

Chapter 3
The Sahel:
Diversity and
Transformation

The Sahel: Diversity and Transformation

IN BRIEF . . .

The United States has played a key and catalytic role in the unique, coordinated, multi-national development efforts in the Sahel. The Club/CILSS framework provided an innovative strategy to combine the talents and resources of both donor and recipient nations in a concerted effort to strive for food security in one of the world's poorest and most vulnerable regions. Over the past decade, inconsistent support from both donor and recipient nations, lack of coordination, management problems, and problems translating agreements into action have constrained the effectiveness of the Club/CILSS efforts in the Sahel. Despite these problems, the United States, through AID's Sahel Development Program, has helped the Club du Sahel and CILSS make substantial contributions to development.

These efforts, from the beginning, were designed as a regional approach because the countries shared some important historical, cultural, economic, and ecological elements. Chapter 3 outlines some of the important historical and cultural similarities and looks in particular at the limits of the Sahelian environment and the future of food production in the region. Highlights of the chapter include:

- The environment in the Sahel is diverse, both in the complexity of its ecological systems and in the variety of its agricultural production and socioeconomic systems. These systems are facing a period of rapid change.
- By many measures, such as infant mortality, life expectancy, and literacy, Sahelian nations are among the poorest in the world. Dependency on a limited number of low-value exports, high levels of debt, and other external economic influences limit the ability of Sahelian nations to improve the quality of life for their people.
- One indication of the region's great vulnerability is the growing gap between food production and food requirements in the Sahel. Over the past two decades, Sahelian crop production has grown at approximately 1 percent per year while the rate of population growth during this time was about 2.8 percent.
- Recurrent droughts, poor soils, and other environmental factors have combined with changing social and economic systems to exacerbate environmental degradation in the Sahel.

A key lesson learned in the past decade is that successful development assistance efforts must conform to the human and physical environment. The environment in the Sahel is diverse, both in the complexity of its ecological systems and in the variety of its agricultural production and socioeconomic systems that have evolved over the centuries. Thus development efforts in the Sahel must be designed with an

understanding that the region is vulnerable, resilient, and continually changing. This chapter reviews the history of agricultural production, the current and projected situation of poverty and development within the Sahel, the role of CILSS countries within the global economy, the growing gap between food production and food requirements, and environmental constraints.

THE SAHEL YESTERDAY

Great empires—the Ghana, Mali, and Songhai—flourished in West Africa during the period known as the Middle Ages in Europe. In the heart of the Sahel, Timbuktu, Gao, and Djenne were centers of power, wealth, and learning. Caravans of camels brought slaves, gold, and salt across the Sahara desert to the Middle East and North Africa. They carried back textiles, firearms, and the religion and culture of the Islamic empires. Over several thousand years, the trans-Saharan trade brought domesticated livestock and new crops such as rice, wheat, beans, bananas, and yams to West Africa.

People of the Sahel developed complex farming and herding systems that were adapted to the environment. Timbuktu was one of several thriving agricultural regions in the Sahel (66). Farmers raised sorghum and millet, crops believed to be indigenous to West Africa, where there was sufficient rainfall. They developed patterns of shifting cultivation that allowed soils to be replenished by fallow periods of up to 20 years. Other farmers irrigated crops in the floodplains of the major rivers, including the Niger, Senegal, and Gambia, planting different crops as the water receded (known as flood recession cultivation).

Herders similarly developed various pastoral systems. Some drove their herds of cattle, sheep, goats, and camels in no fixed pattern to seek grazing lands (called nomadic pastoralism) in the northern areas bordering the Sahara; others migrated with their livestock in regular patterns (called transhumant pastoralism), often north in the rainy season and south during the dry season, and engaged in some cultivation (called agropastoralism). Another traditional system of livestock farming, sedentary animal husbandry, developed in the southern, higher rainfall zones, but was secondary to cultivation there (8,50). While at times there were tensions between the farmers and herders competing for limited resources, more often theirs was a mutually beneficial relationship where the herders provided milk, manure, and other animal products to the farmers in exchange for food grains and the use of their fields after harvest (crop

residues were dry season fodder for their animals]. While both farmers and herders produced food primarily for their own subsistence, they also produced enough surplus to feed small nonagricultural populations as well as to survive periodic droughts,

The decline of the great African empire in Mali in the 15th century, and the defeat of the Songhai Kingdom by a Moroccan force in 1591, ushered in a long period of internal instability and raids. The Europeans arrived along the coast in the late 15th century. The Europeans expanded the ongoing slave trade, which fostered these African inter-ethnic wars. Over the course of the next four centuries, 6 million slaves were taken from West Africa (66). Dakar, Senegal became a center of the enlarged Atlantic slave trade in the 17th century, when slaves were sent from Africa to provide labor on the sugar plantations of the West Indies. Traditional production systems, though disrupted by the wars, raids, and slave trade, survived.

Meanwhile, African farmers gradually adopted crops introduced by the Europeans from the New World and elsewhere (e.g., corn, peanuts, cotton, cassava, and fruits) (36,66). The agricultural production systems were land-extensive, but they were sustainable because the population was small. They were also dynamic, characterized by constant innovation and adaptation. Diversified handicraft production was also developed, including textiles made from locally grown cotton. While the majority of agricultural and handicraft production was for subsistence, there was surplus enough for local and regional trade (59).

During the latter part of the 19th century, the French conquered much of the Sahel while England established control over The Gambia. Portugal retained the Cape Verde Islands. These changes further disrupted traditional production systems. Under colonial rule, colonies were considered providers of raw materials to Europe and markets for its manufactured goods. The French and British, once they gained

administrative control of the Sahel in the 1890s, promoted export crops, especially peanuts and cotton, damaged local artisan industries by giving favored tax status to European goods, and forced rural people into the cash economy by requiring them to pay taxes in cash.

Efforts to develop export production in the colonial period were of limited success, yet had lasting impact on agricultural production in the Sahel. Successes were limited to peanut production in Senegal and The Gambia (see box B) and cotton production in Chad (59). French policies to encourage export production included taxation, forced labor, and resettlement. Selective investment in research and infrastructure complemented these policies. For example, French efforts to encourage cotton production in the 19th and early 20th centuries failed (66). But in the late colonial period French cotton researchers made available the better adapted “Allen” variety brought from the United States and the French began an ambitious irrigation scheme to encourage cotton production.

While emphasizing production of export crops, French colonial administrators gave only modest attention to food production, which stagnated. They justified this neglect by noting that traditional farming methods changed little, and, except for severe drought years, enough food was produced to feed the people. At the same time, rice was imported to Dakar from French Indochina and sold to the growing urban population. Since it required far less time to prepare, was available and inexpensive, urban residents came to prefer it to locally produced sorghum and millet,

Newly introduced animal and human diseases also disrupted traditional systems in the early colonial period (1890-1920) (100), but the introduction of preventive health measures beginning in the late colonial period probably had a greater effect because it decreased death rates and increased population growth. The population of the Sahel increased from an estimated 9 million in 1900 to 13.5 million in 1940, and grew to 18 million by 1960 (60). Traditional agricultural production systems adapted to some

Box B.—Peanuts: How Colonial Powers Favored Export Crops

The story of the development of peanuts as an export crop in Senegal and The Gambia illustrates how colonial powers favored export crops for obvious economic reasons. Peanuts, desired by the Europeans as a source of vegetable oil for cooking and soap, began to be exported from Senegal and The Gambia in the 1830s. Exports increased as the slave trade was gradually suppressed, and peanuts became the dominant export in the last half of the 19th century. Small farmers with little capital could grow peanuts using traditional tools and methods and usually rotated them with food grains. Wolof and Serer farmers dedicated more and more of their land and labor to peanut production in order to obtain cash needed to pay taxes and to purchase the goods they no longer produced as well as new consumer goods. In addition, colonial rulers cleared new lands for peanut cultivation by conscripting men into forced labor brigades, a practice not abolished until 1946 (66).

With the expansion of the French oil industry after World War II, demand increased. The French introduced improved seed varieties and fertilizer, and land under peanut production increased dramatically (115). In the following decades, increased population, without a concomitant intensification of peanut production, put pressure on the land in the Peanut Basin. Fallow periods grew shorter, eventually giving rise to semicontinuous cultivation in some areas, and ultimately reduced fertility and yields. Cultivators moved to new lands, at first good lands, but later increasingly marginal lands, sometimes disrupting the migratory patterns of the pastoralists; others emigrated to cities. Yet, despite some fluctuations in weather and prices, peanut exports continued to climb, reaching their peak in 1975 to 1976 (59). Over the past decade production and exports have declined principally due to falling returns.

of these many changes, but overall they became less self-sufficient and sustainable.

Sahelian nations gained independence from France in 1960; The Gambia won independence from Britain in 1965 and Cape Verde from Portugal in 1975. But the trends accompanying increased production of export crops and integration into the world economy continued, with the support of the new African governments, the French, and providers of development assistance. Agricultural development was not given high priority and a large portion of the external funds for agriculture were used to develop large-scale irrigation schemes to grow rice and

sugar, two crops that often substitute for imports. While France and the United States conducted some research on sorghum and millet, the majority of foreign aid to rainfed crops in the 1960s went to cotton and peanuts. Meanwhile, food production systems stagnated. Total food production increased because new lands were opened by increased numbers of farmers, but yields began to decline in areas where soil fertility was reduced, especially in Senegal and The Gambia.

SOCIETIES IN TRANSITION IN THE SAHEL

Integration into the global cash economy had profound implications for rural Sahelian societies. The gradual transition of most farmers from generally subsistence-oriented to cash crop production that began in the 19th century even affected those farmer and herder households that did not cultivate cash crops for export. For example, in years with good rainfall surplus food crops—sorghum, millet, rice, and maize—were sold for cash. Increasingly, fruits (e.g., mangos, oranges, bananas, pineapples); vegetables (e.g., tomatoes, beans, onions, cabbage, etc.); and nuts (e.g., karite) were produced for sale. Integration into a money economy also affected off-farm work and incomes of rural people, especially in the dry season, and the various roles of men and women in the household and in different production systems.

