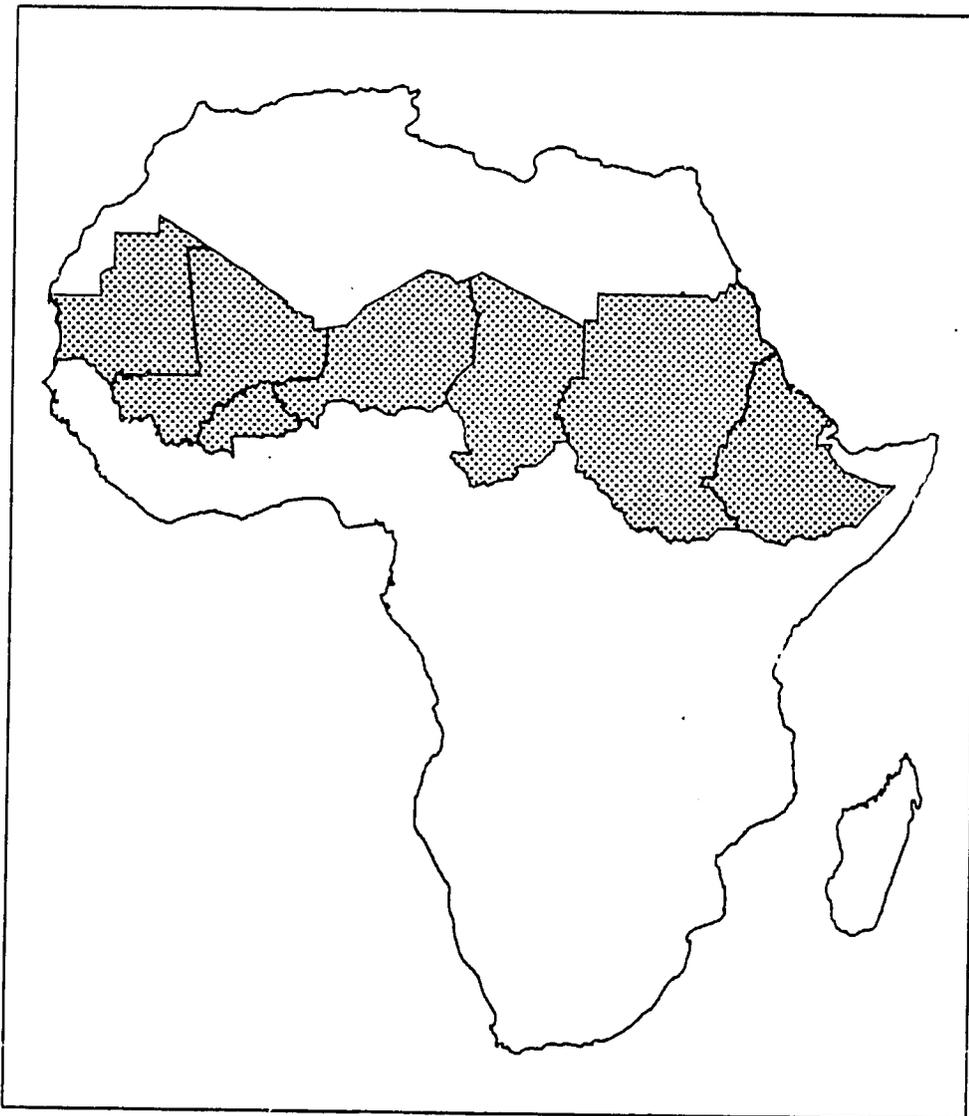


Vulnerability Assessment



Contains reports on:

Mauritania

Mali

Burkina

Niger

Chad

Sudan

Ethiopia

Vulnerability Assessment

June 1991

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Executive Summary

In Sudan and Ethiopia there are some 18 million people who are extremely vulnerable to famine, with large numbers already in famine. Poor infrastructure and continuing civil war in Sudan and the subsiding civil war in Ethiopia have been major factors impeding relief efforts and traditional responses to food shortages, turning a bad situation into disaster. In the Sahel, there are pockets of extremely vulnerable populations in Mauritania, Mali, Niger and Chad, and a small number of highly vulnerable people in Burkina. Of these situations, that in Chad appears the most precarious and Mali's is still evolving -- strife has played a role in each of these cases. The Sahel saw its second consecutive mediocre-to-poor growing season in 1990/91. A poor 1991/92 season could push extremely vulnerable populations over the edge.

Mauritania

Mauritania's most vulnerable groups remain the farmers in the Senegal River Valley and residents of shantytowns south of Nouakchott, but their condition is more severe and their numbers larger, now 125,000 people. In February, the Government of the Islamic Republic of Mauritania and major donors agreed to distribute 40,000 MT of cereals for free distribution. Relief begun in March will supplement the needs of riverine farmers, but not shantytown dwellers, until harvest time. Pledged food aid and unexpected commercial imports will almost cover the 1990/91 deficit of 103,000 MT.

Mali

Pastoralists and agropastoralists in Gao and Tombouctou regions are the most vulnerable populations. Other pockets of extreme vulnerability are found in northern Koulikoro Region and along the Niger River in northern Mopti Region. Altogether, there are 343,500 extremely vulnerable people. The Government of the Republic of Mali and donors began food distributions to these people in February. As of April's end, the distributions were roughly one-third finished. Further aid to Gao and Tombouctou is hampered by civil instability, though food shipments have not been attacked.

Burkina

A poor 1990/91 growing season has caused cereal production deficits for the second consecutive year, resulting in cereal shortages and high cereal prices. Twenty-five thousand smallholder agriculturalists in Yatenga and Soum provinces are highly vulnerable to famine. A further 1.8 million smallholder agriculturalists and agropastoralists in 10 of Burkina's 30 provinces are moderately vulnerable.

Niger

The most vulnerable populations in Niger going into the 1991 rainy season are 1,323,000 farmers and herders in northern Tillabery, central Tahoua, western Agadez and eastern Diffa departments. If food aid distributions for these areas were not to continue as programmed, large portions of these people might migrate in search of food before the 1991 cereal harvest. Of the 1,323,000 people, 235,000 are extremely vulnerable, the remainder are highly vulnerable.

Chad

Chad is on the edge of a possible food security disaster if the 1991/92 rainy season is mediocre or bad. At present, 164,000 people are estimated to be extremely vulnerable to famine, with an additional 382,500 people highly vulnerable. Only a good season or better will allow recovery of agricultural production and reduce cereal prices. Particularly hard hit are women and children in eastern Chad, whose vulnerability increased due to recent armed conflict in the region.

Sudan

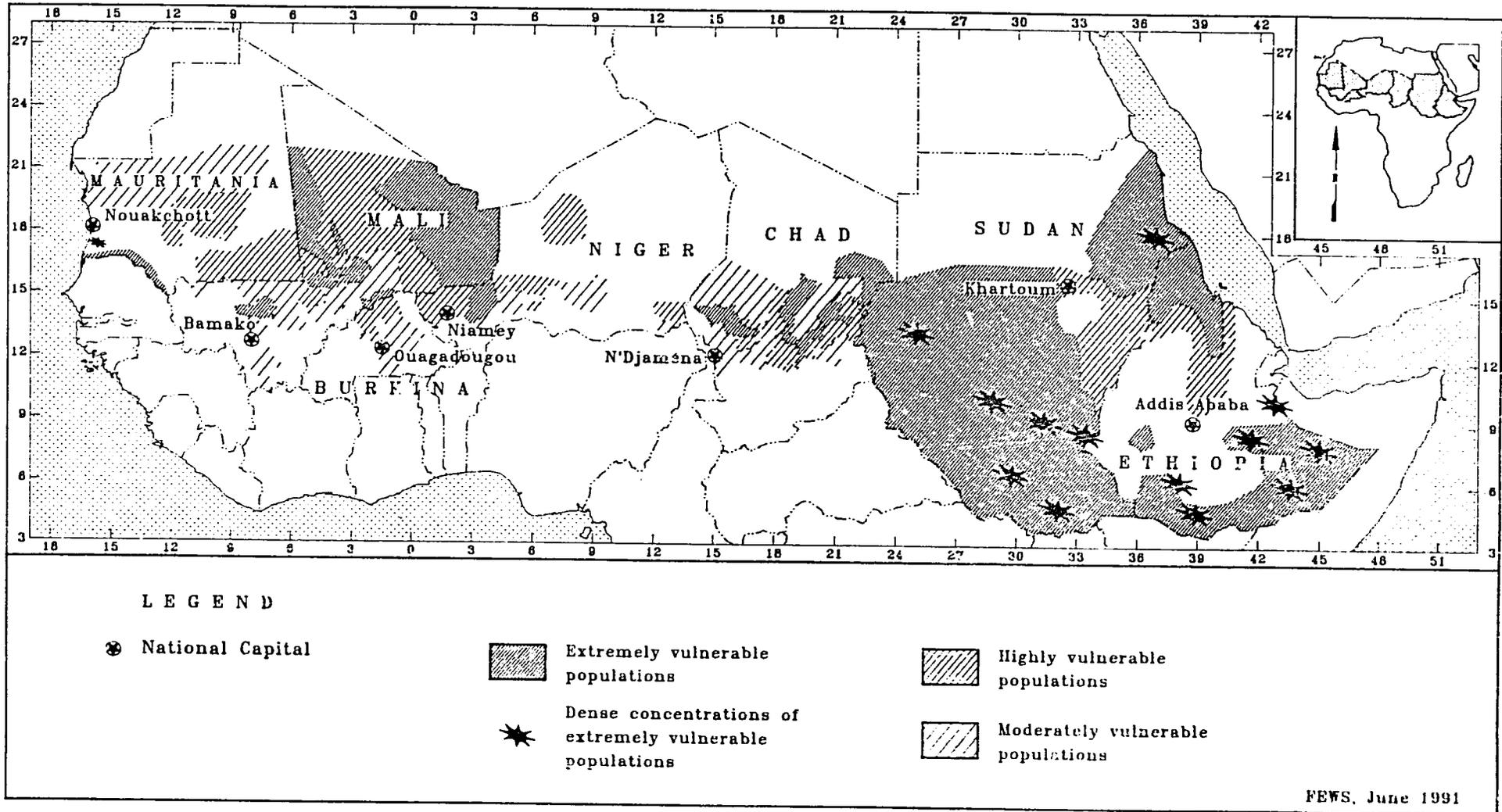
Crop and pasture failures in 1990, a national grain production deficit of 1.2-1.5 million metric tons, absence of reserves, and continuing civil war has placed over 11 million extremely vulnerable, or in the midst of famine in the worst food emergency since 1984. Traditional farmers, pastoralists, agropastoralists, urban poor, displaced persons, and refugees require emergency relief estimated at 1.2 million metric tons. Without ideal agricultural conditions and recovery of productive assets in 1991, millions will again need relief in 1992.

Ethiopia

Many parts of Ethiopia have had a second year of serious drought, with resulting crop, pasture and livestock losses equal to or exceeding those of 1984-85. Civil strife, disruption of traditional economies and coping mechanisms, and the recent collapse of the central government have intensified the drought's impact. Continued political instability, disruptions in the supply of agricultural inputs, and a poor 1991 *belg* (secondary) rainy season have further exacerbated these problems, rendering 6.5 to 7 million Ethiopians and refugees extremely vulnerable to, or in the midst of, famine.

Map 1: Regional Summary of Vulnerable Populations

Regional Vulnerability Assessment



FEWS Region

A Critical Period for Africa

Washington, June 25, 1991

The Missing Famine Response

Rarely has the progression into famine been so early identified, so widely recognized, and so accessibly-detailed by new technologies (live worldwide television broadcasts, satellite images), as during the last year in parts of Africa. Yet, 25-35 million people are today extremely vulnerable to famine, of whom 18.4 million are found in the FEWS-monitored region. Several million across the continent are actually in the midst of famine. The reasons why are both instructive and deeply troubling.

There is a body of opinion that believes that famine only occurs where peoples' coping strategies are limited by warfare or conflict, or by pre-meditated governmental policy. Indeed, most food production problems in the Sahel and the Horn are usually effectively dealt with through a diverse and robust set of local adjustments of behavior and occupation. In the instances where this mitigation does not occur and famine strikes, one usually finds that some type of conflict is impeding access to societal and family structures, constraining movement, disrupting markets, breaking down law and order, and, in more recent times, blocking access to international assistance.

Certainly the root cause of the destitution and famine conditions currently found in southern Sudan, northern and eastern Ethiopia, and large parts of countries not covered by FEWS (Mozambique, Angola, Somalia, and Liberia) is directly linked to fighting and to the difficulty of getting into or out of areas of conflict. The current, high levels of food stress in parts of Mauritania, Mali, and Chad also owe much to recent strife (see Map 1). Active neglect or calculated indifference by a ruling government may have the same effect. Evident in several of the most critical areas of food shortage and destitution in Africa today is an underlying governmental policy that, for whatever reason, has placed other agendas before that of facilitating people's access to food.

This view of the pre-eminent role of conflict as a root cause of famine is a troubling one. It suggests that a mechanism for conflict resolution, or at worst, conflict mitigation, might be as important as relief efforts in averting famine. In this view, however well-meaning the relief and development efforts, and however accurate the early warnings, conflict will continue to impede peoples' access to food, food will successfully be used

as a weapon, and the worldwide audience will continue to be present, live, at the next conflict-related famine.

The Sahel is Getting Closer to the Horn

Approximately 18 million people in Sudan and Ethiopia are at risk of (extremely vulnerable to) famine as the main rainy season begins. These people present an enormous challenge to national and international efforts aimed at avoiding large scale disaster. The scale of the problem is certainly made more difficult by its coexistence with several other immediate, large-scale and deadly crises within the continent. Just how much more difficult may it be to further sub-divide a world's limited attention and available resources if another two to five million people in Sahelian Africa fall into the same straights? As one will see in the chapters to follow, all current signs suggest that food security in the Sahel region is balanced precariously upon hopes for a good agricultural year. The two previous mediocre-to-poor seasons have left little margin with which people might cushion another poor season. Anything less than a good season will push millions into the same conditions as are widely found in the Horn, and elsewhere in Africa.

How Vulnerable?

In the following chapter, short-and-long term causes of vulnerability to famine are examined for each FEWS-monitored country. After weighing factors that predispose certain areas and households to food shortage, and then reviewing the impact of recent events and conditions on food access and availability, the USAID/FEWS authors of each report have provided their best estimate, as of May 1991, of the numbers and locations of vulnerable populations.

In order to allow some comparability of condition and needs across the countries, the reports use a matrix of vulnerability levels, shown below. The Matrix describes some significant stages of response to food shortage that will be found in any community. The Matrix assists USAID/FEWS in detecting roughly similar degrees of food stress in diverse communities exhibiting a variety of coping behaviors, and helps to classify them with common descriptors of vulnerability level.

The underlying assumption of the indicators within the Matrix is that all beings are rational and will always choose to select the least costly and least disruptive response to a food

shortage before they are forced by circumstance to select more costly and disruptive ones. Nevertheless, in any setting or county, the outward behavior being manifested may reflect differing degrees of food stress, depending upon differing values, options, resources, and views of the future. Interpretation of the behaviors within the local context is therefore essential.

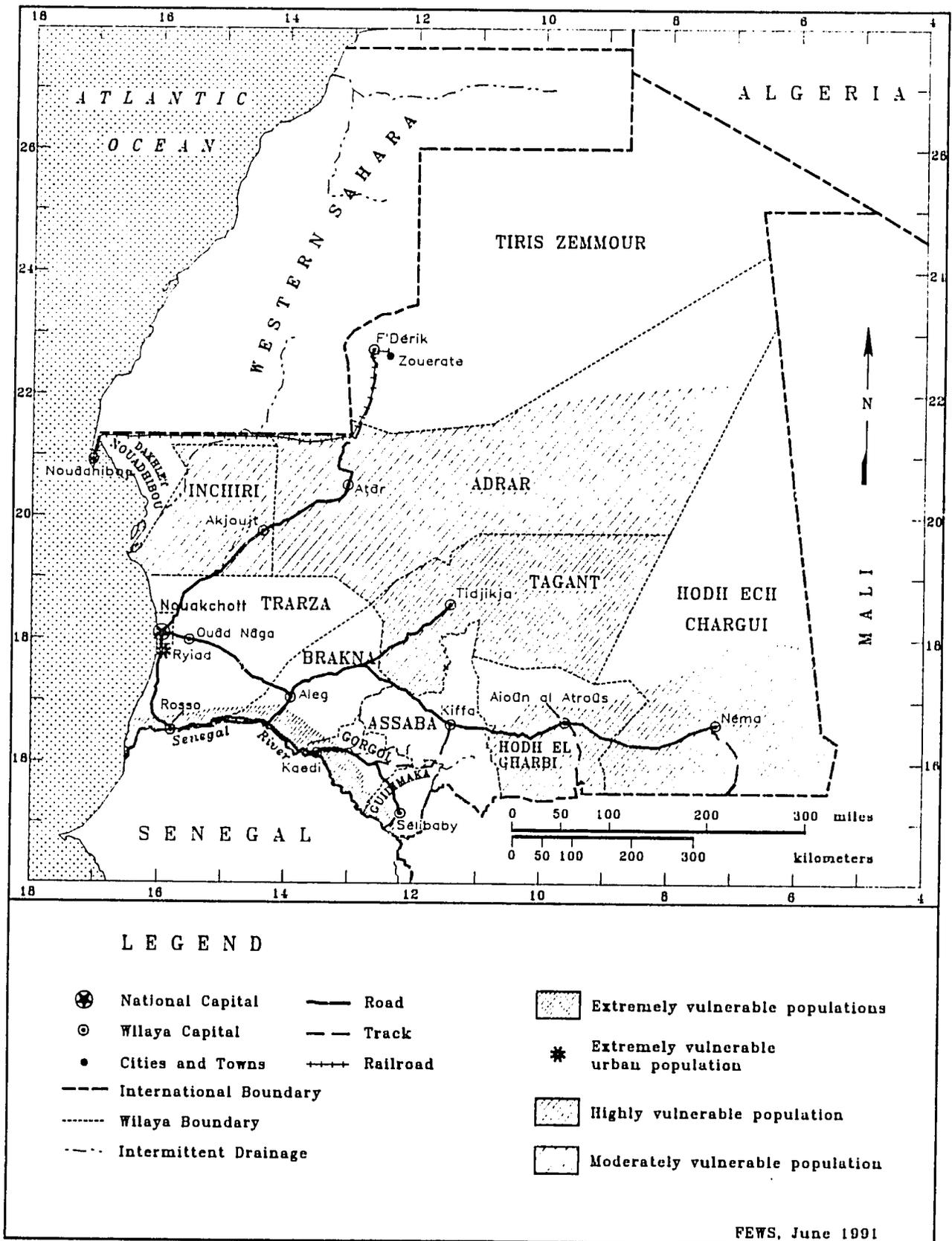
As the reader moves through the successive chapters, he/she should be aware that an attempt has been made to standardize and use the same terms for equivalent conditions among the

countries monitored. As part of an evolving methodology of vulnerability assessment, the terms used here have changed slightly from those used in past FEWS reports. An additional level was created (from four to five present levels), and a set of conditions that describe each level was provided to further insure some common level of comparability between countries. Further refinements of the methodology will undoubtedly continue as understanding of the famine process increases, and as practical, operational needs continue to require more of the present methodology.

Table 1: FEWS Matrix of Vulnerability

| Level of Vulnerability | Conditions of Vulnerability | Typical Coping Strategies and/or Behaviors | Interventions to Consider |
|--|--|---|--|
| SLIGHTLY VULNERABLE | Maintaining or Accumulating Assets | Assets/resources/wealth: either accumulating additional assets/resources/wealth or only minimal net change (normal "belt-tightening" or seasonal variations in) assets, resources or wealth over a season/year. i.e., coping to minimize risk. | Developmental Programs |
| | and Maintaining Preferred Production Strategy | Production Strategy: any changes in production strategy are largely volitional for perceived gain, and not stress-related. | |
| MODERATELY VULNERABLE | Drawing-down Assets | Assets/resources/wealth: coping measures include drawing down or liquidating less important assets, husbanding resources, minimizing rate of expenditure of wealth, unseasonal "belt-tightening" (e.g., drawing down food stores, reducing amount of food consumed, sale of goats or sheep). | Mitigation and/or Development: Asset Support (release food price stabilization stocks, sell animal fodder at "social prices", community grain bank etc.) |
| | and Maintaining Preferred Production Strategy | Production Strategy: only minor stress-related change in overall production/income strategy (e.g., minor changes in cropping/planting practices, modest gathering of wild food, interhousehold transfers and loans, etc.). | |
| HIGHLY VULNERABLE | Depleting Assets | Assets/resources/wealth: liquidating the more important investment, but not yet "production," assets (e.g., sale of cattle, sale of bicycle, sale of possessions such as jewelry). | Mitigation and/or Relief: Income and Asset Support (Food-for-Work, Cash-for Work, etc.) |
| | and Disrupting Preferred Production Strategy | Production Strategy: coping measures being used have a significantly costly or disruptive character to the usual/preferred household and individual lifestyles, to the environment, etc (e.g., time-consuming wage labor, selling firewood, farming marginal land, labor migration of young adults, borrowing from merchants at high interest rates). | |
| EXTREMELY VULNERABLE or AT-RISK | Liquidating Means of Production | Assets/resources/wealth: liquidating "production" resources (e.g., sale of planting seed, hoes, oxen, land, prime breeding animals, whole herds). | Relief and/or Mitigation: Nutrition, Income and Asset Support (food relief, seed packs, etc.) |
| | and Abandoning Preferred Production Strategy | Production Strategy: Seeking non-traditional sources of income, employment, or production that preclude continuing with preferred/usual ones (e.g., migration of whole families). | |
| FAMINE | Destitute | Coping Strategies Exhausted: no significant assets, resources, or wealth; no income/production. | Emergency Relief (food, shelter, medicine) |

Map 2: Mauritania Vulnerability Assessment Summary



MAURITANIA

Food Relief Being Distributed to the Most Vulnerable Populations

Report released by USAID/Mauritania on May 11, 1991

SUMMARY

Farmers residing in the Senegal River Valley, Nouakchott shantytown dwellers, repatriates from Senegal, and children under five in the north-central wilayas¹ are the most vulnerable groups in 1991 (see Map 2). The national cereal production (75,003 metric tons) covered only 23% of Mauritania's 1991 cereal food needs (see Appendix A for USAID/Mauritania's food needs assessment for 1990/91). This was the second disastrous harvest for Senegal River Valley farmers and has increased food stress throughout the country. Close to 40,000 metric tons (MT) of cereal are needed for emergency free food distributions in 1991 and have now been covered with firm or potential donor pledges (16,000 MT of non-cereal food aid are also needed, bringing total food aid needs to 54,000 MT). A distribution plan was submitted by the Commission for Food Security (CSA), and began implementation in March. Over the past two months, almost forty thousand additional tons of cereal were commercially imported by the private sector. This along with additional donor pledges of cereal food aid will almost cover the estimated 103,000 MT deficit originally reported (see Appendix A).

METHODOLOGY

Mauritania contains approximately two million people. This population is primarily composed of agriculturalists, agropastoralists, pastoralists, and small businessmen. Political and social events have also created displaced and repatriate populations. Other small, separate socioeconomic groups include coastal fishermen and miners. It is within this framework that FEWS/Mauritania addresses vulnerability for 1991 (see Appendix B for a chart of the analytical framework).

The Mauritania Vulnerability Assessment utilizes secondary, "hard" data sources, but quantitative data in Mauritania are insufficient. Data on private stocks, incomes, and even interior market prices are currently unavailable. Therefore, this analysis is heavily supplemented with qualitative information coming from informal sources, field trips, and observations.

¹ In order of precedence, Mauritania's administrative units are wilayas and moukhaatas.

VULNERABILITY OF SOCIOECONOMIC GROUPS

The baseline, structural vulnerability for much of the population has increased over the past two years. In 1990, a large portion of the people who were considered at-risk were so not necessarily from environmental causes or conditions, but from political constraints stemming from the 1989 events between Senegal and Mauritania. This year's poor rainfall and agricultural conditions have compounded an already serious situation for the Senegal River Valley farmers, and created an elevated vulnerability for agropastoralists in the east and children in the north-central wilayas. Repatriates remain moderately vulnerable because of their continuing dependence on food aid.

Agriculturalists in the Senegal River Valley

The Office of the A.I.D. Representative to Mauritania (OAR/M) estimated that 75,000 (25%) of the traditional River Valley farmers were extremely vulnerable to (at risk of) famine in 1990. OAR/M now estimates that at least 100,000 (one-third) of this population are suffering from severe food stress conditions and are extremely vulnerable or at risk of famine. Another 75,000 (25%) are highly vulnerable in 1991. Mauritania's 1990/91 combined cereal harvest (rainfed, irrigated, and recession) totalled 75,003 MT, making it the worst harvest recorded since 1985. The Senegal River Valley covers the southern portion of Trarza, Brakna, and Gorgol wilayas and southwestern Guidimaka Wilaya, encompassing the most fertile land in the country. However, last year's poor rainfall and the absence of river flooding resulted in a uniformly poor traditional cereal harvest. Only villages with access to small irrigated perimeters were able to produce enough to sustain their families until the 1991/92 harvest.

In 1989/90, cereal production was poor mainly because of political and social constraints stemming from the April 1989 events between Senegal and Mauritania. In addition to the poor agricultural outcome, many traditional economic coping outlets were cut off (e.g., farming lands on the Senegalese side of the river, market access and trade in Senegal, and supplemental fishing). Although tensions have eased slightly along the border

and restrictions on fishing have recently been lifted, food stress and economic hardships have intensified. On-farm stocks are now thought to be totally exhausted throughout the valley. While cereals can be found in the market (mostly commercial imports), abnormally high prices limit purchases. Migration of "key" family members in search of outside income is increasing, and there are reports of entire villages having liquidated their remaining livestock in order to purchase essential supplies (many villages suffered significant losses during cross-border raids in 1989 and 1990).

Food aid distributions in this zone began in March of this year. Varying percentages of the populations in respective *wilayas* will benefit, according to a distribution plan that was put together by the CSA (see Table 2). Even though food relief will help reduce current food stress on those populations that have become at-risk after two consecutively poor harvests, a good growing season is essential this year for everyone in the Senegal River Valley.

Agropastoralists

Approximately 80,000 (20%) of the agropastoralists residing in the two Hodh *wilayas* (Hodh el Gharbi and Hodh el Chargui -- "the Hodhs") are highly vulnerable in 1991. Last year's assessment found all of these people moderately vulnerable after widespread pest damage was reported in the far eastern areas of Mauritania. A second poor harvest and less substantial pastures in 1990/91 have increased the vulnerability of about a fifth of the Hodh population. Overall vulnerability for agropastoralists in other pastoral zones of the country is considered slight, their normal status.

Pastoral movements depend on three main factors: pastoral conditions, water availability, and security. Continued insecurity and animal theft near the Senegal River has forced most pastoral concentrations in western Mauritania to remain a minimum of 60 kilometers (km) north of the river. However, pastoral conditions were good in 1990/91 in southern Trarza and southwestern Brakna *wilayas*, the central part of Gorgol and Assaba *wilayas*, and the southern part of Guidimaka and Assaba *wilayas*. During the winter rains, some good pasture also appeared about 60 km north of Nouakchott, extending into Inchiri Wilaya (see Map 3). Although the continued monitoring of conditions and a good upcoming rainy season is important, the population in these areas are only slightly vulnerable.

Total cereal production in the Hodhs this year was 60 to 70% less than 1989/90. Both satellite vegetation data and National Livestock service reporting suggest that pastures did not reach as far north and were relatively poor compared to the 1989/90 season. Increased cereal prices and severely decreased animal prices confirm these stressed conditions (there were reports of camels selling for half of last year's price). According to both the National Livestock Service and the CSA, about 20% of the

Table 2: Emergency Food Needs¹ During Pre-harvest Months (October 1990 - March 1991)

| Wilaya | Total 1991 Population ^{2,3} | Beneficiaries Number | % | Cereals | Non-cereal ⁴ | Total (mt) |
|--------------------|--------------------------------------|----------------------|-----------|---------------|-------------------------|---------------|
| Nouakchott | 435,000 | 143,000 | 32 | 10,510 | 4,505 | 15,015 |
| Trarza | 224,000 | 67,000 | 30 | 4,924 | 2,111 | 7,035 |
| Brakna | 212,000 | 44,000 | 21 | 3,235 | 1,385 | 4,620 |
| Gorgol | 204,000 | 22,000 | 11 | 1,617 | 693 | 2,310 |
| Assaba | 184,000 | 33,000 | 18 | 2,426 | 1,039 | 3,465 |
| Guidimaka | 128,000 | 22,000 | 17 | 1,617 | 693 | 2,310 |
| Hodh ech Chargui | 234,000 | 47,000 | 20 | 3,454 | 1,481 | 4,935 |
| Hodh el Gharbi | 176,000 | 37,000 | 21 | 2,720 | 1,165 | 3,885 |
| Tagant | 71,000 | 36,000 | 50 | 2,646 | 1,134 | 3,780 |
| Adrar | 67,000 | 22,000 | 33 | 1,617 | 693 | 2,310 |
| Inchiri | 16,000 | 10,000 | 60 | 735 | 315 | 1,050 |
| Dakhlet Nouadhibou | 69,000 | 20,000 | 29 | 1,470 | 630 | 2,100 |
| Tiris Zemmour | 36,000 | 11,000 | 30 | 808 | 347 | 1,155 |
| Total | 2,056,000 | 514,000 | 25 | 37,779 | 16,191 | 53,970 |

Source: FEWS/Mauritania (population); CSA/GIRM (all other figures)

¹ Calculated at 875 grams per day for a period of seven months (120 days)

² Estimates of emergency food needs based on 1987 population figures with a 2.7% growth rate, but no other changes

³ Estimated food needs would total 51,600 MT if the population estimate preferred by OAR/M (1,981,300) were used instead of the CSA figure

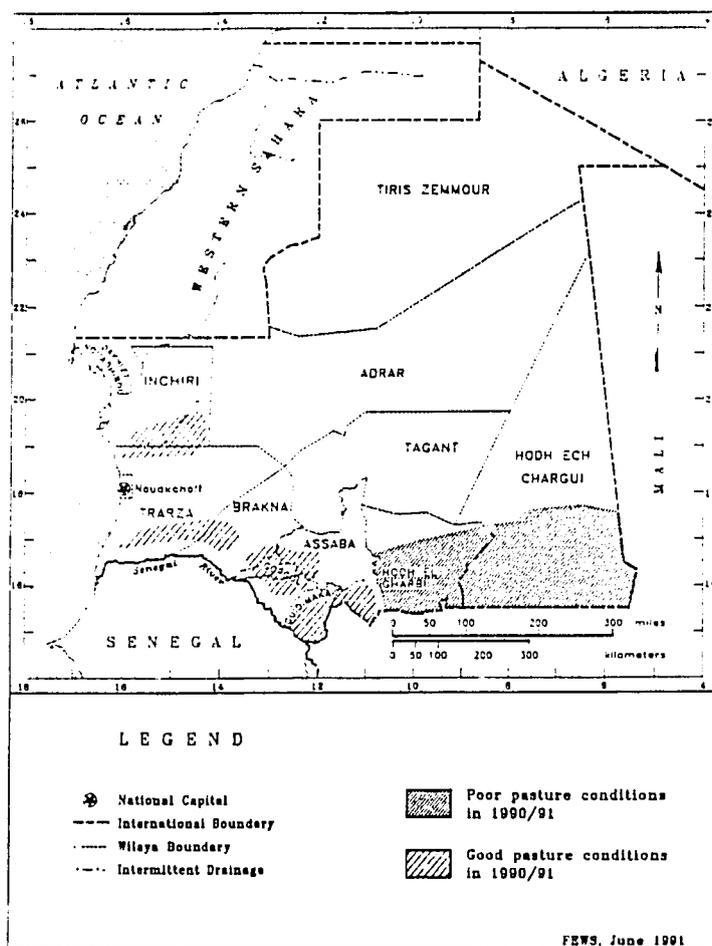
⁴ According to available stocks: powdered milk, butter or vegetable oil, legumes, meat/dried fish

population are highly vulnerable and eligible for free food distributions. However, the remaining population is only moderately vulnerable in 1991, because of the fairly good pastures last year (i.e. herd development), availability of some on-farm stocks from the 1989/90 harvest, and the continuing trade possibilities with Mali.

