

Chapter 2

Introduction

In November 1974 the World Food Conference was convened to address grave concerns over the future world supply of food. The conference declared that:

[A]ll governments should accept the removal of the scourge of hunger and malnutrition . . . as the objective of the international community as a whole, and accept the goal that within a decade no child will go to bed hungry, that no family will fear for its next day's bread, and that no human being's future and capacities will be stunted by malnutrition (U.S. Congress, Oct. 1984).

A decade has passed since this declaration was made but much of Africa is once again facing a famine of enormous proportions. The United Nations' Food and Agriculture Organization (FAO) estimates that during the past year 150 million people were living in countries that suffered severe food shortages as a consequence of the drought (Levy, 1984). Catholic Relief Services (CRS), the private organization with major responsibility for distributing emergency food aid in Ethiopia (the

country hardest hit by the drought), estimates that in that country alone, 6 million to 10 million people are facing starvation. This crisis has prompted massive emergency food assistance from numerous donors, including the United States. While these deliveries are essential to avoid massive starvation, the long-term resolution of African food problems must entail efforts to increase Africa's ability to feed itself.

It is this goal of increased food production in Africa that this report addresses. In particular, this report examines what technologies are needed and how they may best be made available. The report defines various issues in technology development, technology transfer, and technical assistance that could be considered by the U.S. Congress in forging an effective strategy to assist African countries to enhance their food production. The report also addresses problems African governments face in increasing food production, given that the responsibility for achieving this goal lies primarily with them.

FOOD PROBLEMS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa is facing its second severe food crisis in a little over a decade. Chronic food deficits have reached a point where, according to the U.S. Department of Agriculture (USDA), nearly 5 million tons of food aid will be required during 1984-85 just to maintain current per capita consumption levels. Some 10 million tons would be required to reach minimum acceptable nutritional levels, according to dietary standards established by the World Health Organization (WHO) and FAO. These figures represent 40 percent of the requirements for all developing regions of North Africa, the Middle East, Asia, and Latin America (USDA, July 1984b).

In examining the total food aid needs of all developing countries, a recent report suggested that:

In 1984-85, it is estimated that total food aid in cereal from OECD donor countries will be ap-

proximately 9 million tons. Of this total, the United States will contribute approximately 5 million tons. When compared to the 12 million tons needed to sustain current consumption levels and higher quantities to improve diets, it appears that donor countries must greatly increase the quantity of food assistance in the short term and heighten efforts to assist developing countries improve their own agricultural production in the long term (Andreas Task Force, 1984).

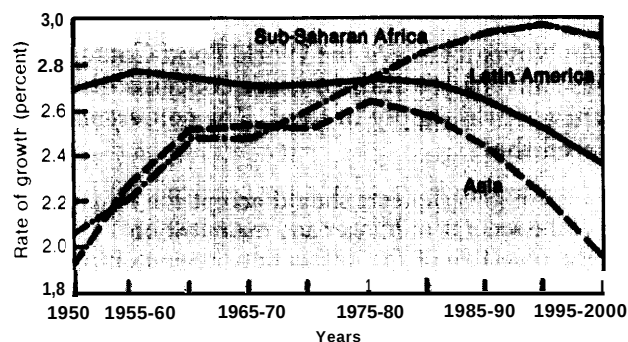
The current African drought, which began in the southern region in 1981 and spread through the Sahel in 1982, continues to have a major impact on crops and livestock in many countries. About 30 countries are suffering from abnormal food shortages according to recent FAO figures. The FAO World Food Program Task Force identified 10 sub-Saharan African countries as "crisis countries for the 1984-85 crop year" and others may be added to the list (U.N. FAO, Sept. 1984).

While the drought has focused international attention on the region, its effects represent only "the most extreme and distressing aspects of the more pervasive economic crisis in Africa" (World Bank, 1984a). The prevailing conditions simply highlight the long-term unfavorable trends that have been developing in Africa for the last two decades.

A unique combination of constraints characterizes this region and helps to explain, in part, why the "Green Revolution," which dramatically raised food production in other developing regions has, to date, bypassed sub-Saharan Africa.

