

WORLD NEED FOR MORE FOOD AND ITS EFFECT:
IN RELATION TO NATURAL RESOURCES

As this Nation enters the last third of this century we face a crisis of staggering proportions. The mounting population of the world, and the prodigality with which we use its resources are mutually opposing facts of our life. These two great forces converge on a collision course. The trends for conservationists are easily discernible. Our Nation faces the prospect of unlimited demands on its vast, but limited resources.

It is hard for most well-fed Americans to know what famine means.

But it is true, and we'd better begin to believe it--that hunger--desperate hunger--is a widespread world problem and one that has a very great impact on economics, politics, ideological conflict, scientific progress, and many other aspects of living.

Here in our comfortable surrounding starving is just a word. But to those who have been in India and seen dead bodies in the streets each morning, it is more than a word. Significantly, the Bengal famine of 1942-43 in India in which over a million people died of starvation was the last great famine in the free world. But the threat of famine remains with us today.

The statistics of this cruel fact assert that every day in the year, around the world, ^{over} 10,000 people die of hunger or the effects of malnutrition.

Today, the world faces perhaps the most crucial challenge in history. The gap between food needs and food production in the less developed world is widening steadily. It will take concentrated and concerted effort on the part of all of us--all nations--to close this gap.

Talk by Norman A. Berg, Deputy Administrator for Field Services, Soil Conservation Service, U. S. Department of Agriculture, Washington, D. C., at the 96th New Jersey Farmers Week, January 24, 1967, Trenton, New Jersey

The food problem is not new, but the rapid growth of population, especially in the countries least able to feed their citizens, has greatly changed the magnitude of the problem. It has taken all the years of human history for the world population to reach 3 billion. But it will take less than 35 years to add the next 3 billion if population growth rates do not decline. For centuries past, many of the low income countries had a death rate equal to their birth rate; consequently, there was little net population growth. Frequent famines and disease epidemics maintained the average death rate at a high level. With the advent of modern disease control measures, the death rate has been cut to less than half, while the birth rate has continued at its high level. Because young people account for a large proportion of the population of these countries, it is likely that high birth rates will continue.

There is still room on the earth for these growing millions, of course, if there were food enough. There's the problem. Food production is not increasing at the same rate as the population.

Cultivated lands occupy only one-tenth of the land surface of the earth but produce most of the food for mankind. Nearly three-fourths of the area is used to grow grain--which directly provides approximately half of the calories for the world population.

During the last 25 years, the land area devoted to food production has increased only 15 percent. It is not probable that it will increase much more during the next 25 years.

The quality of the soil and the amount of the water available for crops varies widely around the globe. Yields in selected countries show a wide variation, and, for the most part, can be identified with water problems. Many areas that were fertile croplands during our period of recorded history are desert today, as a result of deforestation, soil exhaustion, wars, and the unscientific use of the land.

In our own country a great dustbowl emerged during the thirties because we ignored proper management and plowed up a marginal area. In recent years the Russians have had a similar problem since millions of acres of steppe lands that had previously been used only for light grazing have been converted to grain production. Other areas of the world are faced with similar problems of soil erosion after nature's balance has been destroyed. India has many slopes eroding as a result of over grazing and a growing population's search for twigs and branches for firewood; consequently, this needed cover for holding moisture and retarding soil erosion has been destroyed.

Crop production can increase in two ways. We can farm more potential arable land or we can increase the yield on land now farmed. Irrigation, for example, may be required to extend crop acreage and may also be the most productive of all possible improvements on present cropland. The greatest gain from limited capital may result from providing irrigation to the existing farmlands rather than developing new lands of lesser quality.

World Land Use

As I said, about 3 billion acres, or 10 percent of the land area of the earth, is devoted to cultivated crops.^{1/} These cultivated lands, devoted

principally to the production of cereals for direct human consumption, produce about 90 percent of the food consumed by man. Pasture and range lands occupy 20 percent of the land surface. Mostly, these lands are not suitable for the production of cultivated crops.^{2/} They do, however, make an important contribution to the world's food supply.

