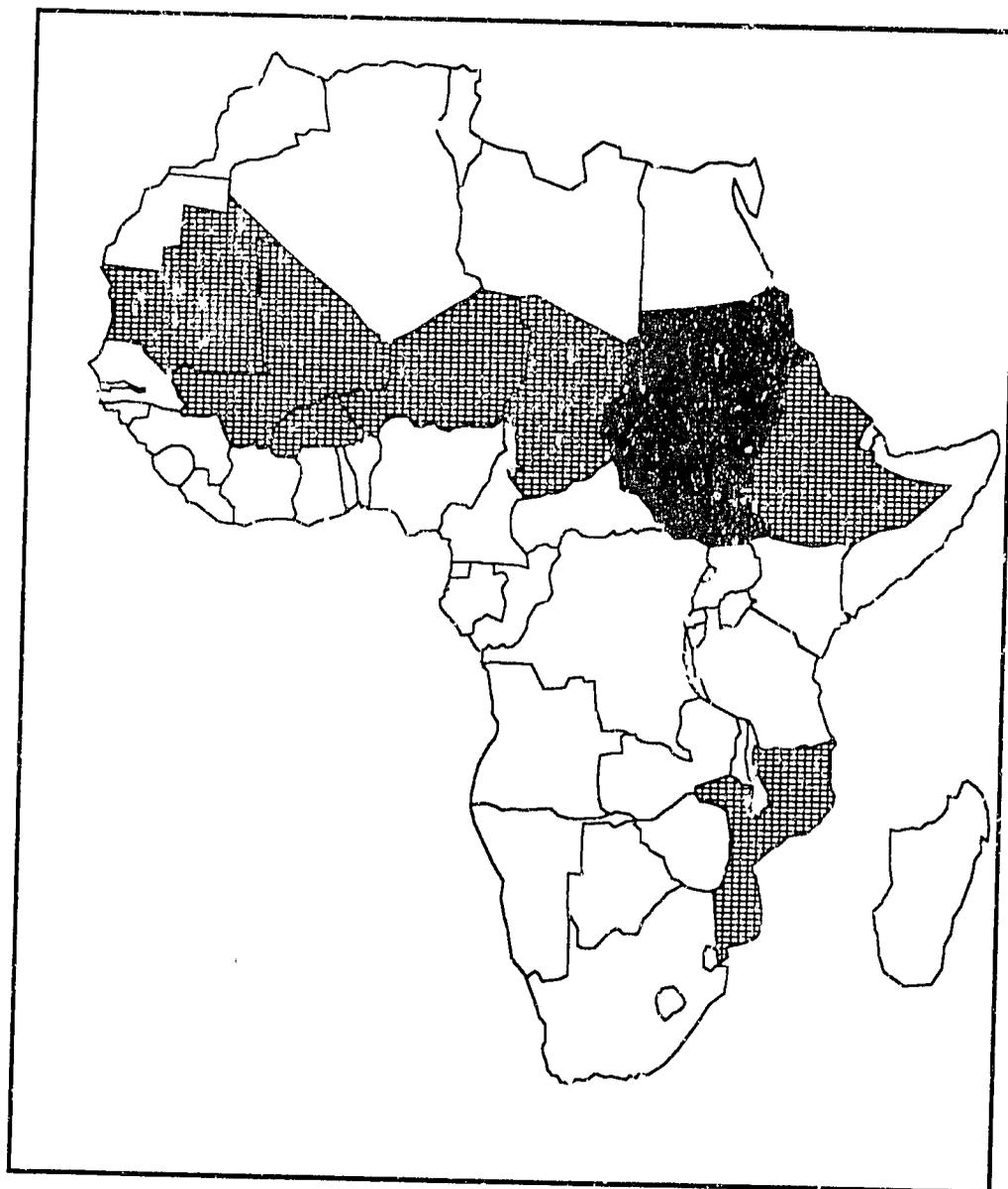


Report Number 12

June 1987

## FEWS Country Report

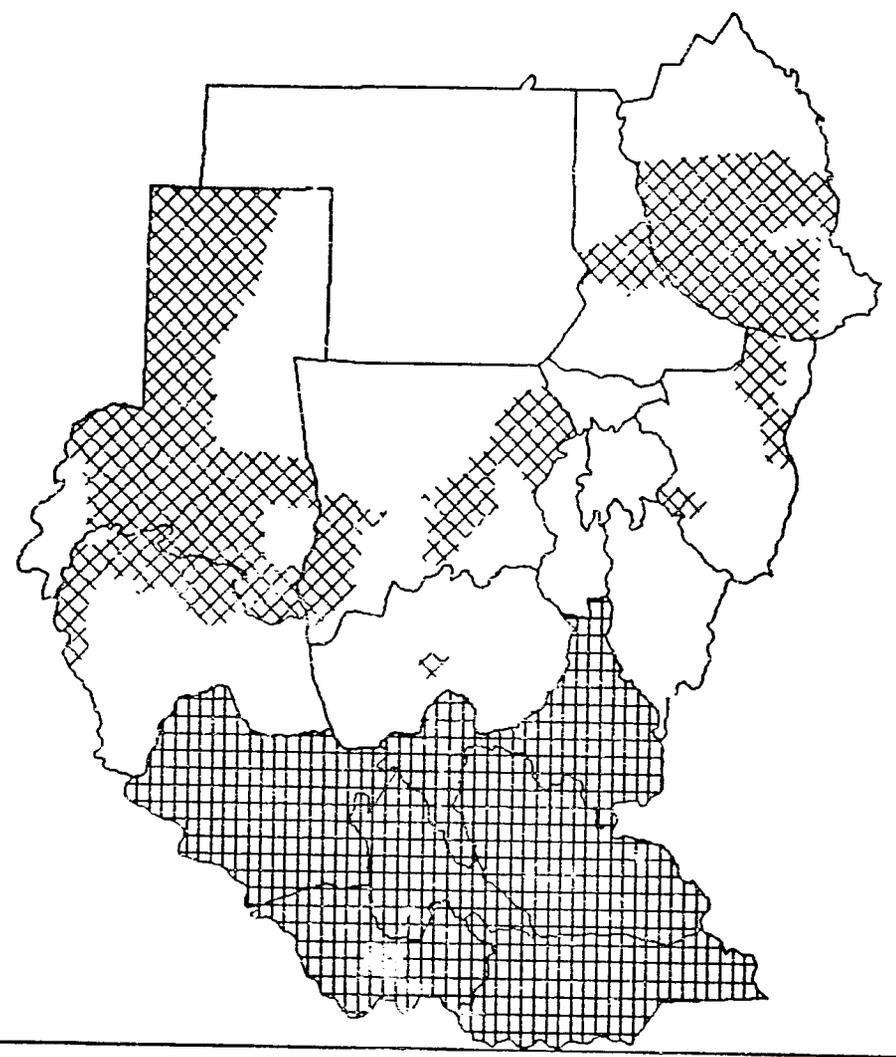
# SUDAN



Africa Bureau  
U.S. Agency  
for International  
Development

# SUDAN: SUMMARY MAP

## VULNERABILITY AND INDICATORS



-  HIGHLY VULNERABLE TO THE RESULTS OF A POOR '87 SEASON.
-  HIGHLY VULNERABLE AS A RESULT OF CIVIL STRIFE.

