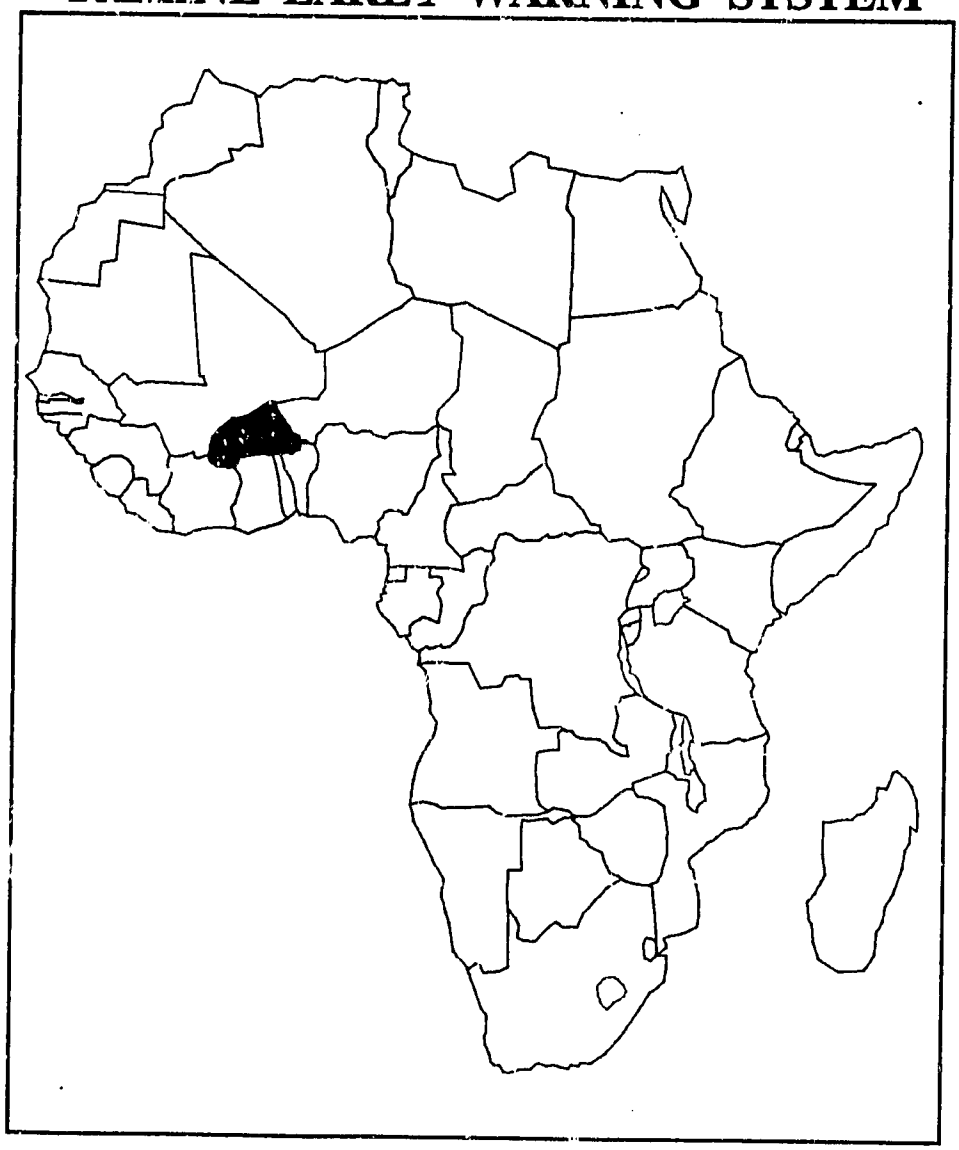
BURKINA

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.