There remains a considerable area of land suitable for the production of food and fiber. Kellogg^{3/} has indicated that the area of potentially arable land is nearly twice that in use in 1961. Great tracts of land in Africa and Central and South America could be developed, but much of this area is in the interior of the continents and adequate transportation, industrial and other facilities must be provided to permit agricultural development.

Effective Utilization of Water for Agricultural Production

Much land now cultivated has potential for higher yields if the production limitation caused by an inadequate water supply could be removed. Water supply development, control and efficient use is essential.

While on a world basis, we have an adequate supply of water and there appears to be sufficient arable land, great problems exist in combining the two resources to create a satisfactory environment for food production. Most areas have either too little or too much water--or perhaps both, depending upon the season of the year.

Traditionally, the first approach toward satisfying water needs has been that of developing additional supplies, providing storage at times of abundance for use during dry periods, and/or collecting the water available and conveying it to a point of greater need. Great possibilities still exist for further development. However, future projects will be more

complex and more costly than those constructed in the past.

It is also an unhappy fact that in most of the world existing water supplies are used very inefficiently. The potential for making more effective use of the water supply is very great on both the non-irrigated and irrigated lands. Sometimes the low cost of the water is the reason for the waste. A farmer often finds it cheaper to use more water than to provide the additional labor and facilities necessary to use his supply to the fullest advantage. The cultivator in the developing nations may further be limited by the habits, customs and laws in his society which encourage misuse of his water and soil.

As important as water is to the production of food, it is but one of the factors necessary to crop and animal growth. High yields are obtained when all the production factors are applied in proper amounts and combinations. Maximum effectiveness of the water supply can be attained only when coupled with adequate fertilizer programs, the control of pests and diseases, the use of high yielding varieties, weed control, proper tillage practices, etc. The principle of interaction is basic in agriculture and fisheries sciences, and any treatment of the subject of resources as applied to food must necessarily give it full consideration.

Other Factors Affecting Food Production

Lack of knowledge and lack of capital are major obstacles to increasing the world's food supply. Any program will have to provide both knowledge and capital. Providing knowledge involves successfully training people in conservation use and development of natural resources. This training

depends to a large degree on their general education in the economic and socio-political fields, as well as on their comprehension of the more direct problems of natural resource use. Even in countries with a high degree of literacy, such educative processes are slow; they are overwhelmingly complicated in countries in which two-thirds or more of the people cannot read. A rise in literacy rates is recognized as one of the essential prerequisites to long-run solution of the developing nations' food problems.

Availability of capital is a parallel need for generating sustained long-term gains in food production. Capital investment in irrigation, drainage and other developments can boost food output if the operating capital requirements of the producer are also met. Studies have shown that in the developing nations a sustained trend of rapidly rising yields has not been achieved where average annual per capita income is below \$200--a condition prevalent in many less developed countries.^{4/}

Deficiencies in the nonagricultural sectors of the economy must also be erased in order to achieve the necessary food supplies. The industrial sector must supply the physical inputs such as fertilizers, insecticides, fungicides, herbicides, tractors, farm implements, tools, energy products, and others. Other sectors must supply such services as transportation, financing, communications, and research. It would thus appear extremely difficult, if not impossible, to achieve a proper balance between the population growth and food supply. The interrelationship of many complicated

in the developed countries which, if properly adapted to the specific conditions of the deficit countries, could go a long way towards solving their food problem. We must find a way to close the gap separating the existing body of known technology from its application. Improved technology has been applied in only a small part of the world, but this does not mean that it cannot be applied in other parts of the world. Nor should it require the same amount of time.

The World Food Supply and Famine

The developed countries--those in Europe, North America, Australia and New Zealand--have plenty of food. But in most of the less developed countries, per capita diets are substandard. The diet-deficient areas include all of Asia except Japan and Israel, all but the southern tip of Africa, the northern part of South America, and almost all of Central America and the Caribbean. This includes two-thirds of the people of the world.

The people in these areas received in 1959-1961, on the average, about 900 calories per day less than the people living in countries with adequate national average diets. They were 300 calories below the average nutritional standard for the diet-deficit areas. The daily consumption of protein was less than two-thirds of the level in the diet-adequate countries; the consumption of fats was less than one-third.