- Sub-Saharan Africa is the only region of the world where the rate of population growth will continue to rise during the 1980s (fig. 2; table 1). The 1980 population of 359 million probably will double by the turn of the century and more than triple by 2020 (World Bank, 1984a).
- Generally speaking, the region suffers from considerable political instability. One in **200** Africans is a refugee. With only one-tenth of the world's population, Africa contains at

Figure 2.—Sub-Saharan Africa, Asia, and Latin America Population Growth Rates, 1950-2000



SOURCE: U.N. Population Trends and Policies, vol. 1, /n: U.S. Department of Agriculture, "Food Problems and Prospects in Sub-Saharan Africa," *Development Digest*, vol. XIX, No. 4, Oct. 1981.

least one-quarter of the world's refugees (World Bank, 1984a).

- Low and erratic rainfall, short growing seasons, low soil productivity, and continuing soil degradation and deforestation due to human activities make raising agricultural productivity in many parts of sub-Saharan Africa more difficult than in most developing regions. Much of the potential grazing

Table 1.—Population Growth Rates in Sub-Saharan Africa

Region and country	1970-75	1985-90	Region and country	1970-75	1985-90
	Percent			Percent	
The Sahel:			Congo	2.44	2.84
Chad	2.00	2.16	Equatorial Guinea	1.71	1.96
Gambia	1.92	2.13	Gabon	1.00	.90
Mali	2.42	2.74	Zaire	2.47	2.85
Mauritania	1.99	2.35			
Niger	2.68	2.97	East Africa:		
Senegal	2.37	2.55	Burundi	2.60	2.72
Upper Volta	2.27	2.49	Ethiopia	2.39	2.60
			Kenya	3.38	3.45
West Africa:			Rwanda	3.04	3.14
Benin	2.70	2.80	Somalia	2.65	3.00
Cameroon	1.84	2.45	Sudan	2.56	2.94
Ghana	2.70	3.19	Tanzania	3.02	3.20
Guinea	2.38	2.68	Uganda	2.93	3.09
Guinea-Bissau	1.51	1.94			
Ivory Coast	2.51	2.79	Southern Africa:		
Liberia	2.29	2.57	Botswana	2.27	2.99
Nigeria	2.67	3.09	Lesotho	1.92	2.32
Sierra Leone	2.41	2.65	Malawi	2.52	2.74
Togo	2.74	2.49	Mozambique	2.32	2.64
			Namibia	2.84	3.07
Central Africa:			Swaziland	2.73	2.92
Angola	2.27	2.73	Zambia	3.13	3.38
Central African Republic	2.09	2.59	Zimbabwe	3.35	3.60
			Madagascar	2.42	2.79

SOURCE: United Nations, *World Population Trends and Policies 1977 Monitoring Report*, In: U.S. Department of Agriculture, *Food Problems and Prospects in Sub-Saharan Africa*, Foreign Agricultural Research Report No. 188, August 1981, p. 38.

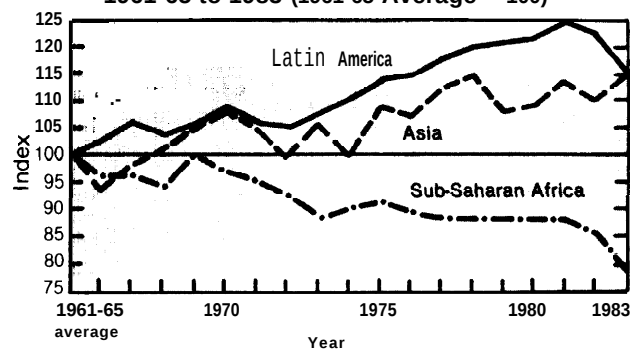
land is unusable because of tsetse fly infestation.

- The colonial legacy in Africa left fewer trained people and institutions than in other developing regions. Despite impressive gains in levels of education since independence, sub-Saharan Africa still has proportionately fewer skilled people than other developing regions. African countries in general also have poorly developed infrastructures.
- Government policies in most African countries have adversely affected food production, including: an urban bias in development strategies, a lack of attention to low-resource farmers (the base of the food production system), a lack of price incentives for farmers to grow food crops, often inappropriate and inefficient government involvement in the marketing and distribution of agricultural inputs and outputs, and often inappropriate import and fiscal policies (U.S. AID, 1983; World Bank, 1981).
- Projects directed at increasing agricultural production by donors and African governments have often been poorly conceived and managed. In some cases the result has been a worsening of the situation because of major damages to the resource base.