Migration

One of the responses to the need for cash in rural areas has been migration and this has resulted in considerable change in nearly every Sahelian village. While migration is not a recent phenomena, it has increased significantly since World War II. It reflects the inequity of wealth and opportunity between Western nations and the Sahel, between urban and rural areas within the Sahel, between export crop and subsistence farmers, and between farmers and herders (33). Cash payments sent home by migrants are a sizable though largely unmeas-

ured part of national income; in Mali, for instance, workers' remittances from outside of the country in 1983 amounted to about \$36 million (147). In some areas, remittances received in rural areas can be a more important source of cash than agriculture, yet they are not usually invested in agriculture due to its low return.

Migration, predominantly by young men, can be either temporary—often alternating with the short growing season—or permanent. When young men migrate for seasonal work to the export crop farms, or even to the large palm oil, coffee, and cocoa plantations in the coastal States, the burden on women, the elderly, and children who grow food crops at home is often increased. However, family incomes are increased by migration, and migration is a risk-reducing strategy for farm families because even in times of drought there will be some income. Migration may occur to gain access to new land or to exchange labor for cash on larger farms, in cities, coastal States, or even Europe. It may also occur as a reaction to drought and increased pressure on the land. An example is emigration from the densely populated Mossi Plateau in Burkina Faso to less populated higher rainfall zones, where river blindness is being contained, in the southern part of the country or northern Ivory Coast. By one estimate there are 1.5 million citizens of Burkina Faso in the Ivory Coast: each year 500,000 migrate for work in the dry season, and 100,000 never return (115).

Pastoral Systems in Transition

The various forms of pastoralism in the Sahel have also been affected by the transition to a cash economy. The fattening and sale of beef to urban dwellers using traditional marketing channels provided cash to herders, and supplemented the food and goods they used for trade. The numbers of animals rose rapidly because of preventive health campaigns, deep wells, a decade of higher than average rainfall, and growing demand during the 1950s and 1960s (59). Seasonal movement of the pastoralists has become more difficult in recent years as farming has expanded onto rangelands and movement across borders has been restricted. Several large-scale irrigation schemes claimed areas previously used for dry season grazing or for flood recession cultivation of crops. This restriction on the pastoralists' mobility has increased conflicts over access to land and water resources (69). However, the traditional cooperative relations between farmers and herders are still common: e.g., FulBe pastoralists may tend livestock owned by Mossi sedentary farmers with their herds, and thus ensure themselves use of the farmers' pasture when they migrate south in the dry season. Even while the traditional herding systems have been primarily oriented to subsistence, transhumant pastoralists in the Sahel are efficient users of land: a comparative study showed that transhumant pastoralists in the Sahel produced more animal protein per hectare than the market-oriented ranches in comparable areas in the Western United States and Australia (8).

The 1968 to 1973 and 1984 droughts decimated many herds, forcing some herders to shift to farming (130) or migrate to the city. During the drought many were forced to sell their animals, their only assets, at low prices to purchase food. The change was most dramatic in Mauritania, where the combined forces of drought, economic modernization, war, and emancipation of slaves have forced pastoralists to abandon their traditional way of life. Between 1965 and 1975 the nomadic proportion of the population decreased from 65 to 35 percent (33),

In other Sahelian countries pastoralists who formerly depended on livestock have turned to mixed systems of crops and livestock because the market is no longer a reliable source of grain or to acquire recognition of land rights (69,106). Perhaps 40 to 60 percent of livestock are no longer in extensive pastoral production systems. Additionally, the presence of tsetse fly and the lack of dry season fodder also constrain sedentary husbandry in higher rainfall areas. Despite these constraints, total herd size returned rapidly to pre-drought levels. Evidence also suggests possible increased concentration among herders (22,67) and new forms of ownership. The sedentarization of pastoralists is being accompanied by an increased number of animals owned by farmers and urban investors. A growing proportion of the traditional pastoralists can only survive by emigration or tending investors' herds (9).

Changing Social Systems

Traditional social systems in the Sahel are also being affected by the changes accompanying development. These changes are affecting the interrelated and diverse systems of ethnic groups, castes, and classes throughout the Sahel. Traditional class structures still function, especially in rural areas, although they are changing as the production systems on which they were based are also being transformed (54). For example, the farmers endowed with preferred land, especially those with large families, have been better able to take advantage of some of the new technologies (84). While customary law still governs land use rights in the Sahel, land ownership is becoming more common. Buying, renting, and speculating in land are occurring and large-scale farmers, merchants, and religious leaders are acquiring land, sometimes working it under types of sharecropping systems (28). In addition to private land acquisition, land concentration in the Sahel is also attributed to acquisition by parastatal organizations¹ in irrigation-driver development schemes and unintentional "demographic" land expro-

¹A parastatal organization has a mixture of public and private ownership or management.

priation—when population increases and traditional inheritance systems lead to divisions of land into areas insufficient for family subsistence—resulting in emigration (102).

Development patterns in the Sahel have significantly affected the role and status of women. Studies have demonstrated that development often worsened the situation of African women (7,24,114). In the past, subsistence-oriented economies had distinct roles for men and women, but they were closely integrated into the family agricultural production unit. With the introduction of the cash economy, men generally appropriated the functions relating to cash exchange, while women were left those relating to subsistence production. In the Sahel women play a great diversity of roles within the household, varying with ethnic group, caste, and class (24,111). The allocation of land is usually controlled by men who give preference to the higher value cash crops that they produce and whose cash return they control. The increased labor demands of the new technologies

for cash crops often means that women and children spend longer hours in the fields of their husbands or fathers as well as, in some cases, their own fields.

Despite the long hours spent obtaining water and fuelwood and preparing food, rural Sahelian women are increasingly entering the cash economy, supplementing family income in a variety of ways. They market vegetables from gardens, food crops, homemade crafts, and animal products (e.g., meat, leather, milk, cheese, eggs, etc.) as well as engage in small-scale trading, especially in the dry season. Herder women, about whom little has been researched, are generally responsible for marketing milk (68). Since much of this trade is informal, it is not included in national statistics and is often invisible to national planners. The money earned is used to pay taxes; pay for celebrations and transportation; and purchase food, textiles, medicine, school books, and other consumer goods that are transforming rural life.

SOCIAL AND ECONOMIC DEVELOPMENT OF SAHELIAN NATIONS

Profile of Poverty

The Sahelian nations are among the poorest in the world by any standard. By one often-used measure, per capita gross national product (GNP), they averaged about \$232 in 1983, far less than that of the developing countries as a whole (\$787) (109). Accounting for inflation the real per capita GNP was 17 percent lower in 1983 than 1975 (26). By another measure, the Physical Quality of Life Index, based on a combination of infant mortality, life expectancy, and literacy, the Sahelian nations average 27 compared to 61 for developing and 96 for developed countries (109). Related important points include the following:

- Many infants die before their first birthday, about 145 of each 1,000 born, compared with 15 in the rich nations, and 92 in all developing nations (109). Up to a third die before their fifth birthday (125). This means, hypothetically, that a woman must

give birth to three children to help ensure the survival of two.

- The average life expectancy of a child born in the Sahel in 1983 is 44 years, far less than the averages of 59 and 74 years of children born in the rest of the developing and the industrial countries, respectively (109).
- Less than 15 percent of the adults in the Sahel are literate, far below the average of 59 percent in other developing countries (109). Less than a third of primary school aged children are in school; enrollment of male children is double that of female children (147).

Yet significant progress has been made in reducing some aspects of poverty in the Sahel. Comparing these three indicators with those of a decade ago, life expectancy has increased approximately 5.75 years, infant mortality rates have decreased by 25 per 1,000, and adult literacy rates have doubled (see table 3-1). However,

Table 3-1.—The Sahel: Social and Economic Indicators

Country	Population, mid-1984 (millions)	Population growth rate (percent)	GNP per capita, 1983 (U.S. dollars)	GNP per capita growth rate, 1960 to 1982 (percent)	Life expectancy, 1983 (years)	Infant mortality, 1983a (per 1,000)	Adult literacy rate ^a (percent)	Primary school enrollment, 1982 (percent of age group)
Burkina Faso	6.7	2.6	180	1.1	44(38)	148 (182)	9 (5-10)	28
Cape Verde . . .	0.3	2.7	210	NA	61(50)	80 (91)	37 (NA)	NA
Chad	5.0	2.1	80	-2.8	43(38)	142 (160)	15 (5-10)	NA
The Gambia	0.7	2.1	290	2.5	36(40)	200 (165)	20 (10)	56
Mali	7.6	2.4	160	1.6	45(38)	148 (188)	10 (5)	27
Mauritania	1.8	2.8	480	1.4	46(38)	136 (189)	17 (1-5)	33
Niger	6.3	2.9	240	-1.5	45(38)	139 (200)	10 (5)	23
Senegal	6.2	3.0	440	0.0	46(40)	140 (159)	10 (5-10)	48

^aNumbers in parentheses refer to 1970 through 1975

SOURCES: John Sewell, et al (eds.), *U.S. Foreign Policy and the Third World Agenda 1985-86* (New Brunswick, NJ: Transaction Books, 1985); Roger Hansen, et al, *The U.S. and World Development Agenda for Action 1976* (Washington, DC: Praeger Publications, 1976), and Robert S. McNamara, *The Challenges for Sub-Saharan Africa* (Sir John Crawford Memorial Lecture, Nov 1, 1985).

national averages obscure social and economic disparities between households, especially in rural areas.

The total population of the Sahel was 35 million in 1984, a number that has doubled in the 25 years since independence (59). Population growth rates range from 2.1 to 3.0 in different countries (109), and now average 2.5 percent for the region (26). This is less than the rate of Sub-Saharan Africa as a whole (3.2 percent) (81). Some Sahelian countries' population growth rates have not increased over the past 20 years (147), in part due to emigration, and population densities are low compared to other developing countries. Yet birth rates are high; about 47 children are born for every 1,000 women each year, compared to 14 in the developed nations. The average woman in the Sa-

hel gives birth to 6.5 children. The World Bank estimates that the population of the Sahel (excluding Cape Verde) will be 52 million in the year 2000, and will almost triple to 92 million by 2025 (81).