It is encouraging to note that the less developed countries have achieved outstanding increases in agricultural production during the last

(1959-61). Consumption of protein and fat is expected to be up 10 and 16 percent, respectively. This indicates an improvement, not only in the quantity of food per person, but also in quality.

A Study of Agricultural Output in 26 Countries

The Economic Research Service, U. S. Department of Agriculture, recently completed a study on factors associated with the differences in rates of increase in agricultural output among 26 countries. The study identifies a rational, but highly variable, pattern somewhat in accord with the uniqueness of each country in its combination of human, land, and capital resources; technical possibilities; and institutional, social, and political features. Crop output has not increased rapidly merely as a result of normal economic and social processes in societies organized on a freedom of choice basis. Rather, the increase has been brought about by aggressive group action, usually national in scope, directed specifically to improving agricultural production conditions.

* { The above mentioned study showed that in 22 of the countries studies, increases in area of crops were more important to crop production in 10 countries; crop yield increases were more important in 12. While many nations, particularly in Latin America and Central and South Africa, still have sizeable land expansion potentials, other countries will have to achieve needed food supplies through increased crop yields. Even in some of the countries that do have potential for land expansion, increasing yields may still be the better means of increasing agricultural output.

Change in yields per unit of land is now the best available indicator of changes in resource productivity for underdeveloped countries. Crop yields have increased since 1948 in all of the study countries. Leaders in yield increases include Israel, Sudan, Mexico, Taiwan, Greece, Yugoslavia, and Thailand. Among the more rapid-growth countries, only Brazil, Tanganyika, Venezuela, the Philippines, and Turkey have failed to achieve substantial yield increases. These countries have brought considerable areas of new land under cultivation some of which may have been of low quality.

In terms of their physical and technical bases, recent yield increases in the study countries have been achieved mainly through increased use of fertilizers; improved crop varieties; more effective pest controls; improvements in planting tillage, and harvesting methods; and better use of water resources. Often, improvements have been made as part of a system of improved production practices. Some of these changes have provided additional employment and have also required some additional capital.

The simplest problem, of course, is fertility maintenance and improvement on the more nearly level areas of good, well-drained soils in the humid zones. Unfortunately, soils of this kind are limited not only in extent but in distribution. Only a small proportion of the world's cropland can be classified in this category. There are hundreds of millions of acres of cropland that have been, and are still being, damaged by erosion. Such lands require complex combinations of vegetative and mechanical controls as well as fertility maintenance and such other improvements as drainage and irrigation.

whether it be in areas of limited total rainfall or in areas of abundance during portions of the year, is to grow crops that make the most efficient

use of the available water. In some areas of Southeast Asia there is not enough rainfall to use all the land for upland paddy rice, but there is enough rainfall to grow other crops on paddies that would otherwise be left idle,

In many parts of Africa and Asia, rainfall is limited, although there is an excess during the rainy season. In such climates there is a need for measures to control run-off and erosion during the monsoon season, and measures to conserve water during the drought periods.

Conservation measures that reduce runoff are of major importance. Practices that hold the water on the land for a long enough period to allow it to infiltrate into the root zone of a well-fertilized crop will increase yields by using the available moisture more efficiently. Terraces, diversions and contour cultivation will save much of the rainfall, that would otherwise be lost, for food and fiber production. Such measures have a wide adaption over much of the world where rainfall is limited.

In areas of low rainfall, the water that falls should be concentrated to permit more efficient use. This can be done by holding the runoff from larger drainages or small areas of arable soil to increase the growth of food and fiber crops.

Inasmuch as cropland, forest and grazing lands go to make up well-defined watersheds, there should be a coordinated land use program which will provide a basis for making the most efficient use of the rainfall, and at

as possible, and the construction of reservoirs, channels and other facilities to control the runoff that occurs. These reservoirs and structures may be used for irrigation, fish production, and water for people and livestock, as well as for providing flood control on the valuable flood plains below.

Needs for Future Action

Future action must be firmly grounded on goals. The earlier and more carefully these goals are defined and set, the more likely that the effort will succeed. Explicit definition of goals is an important and difficult task and most often will be based on political considerations as well as technical knowledge. The course of action will vary from region to region, nation to nation, and basin to basin, for a diversity of social beliefs and structures exist within the many societies involved.