This combination of demographic pressures, environmental constraints, political impediments, limited trained personnel, and inadequate institutional and management capacity has resulted in a variety of symptoms that currently plague the region and threaten to worsen in the future:

- Africa's population growth rate, about 3 percent per year, is outpacing growth in food production, which is about 1.8 percent per year (World Bank, 1984a; USDA, 1981). The result has been a steady decline in per capita food production over the last two decades (**fig. 3**; table 2).
- Consequently, Africa, which was essentially self-sufficient in food production 20 years ago, now imports 20 percent of its cereal re-

Figure 3.—Index of Per Capita Food Production, 1961-65 to 1983 (1961-65 Average = 100)



SOURCE: U.S. Department of Agriculture, In. World Bank, *Toward Sustained Development in Sub-Saharan Africa*, 1984

quirements. Between 1970 and 1980 cereal imports tripled while the cost of those imports increased **600** percent, further straining limited financial resources (Christensen and Witucki, 1982; Huddleston, 1984).

- Sub-Saharan Africa is the only developing region in the world where levels of nutrition have declined in recent years. Despite major increases in food imports and food aid, it is estimated that 20 percent of the population of Africa consumes below-minimum caloric levels for maintaining good health (World Bank, 1984a).
- The rate of urban growth, at 5 to 7 percent per year (a 7 percent growth rate results in a doubling of population in about 10 years), is the highest in the world, although the level of urbanization in sub-Saharan Africa is relatively low compared with other developing regions. Immigrants to Africa's cities often come from impoverished rural areas and their movements add to the destabilizing effects of rapid urbanization.
- The region has shown a declining per capita Gross Domestic Product (GDP) accompanied by fiscal and balance-of-payment problems, oppressive debt burdens, dwindling reserves of foreign exchange, and deteriorating terms of trade (World Bank, 1983).

Table 2.—Food and Agriculture in Selected Countries

	Volume of food imports (000 metric tons)		Food aid in cereals (000 metric tons)		Average index of food production per capita, 1979-81
	1974	1981	1970	1980	1969 - 1971 = 100
Angola	149	244	0	25	81
Benin	8	93	9	11	96
Burundi	7	19	6	12	100
Cameroon	81	106	4	9	101
CAR	7	14	1	3	102
Chad	50	14	13	14	106
Congo	34	56	2	2	82
Ethiopia	118	207	59	228	85
Ghana	177	256	43	94	74
Guinea	63	134	49	34	87
Ivory Coast	172	619	4	0	110
Kenya	15	534	2	173	85
Lesotho	49	95	14	44	86
Liberia	42	111	3	26	95
Madagascar	114	268	7	26	94
Malawi	17	113	—	17	96
Mali	281	102	114	50	88
Mauritania	115	182	48	106	77
Mozambique	62	368	34	155	73
Niger	155	89	75	11	73
Nigeria	389	2,441	7	0	91
Rwanda	3	16	19	15	104
Senegal	341	458	28	153	76
Sierra Leone	72	58	10	12	81
Somalia	42	432	110	330	65
South Africa	127	476	—	—	104
Sudan	125	305	50	195	102
Tanzania	431	265	148	237	91
Togo	6	62	0	4	90
Uganda	37	37	16	57	86
Upper Volta	99	71	0	51	94
Zaire	343	538	—	17	96
Zambia	93	295	1	84	92
Zimbabwe	56	21	—	18	92
Total	3,880	9,099 (+134%)	876	2,213 (+153%)	91*

*Average (mean), weighted by population.

SOURCE: World Bank, *World Development Report, 1983*. In: U.S. Congress, House Committee on Foreign Affairs, *Feeding the World's Population: Developments in the Decade Following the World Food Conference of 1974* (Washington, DC: US. Government Printing Office, 1984), p. 76.

AGRICULTURAL SYSTEMS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa is at least twice the size of the entire U.S. and is made up of 45 countries (fig. 1, ch. 1) with diverse climatic, environmental cultural, socioeconomic, and political characteristics. To understand the limitations and possibilities of increasing food production in Africa, it is essential to examine African agricultural systems carefully. Varying soils and climatic and ecological factors define a multitude of ecological systems ranging from the hot, humid rainforests of the Congo River Basin, to the highlands of Kenya

and Uganda, to the tall and short grass savannas that grade into the Sahara Desert to the north and the Kalahari and Namib Deserts to the southwest. For a more in-depth analysis of African agricultural systems, see Moran (1979) and Ruthenberg (1980).

Despite the considerable diversity of agricultural systems in Africa, some broad generalizations can be made regarding "typical" characteristics and general trends.

