not fast enough to become an important factor in the Western diet. Thus the big factor in the growth in demand for grain in the developed countries will be the continued growth in the livestock sector.

In contrast, substantial increases in demand for grains for direct food use are expected over the next decade in the developing market economies, primarily due to an expected 2.7 percent growth in population. Total cereal consumption is projected to rise at an annual rate of 3.2 percent under alternative I. Consumption of individual grains will depend more on production capabilities (technology) and import policies than on potential demand derived from income and population growth. In India, for example, growth in rice production is not expected to keep pace with the growth in potential demand for rice suggested by income and population growth.

Because wheat is cheaper to import in terms of food equivalent and because productivity in wheat is projected to exceed that of rice, the potential gap between rice production and consumption under all alternatives would be translated into increased consumption of wheat. Thus,

the gap between grain production and consumption in the developing countries will be met mostly with wheat imports. In addition, the developing countries with limited foreign exchange resources are expected to give food grains priority over feed grains. However, those with abundant foreign exchange could import feed grains, particularly under the high demand alternative II.

The projections suggest that the nature of the food problems facing the world over the next decade will hinge on the extent to which the developing world builds up a grain-feed-livestock sector. If the developing countries continue on an essentially cereals diet, particularly under the low demand conditions assumed in alternatives I and III, and if the consumption of animal protein in developed countries rises only moderately, world grain exporters would have no serious problem meeting world import demand. The world is capable of producing enough grain at reasonable prices to meet the demands of a largely cereal diet in the developing world. Even if demand expands by a modest increase in feed use in the developing countries, as projected under alternative II, production should be sufficient to prevent excessive price increases.

The world grain balance also hinges on the extent to which the lower income countries of the developed world follow the feed usage patterns of the United States and the European Community. Consumption of livestock products in the lower income developed countries is low. If income grows rapidly in the developed countries and if this is translated rapidly into a demand for livestock products, grain prices could be pushed up. But substantial price rises could slow the growth in the use of grains for feed. Feed grain demand cannot be expected to increase substantially unless grains are reasonably priced relative to livestock products.

#### B. Outlook for Food Production after 1985

The long run outlook for world food production in year 2000 must be, at best, a very rough estimate based on (a) the recent production trends and (b) information on the possible constraints imposed on production by nature and man.

The long run outlook for future food production depends to a large extent on what happens to seven major crops; wheat, rice, maize, soybeans, sugar, potatoes, and dry beans.

Increased production depends on higher yields per hectare or increased land area in crops. Higher yields have been the major goal in the developed world. Cultivation of new land area has received the greatest emphasis in most of the developing countries; particularly in Latin America and Africa. The sources of production increase for the seven major crops during the past two decades are summarized below.

Wheat: Approximately 80% of the increase in wheat production was obtained from increased yields and 20% from increased land planted to wheat.

Rice: Over 90% of the world's rice is grown in Asia. Approximately 50% of the increase in rice production during the past 20 years has come from higher yields. The remaining 50% from increased land planted to rice.

Maize: Approximately 75% of the increase in the world production of maize has been due to higher yields and 25% to increased land area.

Soybeans: Yields of soybeans have increased by only 1% per year in recent years. Most increases in soybean production will be the result of more land planted to soybeans. Soybeans are primarily a U.S. and Asian crop.

Sugar: On a worldwide basis, almost three-fourths of all sugar comes from sugarcane. Worldwide increases in sugarcane yields were 13% per decade. Sugarcane plantings increased a little over 3% per year in the past two decades. Approximately 45 percent of the increased production of sugarcane has been due to higher yields resulting primarily from increased use of nitrogen fertilizer. Increased land in sugarcane has accounted for 55 percent of the increased production.

Potatoes: Total potato cropland has remained essentially unchanged during the past two decades while yields increased approximately 20 percent during the past decade.

Dry Beans: The worldwide cropland area in dry beans has increased 1.8% annually in recent years. Most of the increased output of beans worldwide is accounted for by expanded plantings.

It is obvious that both yield increases and expansion of land in crops will be necessary to meet food needs during the next twenty-five years. The possibilities of increasing key inputs is discussed below.

Land: In 1970, only 46% of the world's potentially arable land was actually in use as cropland. If all of the world's potentially arable land were producing crops at current yields, almost 8 billion people could be fed. To bring the unused land into production, however, will require vast investments in transportation systems, agricultural industries, research, agricultural machinery, and shifts in population.