About one in five residents of the Sahel lives in cities and Senegal is the most urbanized country (see table 3-2). The average annual growth rate of the urban population over the past decade is nearly double the total population growth. At independence an estimated 7 percent of the population lived in the cities. Yet, if current trends continue one-third of the population of the Sahel will be living in cities by 2000 (37). One consequence of increased urbanization is a reduction in the percentage of people engaged in agriculture, down from 90 to 95 percent in 1960 to about 80 percent now

Table 3.2.—Agriculture-Related Social and Economic Indicators

Country	Percent of labor force in agriculture (1981)	Percent of total population in urban areas (1983)	Annual urban growth rate (1973-83)	Daily calorie supply per capita as percent of requirement (1982)	Percent of GDP ^a from agriculture (1983)	Annual growth rate of agricultural sector (1973-83)
Burkina Faso	82	11	4.8	79	41	1.3
Chad	85	20	6.6	68	64 (1982)	-2.6 (1982)
Mali	73	19	4.4	74	46	5.0
Mauritania	69	25	4.6	97	34	2.6
Niger	91	14	7.0	105	33	1.6
Senegal	77	34	3.8	101	21	0.3

^aGDP—Gross Domestic Product

^bSome data for Chad from World Bank *World Development Report 1984*

SOURCE: World Bank *World Development Report 1985* (New York: Oxford University Press, 1985)

(21). While percentages vary by country, at least 50 percent and probably more than 60 percent of the population is dependent on rain fed agriculture, excluding Mauritania (28); and about one-fifth of the population is principally dependent on herding (140). While the number of people working in agriculture is estimated to increase from 11 million in 1980 to 15 million in 2000, an annual 1.4-percent increase, the greater urban growth rate will mean that where each farmer today must support 2.8 persons, by 2000 each will need to support 3.6 persons (28).

The Sahel in the World Economy

The three pillars of Sahelian exports are rainfed agricultural products, livestock, and minerals (see table 3-3), Sahelian exports are not well diversified, with one or two commodities providing most of each country's export earnings. Senegal has been the only country to at least partially diversify its export economy: peanuts were 50 percent of its export earnings in 1976 (34) but just 13 percent in 1982. Sahelian economies thus are extremely vulnerable to the vagaries of climate and world market prices.

The major export crops are peanuts and cotton, both rainfed crops grown in rotation with food crops by small farmers. Peanuts, also grown as a food crop, are an important export

today only in Senegal and The Gambia, where they cover about 40 and 60 percent of the area cultivated, respectively (28). Production, acreage planted, and share of export earnings reached their peak in 1975 and have since declined due to lower prices (which declined 50 percent in real terms from 1975 to 1982), marketing difficulties, drought, soil degradation, and competition with other food crops (59).

Cotton is an important export crop in Burkina Faso, Mali, and Chad. Yields per hectare of cotton, the only crop where production has intensified in the Sahel, increased fivefold between 1960 and 1980. Total cotton production reached a peak in 1978 to 1979, and in some areas both acreage and yields declined in the early 1980s due to the war in Chad, lower incomes from cotton, and the competition with cereals (28,59). However, in Mali and Chad cotton production reached an all-time high in 1984 in the midst of the drought. Future prospects are clouded by the fact that world prices have dropped steeply in the past 2 years as China has entered the international market.

Livestock exports are very difficult to estimate accurately, but they are significant to Burkina Faso, Chad, Mali, and Niger. Exports are primarily to the West Africa coastal States where livestock production is limited because of the tsetse fly. The recent drought devastated herds and exacerbated a long-term trend: the real value of live-animal and meat exports to the coastal countries is estimated to have fallen 50 percent in the last decade (59). On the other hand, earnings from maritime fishing have been steadily increasing. World market prices also have been falling for Niger's uranium and Senegal's phosphate. Demand for Mauritania's iron ore plummeted in 1982 to 1983 (37).

In general, strong world market prices of Sahelian commodities caused production to increase in the 1960s and early 1970s; fluctuating—but generally declining—world market prices, erratic production, and increased costs of imports worsened the balance of trade in the 1970s and 1980s (figure 3-1). However, declining export earnings are but one major factor in the growing debt among Sahelian countries.

Table 3-3.—Major Exports and Share of Export Earnings, 1980-82

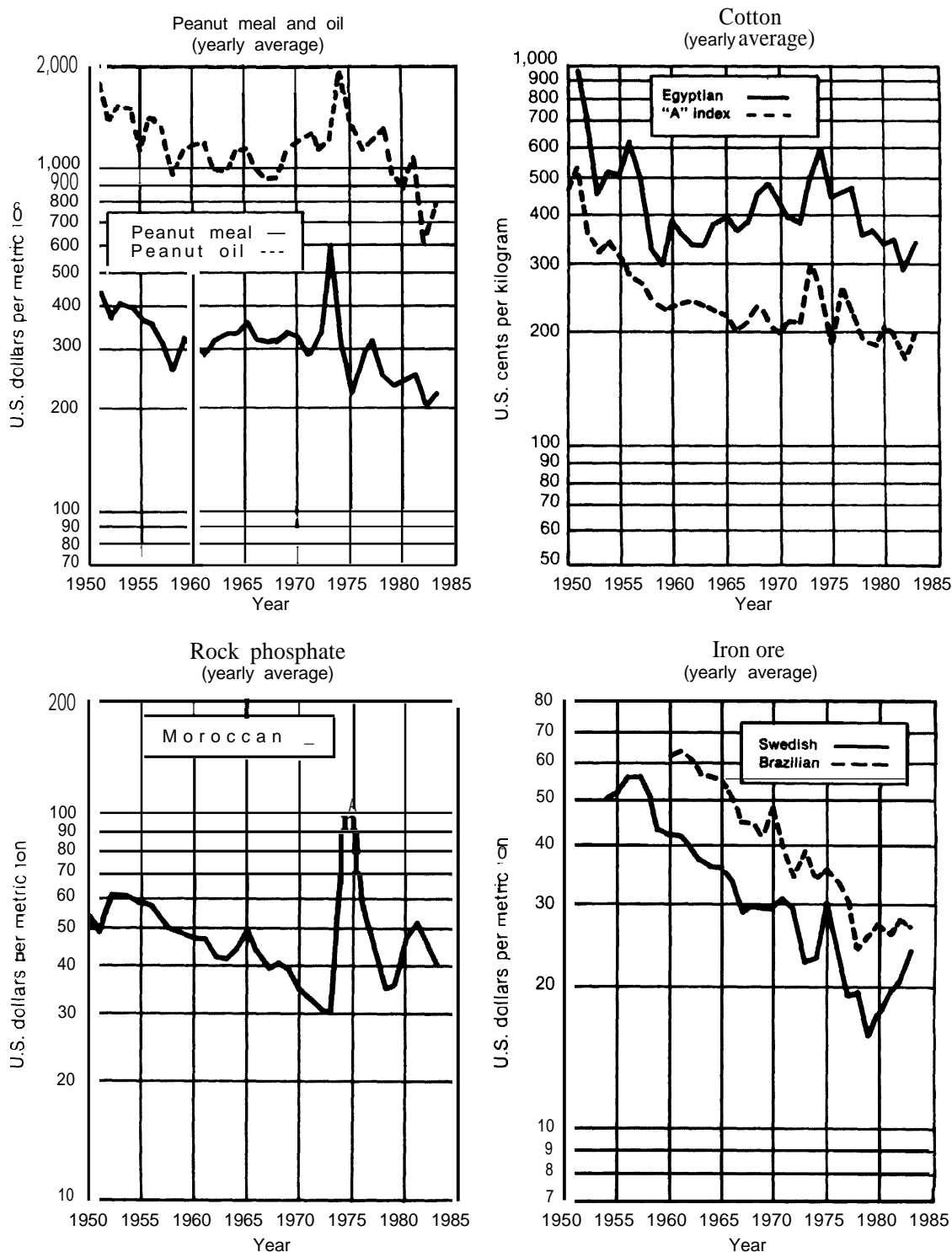
Burkina Faso	cotton (46%), ^a livestock (9%) ^c
Cape Verde	fish (65%), ^a bananas (17%) ^c
Chad	livestock (43%), ^b cotton (31%) ^b
The Gambia	peanuts (51%) ^a
Mali	livestock (42%), ^c cotton (41%) ^c
Mauritania	iron ore (57%), ^a fish (43%) ^a
Niger	uranium (81%), ^a livestock (11%) ^c
Senegal	peanuts (13%), ^a rock phosphate (13%), ^a fish (12%), ^a petroleum products (25%) ^a

a International Monetary Fund, Bureau of Statistics, *International Financial Statistics Yearbook 1985* (Washington, DC: 1985), 1980-83 data for Burkina Faso, The Gambia, and Mali, 1980-84 data for Mauritania

b Food and Agriculture Organization, *FAO Trade Yearbook 1984* (Rome 1985), 1980-83 data.

c Food and Agriculture Organization, *1984 Country Tables: Basic Data on the Agricultural Sector* (Rome 1984) Data for livestock are not very reliable Sources differ on most of these statistics

Figure 3-1.—Commodity Price Trends for Peanuts, Cotton, Rock Phosphate, and Iron Ore (constant price)

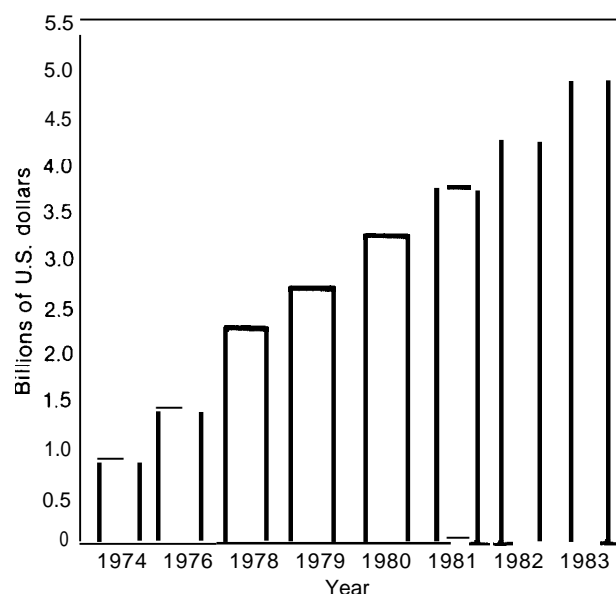


SOURCE: World Bank, *Commodity Trade and Price Trends 1985* Edition (Baltimore, MD: The Johns Hopkins University Press, 1985).

Others include: steep increases in oil prices; world recession; high interest rates; increasing protectionism; and internal policies on investment, trade, prices, and exchange rates (80). The growing national debt limits economic growth and pressures governments to increase export earnings (thus to stress export crops over food crops) and borrow more heavily.