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Vulnerability Assessment

June 1989

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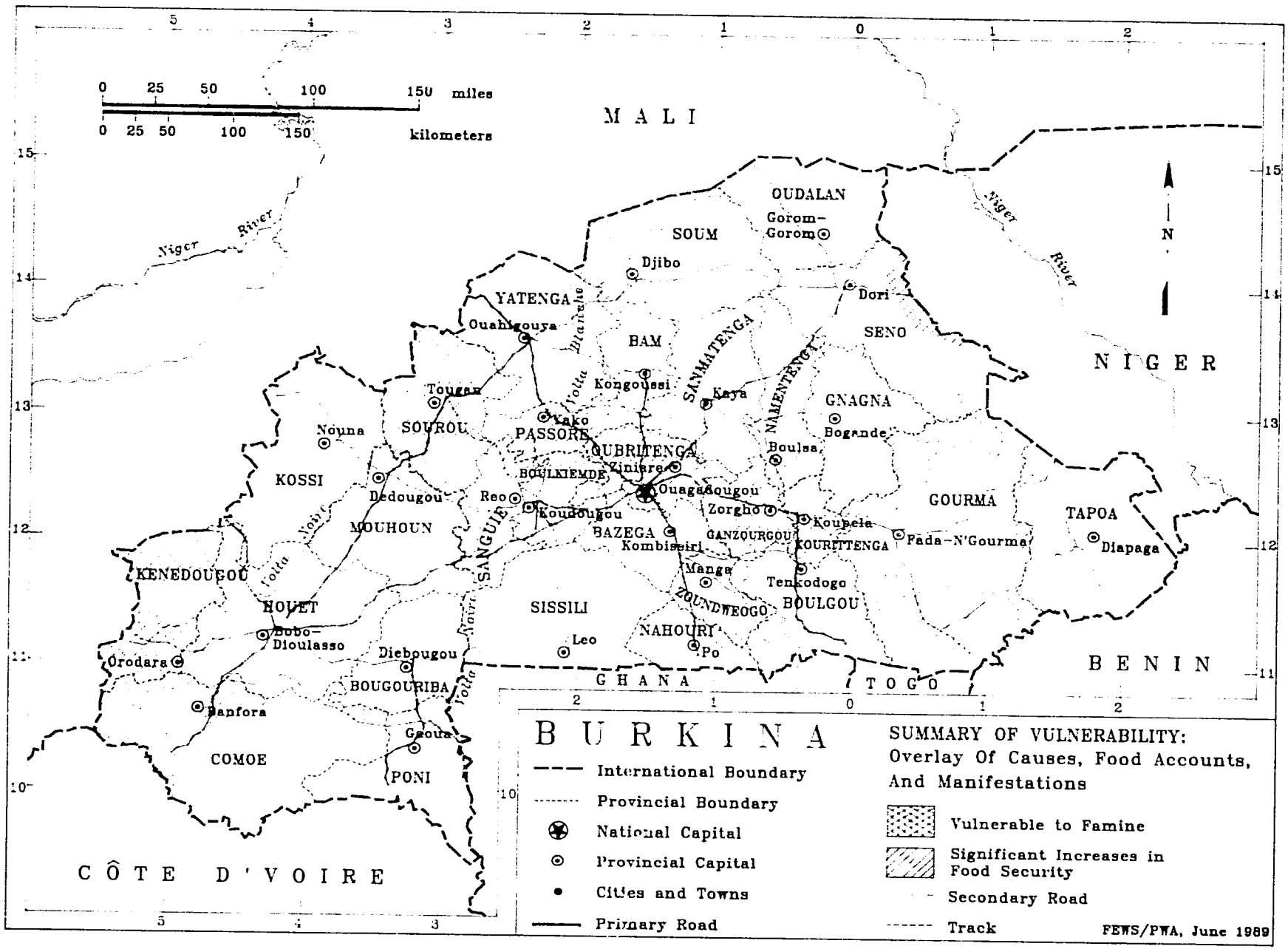
Executive Summary

The record breaking 1988 cereal production in Burkina, brought on by more abundant rains than have been seen in recent years, ensures that there will be no major food emergency in Burkina this year. Burkina's gross 1988 cereal production was 2,100,600 metric tons (MT), some 213,500 MT greater than the previous record harvest of 1986. Important increases in production were seen in the Sahelian provinces of Oudalan, Soum, and Seno, areas that historically produce enough cereals for only 20% to 30% of their cereal needs. Despite the extremely favorable outlook for Burkina as a whole, some very localized shortages may occur in the sahelian Oudalan Province, where certain localities have suffered crop losses from both pest infestation and flooding.

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.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Track
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.

For Burkina, 1988 brought significant increases in food security for much of the population (see Map 1). The generally good and well-distributed rains of the 1988 growing season have moved several areas away from a condition of vulnerability to food emergency, including Yatenga, Bam, and the northernmost areas of Sanmatenga and Namentenga provinces. The same rains that have produced record-breaking crops have also improved pastures and made water readily available to livestock and herders. On the basis of field reports and satellite imagery, we can assume that favorable range and water conditions have benefitted livestock in the Sahelian provinces and given an economic boost to households in the area that rely on livestock for part or all of their income, which will help keep these areas from being vulnerable to food stress.