Of the approximately 400 million people in Africa, at least 70 percent live in rural areas. The vast majority of these represent subsistence farmers and pastoralists. While production generally is geared toward subsistence levels, these low-resource producers also provide the major source of food for the rural and urban sectors, and raw materials for export and domestic manufacturing (Lele, 1981). With 30 to 60 percent of GNP being derived from agriculture, the need for a healthy agricultural sector is evident.

Africa is often misleadingly characterized as having low population densities and abundant availability of land (Moran, 1979). While these factors might suggest favorable conditions, in large measure they simply reflect the poor environmental condition of much of the continent: low, unreliable rainfall and poor soils. In fact, human populations in Africa tend to be strongly clustered around water supplies, roads, and areas with better soil. Even where populations are low in absolute terms, they are high relative to the limited carrying capacity of the land. Large areas of land are not available for settlement because of rock outcrops, tsetse flies, river blindness, or other similar causes. On most of the remaining land, once one takes into account carrying capacity, the population is sufficient to stress the environment (Moris, 1984).

Fourteen sub-Saharan countries have inadequate amounts of land "to support on a sustainable basis populations as large as those already reached in 1975" assuming subsistence food levels (World Bank, 1984b). These countries represent one half of the 1981 populations and approximately one-third of the region's land area.

Land tenure patterns, though changing, are relatively egalitarian. Farms are generally small, with 2 to 10 acres under cultivation at any one time (Eicher and Baker, 1982). Labor comes from the entire family with women playing a major role in food production and contributing significant labor to cash crop production and animal rearing. Land preparation traditionally has been accomplished through slash and burn techniques and planting has been rotated with long fallow periods, usually at least 8 years. Because of increased population pressure on land, however,

these practices are becoming less and less prevalent.

Farmers often engage in intercropping—the staggered planting of several varieties of crops in the same field. Although often not recognized as such by outsiders, these complex cropping patterns are adaptations to the delicate environment in recognition of the soil's susceptibility to leaching and erosion. Intercropping also is less risky and better suited for subsistence farming to provide family food supplies. For similar reasons, farmers sometimes cultivate several separate fields simultaneously. Intercropping has the particular benefits of providing extended soil cover for moisture retention, making better use of soil and water, and decreasing weed growth.

Farmers in Africa make relatively little use of systematic irrigation or commercial inputs such as fertilizers. Yields per hectare of staple crops are lower in Africa than in other developing regions (fig. 4).

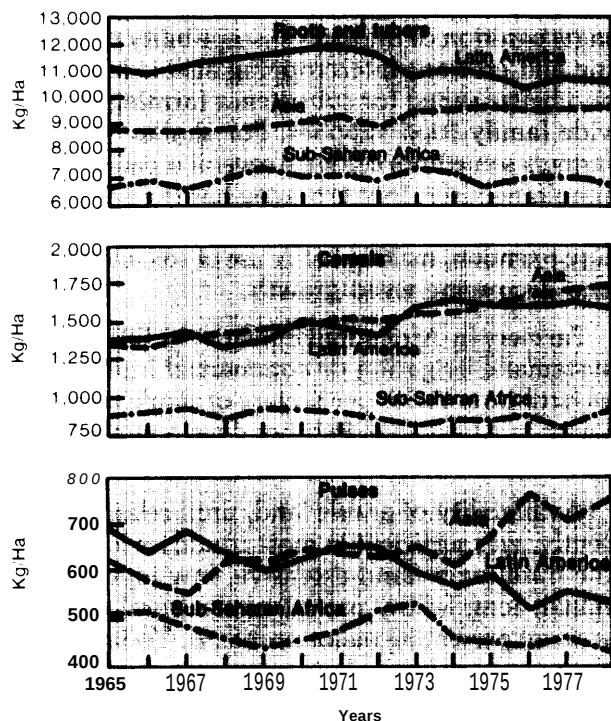
Availability of arable land, until relatively recently, was sufficient in most countries to sustain the traditional (land extensive, low input, rotational, long fallow period) agricultural systems without presenting major problems. Today, however, increased population pressure has resulted in increasing pressure on the land. The need for increased production has led to expanded use of marginal land with low and unreliable productivity. In addition, fallow periods have been reduced leading to even further declines in yields. Savannas, which traditionally have been used for herding, are now being converted to permanent cultivation. These factors contribute to serious degradation of the natural resources.