Water: Irrigated land will have to be increased somewhat more rapidly than in the past if the ratio of irrigated land per person is to be maintained. Water supplies are adequate to allow an increase in irrigated land provided that water is managed more efficiently than at present. The historic traditions for allocating water will have to be changed in many parts of the world. Such changes have always proven difficult to implement. Soil and water salinity will continue to be an environmental problem and one which will increase as irrigated land is expanded.

Climatic Changes: Information on climatic changes is very limited. The world appears to be in a period of extreme climatic variation. If so, we can expect larger changes in year to year food production. This increases the importance of maintaining larger grain reserves throughout the world. There is some evidence of a cooling trend. A drop in the average temperature by as little as 3 degrees centigrade would shift U.S. wheat production to the south and could cut wheat production in Canada and Russia by as much as 50%. Atmospheric pollutants are reducing the solar radiation reaching the earth's surface. This trend could eventually affect crop production but there is still very limited information on which to make predictions.

Man's Inputs, Technology: Nitrogen fertilizer is one of the main technical inputs affecting crop yields. The location of world production of nitrogen fertilizer will shift to areas with large supplies of natural gas. Supplies will increase within the next few years and prices are likely to fall somewhat from present levels.

Crop losses to pests and diseases world wide are approximately 33% of potential production. Additional losses occur during marketing due to birds, rodents, and other pests. Pest and disease control is greatly complicated by the modernization of agriculture. Monoculture systems result in large areas planted to genetically identical crop plants. This increases their vulnerability to damage by pests and diseases. Double and triple cropping further increases crops vulnerability to pests and disease attack.

Chemical control of pests, diseases, and weeds will continue to increase in importance but will also continue to cause environmental problems. Biological controls of pests will also continue to be developed. Increased investment will be required in research and control of pests and diseases. Governments will have to act more swiftly and cooperate more fully to solve pest and disease problems.

Plant improvements will continue to be important. More emphasis will be placed on improving the quality of protein in grains and developing varieties which produce well in tropical areas. Additional attention is also being given to the development of "minimum input" varieties which will produce stable yields under a wide variety of climatic conditions.

Trends in Livestock Production: An estimated 60% of the world's livestock is raised in developing countries, but they account for only 20 to 30% of the world's livestock products.

Livestock production will continue to increase as a result of continued improvement in (a) feed conversion, (b) reproductive efficiency, (c) disease control, and (d) management systems. Nevertheless, world production of most livestock products is expected to be less than the effective demand by 1985. Nearly 7% less in the case of beef and milk and over 11% less in the case of mutton and lamb. This is not considered especially serious, however, because the main shortages will be in the developed nations where protein levels are already adequate. The "production gap" for livestock products is likely to increase after 1985.

Trends in Aquatic Food Production: In 1970, the human population consumed 43 million metric tons of fish. This provided 1% of total human energy consumption (calories) and 2.3% of the world food protein. An additional 26 million metric tons of fish was used for oils and fish meals.

Peru harvested 18% of the world's fish catch in 1970. Russia 10%. The U.S. only 4% of the total.

World production of seafood has leveled off in recent years. Production is expected to increase by approximately 1% to 2% per year during the next 10 years and somewhat more slowly after 1985.

The Indian Ocean offers the greatest possibilities for increased fish production. It is estimated, however, that the world's oceans will be able to provide a maximum sustainable yield of approximately 100 million metric tons per year. Aquaculture will continue to grow in importance as the cost of harvesting "wild" fish increases.

Developing the potential of the world's fishery resources will require:

- a. improving the biological management of "wild" fisheries
- b. increasing the technology and physical capacity of fishing fleets
- c. developing new international cooperative agreements for the management of the world's fisheries.

Progress presently is slow in all areas with the possible exception of increasing the number of fishing boats.

IV. NUTRITION

Nutrition and Vulnerable Groups

Millions of people in the world suffer from malnutrition. FAO has concluded that out of 97 developing countries, 57 were deficit in food energy supplies in 1970, and has estimated the number of malnourished in the world (excluding Communist Asia) at about 460 million people.

The average daily intake of calories per person for major countries are presented in Table 4 and illustrated in Figure 4.

Who Are the Malnourished?

Malnutrition is primarily a function of poverty. Most of the world's malnourished live in the developing countries - in the Far East and Africa. Between one-fifth and nearly one-third of all people living in the Far East (excluding Communist Asia), the Near East, and Africa have an insufficient food supply, compared with only 3 percent in the developed countries.