The areas most vulnerable to cereal shortages are localities in Oudalan Province that have lost part of their crops to flood damage and pest infestations. The spatial impact of these events is too restricted to appear on Map 1. Even though some households may have suffered major losses of their cereal production from pest or floods or from both, overall cereal production in the Sahelian Provinces is above normal. Oudalan Province (and also neighboring Seno Province) historically produces only 20 to 30 percent of the cereals consumed within the province. A typical household in the Sahelian region has an economy that is diversified, drawing its income from several sources: livestock production, commerce, remittances from migrants, and craft activities. Localized crop losses will not necessarily create undue hardship for the population, as they have other resources on which to fall back. Traditional systems of reciprocity and exchange will be able to meet most household emergency needs with local resources and means of intervention. It is generally expected that the private sector will be able to cover the large majority cereal needs in Burkina. In any case, the impact of the problem is so small, and the cereal harvest so good in Burkina as a whole, that the Government of Burkina (GOB) feels that it will be able to deal with any emergency that may manifest itself.

It should be noted that economic data that would permit the assessment of the impact of livestock production on local income is not available. Conclusions about the status of livestock production have been reached by the fact that, in the northern provinces, range conditions have been reported as excellent and general livestock conditions have been reported as good.

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

Burkina has no areas that show a significant decrease in access to food during and following the 1988 growing season (see Map 2). Much to the contrary, most areas of Burkina have had either a significant or at least a probable increase in access to food. The overall level of performance has been so good for Burkina that those areas that were independently identified as possibly being at risk of shortages as a result of localized **flooding** and **pest damage** to crops do not appear on the map as areas of possible food stress. This is a result of the strength of the agricultural and pastoral input indicators, **rainfall** and imputed **vegetation levels**. In spots where flood damage coincides with pest damage, households may suffer cereal shortfalls, depending on the amount of carry-over stock remaining from previous years and the degree to which other resources (such as livestock and cottage production) can be used in purchasing needed foods.

In an effort to assess the impact of food stress on households over several years of production, a measure using vulnerability over time was used. It is generally held that vulnerability is not necessarily the result of a single bad harvest. Rather, vulnerability increases over time with a series of poor or mediocre harvests following each other in close succession. The use of a measure that accounts for stocks over time attempts to take into account granary reserves that, in an ideal situation, would be available to households. The measure used here compares the position of cumulative stocks by province for the last three years (1986 to 1988) to the cumulative stocks of the previous, though overlapping, three year period (1985 to 1987). Using this measure, the cumulative stocks position for Burkina as a whole is better in 1989 than it was in 1988. In other words, the trend of production to population is up over the last three years.

