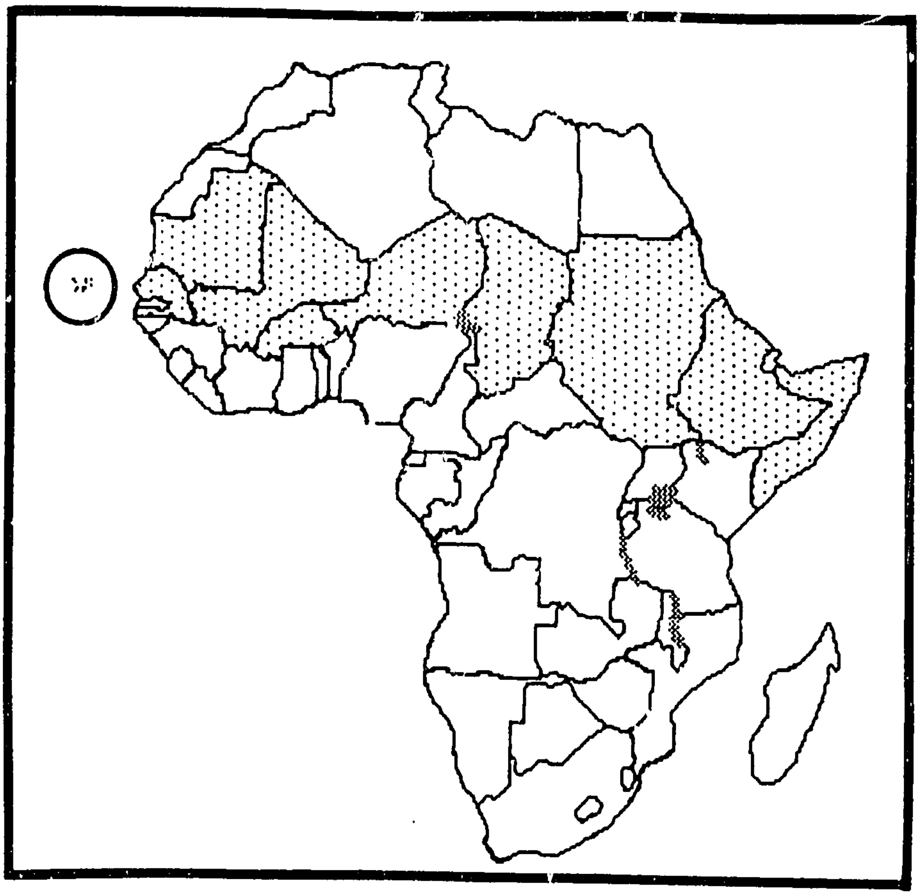
SPECIAL CLIMATE IMPACT ASSESSMENT

CAPE VERDE



NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE (NESDIS)
ASSESSMENT AND INFORMATION SERVICES CENTER (AISC)