Within households in these regions, it is the men, the primary earners of income, who often get first priority in the allocation of food, and when food shortages are especially acute, the women and children may be the most deprived. Children's malnutrition is also affected by their inability to ingest sufficient food when starchy foods are the main staple. FAO has estimated that perhaps one-half of the young children in the developing countries may suffer in varying degrees from inadequate nutrition.

How Much Would it Take to Feed the World's Malnourished?

Cereals alone could conceivably supply the calories and much of the protein needed by the world's malnourished people. The caloric value of most cereals is similar. About 0.15 kilograms daily of wheat, rice, corn, sorghum, or millet would provide 500 calories. If the estimated 460 million malnourished people in the world were each provided daily with additional grain equal to 500 calories, much of the world malnutrition would be alleviated.

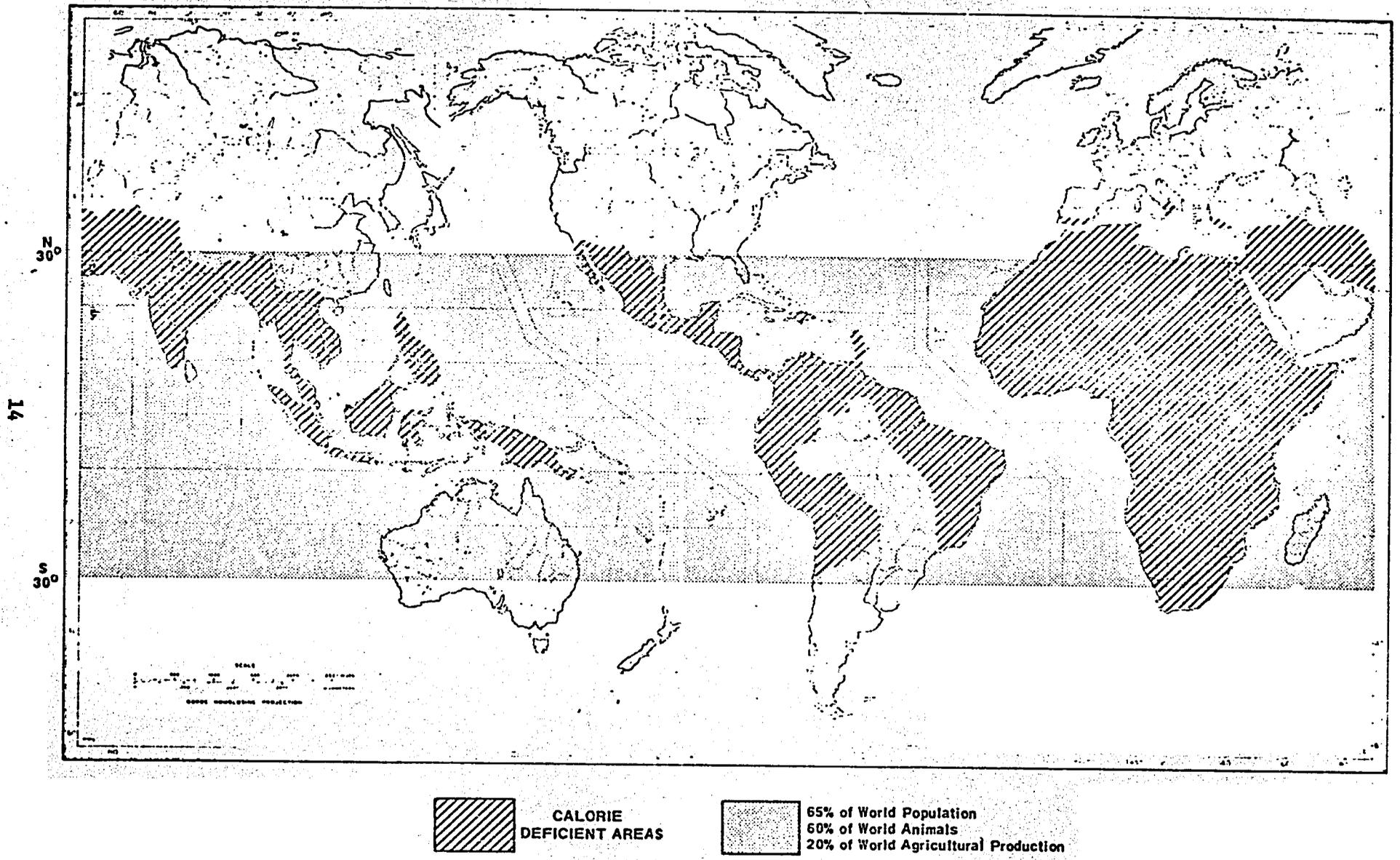
On an annual basis, about 25 million tons of cereals would be needed, about 2 percent of average annual world cereal production during the last decade. The world could rather easily produce 2 percent more grain. But the mere production of 25 million tons more grain would not solve the problem of the world's malnourished.