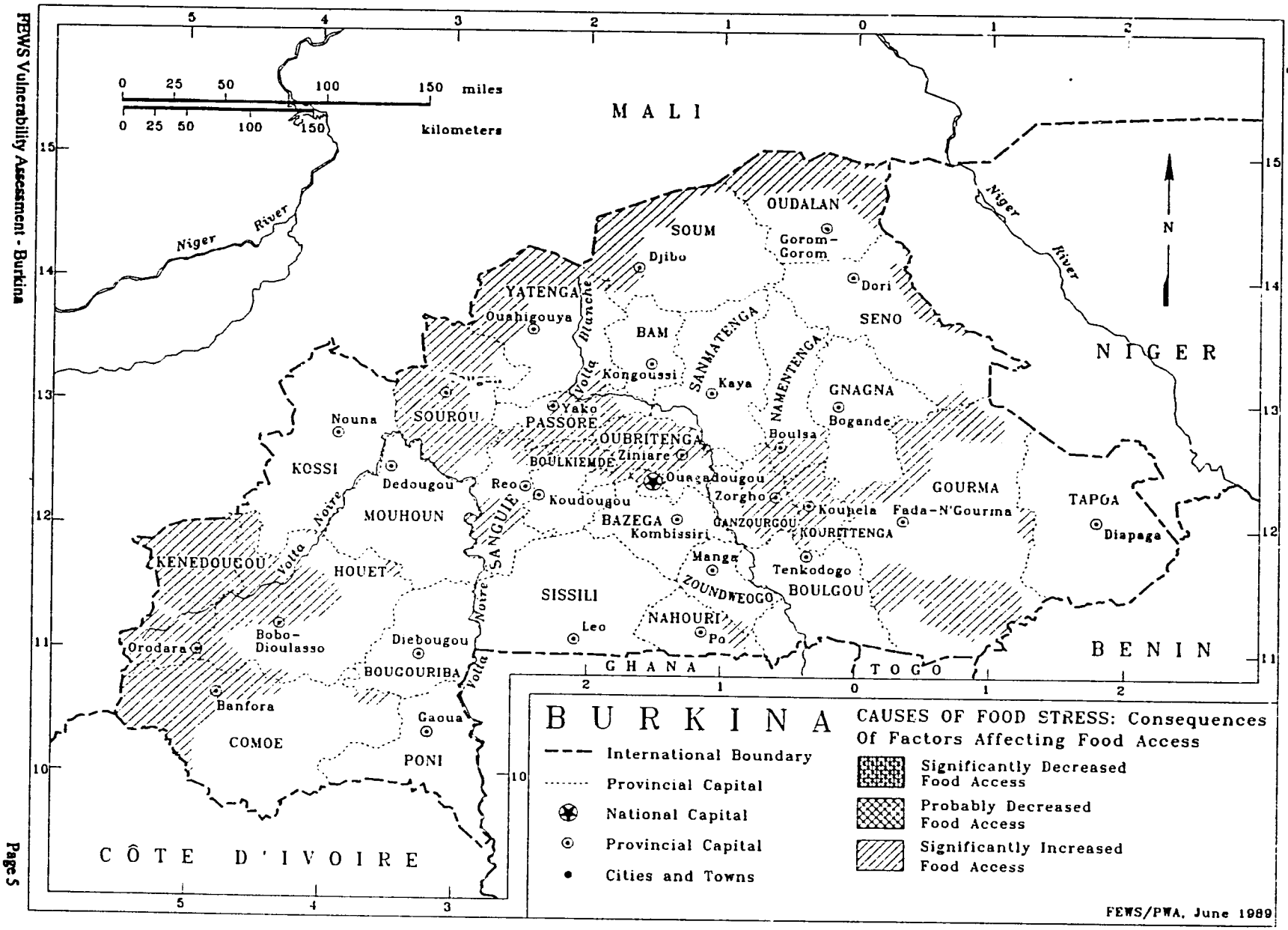
Other indicators that were used to assess vulnerability were rainfall data and the difference between the maximum 1988 Normalized Difference Vegetation Index (NDVI -- see inside back cover) and the average maximum NDVI from 1982 to 1987, which gives some indication of **vegetative potential**. The 1988 NDVI levels were significantly higher than that of the preceding six years for Burkina, particularly in areas of the Sahelian provinces and in northern Yatenga Province, suggesting markedly improved **pasturage** and potential for improved crop yields over those of the past six years. **Rainfall** in Burkina was generally above 80 percent of the long-term norm, and in the far west was above 120 percent of normal. This suggests that crop yields and pasturage were closer to higher, historical norms than to conditions seen in the recent past, which is a good sign.

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 province-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.