PREPARED IN SUPPORT OF THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

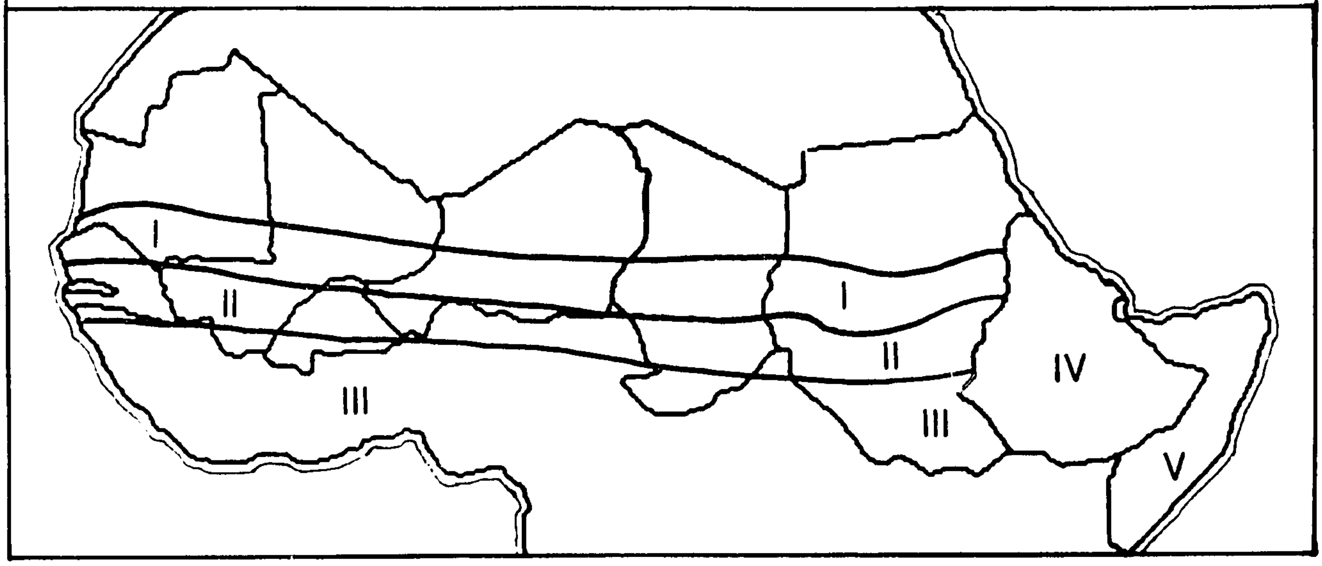
MAY - JULY 1985

ISSUED ON AUGUST 9, 1985 VOLUME I, NUMBER 2

USUAL PLANTING/HARVESTING DATES

(SUB-SAHARAN AFRICA)

CROP CALENDAR REGIONS



SAHEL/HORN MAIN SEASON CROP CALENDAR

Zone	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual Rainfall
I. Sahel			/////--------0000000							250 - 600 mm
II. Soudan			////-----------000000000							600 - 1,000 mm
III. Soudano Guinean		////----------------000000000								>1,000 mm
IV. Ethiopia [1]			///////----------------0000000000							400 - 1,800 mm
V. Somalia [2]	/////------------000000000									250 - 600 mm

// Planting -- Growing 00 Harvesting

This table illustrates the expected planting and harvesting periods for non-irrigated cereals during the main growing season in the Sahel/Soudan zones and in Ethiopia and Somalia. Planting and harvesting dates may vary widely from year to year, depending on the timing of the rainfall. Planting usually begins wnen the rainy season begins.

1 Secondary season crops planted late Feb. to early Apr. and harvested late Jun. thru July.

2 Minor season crops planted Oct. to early Nov., harvested late Jan. to early Mar.

CONTENTS

INTRODUCTION

This is the second in a series of monthly Climatic Impact Assessment Reports issued for the Sahel/Horn countries of Africa during the crop growing season by the NOAA/NESDIS Assessment and Information Services Center (AISC). These special reports are based on state-of-the-art techniques to: (1) use daily meteorological satellite and weather station data for determining rainfall patterns and vegetation/biomass conditions, (2) detect drought and assess weather impacts on agriculture, and (3) present this information in a format that is useful for both non-technical and technical users. They are part of a USAID sponsored program designed to significantly improve the capability of the Sahelian countries, Sudan, Somalia and Ethiopia to assess the impact of weather on agriculture (food crops and rangeland) and use the assessments as input for decision making.

These reports are intended to provide advanced warning of drought induced crop failures and should facilitate early planning for food crisis amelioration and drought/famine relief.

The special assessments, which are air-expressed or hand-carried to U.S. Missions in the field, contain satellite images, narrative analyses of all pertinent data, crop and rangeland maps, and various tables and maps depicting weather impacts on agriculture and containing rainfall statistics.

Rainfall amounts used in these reports are preliminary estimates and may vary greatly from values published elsewhere. The quality of the data received via the WMO Global Telecommunications System (GTS) ranges from good in Senegal, Burkina, and Niger to non-existent in Chad and Sudan. Rainfall data from Somalia, Gambia, and Cape Verde are extremely scarce. Data from Mali, Mauritania, and Ethiopia range from fair to poor. Satellite cloud imagery from Meteosat is used to estimate rainfall where surface reports are missing or appear inaccurate or unrepresentative. Satellite vegetation images from NOAA-9 are used to further adjust the rainfall data. The term "normal rainfall" generally refers to 1951-83 mean rainfall. Readers should keep in mind that rainfall amounts have averaged 15 to 25 percent less since the late 1960's in the Sahel zone.

The AISC Special Assessment Reports will be updated every 10 days by cable. Assessment of quantified weather impacts on 1985 millet and sorghum yields (by major administrative region) will be provided by cable about August 20, 1985. AISC's quantified assessments focus only on weather factors affecting yield, not such non-weather factors as seed availability for planting, losses due to pests/diseases, affects of fertilizer, or farmer's decisions which determine planted area or shifts from one crop to another. Such information can best be determined in the field.