MAP: FEWS, 5/87

# SUDAN

## Vulnerability and Indicators

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Prepared for the  
Africa Bureau of the  
U.S. Agency for  
International Development

Prepared by  
Price, Williams & Associates, Inc.  
June 1987

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## INTRODUCTION

This is the twelfth of a series of monthly reports issued by the Famine Early Warning System (FEWS) on Sudan. It is designed to provide decisionmakers with current information and analysis on existing and potential nutrition emergency situations. Each situation identified is described in terms of geographical extent and the number of people involved, or at-risk, and the proximate causes insofar as they have been discerned.

Use of the term "at-risk" to identify vulnerable populations is problematical since no generally agreed upon definition exists. Yet it is necessary to identify or "target" populations in-need or "at-risk" in order to determine appropriate forms and levels of intervention. Thus for the present, until a better usage can be found, FEWS reports will employ the term "at-risk" to mean...

...those persons 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.

Perhaps of most importance to decisionmakers, the process underlying the deteriorating situation is highlighted by the FEWS effort, hopefully with enough specificity and forewarning to permit alternative intervention strategies to be examined and implemented. Food assistance strategies are key to famine avoidance. However, other types of intervention can be of major importance both in the short-term and in the long-run, including medical, transport, storage, economic development policy change, etc.

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.

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## **SUMMARY**

Estimates from Sudan of Southern Sudanese displaced to northern urban areas must be revised downward to reflect the result of a February survey in Khartoum. Nonetheless, displaced Southerners are still a highly vulnerable group. North and South Darfur Provinces are the areas containing the most vulnerable populations in northern Sudan. Should rainfall or pests limit agricultural production, a large proportion of their rural populations could be at-risk into 1988. Red Sea Province, still highly dependent on food aid, is also vulnerable, since the primarily nomadic population there is unlikely to raise its production to subsistence levels within the next year. North Kordufan Province is also vulnerable; if relatively good nutrition levels there last year were the result of massive food aid distributions in 1986, then nutrition levels have probably declined this year. Pests and poor rainfall could make the majority of its rural population remain at-risk into 1988 as well.

## **Indicators**

- June rainfall and satellite imagery will provide a first look at 1987 crop potential.
- SERISS nutrition data from the third round of the survey will provide the first post-1986-harvest data on childhood nutrition--which is needed for vulnerability mapping.
- Rainfall in the Southern Region, already begun, should decrease the vulnerability of rural populations to military activities as roads become impassable. Rainfall in the southeast corner of E. Equatoria Province is already above normal.

## **DISPLACED PEOPLE**

Partial results from a February survey of displaced people in Khartoum shantytowns do not support earlier reports of one million Southerners displaced to northern urban centers. Previous FEWS analyses, coupled with this new survey, set the upper limit at about 300,000. While substantially lower than earlier reports, these numbers are troublesome and can tax the ability of donors and the Sudanese government to provide minimum services.

The shantytowns contain a population of approximately 150,000 people, but the survey was directed only toward those households that had arrived within the preceding 3 years (half of the households surveyed had been resident from 30-36 months). It included respondents from Kordufan, Darfur and Central Regions, as well as from the southern Regions. Of those surveyed, 25% were from the southern "province" (sic, Region) of Bahr El Ghazel, 29% from Upper Nile and 8% from Equatoria. Of those from

Bahr El Ghazel, 75% were displaced for reasons of security, a percentage that increased to 78% for those from Upper Nile. Almost half of those from Bahr El Ghazel had been resident for less than 12 months.

These partial findings indicate that most of the respondents from the Southern Region had been resident in Khartoum for more than 12 months. It is therefore unlikely that a great exodus from the Southern Region occurred. This is congruent with previous FEWS analyses. An active non-government organization (NGO) registered 48,000 southerners who arrived in Khartoum between October 25, 1986, and February 26, 1987. A large portion of these people are probably not resident in any of the shantytowns, but instead found accommodation with relatives or friends in other areas. Nonetheless, this figure would produce an annualized influx of less than 150,000 people. Combined with previous arrivals, who came to escape the security situation, plus relatively low numbers of displaced people in other urban areas (e.g. Kosti and Rabak--even with the recent arrival there of already displaced people relocating as a result of the Ed Daien massacre), the total number of Southerners displaced to northern urban areas, for motives of security, is probably under 300,000.

An annual influx of 150,000 people would severely tax the ability of local, regional and national governments to provide minimum services. No infrastructure exists to support the populations of the shantytowns. There is no water supply, and childhood malnutrition is said to be twice the national average. Donors and NGOs are acting to provide minimum health and nutrition support to these shantytowns, support that will benefit both recent arrivals and long term residents.

## **SOUTHERN REGION**

Deliveries of emergency food aid to Southern cities has improved. The Sudan Early Warning System reports a total of 12,900 metric tons (MT) was delivered to the Southern Region during the 30 day period ending May 15, 1987.

Air and road deliveries to Juba have kept up with demand, and plans are afoot to deliver increasing quantities by air from Khartoum, after a hiatus during May. The first trucks carrying relief food from Raga have arrived in Wau (Bahr El Ghazel Province) and additional stockpiles in Raga are available for delivery. A military convoy is enroute to escort relief supplies currently stored in W. Equatoria Province and targeted for Wau (totaling 1,500 MT). An estimated 80,000 displaced people (subject to verification) in and around Raga are said to require

2,000 MT of emergency food aid. An initial 600 MT has been delivered to outlying villages. With the exception of Malakal, relief supplies are available in Upper Nile Province cities. Relief flights into Malakal are interdicted, and the greatest need there appears to be tents for the large population of displaced people.

Concern has been expressed over the difficulty in moving food aid from Babanusa in Southern Kordufan Province, by rail, to Aweil in Bahr El Ghazel Province. Food aid stocks exist in Babanusa, but rail and military authorities have not assisted in moving this food to aid the documented 110,000 displaced people in Aweil.

Vulnerable areas in the Southern Region, over the next rainy season, include all urban centers (with the exception of those in W. Equatoria Province), the northeast part of Bahr El Ghazel Province, and the districts along the Ethiopian border in Upper Nile, Jongoli and E. Equatoria Provinces.

