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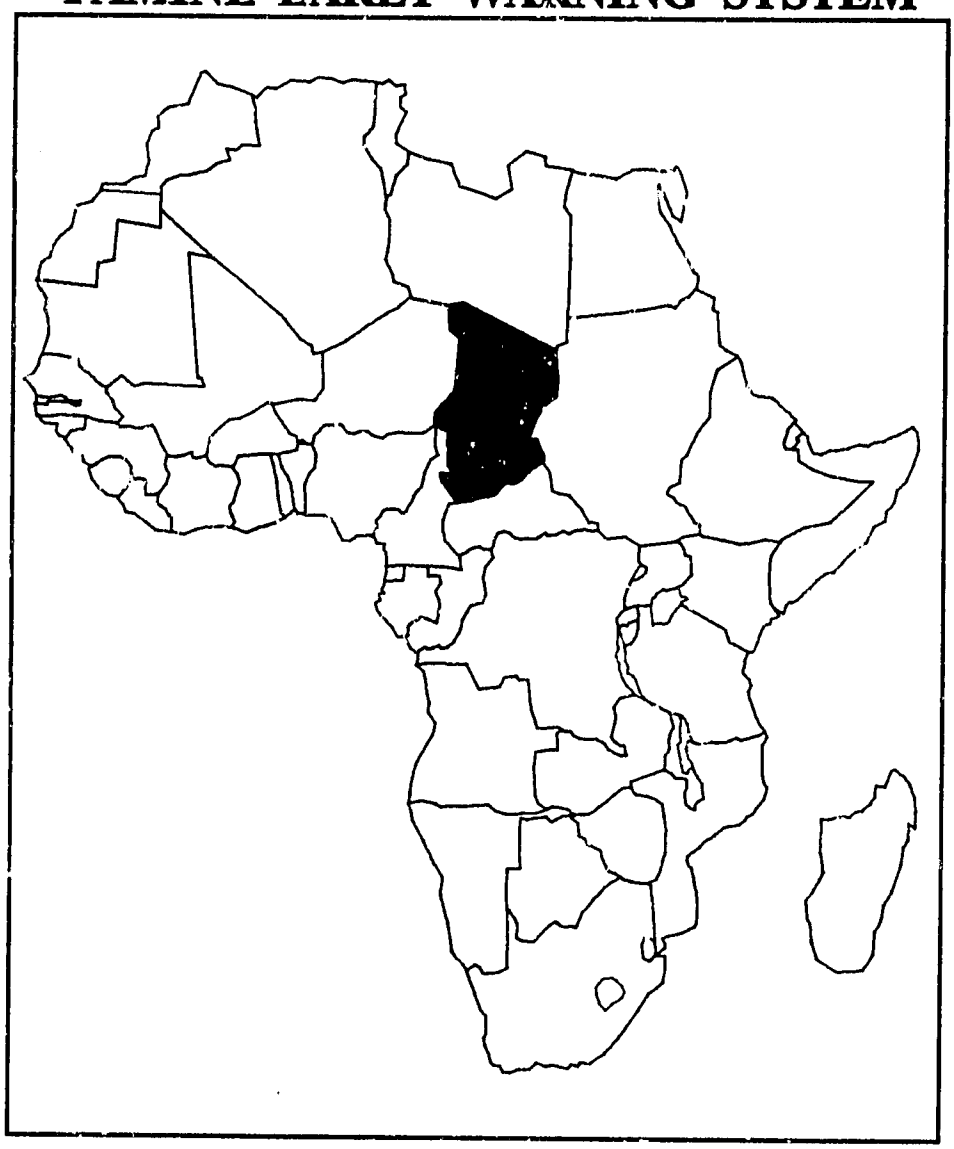
# CHAD

## VULNERABILITY ASSESSMENT

### FAMINE EARLY WARNING SYSTEM



Produced by the Office of Technical Resources - Africa Bureau - USAID

# FAMINE EARLY WARNING SYSTEM

The Famine Early Warning System (FEWS) is an Agency-wide effort coordinated by the Africa Bureau of the U.S. Agency for International Development (AID). Its mission is to assemble, analyze and report on the complex conditions which may lead to famine in any one of the following drought-prone countries in Africa:

- **Burkina**
- **Chad**
- **Ethiopia**
- **Mali**
- **Mauritania**
- **Niger**
- **Sudan**

FEWS reflects the Africa Bureau's commitment to providing reliable and timely information to decision-makers within the Agency, and among the broader donor community, so that they can take appropriate actions to avert a famine.

The FEWS system obtains information directly from FEWS Field Representatives assigned to six USAID Missions. In addition, FEWS relies on information it obtains from a wide variety of sources including: USAID Missions, host governments, private voluntary organizations, international donor and relief agencies, and the remote sensing and academic communities.

This is the final report prepared under FEWS Phase I. The vulnerability assessment was completed for USAID's Africa Bureau by **Price, Williams & Associates, Inc.**

Under Phase I, the work of the FEWS Field Representatives was coordinated by **Tulane University's School of Public Health and Tropical Medicine.**

**NOTE:** This publication is a working document and should not be construed as an official pronouncement of the U. S. Agency for International Development.