This assessment represents the synthesis and evaluation of all available data. Although some of the pertinent input data are included for use by other analysts, all data sets are modified in some way by AISC and no single data set can be used alone. Apparent discrepancies between data sets or between the enclosed data and the analysis can result from the analysis process, which combines all data and analyst experience to produce the best possible assessment.

AISC welcomes comments or suggestions on these reports. Feedback from U.S. Missions is appreciated and has already helped to improve this assessment service. Contact: Douglas LeComte E/AI42, NOAA/NESDIS/AISC, Page Bldg. #2, Room 130, 3300 Whitehaven St., NW, Washington, D.C. 20235, Phone (202) 634-1822.

REGIONAL ANALYSIS

OVERVIEW

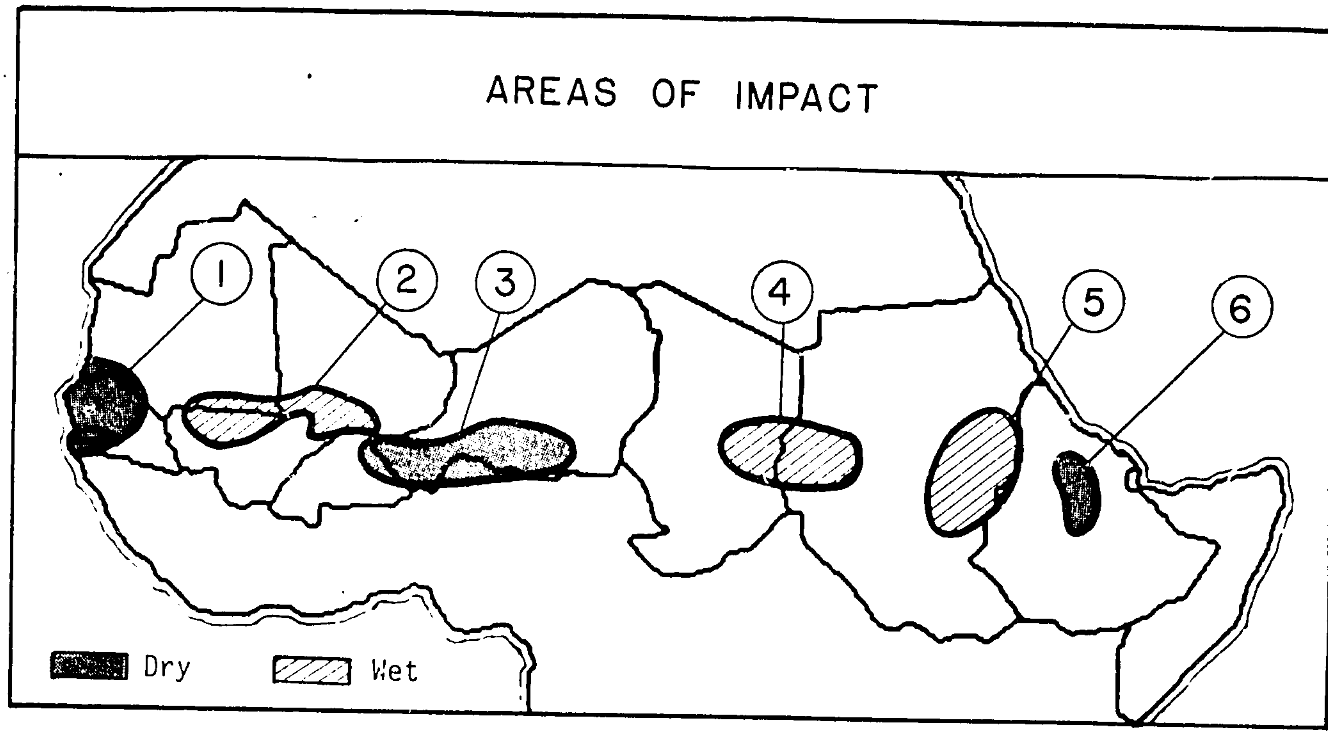


Figure 1

Crop and pasture conditions are much improved over the previous two years across the Sahel/Horn region, as July rainfall helped to offset earlier dryness. Normal to above-normal rainfall in Chad, Mali, Burkina Faso, and Sudan hampered food relief efforts but increased crop yield potential, suggesting an easing of food shortages late this year. Pasture conditions throughout the region improved markedly from June, though they remain below normal in Niger, Senegal, and Gambia. Crop conditions are normal to above normal in Mali, Burkina, Chad, and Sudan. Conditions in Mauritania, Senegal, Gambia (fig. 1, No. 1), and Cape Verde are somewhat unfavorable due to a late beginning of the rainy season, but plentiful rainfall throughout the remainder of the season would produce average crop yields. In Ethiopia, heavy rains have benefitted crops in western areas, but more rain may be needed in some central and northern areas (fig. 1, No. 6). Overall rainfall across the Sahel/Horn region (fig. 3) ranges from 80 to 120 percent of the long-term mean so far this year, except for parts of Niger, Senegal, Gambia, and Mauritania, where rainfall is 60 to 80 percent normal. The Intertropical Discontinuity (fig. 2) was south of normal in April and May, accounting for the slow start of the rainy season in West Africa. During July, the ITD moved sharply northward to the 20th parallel, bringing much heavier rains to the region compared to last year. The ITD remained south of normal throughout the important growing period in 1984, resulting in one of the worst droughts this century.