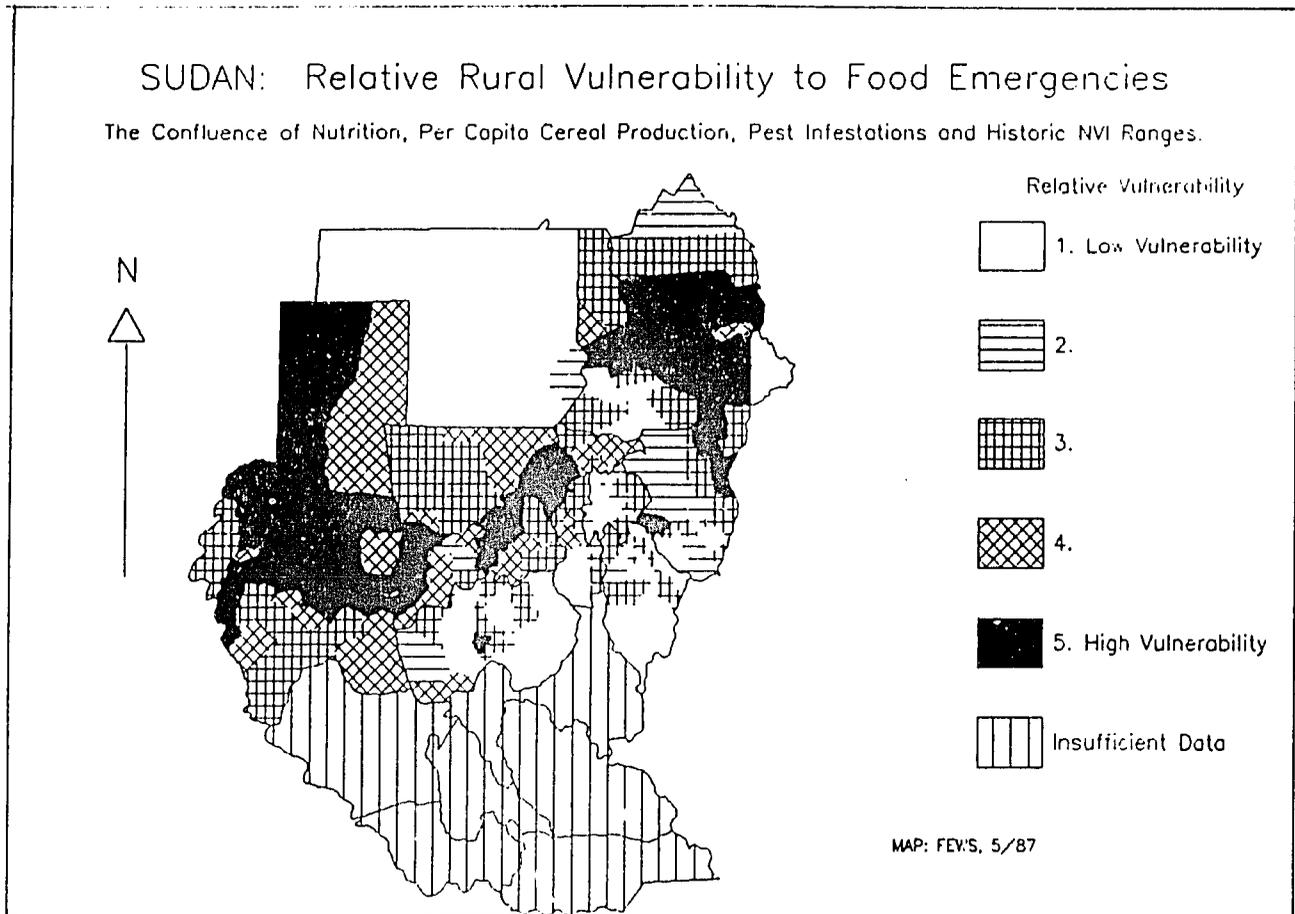
#### **VULNERABLE AREAS**

Rural areas where populations are vulnerable, in the event of a poor 1987 agricultural season, include much of Darfur Region, North Kordufan, and Red Sea Province (see Map 2). Vulnerable areas will be monitored closely over the course of the primary growing season to identify populations that will be at risk in 1988. FEWS identifies vulnerable areas using a geographic overlay approach to correlate nutrition, vegetation, production and pest information. Population distributions (see Map 3), can be used to set priorities for monitoring and intervention.

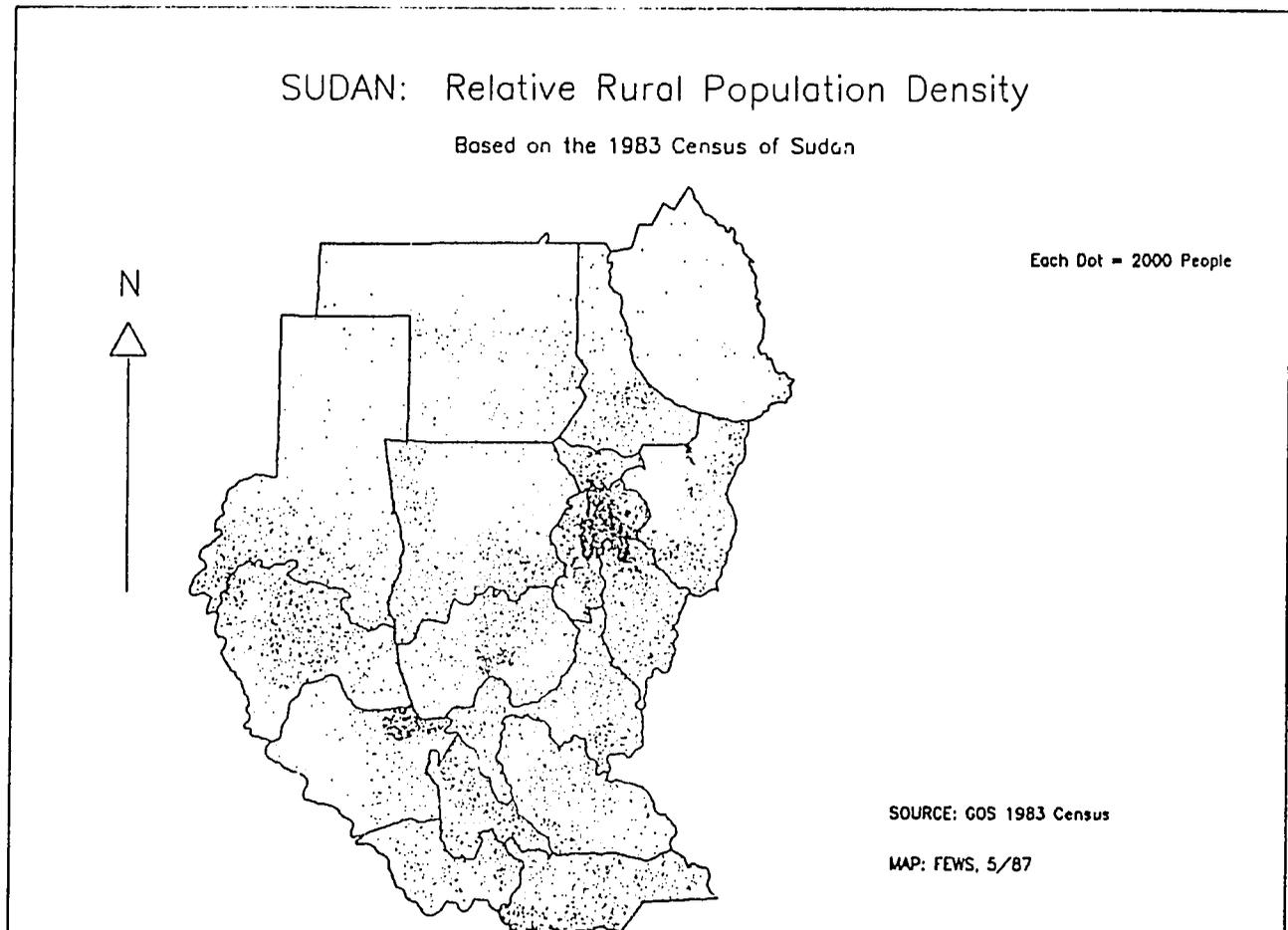
The identification of an area as vulnerable does not necessarily mean that people are currently at-risk there. Nor does the contrary imply that people are not at-risk. Instead, it is an attempt to focus attention on those areas where steps can be taken far enough in advance to mitigate any emergency food aid requirement, should it become necessary.

Map 2, "Relative Rural Vulnerability to Food Emergencies," shows the results of the FEWS computer-based analysis of nutrition surveys, satellite images, estimated crop production and last year's distribution of pest infestations (see detail below). It can be understood as a map of probabilities of risk prior to the agricultural season. These are relative but weighted measures, with each geographic unit rated from high to low in each category. In the analysis, per capita crop production was given a weight of two, relative nutri-

MAP 2: SUDAN



MAP 3: SUDAN



tional status, a weight of 1.5, the historic range of Normalized Vegetation Indices, a weight of 1, and 1986 levels of pest infestations, a weight of 0.6.