There are four provinces in Burkina where local cereal accounts will not meet the population's cereal needs for 1989 (see Map 3). As described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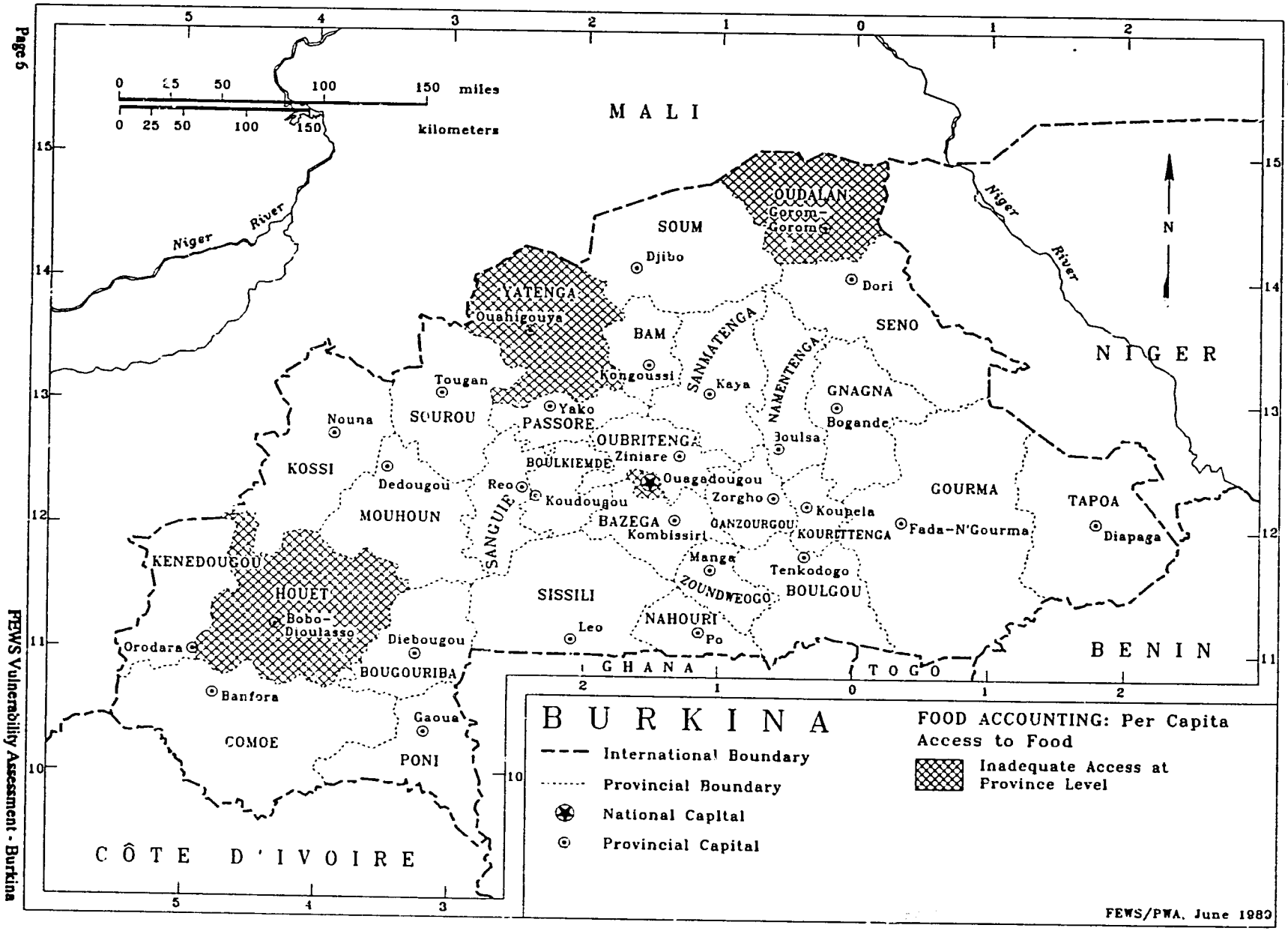
CAUSES OF FOOD STRESS: Consequences Of Factors Affecting Food Access
Significantly Decreased Food Access
Probably Decreased Food Access
Significantly Increased Food Access
FEWS/PWA, June 1989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FOOD ACCOUNTING: Per Capita Access to Food
Inadequate Access at Province Level
FEWS/PWA, June 1983

below, of the four deficit provinces, only Oudalan Province has a food accounting deficit that is not attributable to the fact that there are major cities with important non-cereal-producing urban populations within the province.

- Oudalan Province has never been able to meet its cereal needs. In the light of this, the fact that it is identified as an area having an inadequate production to consumption ratio is not alarming. Households in Oudalan, as in the other Sahelian provinces of Soum and Seno, derive an important part of their income from livestock production and other non cereal producing activities.

- Kadiogo Province is the province surrounding Ouagadougou, Burkina's capital, with its population of one half a million. Kadiogo does not have the capacity to produce enough grain to cover the need of its own population. This cereal deficit is normal and will be overcome by the private commercial market. There is no national level intervention planned to meet these needs.

- Yatenga Province is Burkina's second most heavily populated province. It has a high density of rural population, as well as Ouahigouya, Burkina's fourth largest city. Yatenga Province historically has only produced around 45 percent of its cereal needs. It is not surprising that this area has a cereal deficit. This cereal deficit will also be overcome by the private commercial market. Again, there is no national level intervention planned to meet these needs.