Future action in the field of water resources must entail a very considerable expansion of technical and financial aid. The scope of an effective program cannot be merely that of doubling or tripling present efforts. If immediate results are to be expected, and if the scale of increase is to be sufficient to alleviate hunger, then bold new programs of enormous scope dedicated to this prime problem of humanity will be necessary. The United States cannot accomplish this alone. All developed nations must join with their less fortunate neighbors in the endeavor.

As a stopgap, tremendous amounts of food are being shipped to the under-developed countries by the more fortunate nations. The yield of one out of every four harvested acres in the United States goes out as export. More than half of our wheat and rice goes overseas. One-third

of our soybeans and grain sorghum crops and one-fifth of our cotton is exported.

The more affluent nations are ready and willing to step up exports of food to the needy nations--even to give them food knowing that hunger is a very real threat to world peace. Three-fourths of our U. S. food exports are sold and one-fourth moves overseas as aid.

But we come to grips with the real cause for alarm when we realize that in 20 years or less, the developed nations of the world will have exhausted their combined capability of feeding the hungry people who will populate the developing nations.

What then will be the solution?

The developing nations of the world must find ways to dramatically increase their food production, and soon. We can help them buy a little time with food aid, but very little. This is why the President, in the new Food for Freedom Program, is attempting to use food aid in ways that will stimulate and assist increasing food production in the developing nations. We will be asking them to give agricultural improvement high priority. We will be working out technical assistance programs with them that will accelerate their agricultural improvement.

This is good business--not only because it may save peace in the world but also because it has been demonstrated that as nations improve their agriculture, their economy generally improves and they become better customers for American food products.

How will nations increase their production?

It is true that there are still large acreages of arable land that could be developed. Most countries still have land that could be shifted into crop production.

But the catch is that most of that land cannot be developed in time. It is land that is inaccessible to markets, needs drainage, irrigation, or some other institutional factor.

Farmers themselves need education, capital and incentives they do not now have. Our food authorities fear that those developments cannot be achieved in time to count on new acres solving the problem.

The answer then lies mainly in increasing production on the acres already under the plow.

Research, bringing to the fore higher yielding strains, and improved cultural techniques, offers part of the answer. We are hearing about developments in wheat and corn that will greatly increase per acre yields. Greater use of fertilizer could be part of the answer. But not all countries are geared up for fertilizer production.

Breakthrough in desalinization of salt water would step up production through irrigation, to say nothing of opening up prospects of new farm lands.

But in the final analysis, as Secretary Freeman told the delegates at the Pan American Soil Conservation Congress in Brazil last April, soil and water conservation is the basic cornerstone of agricultural development

This is not because soil conservation is erosion control--important as it is to hold productive soil in place.

It is because what we call soil and water conservation is in fact a sophisticated combination of technologies that fits management of our food-yielding resources to the resources and to the people involved.

Soil and water conservation is a system of land management that recognizes the principle of interactions between plant nutrients, water and air, kinds and varieties of crops, and protection from insects, diseases and other hazards. This calls for things quite familiar to most American farmers--knowledge of soils--their capabilities and fertilizer requirements, the cultural practices that make water and air available to roots, methods of farming that minimize erosion and leaching.

Through the institution of soil and water conservation districts we have, in the United States, found an effective means of maintaining local leadership in our land and water programs while making available from the government to farmers and ranchers skills and services they cannot themselves provide or obtain.

The challenge to the United States is two-fold:

First, we must continue to husband our own resources to be certain that our own needs will continue to be met and at the same time have food that we can share for the time being with needy nations.

Second, we must export the know-how that has brought our agriculture to its present highly developed state. We cannot feed the world forever, but we can help other countries learn how to feed themselves.

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2. Food and Agriculture Organization of the United Nations, Rome, Italy, Improving the World's Grasslands, FAO Agriculture Studies No. 16, 1951.
3. Charles E. Kellogg, "Potentials for Food Production," Farmers World, 1964 Yearbook of Agriculture, U. S. Department of Agriculture, Washington, D. C.
4. Lester R. Brown, Population Growth, Food Needs, and Production Problems, World Population and Food Supplies, 1980, American Society of Agronomy, Special Publication No. 6, February 1965.