Cattle and other livestock play a critical role in the total economy of many African countries, particularly in arid and semiarid areas where agricultural production is more uncertain. In evaluating agricultural development schemes and evolving agricultural systems, particularly mixed crop-livestock systems, it is important to understand the role livestock play and can play as a source of food and investment (see Box A). Practically all producers maintain some form of livestock. In some circumstances livestock can use available resources more effectively than crops

(Henson, 1984). Livestock can also represent the major source of cash flow for low-resource producers, an important factor to consider when ex-

amining strategies for enhancing yields that require the farmer to purchase inputs (Brumby, 1984).

Figure 4.—Sub-Saharan Africa, Asia, and Latin America Yields for Staple Crops



SOURCES: Latin America and Asia—Food Production Yearbook, Sub-Saharan Africa-ESCS estimates, In: U.S. Department of Agriculture, *Food Problems and Prospects in Sub-Saharan Africa*, Foreign Agricultural Research Report No. 166, August 1981.



Photo credit: Emmett George, U.S. Agency for International Development

Livestock products supplement the protein supplies, income, and prestige of many African households, in addition to contributing foreign exchange as exports. In mixed farming systems, livestock also are used for plowing. Here, two Maasai herders watch over cattle in Tanzania.

U.S. INTERESTS IN ASSISTING DEVELOPING COUNTRIES

The United States is in a real sense the creation of European foreign aid, received in relatively small amounts at critical points in our history, applied with energy and ingenuity by Americans to American resources . . . The early experience of the United States demonstrates the value of foreign aid for the military security and economic development of a young, threatened, and relatively poor nation. With the help of foreign grants, military assistance, loans and other capital investments, the national independence of the United States was secured, our essential economic foundations established, and our own economic development begun (U.S. AID, n.d.).

The United States began its own foreign aid programs with the Marshall Plan, the massive U.S. assistance program to rebuild Europe after the devastation of World War II. Aid to developing countries officially began in 1950 when Congress passed the Act for International Development. Despite the proliferation of U.S. foreign aid legislation and changes in strategy and focus, the reasoning for U.S. interest has remained fairly constant.

In general terms, foreign aid is seen as a mechanism to promote U.S. economic and national se-

Box A.—Trends in Livestock Development

The Sahelian drought of 1968-74 focused international attention on African pastoral societies. The overgrazing and famine that followed the absence of rains convinced some environmentalists (Hardin, 1968; UNCOD, 1977) and economists (Monod, 1975; Konzacki, 1978) that traditional pastoral societies failed to manage their resources effectively.

Based on this assumption, range management interventions were supported by both the Agency for International Development (AID) and the World Bank. The early projects either attempted to settle the pastoralists within western style ranches (to introduce range management techniques for the increased marketing of the animals) or to "expand" grazing opportunities into seasonal rangeland by drilling deep wells. However, these interventions generally caused severe deterioration of the range and adversely affected socioeconomic conditions. Proliferation of wells in the Sahel introduced additional livestock into seasonally grazed areas and caused severe overgrazing (Clark, 1977; Glantz, 1976). Ranches introduced in East Africa and Botswana have shown disastrous results, in some cases, completely degrading both the vegetation and soils of the area (Horowitz, 1979; Banks, 1981).

Now a growing awareness exists of the complexity of livestock systems in Africa. "They differ strikingly on the degree of movement involved, from highly mobile nomadic systems to relatively sedentary ones In some of the intermediate rainfall areas, livestock production is integrated with cropping and farmers take care of their own animals . . . "or in other areas" . . . crop producers consign animal care to specialized herder groups" (Institute for Development Anthropology, 1982). Within livestock production systems, livestock serve many purposes. They serve as a source of milk, meat, social prestige, capital, savings, draft power for plowing, and insurance against drought (Hjort and Dahl, 1976; Institute for Development Anthropology, 1982).

Several national and international research centers now generally agree on the types of research that can appropriately benefit livestock producers (Horowitz, 1980). The systems approach used to integrate livestock and cropping systems shows promise in providing solutions to problems of low-resource producers. One organization, the International Livestock Centre for Africa (ILCA), views poor animal health and nutrition during dry seasons as the main constraint to increased production. ILCA emphasizes research on mixed farming systems as its main objective, providing a forage-legume link between cropping and livestock enterprises and increasing yields in both. Alleycropping, for example, can increase crop yields and provide browsing for small ruminants by intercropping trees such as leucaena with cereal crops. In the semiarid zones, intercropping millet and cowpeas can increase yields and improve the value of forage (ILCA, 1984).