- Houet Province is Burkina's most heavily populated province and contains Bobo-Dioulasso, the second largest city in the country. Houet Province's rural population has the capacity to meet their cereal needs from agricultural production, except that Bobo-Dioulasso's cereal needs overwhelm the rural population's level of cereal production. Even so, it is expected that Houet's cereal deficit will be overcome by the private commercial market. There is no national level intervention planned to meet these needs.

It would be a mistake to assume solely on the basis of this cereal production-oriented food account methodology that the four provinces are unable to meet food needs. In fact, the private commercial cereal market in Burkina is one of the most highly developed and active in Sahelian Africa and is a very active and major force in the movement and distribution of cereals within the country. Data on the movements of grain in the commercial sector are not available, however, preventing an analysis of the most important actor in movement and distribution of cereals in Burkina. In an effort to obtain an accurate picture of cereal availability it is also important to establish the level of cereal reserves that may be available to producer households. Such data are also not available, however. Until food accounting (food balance) data and methodologies are better able to monitor meat and milk production and consumption, purchases of grain, and transfers of food and money, marginal agricultural areas such as these will continue to show poorly on a largely cereal production-related scale.

Food Accounting for Burkina is based on the Ministry of Agriculture reported figures of provincial production. Population data used for the food needs calculation are based on Ministry of Planning and Cooperations/Department of Statistics and Demography population figures and are projected for 1989 using rates derived from the 1985 census. The per capita cereal consumption rate used for the same calculation is set at 192 kilograms per year, the figure used by both the GOB and the USAID/Ouagadougou Mission. Where available, the sale of national cereal stocks have been included in the food accounts. In addition, SAP figures on the quantity of National Cereals Board stocks sold in the Provinces of Soum, Seno and Oudalan from November to October are also included.

As a result of the good harvest there are no official plans to make emergency food deliveries in Burkina before June 1989. Some 2,000 metric tons (MT) of the 6,000 MT of surplus sorghum sent to Burkina by the USA under Section 416 (d)

of the 1949 Agricultural Act was not delivered until after October, however, and have been included in the Food Accounting analysis where appropriate.

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.

This year, there are no widespread manifestations of the lack of access to food for Burkina. In previous years, the Sahelian provinces and the northern areas of Yatenga, Bam, Sanmatenga and Namentenga provinces showed some signs of stress as a result of lower than normal production and high **market prices** for cereals. This year, higher cereal production and generally stable prices indicate that there is no stress created by the lack of cereal either in the market or in the hands of producers.

There are no reports of **malnutrition** or any serious disease outbreaks. **Migration** from rural areas to urban centers and to the gold fields, which often increases in the post harvest period, has not manifested itself to date. This is a good indication that households do not feel called upon to attempt supplemental income strategies that are risky.

APPENDIX 1

Mechanics of the Vulnerability Assessment

All available indicator data of major significance to the food security of Burkina 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 the Burkina 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 the 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, Government of Burkina (GOB) National Meteorological Service.

Pest Damage: Areas in which pest damage was judged to have had a significant negative impact on food access were identified. Source: GOB/Ministry of Agriculture/*Direction de la Protection des Vegeteaux et du Conditionement*.

Flooding: Areas in which floods were judged to have had a significant negative impact on food access were identified. Source: *Système d'Alerte Précoce*, September 1988.

Food Production Trend: Provincial production figures for the last four years were compared for trends and for per capita production figures. Source: Ministry of Agriculture and Pastoralism.

Food Stock Reserves: These were noted for their bearing on food security but were not mapped.

Health and Nutrition Data: None reported.

Conflict/Civil Disruption: None reported.

Areas Reported as Vulnerable/Requiring Food Aid: None reported.

Food Accounting Notes: Net harvest includes sorghum, millet, rice, and *fonio*, and is calculated at the province level. The food accounting includes distributions of emergency food aid for 1988 lean period and post-1988 harvest season and cereals sold by OFNACER from October through December, 1988. The calculation assumes no carryover of stocks from 1987-88 and does not count imports or off-season production. Rate of consumption used is 190 kg per person per year. Population is based on 1985 census and brought forward to June 1989. Date of harvest is assumed to be October 15. Amount of cereals consumed is based on the June 1989 population times seven and one-half months of consumption to give amount consumed from harvest until June 1. Sources: GOB/Ministry of Plan, Ministry of Agriculture and Pastoralism/Department of Agricultural Statistics (DSNA), and OFNACER.

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.