# CHAD

# Vulnerability Assessment

# June 1989

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# Vulnerability Assessment

## Executive Summary

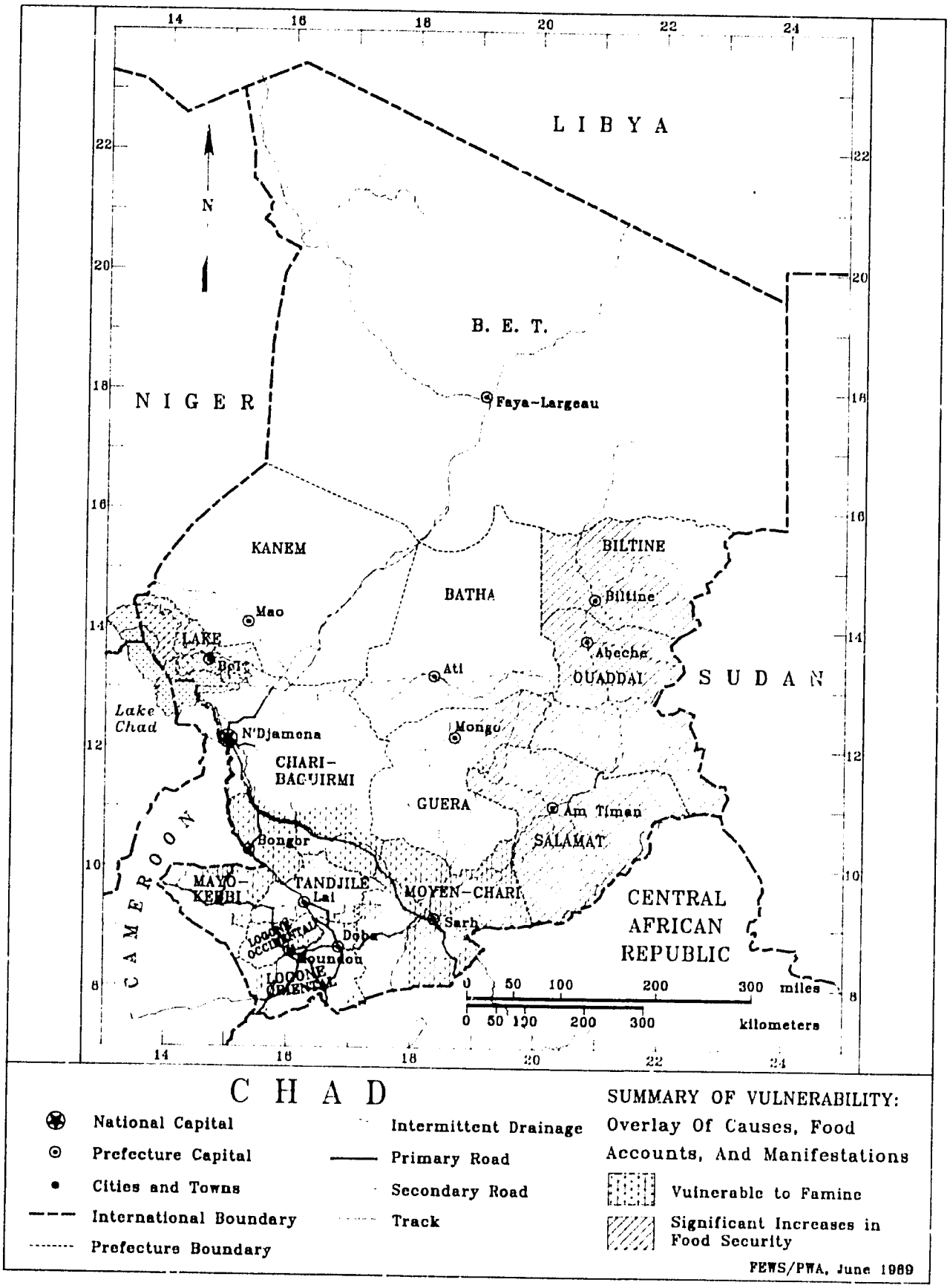
In an unusual turn of events, eastern Chad and the Lake Chad area experienced a bountiful harvest in 1988 and have seen extremely low cereal prices since, while the south of the country contains spots of significant food shortfalls and zones where further food shortfalls may yet surface. The primary causes of the southern food shortfalls are late summer floods and pests. The Sahelian zone bounty can be ascribed in large part to exceptional increases in the east for both the rainfed and the recessional sorghum harvests and to higher water levels in Lake Chad. Both the good and the bad appear the result of one of the heavier rainy seasons seen in the last two decades.

### DRY FORECAST FOR 1989 RAINFALL IN THE SAHEL

The Synoptic Climatology Branch (SCB) of the U.K. Meteorological Office forecasts a 60% chance that the Sahel will receive less than 75% of normal rainfall. The SCB therefore expects rainfall to be less than 1988 (an average year compared to the long-term mean) but more than the "very dry years of 1986 and 1987".

As part of the SCB's research into the effects of sea surface temperatures on Sahelian rainfall, it has made experimental rainfall forecasts each year since 1986. The SCB employs four forecast methods, all based upon sea surface temperature anomaly patterns in April. Three statistical methods predict that 1989 will be dry to very dry. A dynamic general circulation model method predicts more rain in the Sahel than either of the statistical methods. At this early stage of research, the SCB has more confidence in the dry forecast. The SCB warns that the forecasts are experimental and must be used with caution. The forecasts are based on the assumption that sea surface temperature anomalies will not change in an unusual way between spring and summer. This assumption broke down for the 1988 forecast, leading the SCB to continue monitoring sea surface temperatures after April this year.

**Map 1**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LOGONE ORIENTAL
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14 16 18 20 22 24
8 10 12 14 16 18 20 22
C H A D
National Capital
Prefecture Capital
Cities and Towns
International Boundary
Prefecture Boundary
Intermittent Drainage
Primary Road
Secondary Road
Track
SUMMARY OF VULNERABILITY:
Overlay Of Causes, Food Accounts, And Manifestations
Vulnerable to Famine
Significant Increases in Food Security
FEWS/PWA, June 1989

## I. Vulnerable/At-Risk Populations

**Methodology: Vulnerability Assessment**

The FEWS vulnerability assessment uses agro-meteorological and socio-economic indicators to define a population's probable level of vulnerability to famine. Four stages of vulnerability are identified: vulnerable, at-risk, nutritional emergency, and famine. Because available indicator data are frequently of relatively poor quality, or without extensive baselines for reference, FEWS relies upon a "convergence of evidence", a comparison of several indicators, to interpret the meaning of any single indicator. Each section that follows (Causes, Food Accounting, Manifestations) uses indicator data in different ways to locate actual and potential food stress (see Appendix 1 for details). Each surface of food stress thus created is mathematically weighted for significance to vulnerability, subjective judgements are applied, and then the surfaces of food stress are combined into a summary of vulnerability. Maps for each surface and the summary are provided within this assessment.

Coming out of the 1988 agricultural season, there are several vulnerable areas in Chad's Sudanian[1] zone (see Map 1). In contrast, the Lake Chad area and eastern Chad (with the exception of Iriba Sub-prefecture in Biltine Prefecture and two small areas in Salamat Prefecture) are in a much stronger than usual food security position. Both of these areas are in Chad's Sahelian zone.

The main roots of the southern vulnerability are late summer floods and pest damage (mostly from stem borers), which together caused farmers to abandon over one-half of their crops in some areas. The most recent cereals estimate for the south is 202,000 metric tons (MT), which is one-half to two-thirds of most Sudanian harvests since 1974. Since 1974, the population of the area has grown from approximately 1.8 million to 2.6 million people. The worst food crisis in the Sudanian zone, a true famine, was in 1984, following a harvest of 297,000 MT. It should be noted, however, that the 1984 food crisis followed on the heels of a civil war that devastated the population's resources. The current shortfall follows several years of peace and record harvests. Despite the low harvest estimate, the opinion within Chad is that 1989 food supply problems will be small enough that they can be addressed with already available resources.

The Government of Chad (GOC) and donor groups have verified the presence of serious food security problems at sites in Biltine, Chari-Baguirmi, Logone Oriental, Mayo-Kebbi, Moyen-Chari, Salamat, and Tandjilé prefectures. Although the sufficiency of the food supply at the visited sites remains in question, the assessment teams observed no visible signs of malnutrition. The population of these seriously affected areas totals some 178,000 people. For the remaining vulnerable areas, the combination of reported flooding and poor cereal, tuber, peanut, and cotton production for 1988 lead to the conclusion that further pockets of food shortage could be found this summer within those areas. Factors that could mitigate such food shortages include household stocks remaining from previous years and

NOTE: Word received at the time of printing indicates that there was an error in the computer program with which the gross 1988 Sudanian zone harvest was estimated. Sudanian cereal production is now estimated to be 335,940 MT, rather than 202,000 MT as stated above. This is similar to the harvest of 1983 (331,100 MT), larger than the harvest of 1984 (300,580 MT), but much smaller than the harvests of 1985 and 1986 (420,750 and 474,200 MT, respectively). The change in the estimate was greatest for Logone Oriental and Moyen-Chari prefectures -- Logone Oriental now appears to have a cereal surplus, while Moyen-Chari has only a slight cereal deficit. The other three Sudanian prefectures still appear to have serious cereal deficits.