The total debt of the Sahelian nations has increased more than tenfold since 1970, rising from \$450 million to \$4.9 billion in 1983 according to the World Bank or \$5.6 billion according to the Organization of Economic Cooperation and Development (OECD) (26). Figure 3-2 shows this trend of rising debt. Their debt now is equivalent to over half of the GNP and two to four times the export earnings of the Sahelian nations as a whole (147). (See table 3-4.) While the total debt is relatively small, comparing debt to GNP shows that most Sahelian nations are more in debt than Brazil (where debt is 30 percent of GNP) or Mexico (49 percent) (147). Mauritania has the highest debt percentage in the world, 178 percent. By 1982, two-thirds of the public debt of the Sahel as a whole came from official development assistance, with great variation between nations (ranging from 44 percent in Niger to 95 percent in Mali). From 1980 to 1982, 75 percent of new loans to the Sahelian nations were from foreign aid (25). While concessional loans provided as aid were primarily responsible for the increase in indebtedness, the majority of debt service is from nonconces-

Figure 3-2.—Growing Debt Burden of Sahelian Nations, 1974.83



SOURCE World Bank, *World Debt Tables: External Debt of Developing Countries, 1984-85 Edition* (Washington, DC 1985)

sional loans. In the mid-1980s, debt service payments average 32 percent of Sahelian annual export earnings and are rising (26). With the exception of Burkina Faso and Chad, the Sahelian nations have debt burdens that are unsustainable in relation to their resources and growth prospects (26). Since 1981, Senegal has completed five multilateral rescheduling of its debt, Niger four, and Mauritania one (146).

Table 3-4.—Debt of Sahelian Nations

Country	Amount of debt (million U.S. dollars)		Debt as percent of		Debt service		
					Amount (millions of dollars)		As percent of 1981 exports
	1970	1983	1983 GNP	1983 exports	1981	1982 GNP	
Burkina Faso	21	398	38	243	14	2	11
Chad	32	136	43	128	14	0	10
The Gambia	NA	192	98	291	4	3	16
Mali	238	927	89	413	37	1	24
Mauritania	27	1,212	178	330	54	7	17
Niger	32	662	51	222	63	10	21
Senegal	100	1,693	69	232	99	4	24

SOURCES World Bank, *World Development Report 1985* (Washington, DC: 1985), Club du Sahel/CILSS, *Official Development Assistance to CILSS Member Countries in 1983* (Paris: Organization for Economic Co-operation and Development, 1985), Robert S McNamara, *The Challenges for Sub-Saharan Africa*, (Sir John Crawford Memorial Lecture, Nov 1, 1985), U S Agency for International Development, *Country Development Strategy Statement Sahel FY 1986* (Washington, DC April 1984)

THE GROWING GAP BETWEEN FOOD PRODUCTION AND FOOD REQUIREMENTS

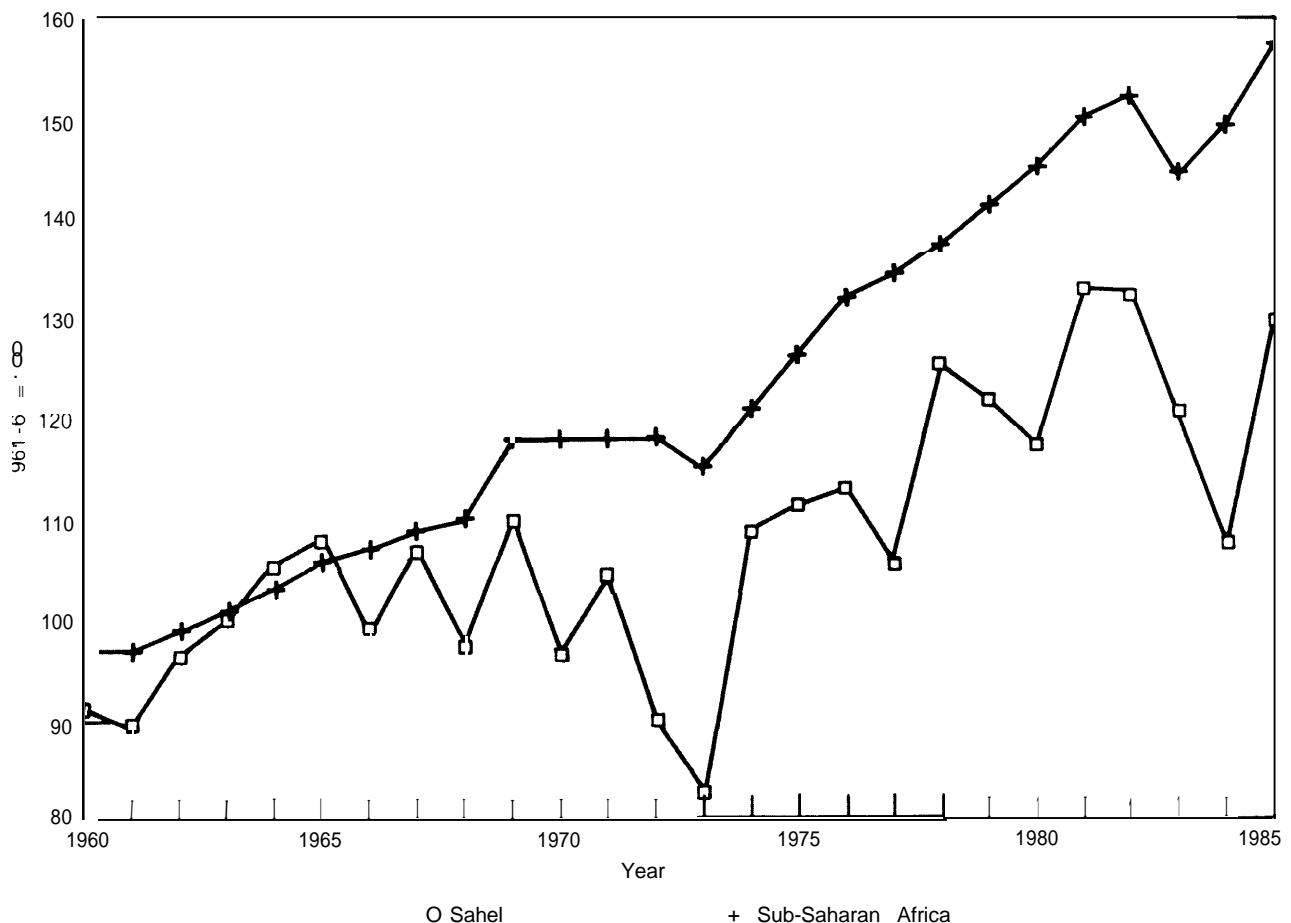
Food security is a must. We must ensure that voltaics will no longer wake up in the morning and ask themselves what they are going to find to eat that day.

—President Thomas Sankara (90)
Burkina Faso

The Sahel faces a growing gap between food production and the population's requirements. In the 1960s the Sahel, with the exception of Senegal, was largely self-sufficient in cereals (37). Over the past two decades, Sahelian food crop production has increased by about 1 percent per year (22). Yet almost all increases in production have been due to more land being cultivated rather than to more intensive use of

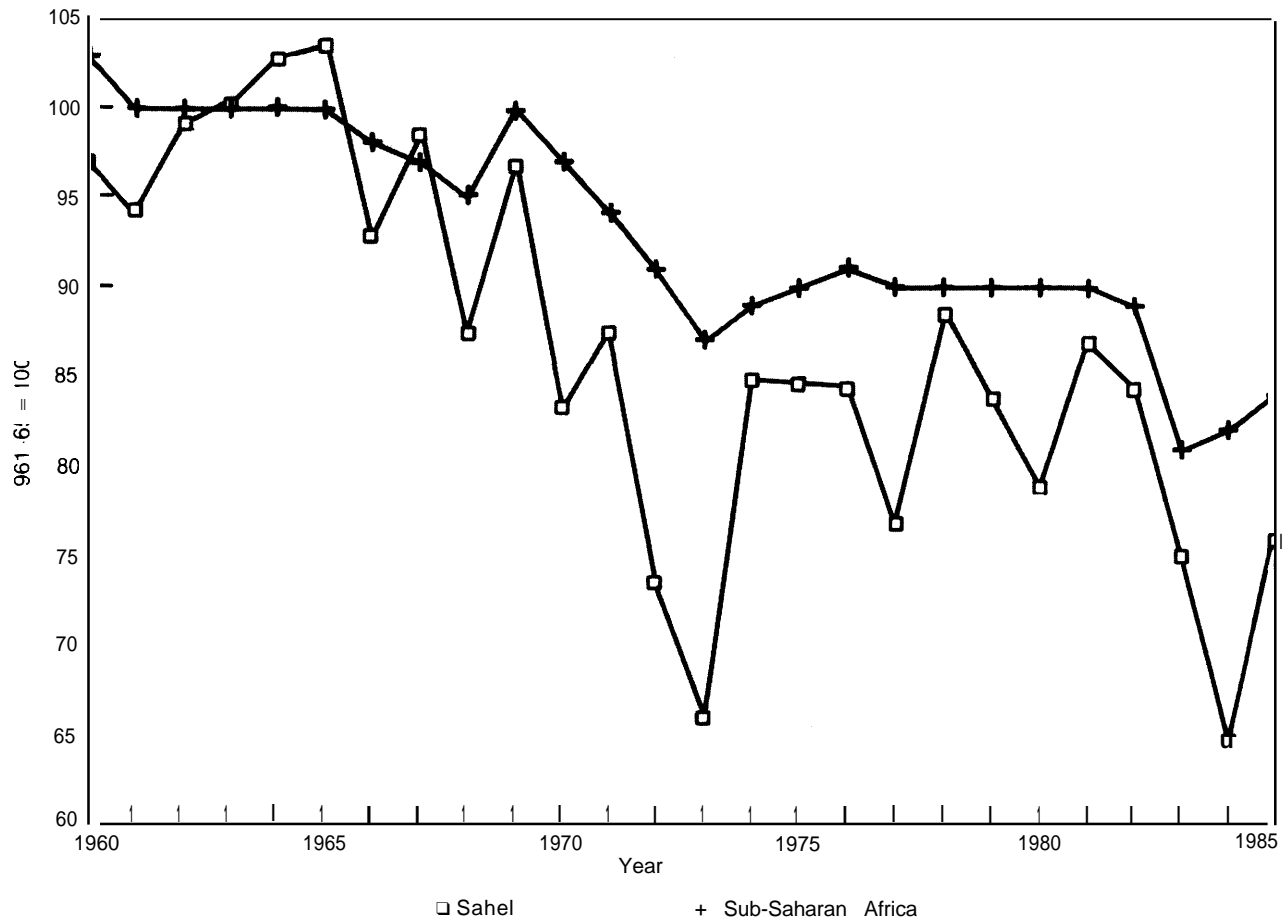
the land and higher yields per hectare. Yields per hectare of the major food crops, sorghum and millet, are lower than in other parts of the world. Production was also adversely affected by two major droughts and successive years of lower than average rainfall. The rate of population growth during this time, however, was about 2.8 percent—more than double that of the rate of growth in cereal crop production (37). Thus, per capita food production has dropped—24 percent by one estimate—since the first half of the 1960s, and has declined more than that of Sub-Saharan Africa (16 percent). (See figures 3-3 and 3-4.) That estimate, by USDA's Economic Research Service (138), excludes four