Displaced and Refugee Populations

There are currently 23,100 registered repatriates. This group continues to be considered by OAR/M as only moderately vulnerable, since it continues to be monitored and assisted by the Government of the Islamic Republic of Mauritania (GIRM) and the United Nations High Commission on Refugees (UNHCR). The repatriates are in 54 distinct sites that are mostly situated in riverine villages along the Senegal-Mauritania border. Although tens of thousands of other Mauritanian's were repatriated from Senegal and assimilated back into their fami-

Map 3: Mauritania's Pastoral Zones



lies, there is no way of monitoring this second group of repatriates separately.

OAR/M has considered the monitored repatriates moderately vulnerable since the 1990 assessment, not because they are economically stable or self-sufficient in food production yet, but because they continue to receive various forms of aid (training, materials and food) and close monitoring. Poor environmental conditions made for a catastrophic cereal harvest for the general populous throughout the river valley, which includes the fields given to the repatriates. Their small irrigated perimeters also brought low yields because of a lack of both skills and inputs. To become less dependent on government and donor assistance in the future, they will need more skills training and inputs, as well as a good harvest this upcoming year.

Shantytown Dwellers (Riyad)

As stated in the 1990 assessment, shantytown dwellers are chronically vulnerable, but there is one group of shantytown dwellers that continues to be extremely vulnerable to (at-risk of) famine due to their decrease in economic resources brought about by relocation. There has been no improvement of condi-

tions for these shantytown dwellers, who were forcibly relocated by the GIRM early last year some 9 to 16 kilometers south of the city along the road to Rosso. This area is now called "Riyad." The latest reports by the GIRM and *Terre Des Hommes* (TDH), a small international non-governmental organization, estimate the population to have risen to at least 50,000.¹ This figure is up from an estimated 20,000 at the time of last year's assessment.

TDH supplies basic medical and nutritional services to women and children. They have been working in Riyad since it was created in January of 1990. They recently finished their first quarter report for 1991, where they registered 80% global malnutrition (defined as weighing less than 80% of the standard weight for the child's age), 50% severe malnutrition (less than 70% of the standard weight for age), and over 30% low birth weight deliveries (newborn weight of less than 2.5 kilograms). This is more than double what was being recorded during the first trimester of last year. As living conditions in Riyad continue to deteriorate, both malnutrition and premature births continue to increase steadily.

As described last year, the GIRM required that all relocated people pay a fee for their plots of land in Riyad. Since many people could not afford this, much less build on their plots, other, more wealthy people have bought the land from them (often, the relatively wealthy have bought up many plots). The buyers have allowed the former owners to stay on that land until sometime in the future (it is assumed that the new owners live in town and will not relocate to Riyad until living conditions are tolerable).

Currently, Riyad has an insufficient water supply, lacks proper sanitation, schools, and electricity, has irregular and high priced transport into town, and no medical facilities apart from the TDH tent. Exact numbers of the relocated population are very hard to obtain. It is also difficult to sift out who is living on land that they own and who is squatting on land that is sold to someone else. Lacking any hard data, FEWS estimated that half, or 25,000 of the approximately 50,000 residents of Riyad, have sold their plots, do not have any regular incomes, and are currently at-risk or extremely vulnerable to famine.¹

Under-Fives in North-Central Wilayas

A recent nutritional survey in the Tagant Wilaya reveals even higher rates of child malnutrition than those reported in 1990. The entire population of children under five in Tagant is highly

¹ Mauritania's urban population has been growing at an alarming rate, owing mainly to rural migration. Many socioeconomic changes and environmental hardships over the past two decades have resulted in accelerated urban immigration. As a result, the capital of Nouakchott estimates that more than half of its population of 420,944 resides in shantytowns that encircle the city center.

² The estimate was based on information gathered through discussions with TDH and medical personnel working in Riyad.

vulnerable in 1991. The total rural population of the Tagant Wilaya is estimated at 70,822, of whom approximately 8,583 are children under five years of age. In January, a survey that included almost a quarter of this population was completed by UNICEF and the Ministry of Health. Global malnutrition was registered at 72% (defined here as measuring less than 85% of the standard weight for a child's height). Severe malnutrition registered at 23% (less than 80% of weight for height), which is 6% higher than 1989 findings. These results have spurred site visits by high ranking CSA and other GIRM officials, increased free food distributions, and a stepped-up operation of UNICEF'S 17 recuperation centers set up throughout the *wilaya*.

Children and pregnant women in both Inchiri and Adrar *wilayas* are moderately vulnerable in 1991. High rates of malnutrition have been recorded in the north-central *wilayas* (Tagant, Inchiri, Adrar) over the past decade, which suggests a chronic public health and food stress problem. The majority of the inhabitants in these areas rely mainly on pastoral-based activities, some date harvesting, and commerce. Cereal production is limited to areas surrounding oases. Transportation is difficult in all three *wilayas*, but the national road allows for more regular transportation of market supplies and food aid into Inchiri and Adrar. However, this group should also be included in nutritional assessments, because past studies found similar rates of malnutrition to those found in Tagant.

Pastoral Populations

According to the National Livestock Service, there has been less "unusual" pastoral migration to the far north in 1990/91 than in 1989/90. The estimated 2,000 additional pastoralists that migrated farther north than "usual" in 1989/90 because of large rangeland fires and insecurity in the south have since returned, and have remained in the more southern pastoral zones of the country.

Winter rains did bring some pasture "green-up" to the northern pastoral zone (starting about 60 kilometers north of Nouakchott, with scattered patches continuing up to Zouerate) this year (see Map 3). However, the high concentrations of animals that contributed to last year's problem of overgrazing and water stress on pastoral land throughout the three north-central *wilayas* have disappeared.

Since pastures in the southwest of the country are average and slightly better than average, FEWS considers this group of pastoralists to be no more vulnerable than "normal" in 1991 (i.e., they continue to be slightly vulnerable).

Iron Ore Miners

Iron ore production occurs in the northern portion of the country, in the towns of F'Derik and Zouerate. Mining was Mauritania's primary export commodity until the early 1980s,

when international prices for iron ore decreased. Even so, mining production progressively increased from 1986 up until last year, when production fell slightly. Employment remains stable for approximately 4,700 full time employees, so this group is still only slightly vulnerable in 1991.

Coastal Fishermen

Commercial fishing replaced iron ore mining as Mauritania's number one source of foreign exchange earnings in 1983. It remains number one despite statistics indicating a decline in the volume of catch (average recorded volume is around 450,000-500,000 tons a year). Mauritanian participation in industrial fishing is small (about two-thirds of the fishermen are Korean), but the GIRM continues to support ongoing training programs for improving Mauritanian commercial fishing skills.

Artisanal fishing is significantly smaller than the commercial fishing sector (employs between 7,000 and 8,000 people). Growth and improvement has been emphasized by the GIRM, even through the many changes made in the last two years. In Mauritania, artisanal fishing was traditionally undertaken by three social groups: the Imragen (a Maur group), Wolof (with Mauritanian citizenship), and Senegalese fishermen. The most productive group of these was the Senegalese, whose participation decreased by 60% after April 1989. Since then, the GIRM and other donors have trained, supplied, and supported with food assistance several hundred repatriates. According to the Ministry of Fish Exports, these cooperatives will probably become fully autonomous by July. Therefore, coastal fishermen are still considered only slightly vulnerable in 1991.

CONCLUSION

The majority of the Senegal River Valley population lies within three *wilayas* (Trarza, Brakna and Gorgol *wilayas*), whose populations total about 614,500. The River Valley population is a subgroup of approximately 300,000 people of the *wilaya* population. OAR/M estimates up to 100,000, or one-third, of those people to be truly at-risk this year and another 75,000 to be highly vulnerable. Last year's catastrophic harvest, combined with the poor harvest in 1989/90 and other unprecedented constraints, has plunged over half of the River Valley population into highly or extremely vulnerable states as they enter their next planting season. Both the GIRM and the international donor community have recognized this group's food stress and programmed almost 10,000 MT of free food aid to be distributed throughout Trarza, Brakna and Gorgol *wilayas* (not just the River Valley) to varying percentages of the at-risk population (see Table 2). Distributions began in March and should be continuing regularly until finished. More targeted intervention and nutritional monitoring should be scheduled in order to isolate the most needy and minimize the disastrous effects of prolonged food stress.

Approximately 25,000, or half, of Nouakchott's shantytown inhabitants residing in the area now called "Riyad" are classified as extremely vulnerable to, or at risk of, famine in 1991. Those who live there full time have completely exhausted their economic base and liquidated their means of production. Immediate food aid distributions have been scheduled (260 MT of wheat, 8 MT of oil, 8 MT of rice, and 6 MT of rice flour), but until mid-May 1991, nothing had been distributed. This group needs immediate and continued assistance through food relief. Further specific needs of this community then need to be addressed through technical assessments and formal surveys. To improve the situation, a reliable infrastructure must be created and food-for-work or similar projects should be put into place for job stimulation.

All 23,100 registered repatriates must continue to receive food aid and monitoring -- at present they are almost completely dependent on distributions and material support. They continue to lack all types of economic and food security.

About 20%, or 80,000, of agropastoralists residing in the Hodh *wilayas* are highly vulnerable in 1991 from the combination of two consecutive poor harvests and below-average pasture green-up in 1990/91. This percentage of the population started receiving free food aid in March. The remaining

agropastoralists are considered moderately vulnerable. After two poor-to-mediocre growing seasons, both early and substantial rains are extremely important for all agropastoralists in the eastern zones this year.

Children under five living in the north-central *wilayas* of Mauritania are a chronically vulnerable group, but with malnutrition levels continuously rising, the children under five (approximately 8,583) in Tagant Wilaya are being considered highly vulnerable in 1991. Survey findings indicated a need for increased food aid intervention, and the CSA is currently doing on-site assessments and programming appropriate actions, while UNICEF continues to operate 17 recuperation centers. The other north-central *wilayas* should be surveyed by the Ministry of Health in case of similar situations, but are currently being considered as moderately vulnerable in 1991.

All other moderately vulnerable groups identified in this report should be closely monitored by following as many of the early warning indicators as possible, including this season's rainfall, Normalized Difference Vegetation Index (NDVI -- see inside back cover), agriculture, price and nutrition data. Intervention plans should be discussed ahead of time in case emergency situations arise.

APPENDIX A: Mauritania Food Needs Assessment for 1990/91, March 30, 1991 (MT)

| | Total | Wheat | Rice | Local Com- modities | Wheat Flour |
|---|-----------|--------|---------|---------------------------|----------------|
| DOMESTIC FOOD SUPPLY | | | | | |
| Initial Stocks | 33,647 | 9,554 | 11,947 | 6,146 | 6,000 |
| Farmers | 5,000 | 0 | 0 | 5,000 | 0 |
| Private | 6,000 | 0 | 0 | 0 | 6,000 |
| Public (CSA) | 12,347 | 9,554 | 1,647 | 1,146 | 0 |
| Public (SONIMEX – import/export parastatal) | 10,300 | 0 | 10,300 | 0 | 0 |
| Net Domestic Production | 75,005 | 0 | 31,063 | 43,942 | 0 |
| Total Domestic Food Supply | 108,652 | 9,554 | 43,010 | 50,088 | 6,000 |
| FOOD REQUIREMENTS | | | | | |
| Human Consumption: | 326,908 | 51,513 | 120,857 | 114,913 | 39,623 |
| Population | 1,981,258 | | | | |
| Annual per capita consumption (kg) | 165 | 26 | 61 | 58 | 20 |
| Feed Use | 8,000 | 0 | 0 | 8,000 | 0 |
| Seed Use | 2,720 | 0 | 1,280 | 1,440 | 0 |
| Food Exports (non-official) | 0 | 0 | 0 | 0 | 0 |
| Carryover Stocks (to 1991/92) | 36,000 | 6,000 | 19,000 | 5,000 | 6,000 |
| Farmers | 5,000 | 0 | 0 | 5,000 | 0 |
| Private | 8,000 | 2,000 | 0 | 0 | 6,000 |
| Public (CSA) | 4,000 | 4,000 | 0 | 0 | 0 |
| Public (SONIMEX) | 19,000 | 0 | 19,000 | 0 | 0 |
| Total Food Requirements | 373,628 | 57,513 | 141,137 | 129,353 | 45,625 |

| | Total | Wheat | Rice | Local Com- modities | Wheat Flour |
|------------------------------------|----------|---------|---------|---------------------------|----------------|
| PRODUCTION GAP | -264,976 | -47,959 | -98,127 | -79,265 | -39,625 |
| COMMERCIAL IMPORTS | | | | | |
| SONIMEX | 32,000 | 0 | 32,000 | 0 | 0 |
| Private | 142,650 | 65,650 | 32,000 | 0 | 45,000 |
| Total Commercial Imports | 174,650 | 65,650 | 64,000 | 0 | 45,000 |
| COMMERCIAL IMPORT GAP | -90,326 | 17,691 | -34,127 | -77,213 | 5,375 |
| FOOD AID IMPORTS | | | | | |
| USAID (October 1990) | 20,000 | 20,000 | | | |
| Germany (October 1990) | 2,000 | 2,000 | | | |
| EC (March 1991) | 15,000 | 15,000 | | | |
| Spain (March 1991) | 4,000 | 4,000 | | | |
| WFP | 101 | | | | 101 |
| Total Food Aid Imports | 41,101 | 41,000 | 0 | 0 | 101 |
| OVERALL IMPORT GAP | -49,225 | 58,691 | -34,127 | -79,265 | 5,476 |
| PROGRAMMED FOOD AID IMPORTS | | | | | |
| WFP (March 1991?) | 13,254 | 11,051 | 151 | 2,052 | |
| France (June 1991?) | 4,000 | 4,000 | | | |
| USA | 10,400 | 10,400 | | | |
| Total Programmed Food Aid Imports | 27,654 | 25,451 | 151 | 2,052 | 0 |
| PROJECTED 1990/91 FOOD GAP | -21,571 | 84,142 | -33,976 | -77,213 | 5,476 |

Source: USAID/FFP; WFP; FEWS/Mauritania

Note: The calculations presented in this appendix were carried out using the A.I.D. Food Needs Assessment (FNA) software package. The table includes the most recent donor pledges as of May 11, 1991. The most recent commercial imports (which were 41,500 MT more than was earlier expected) are also included. The most recent pledges and commercial imports combine to change the projected 1991 cereal deficit from 103,000 MT to 21,571 MT.

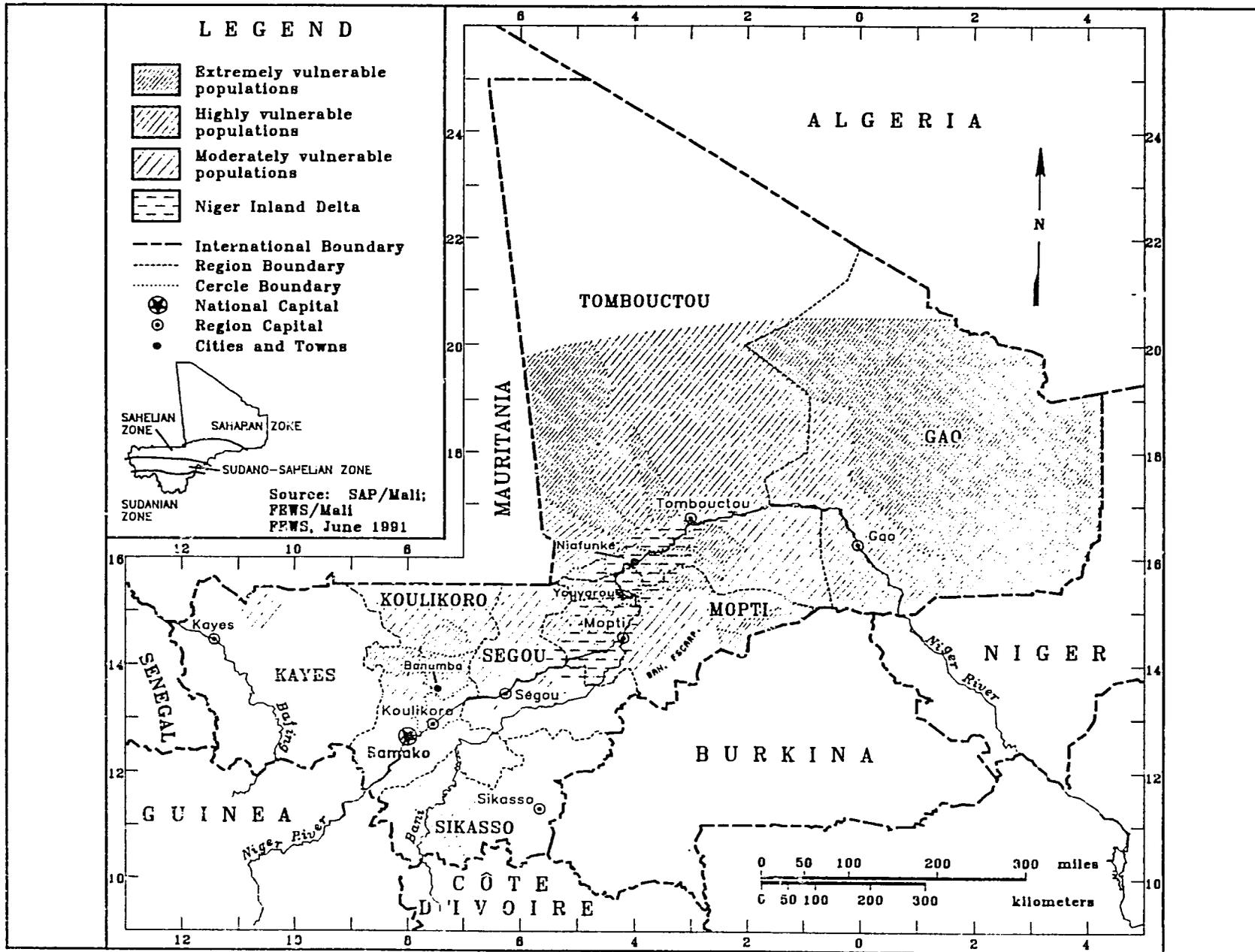
APPENDIX B: Chart of Vulnerable Groups in Mauritania

| Separate Populations in Mauritania | Population (approximate) | Current Vulnerability | Reason for Vulnerability | Using Which Indicators | Geographic Location | Traditional Coping Mechanisms | Mitigation Strategies | Possible Vulnerability Level Within One Season |
|------------------------------------|--------------------------|-----------------------------------|--|--|---|---|--|--|
| SHANTYTOWN DWELLERS | | | | | | | | |
| Ryiad | 25,000 | At-risk of Famine | Lost all means of production, liquidated all assets, living hand-to-mouth | Nutrition statistics, price data, World Bank Life Statistics Measurement Survey (LSMS) | 9-17 km south of Nouakchott, on road to Rosso | | Free food distributions, surveys, food-for-work (FFW), nutritional rehabilitation, | Highly Vulnerable |
| | 25,000 | Slightly to Highly Vulnerable | Menial jobs in town, lack of security | | | | FFW projects, surveys | Moderately Vulnerable |
| Other Shantytowns | 200,000 | Moderately Vulnerable | Menial labor (wage), lack of food security | LSMS, price data | Nouakchott environs | | FFW projects | Moderately Vulnerable |
| FARMERS | | | | | | | | |
| River Valley | 100,000 | At-Risk of Famine | 2 years of poor harvest, loss of assets | Rainfall, NDVI, stock data, prices, qualitative data, production statistics | Southern portion of Mauritania along border with Senegal—parts of Trarza, Brakna, Gorgol, Guidimaka | Fishing in river, trade, wage labor, farming marginal land, making charcoal, drawdown on assets, exploitation of famine foods | Free food distributions, nutritional and agricultural surveys | Moderately to Highly Vulnerable |
| | 75,000 | Highly Vulnerable | 2 years mediocre to poor harvest, drawdowns | | | | Free food distributions to most needy, FFW projects | Moderately Vulnerable |
| | 125,000 | Slightly to Moderately Vulnerable | 0-1 year mediocre harvest, lower stock levels | | | | Food security projects, agricultural development, cooperative support, etc. | Slightly Vulnerable |
| Other Southern Areas (Guidimaka) | 75,000 | Slightly to Moderately Vulnerable | Cross border raiding, no trade with Senegal, high cereal prices, mediocre growing season | Same as River Valley | Southern Wilayas: Trarza, Brakna, Assaba, Gorgol, Guidimaka, H. Gharbi, H. Chargui | Trade with Mali & Senegal, sale of animals, drawdown on assets, herd reductions, wage labor, river fishing | Agricultural development projects, livestock development | Slightly Vulnerable |

| Separate Populations in Mauritania | Population (approximate) | Current Vulnerability | Reason for Vulnerability | Using Which Indicators | Geographic Location | Traditional Coping Mechanisms | Mitigation Strategies | Possible Vulnerability Level Within One Season |
|--|--------------------------|-----------------------|--|--|--|--|--|--|
| AGROPASTORALISTS/PASTORALISTS | | | | | | | | |
| Eastern Wilayas (Hodh el Chargui, Hodh ech Gharbi) | 80,000 | Highly Vulnerable | 2 years of poor harvest, 1 year of poor pastures | Rainfall, NDVI, qualitative price data, crop protection (pest) data, livestock prices, stock data, production statistics | Eastern Mauritania – Hodh el Chargui, Hodh ech Gharbi | Trade with Mali, zonal migration, reduction of herds, wage labor | Free food distributions, FFW projects | Slightly to Moderately Vulnerable |
| | 311,490 | Moderately Vulnerable | 1-2 years of mediocre/poor harvest, 1 year of poor pastures | | | | Livestock development, cereal grain banks, agricultural development projects | |
| Trarza/Brakna | 150,000 | Slightly Vulnerable | Average to slightly better than average pasture "green-up", water points available | NDVI, rainfall, livestock data, transhumance data, waterpoint data, production statistics | SW & SE Trarza/ SW Brakna | Trade w/ Mali & Senegal, herd reduction, wage labor, river fishing (?%), transhumance (crossborder), trade dairy products for cereal | Agricultural and pastoral development projects | Slightly Vulnerable |
| Gorgol/Assaba | 140,000 | | | | Central Gorgol/ West-central Assaba | | | |
| Guidimaka/ Assaba | 130,000 | | | | South-central Guidimaka/ SW Assaba | | | |
| North of Nouakchott – Inchiri, Zouerate | 25,000 | | | | 60 km north of Nouakchott, with patches up to Zouerate | | | |
| REPATRIATES | | | | | | | | |
| In Camps | 23,100 | Moderately Vulnerable | Dependent on regular food assistance (although well monitored) | Production statistics, nutrition statistics, food aid deliveries | Riverine sites | Most were small businessmen in Senegal | FFW, skills training, ongoing monitoring | Moderately Vulnerable |
| Unregistered/ Assimilated | 80,000 | Slightly Vulnerable | N/A | N/A | Throughout country | Same as family group | N/A | Unknown |
| IRON ORE MINERS | | | | | | | | |
| | 4,700 | Slightly Vulnerable | Fairly stable incomes, annual increase in population | Iron ore statistics | F'Derick, Zouerate | | | Slightly Vulnerable |

| Separate Populations in Mauritania | Population (approximate) | Current Vulnerability | Reason for Vulnerability | Using Which Indicators | Geographic Location | Traditional Coping Mechanisms | Mitigation Strategies | Possible Vulnerability Level Within One Season |
|--|--------------------------|--|---|--|--|---|--|--|
| PASTORALISTS, SMALL BUSINESS, DATE HARVESTERS | | | | | | | | |
| Adrar & Inchiri | 70,000 | Moderately Vulnerable (?% Highly Vulnerable) | High cereal prices, mediocre 90/91 date harvest, overcrowded 89/90 pastures | NDVI, rainfall, livestock data, production statistics, cereal prices, stock data, pasture data | Adrar & Inchiri wilayas | Migration of some family members, farm millet near oases, gardening, transhumance, wage labor | Village cereal banks, improved gardening projects | Slightly Vulnerable |
| Tagant | 60,000 | Moderately to Highly Vulnerable | Limited transportation, water stress, high prices | | Tagant Wilaya | | FFW projects, well projects | Moderately to Slightly Vulnerable |
| Infants/Children | 8,500 | Highly Vulnerable | Food stress (sickness), low cereal stocks, high market prices | Nutrition statistics | Tagant Wilaya, Adrar & Inchiri wilayas | | Free food distributions, recuperation centers, nutritional surveys | |
| | 11,500 | Moderately to Highly Vulnerable | | | | | | |
| FISHERMEN | | | | | | | | |
| Industrial | 10,000 | Slightly Vulnerable | Stable income (wages), needed skill | "Catch" statistics from Ministry of Fish Exports, etc. | Fishing boats off coast of Nouadhibou | | | Slightly Vulnerable |
| Artisanal (Some Repatriates) | 8,000 | | Support by GIRM, high demand | Market prices, repatriate monitoring | All Along the Coast, Nouakchott, Cap Timiris | More supplies materials & training, (for repatriates) | | |
| SALARIED EMPLOYEES, COMMERCE | | | | | | | | |
| | 243,968 | Slightly to Moderately Vulnerable | Wages not keeping up with buying power of the Ouguiya | Price indices, LSMS statistics | Mostly in Nouakchott and other wilaya capitals | Back to traditional farming, pastoral activities, etc. | National wage increases | Slightly Vulnerable |
| TOTAL | 1,981,258 | | | | | | | |

Map 4: Mali Vulnerability Assessment Summary



Pastoralists and Agropastoralists Face Limited Food Access

Report released by USAID/Mali on May 21, 1991

SUMMARY

Agropastoralists and pastoralists are the most vulnerable socioeconomic groups entering the 1991/92 agricultural season. Their position is a result of poor crop harvests and declining market access to cereals. This is particularly true for those who live north of the middle Niger River. Their vulnerability position is exacerbated by continued unrest. In all, 343,500 people are extremely vulnerable in 1991. Low food reserves and limited food access may reduce farmers' physical capacity to plant crops as the agricultural year develops. Migration in search of wage labor has been high this year. If these migrants remain away, they will not be available for early season production activities, further limiting labor inputs to agriculture. The Government of the Republic of Mali (GRM) and donors are attempting to assist vulnerable populations through food distributions, food-for-work programs and market support mechanisms. Food distributions began in February 1991. As of the end of April, 3,440 metric tons (MT) of cereal of 10,824 MT authorized had been distributed. Further distributions in Gao and Tombouctou regions have been curtailed temporarily because of recent civil instability.

METHODOLOGY

Susceptibility to food crisis is a function of short- and long-term factors. Vulnerability, then, can be measured along these two temporal dimensions. FEWS/Mali developed a set of indicators to determine vulnerability at the *cercle*-level along each dimension. All 46 *cercles*¹ were assigned values between 1 and 46, according to their relative positions for a given indicator. A high rank score indicates high vulnerability and a low rank score indicates low vulnerability. The rank score for short term indicators was totalled and a new ranking was done. This yielded an overall score for short-term vulnerability. The same was done for long-term vulnerability indicators. Finally, the short- and long-term vulnerability scores were totalled and a last ranking made. This provided an assessment of overall

¹ In order of precedence, Mali's administrative units are regions, cercles and arrondissements.

current vulnerability for each *cercle* (see Appendix C for a description of each indicator).

Initial categorization was made based on the value of the score relative to the standard deviation from the mean (average) score value. Cercles were considered to be slightly vulnerable if their scores were below the mean. Cercles were considered to be moderately vulnerable if their scores were above the mean. If the score for the *cercle* was greater than one standard deviation above the mean, it was classified as highly vulnerable. Extremely vulnerable areas were determined at the *arrondissement* level. Classification was based on GRM Early Warning System (SAP) reports.

Socioeconomic groupings were identified through dominant land uses and the indicators that most affected the area. The size of the group was estimated from the most recent reliable demographic data. The groups and their classifications are presented in Table D-1.

VULNERABILITY OF SOCIOECONOMIC GROUPS

The combination of long- and short-term factors contribute to a relatively broad categorization of vulnerability that is depicted at the *cercle* level (see Map 4). Extreme vulnerability, however, is a much more localized phenomenon in Mali. Due to the spotty nature of crop failures throughout the country, cases of extreme vulnerability caused by crop failure transcend *cercle*-level classifications. The most precise depiction possible is at the *arrondissement* level. Thus, incidents of extreme vulnerability may be found in *cercles* that otherwise are classified as being slightly vulnerable.

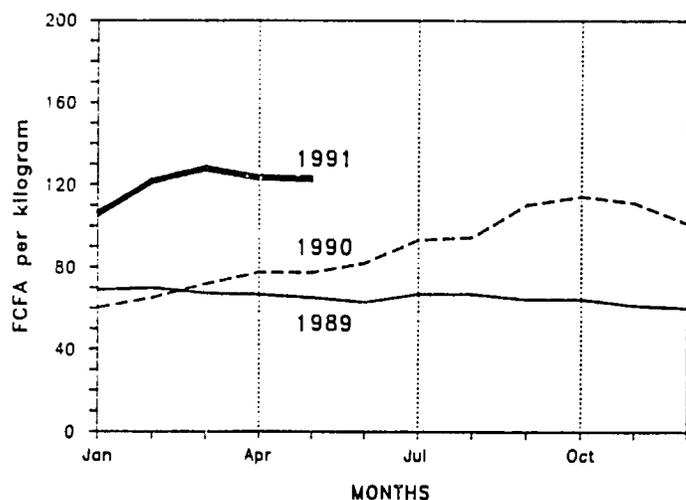
Population groups are defined somewhat differently from the 1990 Vulnerability Assessment for Mali. Based on different perspectives in analysis used, some groupings have changed or been subsumed into other groupings. Where possible, however, the status of those populations described last year is updated in the present assessment.

Agropastoralists in Semi-Arid and Arid Zones

Agropastoralists are very vulnerable in 1991. The most vulnerable of these are found in northern Koulikoro and Ségou regions and in non-irrigated cropping zones of Gao, Mopti and Tombouctou regions. These are sedentary farmers and recently sedentarized nomads who also have some herds. They have suffered significant crop losses from insect damage and mid-season drought. For some, this was the second poor harvest in a row. Many have had to sell off the major portion of their herds to meet food needs.

Increasing millet price levels over the last year (see Figure 1) have reached a degree last seen at the end of 1988. The rising price trend over the last 12 months (through the 1990/91 agricultural season) is of a nature reflecting market expectations of a mediocre harvest. Increasingly volatile prices over the same period also reflect uncertainty in the market, and have contributed to the vulnerability of the resident population. Populations dependent upon the market for the bulk of their foodstuffs are experiencing reduced access due to these increases in price level and volatility. Similar millet price behavior has been observed in neighboring countries.