[1] By custom, Chad's 14 prefectures are divided into three climate zones: Borkou-Ennedi-Tibesti (B.E.T.) in the Saharan zone; Batha, Biltine, Chari-Baguirmi, Guera, Kanem, Lake, Ouaddai, and Salamat in the Sahelian zone; and Logone Occidental, Logone Oriental, Mayo-Kebbi, Moyen-Chari, and Tandjilé in the Sudanian zone.

wealth sufficient to purchase needed food. Because there is currently no data about these factors and little data on the function of the south's commercial sector, the exact locations of further food problems cannot be predicted. Rather, local reports of problems will trigger the intensive assessments used in Chad to target emergency food aid distributions. The degree of food supply problems found in the south this summer will greatly aid the understanding of the resilience of Chad's Sudanian zone under peace-time shocks to the food supply.

For the most part, the pattern in the south is not one of several bad years running, though there were food production problems in some parts of the Sudanian zone in 1987. There is little danger, however, of the sort of famine seen in 1984. This year's problems are much more severe than those following the 1987 harvest, and they appear to have affected new areas. In addition, the 1985 and 1986 harvests were exceptionally good in the south. If households have not saved food stocks from these harvests, as has been reported in the last few years,[1] they should at least have some wealth remaining from the harvests' sale. Where buying power exists and roads to cereal sources are passable, the market could take care of immediate food problems. There is at least one example of a canton chief organizing a buying cooperative among his constituency in which the cooperative is funding a truck to go north to purchase food for the canton. This will, however, be a definite resource-depleting year of a magnitude not previously seen during peace-time. More intense food security problems should be anticipated in 1990 if the Sudanian zone's 1988 agricultural pattern is repeated in 1989.

Donors expect that the most urgent food shortages will be addressed with existing and already-pledged aid. As of the end of March, emergency food stocks totaled 5,275 MT, of which 3,475 MT were in N'Djamena (the closest store of emergency stocks to the Sudanian zone) and 140 MT were pre-positioned close to the potential problem areas in Iriba (see Figure 1). There were also 2,500 MT of emergency aid in the pipeline at that time. The Food Aid Action Committee (FAAC or CASAU, a multi-ministry, donor, and private voluntary organization group) was finalizing a distribution plan for aiding the areas of greatest need at the end of May. Once adopted, this plan had to be put quickly into action in order to get food south before the annual rains closed roads.

In addition to emergency stocks, some 13,600 MT of price support stock under the control of the GOC National Cereals Office (ONC) were in position throughout the country at the end of March (see Figure 1). Given the strong harvest in Chad's Sahelian zone, it is probable that the ONC will have purchased more stock by the beginning of the rainy season, which could be used for sales in the south.

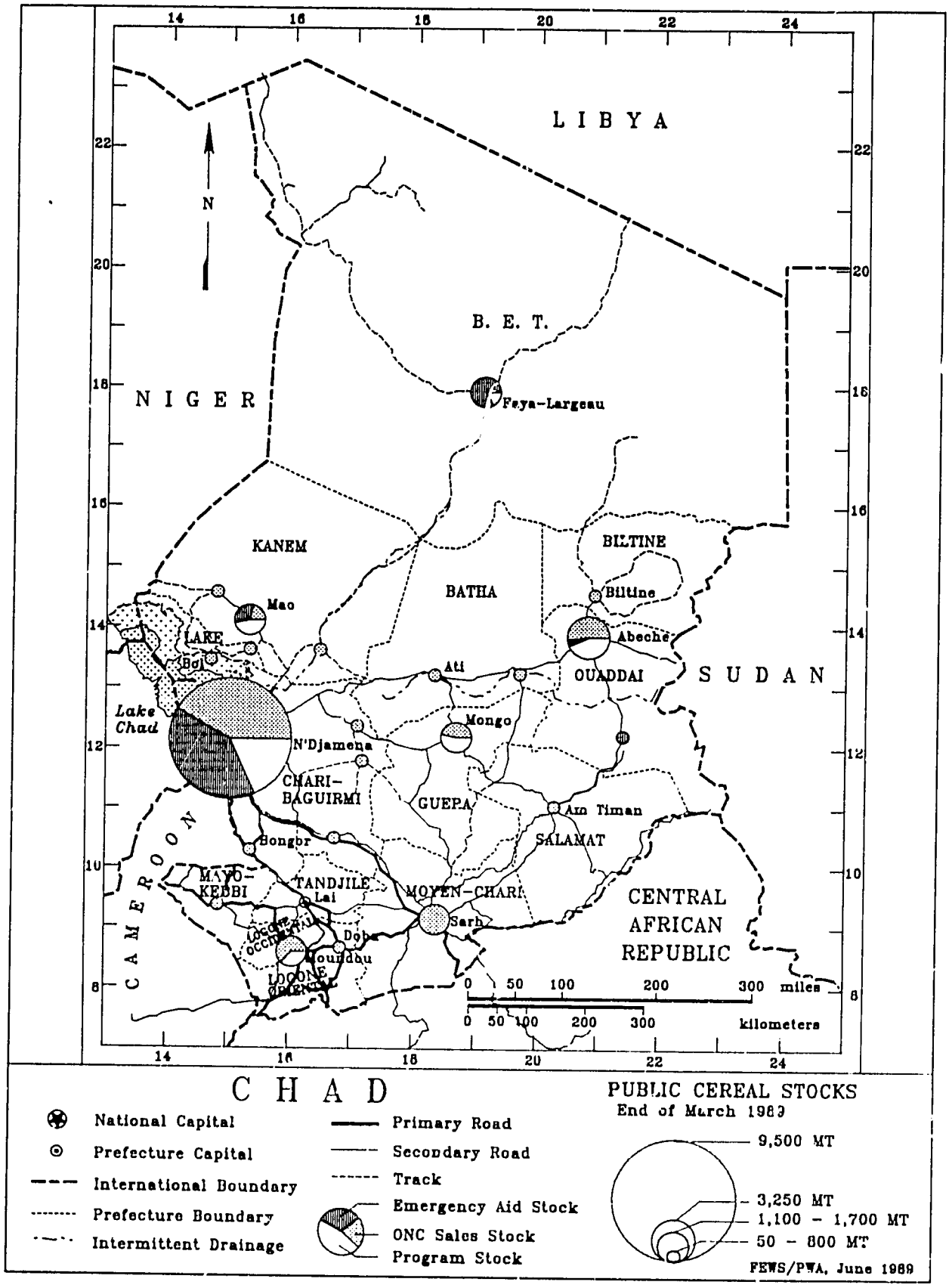
There are several indicators that should be monitored during the rainy season, besides reports of problems by local authorities, that may reflect a significant change in an area's vulnerability:

- Since mid-1987, the ONC has been collecting cereal price data from, among other towns outside of the Sudanian zone, Pala (Mayo-Kebbi Prefecture), Moundou (Logone Occidental Prefecture), Doba (Logone Oriental Prefecture), Sarh (Moyen-Chari Prefecture), Am-Timan (Salamat Prefecture), and Biltine (Biltine Prefecture). The trends in these prices should at least signal the market situation in those towns during the lean seasons. In addition, the European Community-funded Système d'Alerte Précoce (SAP) has been tracking cereal prices in most Sahelian sub-prefectures since mid-1986, including Iriba Sub-prefecture.

- In the Sudanian zone, the harvest of off-season crops, including vegetables, is usually begun well before the end of the rainy season. The success of this harvest could make the difference in a population's ability to continue to

[1]This non-saving behavior has been ascribed to the civil war, during which stores were often destroyed or abandoned.