ILCA and others are conducting research in arid and semiarid zone on the control of the tsetse-transmitted trypanosomiasis, the introduction of appropriate plants for people with few livestock, range management for communal livestock systems, and dry season water management. However, much needs to be done in improving dairy yields of livestock, exploring possible supplemental feeds, and decreasing calf mortality rates.

curity interests. More specifically, the economic argument is made that assisting the developing countries helps "convert the threat of economic chaos into long-range opportunities: the building of new trading partners, and new free societies of private enterprise" (Andreas Task Force, 1984). Developing countries represent 40 percent of U.S. export markets and are the fastest growing market, by value, for U.S. goods and services. A large

part of U.S. assistance spending comes back in the form of demands for American goods and services. It has been estimated that about 70 percent of bilateral U.S. assistance disbursements and 50 percent of our contributions to multilateral development banks are spent on U.S. goods and services (U.S. Department of State, 1983). Developing countries are particularly important markets for agricultural products, with 20 percent of

U.S. farm acreage devoted to producing for them (U.S. Department of State, 1983). Every billion dollars of farm exports generates another 25,000 to 30,000 jobs in the United States (Andreas Task Force, 1984).

In terms of security interests, aid is seen as a non-military tool to achieve numerous foreign policy objectives including:

- promoting regional and economic stability,
- encouraging democracy,
- securing or maintaining access to strategic facilities,
- countering Soviet influence,
- encouraging cooperation with the U.S. on international-issue (U.S. GAO, 1983).

The plight of the developing world poses a threat to our own security. A contented United States cannot live unscathed in a world of hunger and famine. Nor can the United States live unharmed in a world of seething unrest and unstable governments that hunger and famine creates (Andreas Task Force, 1984).

The United States depends on developing countries for a number of important commodities and Africa possesses a significant share of many of these. For example, the United States imports over 90 percent of its cobalt, bauxite, and manganese. Zaire and Zambia are the world's leading producers of cobalt and together provide about 80 percent of U.S. import requirements. Guinea has more than a quarter of the world's bauxite reserves and provides some 30 percent of U.S. imports. Gabon provides 26 percent of total U.S. import requirements of manganese, which in 1983 reached 99 percent (Kamarck, 1982; U.S. Department of the Interior, 1984a, b).

Each of these materials has vital industrial and military applications. Concern exists that strategic materials from Africa are particularly susceptible to interruption due to instability in many supplier countries. The argument is made that economic assistance acts as a stabilizing factor and cements U.S.-supplier country ties, thereby reducing the threat of supply disruptions.

Beyond the arguments related to U.S. economic and security interests, more altruistic motivations historically have played a large part in development assistance. The arguments of humanitarian or moral obligations to alleviate suffering in the

world have been used effectively to generate considerable support, particularly during periods of crisis such as drought, famine, and other natural disasters.

Conflicts may arise between U.S. interests in assisting sub-Saharan African countries and broader domestic and foreign policy goals. In particular, the objective of making Africa more food-self-sufficient may conflict with United States desires to expand international markets for its agricultural products. The Overseas Private Investment Corporation (OPIC), the Federal agency created to mobilize and facilitate "the participation of U.S. capital and skills in the economic and social development of less developed countries," places high priority on export development. However, the General Accounting Office (GAO) notes that OPIC should "explore possible conflicts which might arise between country development objectives and U.S. export interests" (U.S. GAO, Feb. 1981).

The objective of greater agricultural development in the Third World quickly confronts the question of competition with U.S. exports for existing markets. Short-run competitive relationships will, of course, arise. However, the real interest of American agriculture is in expanding the total world market . . . rather than obtaining slightly larger shares of a stagnant or shrinking market (Andreas Task Force, 1984).

The divergence of interests, however, threatens to widen, especially given U.S. efforts to expand its agricultural exports significantly in the short term as a means of reducing its overall trade deficits. This issue raises a number of issues relating to agriculture, technology, and assistance for sub-Saharan Africa which the Congress should address.

Agricultural surpluses traded on new international markets transformed the United States into the prime world agricultural exporter. This provoked a continuing debate regarding the appropriate U.S. role in world agriculture: Should the United States be the "breadbasket of the world" (with potential long-run depletion of its natural resources)? Or should the United States act as technical assistance provider to help less developed countries strengthen their own agricultural systems (with long-term prospects of LDCs reducing their need for American agricultural imports and eventually even competing with U.S. imports in world markets)? (USDA, 1984c).