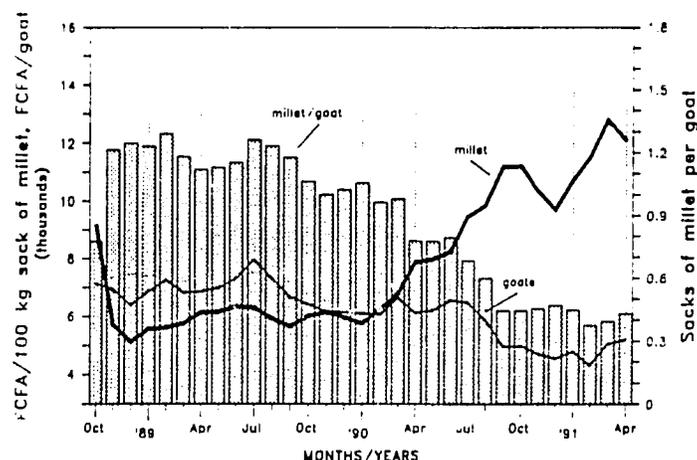
Figure 1: Nominal Monthly Millet Prices, Average Over Eight Major Markets, 1989-91



Source: GRM/Market Information System (SIM);FEWS/Mali

Agropastoralists and pastoralists are selling productive livestock to meet their food needs. Small ruminant prices have declined while cereal prices have increased, reducing the exchange ratio between small ruminants and cereals (terms of trade). The reduced access to food for these groups is revealed by the comparison between recent goat and millet prices. Figure 2 shows how far terms of trade for these populations have declined, with the average amount of millet (in kilograms) obtained from the sale of one goat roughly halved over the past year.

Figure 2: Terms of Trade between Millet and Goats, Average of SAP/Mali-Monitored Markets



Source: SAP/Mali; FEWS/Mali. Note: Lines indicate prices of millet and goats. Bars indicate the number of sacks of millet that can be purchased with the proceeds from selling one goat.

Major departures of able-bodied workers have also taken place. Some villages have been emptied in arrondissements in northern Koulikoro and Banamba cercles (Koulikoro Region), Youvarou Cercle (Mopti Region), and Niafunke Cercle (Tombouctou Region). These migrants must return for there to be enough labor on hand to cultivate this year's crops.

Agropastoralists along the middle Niger River Basin suffer additional risk, because of the threat of civil instability. The continued tension in northern Mali will contribute to shortages of supplies in local markets.

Agropastoralists along the Bandiagara Escarpment and in the neighboring Seno Plain, who experienced disastrous insect damage in 1989/90, have benefitted from a moderately good harvest in 1990/91. They are less vulnerable now than they were in 1990, but remain moderately vulnerable because of low cereal stores and high credit obligations.

In Kayes Region, crop harvests have been fair and pasture conditions generally good. Though prices have been relatively high, food access has not been limited enough to raise the vulnerability of agropastoralists. No assistance has been recommended for this group as of the end of April.

Pastoralists

Pastoralists represent the other most vulnerable group in 1991. This population includes nomadic herders who have been displaced by civil unrest in the north of Mali (classified as displaced persons in 1990). Livestock prices continue to fall in comparison to cereal prices (see Figure 2). Pastoralists in the

northern portion of Koulikoro and Ségou regions have been especially affected by declining access to cereals.

The situation for pastoralists in Tombouctou, Gao, and western Mopti regions is exacerbated by civil unrest. Commercial trading may be disrupted, causing shortages in local markets. Transhumant routes were disrupted in 1990. They may be disrupted further because militant groups have again become active. This disruption will serve to concentrate herds in certain zones, thereby degrading range conditions. Should violence intensify, herd losses could be expected.

Agriculturalists in Humid Zones and Irrigated Perimeters

In Mali, agriculturalists represent the least vulnerable rural grouping. They are found in zones receiving greater than 900 millimeters of annual rainfall and on irrigated land. These zones have a more developed infrastructure and stable production base. Harvests in these zones were average to good during 1990. Agriculturalists have been able to add to their reserves or commercialize their produce. The sale of cereals has been very profitable. No short term assistance is necessary for this group. Nevertheless, agriculturalists in arrondissements scheduled for food distributions (in the north of Koulikoro and Ségou regions -- a less humid area) may merit assistance because of significant crop losses.

Riverine Traders

Populations depending upon inland waterways for a living (fishing and boating) are moderately vulnerable in the Niger Inland Delta and along the middle Niger River. The fishing season started late and ended early. Their situation is ameliorated somewhat by relatively higher fish prices. Riverine populations in other parts of the country are slightly vulnerable.

Urban Poor

The urban poor are identified as those city dwellers having the most sub-standard housing in urban areas. They are estimated as comprising 5.5% of the urban population, based on census data. Their vulnerability is slight throughout the country. Should urban disturbances of the magnitude experienced in March 1991 become frequent in urban areas, their vulnerability may increase. This would particularly be the case if there were significant displacements of urban residents in Gao and Tombouctou regions.

FOOD AID PLANS

GRM has begun the distribution of 10,795 MT of cereal to vulnerable populations. Food distributions to the most vulnerable arrondissements in Niafunké Cercle took place in March.

Nationwide, of 10,824 MT authorized for distribution by June, 3,440 MT were distributed at the end of April. Of this, 3,115 MT of 8,164 MT previously planned for Tombouctou and Gao regions were distributed. Recent militant attacks in Mopti, Tombouctou and Gao regions have interrupted distributions to some of the most vulnerable populations north of the Niger River. If the distributions cannot be completed before the onset of rains in June, these populations may experience severe food stress before the next cereal harvest begins. Private voluntary organizations (PVOs) had developed plans for increased food-for-work programs in Gao and Tombouctou regions. Instability has caused the temporary suspension of most PVO activities in these regions, however, increasing the vulnerability of the beneficiaries of such programs.

The GRM Agricultural Marketing Parastatal (OPAM) is releasing cereal for sale in vulnerable markets in an effort to keep grain prices within access of vulnerable populations. A total of 806 MT have been released in 18 markets since January. Cereal price increases have slowed somewhat in affected markets.

CONCLUSIONS

Agropastoral and pastoral groups are the most vulnerable populations entering the 1991/92 agricultural season. They have suffered major crop failures and declining access to food during the past year. Populations living north of the middle Niger are of the greatest concern. In addition to production shortfalls, they face the threat of civil unrest. In all, 343,500 people are extremely vulnerable in 1991.

It will be necessary to monitor the progress of the agricultural season to assess the ability of these groups to recover from previous bad harvests. Special attention will be placed on monitoring unusual population movements resulting from civil unrest. Household stocks and food balances will be monitored. Finally, analyses of market performance of cereals and livestock will continue. Such an analysis includes estimates of quantities offered and sold to better reflect supply and demand considerations.

In sum, the food security situation in Mali is very susceptible to crisis. This is due to a combination of low levels of cereal production from the 1990/91 agricultural year, highly unstable cereals market conditions, and civil unrest. The ability for highly (and extremely) vulnerable populations to deal with food shortages depends upon the timely distribution of food, sufficient agricultural production in the forthcoming season, and relative calm. Even with a return of social, economic, and climatic conditions to optimum levels, groups who are now extremely vulnerable would improve their conditions only to the moderately vulnerable level well into 1992.

APPENDIX C: Explanation and Formulation Of Vulnerability Indicators

Overall vulnerability is a function of long-term and short-term factors. In this case, both factors are weighted equally, as are all indicators within each factor. The indicators contained in each factor were used based on the robustness of data available and the relevance of the data for indicating vulnerability. These indicators will be followed throughout the year to identify the changing levels of vulnerability in all *cercles* of the country. The indicators will be refined through further analysis and as data become available. Analysis will also be conducted to determine what weighting factors, if any, should be applied to the indicators.

Long-Term Indicators

Five long term indicators were selected: Physical Quality of Life, Riskiness of Cereals Production, Livestock Wealth, Cash Crop Income Potential, and the Potential for Cash Income or Remittances. This set of indicators establishes a "baseline" level of vulnerability for each *cercle*.

Physical quality of life is a function of six health and education factors. Every attempt was made to collect data at the *cercle* level. Where *cercle*-level data was unavailable, levels for the region were assigned uniformly across *cercles*. The factors are the following:

- doctors per 100,000 patients at the *cercle* level in 1986.
- square kilometers per clinic at the *cercle* level in 1976.
- gross mortality rate at the regional level in 1986.
- infant mortality rate at the regional level in 1986 (number of deaths within the first year of life per thousand live births).
- literacy rate for population over six years of age at the regional level in 1976.

Riskiness of cereal production depends on average millet and sorghum yields, average surface area planted to millet and sorghum, and gross average per capita cereal production. In addition, it is felt that an area having a higher proportion of total cereal cropland planted in millet is preferable to having it planted in sorghum. The millet/sorghum index was calculated based on the average proportional surface area dedicated to millet and sorghum for each *cercle*.

Data from the DNSI agricultural surveys for the years 1985-1989 were used. Rice production was not considered in this calculation because of insufficient data.

In addition to inter-annual averages, inter-annual variation was considered. The Coefficient of Variation (CV) was calculated for each of the preceding variables. CV is the standard deviation divided by the mean for each factor. A high CV for average yields, average area planted, and average per capita production connotes more risk. A high CV for the millet/sorghum index connotes greater flexibility in cereal production and, therefore low risk.

Relative livestock wealth is the number of tropical livestock units (TLU) per capita based on livestock estimates for each *cercle* in 1984. One TLU equals 1.5 cattle or 12 small ruminants (sheep or goats).

Cash crop income potential is based on the average percent of total surface area in each *cercle* that was devoted to either cotton or ground nut production during the period from 19865 to 1989.

Cash income and remittance potential is based on access to wage labor opportunities and remittances. A *cercle* was assigned a value of 0.5 if there were mining or major irrigated perimeters in the *cercle* or a value of 0.25 if such a facility was located in an adjacent *cercle*. Remittance potential was based on the percentage of the adult male population that was absent during the 1976 census. The cash income and remittance potential was calculated as the rank of the summed scores

Short-Term Indicators

Short-term vulnerability describes the departure from the norm, as established by long-term vulnerability. Four indicators were selected: Cereal Price Volatility, Relative Cereal Balance, Range Quality, and Civil Unrest. The set of indicators are intended to include short-term social and economic factors as well as production factors in the assessment. In this case, the short-term is generally the immediately completed production season, but also includes some indication of the effects of the previous season.

Volatility of the cereals market: Frequent and substantial changes in consumer prices for millet can be used to indicate risk of access to the primary source of nourishment for most of the population. The relative magnitude of these changes are indicated by the coefficient of variance (CV) for average monthly millet prices in area markets. In most cases, GRM/Market Information System (SIM) prices for the major *cercle* market were used. In those cases where SIM does not list these prices, the average of neighboring markets were used.

Range quality was determined based on estimates of annual carrying capacity relative to the inter-annual average from 1984 to 1989. Average carrying capacity was established based on a map developed by the Institut d'Élevage et Médecine Vétérinaire Tropicale (IEMVT). The values from this map were assumed to represent the average. Annual average maximum NDVI values were calculated for each *cercle* (see inside back cover for explanation of the term NDVI). The maximum NDVI value for 1990 was then divided by the inter-annual average (1984 to 1989) to form a vegetative quality index. The average carrying capacity was then multiplied by the vegetative quality index to yield a relative carrying capacity for each *cercle*. Each *cercle* was then ranked relative to the others to produce a range quality value.

Relative Cereal Balances: Food security depends not only on current food production but also on previous production. The *cercle*-level 1989 cereal balances were ranked for by size. In addition, a qualitative scale was calculated for cereal production in 1990: in the traditionally deficit zones north of the 14th parallel, SAP evaluations were used (Poor, Below Average, Average, Good/Above Average); in those *cercles* south of the 14th parallel, ODR production figures were compared with previous production figures to achieve a qualitative estimate that was consistent with those estimates made by the SAP. The relative cereal balance was then calculated by adding the rank scores for each *cercle* in 1989 and 1990, respectively.

Civil unrest serves to limit access to food by disrupting production systems and markets. During 1990 and 1991, two types of civil unrest were important: urban disturbances during the coup d'état in March of 1991 and Tuareg rebel activity. Each *cercle* was assigned a value of 0.25 if there was significant urban disturbance and 0.5 if there were rebel attacks during the past year. The *cercles* were then ranked according to their scores.

Table C-1: Vulnerable Populations In Mali

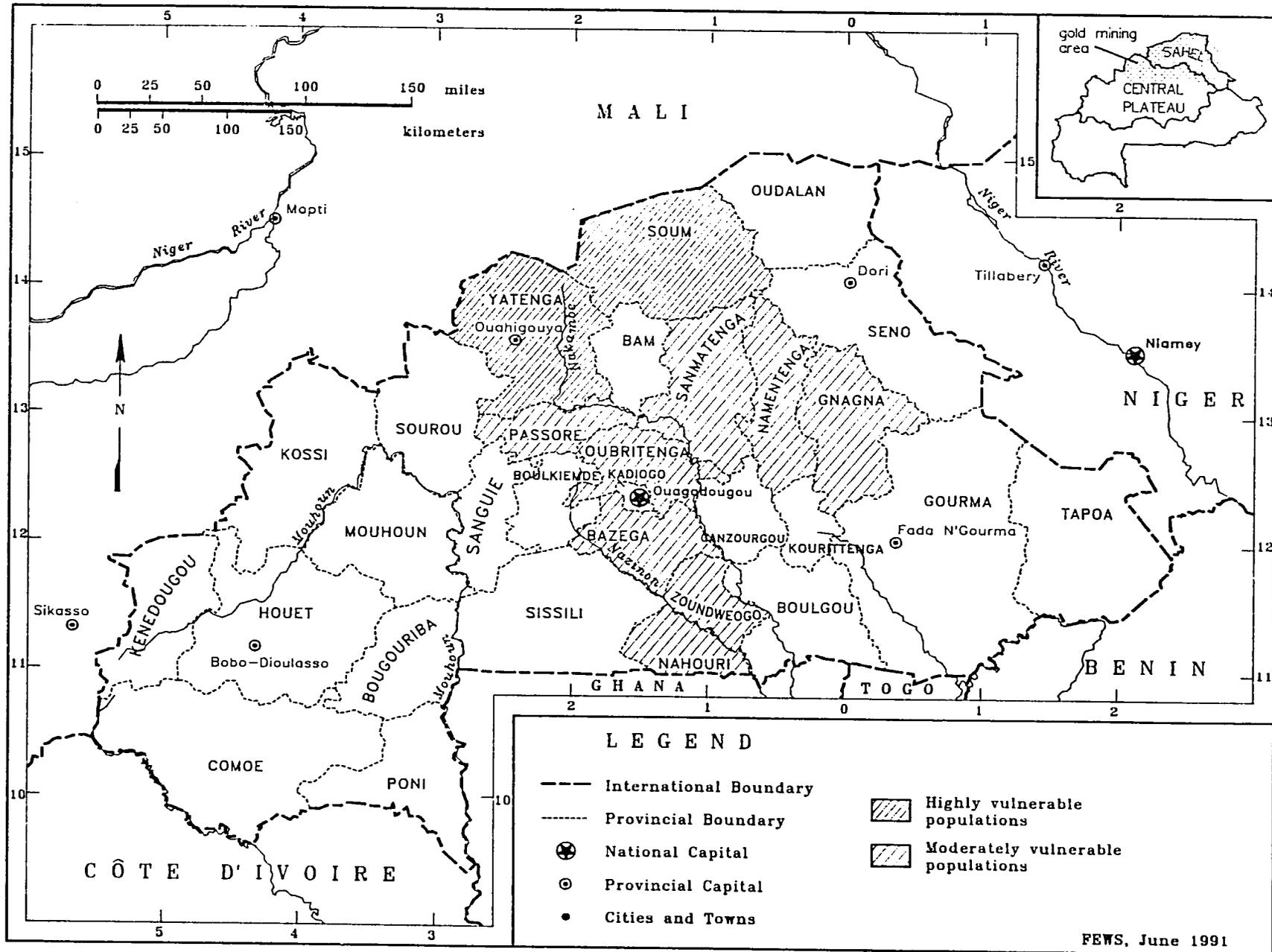
The population estimates in this table represent 95% of the total population of Mali.

| Socio-Economic Group/Region | Estimated Population | Major Long-Term Factor | Major Short-Term Factor | Vulnerability Ranking |
|-----------------------------|----------------------|---|---|-----------------------|
| AGRICULTURALISTS | | 3,719,800 | | |
| Kayes | 371,300 | Risk of Crop Failure | Cereal Market Uncertainty | Slight |
| Koulikoro | 130,700 | Limited Cash Income | Cereal Market Uncertainty | Moderate |
| | 494,400 | Potential | | Slight |
| Mopti | 176,800 | Risk of Crop Failure, Limited Cash Income | Low Cereal Stocks | Slight |
| Sgou | 784,900 | Limited Cash Income | Cereal Market Uncertainty | Slight |
| Sikasso | 1,333,700 | Low Asset Liquidity, | | Slight |
| | 428,000 | Low PQLI | | Slight to Moderate |
| AGROPASTORALISTS | | 3,419,400 | | |
| Gao | 14,900 | Limited Cash Income | Low Cereal Stocks, Poor Range, | Extreme |
| | 209,500 | Sources | Rebel Activity | High |
| Kayes | 339,800 | Risky Crop Production | Cereal Market Uncertainty | Slight to Moderate |
| | 868,800 | | | Slight |
| Koulikoro | 31,800 | Limited Cash Crop Income | | Extreme |
| | 286,100 | | Crop Failure, Cereal Market Volatility, | Moderate |
| | 123,200 | Limited Liquid Assets | Poor Ranges | Slight |
| Mopti | 66,800 | Low PQLI, High Risk of | Crop Failure, Cereal Market Volatility | Extreme |
| | 105,100 | Crop Failure | | High |
| | 429,800 | Limited Cash Crop Income | Crop Failure, Cereal Market Volatility, | Moderate |
| Sgou | 174,000 | | Rebel Attack, Low Cereal Stocks | Slight |
| | 49,200 | Low Liquid Assets | Poor Range, Low Cereal Stocks, | Moderate |
| | 30,100 | | Uncertain Cereal Market | |
| Tombouctou | 64,800 | | Low Cereal Stocks | Slight |
| | 596,200 | High Crop Risk, Low | Crop Failure, Rebel Activity, | Extreme |
| | 29,300 | PQLI, Low Liquid Assets | Low Cereal Stocks | High |
| | | | Crop Failure, Low Cereal Stocks | Moderate |

| Socio-Economic Group/Region | Estimated Population | Major Long-Term Factor | Major Short-Term Factor | Vulnerability Ranking |
|-----------------------------|----------------------|---|---|-----------------------|
| PASTORALISTS | | 737,200 | | |
| Gao | 106,000 | Limited Cash Income Potential | Rebel Activity, Low Cereal Stocks, Low Range Quality | Extreme |
| | 345,800 | | | Moderate |
| Kayes | 29,400 | Limited Cash Income Potential | Low Range Quality, Cereal Market Uncertainty | Moderate |
| | 24,200 | | | Slight |
| Koulikoro | 21,800 | Limited Cash Income Potential | Low Range Quality, Cereal Market Uncertainty | Moderate |
| | 2,500 | | | Slight |
| Mopti | 9,200 | Low Cash Income Potential, Low PQLI | Cereal Market Uncertainty, Low Cereal Stocks, Rebel Attacks | High |
| | 23,800 | | | Moderate |
| | 4,300 | | | Slight |
| Tombouctou | 59,200 | Low PQLI | Low Cereal Stocks, Rebel Attacks | Extreme |
| | 111,000 | | | Moderate |
| URBAN POOR | | 91,800 | | |
| Gao | 6,400 | Limited Cash Income Potential | Cereal Market Uncertainty, Rebel Attacks | Moderate to Extreme |
| Kayes | 200 | Limited Cash Income Potential | Cereal Market Uncertainty | Moderate |
| | 11,500 | | | Slight |
| Koulikoro | 47,700 | Limited Cash Income Potential | Cereal Market Uncertainty, Urban Disturbance | Slight |
| Mopti | 1,400 | Limited Cash Income Potential, Low PQLI | Cereal Market Uncertainty, Rebel Attack | Moderate |
| | 6,100 | | | Slight |
| Sgou | 7,500 | Low PQLI | Cereal Market Uncertainty, Urban Disturbance | Slight |
| Sikasso | 8,300 | | Cereal Market Uncertainty, Urban Disturbance | Slight |
| Tombouctou | 2,700 | Low PQLI | Cereal Market Uncertainty, Rebel Attacks | Moderate |
| RIVERINE TRADERS | | Unknown | | |
| | Unknown | River Levels | Short Fishing Season | Moderate |

Source: FEWS/Mali analysis

Map 5: Burkina Faso Vulnerability Assessment Summary



BURKINA

Cereal Deficit Again

Report released by USAID/Burkina on May 28, 1991

SUMMARY

Burkina's most economically stressed areas and populations are located in ten provinces on the Central Plateau (see Map 5). All ten provinces have suffered below average cereal balances for two consecutive years. In Yatenga and Soum provinces, approximately 25,000 smallholder agriculturalists (SHAs) are highly vulnerable to famine. Other SHAs in these two provinces are moderately vulnerable. In the remaining economically stressed provinces, SHAs and agropastoralists (AGPs) are moderately vulnerable.

METHODOLOGY

Vulnerability assessments attempt to foreshadow locations and populations vulnerable to food insecurity following cereal production deficits and other economically stressful events. Burkina has an official cereal production deficit for 1990/91 of 360,000 metric tons (mt), which is 260,000 mt greater than the 1985-89 average (100,000 mt), and would lead one to expect an increase in vulnerability to famine among the population. The 1991 Vulnerability Assessment identified components of long-term or structural vulnerability to famine by characterizing the level of development and general economic situation (purchasing power) at the provincial level (Burkina has 30 provinces). Indicators of short-term economic shocks, including annual cereal balance and pasture quality, were then layered (superimposed) over the long-term components to identify vulnerable provinces.

The assessment made three key assumptions:

- low levels of development increase vulnerability to famine,
- household purchasing power in a province is related to the general economic situation of that province, and
- agricultural production (both crops and livestock) provides the greatest proportion of household income for the most vulnerable socioeconomic groups.

The three assumptions address, respectively, the vulnerability of a province in the long (10 years), medium (3-10 years) and short term (less than 3 years).

In this Vulnerability Assessment, each province was ranked according to the relative value of eighteen specific indicators. These rankings were then combined using a weighted average of the ranks. The indicators and their weights are presented in Appendix D, at the end of this chapter. Long- and short-term indicators were given roughly equal weights. Medium-term economic indicators were weighted by their relative contribution to the Gross National Product of Burkina.

The rankings indicated that the ten most economically stressed provinces, i.e., those most vulnerable to food insecurity, are on the densely populated Central Plateau (see Map 5). These provinces have a low level of development, few livestock, limited cash cropping, poor pastures this year, and a below average per capita cereal production for two consecutive years (the average covers production for 1982-89). These ten provinces have a high proportion of smallholder agriculturalists and agropastoralists, the two socioeconomic groups in Burkina most vulnerable to drought-related food shortages.

VULNERABILITY OF SOCIOECONOMIC GROUPS

Smallholder Agriculturalists (SHA)

SHA households depend mostly on their own cereal production for the bulk of their annual food supply. Livestock and cash cropping only contribute a small portion of household income. SHAs may engage in off-season market gardening, gold mining or seasonal wage labor. Due to below average cereal production deficits for two consecutive years, SHAs have had to purchase most of their cereal this year, seriously depleting household resources. The population of this group is given in Table 3.

Reconnaissance surveys by FEWS, Système d'Alerte Précoce du Sahel (SAP/Sahel), national and provincial Drought Commissions (CNLES) of the Government of Burkina's (GOB) Ministry of Health and Social Action, and the United Nations World Food Program (WFP) have verified that in Soum and Yatenga provinces, where the cereal deficit has been especially severe for the past two years, school age children and young males have left or been sent away, whole families have moved to gold mining sites and a small number of households have migrated permanently. Those who have stayed have sold off

Table 3: SHAs and AGPs in the 10 Most Economically Stressed Provinces

| Province | Total Population June 1991 | SHA | | AGP | |
|--------------|----------------------------|-----|----------------|-----|------------------|
| | | % | Number | % | Number |
| Nahouri | 121,469 | 35 | 42,713 | 20 | 24,294 |
| Gnagna | 272,159 | 9 | 25,283 | 52 | 140,615 |
| Zoundweogo | 175,640 | 28 | 48,709 | 27 | 46,837 |
| Yatenga | 562,063 | 35 | 195,801 | 33 | 187,354 |
| Bazega | 351,743 | 31 | 110,232 | 33 | 117,248 |
| Passore | 234,461 | 21 | 49,775 | 23 | 54,708 |
| Soum | 217,319 | 23 | 50,767 | 60 | 130,391 |
| Namentenga | 215,040 | 27 | 57,579 | 52 | 111,104 |
| Oubritenga | 328,971 | 33 | 110,106 | 27 | 87,726 |
| Sanmatenga | 406,024 | 25 | 103,170 | 35 | 142,108 |
| Total | 2,884,911 | | 794,135 | | 1,042,385 |

Source: *Analyse des Resultats Definitifs: Recensement General 1985*, GOB/National Institute of Statistics

jewelry and radios and are gathering famine food. Some households are totally dependant on aid from relatives working in urban areas, non-governmental organizations (NGOs) and the GOB. These smallholder agriculturalists are highly vulnerable. They make up about 10% of the SHAs in these two provinces, or about 25,000 people.

In the other eight economically stressed provinces, SHAs are moderately vulnerable. They are drawing down assets and conserving resources by, for example, postponing funeral and other celebrations until times are better, and they are eating only once a day. These "belt tightening" strategies of moderately vulnerable populations in Burkina have serious consequences for women of childbearing age and infant children. They are the first to suffer the effects of reduced food consumption in the household, as evidenced by their high rates of malnutrition even in years when cereal production is average. Below average cereal production for a third consecutive year in the 1991 agricultural season would push all affected SHAs into the highly vulnerable category and some into extreme vulnerability.

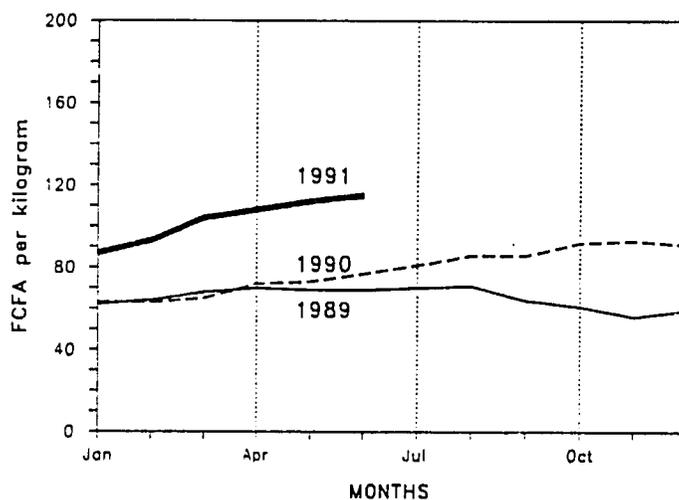
Agropastoralists (AGPs)

AGPs in the 10 most economically stressed provinces are moderately vulnerable due to poor pastures, high cereal prices and low livestock prices. Similar to the situation among SHAs, women and children bear the brunt of reduced access to cereals within the household. In Burkina's other 20 provinces, AGPs are only slightly vulnerable.

AGPs rely mostly on livestock raising and the sale of livestock products for household income. AGPs are dependant on pasture quality and the availability of surface water for their livestock. Their vulnerability is also a function of the prices they receive for their livestock and animal products, which have been falling for the past year. This income allows AGPs to purchase cereals, a large component of their diets. Data show that, in Ouahigouya (capital of Yatenga Province) the combination of increasing millet prices and low animal prices has reduced the amount of millet purchased from the proceeds of the sale of one goat. This decline in the terms of trade in Yatenga over the past year has particularly affected agropastoralists.

Marketed surplus in Burkina from the 1990/91 season was limited. This has resulted in steadily increasing cereal prices throughout the country. Cereal price data available from the National Cereals Office (OFNACER) indicate a steadily increasing trend since October 1990 and price levels that are the highest since 1988 (see Figure 3). Cereal prices during the harvest period (October-December) reflect market expectations of the agricultural season. In good years, prices usually fall. Note that prices continued an upward trend throughout the 1990/91 harvest period and beyond, reflecting the market shortages caused by the poor harvest. With prices at a three year high, many households that depend on market purchases for cereals are facing reduced access to food. Current prices are near 130 West African Francs (FCFA) per kilogram (kg). If cereal prices reach 160 FCFA per kg, it will indicate extreme cereal shortages like those of the 1984/85 drought year. In the near future, these price levels may be eased somewhat through additional supplies (e.g., targeted food aid distributions, an early corn crop, etc.), but their trend can only be reversed by an excellent 1991/92 harvest.

Figure 3: Nominal Monthly Millet Prices, Average of Nine Markets, 1989-91



Source: GOB/INSD; FEWS/W

Wage Earners and Artisans

This group includes public and private employees, mechanics, weavers, metalworkers, and all other service-oriented occupations. Except in the more urbanized provinces of Kadiogo, Boulkiemde and Yatenga, they were arbitrarily estimated to be about 10% of the population in each province. In Kadiogo, Boulkiemde and Yatenga provinces, they were estimated to be 60%, 20% and 20%, respectively, of the population. These populations were found to be only slightly vulnerable.

Urban Poor

Members of these households were arbitrarily estimated to be about 5% of the population of each province, and were found to be slightly vulnerable.

Largeholder Agriculturalists (LHAs)

LHA households have larger farms. They have more diversified cropping possibilities owing to their favorable locations (south-western Burkina or the best land in other parts of the country) and engage in cash cropping. Because they have diversified income sources, cereal surpluses and greater wealth (assets), these households can more easily adjust to consecutive national level production shortfalls. They were found to be slightly vulnerable in 1991.

CONCLUSIONS

Two consecutive years of below average cereal production, lack of potable water, high cereal prices and poor pastures have combined to make roughly 10% (25,000) of the smallholder agriculturalists in Yatenga and Soum provinces highly vulnerable to famine as the 1991/92 agricultural season begins. Other SHAs in the ten most economically stressed provinces of the Central Plateau are moderately vulnerable. Agropastoralists in these ten economically stressed provinces are moderately vulnerable, stressed by poor pastures, high cereal prices and low livestock prices. This zone will need far above average cereal production in 1991/92 to reverse the deterioration in the food security situation. Above average cereal production is not certain, even if the rains are good, because of a serious threat of grasshopper damage following egg-laying last year.

Monitoring efforts for SHAs will concentrate on millet prices, which are currently about 130 FCFA per kilogram. If millet prices reach 160 FCFA/kg, it will indicate cereal shortages on the order of those of the 1984/85 drought year. For agropastoralists, monitoring efforts during 1991/92 will concentrate on the evolution of the agricultural season through data on rainfall, satellite imagery, cereal and livestock prices.

Rainfall data will be available from the national meteorological service, satellite imagery through FEWS, while price data is available from SAP/Sahel and the OFNACER Market Information System (SIM). CNLES reports will provide periodic updates of food distribution needs while other GOB technical services will supply information on the evolution of the 1991/92 cereal production season.

APPENDIX D: Methodology for Burkina Vulnerability Assessment

Long-term Components of the Regional Domain of Food Security

To characterize regional differences in vulnerability for Burkina, the VA ranks the 30 provinces by demographic indicators of "general well being." General well being includes health, nutritional status, access to health care, and education. These convey the overall level of development in each province. The indicators are; the crude death rate, infant mortality rate, literacy rate, school attendance of 7-13 year-olds (*Recensement General de la Population 1985: Analyse des Resultats Definitifs*), hospital beds per capita (Ministry of Health and Social Action – MOHAS) and the variability of cereal production.

Medium-term Economic Indicators

Gold Mining

Gold mining is very important to the economy of Burkina. Artisanal gold miners take 4.5 metric tons of gold per year from the northern and central provinces (see Map 5). This contributes an estimated 1.5 billion FCFA a year to the economy. Gold outranks cotton in export revenue (Economist Intelligence Unit on Niger and Burkina).