**Figure 1**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LOGONE OCCIDENTAL
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CENTRAL AFRICAN REPUBLIC
0 50 100 200 300 miles
0 50 100 200 300 kilometers
CHAD
PUBLIC CEREAL STOCKS
End of March 1989
National Capital
Prefecture Capital
International Boundary
Prefecture Boundary
Intermittent Drainage
Primary Road
Secondary Road
Track
Emergency Aid Stock
ONC Sales Stock
Program Stock
9,500 MT
3,250 MT
1,100 - 1,700 MT
50 - 800 MT
FEWS/PWA, June 1989

feed itself through the next cereal harvest without requiring emergency food aid.

- For Iriba, a massive influx of returnees from Sudan is possible, as civil disturbances in western Sudan have prompted Chadians to return to their home territories. It should be noted, however, that a recent large influx (5,000 - 6,000 people) into neighboring Ennedi Sub-prefecture prompted a quick response by the GOC Ministry of Food Security and Disaster Victims (MSAPS) in the form of 500 MT of food aid.

- There also may be more destitute refugees who will be in need of assistance returning to the south from the Central African Republic (CAR), although not in large numbers.

There are two exceptions to the pattern of stronger than usual food security in eastern Chad, which appear on Map 1 as areas without hatching. In the first exception (Iriba Sub-prefecture, in Biltine Prefecture), Desert Locusts destroyed enough crops in this area of herders-recently-become-farmers to put their food security in doubt. Cantons in this sub-prefecture have required food aid for several years running. Iriba's markets show a conflicting signal, however, in that post-harvest cereal prices are significantly lower than they were in 1988.

The second exception involves Salamat Prefecture, where crop-destroying floods and a lack of purchasing power in two cantons of Haraze-Mangueigne Sub-prefecture show their populations to be at a disadvantage compared to neighboring cantons in terms of their food security. While floods in the immediate vicinity of Am-Timan may have caused some crop damage, there are no reports of hardship. For both of these Salamat areas, the record breaking harvest in the rest of the prefecture provides an easily accessible source of food for purchase and for aid provision.

One notable absence from the list of vulnerable areas is Logone Occidental Prefecture. Although the 1988 cereal and peanut harvests were abysmal and some cantons in the prefecture experienced food supply problems during the 1988 lean season, the Prefect has said that there is no problem this year. A prime mitigating factor is that the prefecture's 1988 cotton harvest was almost 25 percent larger than that of 1987, in contrast to the poor cotton harvest seen last fall in Mayo-Kebbi and southern Chari-Baguirmi prefectures.

Most of the Sahelian locations that have chronically been on the vulnerability lists are also absent this year (southern Kanem, southeastern Batha, northern Ouaddai, and western Biltine prefectures). The heavy rains that brought devastating floods to the south brought ample beneficial soil moisture to the Sahelian zone. The recessional sorghum harvest has been one of the best ever. Except for Iriba Sub-prefecture (mentioned above), harvests in this zone have been as much as double those seen in any year since 1980.

## II. Causes of Reduced/Increased Access to Food

**Methodology: Causes of Reduced or Increased Access to Food**

Food is acquired through production, exchange, or transfer (gifts). Many factors, including rainfall, pests, floods, and warfare, can affect these acquisition mechanisms. This section provides a qualitative assessment of these factors and their likely impact on food access.

In Chad, direct food production takes the form of animal husbandry, fishing, and cereal, vegetable, and tuber production. Resources used for exchange range from cotton, peanut, and fish production in the Sudanian zone to cottage industry and livestock sales in the Sahelian zone to the production of dates and general commerce in the Saharan zone. While estimates are available for some of these sectors at a fairly gross level (prefecture, zone, or nation-wide), a more geographically refined understanding of the function of these sectors must be obtained on the basis

of indirect indicators. The indicators mapped for this section are listed in Appendix 2.

The available indirect indicators show that, for the most part, the food acquisition systems of the Saharan zone probably functioned normally during 1988, although there are two areas of potentially reduced access to food and two areas of probably increased access to food (see Map 2). The food acquisition systems in the Sahelian zone performed fairly well, while those in the Sudanian zone functioned mostly at a marginal level, or, in one small area of Mayo-Kebbi Prefecture, functioned poorly. In all three zones (Saharan, Sahelian, and Sudanian), emergency food aid distributions since the 1988 harvest have been small and tightly targeted, contributing to the food security of very small areas.

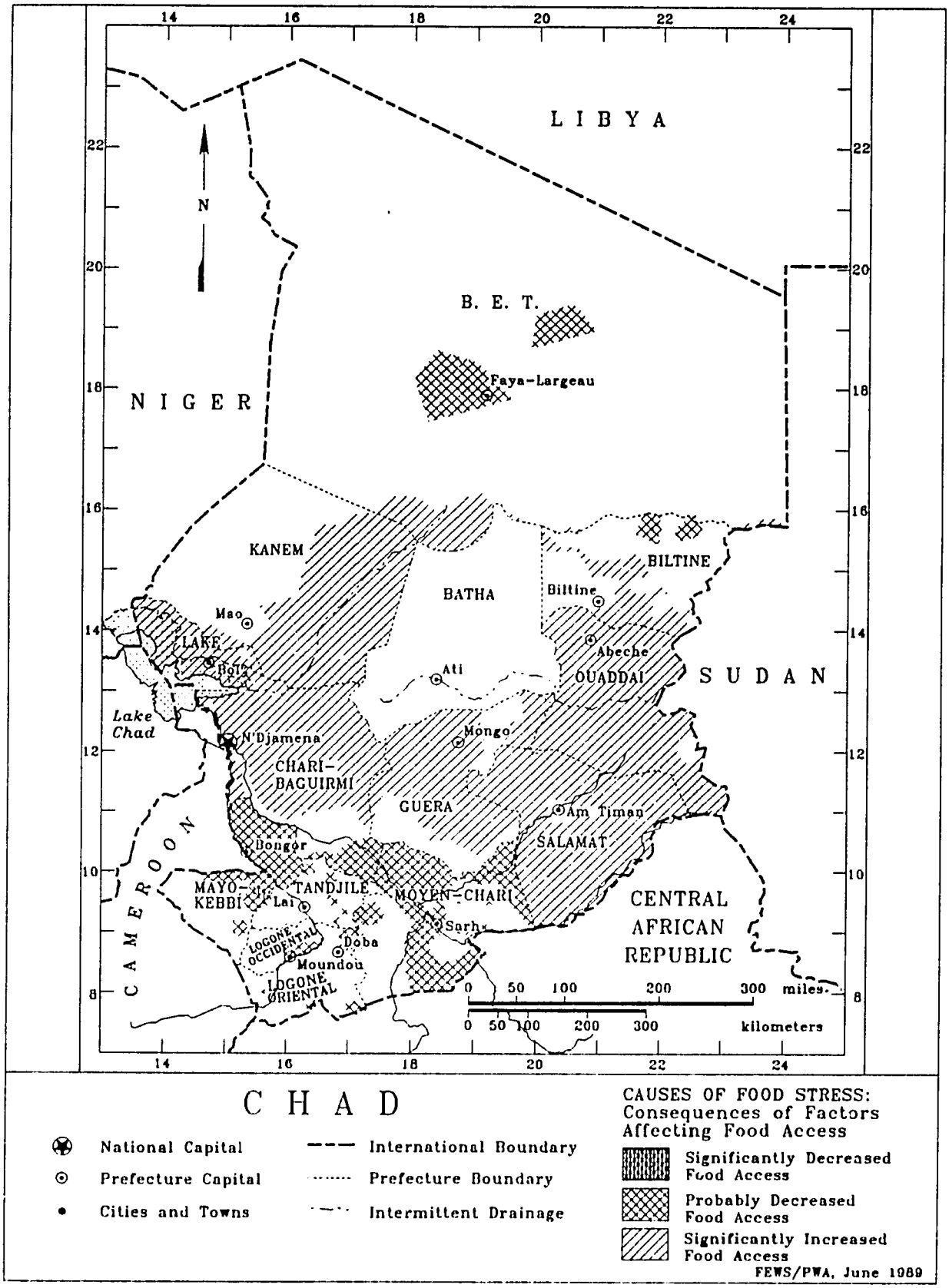
In Borkou-Ennedi-Tibesti Prefecture (B.E.T.), the assessment of potentially reduced access to food is based on reports of winter 1988/89 Desert Locust infestations of date palms. If these infestations damaged trees sufficiently to diminish the 1989 date harvest, this would lessen the ability of people in those areas to purchase needed foods. The degree of infestation was greater in 1988/89 than previously. In addition, freak May rains may have yielded enough moisture to provide a beneficial habitat for locust reproduction in those limited areas. If this is the case, there will be further potential for damage at oases over the summer.