Available nutrition data show that, despite record production in 1985 and high levels of emergency food distribution in 1986, poor childhood nutrition was widespread in Sudan during 1986. Lower production in 1986, and a cutback in emergency food distribution in 1987, should mean that nutrition levels will remain static or decline further during 1987, while populations at-risk should increase over 1986.

Potential crop yield in 1987 is not likely to match 1986 potential, as last year's physical conditions (as shown by the record vegetation levels on satellite images) were excellent and it is unlikely that this will be repeated two years in a row. Nonetheless, actual production could exceed that of 1986 if farmers are motivated to plant more acreage in 1987. This is not anticipated. Current low sorghum prices should inhibit production and a net decline (estimated at 12%) in acreage devoted to food grains can be anticipated in 1987.

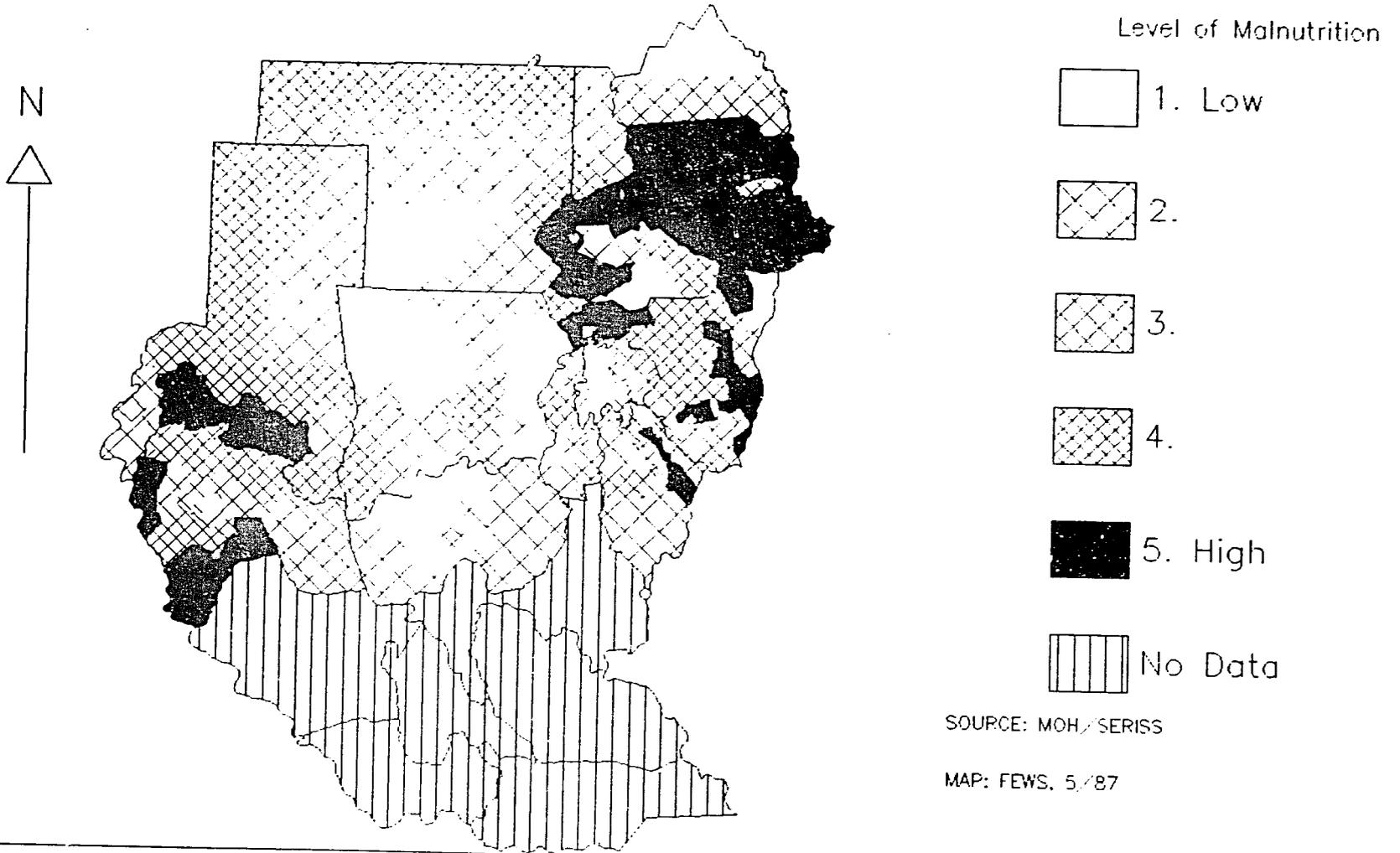
## **Nutrition**

Rural nutrition surveys in 1986 showed large areas of very poor nutrition among rural populations in North Darfur Province and in western South Darfur Province. Other areas of very poor rural nutrition were found in Red Sea, Nile, Khartoum and parts of Kassala Provinces (see Map 4). The Sudan Emergency Rehabilitation Information and Surveillance System (SERISS) surveys of childhood nutrition during 1986 provide a measure of food stress (and, by extension, relative rural poverty) within northern Sudan. These surveys date from May - June and September - November 1986. Survey results from the January - February 1987 survey (Round 3) should be available in June and will allow further refinement of this analysis.

The results of Rounds 1 and 2, while providing valid measures of childhood nutrition, are not directly comparable. FEWS analyzed the results for each round by dividing results from each survey along quartile lines and combining the two maps to obtain relative rural childhood nutrition, to the level of rural councils, across most of northern Sudan. Childhood nutrition levels were estimated for those rural councils not covered in either round, based on the levels extant among their neighbors. For the purpose of vulnerability mapping, this method is adequate for assigning relative measures of nutritional stress. In the absence of complete data, however, it cannot be totally accurate.

# SUDAN: Relative Rural Malnutrition

Estimated Levels of Rural Childhood Malnutrition Based on 1986 SERISS Surveys



Map 4 shows the results of this analysis mapped to the resolution of rural councils. Low levels are the result of relatively high production, primarily on small farms (e.g., Gezira Province), or the distribution of large amounts of emergency food aid (North Kordufan Province). Neither of these factors has so far been shown to be sufficient to reduce childhood malnutrition to relatively low levels. In Kassala Province, relatively mediocre childhood nutrition was found in one of the areas of highest per capita production in the country, albeit from large mechanized schemes. In North and South Darfur Provinces, relatively poor childhood malnutrition was found even though large scale emergency food aid distributions were carried out in 1986.