It is difficult to quantify gold's contribution at the provincial level, but it must be included in any analysis of food security. We know that mines are located in the northern and central provinces and in Poni Province in the south. We know that people usually migrate to the mines nearest their home village. Thus, proximity to the mines was the indicator.

Remittances

Remittances from the over 2 million Burkinabé working in other countries (primarily Côte d'Ivoire) contributes a substantial amount to the economy. To rank income from remittances, the percentage of the administrative population that was in a foreign country in 1985 was used. The assumption was, if someone was in a foreign country he was sending money back. These rankings correspond with other data that suggest that Yatenga and Passore have a many people working in Côte d'Ivoire.

Cotton, Peanuts and Other Crops

These commodities are cash crops (more or less) and thus contribute to the provincial economy and production diversity.

Livestock Population

Livestock products contribute 18% of total export revenues for Burkina, ranking behind gold and cotton. The livestock population is a general indicator of economic diversity and agricultural wealth. It reveals that portion of the agricultural sector where livestock are an important source of household income. It is also the primary determinant when separating the socioeconomic groups of agropastoralists from smallholder agriculturists. The total of cows, goats, and sheep per capita for each province was used.

Pasture Carrying Capacity

Pastures are a source of wealth. If pastures are good, farmers do not have to move their herds. Also, herders will come with animals, which brings manure (fertilizer) to farmers' fields and reduces the prices of animal products.

Cereal Production per capita (1984-1989 average)

The locus of food security in Burkina is cereal production. It is the most important economic activity in Burkina and the major source of food and purchasing power. Burkina rarely produces enough cereal for its own needs. Each year there are cereal deficit and surplus areas. The locations of these areas depend on the agroclimatic zone, population density, rainfall and the pest damage pattern.

Short-term Economic Shocks

Cereal Balance

Historically, the major shocks to the household economies of Burkina have come from droughts. Droughts affect cereal production, pasture production and availability of water to people and livestock. These effects are by no means uniform.

For example, in 1989, Soum, Oudalan and Seno provinces had an almost complete failure of the cereal crop due to the timing of late season rains and insect attacks. However, pasture production and water availability that year were excellent. Since the primary income for people living in these provinces is the sale of animal products, there was very little food stress. Thus, the cereal balance alone is not sufficient to characterize the food security status of provincial economies.

Most Burkinabé households participate in the cereal market. They sell cereal at harvest to get cash and will often have to purchase cereal later on in the year to cover household needs. Thus, cereal production is a source of income. Understanding cereal as a source of income will help bring the analysis of the cereal balance into perspective.

The important considerations when looking at the cereal balance for any year is to compare it with the average cereal balance. There are clearly areas in Burkina where cereal production is not the major source of household wealth. This is the case in most of the chronically cereal deficit provinces -- those provinces where the 1985-89 cereal balance is deficit. Extreme examples are the provinces of Kadiogo and the Sahel, where cereal production contributes only a small amount to household income.

Of equal importance is last years' cereal balance. Two consecutive years of above or below average balance have a significant effect on the provincial economy. This indicator points out provinces that have had below average cereal balances over the last two years and, thereby, where household purchasing power has declined.

Pasture Quality

The other major component of short-term vulnerability is pasture quality and availability of water for livestock. To assess this component, maximum NDVI values for the season in each province in 1990 were compared with an average maximum (in this case, composed of data from 1984-89). Maximum NDVI (see inside back cover) gives an indication of biomass production.

Conclusion

The advantage of ranking is that the absolute values of data points are less important than their relationship with other data points. In Burkina, this is important because the absolute values of most of the data related to food security are not

Table D-1: Ranking of Provinces by Long-term Indicators

| Province / Indicator Weight | Death Rate 6 | Infant Mortality Rate 6 | Literacy Rate 6 | School Attendance 6 | Hospital Beds Per Capita 4 | Coefficient of Variation for Cereal Production 2 |
|-----------------------------------|--------------------|----------------------------------|-----------------------|---------------------------|----------------------------------|--|
| | Rank | | | | | |
| Nahouri | 23 | 5 | 2 | 24 | 17 | 7 |
| Gnagna | 10 | 6 | 1 | 5 | 9 | 4 |
| Zoundweogo | 7 | 8 | 8 | 11 | 8 | 27 |
| Bazega | 17 | 22 | 13 | 19 | 3 | 9 |
| Yatenga | 5 | 2 | 20 | 15 | 20 | 6 |
| Soum | 1 | 15 | 11 | 3 | 4 | 5 |
| Passore | 8 | 16 | 12 | 14 | 6 | 8 |
| Namentenga | 4 | 10 | 16 | 4 | 13 | 2 |
| Oubritenga | 9 | 4 | 15 | 16 | 11 | 10 |
| Sanmatenga | 3 | 9 | 10 | 10 | 21 | 22 |
| Kouritenga | 14 | 23 | 18 | 18 | 22 | 24 |
| Boulkiemde | 6 | 11 | 24 | 28 | 16 | 18 |
| Boulgou | 11 | 24 | 14 | 17 | 27 | 23 |
| Sanguie | 18 | 3 | 19 | 21 | 1 | 16 |
| Gourma | 15 | 14 | 6 | 7 | 18 | 12 |
| Sourou | 20 | 18 | 23 | 22 | 14 | 19 |
| Tapoa | 12 | 26 | 3 | 6 | 12 | 14 |
| Bam | 19 | 17 | 22 | 12 | 10 | 3 |
| Ganzourgou | 13 | 7 | 5 | 9 | 2 | 17 |
| Seno | 2 | 12 | 4 | 1 | 19 | 15 |
| Kadiogo | 30 | 30 | 30 | 30 | 29 | 1 |
| Oudalan | 16 | 1 | 7 | 2 | 24 | 11 |
| Sissili | 29 | 19 | 21 | 13 | 5 | 13 |
| Bougouriba | 25 | 20 | 17 | 27 | 25 | 25 |
| Kossi | 26 | 21 | 28 | 8 | 15 | 20 |
| Kenedougou | 21 | 13 | 27 | 26 | 7 | 29 |
| Mouhoun | 24 | 28 | 25 | 23 | 26 | 26 |
| Houet | 28 | 29 | 29 | 29 | 28 | 21 |
| Comoe | 27 | 25 | 26 | 25 | 23 | 30 |
| Poni | 22 | 27 | 9 | 20 | 30 | 28 |

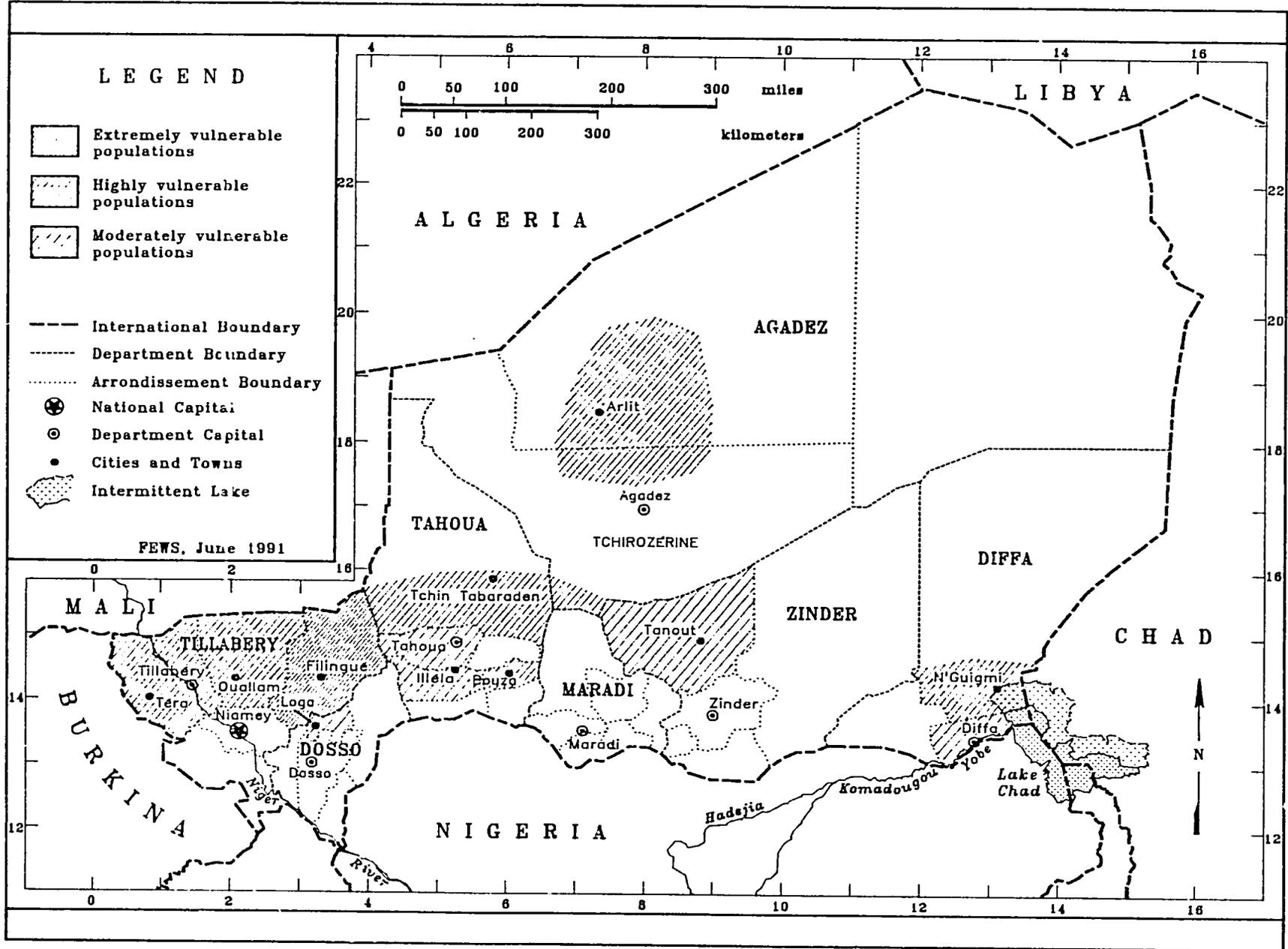
Sources: *Analyse Des Resultats Definitifs: Recensement General 1985*, GOB/National Institute of Statistics and *Report Annuel 1988, Statistique Sanitaires*, MOHAS

Table D-2: Economic and Crop Production Indicators

| Province / Indicator Weight | Medium-term Indicators | | | | | | | | Short-Term Indicators | | | |
|--------------------------------|------------------------|----------------|--------|-------------------------|---------------------------------|-------------------------------------|---------|----------------|---------------------------|---------------------------------------|------------------------------------|--|
| | Gold Mining | Migra- tion | Cotton | Livestock Population | Pasture Carrying Capacity | Average Per Capita Production | Peanuts | Other Crops | 1989 Cereal Balance | 1990 Province Cereal Balance | 1990 Final Cereal Balance | Pasture Quality, NDVI Maximum |
| | 7 | 7 | 4 | 4 | 4 | 2 | 2 | 2 | 10 | 5 | 10 | 10 |
| Nahouri | 4 | 10 | 18 | 6 | 23 | 6 | 27 | 13 | 1 | 1 | 5 | 18 |
| Gnagna | 21 | 1 | 5 | 26 | 16 | 21 | 23 | 11 | 6 | 8 | 6 | 23 |
| Zoundweogo | 7 | 18 | 21 | 15 | 14 | 15 | 11 | 3 | 4 | 7 | 12 | 20 |
| Bazega | 15 | 16 | 9 | 21 | 11 | 14 | 14 | 12 | 2 | 4 | 13 | 6 |
| Yatenga | 28 | 29 | 6 | 20 | 6 | 3 | 12 | 9 | 12 | 10 | 9 | 1 |
| Soum | 24 | 6 | 3 | 29 | 24 | 5 | 4 | 19 | 7 | 13 | 16 | 30 |
| Passore | 30 | 30 | 14 | 10 | 5 | 24 | 18 | 23 | 3 | 3 | 4 | 12 |
| Namentenga | 25 | 15 | 8 | 25 | 17 | 7 | 6 | 16 | 14 | 15 | 28 | 3 |
| Oubritenga | 16 | 24 | 12 | 13 | 4 | 10 | 16 | 5 | 23 | 16 | 20 | 4 |
| Sanmatenga | 23 | 17 | 15 | 22 | 7 | 16 | 25 | 25 | 5 | 12 | 8 | 26 |
| Kouritenga | 17 | 27 | 7 | 18 | 2 | 4 | 24 | 10 | 26 | 9 | 3 | 2 |
| Boulkiemde | 18 | 28 | 10 | 5 | 3 | 9 | 9 | 17 | 8 | 6 | 15 | 17 |
| Boulgou | 5 | 19 | 17 | 14 | 9 | 19 | 30 | 14 | 22 | 2 | 1 | 14 |
| Sanguie | 12 | 25 | 20 | 7 | 12 | 17 | 7 | 24 | 13 | 17 | 11 | 16 |
| Gourma | 14 | 7 | 11 | 24 | 29 | 25 | 20 | 22 | 21 | 18 | 14 | 7 |
| Sourou | 20 | 14 | 22 | 17 | 18 | 13 | 5 | 4 | 15 | 11 | 10 | 9 |
| Tapoa | 13 | 2 | 16 | 23 | 30 | 22 | 21 | 21 | 20 | 19 | 27 | 5 |
| Bam | 27 | 13 | 19 | 19 | 8 | 8 | 22 | 26 | 10 | 5 | 7 | 28 |
| Ganzourgou | 19 | 23 | 24 | 27 | 10 | 20 | 13 | 8 | 19 | 28 | 21 | 8 |
| Seno | 26 | 8 | 1 | 30 | 22 | 11 | 3 | 6 | 27 | 29 | 22 | 21 |
| Kadiogo | 10 | 3 | 4 | 1 | 1 | 1 | 2 | 2 | 30 | 30 | 2 | 27 |
| Oudalan | 29 | 21 | 2 | 28 | 27 | 2 | 1 | 1 | 28 | 22 | 29 | 22 |
| Sissili | 3 | 11 | 23 | 12 | 25 | 18 | 15 | 28 | 29 | 20 | 24 | 10 |
| Bougouriba | 9 | 20 | 26 | 11 | 15 | 26 | 26 | 15 | 9 | 14 | 25 | 11 |
| Kossi | 2 | 4 | 30 | 16 | 19 | 28 | 10 | 18 | 24 | 26 | 26 | 13 |
| Kenedougou | 1 | 12 | 28 | 3 | 26 | 30 | 17 | 29 | 18 | 24 | 23 | 19 |
| Mouhoun | 11 | 9 | 29 | 8 | 20 | 27 | 8 | 7 | 16 | 25 | 17 | 15 |
| Houet | 6 | 5 | 27 | 2 | 13 | 23 | 28 | 20 | 25 | 21 | 19 | 25 |
| Comoe | 8 | 22 | 25 | 4 | 28 | 29 | 29 | 30 | 11 | 23 | 18 | 24 |
| Poni | 22 | 26 | 13 | 9 | 21 | 12 | 19 | 27 | 17 | 27 | 30 | 29 |

Sources: *Resultats de l'Enquete Agricole Permanente, 1984-89* and *Enquete Nationale sur les Effectifs du Cheptel, Vol 1, Resultats et Analyse*, Ministry of Agriculture and Livestock; *Rapport Annuel 1988, Statistics Sanitaires*, Ministry of Health and Social Action; *Analyse des Resultats Definitifs: Recensement General 1985*, GOB/National Institute of Statistics.

Map 6: Niger Vulnerability Assessment Summary



NIGER

Over One Million People Highly Vulnerable to Famine

Report released by USAID/Niger on June 6, 1991

SUMMARY

The most vulnerable populations in Niger going into the 1991 rainy season are farmers and herders in northern Tillabery, central Tahoua, western Agadez and eastern Diffa departments (see Map 6).¹ They are highly vulnerable because of severely deficit cereal and pasture production in 1990/91, elevated millet prices in 1991, and poor purchasing power over the past year. Among these groups, 235,000 farmers in Filingué Arrondissement (Tillabery Department) are extremely vulnerable to famine. If food aid distributions for these areas were not to continue as programmed, up to 1,323,000 people in Téra, Tillabery, Ouallam, Filingué, Tchir Tabaraden, Bouza, Tchirozérine, Arlit and N'Guigmi arrondissements might migrate in search of food before the 1991/92 cereal harvest.

In addition to the above areas, farmers and herders in northern Dosso and northern Zinder departments need to be closely monitored during the upcoming agricultural season. These groups experienced highly deficit cereal and pasture production in 1990/91 and elevated millet prices in 1991. Were rainfall in 1991 low, households would be further stressed as they deplete resources to make up for lost production. In addition, such poor production would contribute to higher millet price levels in 1991/92. In this scenario, approximately 442,000 more people would become highly vulnerable to famine.

METHODOLOGY

The 1991 vulnerability assessment identifies socioeconomic groups most vulnerable to famine at the onset of the 1991/92 agricultural season. Niger's three major socioeconomic groups are farmers, herders, and urban dwellers. In the past it has been assumed that, because of their dependence on wages and trade, urban dwellers' vulnerability did not change significantly from year to year. Although this assumption is being challenged by field reports and a worsening overall economic situation, we currently lack accurate data for an analysis of this group's vulnerability. In general, we assume the famine vulnerability

¹ Niger's administrative units are, in order of precedence, departments, arrondissements and cantons.

of urban populations is slightly less than that of the surrounding rural farming and herding populations. Therefore, only farmers and herders are covered in this assessment. These groups make up 85% of the population and have the highest level of current vulnerability.

Quantitative (production, prices, health and nutritional status) and qualitative (alternative income sources) information from Government of Niger (GON) databases and reports were used to assess the vulnerability of farmers and herders for each arrondissement of Niger. An initial screening for vulnerability was made based on the sufficiency of cereals production for agriculturalists or pasture production and terms of trade for herders. This screening revealed that 17 out of the 34 arrondissements in Niger are at least moderately vulnerable to famine going into the 1991 rainy season.

The definition of the relative levels of vulnerability among the 34 arrondissements was developed from a rating of the socioeconomic groups according to indicators which measure the regional, household, and individual parameters, using the quantitative and qualitative information outlined above. The results of this arrondissement-level rating is discussed below. The indicators used in the rating of the arrondissements and details on methodology are presented in Appendix E. Caveats concerning the arrondissement assessment data and analysis are provided at the end of that appendix. A summary of indicators and resulting indices for farming and herding populations can be found in appendix Tables E-1 and E-2.

VULNERABILITY OF SOCIOECONOMIC GROUPS

Farmers and Agropastoralists

In this assessment, the farming group consists of sedentary subsistence farmers and the more recently sedentarized agropastoralists. The two groups are evaluated together because of the similarity of the indicators used in assessing their vulnerability to famine. Of the 34 arrondissements in Niger where farming activity occurs, 11 arrondissements were not self-sufficient in cereal production after the 1990 rainy season

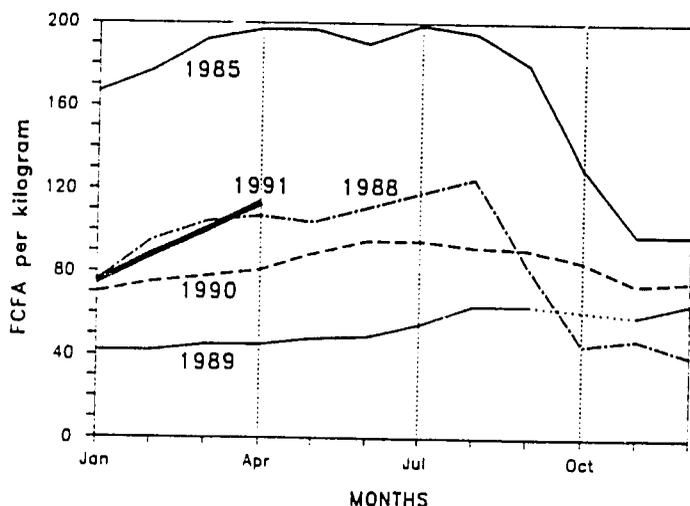
harvest (self-sufficient farmers were defined as those producing a minimum of 220 kilograms (kg) per capita per year).

After assessing the 11 deficit arrondissements by production, price, and alternative income criteria (see Appendix E for more details), one arrondissement was found to be extremely vulnerable (Filingué), eight were highly vulnerable (Téra, Tillabery, Ouallam, Tchén Tabaraden, Bouza, Tchirozérine, Arlit, and N'Guigmi) and two were moderately vulnerable (Loga and Diffa).

Agropastoralists in Northern Tillabery Department

The most vulnerable agropastoral populations in the country are those in Filingué Arrondissement (Tillabery Department), found to be extremely vulnerable going into the 1991 rainy season. Their vulnerability has increased substantially since 1990 from below normal and extremely deficit cereals production for a second year in a row and abnormally high 1991 cereal prices. The 1990/91 cereal harvest was only half the ten-year average (1980-89). Although not yet near 1985 famine-time levels, April millet prices were more than 50% higher than the average over the last five years (see Figure 4).

Figure 4: Nominal Monthly Millet Prices, Average Over Four Tillabery Markets, 1985 & 1988-91



Source: GON/Market Information System (SIM); FEWS/Niger

Agropastoral populations in Téra, Tillabery, and Ouallam are all rated as highly vulnerable going into the rainy season. They also experienced deficit cereals production and high millet prices. Téra's 1990/91 harvest was as bad as Filingué's and Ouallam's millet prices are as high.

The major alternative revenue sources for these areas are animal sales and remittances from family members engaged in wage labor in Niamey and coastal west Africa. Terms of trade, measured by how much millet the sale of a buck (male reproductive goat) will buy, has been declining steadily over the last

year. In addition, unemployment for seasonal workers has been increasing over the past few years. The net result is that agropastoralists in northern Tillabery Department have few means with which to buy the cereals that they need to last until the next harvest.

Food aid distributions have begun in these areas. If food distributions were not to continue as planned (up to 24,000 mt have been programmed), vulnerable populations in Filingué would continue a significant liquidation of resources in order to buy cereals. Should these people be forced to continue liquidation of resources and also experience crop failure in the fall of 1991, there would be massive population displacement and possible famine.

If food aid distributions were disrupted in Téra, Tillabery, and Ouallam, agropastoralists in these areas would also become extremely vulnerable. Another poor harvest in 1991/92 would lead to large population displacement in these areas.

Preschool children throughout northern Tillabery Department are the most vulnerable because they have the worst nutritional status (6% to 8% severe malnutrition of the under-five-years-of-age population reporting to health clinics¹) and the lowest measles vaccination coverage in the country (as low as 10% in Téra Arrondissement).

Farmers and Agropastoralists in Dosso and Tahoua Departments

Farmers and agropastoralists are moderately vulnerable at the outset of the 1991 rainy season in Loga (Dosso Department), but are highly vulnerable in Tchén Tabaraden and Bouza arrondissements (Tahoua Department). Loga is rated as moderately vulnerable because of deficit and below average harvest and somewhat elevated millet prices. Populations are beginning to draw down reserves left over from last year. Another below-average harvest in 1991 would result in an increase in their vulnerability status.

Agropastoralists in Tchén Tabaraden and Bouza are highly vulnerable because 1990 production was extremely deficit and significantly below the ten-year average. Populations in Tchén Tabaraden are more vulnerable than last year because of the draw down on household reserves necessitated by a second bad harvest and because of higher than average millet prices.

Relative to northern Tillabery Department, greater supplementary income and lower millet prices keep Tchén Tabaraden out of the extremely vulnerable category. Populations are depleting their assets, but not yet liquidating resources required for food production. A poor harvest in 1991 and the absence

¹ In this case, a child is considered severely malnourished when its weight falls two or more standard deviations below the mean weight for a child of the same age.

of intervention in the meantime would render these populations extremely vulnerable to food shortages.

Agropastoralists in Western Agadez Department

A slightly different rating system was used for the populations engaged in farming in Arlit and Tchirozérine arrondissements. The agropastoralists in these areas are sedentarized herders who depend more heavily upon small-scale, irrigated crops and alternative sources of income for their subsistence than do the rest of the farming population.

Because of these differences, the rating system was modified to exclude the cereal production index and to weight the alternative income index twice as heavily. This modification gives both areas a highly vulnerable rating. Were there severe drought conditions or unusual grasshopper and locust damage next year, agropastoralists in both areas would be placed in the extremely vulnerable category.

Agropastoralists in Diffa Department

Agropastoralists in Diffa and N'Guigmi arrondissements are moderately and highly vulnerable, respectively, going into the 1991 rainy season. Cereal production in 1991 was extremely deficit and well below average in Diffa and disastrous in N'Guigmi. Millet prices are well above average, but relatively low compared to the rest of the country. Greater opportunities for alternative income, especially cross-border trade with Nigeria and active irrigated gardening sites, render populations in Diffa less vulnerable than those in N'Guigmi. Households in N'Guigmi are depleting their immediately available assets in order to buy millet, but are not yet liquidating resources required for food production. A poor harvest in 1991 and the absence of intervention in the meantime would render these populations extremely vulnerable in 1991/92.

Nomadic Herders

Herders were rated separately for the first time this year. Of the 34 arrondissements in Niger where herding activity occurs, 15 arrondissements experienced insufficient pasture production or low terms of trade (see Appendix E for methodology details). These 15 arrondissements were then assessed for three-year pasture production and terms of trade, and effectiveness of alternative income sources for purchasing millet. The refined assessment revealed herders in four arrondissements to be highly vulnerable (Tillabery, Téra, Ouallam and Bouza); in five, moderately vulnerable (Filingué, Tahoua, Illéla, Tanout and N'Guigmi); and in five more, slightly vulnerable (Tchin Tabaraden, Dosso, Tchirozérine, Mirriah and Gouré) to famine at the beginning of the 1991 rainy season (see Map 6). Although data were not available, herders in Arlit Arrondissement were estimated to be slightly vulnerable, based on conditions judged to be similar to those in Tchirozérine (both are in Agadez Department).

Vulnerable herders are found in three geographic zones across the country. The largest group is in northern Tillabery Department, where herders in Tillabery, Téra and Ouallam arrondissements are highly vulnerable while those in Filingué Arrondissement are moderately vulnerable. These areas experienced insufficient pasture because of poor rains. This was especially true in Tillabery Department, which suffered severely from lack of pasture. Purchasing power in all four arrondissements is the lowest in the country when bull and buck prices are compared to those for millet (terms of trade). In addition, alternative income sources are relatively meager in Ouallam and Filingué.

A contiguous secondary concentration is in Tahoua and Agadez departments, where herders in Bouza Arrondissement are highly vulnerable, those in Tahoua and Illéla arrondissements are moderately vulnerable, and those in Tchin Tabaraden and Tchirozérine are slightly vulnerable. These areas (except for Tchin Tabaraden) experienced insufficient pasture, with Tahoua, Bouza and Tchirozérine arrondissements the most severely affected. Herders in Bouza have the lowest purchasing power among these arrondissements vis à vis poor terms of trade and few alternative income sources.

Further east, herders in Tanout and N'Guigmi arrondissements are moderately vulnerable and those in Mirriah and Gouré are slightly vulnerable. N'Guigmi has the worst pasture conditions and few alternative income sources. Tanout also has few alternative income sources, as well as the worst terms of trade of this group.

FOOD AID PLANS

Projected emergency food assistance could contribute toward a locally important reduction of extreme vulnerability in several areas of Niger. Table 4 (below) provides a summary of ongoing and expected emergency food aid operations up to the 1991 harvest.

CONCLUSIONS

The most vulnerable populations in Niger going into the 1991 rainy season are farmers and herders in northern Tillabery and central Tahoua departments, and farmers in western Agadez and eastern Diffa departments. These groups are highly vulnerable to famine (with up to 235,000 farmers in Filingué Arrondissement extremely vulnerable) because of severe cereal and pasture production deficits in 1990/91, elevated millet prices in 1991, and poor purchasing power. Immediate food aid operations must continue to ensure that as many as 754,000 farmers and 175,000 herders in northern Tillabery Department, 177,000 farmers and 175,000 herders in central Tahoua, 131,000 farmers in western Agadez, and 25,000 farmers in eastern Diffa do not need to migrate in search of food before the 1991 harvest.

Moderately vulnerable populations include 137,000 farmers in Loga and Diffa arrondissements and 305,000 herders in Filingué, Tahoua, Illéla, Tanout and N'Guigmi arrondissements. These populations experienced insufficient cereals and pasture production and elevated millet prices in 1990/91. Another poor production year would contribute to greater millet

price levels and further stress households' currently depleting resources, consequently rendering these populations highly vulnerable to famine in 1992. The likelihood of a significant degradation in the vulnerability status of these groups is particularly high in Filingué and N'Guigmi arrondissements where, historically, rainfall is marginal at best.

Table 4: 1991 Emergency Food Aid Plans for Niger (MT)

| Donor / Commodity | Tonnage | Location | Distribution Status |
|---|---------|-------------------------------|--|
| USAID/Title II (by arrondissement, all sorghum) | | | |
| | 671 | Tillabery | completed |
| | 1,000 | Téra | completed |
| | 884 | Filingué | completed |
| | 250 | Ouallam | completed |
| USAID/Sec. 416 (by arrondissement, all sorghum) | | | |
| | 2,500 | Tillabery | ongoing |
| | 6,600 | Téra | ongoing |
| | 6,500 | Filingué | ongoing |
| | 4,400 | Ouallam | ongoing |
| | 4,100 | Mirriah | July eta |
| | 2,300 | Magaria | July eta |
| | 2,300 | Tanout | July eta |
| | 1,300 | Gouré | July eta |
| | 2,000 | Mainé Soroa | July eta |
| | 2,000 | Diffa | July eta |
| | 1,000 | N'Guigmi | July eta |
| WFP (by department) | | | |
| millet | 4,500 | Tahoua, Dosso, Agadez, Maradi | local purchase; June/July procurement in Maradi, Zinder, Diffa |
| sorghum | 9,900 | Tahoua, Dosso, Agadez, Diffa | USG request, no eta |
| Belgium (by department) | | | |
| rice | 416 | Tillabery, Dosso | local purchase; June/July |
| EEC (by department) | | | |
| sorghum | 3,300 | Maradi, Tahoua | local purchases ongoing |
| rice | 2,500 | Tahoua | local purchases June/July |
| wheat/potatoes | 640 | | local purchases |
| Germany (by department) | | | |
| | 4,000 | Tahoua, Diffa, Agadez, Zinder | local purchase; ongoing |
| Saudi Arabia | | | |
| wheat | 15,000 | | no distribution - sales to finance cereals purchases |
| Canada | | | |
| wheat | 15,000 | | wheat to be sold; millet to be purchased locally |
| Italy | | | |
| millet/sorghum | 6,000 | | local purchase |
| France | | | |
| wheat | 3,000 | | wheat to be sold; millet to be purchased locally |
| England | | | |
| cereals | 3,000 | | unknown |
| CARITAS | | | |
| cereals | 1,000 | | unknown |
| SOS Sahel | | | |
| cereals | 1,000 | | unknown |

Source: USAID/GDO/Drought Relief Unit

APPENDIX E: Methodology for Niger Vulnerability Assessment

Initial assessment of immediate vulnerability to food insecurity for farmers and nomadic herders determined per arrondissement using GON data:

Initial assessment of vulnerability for farmers based on cereal production sufficiency. Arrondissements producing less than 220 kg of millet and sorghum per farming capita were rated.

Initial assessment of vulnerability for nomadic herders based on overlay of:

Herding productivity defined as tropical livestock units (TLU) per ton of dry edible biomass (pasture balance) -- arrondissements with less than 0.18 tons of biomass per TLU were rated; and

Terms of trade defined as bull/millet and goat/millet price ratio. Arrondissements where less than 89 kg or 1,000 kg of millet could be bought during the March 1990 to February 1991 period from the sale of 1 goat or 1 bull, respectively, were rated.