The assessment of "probably increased access to food" along B.E.T.'s southern border is based on rainfall data and satellite-derived Normalized Difference Vegetation Index imagery (NDVI -- see inside back cover). Both sets of data imply that **significant vegetation** actually reached into B.E.T. this year. While rainfall was far too low to support rainfed agriculture, the increased amount of vegetation will have helped herders who traditionally graze their animals in those southern B.E.T. areas. The GOC has pre-positioned 1,000 MT of **emergency aid** within the prefecture for use in the event that it might be needed. The only other information available about B.E.T. is the fact that 5,000 to 6,000 Chadians returned from Sudan to the southeastern corner of B.E.T. These individuals were quickly aided by the GOC, and so do not constitute a vulnerable population.

The primary indicators for the two small areas of marginally decreased access in the northeastern Sahelian zone (in Biltine Prefecture) are a lack of the outstanding rainfall and NDVI levels seen elsewhere in the Sahel combined with intense **pest damage** and **chronic vulnerability**. The area of marginally decreased access in the south of Chari-Baguirmi experienced the problems seen in the Sudanian zone, described below. For the two areas in Biltine, the first three indicators point to reduced crop production and limited **pasturage**, while the fourth reflects a consistent lack of resources with which to cope with the failure of production systems. Although people of this area traditionally have not relied on farming, the slow rebuilding of herds following the 1983/84 droughts has forced the local population to depend more on crop production.

Chad's Sahelian areas of increased access to food benefitted from the same outstanding rainfall seen in most of the Sahel. While there are locations in these areas that had been vulnerable over the past few years, 1988 saw much less pest damage, minimal **flooding** (compared to the south), and much more food on the **market** than in the past several years. Only Batha Prefecture did not show the phenomenal increase over usual production seen in the other Sahelian prefectures (although a decent harvest by Sahelian standards, Batha's 1988 per capita production was still less than the 90 percent of its 1980 to 1987 average, while the per capita production of the other Sahelian prefectures ranged from 120 to 280 percent of the prefectural average).

**Map 2**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CAUSES OF FOOD STRESS: Consequences of Factors Affecting Food Access
Significantly Decreased Food Access
Probably Decreased Food Access
Significantly Increased Food Access
FEWS/PWA, June 1989

There are no areas of increased access to food in the Sudanian zone. There were few areas of higher than average rainfall or NDVI, as was seen in the Sahelian zone, and, except in Tandjilé Prefecture, per capita cereal production was much less than the eight year average. There are fairly widespread areas of decreased access to food, however. The most immediate causes of the decrease were flooding and pests.[1] The same floods decreased **tuber and peanut production** in much of the south and **cotton production** in eastern Mayo-Kebbi, southern Chari-Baguirmi, Tandjilé, and eastern Moyen-Chari prefectures. While tubers are an important food source in these areas, cotton and peanuts are the main cash crops. A shortfall in all three leaves the farmer with little food and little new money with which to buy food.

Animal husbandry, which contributes both food (milk products and meat) and a means of exchange for other food stuffs, is practiced in all three zones. There is insufficient information on the herding sector to include it in the mapping process. It has been reported, however, that 1988/89 pastures in the Sahelian zone have been bountiful, long lasting, and of a more northerly extent than has been seen in many years, and that Sahelian herds are generally doing very well. Less has been reported about Sudanian herds, although they could provide an important source of income for obtaining food in areas where both food crops and cash crops have fallen short. **Fishing** is a major source of food and income in the Sudanian zone and in Chari-Baguirmi and Salamat prefectures. Again, only partial, anecdotal information is known about this sector -- for instance, it has been reported that people in one cereal-short area of southern Salamat are able to trade fish for millet.

Another area not covered in the mapping process of this assessment is **food aid stockpiles** and future food aid distributions. The difficulty with mapping stockpiles is that it is difficult to attribute their effect to any one area. In the case of stocks in N'Djamena, for instance, it is likely that they will be distributed elsewhere. In the case of actual distributions in Chad, allocations tend to be set only shortly before the aid is disbursed, so that it is difficult to anticipate which areas will enjoy the benefits such aid provides. Finally, there have been reports of increasing numbers of Chadians repatriating from Sudan. Except for the group that arrived in Ennedi Sub-prefecture, it is not clear where these people are finally settling, whether they will need aid, and whether they will be present in sufficient number to strain the local markets.