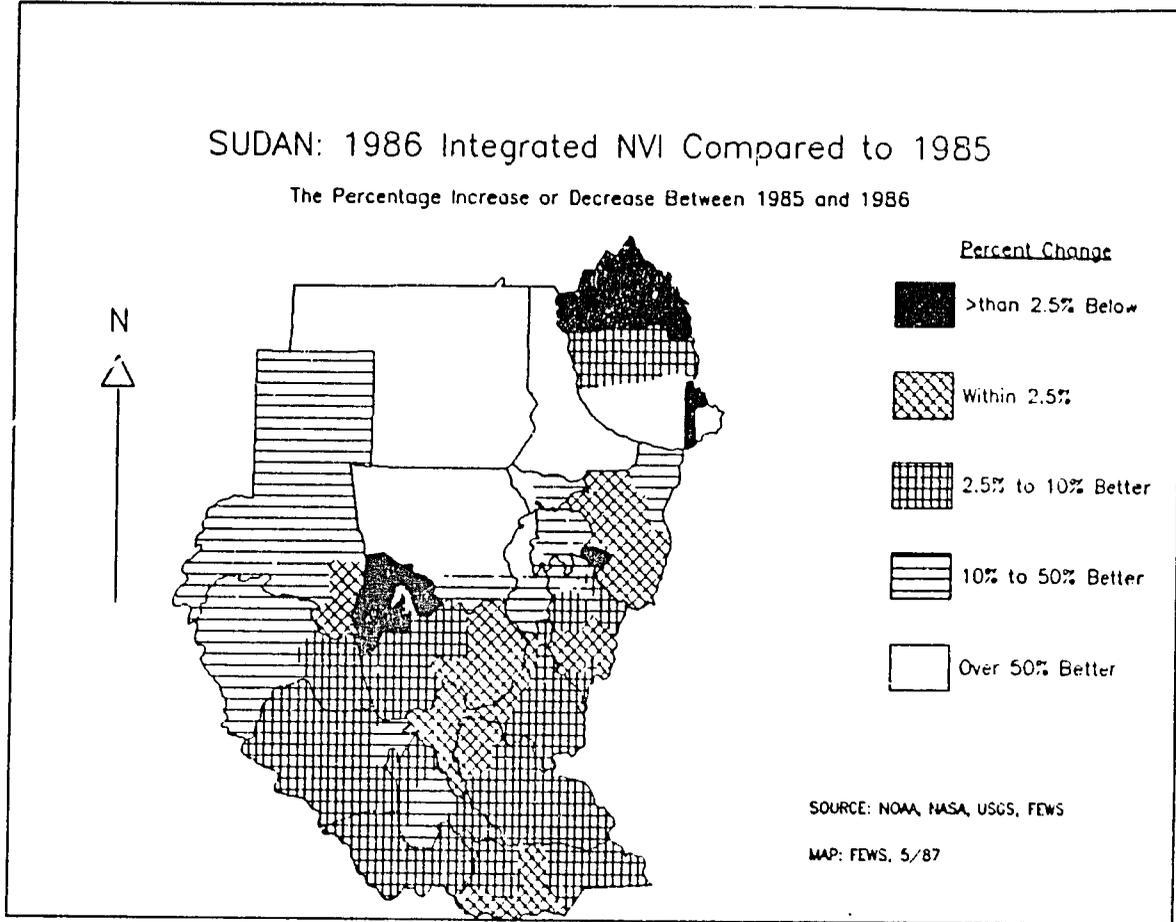
## NVI

Food grain production in 1986 was below that of 1985, while the Normalized Vegetation Index (NVI) showed potential yield to be higher than in 1985 (see Map 5). Indeed, actual yields increased over 1985, but acreage under cultivation declined. The year 1986 produced 52% of the record high NVI readings in the historical record (1981-1986). Map 6 shows those areas where large swings in the NVI (for the six years of the historical record) put particular stress on farming systems that rely on traditional and mechanized, rainfed agriculture. Other variables (including pest levels and planting decisions) intervene to transform potential into actual production. Pest and NVI measures will be monitored during the course of the 1987 season to identify those areas where a poor 1987 crop might occur.

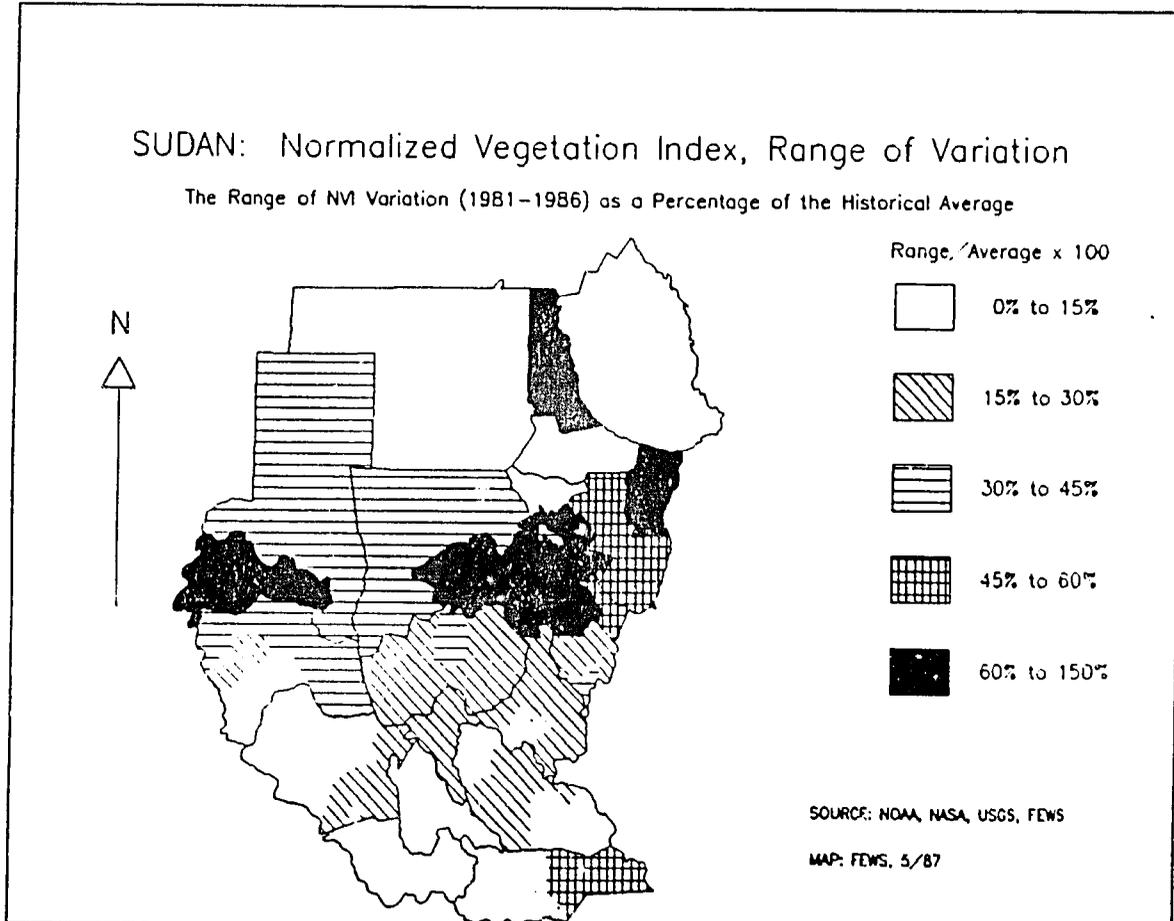
The NVI is derived from the National Oceanographic and Atmospheric Administration's (NOAA) Advanced Very High Resolution Radiometer (AVHRR) satellite imagery and is a measure of photosynthetic activity on the ground. It is used as an indicator of pasture and crop yield potential. Map 7 shows four "agricultural potential" zones generated from average annual integration of NVI measures for the six years of the historical record (1981-1986).