Figure 3-3.—Index of Total Food Production in the Sahel,*1960-85



*Data is for Burkina Faso, Mali, Niger, and Senegal

SOURCE U S Department of Agriculture, Economic Research Service Africa and Middle East Branch prepared for the Office of Technology Assessment February 1986

Figure 3-4.—index of Per Capita Food Production in the Sahel,^a1960-85

^aData is for Burkina Faso, Mali, Niger, and Senegal

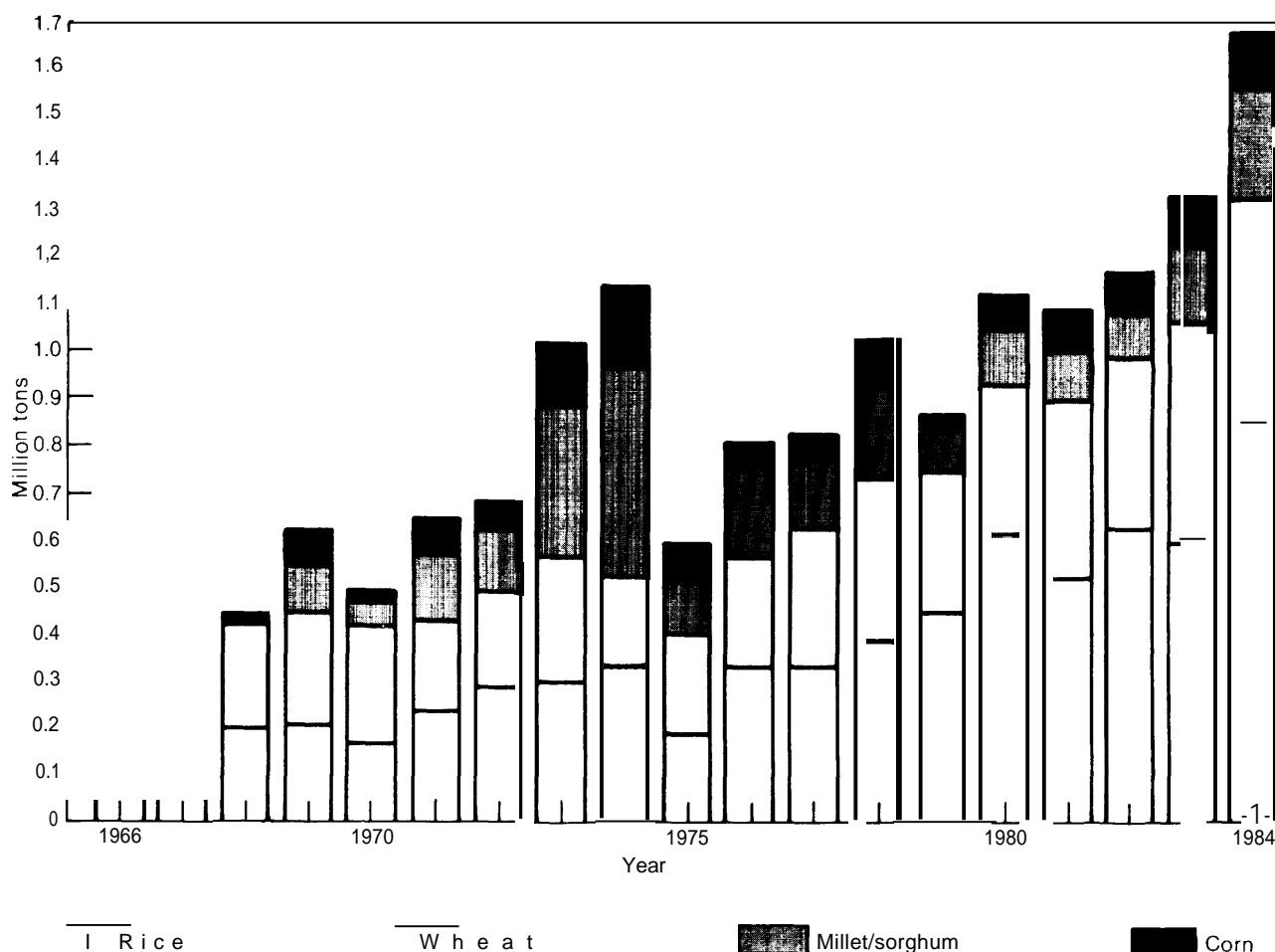
SOURCE U S Department of Agriculture, Economic Research Service, Africa and Middle East Branch, prepared for the Office of Technology Assessment, February 1986

Sahelian countries that have even greater food deficit problems: Mauritania, Cape Verde, Chad, and The Gambia.

By the mid-1970s, at the time of the formation of the CILSS and the Club du Sahel, this growing gap between food production and food needs was recognized as a critical problem. Achieving food security was identified as the first priority for the new effort. However, donors and recipients differed on what the goal meant and how to achieve it. Sahelian nations have traditionally stressed achieving regional food *self-sufficiency*, a position reiterated in the Lagos Plan of Action, a major policy statement made by Organization of African Unity in 1980.

The emphasis on increasing local food production reflects an awareness of their vulnerability to drought and of the disadvantages of an economic dependence on a few export commodities and food aid. The other emphasis, articulated most forcibly by the World Bank (101,153), is on achieving food security by increasing national incomes through trade. Since sufficient food is currently produced in the world, that argument goes, what is required is a balancing of production for trade and production for consumption to reduce the lack of food security caused mainly by a lack of purchasing power. Thus nations and individuals should produce whatever provides the greatest return. The different positions, while not

Figure 3-5.—Sahel Grain Imports by Commodity, 1966-84



SOURCE U.S. Department of Agriculture, Economic Research Service Africa and Middle East Branch, prepared for the Office of Technology Assessment February 1986

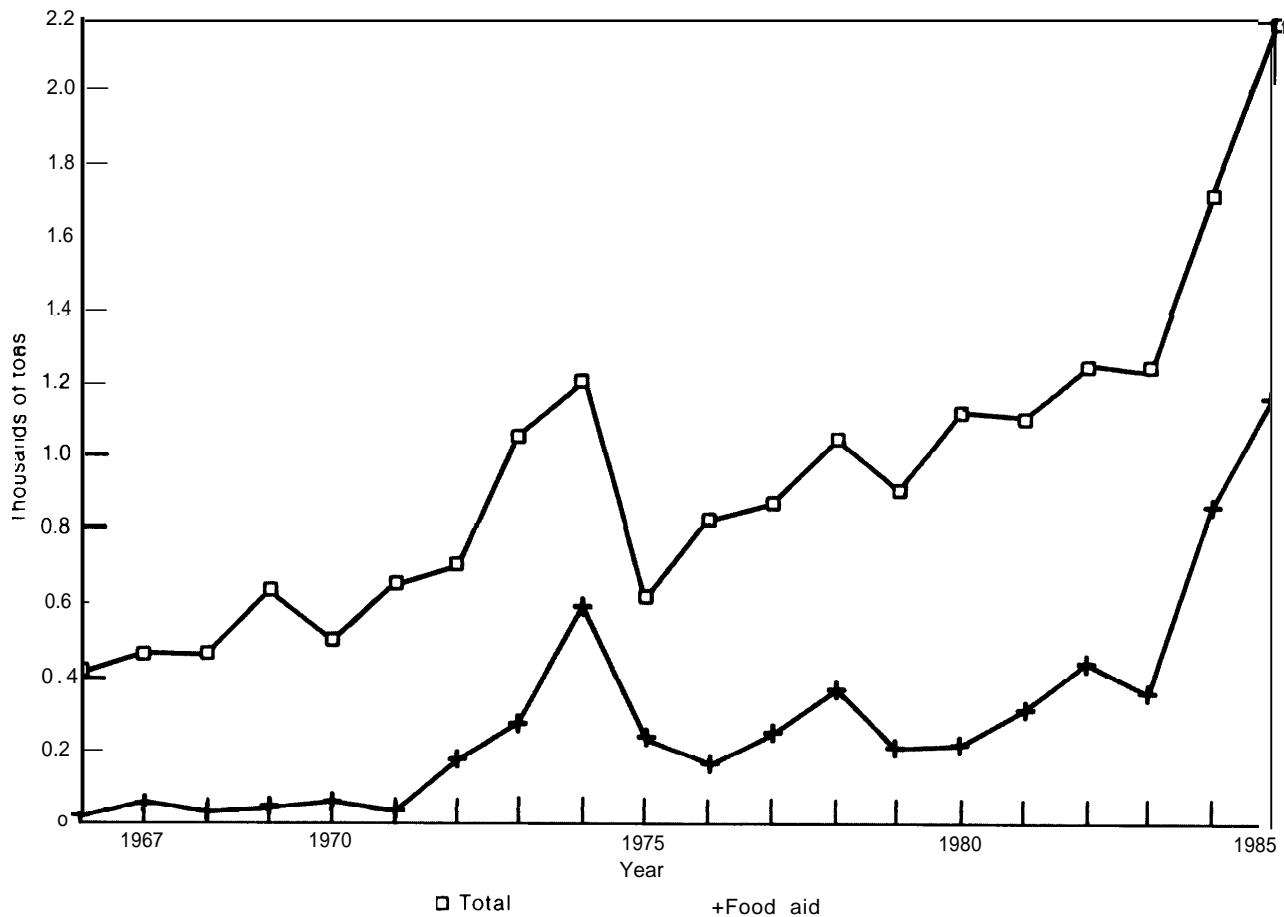
mutually exclusive, affect debates over relative priority between food and export crops, rainfed and irrigated agriculture, crops and livestock, and other issues that will be described in the next chapters,

In the past two decades, the Sahel's supply of food grains has increasingly come to depend on imports and food aid. The decline in per capita food production has been accompanied by increased imports of cereals. (See figures 3-5, 3-6, and 3-7.) At the time of independence, for instance, the Sahel (except for Senegal) received negligible food imports. During 1976 to 1982, a period between droughts, cereal imports fluctuated between 14 and 18 percent of the total

cereals available in the Sahel. By 1985, at the peak of the drought, imports provided one-third of the total cereal available. It is important to remember that the data on food production and consumption in the Sahel are at best only rough estimates (28). Data on imports, including both commercial imports and food aid, are more reliable.