Cereal production index calculated for farmers by rating the sum of a), b), and c), with weightings of 1, 1 and 2, respectively:

a) 1990/91 millet and sorghum net production in kilograms per capita: greater than 240 = 0; 190-240 = 1; 140-190 = 2, less than 140 = 3

b) 1989/90 millet and sorghum net production in kilograms per capita: greater than 240 = 0; 190-240 = 1; 140-190 = 2, less than 140 = 3

c) Percent change in millet and sorghum production, 1990/91 vs 1980-1989 average. less than 5% change = 0; 5-25% decrease = 1; 25-50% = 2; greater than 50% decrease = 3

Cereal Production Index: 0-2 = 0, 3-6 = 1, 7-10 = 2, 11-14 = 3

Millet price index calculated for farmers by rating the sum of a), b), and c) below, all weighted equally:

a) Average price levels for the past year, May 1990 to April 1991: less than 65 FCFA/kg = 0, 65-80 FCFA/kg = 1 FCFA/kg, greater than 80 FCFA/kg = 2

b) April 1991 millet price levels: less than 80 FCFA/kg = 0, 80-95 FCFA/kg = 1, greater than 95 FCFA/kg = 2

c) Percent change in millet price, April 1991 vs 1986-90 April average: little change or lower = 0; 5-10% higher = 1; 10-20% higher = 2; greater than 20% higher = 3

Millet Price Index: 0-1 = 0 normal or low, 2-3 = 1 slightly high, 4-5 = 2 moderately high, 6-7 = 3 very high

Other production index calculated for farmers by rating the sum of a) and b), weighted 2 and 1, respectively:

a) Nibe sales expressed as market equivalent of millet in kg: greater than 100 = 0, 60-100 = 1, 20-60 = 2, less than 20 = 3

b) Animal sales measured as annual average terms of trade from March 1990 to February 1991 representing kg of millet purchasable through sale of one goat. Terms of trade was set to a scale of 0-100, where 0 represents the average from the sustained period of low terms of trade between January and June 1985 and 100 represents the average from the sustained period of high terms of trade from January to June 1989: greater than 65 = 0, 55-65 = 1, 45-55 = 2, less than 45 = 3

Other Production Index: 0 = 0, 1-3 = 1, 4-6 = 2, 7-9 = 3

Herding productivity calculated for nomadic herders as pasture balance based on tropical livestock units (TLU) per ton of dry edible biomass: less than 0.18 = 0, 0.18-0.22 = 1, 0.23-0.29 = 2, 0.30 or more = 3

Terms-of-trade index calculated for nomadic herders as a composite ratio of average bull/millet and goat/millet prices over the last three years, with weightings of 2 and 1, respectively. The three year average (March 1988 to February 1991) was weighted with the past year at one-half, two years ago at one-third, and three years ago at one-sixth. The resulting terms-of-trade was set to a scale of 0-100 where zero represents the average from the sustained period of low terms of trade between Jan. and June 1985 and 100 represents the average from the sustained period of high terms-of-trade from Jan. to June 1989: greater than 85 = 0, 76-85 = 1, 66-75 = 2, less than 66 = 3

Alternative income index calculated for farmers and nomadic herders by rating the sum of six alternative income sources (irrigated gardening, wage labor, remittances, crafts sales, trading, and other) with weightings of 2, 1, 1, 1, 1, 1, respectively. Each alternative income source was rated according to its potential importance to overall household revenue: 0 = important, 1 = insignificant, 2 = not practiced.

Alternative Income Index: 0-2 = 0, 3-6 = 1, 7-10 = 2, 11-14 = 3

Overall vulnerability rating for farmers: final score derived from sum of cereal production, millet price, other production, and alternative income indices, all with equal weightings: 0-1 = 0 not vulnerable, 2-4 = 1 slightly vulnerable, 5-7 = 2 moderately vulnerable, 8-10 = 3 highly vulnerable, 11-12 = 4 extremely vulnerable or at-risk

Overall vulnerability rating for nomadic herders: final score derived from sum of herder productivity, terms of trade, and alternative income indices, all with equal weightings: 0-1 = 0 not vulnerable, 2-3 = 1 slightly vulnerable, 4-5 = 2 moderately vulnerable, 6-7 = 3 highly vulnerable, 8-9 = 4 extremely vulnerable or at-risk

Health risk index calculated for farmers and herders by rating sum of a) and b):

a) Level of vaccination coverage: greater than 70% = 0, 60-70% = 1, 50-60% = 2, less than 50% = 3

b) Severe malnutrition cases reporting to health clinics: less than 4% = 0, 4-6% = 1, 6-8% = 2, greater than 8% = 3

Health Risk Index: 0 = 0, 1-2 = 1, 3-4 = 2, 5-6 = 3

Notes and Background

Caveats concerning the arrondissement assessment data and analysis include:

- Revenue from alternative sources of income for farmers and herders could not be quantified. Information gathered from GON reports and qualified by current economic conditions was used to estimate the importance of alternative income sources in meeting household-level consumption requirements.
- Terms of trade is expressed as kilograms of millet purchasable through the sale of one animal (bull or buck) instead of a direct ratio expressing kilograms of millet to kilograms liveweight of animal. Historical kilogram liveweight prices by arrondissement are not available in Niger, which means that seasonal and annual variations in liveweight are not reflected in terms of trade curves for this assessment.
- Herding productivity is expressed as the concentration of animals on available pasture. The GON pasture estimates convert remotely-sensed greenness data (NDVI -- see inside back cover) to available edible biomass. This conversion does not take pasture quality or water availability into consideration, both of which are important components of herding productivity.
- Statistics on numbers of animals per arrondissement are GON estimates based on vaccination records and theoretical herd growth rates. It is unclear how accurately they reflect reality.

Table E-1: Indicators for the 1991 Niger Vulnerability Assessment

| Arrondissement | Initial Assessment of Farmers and Herders | Farmer Specific Indicators | | | | | | | | Herder Specific Indicators | | Farmer and Herder Indicators | | | | | |
|-----------------|---|----------------------------|---------------------------|-----------------------------|--|------------------------------|-------------------------------|-------------|--------------|----------------------------|---------------------------|------------------------------|------------|-------------|-------------|---------------------|-------|
| | | 90/91 Production (kg/cap) | 89/90 Production (kg/cap) | 90/91 Production vs Average | Average Millet Price 5/90-4/91 (FCFA/kg) | April Millet Price (FCFA/kg) | April Millet Price vs Average | Niebe Sales | Animal Sales | Tons of Biomass per TLU | Terms of Trade vs EXT (%) | Irrigated Gardening | Wage Labor | Remittances | Craft Sales | Small Scale Trading | Other |
| Filingué | F/H | 128 | 170 | 50 | 90 | 125 | 60 | 6 | 49 | 0.17 | 64 | 1 | 2 | 0 | 1 | 1 | 2 |
| Téra | F/H | 159 | 233 | 65 | 83 | 93 | 23 | 10 | 42 | NA | 53 | 1 | 1 | 0 | 1 | 0 | 1 |
| Ouallam | F/H | 190 | 174 | 94 | 94 | 125 | 65 | 2 | 18 | 0.29 | 46 | 1 | 2 | 0 | 1 | 1 | 2 |
| Bouza | F/H | 169 | 420 | 54 | 73 | 79 | 19 | 2 | 53 | 0.27 | 69 | 1 | 2 | 0 | 1 | 1 | 1 |
| Tillabery | F/H | 133 | 196 | 55 | 91 | 110 | 31 | 4 | 35 | 1.10 | 53 | 0 | 1 | 0 | 1 | 2 | 1 |
| Tchiro-zérine | F/H | | | | 78 | 83 | 17 | 0 | 45 | 0.25 | 87 | 1 | 0 | 2 | 0 | 2 | 0 |
| Tchin Tabaraden | F/H | 125 | 66 | 66 | 79 | 84 | 36 | 5 | 68 | 0.12 | 87 | 1 | 2 | 2 | 0 | 1 | 1 |
| N'Guigmi | F/H | 46 | 194 | 35 | 75 | 79 | 22 | 0 | 65 | 0.24 | 83 | 1 | 2 | 0 | 1 | 1 | 2 |
| Arlit | F/H | | | | 79 | 91 | 22 | 0 | 55 | NA | NA | 0 | 0 | 2 | 0 | 0 | 1 |
| Loga | F/ | 216 | 265 | 84 | 78 | 87 | 15 | 82 | 64 | | | 2 | 2 | 0 | 1 | 1 | 1 |
| Diffa | F/ | 110 | 31 | 78 | 72 | 83 | 31 | 51 | 64 | | | 0 | 2 | 0 | 0 | 1 | 1 |
| Tahoua | /H | | | | | | | | | 0.43 | 81 | 0 | 2 | 0 | 1 | 1 | 1 |
| Tanout | /H | | | | | | | | | 0.11 | 64 | 1 | 2 | 0 | 1 | 0 | 2 |
| Ilélla | /H | | | | | | | | | 0.21 | 76 | 1 | 2 | 0 | 2 | 1 | 1 |
| Mirriah | /H | | | | | | | | | 0.17 | 77 | 1 | 1 | 1 | 2 | 0 | 1 |
| Gouré | /H | | | | | | | | | 0.11 | 68 | 1 | 0 | 0 | 0 | 0 | 1 |
| Dosso | /H | | | | | | | | | 0.04 | 99 | 2 | 2 | 0 | 1 | 0 | 1 |

Sources: Cereal and *niebe* production -- GON/MOA/DSA; millet prices -- GON/SIM; animal prices, TLU and biomass statistics, alternative income information -- GON/MOA/DEP; population -- FEWS/Niger 1991 projections based on arrondissement-specific growth rates derived from comparisons of GON 1977 and 1988 censuses; farmer/herder breakdown -- GON/Census Bureau analysis of 10% sample of 1988 general census.

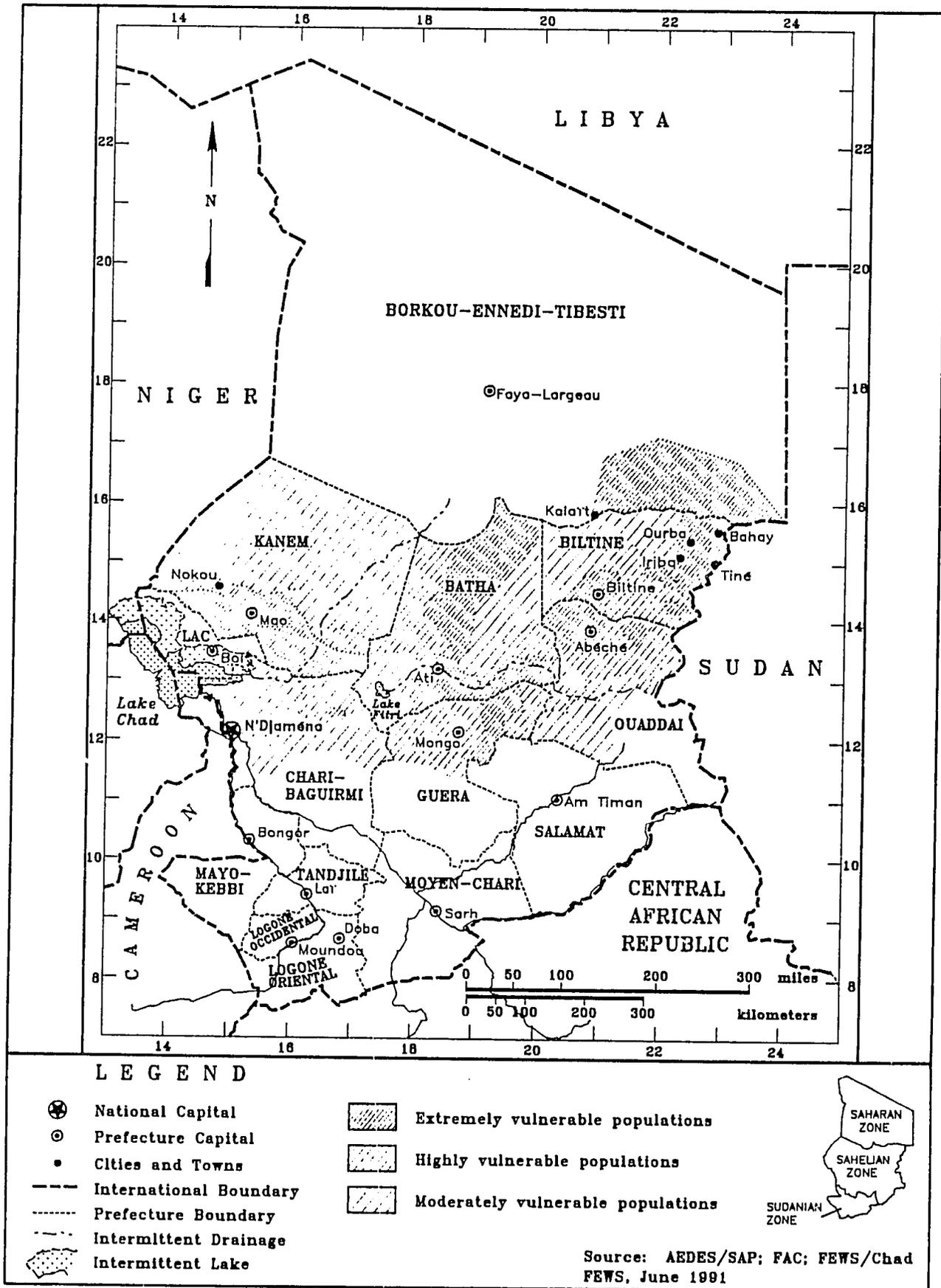
Table E-2: Indices for the 1991 Niger Vulnerability Assessment

| Arrondissement | Initial Assessment of Farmers and Herders | Farmers | | | Herders | | Farmers & Herders | Overall Farmer Vulnerability | | Overall Herder Vulnerability | |
|-----------------|---|-------------------------|--------------------|--------------------------|----------------------------|----------------------|--------------------------|------------------------------|-----------------------------|------------------------------|-----------------------------|
| | | Cereal Production Index | Millet Price Index | "Other Production" Index | Herding Productivity Index | Terms of Trade Index | Alternative Income Index | Final Rating for Farmers | Farming Population Affected | Final Rating for Herders | Herding Population Affected |
| Filingué | F/H | 3 | 3 | 3 | 0 | 3 | 2 | 4 | 235,000 | 2 | 79,000 |
| Téra | F/H | 2 | 3 | 3 | NA | 3 | 1 | 3 | 241,000 | 3 | 81,000 |
| Ouallam | F/H | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 154,000 | 3 | 52,000 |
| Bouza | F/H | 2 | 1 | 3 | 2 | 2 | 2 | 3 | 119,000 | 3 | 71,000 |
| Tillabery | F/H | 2 | 3 | 3 | 3 | 3 | 1 | 3 | 124,000 | 3 | 42,000 |
| Tchirozérine | F/H | | 2 | 3 | 2 | 0 | 1 | 3 | 61,000 | 1 | 16,000 |
| Tchin Tabaraden | F/H | 3 | 2 | 2 | 0 | 0 | 2 | 3 | 48,000 | 1 | 29,000 |
| N'Guigmi | F/H | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 25,000 | 2 | 4,000 |
| Arlit | F/H | | 2 | 3 | NA | NA | 1 | 3 | 7,000 | NA | 19,000 |
| Loga | F/ | 1 | 2 | 1 | | | 2 | 1 | 82,000 | | |
| Diffa | F/ | 2 | 2 | 2 | | | 1 | 2 | 55,000 | | |
| Tahoua | /H | | | | 3 | 1 | 1 | | | 2 | 77,000 |
| Tanout | /H | | | | 0 | 3 | 2 | | | 2 | 75,000 |
| Ilélla | /H | | | | 1 | 1 | 2 | | | 2 | 70,000 |
| Mirriah | /H | | | | 0 | 1 | 2 | | | 1 | 170,000 |
| Gouré | /H | | | | 0 | 2 | 1 | | | 1 | 63,000 |
| Dosso | /H | | | | 0 | 0 | 2 | | | 1 | 39,000 |

Sources: Cereal and *niebe* production – GON/MOA/DSA; millet prices -- GON/SIM; animal prices, TLU and biomass statistics, alternative income information – GON/MOA/DEP; population -- FEWS/Niger 1991 projections based on arrondissement-specific growth rates derived from comparisons of GON 1977 and 1988 censuses; farmer/herder breakdown -- GON/Census Bureau analysis of 10% sample of 1988 general census.

Note: Cereal production index not applicable for Tchirozérine and Arlit. Subsistence production is based on small scale irrigation and other income. The alternative income index was therefore weighted double.

Map 7: Chad Vulnerability Assessment Summary



Source: AEDS/SAP; FAC; FEWS/Chad
FEWS, June 1991

Famine Imminent if Crops Fail Again

Report released by USAID/Chad on May 21, 1991

SUMMARY

Chad's overall vulnerability is higher than at any time during the past five years. Below normal rainfall in 1990 resulted in greatly reduced agricultural production and diminished water tables at water holes for the second year in a row, increasing the vulnerability of agriculturalists and pastoralists in the Sahelian zone (Map 7). Significant displacement of rural populations has already occurred, with the destitute congregating in urban centers or dispersing into the bush, scavenging for wild grain. Rates of childhood malnutrition are reaching unacceptably high levels. It is estimated that 164,000 persons are extremely vulnerable or at-risk, whereas 382,500 persons are highly vulnerable; both groups require outside food assistance. An additional 362,000 persons are moderately vulnerable and require close monitoring during the 1991/92 agricultural season. Political events have also increased the vulnerability status of certain groups. These include approximately 17,000 widows and orphans in Biltine Prefecture¹ and Ennedi Sub-prefecture, near the Sudan border.

High cereal prices and reduced terms of trade for livestock owners are hampering access to the limited cereal now available. The publicly held food security stock will be depleted by the end of May 1991 and neighboring countries, facing similar problems, are preventing grain exports. On-farm stocks are extremely low or non-existent. Thus, with current grain availability low, prices unseasonably high, and the population already suffering from the effects of two consecutive poor harvests, Chad will cross the famine threshold if the rains in 1991 fail.

METHODOLOGY

The 1991 Fews Vulnerability Assessment identifies locations and number of persons in Chad who are vulnerable to famine as the 1991/92 agricultural season begins. A non-parametric ranking system was incorporated into the analysis (see Appendix F). The results of this ranking were combined with information obtained from field visits, nutritional surveys, and reports from the European Community (EEC) funded "Système d'Alerte Précoce" (SAP) Project to identify specific groups that are

currently experiencing, or have historically experienced, food acquisition problems.

Two important caveats to this assessment are:

- population figures for Chad are approximate in the extreme and
- most data are not available in disaggregated form.

Current population figures are based on a 1964 survey in only eleven of Chad's fourteen prefectures, adjusted with data from the 1989 voters registration. In recent years, massive outflows and inflows of people have taken place in response to drought, war, and poor economic conditions. Furthermore, indicators used in the ranking system do not address all the components of household-level income that directly affect purchasing power. This is especially evident in the Saharan and northern Sahelian zones, where date production, wild grain gathering and nomadic migrations are part of the normal lifestyle. As a result, anecdotal information and field observations are used to supplement the scarce data in certain areas.

Table 5 includes a summary of persons identified by the Government of Chad (GOC)/donor Food Aid Action Committee (FAAC) as being in need of food assistance. Groups in the "at-risk" and "highly vulnerable" columns are currently receiving, or are programmed to receive, food aid rations. It is difficult, without a sample survey, to estimate accurately the number of people "at-risk." However, women and children have historically been the most affected in times of stress. (At-risk population for Guéréda, Ennedi, and Iriba sub-prefectures are presented in the "Widows and Orphans" group.) Their proportion in the general population, 30%,² is therefore used to estimate the number of persons at risk of famine. Thus, 164,000 persons are extremely vulnerable (or at-risk), and 382,500 persons are highly vulnerable.

The remaining population in the Sahelian prefectures, excepting Salamat and Lac, are identified as moderately vulnerable since another poor rainy season would spell disaster for the whole region. Using this approach, 362,000 persons in the

¹ In order of precedence, Chad's administrative units are prefectures, sub-prefectures and cantons.

² This figure was obtained from the Ministry of Planning/National Statistics Bureau (DSEED).

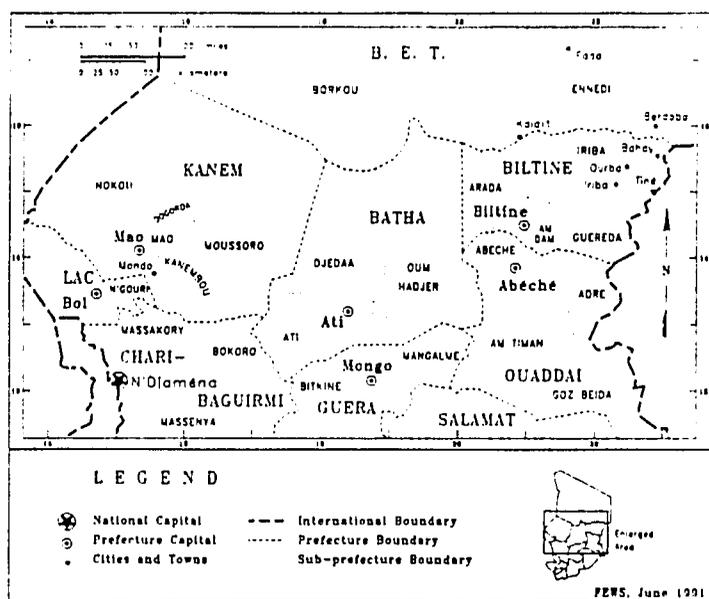
Table 5: 1991 Vulnerable Groups in Chad

| Prefecture | Sub-prefecture | Extremely Vulnerable/ "At-Risk" | Highly Vulnerable | Moderately Vulnerable |
|---|----------------|------------------------------------|-------------------|-----------------------|
| Agriculturalists / Former Pastoralists | | | | |
| Kanem | Mao | 7,100 | 16,500 | 15,800 |
| Kanem | Moussoro | 2,400 | 5,600 | 5,300 |
| Kanem | Nokou | 1,500 | 3,400 | 3,200 |
| Sub-total | | 11,000 | 25,500 | 24,300 |
| Smallholder Agriculturalists | | | | |
| Guéra | Bitkine | 14,400 | 33,800 | 32,100 |
| Guéra | Mangalmé | 9,000 | 20,800 | 19,900 |
| Guéra | Mongo | 6,600 | 15,400 | 14,700 |
| Sub-total | | 30,000 | 70,000 | 66,700 |
| Agropastoralists¹ | | | | |
| Ouaddaï | Abéché | 31,000 | 72,500 | 68,800 |
| Ouaddaï | Adré | 21,500 | 50,000 | 47,400 |
| Batha | Oum Hadjer | 20,000 | 46,000 | 43,500 |
| Chari-Baguirmi | Bokoro | 10,500 | 24,000 | 23,000 |
| Batha | Ati | 8,000 | 19,000 | 18,000 |
| Batha | Djédaa | 7,000 | 16,000 | 15,200 |
| Biltine | Guéréda | -- | 16,000 | 15,000 |
| B.E.T. | Ennedi (Fada) | -- | 15,000 | 14,500 |
| Ouaddaï | Am Dam | 6,000 | 13,500 | 12,600 |
| Biltine | Iriba | -- | 10,000 | 9,000 |
| Biltine | Arada | 2,000 | 5,000 | 4,000 |
| Sub-total | | 106,000 | 287,000 | 271,000 |
| Widows and Orphans | | | | |
| B.E.T. | Ennedi | 6,500 | -- | -- |
| Biltine | Guéréda | 6,500 | -- | -- |
| Biltine | Iriba | 4,000 | -- | -- |
| Sub-total | | 17,000 | -- | -- |
| Chad Total | | 164,000 | 382,500 | 362,000 |

Source: FAAC, FEWS/Chad

¹ At-risk population for Guéréda, Ennedi, and Iriba sub-prefectures are presented in the "Widows and Orphans" group.

Map 8: Chad's Sahelian Zone



Sahelian zone are moderately vulnerable, requiring close monitoring (see Map 8 for sub-prefecture locations).

VULNERABILITY OF SOCIOECONOMIC GROUPS

The three major socioeconomic groups in Chad are agriculturalists, pastoralists, and urban dwellers. This Vulnerability Assessment focuses mainly on the first two groups, as they make up most of Chad's population and possess higher levels of vulnerability than the last group (urban dwellers). A February 1991 field trip to the Sahelian zone, led by the GOC Commissioner for Food Security with donor and PVO participation, confirmed widespread problems in the area. Many villages were abandoned. Displaced persons arrived in towns destitute. Villagers were opening ant hills and termite mounds to retrieve grain. Women swept the ground for wild grain. Although some of these activities are part of the Sahelian lifestyle in Chad, the level observed in 1991 has been abnormally high and is indicative of serious food insecurity.

Agriculturalists

Former Pastoralists in Kanem Prefecture

There are currently 36,500 persons in Kanem Prefecture in need of food assistance, of which 11,000 are deemed at-risk. The remaining 25,500 persons are highly vulnerable to famine. Many of these people are former pastoralists who turned to subsistence agriculture when their herds were lost during the 1984/85 drought. Inadequate rainfall in 1989 and again in 1990 (120 and 185 millimeters respectively) precluded any significant harvest of rainfed crops. Two successive years of poor cereal production has limited the effectiveness of most household level

coping strategies. Displaced persons are reported congregating around the north Kanem town of Nokou. According to an April 1991 nutritional survey carried out by the National Nutrition Center (CNNTA) in collaboration with the SAP Project, malnutrition rates (below 80% normal weight for height) among pre-school aged children vary from 16.7 to 19.4% for the three sub-prefectures of Kanem. A similar survey in 1990 reported a malnutrition rate of 15.6%, which was the highest ever recorded in Chad at that time (see Table 6). The recommended intervention level of the GOC Ministry of Health is 10 percent.

Smallholder Agriculturalists in Guéra Prefecture

The number of persons in Guéra Prefecture targeted for food assistance is estimated to be 100,000, of which 30,000 are at-risk and 70,000 are highly vulnerable. These people do not practice off-season agriculture or animal husbandry. Historically, people in Guéra have been less successful in coping with food shortages than populations elsewhere in the Sahelian zone. As a result, the long-term vulnerability status for Guéra Prefecture ranks worst in the country. Another year of below normal rainfall will be disastrous for the entire prefecture.

Southern Agriculturalists

The 1990 FEWS Vulnerability Assessment identified southern agriculturalists as slightly vulnerable due to the lack of a diversified income base leading to reduced coping mechanisms. Although the 1990 harvest estimate indicated a slight increase in cereal production in the Sudanian zone, rainfall was poorly distributed in space and in time, resulting in several pockets where shortages have been reported.

The worst cases of documented famine in Chad have occurred in the south, rather than in the north where crop production is riskier. Although southern farmers remain slightly vulnerable in 1991, inadequate rainfall could place the population in a moderate to highly vulnerable status.

Pastoralists

Nomadic Pastoralists

Nomadic cattle-raising is common in the northern Sahelian zone, with herders migrating south at the end of the rainy season. In 1990, this annual migration started one to two months earlier than in a normal year. Although 1990 rain in the Sahelian zone was sufficient to produce adequate pastures and dry season fodder stock, early cessation of rain caused many water holes to dry up, diminishing available watering points.

Nomadic populations depend mainly on animal products for their income. With annual migration, herders are able to leave drought areas for better pastures in the south. They are thus deemed only slightly vulnerable. However, inadequate rainfall for the whole country can place nomadic populations in a

Table 6: Malnutrition Rates, March - April 1991

| Prefecture | Sub-prefecture | Locality | Malnutrition Rate (%) |
|------------|----------------|------------------|-----------------------|
| Biltine | Iriba | Tiné | 40.6 |
| B.E.T. | Ennedi | Berdoba | 25.0 |
| B.E.T. | Ennedi | Fada | 23.4 |
| B.E.T. | Ennedi | Kalaït | 20.7 |
| Kanem | Mao | Mondo | 19.4 |
| Kanem | Moussoro | Kanembou | 18.9 |
| Kanem | Nokou | Dogorda | 16.7 |
| Ouaddaï | Adré | Kado | 9.0 |
| Ouaddaï | Adré | Mabrone/Troane | 6.9 |
| Ouaddaï | Abéché | Bourtail/Guérrri | 5.1 |
| Biltine | Biltine | Mimi | 4.4 |
| Ouaddaï | Adré | Marfa | 3.6 |
| Biltine | Guéréda | Guéréda | 3.5 |
| Ouaddaï | Abéché | Bourtail | 2.6 |
| Biltine | Guéréda | Lima | 2.0 |

Source: GOC/CNNTA Surveys

moderate to highly vulnerable situation as cereal prices rise and terms of trade decrease.

Agropastoralists

Most pastoralists in the Sahelian zone are cattle herders who sometimes engage in agriculture. They are located mainly in Biltine, Ouaddaï, Batha, Kanem, southern Borkou-Ennedi-Tibesti (B.E.T.), and Chari-Baguirmi prefectures. The 1990 Vulnerability Assessment placed most of this population in the moderately vulnerable status. With a second year of below normal rainfall, traditional coping methods are now extremely stressed or exhausted. Recent nutritional surveys by the CNNTA in the northern Sahelian zone reported unusually high levels of malnutrition (see Table 6). The problem is especially worrisome in southern Ennedi Sub-prefecture and northeastern Biltine Prefecture, where malnutrition rates of 23.4% and 40.6% respectively were obtained (see Map 8 for location of sites with highest malnutrition rates). CNNTA has not carried out nutritional surveys in these areas before. Thus, lacking a baseline for comparison, it is difficult to determine the chronic malnutrition level of these populations. Nonetheless, these high rates are indicative of the seriousness of the problem.

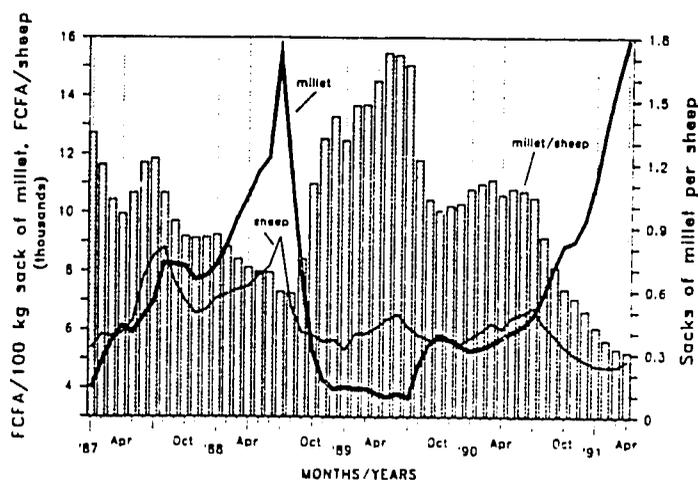
There are an estimated 106,000 persons at-risk in five Sahelian prefectures (Biltine, Ouaddaï, Batha, southern B.E.T., and Chari-Baguirmi), and another 287,000 who are highly vulnerable. A two-month ration of food aid is currently being distributed in these regions. A good 1991/92 agricultural season will be crucial for the recovery of these groups.

Urban Dwellers

The 1991 Vulnerability Assessment does not focus on urban groups. Urban population in Chad is concentrated in N'Djaména, Sarh, Moundou and Abéché. Most urban dwellers rely on income from salaried employment, commerce, occasional wage labor, and remittances. A portion of urban residents depart for their respective villages at the onset of the rainy season to cultivate. All of the urban population, especially urban poor, are slightly to moderately vulnerable to the impact of increasing prices and decreasing supplies on their access to food.