NVI measures for Sudanese District Councils in 1986 were compared to "normal" (the average of the four highest of the last five years' NVI for the same period and District Council), and all of Sudan was found to have higher than normal NVI. Map 8 shows the relative superiority of the 1986 NVI compared to normal for the specific time period of September 20 - October 10. In almost all districts, this key period of crop maturation would predict above average yield potential. This period, just prior to harvest, is a key indicator for forecasting potential yield. Figure 1 shows, for all areas of the country, the difference between the 1986 NVI and the normal NVI

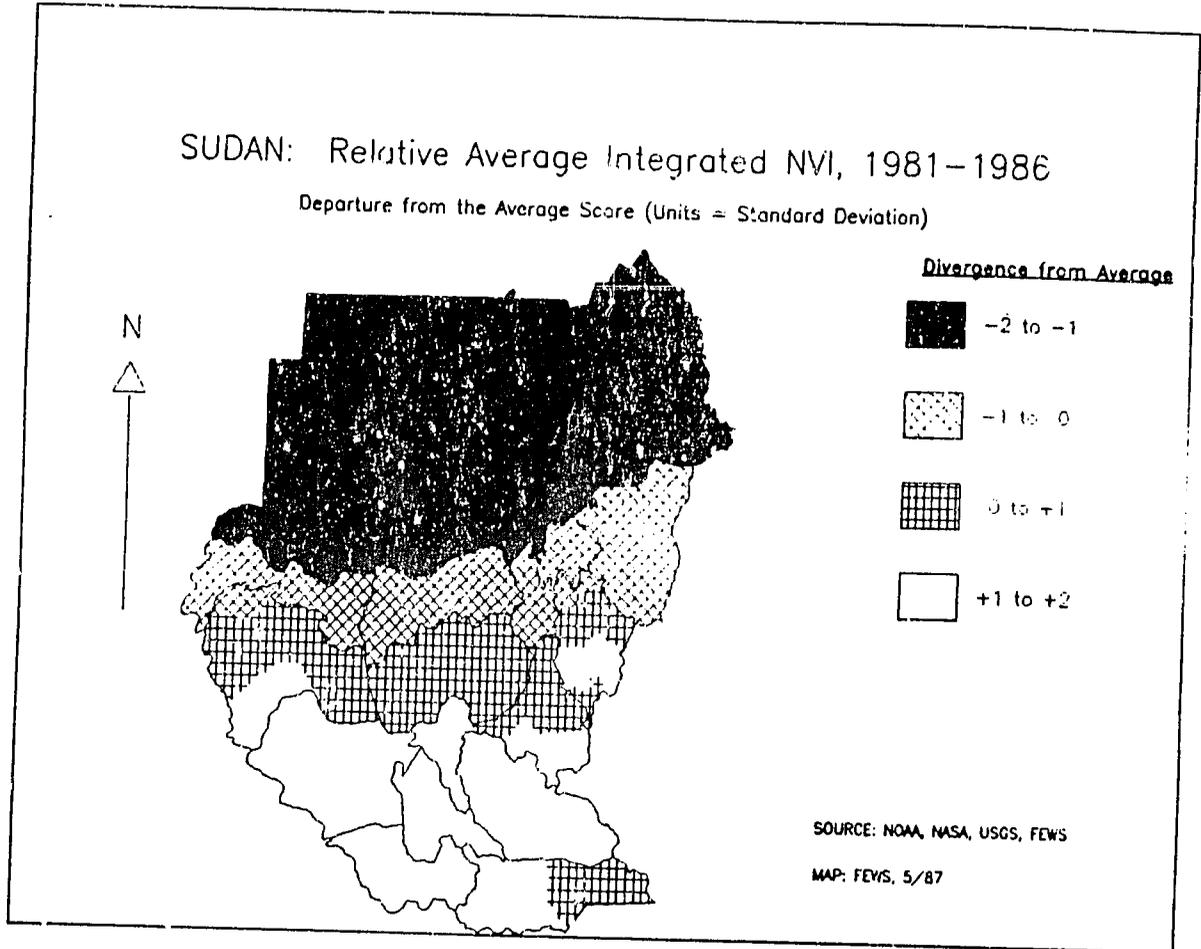
MAP 5



MAP 6



MAP 7



MAP 8

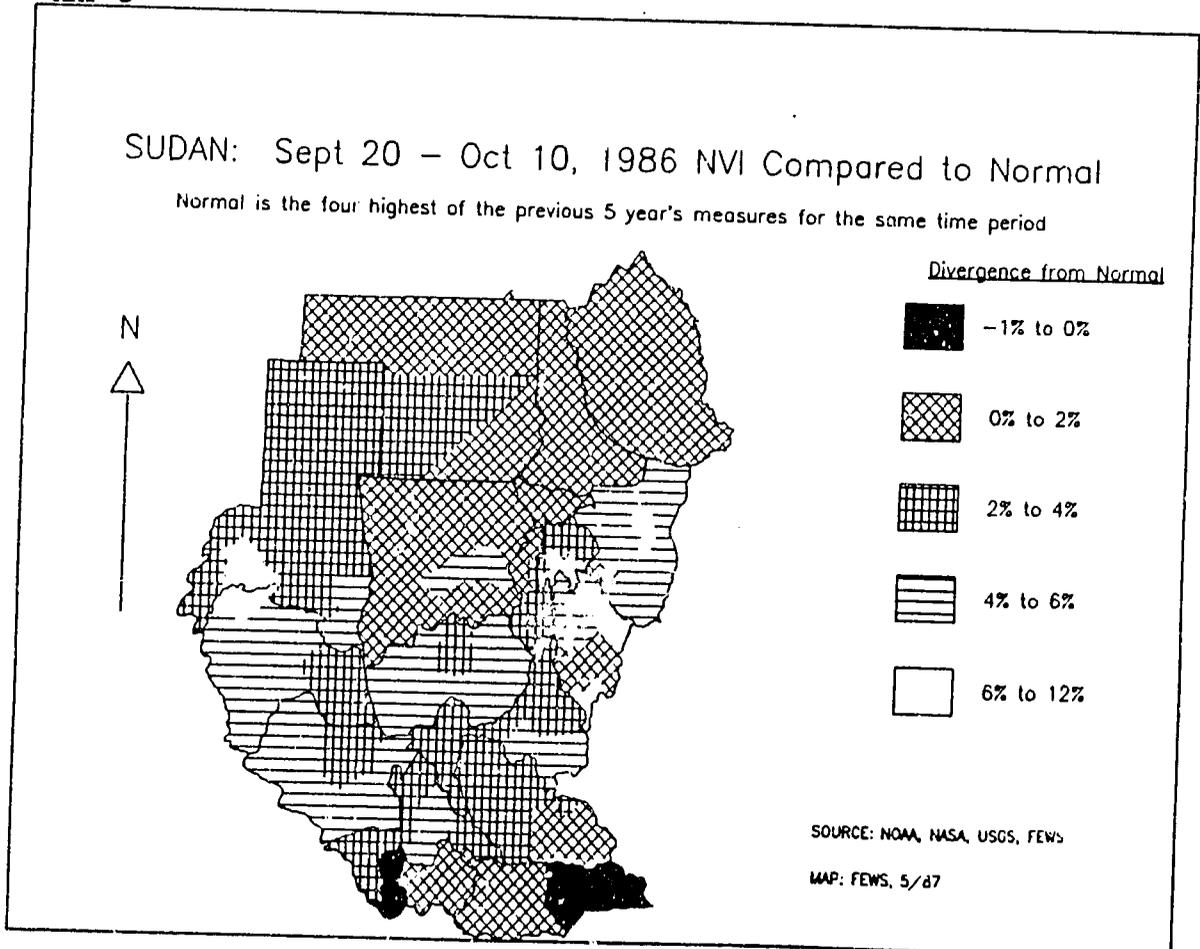
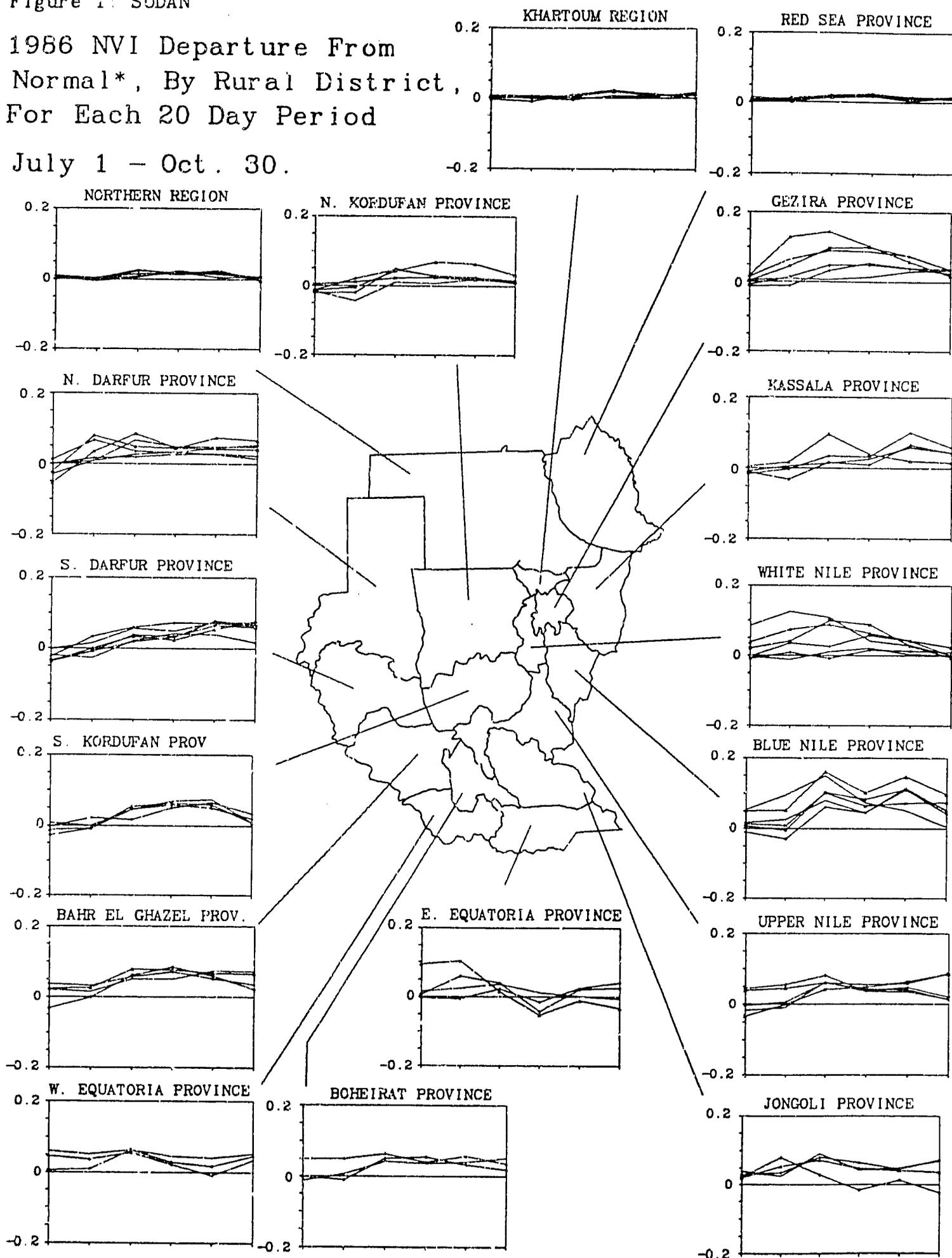