## III. Food Accounting

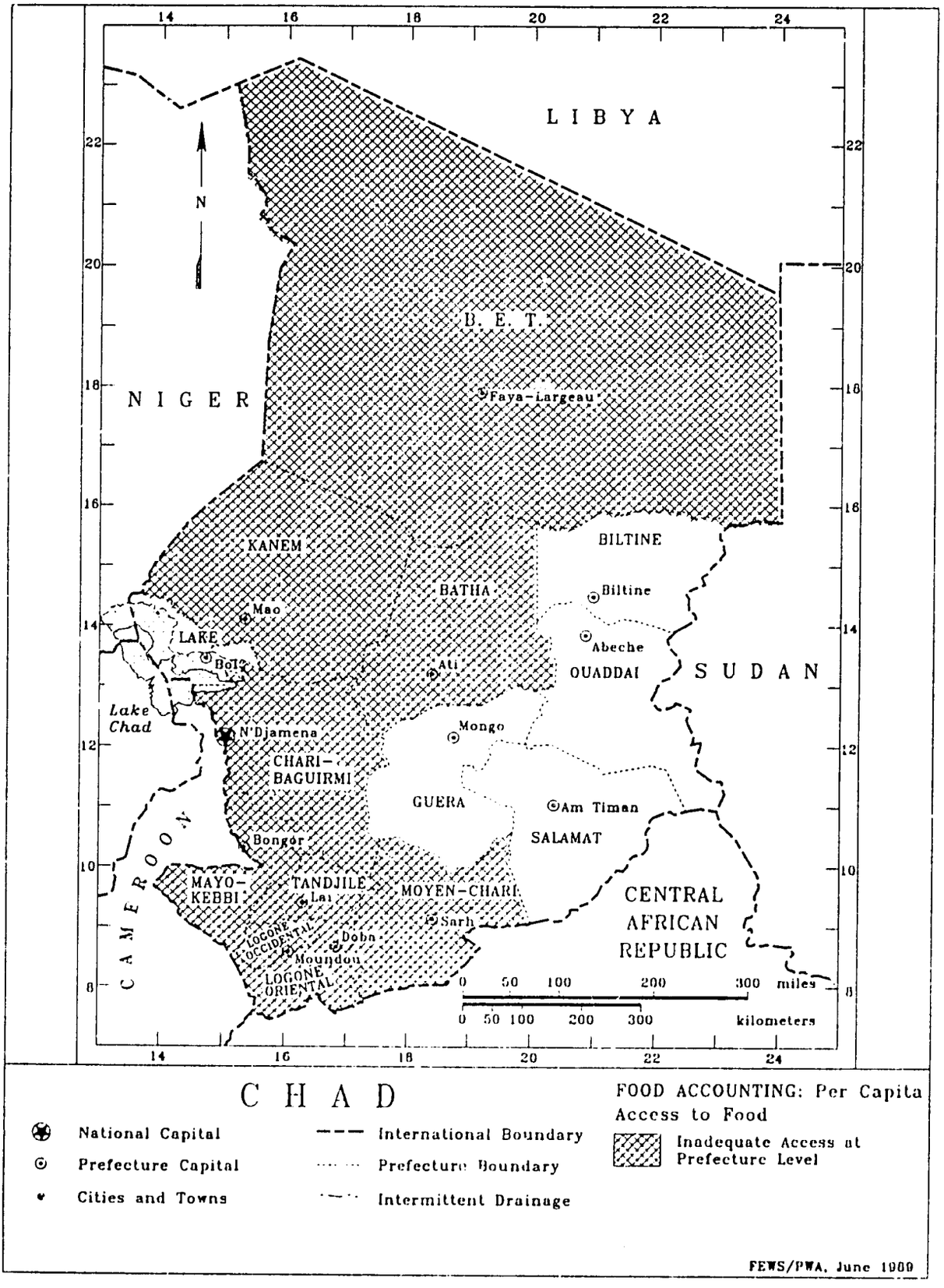
**Methodology: Food Accounting**

A quantitative account of all estimable food resources (production and aid) available for consumption until harvest is calculated using prefecture-level data. Seed, feed, post-harvest losses, exports, and consumption-to-date are subtracted from this account. The months of food remaining are then calculated by dividing the food resources by the consumption rate (population times monthly consumption rate). Inadequate food access is assumed if stocks fall short of needs until harvest.

The current food accounting picture in Chad is very much the converse of that seen over the past several years (see Map 3). Food is plentiful in the east and more scarce in the west and south. Frequently, eastern Chad experiences food supply problems while southern Chad has plenty. It would be a mistake, however, to assume solely on the basis of the present food accounting that apparent deficit areas are unable to meet food needs. Until food accounting (food balance) data and methodologies are better able to monitor

[1] It may seem counter-intuitive that less-than-average rainfall could cause widespread flooding. For the previous decade, however, rainfall in Chad had been much less than average rather than close to average. In addition, much of the flooding in Chad was caused by increased rainfall over tributaries of Chadian rivers located in Cameroon and CAR.

**Map 3**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FOOD ACCOUNTING: Per Capita Access to Food
Inadequate Access at Prefecture Level
FEWS/PWA, June 1989

meat and milk production and consumption, purchases of grain, the success of forage, household stock levels, and transfers of food and money, marginal agricultural areas will continue to show poorly on a largely cereal production-related scale. It is quite possible, for instance, that herding and commerce make enough food available to B.E.T., Kanem, and Batha prefectures to make up for the customarily small cereal harvests. The same weakness of data and methods makes Chari-Baguirmi Prefecture (with the large urban center of N'Djamena and its market-oriented food acquisition habits) appear to have inadequate access to food. If N'Djamena's population and food needs were subtracted from the prefecture's food account, the food supply would be much more than adequate (see Table 1). While the bulk of that food is actually grown to supply N'Djamena, there are still probably enough imports that would move the prefecture's food account much closer to sufficiency.

The situation in B.E.T. is relatively unknown. The area is arid and commerce, oasis production, and some animal husbandry are the mainstay of the population. There is little way to judge how these sectors are doing, however, nor how they have done in the recent past. Knowledge is lacking partly because the area was outside of Chadian

NOTE: With the new Sudanian zone harvest estimate, cited on page 3, the months of cereal remaining for Logone Occidental, Logone Oriental, Mayo-Kebbi, Moyen-Chari, and Tandjilé prefectures become -0.18, 7.99, 0.24, 4.33, and 1.34, respectively. Altogether, Chad had 3.74 months of cereal remaining as of the first of June.

**Table 1: Chad, Prefecture-level Food Accounts (MT)**

| Prefecture | HH or Farm Carryover Stocks 1988 | Estimated Net 1988 Cereals Harvest | Food Aid, Harvest 1988 -Harvest 1989 | Consumption Total From Harvest 1988[1] To June 01 | Cereal Supply @ June 01 | Months of Cereals Remaining (5 required) |
|---|---|---|---|---|---|---|
| Batha | NA | 41,956 | 319.9 | -30,468 | 11,808 | 2.71 |
| BET | NA | 0 | 621.1 | -4,564 | -3,943 | -6.05 |
| Biltine | NA | 29,425 | 70.4 | -15,262 | 14,234 | 6.53 |
| Chari-Baguirmi | NA | 81,216 | 1,824.8 | -59,653 | 23,387 | 2.74 |
| Guera | NA | 35,164 | 180.2 | -17,947 | 17,397 | 6.79 |
| Kanem | NA | 11,596 | 441.3 | -17,317 | -5,280 | -2.13 |
| Lake | NA | 50,419 | 64.7 | -11,663 | 38,821 | 23.30 |
| Logone Occidental | NA | 25,409 | 238.8 | -28,665 | -3,017 | -0.74 |
| Logone Oriental | NA | 21,344 | 20.8 | -29,601 | -8,237 | -1.95 |
| Mayo-Kebbi | NA | 42,643 | 42.8 | -66,911 | -24,225 | -2.53 |
| Moyen-Chari | NA | 55,355 | 54.4 | -50,733 | 4,677 | 0.65 |
| Ouaddai | NA | 55,963 | 604.9 | -29,831 | 26,738 | 6.27 |
| Salamat | NA | 27,680 | 283.2 | -9,261 | 18,702 | 14.14 |
| Tandjilé | NA | 23,206 | 168.4 | -29,138 | -5,763 | -1.38 |
| **Total** | NA | **501,376** | **4,936** | **-401,013** | **105,299** | **1.84** |
| N'Djamena Town | NA | 0 | 1,221.8 | -39,940 | -38,718 | -6.79 |
| Rural Chari-Baguirmi | NA | 81,216 | 603.0 | -19,713 | 62,106 | 22.05 |

[1]Harvest is defined as October 31, as a compromise between the rainfed and recessional schedules. There are, therefore, five months remaining in the food accounting year. The food aid column consists of actual aid distributed from November 1988 through March 1989 via all channels (per USAID/Chad) plus 500 MT of emergency aid distributed in B.E.T. at mid-May.

control for several years and partly because the area is still fairly inaccessible.