Reduced foreign exchange earnings from export commodities and mounting debt—as well as a host of other reasons ranging from the availability of surplus food from donor nations, exchange rates, and other policies—have meant that the gap between food production and consumption was not met by commercial imports

Figure 3-6.—Sahel Grain Imports, 1967-85



SOURCE U.S. Department of Agriculture, Economic Research Service, Africa and Middle East Branch, prepared for the Office of Technology Assessment, February 1986

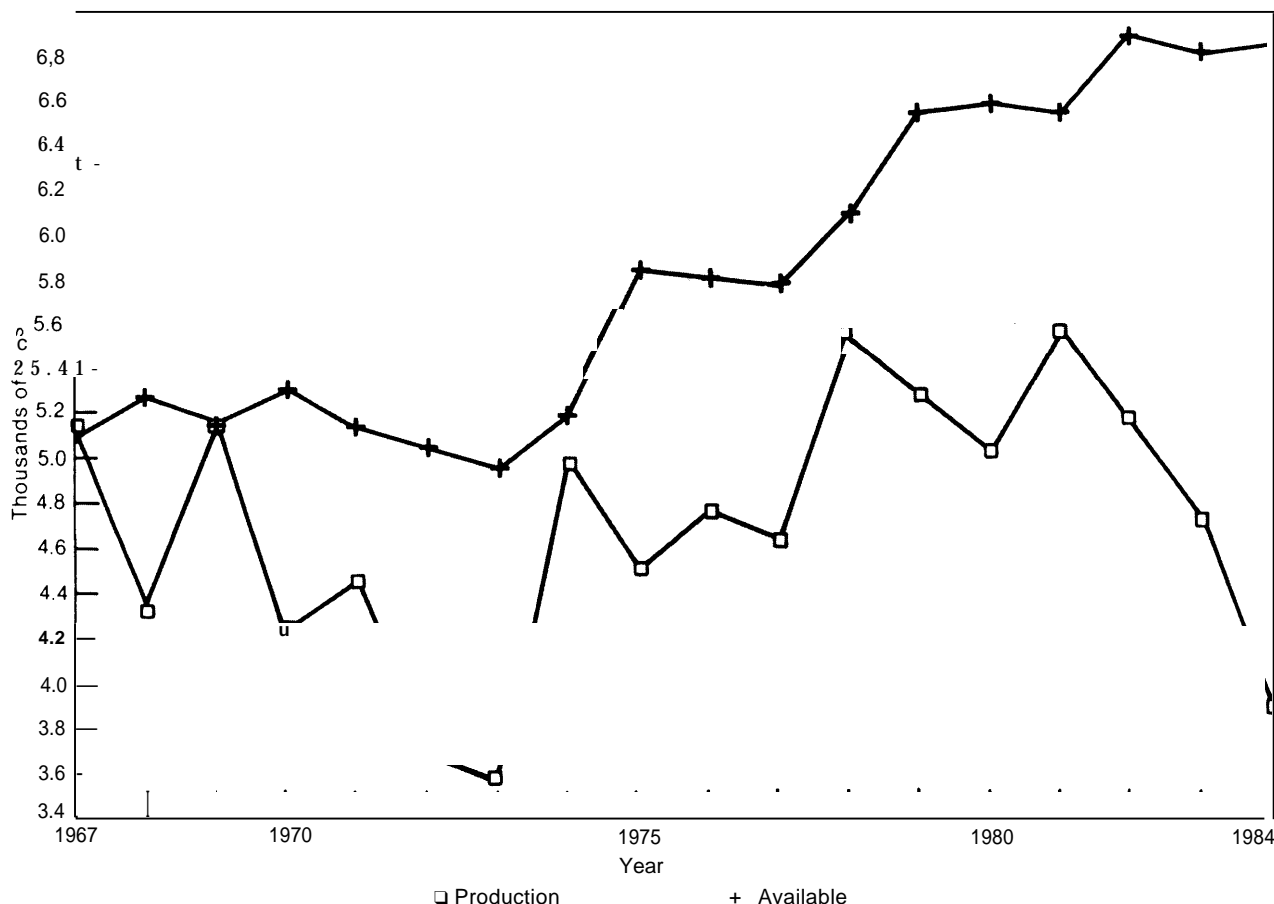
alone. (See figures 3-6 and 3-8.) Food aid, which was largely unknown in the Sahel before 1970, filled the gap. In 1983, food aid accounted for 85 percent of cereal imports in Burkina Faso, 80 percent in Cape Verde, 75 percent in Chad, 55 percent in Mauritania, 50 percent in Mali, and 22 percent in Senegal (63). In 1985, half of the cereal imports of the Sahelian nations were concessional food aid.

Even with increased imports, the gap between availability of food and food need is not being bridged completely. Current statistics on food availability, even without considering uneven distribution of food, indicate an inadequate diet according to the minimum caloric standard set by the Food and Agriculture Organization (FAO). Per capita consumption of ani-

mal products, already low, has also fallen significantly since the 1960s (59). However, cereals comprise only a part of Sahelians' diets and little data exist on consumption of uncultivated foods and animal protein. In rural areas, these are traditional backup systems and are as important as food aid in times of drought.

Subsidized imports have helped keep urban food prices low, but they also have affected people's food preferences. Most food imports are rice and wheat, which reflect both surplus production in other parts of the world and increased demand for these products in urban areas in the Sahel. These foods require less time to prepare than do sorghum and millet. Wheat and rice are now the staple foods in the large cities in the Sahel, while sorghum and millet

Figure 3.7.—Total Amount of Food Grains Available (produced and imported) in the Sahel, 1967-84



SOURCE U S Department of Agriculture, Economic Research Service, Africa and Middle East Branch, prepared for the Office of Technology Assessment, February 1986

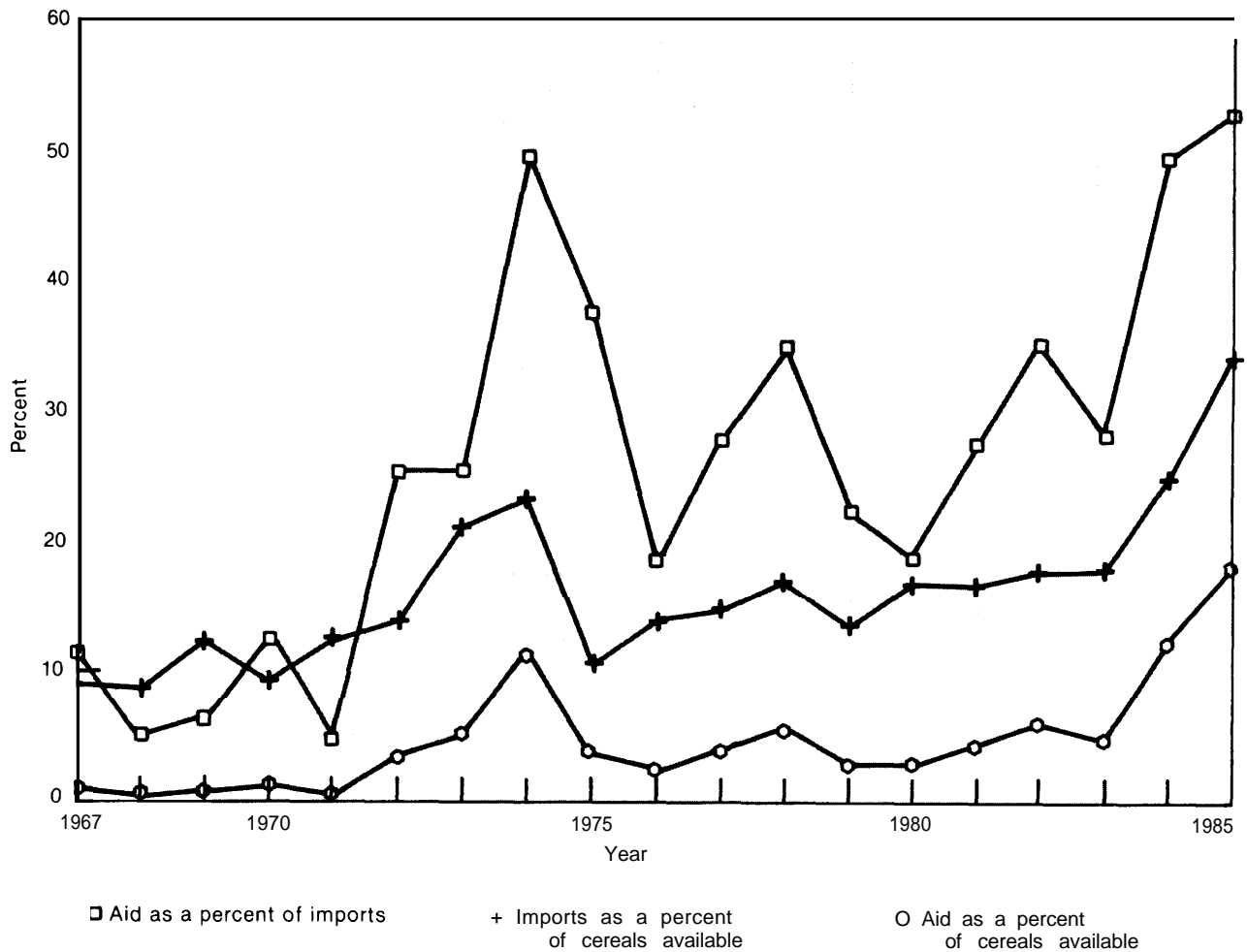
remain the staples in most rural areas. Rice is also increasingly consumed by the better off rural residents because it is easier to prepare and store (21). This changing demand has an impact on farmers, reducing their incentive to grow sorghum and millet while the climate usually prevents them from growing rice and wheat. One remedy is improved food processing technologies—to reduce women's labor—for traditional cereals. For example, millet grinders are becoming popular in urban and more prosperous rural areas and have begun to increase consumption of millet in these areas.