The following paragraphs briefly describe areas highlighted in figure 1. Note that 1984's AVHRR image (fig. 5) has a 20-km resolution, whereas the 1985 image (Global Area Coverage, or "GAC") has a 5-km resolution. GAC coverage is not available for last year.

Area 1. In Senegal, Gambia, and adjacent areas of Mauritania, below normal June rainfall delayed planting to some extent, but near normal July rainfall improved prospects in most areas. Satellite indices (fig. 4) and imagery (fig. 6) suggest unfavorable biomass conditions, except in extreme southeast Senegal. Cloud "contamination" makes this year's image in figure 6 difficult to interpret, but "greening" appears to be farther north in the 1984 image (fig. 5).

Area 2. The 1985 satellite image (fig. 6) shows a marked improvement in biomass in Sahelian areas of Mali and adjacent areas in Mauritania compared with last month. Note, especially, the bright yellow hue along the Mali-Mauritania border.

Area 3. Overall crop and livestock prospects remain below average in Niger, though better than last year. Higher rainfall and lower temperatures in July boosted cereal and pasture growth following hot, dry weather in June.

Area 4. Normal to excessive rains interfered with surface transport of relief aid to drought victims in Chad and Sudan, though the moisture should ensure improved crop production this year (subject to availability of seeds). Heavy showers damaged roads in Sudan's Darfur province, hindering food supplies shipped by truck.

Area 5. Satellite data show substantial biomass improvement this year in eastern Sudan (figs. 4, 5 and 6), where the bulk of the country's cereals are grown. Crop yields should be much greater than 1984's drought-reduced levels.

Area 6. Abundant rains have favored main season crops over much of Ethiopia, especially in the west, but satellite biomass conditions do not appear good in parts of Wollo and Tigray in the north, as well as Shoa and Sidamo in the center. Cloud "contamination" may be a problem in interpreting the image. This area should be monitored closely for signs of dryness in August.