Several significant data gaps limit the information that can be gained from this food accounting. No attempt has been made to estimate the amount of household stocks available going into the 1989 food year. Another tremendous gap in our knowledge of Chad's food security is our inability to estimate food flows across the national border. No quantitative account has been taken for this assessment of the sizeable contribution that *niébé*, tubers, and such foraged foods as *krep* make to the diet. In a year of low food security, this variable could be key in determining likely food assistance needs.

Finally, although a food accounting at the prefecture level is more descriptive of areas potentially requiring food assistance than a national level accounting, it suffers from the same type, if not scale, of summarization of disparate conditions. For example, the food security of southern Ouaddai Prefecture is likely much different than that of the northern half of the prefecture.

## IV. Manifestations of Reduced Access to Food

**Methodology: Manifestations of Reduced or Increased Access to Food**

Populations may manifest their current vulnerabilities to famine by their physical and socio-economic reactions to food access conditions. Based upon observed behaviors and conditions compared to a reference baseline, a subjective judgement is made of their degree of vulnerability.

Since the 1988 harvest, GOC and donor group missions have verified several areas with serious **food security problems**, which are listed in Table 2 and which appear as spots of dense hatching in the Sudanian zone in Map 4 (see Appendix 2 for a list of the indicators mapped for the manifestation assessment).

In addition, **cereal prices** seen in central Chari-Baguirmi Prefecture and in southern Guera Prefecture during January and February 1989 are two to three times the prices seen in the same areas in 1987, although they are mostly lower than those of the same months in 1988. If farmers in these areas sell all their cereal stock early as some did in 1988, they may once again face a situation where cereal prices later in the lean season are too high for them to buy their food back. If, on the other hand, farmers in these

**Table 2: Areas With Serious Food Security Problems**

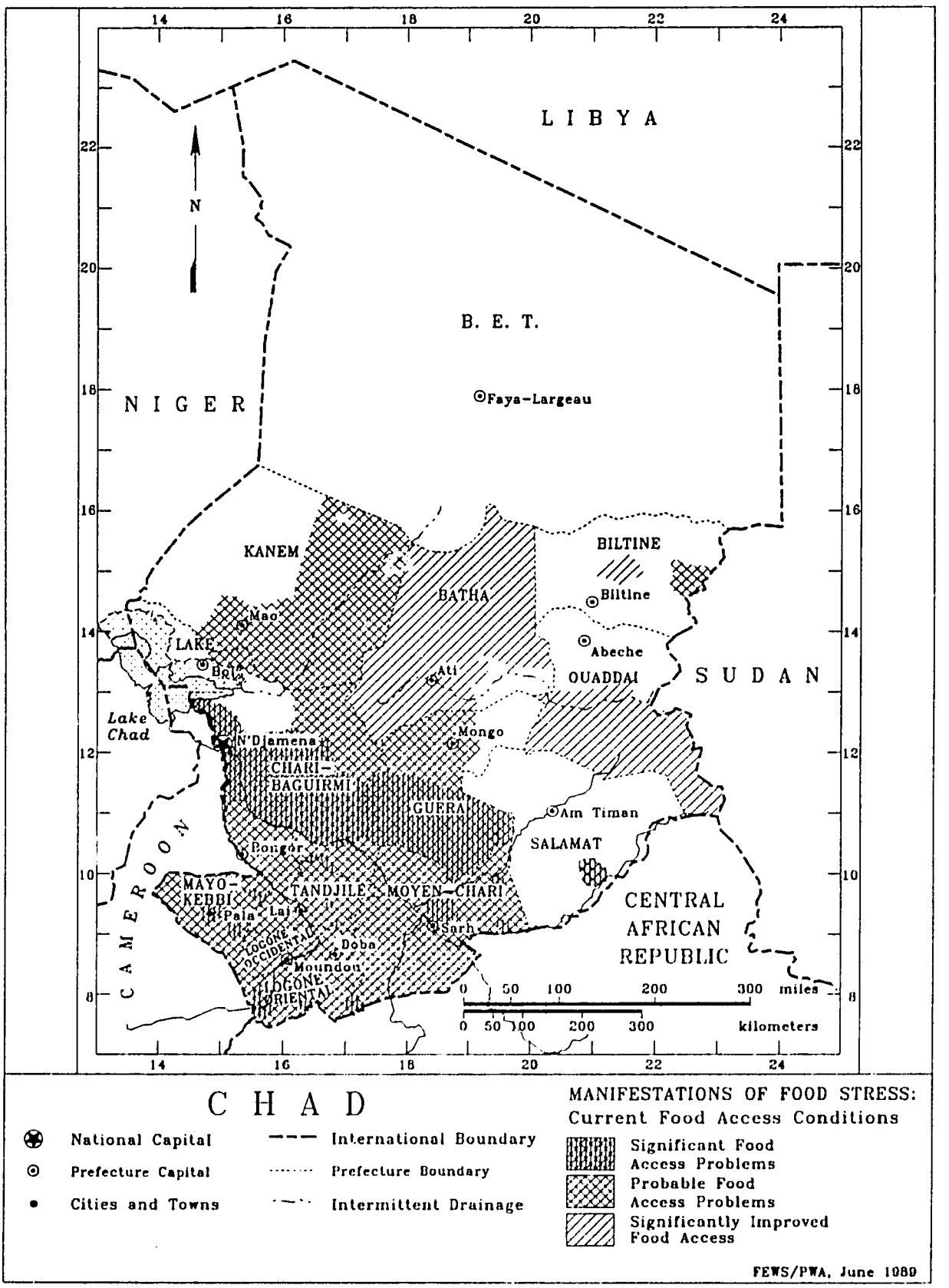
| Prefecture | Sub-prefecture | People in Affected Areas |
|---|---|---|
| Biltine | Iriba | 3,750 |
| Chari-Baguirmi | Bousso | 11,900 |
| Logone Oriental | Goré | 9,600 |
| Mayo-Kebbi | Bongor | 18,000 |
| | Gounou-Gaya | 37,700 |
| | Pala | 21,300 |
| | Fianga | 16,000 |
| Moyen-Chari | Kyabé | 31,250 |
| Salamat | Haraze-Mangreigne | 7,150 |
| Tandjilé | Laï | 19,000 |
| | Kelo | 2,000 |
| **Total Population in Affected Areas** | | **177,650** |

areas reserve sufficient stocks for their own use during the lean period, they should experience little difficulty finding enough to eat.

The western and southern areas of marginal food insecurity shown in Map 4 are places where winter prices were higher than they were at the same time in 1987, but not to the extent seen in the areas of denser hatching. The eastern area of marginal food insecurity is the one place in Chad where nutritional surveys in the past year uncovered malnutrition levels that were anywhere close to the threshold for action. The value found was 7.1 percent of children weighing less than 80 percent of the standard weight for their height. The threshold used in Chad for deciding when immediate food distributions are required is a finding of more than 10 percent of children measuring less than 80 percent of the standard weight for their height. In other surveys completed within the last year, malnutrition rates were very low, ranging from 1.4 to 4.6 percent.

The areas hatched as having increased food security experienced winter 1989 prices that were significantly lower than those seen in either 1987 or 1988. Using the one long-term Chadian price database (for N'Djamena Town) as a price-trend baseline, the prices seen in these areas could be the lowest since well before 1983.