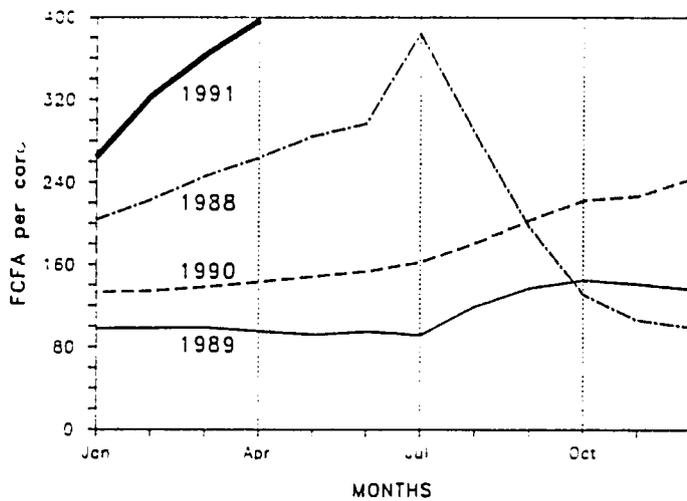
Millet prices throughout Chad have continued the upward trend identified in the 1991 FEWS Harvest Assessment Report. Prices have been consistently higher than in the past five years. Reduced incomes due to the last two poor harvests, combined with rising cereal prices, have both worked to reduce household level access to marketed foodstuffs. The vulnerability of agriculturalists, pastoralists and those groups without other sources of income (e.g., widows and orphans) is increasing. Livestock owners (pastoralists and agro-pastoralists) have also seen a declining market price for their animals. For example, in April 1991 approximately three sheep were required to obtain a one hundred kilogram sack of millet, whereas one year earlier, in April 1990, a similar sack could be obtained by selling only one sheep (Figure 5).

Figure 5: Terms of Trade Between Millet and Sheep, Average over Eight Sahelian Markets



Source: SAP/Chad; FEWS/Chad. Note: Lines indicate prices of millet and sheep. Bars indicate the number of sacks of millet that can be purchased with the proceeds from selling one sheep.

Figure 6: Nominal Monthly Millet Prices, Average Over Eight Sahelian Markets, 1988-91



Source: USAID/Chad; FEWS/Chad.

Note: In Chad's Sahelian zone, one corco equals 2.5 kilograms.

The graph presented in Figure 6 indicates the high level of millet prices in 1991 compared to previous years. The July to September period will be particularly important for monitoring the market's expectations of the upcoming harvest. If the harvest is good, then prices are expected to decline as they did in 1988. On the other hand, if prices stabilize, increase, or decrease only slightly, then food insecurity will intensify and could lead to a crisis of 1983-84 proportions.

ADDITIONAL GROUPS FOR 1991/92

Widows and Orphans

Armed conflict during 1990 heightened the vulnerability status of women and children in the areas of Biltine Prefecture and southern Ennedi Sub-prefecture bordering on Sudan. These people are referred to as widows and orphans since their husbands and fathers have fled the area or disappeared during the past year's conflicts. A recent CNNTA nutritional survey reported a malnutrition rate of 40.6% (under 80% normal weight for height). This is the highest malnutrition rate recorded in Chad since 1986, when CNNTA initiated standardized nutritional surveys. Approximately 17,000 widows and orphans are at-risk, in and around the towns of Tiné, Bahay, Ourba, Iriba, and Kalait.

Repatriates

Chadians continue to return from neighboring countries as they have done off and on for the past decade. For the most part, they return spontaneously and are absorbed into the existing social framework without significant difficulty. They are nonetheless considered to be moderately vulnerable during their initial settling-in period, until gainful employment has been found or until they have gone through one successful agricultural cycle. A renewed impetus is being placed on repatriating Chadians and the likelihood is that this trend will continue.

During April/May 1991, approximately 2,000 Chadians were forcibly expelled from Libya and were flown to N'Djaména by plane; more are reported to be on their way. Most dispersed into the *quartiers*, but a small group of 300-500 was recently located on the town's outskirts. Efforts are underway to assist those desirous of returning to their villages in the north. A current cholera outbreak in the city is placing these displaced people in a moderately vulnerable status.

CONCLUSION

Chad is in an extremely precarious food security situation. Stocks are low, cereal prices are high, livestock prices have taken a precipitous fall and food aid is arriving late. These conditions have resulted in increased anticipation for the 1991/92 agricultural and pastoral season. Another bad season, even a mediocre one, will create severe hardship and possible famine conditions. If the rains are good to abundant, however, then 1991/92 would resemble the 1988/89 season (with a reduction in food insecurity).

Monitoring of the agricultural situation and food availability in the Sahelian zone will be performed by the EEC-funded SAP Project. Its reporting will be particularly important in targeting food aid as the agricultural season begins. Within USAID/Chad, the Food Security Operations Group (FSOG) will closely monitor satellite imagery, both NDVI and METEOSAT (see inside back cover), to follow the progress of the 1991/92 agricultural and/pastoral season. This information will be confirmed by station rainfall data from the national meteorological service in Chad and field trips. Cereal and livestock prices will be monitored to determine the market's expectations about the outcome of the 1991/92 season. All these indicators will be factored into a convergence of indicators approach that should, by early to mid-September, allow an update on the anticipated outcome of the 1991/92 agricultural and pastoral season.

APPENDIX F: Methodology for Chad Vulnerability Assessment

Introduction

The Vulnerability Assessment (VA) attempts to identify locations and number of socioeconomic groups which are susceptible to food insecurity in Chad. For the 1991 VA, FEWS/Chad uses a non-parametric, or ranking, system first introduced by FEWS/Burkina. Food security indicators are examined at the prefecture or sub-prefecture level, depending on the types of data available. The analysis first examines long-term, or chronic components of vulnerability status. Short-term, current shocks are then combined with the long-term component to arrive at a sub-prefecture level, current vulnerability ranking.

Long-term Vulnerability

Six major categories of indicators are used to address long-term vulnerability status. The categories are epidemiology, traditional lifestyle, cereal production, livestock, climatology, and cash crop activities. The indicators used in each category are listed in Table F-1. The coefficients of variation (CV) for selected indicators, which measure the magnitudes of variation over time, are used wherever appropriate as indicators themselves. The inclusion of CV as indicators introduces the notion of risk as a result of the stability, or instability, of an indicator.

The categories of indicators are weighted according to geographic location before arriving at a final vulnerability ranking. Since no household-level income component information is available for Chad, the weighting scheme used is subjective (Table F-2). The final result indicates highest vulnerability status for Guéra Prefecture (which contains Bitkine, Mangalmé, Mongo and Melfi sub-prefectures), followed by other northern prefectures, and lowest levels for the southwestern prefectures. Table F-3 shows the long-term vulnerability categories and the final long-term vulnerability ranking.

Short-term Vulnerability

For short-term (current) vulnerability, four categories of indicators are combined with the long-term ranking. These four are: NDVI of the past two years as indication of pasture quality; per capita cereal production of the past two years; market cereal prices of the past six months; and malnutrition rates as determined by the CNNTA medico-nutritional surveys. These indicators represent the current shocks to food security. Data for the two recent years are included in order to lend emphasis to areas where two consecutive years of negative shocks have been experienced. The final short-term ranking is presented in Table F-4.

Conclusions

A ranking system helps to identify the relative vulnerability status between sub-regions. However, the categories of indicators used in the Chad analysis are restricted by data availability and do not address all the components of household-level income, which directly affects purchasing power. For example, remittances and oasis date production are important elements of Sahelian and Saharan lifestyles. These data are not available. Consequently, the ranking of the B.E.T. sub-prefectures (Bourkou, Ennedi and Tibesti) do not truly reflect their vulnerability status in relation to other areas.

Despite this restriction, the ranking system agrees in general with the local qualitative assessment of the food insecurity situation. This system served as a starting point for the VA, which combines other anecdotal information to arrive at a picture of the food insecurity situation in Chad as the country enters the 1991/92 agricultural season.

Table F-1: Indicators used in Long-term Vulnerability Ranking

| Category | Indicators |
|--------------------------------|--|
| Epidemiology | Concentration of health facilities, incidence of conjunctivitis and fever, vaccination coverage for children under one year of age, malnutrition rate at out-patient clinics |
| Traditional | Qualitative ranking of prevalence of traditional coping activities such as gathering wild grain, transhumanance |
| Cereal Production ¹ | Average cereal yield, coefficient of variation of average yield, crop diversity, average per capita cereal production, coefficient of variation of average per capita production |
| Livestock | Number of cattle present per prefecture, normalized difference vegetation index (NDVI), qualitative ranking of the availability of surface water |
| Climatology | 20-year (1961-80) average cumulated rainfall |
| Cash Crop | Peanut and sesame yield, cotton sales |

¹ 1983 to 1990 cereal production data used.

Source: BSA/ONDR; MOH; SAP; MADR; NOAA/NASA; GAC; ONC; FEWS/Chad

Table F-2: Weighting Scheme by Category of Indicators and by Zone

| Zone | Epidemiology | Traditional | Cereal Production | Livestock | Climatology | Cash Crop |
|-------------------|--------------|-------------|-------------------|-----------|-------------|-----------|
| Saharan | 20% | 20% | 5% | 40% | 10% | 5% |
| Northern Sahelian | 20% | 20% | 10% | 30% | 10% | 10% |
| Southern Sahelian | 20% | 20% | 10% | 20% | 10% | 20% |
| Sahelo-Sudanian | 20% | 20% | 20% | 10% | 10% | 20% |
| Sudanian | 20% | 20% | 30% | 0% | 10% | 20% |

Source: BSA/ONDR; MOH; SAP; MADR; NOAA/NASA; GAC; ONC; FEWS/Chad

Table F-3: Chronic (Long-term) Vulnerability Categories and Final Ranking

| Sub-Prefecture | Epidemiology | Tradition Practice | Cereal Production | Livestock | Rainfall | Cash Crop | RANK | |
|-------------------|--------------|--------------------|-------------------|-----------|----------|-----------|------|-------|
| | | | | | | | Avg | Final |
| Bitkine | 15.5 | 27.0 | 27.5 | 1.0 | 29.0 | 27.5 | 19.9 | 1 |
| Mangalmé | 15.5 | 31.0 | 27.5 | 3.0 | 17.0 | 27.5 | 19.9 | 2 |
| Mongo | 15.5 | 28.0 | 27.5 | 2.0 | 27.5 | 27.5 | 20.1 | 3 |
| Tibesti | 38.0 | 52.0 | 2.0 | 5.0 | 2.0 | 9.0 | 20.8 | 4 |
| Borkou | 38.0 | 51.0 | 2.0 | 6.0 | 2.0 | 9.0 | 21.0 | 5 |
| Ennedi | 38.0 | 50.0 | 2.0 | 7.0 | 2.0 | 9.0 | 21.2 | 6 |
| Melfi | 15.5 | 22.0 | 27.5 | 4.0 | 33.0 | 27.5 | 22.2 | 7 |
| Massenya | 20.0 | 26.0 | 20.0 | 26.0 | 15.5 | 23.0 | 22.6 | 9 |
| Bokoro | 20.0 | 32.0 | 20.0 | 23.0 | 10.0 | 23.0 | 22.6 | 8 |
| Arada | 6.0 | 45.0 | 6.0 | 38.0 | 7.0 | 9.0 | 23.8 | 11 |
| Bouso | 20.0 | 20.0 | 20.0 | 45.0 | 32.0 | 23.0 | 24.3 | 10 |
| N'Djaména | 20.0 | 30.0 | 20.0 | 30.0 | 21.0 | 23.0 | 24.7 | 12 |
| Iriba | 6.0 | 46.0 | 6.0 | 40.0 | 8.5 | 9.0 | 24.8 | 14 |
| Biltine | 6.0 | 42.0 | 6.0 | 41.0 | 15.5 | 9.0 | 24.9 | 15 |
| Massakory | 20.0 | 34.0 | 20.0 | 25.0 | 23.5 | 23.0 | 25.0 | 13 |
| Am Zoer | 6.0 | 41.0 | 6.0 | 43.0 | 25.0 | 9.0 | 26.3 | 17 |
| Guéréda | 6.0 | 43.0 | 6.0 | 46.0 | 14.0 | 9.0 | 26.5 | 16 |
| Goz Beïda | 41.5 | 29.0 | 15.5 | 39.0 | 18.0 | 9.0 | 27.1 | 18 |
| Am Timan | 27.0 | 24.0 | 39.0 | 27.0 | 27.5 | 19.0 | 27.3 | 19 |
| Haraze Manguaigne | 27.0 | 23.0 | 39.0 | 28.0 | 30.0 | 19.0 | 27.4 | 20 |
| Ati | 2.0 | 35.0 | 24.0 | 52.0 | 12.0 | 9.0 | 27.5 | 21 |
| Am Dam | 41.5 | 33.0 | 15.5 | 37.0 | 21.0 | 9.0 | 27.7 | 22 |
| Djédaa | 2.0 | 47.0 | 24.0 | 47.0 | 6.0 | 9.0 | 27.8 | 25 |
| Ngouri | 4.5 | 36.0 | 11.0 | 24.0 | 26.0 | 9.0 | 27.9 | 23 |
| Abou Déia | 27.0 | 25.0 | 39.0 | 29.0 | 31.0 | 19.0 | 28.0 | 24 |
| Bongor | 11.0 | 21.0 | 50.0 | 14.0 | 23.5 | 40.5 | 28.3 | 26 |
| Oum Hadjer | 2.0 | 44.0 | 24.0 | 51.0 | 8.5 | 9.0 | 28.7 | 27 |
| Abéché | 41.5 | 38.0 | 15.5 | 33.0 | 12.0 | 9.0 | 29.5 | 28 |
| Bol | 44.5 | 39.0 | 11.0 | 31.0 | 19.0 | 9.0 | 29.9 | 29 |
| Pala | 11.0 | 10.0 | 50.0 | 16.0 | 36.0 | 40.5 | 30.9 | 30 |
| Adré | 41.5 | 37.0 | 15.5 | 36.0 | 21.0 | 9.0 | 31.1 | 31 |
| Maro | 34.0 | 4.0 | 32.0 | 42.0 | 45.5 | 47.0 | 31.2 | 32 |
| Moissala | 34.0 | 3.0 | 32.0 | 35.0 | 50.0 | 47.0 | 31.4 | 33 |
| Fianga | 11.0 | 15.0 | 50.0 | 13.0 | 34.5 | 40.5 | 31.8 | 34 |
| Léré | 11.0 | 16.0 | 50.0 | 15.0 | 34.5 | 40.5 | 32.0 | 35 |
| Koumra | 34.0 | 11.0 | 32.0 | 32.0 | 40.0 | 47.0 | 32.0 | 36 |
| Moundou | 30.0 | 6.0 | 36.0 | 18.0 | 42.0 | 51.0 | 32.4 | 37 |
| Gounou Gaya | 11.0 | 14.0 | 50.0 | 12.0 | 44.0 | 40.5 | 32.5 | 38 |
| Beinamar | 30.0 | 7.0 | 36.0 | 19.0 | 45.5 | 51.0 | 33.0 | 39 |
| Sarh | 34.0 | 18.0 | 32.0 | 34.0 | 37.0 | 47.0 | 33.1 | 40 |
| Mao | 24.0 | 40.0 | 11.0 | 50.0 | 12.0 | 31.0 | 33.2 | 41 |
| Kyabé | 34.0 | 19.0 | 32.0 | 44.0 | 39.0 | 47.0 | 33.5 | 43 |
| Benoye | 30.0 | 9.0 | 36.0 | 17.0 | 47.5 | 51.0 | 33.6 | 44 |
| Nokou | 24.0 | 49.0 | 11.0 | 48.0 | 5.0 | 31.0 | 33.7 | 42 |
| Moussoro | 24.0 | 48.0 | 11.0 | 49.0 | 4.0 | 31.0 | 33.7 | 45 |
| Goré | 50.5 | 2.0 | 42.5 | 10.0 | 47.5 | 34.5 | 34.9 | 46 |
| Bébédjia | 50.5 | 5.0 | 42.5 | 8.0 | 43.0 | 34.5 | 35.1 | 47 |
| Paibokoum | 50.5 | 1.0 | 42.5 | 11.0 | 52.0 | 34.5 | 35.2 | 48 |
| Doba | 50.5 | 8.0 | 42.5 | 9.0 | 41.0 | 34.5 | 35.5 | 49 |
| Lai | 47.0 | 17.0 | 46.0 | 22.0 | 38.0 | 40.5 | 38.5 | 50 |
| Béré | 47.0 | 12.0 | 46.0 | 20.0 | 49.0 | 40.5 | 38.6 | 51 |
| Kélo | 47.0 | 13.0 | 46.0 | 21.0 | 51.0 | 40.5 | 39.0 | 52 |

Source: BSA/ONDR; MOH; SAP; MADR; NOAA/NASA; GAC; ONC; FEWS/Chad

Table F-4: Current (Short-term) Vulnerability Categories and Final Ranking

| Sub-Prefecture | Long-Term Ranking | 1989-91 Per Capita Production | 1991 Cereal Price | 1990 NDVI | CNNTA Survey | RANK | |
|-------------------|-------------------|-------------------------------|-------------------|-----------|--------------|------|-------|
| | | | | | | Avg | Final |
| Ennedi | 6.0 | 2.0 | 2.0 | 33.0 | 2.0 | 9.0 | 1 |
| Iriba | 14.0 | 16.0 | 4.0 | 23.5 | 1.0 | 11.7 | 2 |
| Guéréda | 16.0 | 16.0 | 12.5 | 6.5 | 10.0 | 12.2 | 3 |
| Biltine | 15.0 | 16.0 | 10.0 | 16.0 | 9.0 | 13.2 | 4 |
| Abéché | 28.0 | 16.0 | 14.5 | 3.0 | 8.0 | 13.9 | 5 |
| Bokoro | 8.0 | 9.0 | 14.5 | 9.5 | 32.0 | 14.6 | 6 |
| Tibesti | 4.0 | 2.0 | 2.0 | 33.0 | 32.0 | 14.6 | 7 |
| Borkou | 5.0 | 2.0 | 2.0 | 33.0 | 32.0 | 14.8 | 8 |
| Adré | 31.0 | 16.0 | 19.0 | 3.0 | 7.0 | 15.2 | 9 |
| Massakory | 13.0 | 9.0 | 26.0 | 1.0 | 32.0 | 16.2 | 10 |
| Mangalmé | 2.0 | 40.5 | 26.0 | 6.5 | 6.0 | 16.2 | 11 |
| Nokou | 42.0 | 5.0 | 8.0 | 21.0 | 5.0 | 16.2 | 12 |
| Oum Hadjer | 27.0 | 25.5 | 11.0 | 9.5 | 11.0 | 16.8 | 13 |
| Arada | 11.0 | 16.0 | 5.0 | 23.5 | 32.0 | 17.5 | 14 |
| Am Zoer | 17.0 | 16.0 | 9.0 | 14.5 | 32.0 | 17.7 | 15 |
| N'Djaména | 12.0 | 9.0 | 34.0 | 3.0 | 32.0 | 18.0 | 16 |
| Mao | 41.0 | 5.0 | 30.0 | 12.5 | 3.0 | 18.3 | 17 |
| Ati | 21.0 | 25.5 | 12.5 | 5.0 | 32.0 | 19.2 | 18 |
| Massenya | 9.0 | 9.0 | 36.0 | 12.5 | 32.0 | 19.7 | 19 |
| Moussoro | 45.0 | 5.0 | 30.0 | 18.0 | 4.0 | 20.4 | 20 |
| Am Dam | 22.0 | 16.0 | 26.0 | 9.5 | 32.0 | 21.1 | 21 |
| Ngouri | 23.0 | 21.5 | 17.0 | 14.5 | 32.0 | 21.6 | 22 |
| Bitkine | 1.0 | 40.5 | 18.0 | 18.0 | 32.0 | 21.9 | 23 |
| Mongo | 3.0 | 40.5 | 16.0 | 18.0 | 32.0 | 21.9 | 24 |
| Goz Beïda | 18.0 | 16.0 | 30.0 | 21.0 | 32.0 | 23.4 | 25 |
| Bol | 29.0 | 21.5 | 32.0 | 9.5 | 32.0 | 24.8 | 26 |
| Djédaa | 25.0 | 25.5 | 28.0 | 21.0 | 32.0 | 26.3 | 27 |
| Bousso | 10.0 | 9.0 | 50.5 | 38.0 | 32.0 | 27.9 | 28 |
| Melfi | 7.0 | 40.5 | 33.0 | 33.0 | 32.0 | 29.1 | 29 |
| Moissala | 33.0 | 31.0 | 22.0 | 33.0 | 32.0 | 30.2 | 30 |
| Koumra | 36.0 | 31.0 | 22.0 | 42.0 | 32.0 | 32.6 | 31 |
| Sarh | 40.0 | 31.0 | 22.0 | 42.0 | 32.0 | 33.4 | 32 |
| Maro | 32.0 | 31.0 | 22.0 | 51.5 | 32.0 | 33.7 | 33 |
| Baibokoum | 48.0 | 44.5 | 6.5 | 38.0 | 32.0 | 33.8 | 34 |
| Abou Déïa | 24.0 | 51.0 | 35.0 | 27.0 | 32.0 | 33.8 | 35 |
| Bongor | 26.0 | 36.0 | 50.5 | 27.0 | 32.0 | 34.3 | 36 |
| Beinamar | 39.0 | 25.5 | 39.0 | 38.0 | 32.0 | 34.7 | 37 |
| Doba | 49.0 | 44.5 | 6.5 | 42.0 | 32.0 | 34.8 | 38 |
| Léré | 35.0 | 36.0 | 45.0 | 27.0 | 32.0 | 35.0 | 39 |
| Kyabé | 43.0 | 31.0 | 22.0 | 47.5 | 32.0 | 35.1 | 40 |
| Pala | 30.0 | 36.0 | 45.0 | 33.0 | 32.0 | 35.2 | 41 |
| Am Timan | 19.0 | 51.0 | 50.5 | 27.0 | 32.0 | 35.9 | 42 |
| Fianga | 34.0 | 36.0 | 45.0 | 33.0 | 32.0 | 36.0 | 43 |
| Haraze Mangueigne | 20.0 | 51.0 | 50.5 | 27.0 | 32.0 | 36.1 | 44 |
| Moundou | 37.0 | 25.5 | 39.0 | 47.5 | 32.0 | 36.2 | 45 |
| Benoye | 44.0 | 25.5 | 39.0 | 42.0 | 32.0 | 36.5 | 46 |
| Gounou Gaya | 38.0 | 36.0 | 45.0 | 42.0 | 32.0 | 38.6 | 47 |
| Goré | 46.0 | 44.5 | 39.0 | 47.5 | 32.0 | 41.8 | 48 |
| Bébédjia | 47.0 | 44.5 | 39.0 | 51.5 | 32.0 | 42.8 | 49 |
| Laï | 50.0 | 48.0 | 45.0 | 47.5 | 32.0 | 44.5 | 50 |
| Béré | 51.0 | 48.0 | 45.0 | 47.5 | 32.0 | 44.7 | 51 |
| Kéïo | 52.0 | 48.0 | 45.0 | 47.5 | 32.0 | 44.9 | 52 |

Source: BSA/ONDR; MOH; SAP; MADR; NOAA/NASA; GAC; ONC; FEWS/Chad

Map 10: Sudan Vulnerability Assessment Summary



Thirty Percent of the Population At-Risk

Report released by USAID/Sudan on June 6, 1991

SUMMARY

Disastrous harvests in 1990 following severe drought resulted in a grain production deficit of 1.2-1.5 million metric tons (MT) that affected virtually everyone in Sudan, a country of some 25.7 million people (see Map 9). In December 1990, the World Food Program (WFP) estimated emergency food needs for 1991 of 1.19 million MT for about 8 million drought victims, displaced persons, malnourished children, and refugees. Conditions have worsened since then, especially among traditional groups in Southern Kordofan. Relief agencies will be hard pressed to meet even the needs predicted in December.

Food assistance pledges (free and commercial) of almost 700,000 MT, plus anticipated commercial imports should make up this deficit. However, relief must reach vulnerable people in order to avert massive starvation in 1991. Seeds, now entirely depleted, must also reach rural farmers in time for the new agricultural season that starts in June. Agencies plan to distribute seeds with relief food.

Two straight years of drought, lack of reserves, and serious economic deterioration (with a general inflation rate of 122%), have overwhelmed normal coping strategies. Chronically, and currently, the most vulnerable groups are:

- traditional small farmers, pastoralists throughout Sudan, and agropastoralists in the West because of drought, crop and pasture failures, lack of alternate employment opportunities, depleted reserves and assets, and high grain prices;
- agropastoralists in southern Sudan because of drought and insecurity;
- displaced persons in southern towns because of relief delivery problems; and
- urban poor throughout the country because of grain scarcity and exorbitant prices.

The elderly, pregnant and lactating women, and young children in these groups are particularly vulnerable and many may be in a condition of famine.

The current vulnerability of these many groups makes the success of the 1991/92 agricultural season absolutely critical. Ideally, an excellent 1992 harvest would provide adequate subsistence for smallholders, allow for agricultural employment, and produce sufficient surplus to reduce prices for nomads and urban consumers, and provide for relief needs of the displaced. Given a failure in delivery of seeds or insufficient rains in the coming months, massive amounts of relief would be necessary in 1992.

METHODOLOGY

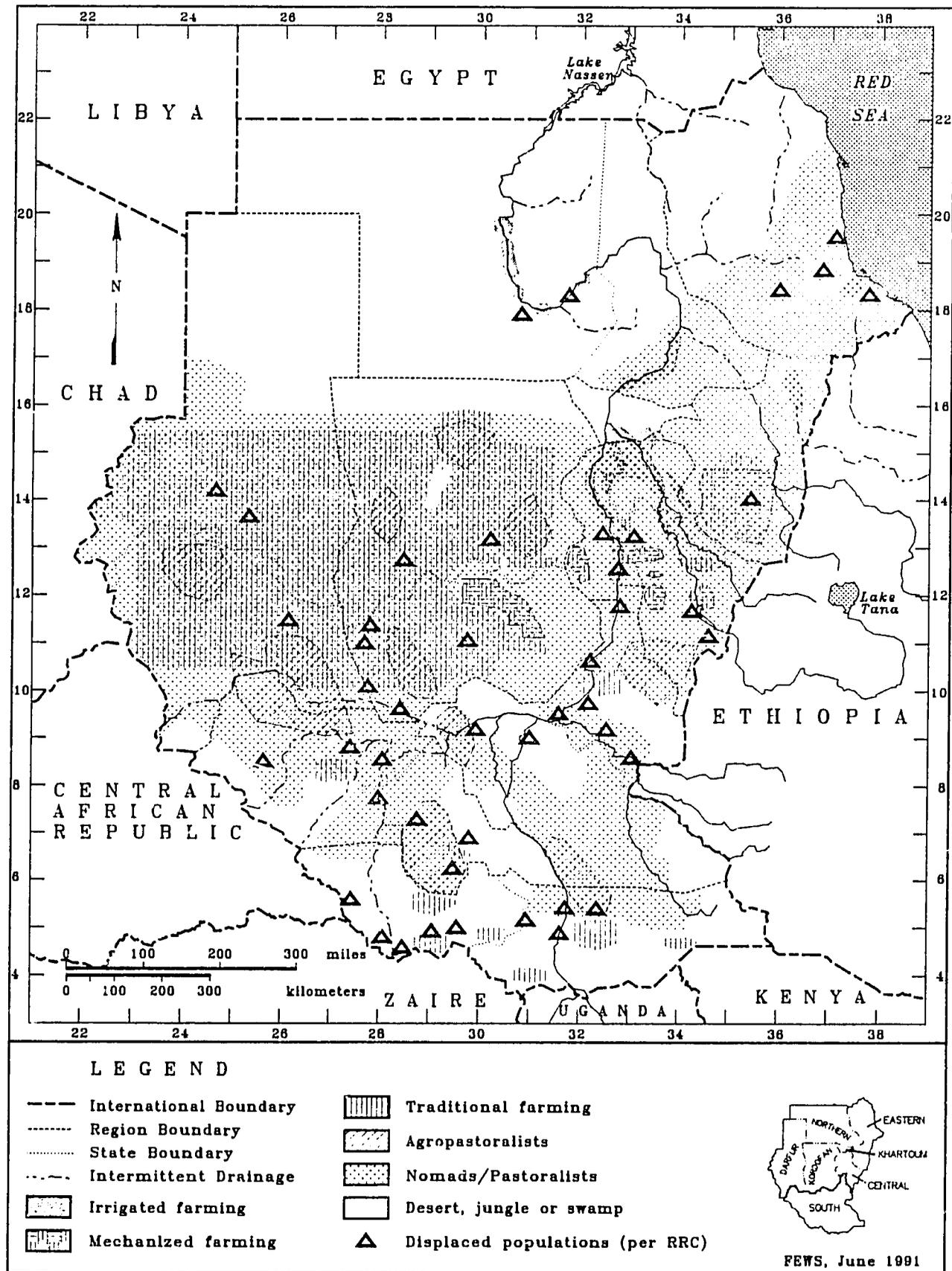
Quantitative data in Sudan are infrequently and inconsistently collected. Most reliable and most widely available are grain prices, animal prices, and rainfall. Historic comparative data is spotty. Other data collection tends to be ad-hoc. Agricultural production estimates and numbers of displaced persons are available but only reliable as general indications of magnitude. Nutrition data is collected in areas where problems are suspected and there is often no comparable time series data. Most information is qualitative and comes from interview and observation based field assessments. Sources of quantitative and qualitative data include Sudan national and regional government offices, USAID/Sudan analysis, UN agencies, NGOs, and other donors. Areas such as the South are virtually inaccessible and conclusions must be drawn on a minimum of information. A summary table describing the vulnerable groups can be found in Appendix G. See Map 10 for locations of the socio-economic groups described below.

VULNERABILITY OF SOCIOECONOMIC GROUPS

General Conditions

Grain is either unavailable or prohibitively priced in rural markets. Prices have increased 400-700% since last year. In Darfur, millet in August 1990 cost £S 525 per "90 kilogram" sack (£S 525/90 kg), in December £S 1,800/90 kg, in January £S 2,000/90 kg and March £S 3,400/90 kg. Normally prices decline after the October harvest. Even the price of wild grain is £S 700/90 kg, over double last year's price for sorghum.

Map 11: Sudan's Socioeconomic Groups



In Khartoum, grain prices are at unprecedented levels and beyond the purchasing power of many, while the volume available is low. In January, sorghum was £S 1,650/90 kg and in April it was £S 2,000/90 kg. During the same period in 1990, the prices were £S 240/90 kg and £S 675/90 kg, respectively. Prices are even higher in the South, where harvest is low and access is severely limited. Although only tiny quantities are found, the price of sorghum in Malakal is £S 4,000/90 kg. As an expected one million MT of relief and commercial grain enter Sudan, market prices in northern Sudan should decrease, possibly significantly. This will have a positive effect on middle income groups who cannot afford food but are not targeted for relief.

Farmers and nomads sell animals to purchase food grain. Animal prices are now one-half to one-fourth last year's prices. Sale of one goat will buy about 3-10 kg of sorghum (about a 2-5 day family supply), compared to last year when one goat could be exchanged for about 54-110 kg grain. In a good year, such as early 1989, one goat exchanged for 150-250 kg grain.

There is a general absence of income opportunities for rural peoples. The 50% failure of the mechanized farming sector dramatically diminished employment opportunities and kept wages low on agricultural schemes. Workers are often paid in food, but this year employers have no food for payment and can not offer employment. Many seeking jobs were forced to return to their villages or go to displaced camps instead. Other income strategies such as wood gathering, charcoal making, and water sales are impossible because of the current lack of animals for transport. Even when possible, they are hardly sustaining. At current grain and wood prices in Southern Kordofan, a family would have to collect 7.3 MT per month to satisfy their food needs. Long-term environmental degradation have made these strategies less and less viable, even in better years.