Figure 1: SUDAN

1986 NVI Departure From Normal\*, By Rural District, For Each 20 Day Period

July 1 - Oct. 30.



\*Normal = 0, and is the average of the four highest readings in the preceding five years.

(defined as zero) over the course of the main growing season from June 20 to October 30, 1986. Clearly, 1986 was better than normal throughout the growing season, implying that the rainfall distribution would have supported record production. This latter conclusion is supported by the tendency of 1986 NVI measures to rise and fall on schedule (i.e., few slope anomalies).

FEWS is particularly interested in those District Councils that historically show a great range in NVI measures (integrated over the course of the growing season) as compared to the average annual integrated NVI measure for that district. Map 6 shows that District Councils with relatively high inter-annual variation are concentrated in the center of the country, corresponding to the Sahelian zone through the rest of Northern Africa. (An exception is Barbar District Council in Nile Province, where a very low average NVI inflates the significance of the range and thus is an artifact of the statistics used in this analysis).

#### **Pastoralists**

Map 6 is also a first approximation to the relative vulnerability of nomads and others dependent on pastoralism. Reports from Sudan emphasize that herds have been rebuilt, with the probable exception of those in Red Sea Province. Should poor rains, and consequent poor grazing, occur in 1987, the current recovery from the drought of 1982-85 could be reversed.

#### **Pests**

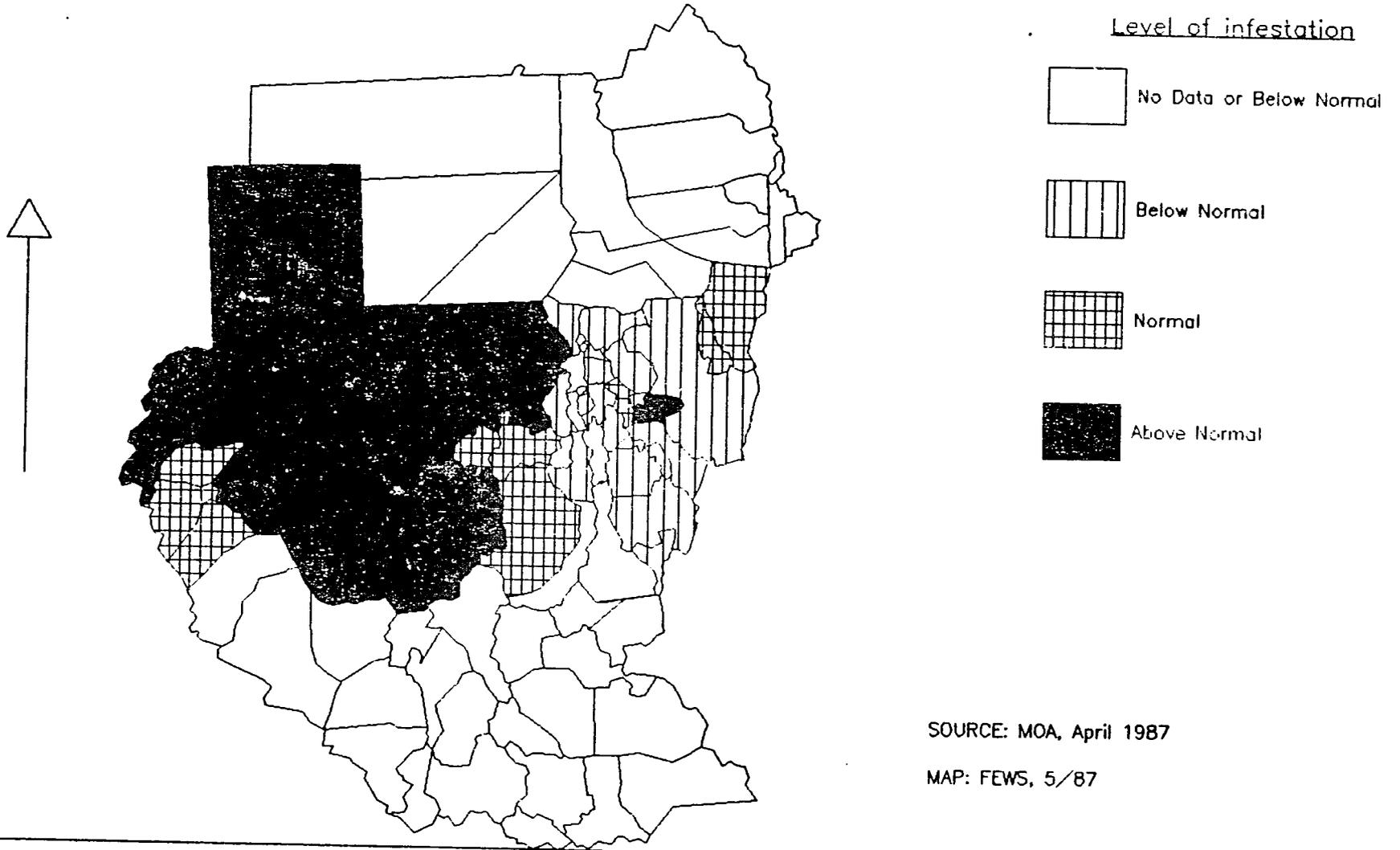
Pest depredations (primarily those of rats and grasshoppers) were especially severe in western Sudan in 1986. In the absence of effective control measures, pest infestations and pest destruction during the 1987 agricultural season could match that of 1986. Map 9 shows the Ministry of Agriculture's (MOA) assessment of pest infestation during 1986.