**Map 4 .**


LIBYA
N
B. E. T.
Faya-Largeau
NIGER
KANEM
BATHA
BILTINE
Biltine
Mao
LAKE
Bol
Abeche
Ati
OUADDAI
SUDAN
Lake Chad
N'Djamena
Mongo
CHARI-BAGUIRMI
GUERA
Am Timan
SALAMAT
Bongor
CAMEROON
MAYO-KEBBI
TANDJILE
MOYEN-CHARI
Pala
Laï
Sarh
LOGONE OCCIDENTAL
Doba
Moundou
LOGONE ORIENTAL
CENTRAL AFRICAN REPUBLIC
0 50 100 200 300 miles
0 50 100 200 300 kilometers
CHAD
National Capital
Prefecture Capital
Cities and Towns
International Boundary
Prefecture Boundary
Intermittent Drainage
MANIFESTATIONS OF FOOD STRESS:
Current Food Access Conditions
Significant Food Access Problems
Probable Food Access Problems
Significantly Improved Food Access
FEWS/PWA, June 1989

# APPENDIX 1

## Mechanics of the Vulnerability Assessment

All available indicator data of major significance to the food security of Chad was gathered and analyzed for significance. The geographic boundaries for each were mapped as accurately as possible. Using a computer-based Geographic Information System (ArcInfo), the indicator maps were scored according to a three position scale of food stress to indicate whether they showed 1) an obvious cause of food stress, 2) no obvious food stress or significant increase in food access, or 3) a significant increase in food access (only applicable in areas without stress).

All indicators relating to "Causes" of food stress were overlaid to produce a summary surface of food stress as seen by these indicators (Map 2). A similar process was used for all indicators relating to "Manifestations" of food stress (Map 4). For the food accounting analysis, areas were mapped and scored as having adequate or inadequate access depending upon whether all food resources identified met assumed food needs (Map 3).

In a final step, the "Causes", "Manifestations", and "Food Accounting" summary maps were themselves overlaid for a grand summary of "Food Access" (Map 1). Analysts were free to use subjective criteria in applying food stress scores at each stage based upon their best judgments.

# APPENDIX 2

## Indicators Used in Chad Vulnerability Assessment

**NDVI - Growing Conditions:** The 1988 NDVI maximum was compared to the normal (1982-1987) yearly maximum. All areas significantly higher or lower (+/- 0.05 NDVI) than normal were identified. Areas of sparse vegetation (less than 0.1 NDVI) were excluded from this analysis. Sources: NOAA/NASA GAC NDVI

**Rainfall:** 1988 cumulative rainfall was compared to 30 year normal historic cumulative rainfall. All areas receiving more than 120 percent or less than 80 percent of normal were identified. Areas where 1988 cumulative rainfall was less than 200 mm were excluded from this analysis. Sources: Joint Agriculture Weather Facility and the Government of Chad (GOC) Department of Meteorology and Water Resources (DREM).

**Pest Damage:** Areas in which pest damage was judged to have had a significant negative impact on food access were identified. Sources: GOC/Crop Protection Service and USAID/N'Djamena.

**Flooding:** Areas in which floods were judged to have had a significant negative impact on food access were identified. Sources: *Système d'Alerte Rapide* (SAR), GOC/Ministry of Agriculture and Rural Development (MADR)/Department of Crop Statistics (BSA), and GOC/MADR/National Office of Rural Development (ONDR).

**Contribution from Cash Crop:** By agricultural sector, comparison of 1988 cotton harvest with 1980 to 1987 historical base. Other cash crops were noted for their bearing on food security but were not mapped. Sources: GOC/MADR/ONDR and SAR.

**Contribution from Non-Agricultural Resources:** By canton, areas in which significant non-agricultural resources are used in the food acquisition process. Source: *Système d'Alerte Précoce* (SAP).

**Cereal Price Behavior:** By Sahelian zone sub-prefecture/Sudanian zone town, comparison of average of January 1989 millet prices to January 1987 prices. Where 1989 prices were more than 100 percent higher than hose of 1987, food access was judged bad; where more than 15 percent higher access was judged as marginally declined; and where less than 85 percent of 1987, food access was judged as good. Source: GOC/MADR/ONDR, SAR, and SAP.

**Food Production Trend:** By prefecture, subjective assessment of the possibility that carry-over stocks 1) exist and 2) are substantial. Based on historical agricultural statistics and population growth from 1980 through 1987. Sources: Population data from FEWS projection of FY1987 Congressional Presentation population for Chad, distributed according to GOC/DESEED 1988 population statistics; production data from GOC/MADR/ONDR, SAR, and FEWS/Chad.

**Public Food Stock Reserves:** These were noted for their bearing on food security and were shown only as a graphic. Source: USAID/ADO/PUFF.

**Nutrition Data:** Areas in which nutrition rates were of marginal concern or were exceptionally good. Available nutrition data do not currently show any areas of serious concern. Source: GOC/Ministry of Health/Center for Nutrition and Food Technology.

**Reported Areas of Risk:** Areas reported to have experienced significant decreases in food security. Sources: SAP, FAAC.

**Emergency Food Distributions:** Sites where emergency food aid has been distributed since September 1988 were judged to have improved food access. Source: FAAC.

**Conflict/Civil Disruption:** No reports were received from which conflict could be judged to have had a significant negative impact on food access.

**Food Accounting notes and sources:** Net harvest includes millet, sorghum, maize, rice, and wheat and is calculated at the prefecture level. The food accounting includes distributions of emergency food aid from November 1988 through March 1989 plus one emergency distribution to B.E.T. Prefecture in May. The food accounting assumes that carryover of stocks from 1987-88 cannot be calculated and does not count imports or off-season production. Rate of consumption used is 150 kg per person per year for the Sudanian zone population, 135 kg per person per year for the Sahelian zone population, and 80 kg per person per year for the Saharan zone population. N'Djamena population is included in Chari-Baguirmi Prefecture. Date of harvest is assumed to be October 31. Amount of cereals consumed is based on a June 1989 population times seven months of consumption to give amount consumed from harvest until June 1. Sources: GOC/MADR, FAAC, USAID/ADO/PUFF.

## Key Terms

**At Risk** - FEWS Reports employ the term "at risk" to describe those populations or areas either currently or in the near future expected to be lacking sufficient food, or resources to acquire sufficient food, to avert a nutritional crisis (i.e., a progressive deterioration in their health or nutritional condition below the status quo), and who, as a result, require specific intervention to avoid a life-threatening situation.

Where possible, food needs estimates are included in the FEWS reports. It is important to understand, however, that no direct relation exists between numbers of persons at risk and the quantity of food assistance needed. This is because famines are the culmination of slow-onset disaster processes which can be complex in the extreme. The food needs of individual populations at risk depend upon when in the disaster process identification is made and the extent of its cumulative impact on the individuals concerned. Further, the amount of food assistance required, whether from internal or external sources, depends upon a host of considerations. Thus the food needs estimates presented periodically in FEWS reports *should not* be interpreted to mean food aid needs, e.g., as under PL480 or other donor programs.

**ITCZ** - The Intertropical Convergence Zone (ITCZ) is where the high pressure system originating in equatorial regions of the Atlantic (the St. Helena's High) collides with the Azores High descending from the north. The ITCZ tends to move northward during the spring and summer in response to normal global weather patterns. 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). These images are derived from Global Area Coverage (GAC) imagery (of approximately 4 km 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 5 spectral bands. Bands 1 and 2 sense reflected red and infra-red wavelengths respectively, and the remaining 3 bands sense emitted radiation in 3 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.