There are widespread distress migrations of farmers. In some areas over 30% of village residents have left. Pastoralists are also moving in search of food and water for themselves and their remaining animals. There are indications that some migrants are returning home as a result of relief distributions. However, the absence of seeds and scarcity of drinking water have deterred some displaced farmers from returning to their villages.

There is now soaring child malnutrition throughout Sudan. One unconfirmed report claimed 80% malnutrition rates in some eastern areas. Malnutrition among children in Haya district of the Red Sea Hills was 70%, of which 30% were severely malnourished.¹ In parts of Kordofan malnutrition is over 60% among children under five. In many areas, malnutrition rates

¹ For the most part, nutritionists in Sudan define "malnourished" as being less than 80% of the standard weight for a child's height, and "severely malnourished" as being less than 70% of the standard weight for a child's height.

have doubled and tripled since December of 1990. Anemia in as many as 50% of nursing mothers in some areas is preventing breast feeding, further threatening child survival.

Malnutrition related mortality is reported in rural areas and among the displaced in urban centers. In one rural council in Northern Kordofan, mortality has increased fivefold over last year, primarily among young children and the elderly. In Sodari (Northern Kordofan), from January through the end of March, deaths were averaging about 240 persons per month.

Farmers

Traditional Smallholders

Subsistence farmers throughout Sudan are the largest single group currently at-risk and dependant on relief. Without emergency relief they would be in a condition of famine. The majority of them, about 5.1 million, are in Kordofan and Darfur (in western Sudan), and are normally moderately to highly vulnerable. Others are in eastern, central and southern Sudan (see Appendix H for a definition of "eastern Sudan," "central Sudan," etc.).

For at least 30 years these farmers, particularly in the West, have experienced declining agricultural productivity due to environmental deterioration and socio-economic factors. In 1990, production for the traditional sector was 280,000 MT, compared to 418,000 MT in 1984. For every year in the past 10, western Sudan has experienced production deficits ranging from 200,000 MT to 470,000 MT. In Kordofan, the average crop yield has declined 63% in the last 25 years and 44% in just the last 10 years. Overall yield (millet and sorghum) for 1990 in Kordofan was about 15-22 kg/feddan, compared with 52 kg/feddan in 1984.

Every year, traditional farmers (and pastoralists) must buy grain grown on the mechanized and irrigated schemes. These families have grown increasingly dependent on seasonal agricultural labor migration, sometimes permanent migration, and remittances by some family members. These adjustments are failing to prevent increasing vulnerability. In addition, increased labor migrations have led to labor scarcity on the small farms, further decreasing local capacity. Western Sudan is fast becoming permanently destitute.

In 1990/91 smallholder farmers have depleted or lost virtually all of their assets and are nearly destitute. They have no reserves, have eaten their seed stocks and sold or eaten their limited livestock, and are virtually without outside income. Nutrition and health are very poor (see General Conditions, above).

Mechanized

These several thousand mechanized farming families are normally food secure by virtue of their relatively large farms which usually produce significant surpluses. They are able to store reserves of food and other assets. Laborers do the cultivation while the owners live in towns. Even with the 50% production failure of this sector in 1990, stored assets and reserves should mean this group is only moderately vulnerable.

Irrigated

This group in eastern, central and northern Sudan number only about 200,000 families. They are not dependent on erratic climatic conditions. Their surplus supplies their own needs and feeds other areas and urban populations. High government priority on irrigated farming ensures them adequate and timely inputs. In 1990 irrigated production was excellent. They are among the least vulnerable.

Agropastoralists

North

Agropastoralists in western Sudan are primarily semi-sedentarized nomads, forced to partially adopt farming as a result of previous droughts and livestock losses. Members of the families still participate in animal migrations to follow pasture and water sources.

They have been affected by the same drought circumstances as both traditional farmers and nomads throughout north Sudan and have had to respond with the same coping strategies with the same results. They are targeted to receive relief and are assessed as currently being at-risk.

South

Southern subsistence farmers and agropastoralists are currently highly vulnerable. Normally they practice a mixed agricultural strategy which includes cultivation of crops such as sorghum, corn, and vegetables; fishing; and animal husbandry of cattle and small livestock. Herding remains the mainstay and most preferred strategy for a diet made up largely of meat and dairy products. Rains throughout the South are usually adequate for cultivation and pastures. In the most southern areas, however, heavy rains, swamps and flooding breed mosquitos that carry cattle-killing diseases, making herding impracticable (especially in much of Eastern and Western Equatoria, and the western border of Bahr el Ghazal).

Women now head a large proportion of the households and conduct most of the farming because of the absence of men due to the war or herding. War, localized drought (particularly in western Bahr El Ghazal) and flooding (in Jonglei), have seriously disrupted subsistence over the past decade. No reserves

of food or livestock have been built up. Cattle losses due to disease and raiding have been large. In some areas, farming has been impossible because of fighting. Reserves, seeds, and livestock have been taken or destroyed. A shortage of equipment has greatly reduced fishing. In many areas people are surviving on their remaining animals or wild foods. The situation is compounded by the difficulty and insecurity of reaching many of these remote areas to make assessments, and to provide relief.

Pastoralists/Nomads

Pastoral and nomadic groups, with a population of about 2.6 million, are spread throughout Sudan. As with the smallholder farmers, they have been experiencing continually deteriorating resources as degradation, overgrazing, and land competition increase, making their long-term vulnerability moderate. Many have not fully recovered from stock losses in 1984. Migratory routes have been squeezed between insecurity in the south and encroaching desert in the north.

A large proportion of this group is targeted for emergency relief. Many are reported to have lost most of their animals and are now destitute. Assuming relief arrives, they will remain at-risk because of the long-term effects of the drought on their production. Without immediate and ongoing relief they would be in famine.

In Sudan, pastoralists are less economically diversified than farmers, with fewer alternative sources of income. They require less of an economic or environmental shock and take longer to recover than farmers.

For two consecutive years, pastures in the north have failed and water has been virtually unavailable. Livestock mortality is extremely high. Unconfirmed reports claim 90% losses in the East. In March in Kordofan there were reports of 80-100 animal deaths per day.

Landless

Permanently settled, rural-based farm laborers live near the mechanized and irrigated agricultural schemes in eastern and central Sudan. They are paid in both cash and food. When not working, they depend on the market for their food.

In 1990, the poor mechanized harvests, combined with considerable employment competition and high food prices, made this group moderately to highly vulnerable. In some areas, such as Gedaref, they are included in famine relief plans because of mechanized farming failures that have put the landless at-risk of famine. Employment was available further south in Blue Nile, where mechanized crops fared better, and in irrigated areas such as Gezira. The landless in these latter areas may be only moderately vulnerable.

Urban

Poor and unskilled laborers

This group normally has little savings, few assets, and low, inconsistent income. Increased unemployment, continued low wages, and food price increases have made this group currently highly vulnerable. Children, pregnant women, and the elderly could be at-risk.

In Khartoum, although there are occasional subsidized food ration programs, there is no mechanism nor inclination for providing greater assistance. There are no ongoing nutrition surveys conducted to examine the condition of this group.

In large towns, particularly in the West, there are fewer employment opportunities than in Khartoum, less food available in the markets, and higher food prices. In some towns, 60% of the poor are being included for emergency relief and supplemental feeding programs.

Middle income (including civil servants)

Although this group has steady employment, food prices have outstripped wages. In Khartoum, this group is now moderately vulnerable. In some rural towns they are highly vulnerable and have been included for assistance, because of fewer secondary employment opportunities and higher food prices.

Southern Towns

A large proportion of people, particularly poorer residents, children and the elderly, are probably highly vulnerable and many are probably at-risk. In many cases, relief and supplemental feeding is targeted for displaced people in southern towns, but is not available for permanent residents, making them more vulnerable than the displaced. Little is known about their current asset base or income, but access to food is extremely limited. Long-term war and other problems have prevented sufficient food from being grown locally. Southern towns have been virtually cut off from normal food supplies from elsewhere. Grain prices are often double Khartoum's exorbitant prices.

Displaced

Tragically, the displaced represent about 15% of the total population of Sudan, or about 3.5 to 4 million people. Both estimates and the numbers themselves vary widely and fluctuate continually.

Khartoum and North Sudan

There are approximately 1.8 million displaced in Khartoum, about 800,000 of whom live in camps and settlements around the city. The remainder are integrated into the city and can be regarded here as urban poor. The majority of displaced are not

normally assisted and depend on occasional employment. Many are long-term war-displaced or victims of previous famines in 1984 and 1987. Many others are recent arrivals and have had little time to establish themselves.

A failing national economy, soaring inflation, lack of jobs, low wages, and high food and water prices has made them all highly vulnerable and some at-risk. All children, pregnant and lactating mothers, and elderly should be regarded as at-risk. Many of these most vulnerable individuals receive emergency and supplemental feeding. Overall child malnutrition in April 1991 was about 17%. It was up to 24% in some settlements, with up to 7% severe malnutrition.

Future vulnerability could increase and many more could require assistance, because the government wants to remove all displaced from Khartoum. It has recently moved thousands to satellite camps outside of Khartoum, where the displaced incur huge resettlement costs (£5 6,000-12,000 to build a mud hut for a population that earns £5 50 per day), no services are available, and access to employment is very limited.

Many thousands of newly displaced are living near rural towns throughout Northern Sudan, particularly in the West. They are generally destitute and sometimes find occasional employment, but primarily depend on relief. Relief is more dependably and more widely given to this group than to southern- or Khartoum-displaced. They are therefore assessed here as highly vulnerable, but would be at-risk if relief were to stop.

Camps/Settlements South

Displaced at camps and settlements around GOS and SPLA towns are destitute and depend almost entirely on relief. Currently, they are at-risk, as erratic delivery of some relief has prevented famine. Often they receive half rations, or nothing for long periods. There are frequent delays and cancellations of food airlifts, problems with supply by barge, and ongoing difficulties with the poor security and conditions of roads. If relief deliveries improved, they would be only highly vulnerable.

Rural South

There is a large but uncounted number of people throughout the South displaced from their villages and moving, with or without animals, in search of food and pastures. They survive on wild foods and remaining animals. They are at-risk.

Refugees

There are currently about 730,000 refugees in Sudan. About 700,000 are Ethiopians residing in eastern Sudan, with about 20,000 Chadians in the West and 10,000 Ugandans, Zairians, and others in the South and elsewhere.

Settled/Integrated

At least 330,000 Ethiopians live in planned settlements or are integrated into eastern towns, Khartoum, and Port Sudan. Most have been in Sudan a long time and have found employment, or have been given land in settlement areas. They are not normally relief recipients, except for particularly vulnerable individuals (women, children, newcomers), who receive assistance when necessary. However, they are now subject to the same crop failures, employment scarcity, and food prices as Sudanese and so are now highly vulnerable.

Camps

About 370,000 Ethiopians and 20,000 Chadians are assisted by the UNHCR. They generally have few assets and have abandoned their normal production strategies. Although they depend largely on relief and supplementary feeding programs, they sometimes find marginal sources of income. This year, relief delivery problems have sometimes resulted in half rations. Malnutrition rates of over 30% have been reported among children. Because of this disruption of their relief food supply, and their inability to purchase food, they are now at-risk.

CONCLUSIONS

Emergency relief needs in 1992 are a certainty. The overall high level of vulnerability for Sudan and the millions who are presently at-risk or in a condition of famine dictate that Sudan will certainly require significant levels of emergency relief in 1992, in addition to all currently planned relief in 1991. Several factors, discussed in the scenarios below, will influence whether relief needs will be as little as 200,000 MT or as much as 1,000,000 MT. Even in the best case, the depletion of assets and disruption of production over the past two years has been so severe that it will take years to recover.

In the best case scenario, farmers receive relief and seeds, can return to their land to farm, and rains are good. As usual, there would still be a localized production deficit in the West, but the harvest would be sufficient for part of the area's food needs. The irrigated and mechanized sectors would produce enough to provide agricultural employment, surplus to the traditional consumers, and reduce market prices. Vulnerability of the urban poor would be reduced. With no reserves, farmers

would be moderately vulnerable, but probably need no relief. For nomads, even good pastures would not insure recovery because of their inability to quickly replace lost animals. Their need for emergency assistance may well continue to 1992 and for some time after, depending on the final severity of their stock losses. In addition, relief would still be needed by war-displaced persons residing in northern and southern Sudan and by some refugees. At current figures, this could mean about 200,000 MT relief for displaced and refugees in 1992. This amount could potentially come from in-country production.

Mid-range scenario: Rains could be sufficient but seeds unavailable for the traditional sector, or delivered too late. The other sectors could produce enough for surplus, employment and reduced prices. The West would again be totally dependant on outside employment and grain. Subsistence farmers, experiencing a third year of low production and depleted assets, and without reserves, would be highly vulnerable or at-risk and would require significant relief. Assuming agricultural employment in the East is available for some western farmers, relief needs could be about 200,000 MT, in addition to the 200,000 MT cited above for displaced persons and refugees. Supplementary feeding for mothers and children would be an important requirement. National production could potentially provide sufficient supply for relief needs.

In the worst case, there could be another drought. This would lead to worse conditions than those obtained in 1990/91 (given pre-existing vulnerability) and necessitate massive relief for all highly vulnerable groups. With poor production and no reserves, imported food needs could again exceed one million MT, much of which would need to be in the form of donated relief. Emergency relief needs would approach one million MT.

In each currently at-risk group, nutrition data and cultural practices suggest that pregnant and lactating women, the elderly, and young children in particular may now be in a famine condition. Where the overall groups are now highly vulnerable, these individuals may be at-risk. Special attention will be paid to monitoring these individuals. Primary indicators for monitoring any change in vulnerability levels among at-risk and highly vulnerable groups will be rainfall, access to agricultural inputs, pasture development, relief deliveries, grain prices, and, later, agricultural and livestock production. Secondary indicators will be nutrition and employment.

APPENDIX G: 1991 Vulnerability Assessment for Sudan

| Groups/ Subgroups | Population (millions) | Place | Current Vulnerability | Reasons | Indicators | Base Vulnerability | Future Vulnerability |
|---------------------------------------|--------------------------|-------------------------------|--------------------------|---|---|-------------------------|-------------------------|
| FARMERS | | | | | | | |
| Traditional | 4.48 | West | At-risk | Drought, no employment, no reserves, war | Agricultural production, prices, migration, nutrition | Moderate | High |
| | 0.40 | Central | | | | | |
| | 0.87 | East | | | | | |
| | 2.40 | South | | | | | |
| Mothers/ Children (traditional) | | All | Famine | Food access | Malnutrition, disease, mortality | | |
| Mechanized | 10,000 families | East Central | Moderate | Assets | Past production | Slight | Slight |
| Irrigated | 200,000 families | East, Central, Northern | Slight | Production, assets | Current production | Slight | Slight |
| AGROPASTORALISTS | | | | | | | |
| Mothers/ Children | 0.92 | West | At-risk | Same as farmers and pastoralists | | Moderate | High |
| | 0.77 | South | High | | | High | High |
| | | | All | Famine to at-risk | Food access | Health | |
| PASTORALISTS | | | | | | | |
| Mothers/ Children | 1.20 | West | At-risk | Water, drought | No pastures, stock loss, terms of trade | High to Moderate | At-risk to High |
| | 0.47 | East | | | | | |
| | 0.94 | South | | | | | |
| | | | All | Famine | | Malnutrition, health | |
| LANDLESS | | | | | | | |
| | 0.12 | East | At-risk to moderate | Employment, prices | No employment, high prices | Slight to Moderate | Slight to Moderate |
| | 0.27 | Central | | | | | |
| URBAN | | | | | | | |
| Poor | 3.58 | North | High to at-risk | Prices | | Moderate | High |
| | 0.43 | South | High to at-risk | Scarcity, food access, prices, war, | | Moderate | Moderate to High |
| Middle Income | 1.80 | North | Moderate | Assets, savings | | Slight | Slight |
| | 0.21 | South | High | Lack of access, prices | | Moderate | Moderate |

| Groups/ Subgroups | Population (millions) | Place | Current Vulnerability | Reasons | Indicators | Base Vulnerability | Future Vulnerability |
|---------------------------|-------------------------------|------------------|--------------------------|-------------------------------|------------------------------------|-----------------------|-------------------------|
| DISPLACED | | | | | | | |
| Integrated | 1.00 | Khartoum | High | Scarcity, prices | | Moderate | High |
| Camps | 0.80 | Khartoum | High to At-risk | | Malnutrition | Moderate to High | Moderate to High |
| | 0.49 | North | High | | | | |
| | 0.91 | South | At-risk | Relief delays, shortages | | At-risk | At-risk |
| Rural | Several Thousand People | South | At-risk | No access | Migration | At-risk | At-risk |
| Mothers/ Children | | All | Famine | | Malnutrition, anemia, mortality | At-risk | At-risk |
| REFUGEES | | | | | | | |
| Settled and Integrated | 0.33 | Khartoum East | High | Prices, employment | Malnutrition | Slight | Moderate |
| Camps | 0.39 | East West | At-risk | Relief delays, low rations | | High | High |

Sources: pastoralists – proportionate estimate of nomadic population (1983 census); agropastoralists – proportionate estimate of rural western and southern population (1983 census); mechanized farmers – the total acreage divided by holdings; irrigated farmers – USAID/Sudan estimate; landless laborers – 5% of total population in eastern and central states (1983 census); urban poor – 60% of urban population; urban middle class: 30% of urban population; displaced – Commission on Displaced/RRC figures; refugees – UNHCR

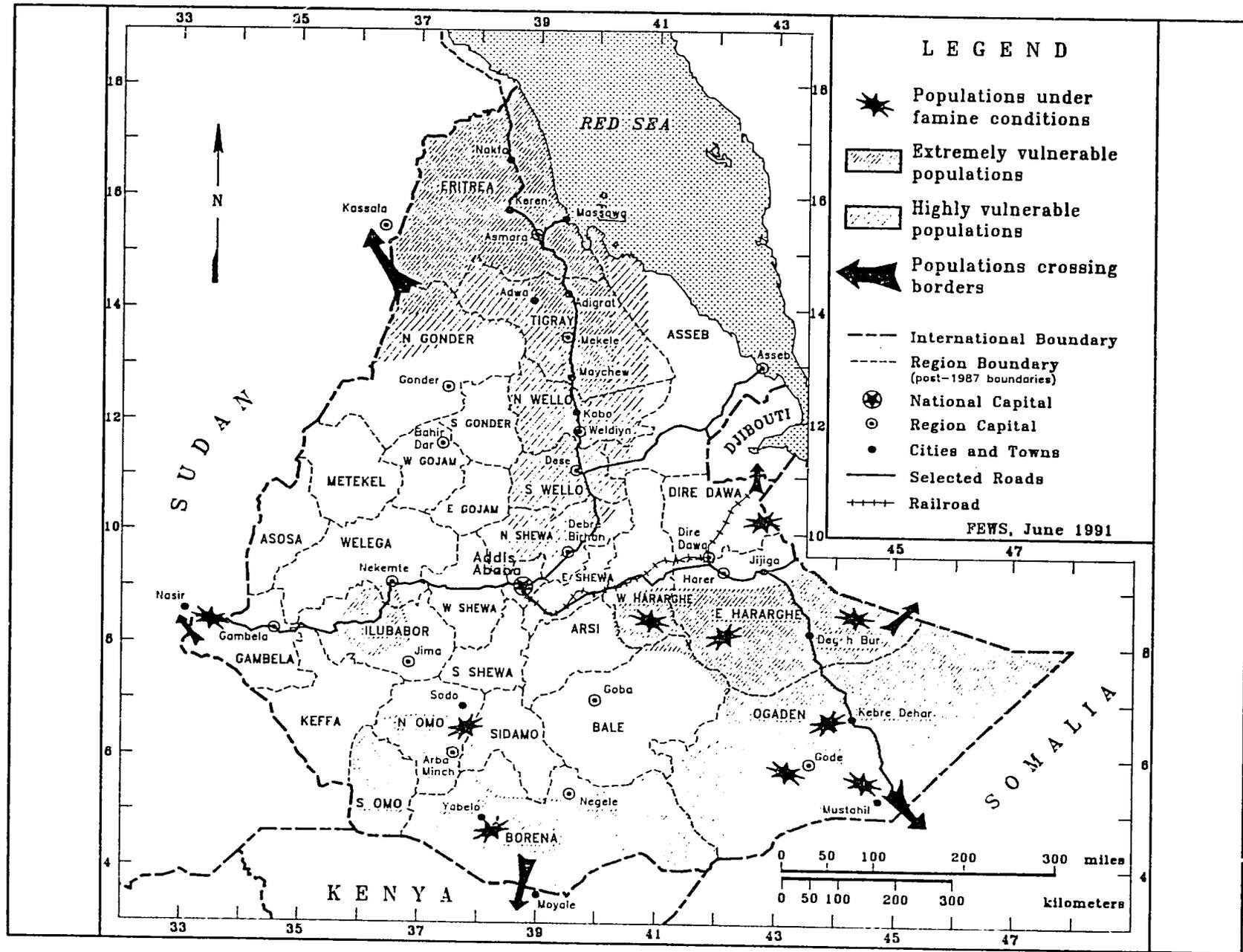
NOTES: Not all members of each group necessarily have the same level of vulnerability. Designations refer to the majority of the group. There are no official census figures which cover the division of groups and geographic zones represented. All figures are estimates based on extrapolation and projections from the 1983 Sudan census.

APPENDIX H: Geographic Divisions of Sudan

A variety of names for the geographic divisions of Sudan are used in this and other reports. An organizational guide to the common and administrative names used for the many regions and states of Sudan is presented here.

| Common Divisions | "Compass Point" | Administrative Region | State |
|------------------|-----------------|-----------------------|--|
| North | North | Khartoum | Khartoum |
| | | Northern | North Nile |
| | East | Eastern | Red Sea Kassala |
| | | Central | Blue Nile White Nile El Gezira |
| | West | Darfur | Northern Darfur Southern Darfur |
| | | Kordofan | Northern Kordofan Southern Kordofan |
| South | | Upper Nile | Upper Nile Jonglei |
| | | Bahr el Ghazal | Bahr el Ghazal el Buheyra (Lakes) |
| | | Equatoria | Eastern Equatoria Western Equatoria |

Map 11: Ethiopia Vulnerability Assessment Summary



ETHIOPIA

Record Numbers Extremely Vulnerable to Famine as Regime Collapses

Report released by FEWS/Ethiopia on June 10, 1991

SUMMARY

With the May 1991 collapse of the Mengistu government (GPDRE) and the resulting civil disorder disrupting the economy, hampering relief efforts, and severely limiting inputs for the 1991 agricultural season, Ethiopia is arguably at its most vulnerable this year. Unless civil order is restored quickly and relief efforts resumed nationwide, a disaster of major proportions is likely. Current levels of vulnerability in Ethiopia are towering when compared to other FEWS countries (excluding Sudan), and are even high when compared to previous years in Ethiopia. The number of people living at the margin has increased dramatically over the past decade due to an untenable mix of consecutive years of drought and increasing civil strife. Chronic and episodic food stress have left up to 7,000,000 people in Ethiopia and along its borders extremely vulnerable to famine (see Map 11).

In the East, up to 750,000 refugees and returnees and over one million lowland pastoralists in Harerghe, Dire Dawa, and Ogaden regions¹ are extremely vulnerable from a combination of chronic and current events. In the North, civil strife and drought have rendered an estimated 4,000,000 agriculturalists and agropastoralists in Eritrea and northern Tigray regions extremely vulnerable for a second year. Up to 1,000,000 people in southern Tigray, North and South Wello and Northern Shewa regions remain moderately to highly vulnerable following successive years of poor harvest and civil strife. To the south, chronic food insecurity, exacerbated by poor agricultural and pastoral conditions, has made 330,000 agropastoralists in North Omo, South Omo and Borena regions extremely vulnerable to famine. Other pockets of extreme vulnerability include up to 400,000 Sudanese refugees in Gambela Region, 34,000 lowland agropastoralists in the trypanosomiasis-infected areas of Welega and Ilubabor, and a rapidly increasing population of

¹ In order of precedence, Ethiopia's administrative units are regions and awrajas. New region and awraja boundaries were drawn in 1987 under the GPDRE. While these new boundaries have remained unofficial, much of the information FEWS now receives refers to the new boundary definitions. The thematic maps in this chapter are therefore based on the new boundary definitions. Appendix I contains maps showing post- and pre-1987 regions boundaries for the reader's reference. It is likely that the new government will redefine region and awraja boundaries.

poor, unemployed and displaced people in urban areas around the country. The latter already number in the hundreds of thousands and are increasing daily as a result of political developments.

METHODOLOGY

This analysis is the result of an examination of available agrometeorological and socioeconomic information using a "convergence of evidence" approach. Interpretation of information gathered through remote sensing (vegetation indices) and not yet confirmed in the field has been cautious. Information on "disputed" areas of Ethiopia is frequently subjective and the baseline data against which to evaluate this information are only now under construction.

The FEWS Project does not have a field representative in Ethiopia. Instead, Ethiopia is covered from the FEWS/Washington office, using a variety of physical and socioeconomic data obtained in the U.S., Addis Ababa and elsewhere. Events in Ethiopia have prevented FEWS personnel from visiting the country since December 1990. Therefore, much of the information included in this analysis is taken from reports contributed by the U.S. Agency for International Development in Addis Ababa (USAID/Addis Ababa), the Government of Ethiopia (GOE), the United Nations community, and a number of non-governmental and private voluntary organizations (NGOs and PVOs, respectively). For this reason, the nature of the analysis is often more descriptive or interpretive than is the case where FEWS has an in-country presence.

VULNERABILITY OF SOCIOECONOMIC GROUPS

Returnees, Refugees and Displaced People

The 1990 FEWS Vulnerability Assessment identified 700,000 Somali and Sudanese refugees in border camps in the East and West as being moderately vulnerable to famine. By April 30, 1991, their number had increased to nearly 1.1 million. Relief operations that were adequate to maintain this

population at a moderate level of vulnerability last year have been overwhelmed by the events of early 1991, rendering many of these people extremely vulnerable to, or already in the midst of, famine. The recent political changes have also added several hundred thousand prisoners of war (released from former GPDRE garrison towns) and internally displaced people to the ranks of those already extremely vulnerable to famine.

Ethiopian Returnees and Somali Refugees

Up to 750,000 Ethiopian returnees and Somali refugees are extremely vulnerable in camps and towns throughout Dire Dawa, East Harerghe, and Ogaden regions (see Map 12). The most immediate needs can be found among Ethiopian "returnees" -- those who fled to Somalia after the Ogaden War of 1977/78 and began returning in January 1991 after months of food insecurity in refugee camps in Somalia. The collapse of the Somali government in March 1991 brought many more, with a great many arriving in a deteriorated state of health. The worst-affected of these refugees and returnees have very few if any personal resources, and little or no capacity for self-provision.

Nutritional surveys indicate an alarming deterioration in health, especially among children, who are suffering from pneumonia, diarrhea and other related diseases. Save the Children Federation of the United Kingdom (SCF/UK) reported in March 1991 that 2,000 children (59% of those under five years of age) in the Kebre Bayih refugee camp were malnourished (fell below 80% of the standard weight for height), with many severely malnourished and worse (in the "less than 70% and 60% weight for height" categories, respectively). Initial screening of children at Darawanaji and Teferi Ber camps revealed malnutrition rates of 29% and 15%, respectively. Visitors to the area at the end of May reported ten children dying per day in the Teferi Ber camp alone. Much of this population is already in the midst of famine. By most estimates, many hundreds, possibly thousands, of these people have already died.

Relief officials have been trying for months to mount an effective relief program in the Ogaden. These efforts have been hampered from the beginning by excessive rains, a notoriously poor transportation infrastructure, the relative paucity of relief resources (i.e. personnel, fuel, trucks, or existing PVG/NGO and government relief programs), and myriad political sensitivities among and between the various groups and governments involved. Recently, efforts have been further complicated by the breakdown of civil order along the relief supply route. Relief convoys have been hijacked, drivers have been killed, and food stores have been sacked in Jijiga and in the Aware camps (from which all relief officials recently have been forced to flee). Relief deliveries throughout the region were stopped in late May. Reports as of June 10 indicate that tens of thousands of refugees have begun to move back into Somalia in search of food. The United Nations World Food Program (WFP) warned

on May 31 that "the lack of food commodities due to continuing insecurity is likely to cause a major disaster for refugees, returnees and people affected by drought." Only the immediate resumption of all relief activities on a massive scale could prevent a major disaster for these populations.

Sudanese refugees

Up to 400,000 Sudanese refugees in Gambela Region are "at risk" of famine due to low food supplies, continued disruptions in relief food deliveries, and civil strife. The United Nations High Commission for Refugees (UNHCR) reported the loss of large quantities of relief food destined for these western camps just prior to the Ethiopian Peoples Revolutionary Democratic Front (EPRDF) takeover of Welega Region in March. The closing of regular supply routes to Gambela forced the UNHCR to use a more costly and time-consuming alternative route, delaying new deliveries and reducing camp reserves to a one week supply. Civil disorder in early June led to the theft of 50 relief trucks, halting the UNHCR program in its tracks and putting the quick resumption of relief efforts in great question. Reports from the area as of June 10 suggest that a spontaneous, and possibly massive, repatriation of Sudanese refugees may already be underway.