A number of projections have been made of future food needs, looking at probable trends of both increased demand for and supply of food, for Sub-Saharan Africa (21). All agree that

the gap will continue to widen unless there are significant changes in either production or demand. For the Sahel, the Club/CILSS estimated that if productivity per unit of land and per agricultural worker does not increase, the cereal deficit, roughly 800,000 tons in an average year at the beginning of the 1980s, will exceed 3 million tons per year by 2000. Given existing trends, even in years of normal rainfall, approximately one-third of the cereals consumed in the Sahel will be imports or food aid. They observe that "the present system is entering a dead end" (28).

However, the Club/CILSS concludes that the Sahel's resources for cereal crop production—principally sorghum and millet—are greater than its needs. Internal migration and new land

Figure 3-8.—Ratios of Food Aid, Grain Imports, and Grain Availability in the Sahel, 1967-85



SOURCE: U.S. Department of Agriculture, Economic Research Service, Africa and Middle East Branch, prepared for the Office of Technology Assessment, February 1986

development in higher rainfall areas can help relieve pressure on overworked land. But they will not be enough to provide sufficient food grains to the growing urban population unless the rainfed cereal production systems are intensified and productivity increased through a number of means (28). While the report does not deal explicitly with the problem of changing urban demand, it mentions the need to pro-

tect national markets against low-cost imports. The effect of changing urban food preferences on demand presents a challenge to those who seek to increase production of sorghum and millet through agricultural development projects or policy and other reforms. Environmental degradation, exacerbated by the drought, presents another challenge.

A DIVERSE AND CHANGING ENVIRONMENT

The Club/CILSS priority goal of increased food security included a commitment to halting and reversing environmental degradation.

Agricultural production in the Sahel is constrained by the environment, especially low soil fertility, erratic rainfall, and land degradation.

The recent drought exacerbated ongoing damaging trends and made them more visible; cattle dying of hunger because of a lack of natural fodder and farmers unable to grow even sorghum or millet on hard-packed fields degraded by wind and water erosion were common scenes.

A Harsh Environment: Climate, Rainfall, and Soils

The climate of the Sahel is extreme: a short rainy season, usually between June and October, characterized by often violent and unpredictable showers, is followed by a long dry season. Rainfall is low, highly variable, and unevenly distributed. Much of the rain that falls is not retained in the soil and runs off. There are high temperature fluctuations between day and night and low humidity during the dry season—with the “harmattan,” a dry northeasterly wind, occurring from November through February. Most important, recurrent drought is a permanent feature of the Sahel (86).

Defined ecologically according to average rainfall, the term “sahel” refers to the 200 to 400 km wide semiarid zone between the 200 mm and 600 mm average annual rainfall lines. The Sahel band extends across Africa and is located between the Sahara desert and the savannah of higher rainfall, termed the Sudanian zone.² (See figure 3-9.) In the CILSS States, the ecological “sahelian zone” covers 27 percent of Senegal, 39 percent of Mauritania, 40 percent of Mali, 7 percent of Burkina Faso, 50 percent of Niger, and 32 percent of Chad (86).

Of the 530 million hectares in the seven continental CILSS countries, two-thirds are north of the northern limit of cultivation, the theoretical line beyond which rainfed agriculture is no longer possible. Large yearly variations of rainfall patterns, however, mean that the

rainfall lines (isohyets)³ only indicate an average. Soils are suitable for cultivation on about 60 million hectares—only 12 percent of the total area. About 20 percent of this was actually being farmed in the 1970s. About 150 million hectares are classified as rangeland, where grazing is the best use of the land (148). (See table 3-5.)

Soils throughout most of the Sahel are shallow and have low fertility. They especially lack phosphorus, nitrogen, organic content, and water retention capacity. Common problems include: wind and water erosion, concentration of iron (laterization) and aluminum hydroxides, waterlogging, and hard clay layers (148). Soils vary from predominantly sandy to clay. Combined with uneven rainfall, this means that the Sahel is diverse agroecologically, even within a given climatic zone.

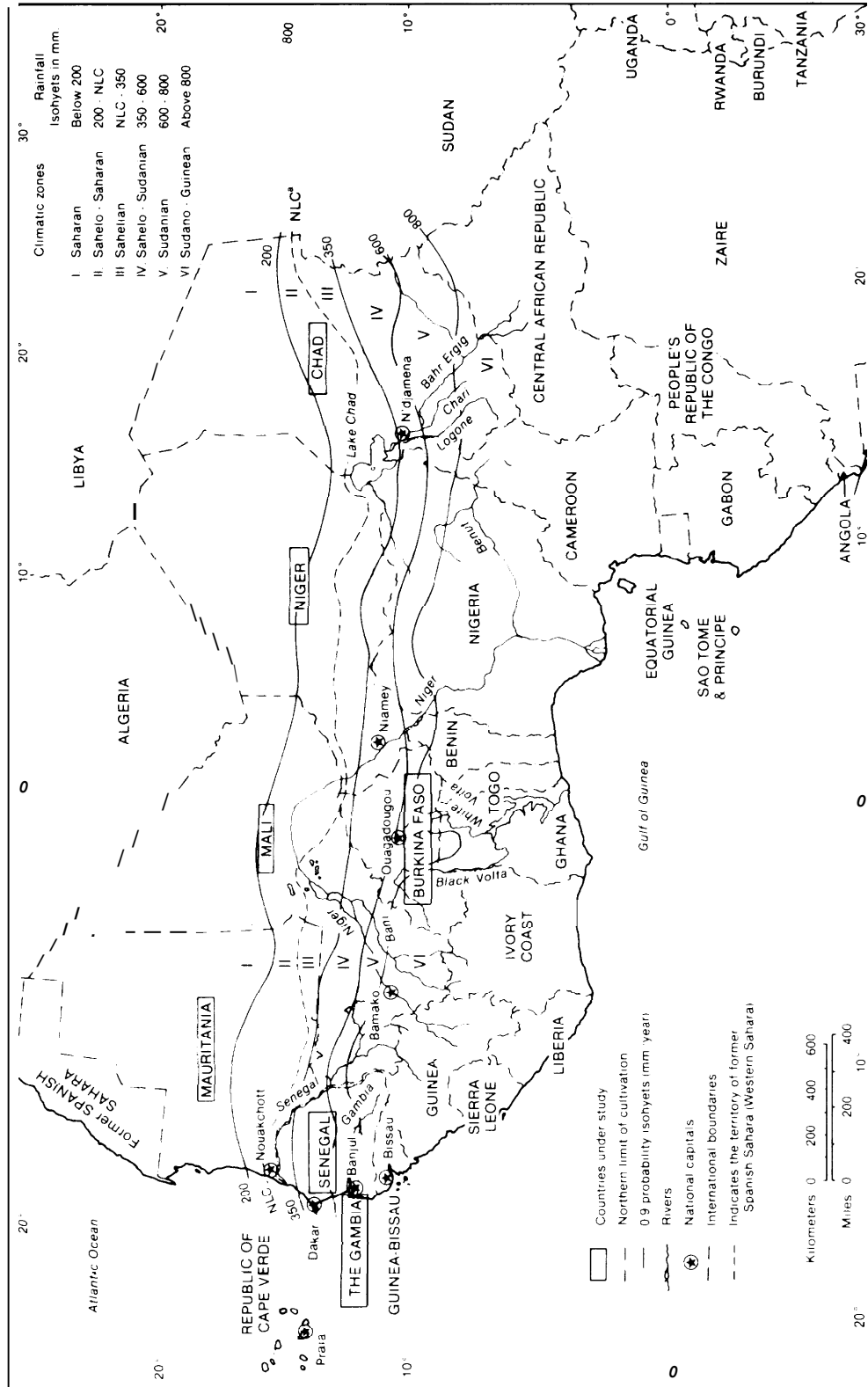
Generally—but depending on specific rainfall distribution in a given year—rainfed crop production ceases in areas that receive an average of less than 350 mm rainfall. Millet predominates in the areas up to 600 mm, while above 600 mm sorghum is the major grain crop and peanuts are important exports. Maize and cotton are grown in areas receiving above 1,000 mm of rainfall (125). About 13 million hectares are under rainfed cultivation in the Sahel: 70 percent are under millet and sorghum; 23 percent under peanuts and cowpeas; less than 3 percent each under cotton, maize, and rice (28). Yet 20 percent of the cultivable land is located north of the 350 mm rainfall line (in zone III on figure 3-9). In years when rainfall is less than average, that land is more suitable for pastoralism. This area of shifting use is one where conflicts arise between farmers and herders, or where herders sometimes cultivate crops given sufficient rainfall (148). In times of drought, the farmers and herders in these northern areas are greatly at risk.

The Sahel region suffers periodic droughts; major ones occurred this century in 1910 to 1914, 1930, 1940 to 1944, 1967 to 1973, and 1980 to 1984. BOSTID, after a paleoenvironmental

²Definitions of the major ecological zones in West Africa, by isohyets of rainfall, used by AID and CILSS, BOSTID and the World Bank in its report on desertification (148) differ somewhat. The World Bank definitions and map, while complex, are used here because of the availability of data about suitability of land use (table 3-5) and sustainable populations (table 3-6).

³An isohyet is a line drawn on a map connecting points receiving equal rainfall averaged over an extended period of time.

Figure 3-9.—Climatic Zones in the CILSS Countries



^a Northern Limit of Cultivation.

SOURCE: World Bank, *Desertification in the Sahelian and Sudanian Zones of West Africa* (Washington, DC: 1985).

Table 3-5.—Land Distribution by Climatic Zone and Suitability of Soils

Zone	Rainfall (isohyet) ^a	Soil suitable for					
		Area		Cultivation		Pasture	
		Million hectares	Percent	Million hectares	Percent	Million hectares	Percent
Saharan	less than 200 mm	296	56			50	14
Sahelo-Saharan	200 mm to NLC ^b	56	11				
Sahelian	NLC to 350 mm	45	8	13	29	28	62
Sahelo-Sudanian	350 to 600 mm	55	10	18	33	34	62
Sudanian	600 to 800 mm	38	7	14	37	19	50
Sudano-Guinean	more than 800 mm	40	8	17	42	19	48
Total area		530	100	62	12	150	28

^aAn isohyet is a line drawn on a map connecting points—receiving equal rainfall averaged over an extended period of time

^bNLC—Northern Limit of Cultivation

SOURCE: World Bank, *Desertification in the Sahelian and Sudanian Zones of West Africa* (Washington, DC 1985)

and historical review, concluded that little significant long-term climatic change has occurred in the Sahel during the last 2,500 years, and drought is an inherent feature of the region. However, the present century may be the driest one in 1,000 years (86).