Table 4 - Calories per person per day from 11 food groups, 1964-66 average

Country	Region	Cereals	Starchy crops	Sugar	Pulses, nuts & cocoa	Vegetables	Fruit	Meat	Eggs	Fish	Milk	Fats & oils	
<b>Developed</b>													
United States		3,156	649	95	513	103	73	101	598	71	26	397	530
Canada		3,142	670	155	520	73	62	101	622	57	23	378	481
Australia & N. Zealand		3,192	821	101	550	61	47	102	655	52	23	403	377
USSR		3,182	1,544	265	412	60	41	27	240	27	21	252	293
EC-9		3,111	878	179	391	68	59	109	474	50	30	305	568
Eastern Europe		3,080	1,498	183	307	59	49	58	314	31	13	189	379
Japan		2,416	1,397	134	197	116	90	53	53	38	85	62	174
South Africa		2,734	1,583	33	403	55	14	37	254	11	28	147	167
Other Western Europe		2,897	978	191	304	103	69	126	288	38	50	267	483
Average		3,043	1,127	175	388	32	59	76	371	44	32	270	419
<b>Less Developed</b>													
Argentina		2,885	999	180	378	28	30	88	614	24	12	206	326
Mexico & Cent. America		2,425	1,197	107	388	188	14	82	131	16	11	104	187
Other South America		2,276	898	291	363	80	23	62	203	13	21	142	180
West Asia		2,316	1,480	41	187	91	39	113	78	7	4	91	185
China (PRC)		2,045	1,383	224	35	134	33	6	134	12	14	5	65
Brazil		2,541	861	410	401	312	11	48	203	18	13	135	129
East Asia & Pacific		1,969	1,271	245	99	107	27	31	58	7	31	8	85
North Africa		2,290	1,461	104	198	72	43	67	69	5	6	78	187
South Asia		1,975	1,300	29	192	176	35	26	8	1	5	89	114
Southeast Asia		2,121	1,589	70	84	78	29	58	77	8	39	18	71
Africa South of Sahara		2,154	1,109	568	53	180	13	18	61	3	13	32	104
Average		2,097	1,300	191	135	146	30	30	89	8	13	50	105
World		2,386	1,247	186	212	127	39	44	175	19	19	117	201

Source: FAO Food Balances 1964-66.

Fig. 4 GEOGRAPHICAL DISTRIBUTION OF WORLD FOOD PROBLEM



The most difficult problems are not those of increasing production of food, but of distributing it properly. Nevertheless, it is noteworthy that the amounts of grain needed to eliminate the worst aspects of malnutrition would be only about twice the quantities of grain moved under food aid programs in the past decade.

However, only a small share of food aid has gone directly to the malnourished. Most has gone to reduce prices and benefit all consumers in the receiving countries. Although malnutrition can result when the intake of any essential food element is too low, most of the world's underfed suffer primarily from inadequate caloric intake, which for the developing countries is clearly linked to low incomes.

The best long-run solution to the problem of malnutrition is to develop programs and policies to provide farmers in the developing countries with techniques and assistance to raise their production, and to provide others with employment opportunities to raise their incomes to enable them to pay for adequate diets. For some developing countries, special feeding programs for those most affected by malnutrition may be needed. Fortification of foods, educational programs, and other means may also contribute to improved nutrition.

The Situation in Year 2000: It is difficult to predict the number of persons who will be starving or malnourished in 2000. The number will depend on (a) the world's ability to continue to increase food production and (b) on improvements in the distribution of income.

If the proportion of total population malnourished in 1970 is projected to 2000, there would be approximately 825 million persons malnourished in the 97 developing countries included in the original FAO estimates. Using the estimate that one out of six people in the world is undernourished in 1975 and projecting this to 2000 with a world population of approximately 6.6 billion persons, the number of undernourished in 2000 would be 1.1 billion persons. If only 10 percent of the undernourished were classified as starving, the total number of starving persons in 2000 would be over 100,000,000 persons.