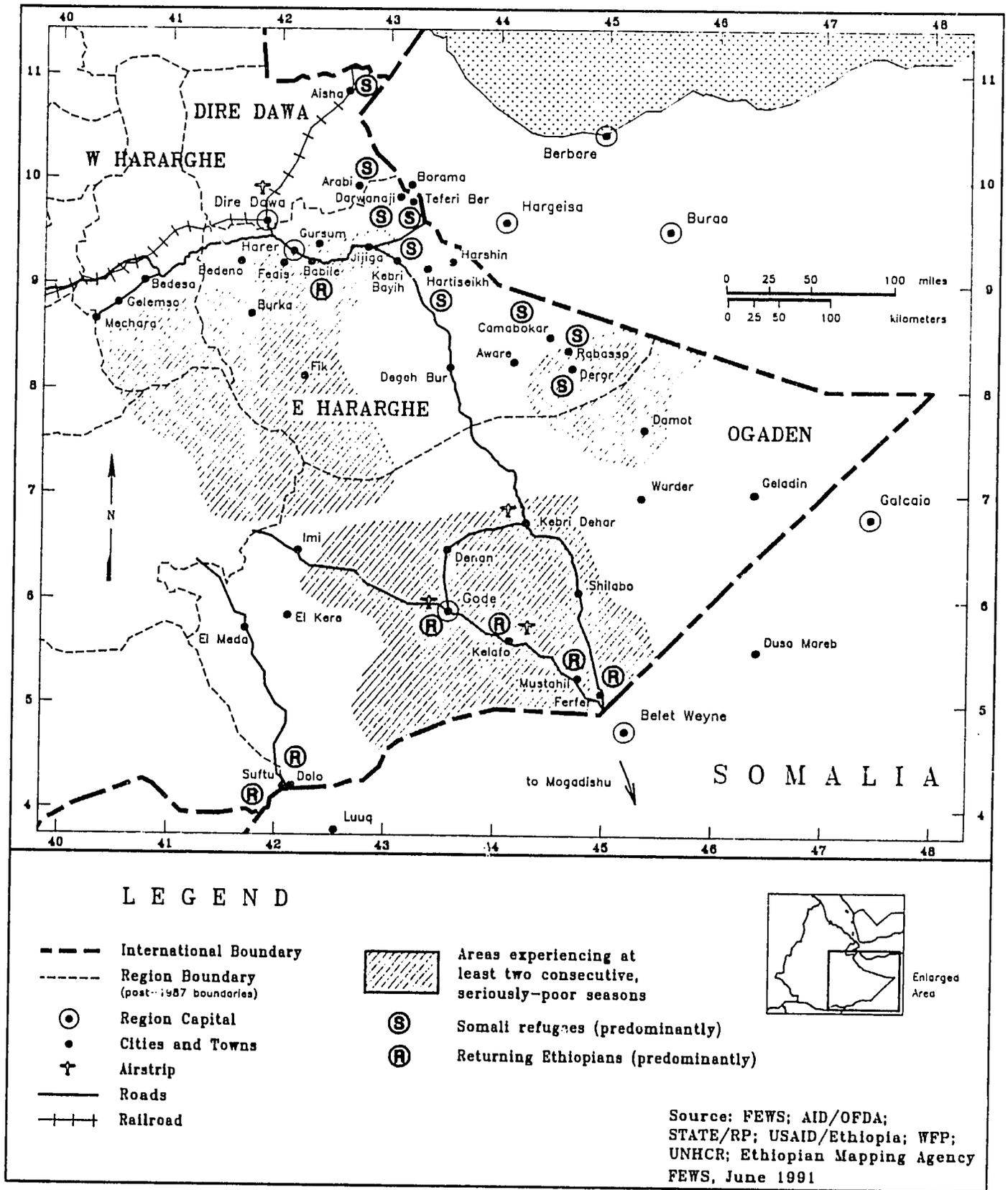
Displaced Populations

Previous FEWS reports cited extreme vulnerability among displaced populations, particularly in GPDRE-held areas in the North. A second consecutive year of drought combined with civil warfare has prolonged the vulnerability of these populations and added greatly to their numbers. As of June 15, several hundred thousand people were estimated to be newly displaced, primarily in Addis Ababa and the North. Many of these are prisoners of war from former GPDRE garrison towns in Eritrea and Wello. In addition, the collapse of the GPDRE sent tens of thousands of former government officials, sympathizers, military personnel and their dependents scurrying across borders into Djibouti, Sudan, Kenya and Somalia. Sudanese officials claim up to 150,000 refugees have sought asylum in Kassala. U.S. Government and UNHCR officials believe the true number is closer to 30,000. There are also reports of 25,000 displaced Ethiopians in Moyale, Kenya, and up to 35,000 people in or recently expelled from Djibouti. These displaced people, many of whom were forced to flee overnight and had not been paid in months, are extremely vulnerable to famine. The international community will certainly be called upon to provide immediate assistance to these displaced persons. Unless and until the EPRDF-led provisional government offers an extensive and convincing political amnesty, these numbers are unlikely to diminish.

Drought-Affected Pastoralists in the Ogaden

Over 500,000 pastoralists in the Ogaden are suffering from successive seasons of drought and the breakdown of traditional

Map 12: Eastern Ethiopia



economies, food systems and drought response mechanisms caused by civil and economic disorder in Somalia. The unexpected influx of refugees and returnees from Somalia further strains a population already under severe food stress (see Map 12). The recent collapse of civil order in eastern Ethiopia has made an already difficult relief operation almost impossible, rendering these nomadic and semi-nomadic people extremely vulnerable to famine. Only the restoration of traditional trade economies with Somalia offers any real hope for the rebuilding process to begin.

The overwhelmingly pastoral population of the Ogaden is traditionally oriented toward Somalia for nearly all of its trade and commerce. While these households are quite familiar with drought and typically quite able to sustain themselves through successive poor seasons, they are not equipped to deal with the near-complete breakdown of traditional economies and food systems in the Ogaden resulting from the March 1991 collapse of the Somali state. Local and regional markets disappeared, denying Ogadeni pastoralists both their source of earnings and traditional supplies of purchased food. The terms of trade for pastoralists declined precipitously as the demand for livestock dried up and grain prices increased. In March in Gode, 20 goats had to be exchanged for 100 kilograms (kg) of maize. In Korahe, the exchange was 15 goats for 100 kg of maize. Ominously, these towns are not even in the areas most affected. Food stocks are reported to be exhausted everywhere and all market supplies are short. Grain prices are well beyond the level most of these pastoralists can afford. While trade in grains from other parts of the country may pick up some of the deficit left by the cut in trade with Somalia, supplies in the Ogaden are certain to remain very limited and the price of grain, exorbitant.

The 1991 main rainy season (March through May in the Ogaden) offers no real hope for a quick recovery. The satellite-derived vegetation index suggests that while the main rains were quite strong at the start, especially throughout western Ogaden, Korahe, Danot, and northern Welwel *awrajas*, these rains were not consistent or well-distributed through the rest of the season. Below-average pasture conditions were evident by the middle of May, especially in Shilabo, Mustahil and Kelafo *awrajas*, and the next rains are not expected until October.

Many animals have died or have been traded away for small quantities of grain, severely reducing the major economic resource of the pastoral household and forcing households to abandon their preferred means of production. This population is extremely vulnerable and many have already died. The RRC estimates 107,000 metric tons (MT) of food assistance is needed, but by the end of May only a small portion of that was delivered or in the pipeline. The same difficult relief environment hampering the refugee and returnee relief operations in the Ogaden obstructs relief to this indigenous population as well. Even a good rainy season in October is unlikely to restore these pastoral people to economic independence. Until herds can be rebuilt

to a viable level, many of these households will remain dependent upon the kindness of strangers for the resources necessary for their survival.

Agropastoralists in East and West Harerghe and Dire Dawa

Up to 500,000 midland and lowland agropastoralists in East and West Harerghe and Dire Dawa regions are extremely vulnerable to famine owing to two or three successive years of drought and chronic food stress caused by civil insecurity, declining land holdings and an increasing reliance on agriculture in areas not well suited for permanent cultivation. Poor 1990 rainfall in areas below 1,500 meters altitude led to the near-complete failure of maize and sorghum, which together are said to account for 80% of the annual cereal harvest in these regions. In East Harerghe, the lowland areas of Gursum, Garamuleta, Bedeno, Fedis, Meyu Burka and Burka *awrajas* are the most affected. In West Harerghe, the lowlands of the southern-most *awrajas* (Darolebu and Boke Kuni) are worst off. Cereal stocks in most midland and lowland areas have been depleted for some time and cereal prices in all areas are unseasonably high. Exceedingly high consumption of famine foods, migration for wage labor and sales of firewood have been observed everywhere. SCF/UK reported unseasonal population movements in March in Gursum, Jijiga, Fedis and Bedeno (northwestern East Harerghe). In addition, their nutritional monitoring reports indicate that the mean (average) weight-for-length of children has declined significantly in all zones surveyed. SCF/UK field reports from Garamuleta, Bedeno and Meyu Burka (southwestern East Harerghe) cited severe malnutrition in a number of villages. CARE reported four deaths per day in April in two small displaced persons camps in Burka Town. These statistics are particularly alarming as they come at a time when recovery following replenished food stocks would be expected.

The prospects for early relief in East and West Harerghe are grim. Field reports suggest an irregular 1991 early rainy season in these areas, and the vegetative conditions as of June 1 were well below average precisely in those midland and lowland areas so heavily affected last year. A bad 1991 season would make for a third (fourth, for some) consecutive bad harvest, and would likely have disastrous effects. Furthermore, the recent collapse of the GPDRE has disrupted civil order in Dire Dawa Region, threatening one of the strongest regional economies in Ethiopia. This is particularly ominous since cash crops and seasonal wage earnings are an important element in the household income calculations of many households in good agricultural years, and absolutely essential for their survival in bad years.

Drought-Affected in Eritrea and Northern Tigray

Nearly 4,000,000 highland and lowland Eritrean and Tigrean agriculturalists, agropastoralists and pastoralists are extremely vulnerable because of consecutive years of drought and civil strife, high livestock mortality and the breakdown of traditional

economies and drought response mechanisms. These factors have combined to reduce herds, level food stocks and deplete overall household resources to the point that preferred production strategies have long since been left behind by most of these households.

The 1990 drought was the fourth drought to hit Eritrea and Tigray in seven years. Because it immediately followed another drought year (1989), its effects were intensified. Even drinking water supplies were severely affected. Field and satellite data confirm near total crop and pasture failure from Asmara to the north (in Eritrea) and throughout much of Enderta, Agame and Kilde Awlaello *awrajas* in northeastern Tigray. In most other areas of Eritrea and much of northwestern Tigray, crop production was somewhat better but still significantly reduced.

The 1990 FEWS Vulnerability Assessment identified many Eritreans and Tigreans as extremely vulnerable due to consecutive poor harvests and the reduction of off-farm labor and trade opportunities. This year, many more fell into this category as off-farm labor opportunities were further curtailed. Agricultural and agropastoral populations in the north and west of Eritrea were particularly affected as they are more dependent on trade and labor opportunities in the Sudan, opportunities that did not exist this year. Likewise, those people dependent seasonally or otherwise upon the urban economy of Asmara were hard hit in 1990 as industry shut down. The closing of Massawa Port tripled cereal prices in much of Eritrea overnight, further complicating the food security of those dependent upon food purchases for all or part of their food consumption.

The traditional reliance on livestock in Eritrea and Tigray to mitigate the effects of poor agriculture was also weakened. The severe lack of pasture and water resulted in a drop in milk offtake, an overall weakened state of health in most herds, and many livestock deaths. Livestock prices declined precisely when cereal prices were increasing dramatically, driving terms of trade lower than ever before for many pastoralists and agropastoralists. In some areas, the sale of livestock as a drought response mechanism became unfeasible, as the animals were virtually without value. In Hamasien Awraja (surrounding Asmara), for instance, goats were traded for as little as eight kg of grain, as compared to the 50-60 kg of grain obtained in good years.

Rains in May were sufficient to relieve most parts of Eritrea of the serious water shortage evident since November. Pasture is also greening up again in northern areas. This promises to relieve pressure on grazing areas in the southwest of Eritrea. Tigray has not been as fortunate. Field reports indicate a complete failure of the *belg* (short, or secondary) rainy season in Tigray, especially in Raya Azebo (on the Tigray-Wello border), where *belg* production is usually quite significant. Indeed, satellite vegetation estimates for Tigray show critical cropping areas in the south and east to be well below average

going into June. While it is too early to predict the extent of the impact this might have on 1991 *meher* (main, or long, season) production, it is likely that production levels will be somewhat reduced even if Tigray receives sufficient and well distributed rainfall throughout the *meher* season. Shortages of fertilizer, seeds and labor alone will ensure this outcome.

Those in most immediate need are people in former GPDRE-controlled areas or dependent on Southern Line relief, since prolonged interruptions in the delivery of relief assistance in early 1991 have left them in a weakened state of health. Up to 100,000 Eritreans affected by the recent battle for Asseb and the Danakil area (to the northwest of Asseb Town) are also likely to be extremely vulnerable, having left their homes and resources in advance of the March offensive. As always, those households that have lost livestock, especially plow oxen, are extremely vulnerable as well. Households fortunate enough to have family members working outside of Eritrea and Tigray and remitting wages are somewhat better off. It is estimated that 350,000 MT of food relief is needed in Eritrea and up to 300,000 MT in northern Tigray. As of June 15, less than half of this amount had arrived or was in the pipeline. While relief distribution in these areas has improved considerably since the fall of the GPDRE, relief supplies are still not sufficient to meet the estimated need.

Drought-Affected in Southern Tigray, North Wello, South Wello and Northern Shewa

Up to one million agriculturalists, agropastoralists and pastoralists in southern Tigray, North Wello, South Wello and Northern Shewa regions are somewhat better off than their neighbors, but are still moderately to highly vulnerable, many for a second straight year. Below average 1990 *meher* agricultural production in Tigray and severely reduced *belg* 1991 harvests in the highlands of southern Tigray, North and South Wello and Northern Shewa unite with continued civil strife, disrupted economies and severely depleted household resources to keep these people vulnerable.

Overall, southern Tigray and Wello are less vulnerable than Eritrea and eastern Ethiopia due primarily to:

- the growing recovery of the local economies that began when GPDRE forces were forced out in 1989,
- restored opportunities for off-farm income made possible through the renewal of regional trade,
- the greater number and relative strength of drought response mechanisms, and
- their close proximity and easy access to surplus agricultural areas to the immediate south and west.

This is mitigated, however, by the fact that household resources are low, purchasing power is severely restricted and many people have come to depend on food aid as a first drought response. Add to this the poor start and reduced expectations of the 1991 agricultural season, and most agree that this population will remain moderately to highly vulnerable for at least the rest of this year. Continuation of relief food deliveries in the coming months is essential.

Drought-Affected in North and South Omo

Approximately 300,000 agriculturalists in the chronically resource-poor, overpopulated region of North Omo are finding their usual burdens exacerbated by successive seasons of poor rainfall. These people depend primarily upon root crops, which performed poorly in the 1990 *meher* season. Pest damage to sweet potatoes was close to 50% in some areas. According to the RRC, the most affected populations are in the lowland areas of Konso, Damot Weide, Damota, Kindo, Koisha, Mazie, Uba Mazie, Kemba, Zenti and Satusa *awrajas*.¹

Small land holdings and a dependence on two growing seasons, with the need to plant crops back to back, means there is rarely much surplus in household stores. Any shortfall can turn into a significant problem in regions as remote and highly-populated as these. SCF/UK nutritional teams reported rapid deterioration of health as early as January, with the situation in Kalso, Damot Weide and Damota *awrajas* serious enough to warrant emergency food distribution immediately. In one peasant association in Damot Weide, 45% of measured children were under 85% of the standard weight for length. SCF/UK also reported the presence of marasmus and kwashiorkor and a higher than average incidence of malaria, measles and diarrhea.

The RRC estimates that these people need 45,000 MT of relief food to get them through to the next harvest, in September 1991. Needs beyond that point are dependent on the outcome of the 1991 *belg* rains, which appear to have been quite strong everywhere except Konso, Damota, and Kinda Koisha *awrajas*. Coffee is an important cash crop in this area, so any significant disruptions in coffee economy this year would have an additional impact on this population.

Drought-Affected in Borena

An estimated 30,000 pastoralists and agropastoralists in southern Borena Region are extremely vulnerable to famine following the recent failure of their main rainy season (March to mid-May). Satellite imagery shows vegetative levels seriously below average at the end of May, particularly in Teltele Yabello, Dire, Arero, Liben, Moyale and Dolo Odo *awrajas* (all in southern Borena). Officials from CARE working in this

region confirm the poor rainy season and report a serious deterioration of health and even some deaths among the general population, especially women. In March, livestock deaths in Teltele Yabello *awrajas* were reported to have exceeded 25,000 animals. Prices for maize have skyrocketed, but there is very little available for sale due to poor grain production in the few cropping areas of the region and recent restrictions by the Kenyan government on the export of maize from that country. Many households are reported to have adequate financial resources from exceptional production last year, but there is no grain available in the markets for sale. Food relief or food supply relief is required immediately if further deterioration of health is to be prevented.

Trypanosomiasis-Affected areas of Welega and Ilubabor

Areas exposed to Tsetse flies, and therefore trypanosomiasis, are increasing in the lowlands and mid-lowlands of Welega and Ilubabor regions. This is a chronic problem that each year reduces the labor supply, thereby reducing household productivity in the lowlands. Each year, more and more people are forced out of fertile lowland areas into the already crowded and environmentally-degraded highlands. The populations of these lowland areas are extremely vulnerable, as they do not have root or cash crops upon which to rely. The RRC estimates 34,000 agropastoralists are now affected and will require approximately 3,500 MT of relief food.

Urban Dwellers

The GPDR for many years relied on a grain quota system to supply the military, government institutions, and urban consumers -- particularly several million residents of Addis Ababa -- with food grains at below market prices. The March 5, 1990 reforms abolished this system of forced transfers, leaving urban households and other former beneficiaries to fend for themselves in the open market. Since urban dwellers are typically dependent upon food purchases for the majority of their food consumption and lack alternative income or coping strategies to fall back upon when market access or purchasing power is curtailed, they become increasingly vulnerable to famine whenever food prices rise faster than real wages. Food prices have risen significantly since the March 1990 reforms and, given the uncertain political environment and agricultural outlook, they are likely to go much higher. As prices increase, hundreds of thousands of urban people, in Addis Ababa primarily, will become more vulnerable. Until more price information is available, these people should be considered moderately vulnerable.

Where continued civil strife has curtailed local economies (as in Asmara, Keren, Mekele and Dese), earnings and employment opportunities have fallen, further weakening the resources available to urban households and increasing their vulnerability to famine. Much of the population of Asmara and Keren are

¹ Damot Weide, Damota, Kindo, Koisha and Satusa are in northernmost North Omo Region; Mazie, Uba Mazie, Kemba and Zenti are in central North Omo; and Konso is in the south of North Omo.

extremely vulnerable and will remain so until the economies of these cities are restarted and regional economic and food systems (including those based on trade with the Sudan) are working once again. Most urban dwellers in Mekele and Dese remain moderately to highly vulnerable, though their situation continues to improve. The defeat last year of GPDRE forces in these areas and the opening of Southern Line relief operations have had a stimulating effect on these urban economies, and regional trade and labor opportunities have increased. However, relief food deliveries have played a critical role in sustaining these populations this year. Those deliveries must continue if the situation is to remain stable.

Urban populations in the eastern part of the country are also highly vulnerable at this time. Dire Dawa is the seat of a powerful regional economy and hence is critical to the food security of many. With the recent defeat of the GPDRE, Dire Dawa fell temporarily into civil disorder, from which it may take some time to fully recover. If the economy of Dire Dawa remains disrupted for an extended time period, many people, urban and rural, will become extremely vulnerable very quickly. Furthermore, extended problems in the Dire Dawa economy are likely to produce follow-on effects on the urban populations of neighboring Harer and Jijiga. If disruption in these areas were short lived, all but the urban poor can be expected to return to a moderately vulnerable status.

CONCLUSIONS

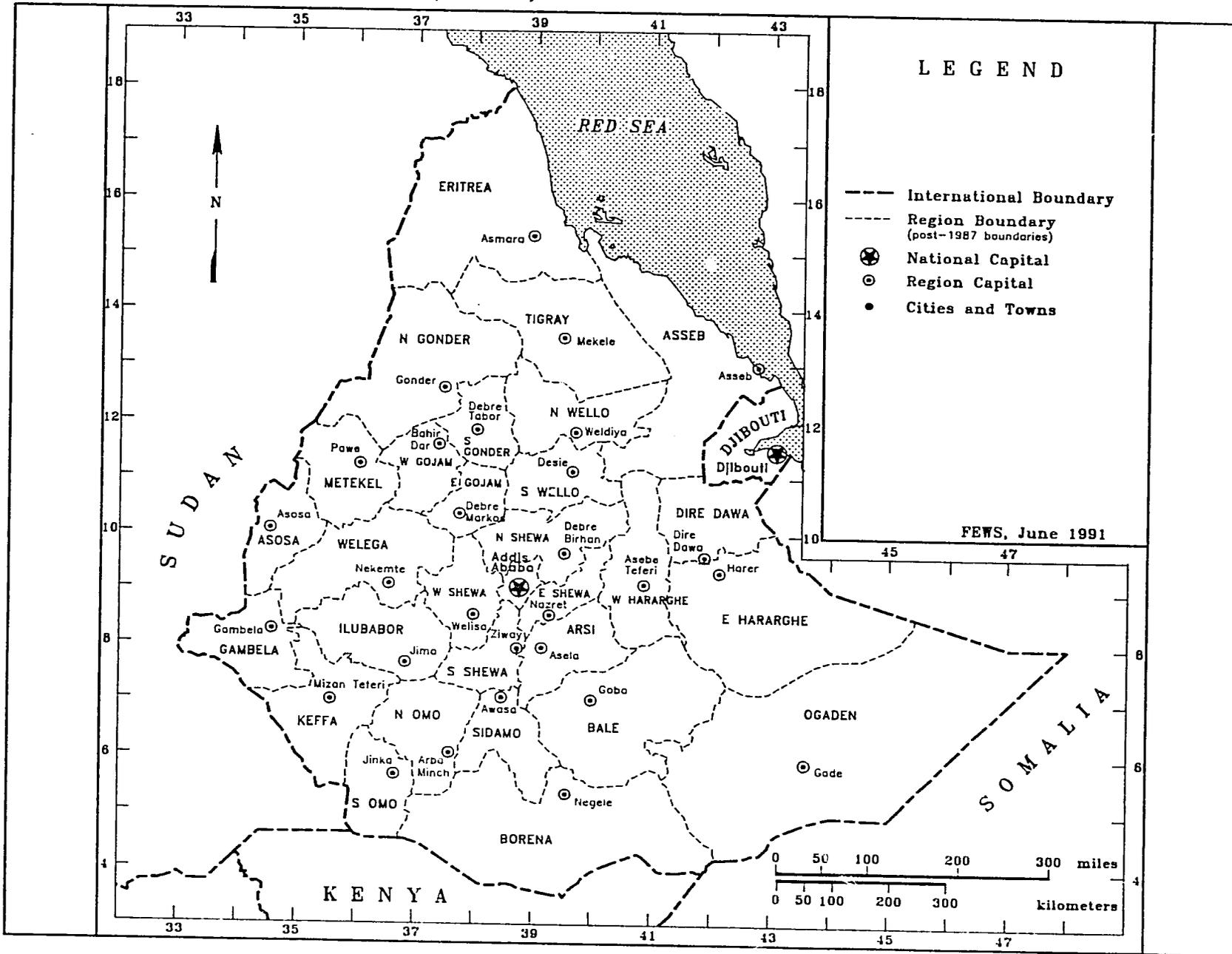
An estimated 6.5 to 7 million people in Ethiopia and on its borders are extremely vulnerable to famine and will need 750,000 to 1 million metric tons of food between now and the main harvest, which begins in November. As of April 31, approximately 250,000 MT of relief food had been delivered and 300,000 MT additional were pledged or in the pipeline. Many millions of other people around the country must be considered moderately vulnerable this year, because of the widespread erosion of assets and means of livelihood due primarily to four droughts in seven years combined with ongoing warfare and civil instability.

In the near future, much will depend upon the new government's ability to restore political processes and public policies and to maintain order in all regions of the country. The recent political instability and civil strife has already had an irreversible impact on the 1991 main agricultural season, hampering the supply of seeds, fertilizer, credit and other agricultural inputs to farmers in the most productive areas. Ominously, satellite imagery already suggests that vegetative conditions from late April through mid-June were significantly below average throughout many of the most important agricultural and pastoral areas of the country. In addition, field reports confirm that the *belg* harvest will be significantly reduced, especially in the critically *belg*-dependent areas of Northern Shewa and Wello.

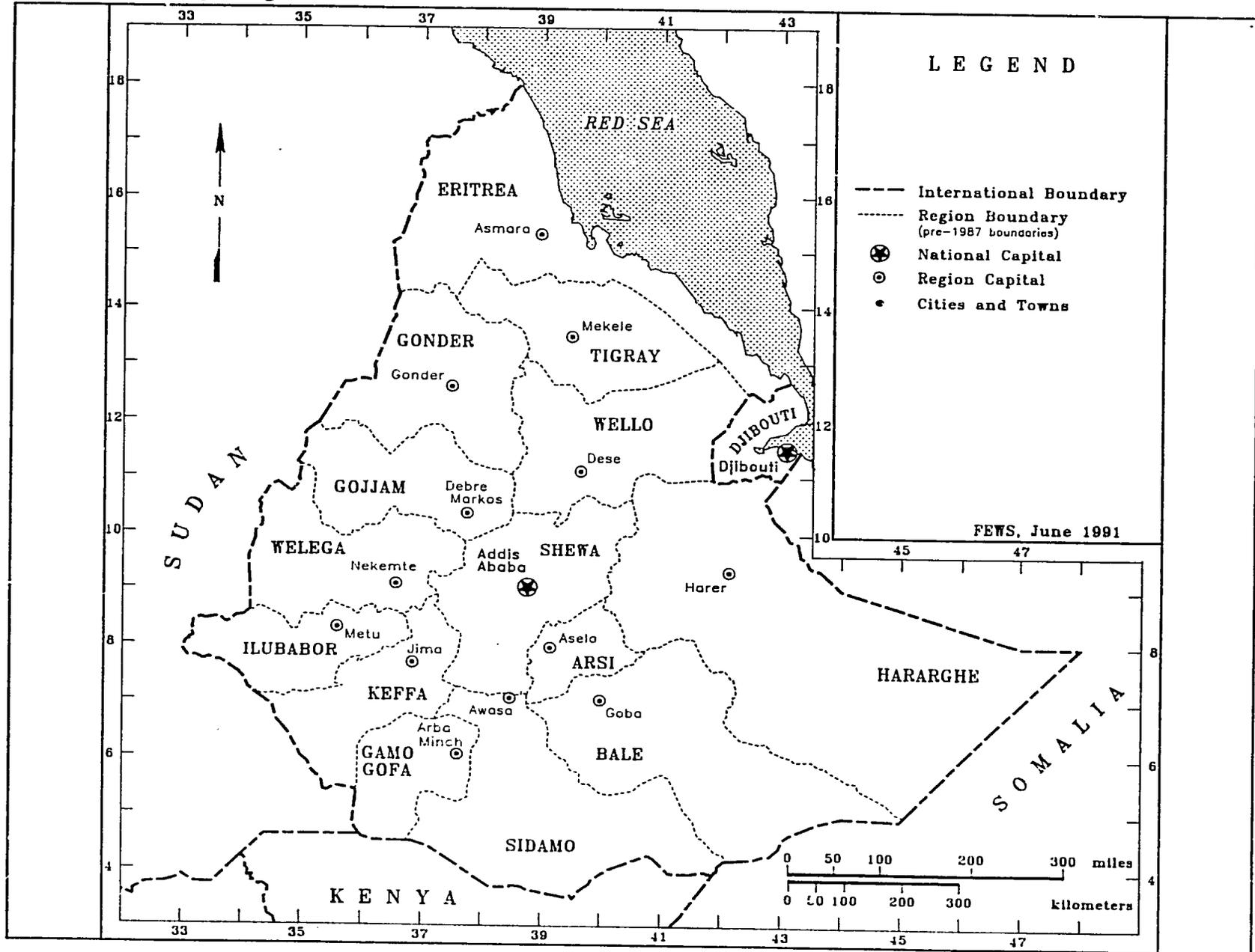
There is one small bright spot, regarding the relief efforts to millions of extremely vulnerable people in Eritrea. WFP has recently reported that distribution of relief food is taking place in all areas affected by drought. The resumption of daytime deliveries is making it possible to clear backlogs in Massawa and Asmara. However, as of the end of May, total relief food deliveries to Eritrea through all routes was only 135,000 MT, or 40% of ERA-estimated need for the region. Likewise, Southern Line relief activity into Wello and Tigray has also resumed, but is operating at a reduced rate. Total relief shipments up the Southern Line from January 1 to May 16 are estimated at 47,000 MT. Beyond the immediate, enormous, and deadly food shortages that prevail in the North, East and South of the country, there is an underlying fragility all across Ethiopia that threatens even those food supply institutions and processes that are currently functioning. The international community must continue and intensify its relief efforts in the coming months if it is to assure minimum loss and suffering of a very large and vulnerable population and mitigate the effect of agricultural and economic destitution on the next growing season, which has already begun. The latter will be more difficult, as it is already very late.

APPENDIX I: Post- and Pre-1987 Ethiopia Region Boundaries

Map I-1: Post-1987 Ethiopia Region Boundaries (unofficial)



Map I-2: Pre-1987 Ethiopia Region Boundaries



Key Terms

At Risk - FEWS Reports employ the term "at risk" to describe populations either currently, or in the near future, expected to have insufficient food, or resources to acquire food, to avert a nutritional crisis (i.e., progressive deterioration in health or nutritional condition below the status quo). "At risk" populations require specific intervention to avoid a life-threatening situation. Food needs estimates are sometimes included in FEWS reports. However, no direct relation exists between the numbers of persons deemed "at risk" and the quantity of food assistance needed. Famines are the culmination of a slow-onsetting process, which can be extremely complex. The food needs of specific "at risk" populations depends upon the point in this process when the problem is identified and the extent of its cumulative impact on the individuals concerned. The amount of food assistance required, from either internal or external sources, depends upon many considerations. Food need estimates periodically presented in FEWS reports *should not* be interpreted as food aid needs (e.g., as under PL-480 or other specific donor programs).

Vulnerability - FEWS Reports use the term "vulnerability" to indicate relative susceptibility to food insecurity of groups of people or areas. In FEWS usage, vulnerability is always characterized by its degree: slight, moderate, high, or extreme. Extreme vulnerability is synonymous with "at risk." Vulnerability is a dynamic concept that incorporates both chronic and current conditions. Chronic vulnerability involves long-term conditions that predispose a particular group or region to food insecurity. Current vulnerability highlights short-term changes in food security status and their implications. Vulnerability analysis involves three levels of concern: food availability, food access, and food utilization. These levels are linked by a common analytical framework that interprets all relevant information for its food security impact on the diversified income generating possibilities of different groups of households.

ITCZ - The Intertropical Convergence Zone (ITCZ) is equivalent to a meteorological equator; a region of general upward air motion and relatively low surface pressure bounded to the north and south by the northeast and southeast Trade Winds, respectively. The upward motion in the ITCZ forms the rising branch of the meridional Hadley Circulation. The ITCZ moves north and south following the apparent movement of the sun. It is at its most northerly position in the summer months. The position of the ITCZ normally defines the northern limits of possible precipitation in the Sahel; rainfall generally occurs 100 to 300 kilometers south of the ITCZ.

NDVI - Normalized Difference Vegetation Index (NDVI) images are created at the laboratory of the National Aeronautic and Space Administration (NASA) Global Inventory Modeling and Monitoring System (GIMMS). The images are derived from Global Area Coverage (GAC) imagery (of approximately seven kilometers resolution) received from the Advanced Very High Resolution Radiometer (AVHRR) sensors on board the National Oceanic and Atmospheric Administration (NOAA) Polar Orbiting series of satellites. The polar orbiter satellites remotely sense the entire Earth and its atmosphere once each day and once each night, collecting data in five spectral bands. Bands 1 and 2 sense reflected red and infrared wavelengths respectively, and the remaining three bands sense emitted radiation in three different spectral bands. The NDVI images are created by calculating $(\text{infrared} - \text{red}) / (\text{infrared} + \text{red})$ for each pixel from the daytime satellite passes. Since chlorophyll reflects more in the infrared band than in the red band, higher NDVI values indicate the presence of more chlorophyll and, by inference, more live vegetation. A composite of daily NDVI images is created for each 10-day period, using the highest NDVI value for each pixel during that period. This technique minimizes the effects of clouds and other forms of atmospheric interference that tend to reduce NDVI values. NDVI is often referred to as a measure of "greenness" or "vegetative vigor." The NDVI images are used to monitor the response of vegetation to weather conditions.

METEOSAT - METEOSAT-based Rainfall Estimates. FEWS uses rainfall estimates based on cold cloud duration as measured by thermal infra-red radiometers on the METEOSAT satellite. The estimates are calculated by the Department of Meteorology at the University of Reading in the U.K. Cold cloud duration correlates well with thunderstorm generated rainfall and, thus, is suitable for use in the semi-arid Sahel. The method works best on level terrain; hilly areas may produce local enhancements or rain-shadow areas that are not detected. In level areas the method has an accuracy of "rain/no rain" of at least 85% (based on a comparison with ground data). At a dekadal (ten-day) scale, 80% of rainfall amounts under 60 millimeters (mm) are accurate to plus or minus 10 mm, while rainfall over 60 mm is accurate to plus or minus 20 mm. This accuracy is acceptable for use in the FEWS-monitored region given that the method provides near-real-time coverage for a large area at a resolution of less than 10 kilometers.

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