There is an ongoing debate about the degree to which human actions influence climate and drought. According to one theory, clearing ground cover increases the land's reflectivity and this together with reduced evapotranspiration inhibits cloud formation. The diminished rainfall degrades the environment further in a self-reinforcing process (11,86,148). Current opinion accepts that human actions may affect the local climate, but there is not agreement on their effects on climate over larger areas.

Desertification is also a major concern in the Sahel. Researchers for the World Bank concluded that it is a complex, poorly understood process that appears to be caused by interactions between drought and human abuse of the environment (148). Desertification can be defined as "the formation and expansion of desert-like patches around cities, villages, wells, and other centers of concentrated activity" (87). One form is the expansion of the Sahara desert, but more serious is destruction of the natural resource base further south in the Sahelo-Sudanian zone (zone IV on figure 3-9), where crop yields are falling in many areas. Signs of desertification include a reduction in the amount and diversity of plant and animal species, loss of water retention capacity, lessened

soil fertility, and increasing wind and water erosion (148).

Some experts question the data available on the nature and extent of desertification (106). Careful environmental analyses have concluded that the natural systems are resilient, and if the pressure is relieved they can regenerate or be rehabilitated (86,148).

By comparing actual populations with estimated carrying capacities of the land in each of the climatic zones, World Bank researchers concluded that the sustainable rural population, given traditional crop and livestock systems, is 36 million, a number greater than the present rural population of 27 million. Some people, however, dispute the usefulness of the concept of carrying capacity because of its relativity to changes in climate, technology, management, and other factors. Degradation, while occurring in both the northern Sahel and to a lesser extent in the better watered south, was most serious in the middle zones. The middle zones are where the population already exceeds the sustainable level, and it is where trees are the most vulnerable and over-exploited (148). (See table 3-6.)

Impact of Human Activity on the Environment

Traditional land use systems were generally in equilibrium with the environment, however, human activity began having negative impacts on the Sahelian ecosystems centuries ago (86).

Table 3-6.—Sustainable and Actual Numbers of People in the Sahel (millions)

Zone	Crops/livestock			Fuelwood		
	Sustainable population	Actual rural population	Sustainable less actual population	Sustainable population	Actual total population	Sustainable less actual population
Saharan	1.0	0.8	—0.8	0.1	0.8	—1.7
Sahelo-Saharan		{ 1.0 }			{ 1.0 }	
Sahelian	3.9	3.9	0.0	0.3	4.0	—3.7
Sahelo-Sudanian	8.7	11.1	—2.4	6.0	13.1	—7.1
Sudanian	8.9	6.6	2.3	7.4	8.1	—0.7
Sudano-Guinean	13.8	3.6	10.2	7.1	4.0	3.1
Total	36.3	27.0	9.3	20.9	31.0	—10.1

SOURCE Jean Gorse, "Desertification in the Sahelian and Sudanian Zones of West Africa," *Unasylva: An International Journal of Forestry and Forest Industries* 37(4), 1985

Colonialism, economic development, and population increases in the 20th century have resulted in cumulative damages to the environment. Overuse and abuse of the natural resource base by increased numbers of farmers, herders, and city dwellers as well as by donor and African government-supported development have taken a great toll. Tree cover, grasslands, and soils have all been harmed.

As a result, some experts conclude that human and animal pressure must be reduced to allow the land to regenerate naturally. Various solutions have been proposed, including encouraging migration, increasing the intensity of agricultural production, and increasing rural incomes through other mechanisms. The biggest technical issues to be resolved include loss of trees, destruction of grasslands, and reduced soil fertility,

Loss of the Trees

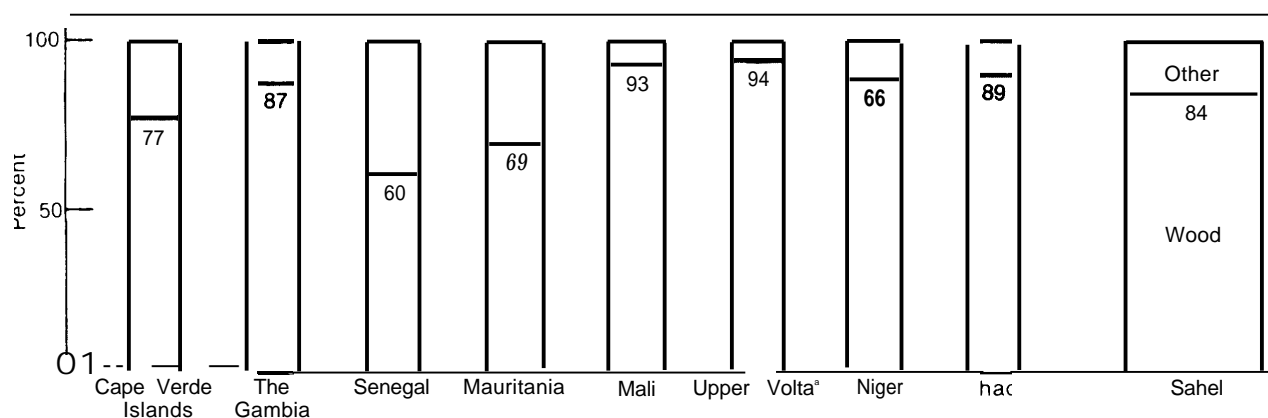
In traditional agropastoral systems, trees provide food, medicine, fuelwood, building materials, and fodder for animals. Leguminous trees also add fertility to the soil and prevent erosion. For example, the *Acacia albida* tree provides shade and increases soil fertility because it fixes nitrogen. Its leaves and protein-rich pods provide fodder for livestock in the dry season and mulch for the soil. But tree cover has been sharply reduced in the past several decades. According to one observer, two-thirds of the acacia trees within 60 miles of the Senegal River in Mauritania have disappeared in the past decade (107).

Of the estimated 18 million tons of wood consumed in the Sahel annually, about 90 percent is for fuelwood. Only 15 percent of the region's energy comes from sources other than wood (29). (See figure 3-10.) The constant search for fuelwood for cooking is one of the major factors causing the loss of trees around cities and villages. Since obtaining household fuelwood is often the women's responsibility, this shortage increases the time and labor women must spend collecting wood. Commercialization of fuelwood and charcoal has accelerated environmental destruction. As a result of increased population and urbanization, far more trees are being lost than are being regenerated or replanted, despite a variety of forestry programs.

The shortage of fuelwood or alternative energy sources especially affects the poor; many poor families now only cook one meal a day. In urban areas of Burkina Faso, 15 to 20 percent of a typical salaried worker's income is spent on firewood and charcoal; in Bamako, Mali the figure is 30 percent. Over 70 percent of the people of Niger face acute fuelwood scarcity (145). A 1983 Club/CILSS study concluded that a growing regional fuelwood deficit will occur in the next 5 to 10 years if present trends continue (29). In all but the most southern areas, fuelwood need already exceeds available fuelwood supplies (148). (See table 3-6,) Six of the eight Sahelian countries have an acute scarcity, where available supplies are insufficient to meet minimum requirements (145).

Other factors contribute to the loss of tree cover. Land is being cleared to plant more

Figure 3-10.— Percentage Share of Wood in the Sahel Countries' Supply of Energy, Mid-1970s



*Now Burkina Faso

SOURCE Club du Sahel/CILSS, *Energy in the Development Strategy of the Sahel* (Paris: OECD, October 1978)



Photo credit: U.S. Agency for International Development

Fuel wood supplies 85 percent of the Sahel's energy needs and its increasing scarcity alters people's lives significantly.

crops. Shorter fallow periods and unrestrained browsing of animals slow or prevent regrowth. Trees are also lost because of fires: farmers burn fields as part of "slash and burn" shifting cultivation methods (a low-cost method of fertilizing the soil that is not sustainable under short fallow periods); herders start fires to stimulate new growth of grasses for dry season grazing; and hunters burn areas to flush out game. Trees

also are cut to provide building materials or forage for animals during droughts.

Destruction of the Grasslands

Pastoralists' traditional ways of using the land were low density and periodic and thus helped protect the grasslands. The current problem of grasslands degradation is due to a number of

factors including: increasing numbers of livestock, concentrating herds around deep wells (boreholes) which replaced traditional shallow watering holes, the associated breaking down of controlled access to water and pasture rights, and restrictions on herders' mobility. As farming expanded further and further into rangelands and irrigation projects were developed along major rivers, pastoralists' faced limited access to dry season grazing. Therefore some herders moved into marginal lands or congregated near boreholes and consequently overgrazed the surrounding areas.

Some experts question, however, whether overgrazing is a major cause of desertification. They point out other more important factors that contribute to the degradation of the grasslands, such as expansion of cultivation into areas better suited for pasture, fires, and extended periods of low rainfall (106). Some experts attribute the replacement of more nutritious perennial grasses with annual grasses to overgrazing combined with a long period of less than average rainfall (86,148). However, rangeland experts have been unable to clearly identify that such a change is occurring (48). Others are concerned that browsing, especially by goats, will lead to increased deforestation. Yet goats and sheep have increased more rapidly

than cattle since 1970 because they are better adapted to drought (86).

Reduced Soil Fertility

The processes of deforestation and grassland degradation reduce soil fertility by reducing the vegetative cover and making the soil vulnerable to erosion. The expansion of the area planted in cash crops, together with the need to produce more food for an increasing population, has shortened fallow periods, a traditional way to restore fertility. Continuous cropping depletes the soil and fertilizers are used only on a small portion of the land, principally that planted in cotton or irrigated crops. Continuous cropping also makes the land more prone to erosion. In certain areas, the use of the modern plow in place of traditional minimum tillage methods may also contribute to erosion. The use of crop residues for fuel, fodder, or fencing and the decrease in available manure have further reduced the regenerative process of traditional systems and reduced the organic content of the soil. In a self-perpetuating downward cycle, these processes interact with drought and contribute to wind and water erosion to remove the relatively fertile topsoil and reduce the ability of the remaining soil to absorb and store water.