The primary concern in 1987 is the continuation of above normal rat populations, especially in the west. Rat populations should have weathered the dry season with stocks stored from last year's production and are probably poised to enter this year's rainy season in large and fecund numbers.

Desert locusts are not likely to be a major threat to Sudanese agriculture during the summer breeding season, thanks to Sudanese, Ethiopian, Saudi Arabian and Desert Locust Control Organization control efforts in winter breeding areas. Normal, or below, levels of Desert locust damage are anticipated. In addition, there are no indications that Migratory locusts threaten greater than normal levels of crop damage.

# SUDAN: Pest Infestation During the 1986/87 Agricultural Season

Indications from operations in support of the Area Sample Frame Survey.



## Crop Production

Provincial per capita grain production in 1986 varied from a high of 565 kg to a low of 7 kg, according to official MOA statistics. Total grain production fell below record 1985 levels--primarily due to a reduction in acreage. Yet, yields in 1986, for irrigated and mechanized sorghum and millet production, were generally higher than average, and higher than in 1985. The clear exception to this trend was in Dilling District Council in northern South Kordufan Province. For traditional rainfed agriculture, yields were below average in North Darfur, South Darfur and North Kordufan Province. The most obvious factor to account for this (divergence from the yield potential measured by NVI) would be the high level of rat infestation in these western areas.

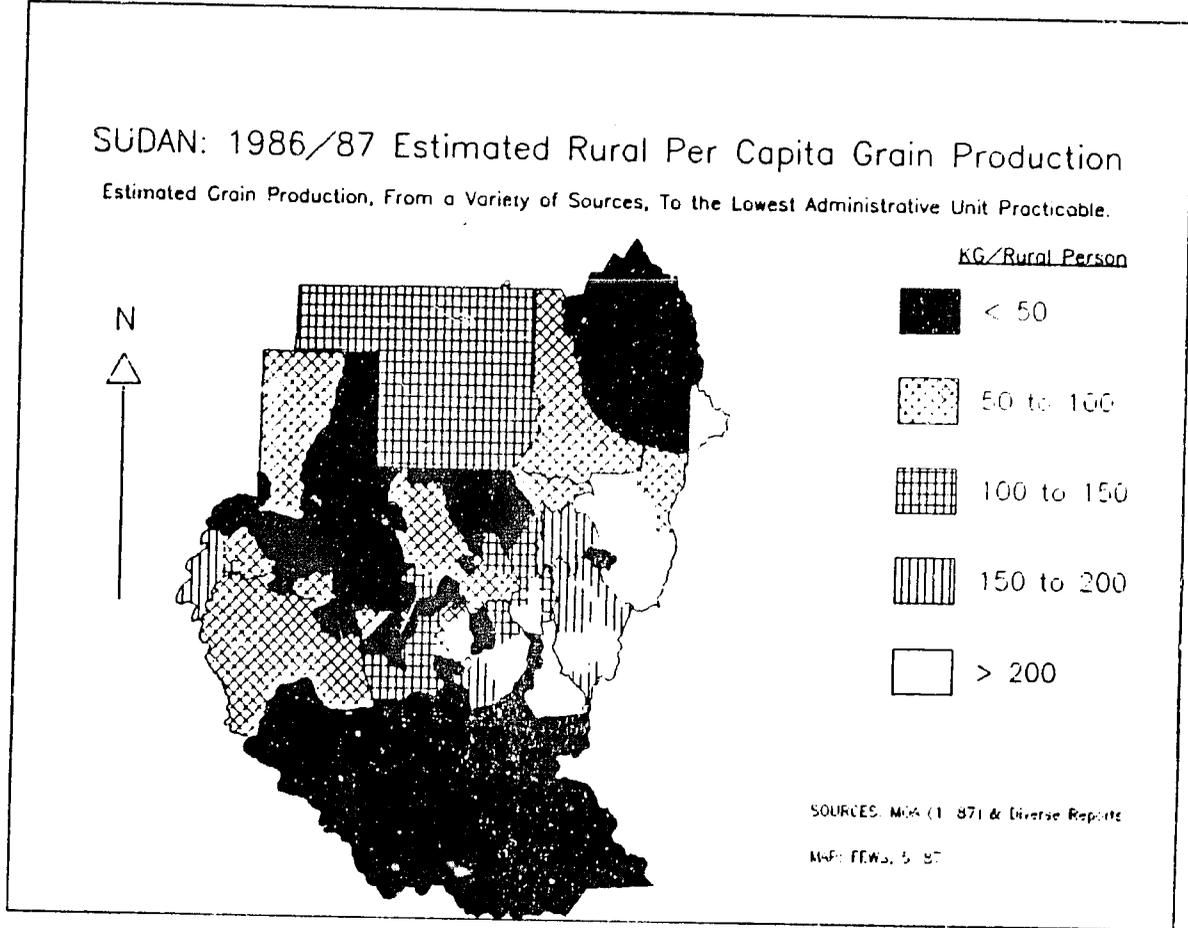
Using all available information, FEWS attempted to estimate and map rural per capita grain production to the lowest practicable administrative unit (Map 10). Units mapped include Rural Councils (N. Darfur Province, Kordufan Region), Districts (Kassala), Provinces (Gezira), whole Regions (Southern) and combinations of the above when only partial data was available. This map provides a fairly good picture of relative rural grain availability until harvest later this year. It uses as its basis the most recent Ministry of Agriculture estimates of production. There is reason to believe that some traditional production is not included, especially in the Southern Region, but also in the other Regions of Sudan.

Vulnerable areas, with production under 50 kgs per capita, cover most of the Southern Region and North Darfur Province, parts of Kordufan Region, most of Red Sea Province and El Fau District in Kassala Province. Cash crop production, unseen traditional agriculture, and livestock production ameliorate low grain production in some of these and other marginal areas. Nonetheless, this map, in combination with Map 11 (last year's sorghum crop condition), provides a picture of relative vulnerability due to low crop production.

## INDICATORS

Crop potential in 1987 will be monitored by assessing the vulnerability mapping indicators used here, as well as rainfall estimates, price data, and descriptions of farmers' decisions. A most important indicator, area under production, is readily available for irrigated and mechanized demarcated agriculture in Sudan (producing 86% of sorghum production), but is unavailable for the most vulnerable areas, outside of these schemes, where people depend on traditional rainfed production.

MAP 10



MAP 11