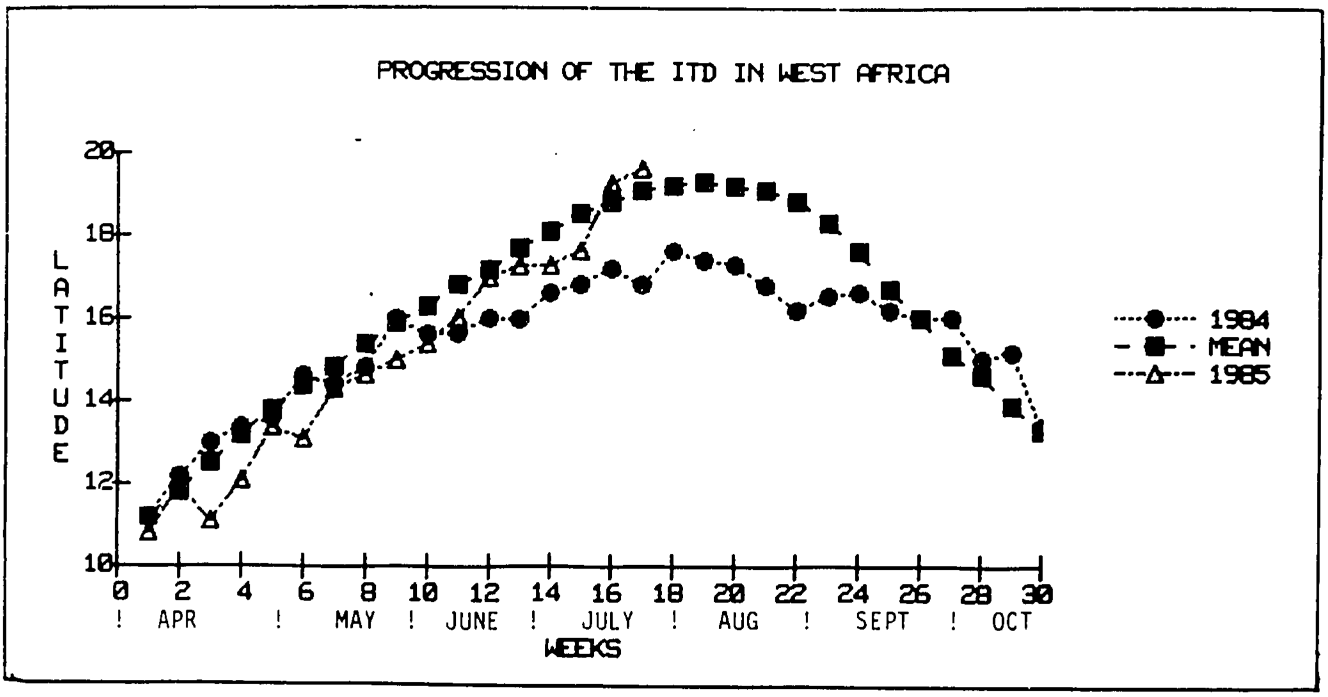


Figure 2

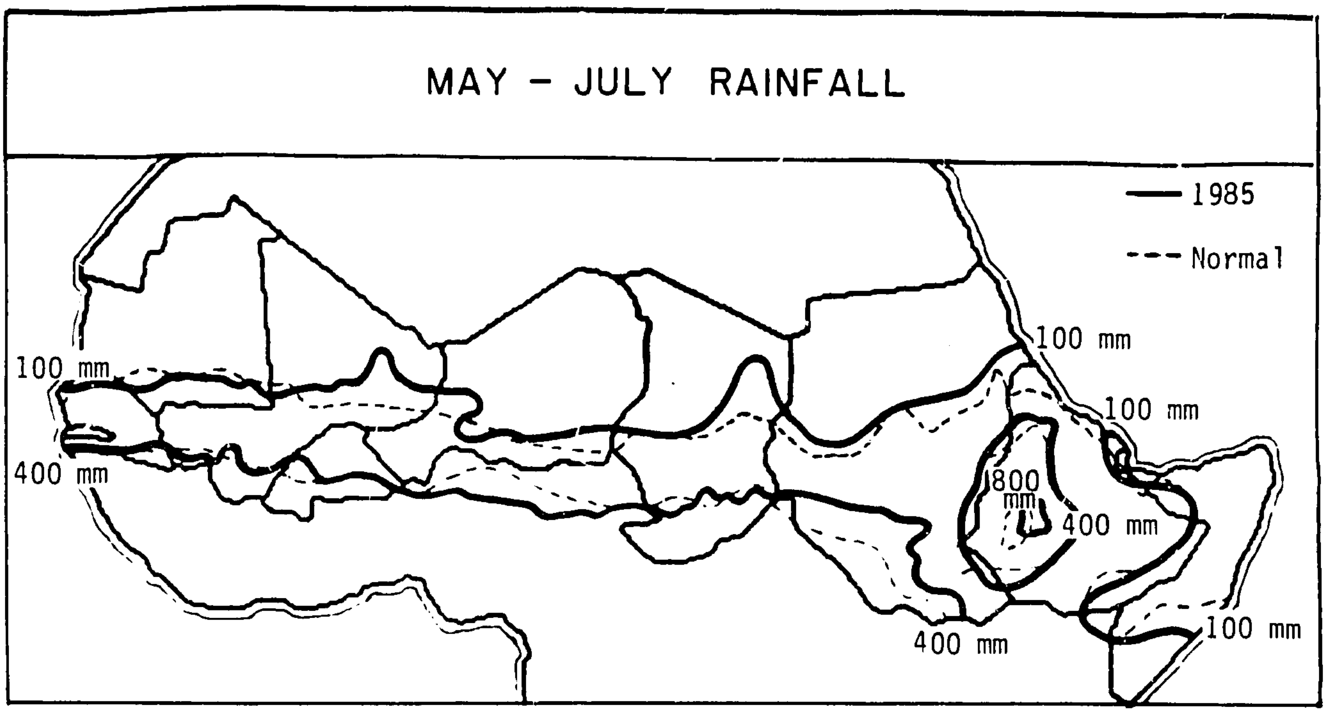


Figure 3

The northern edge of the rains (100 mm isoline) was south of normal in Mauritania, but north of normal in Mali, parts of Niger, eastern Chad, and Sudan. Heavier rains (400 mm) were north of normal in southwest Burkina and southern Sudan.

NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

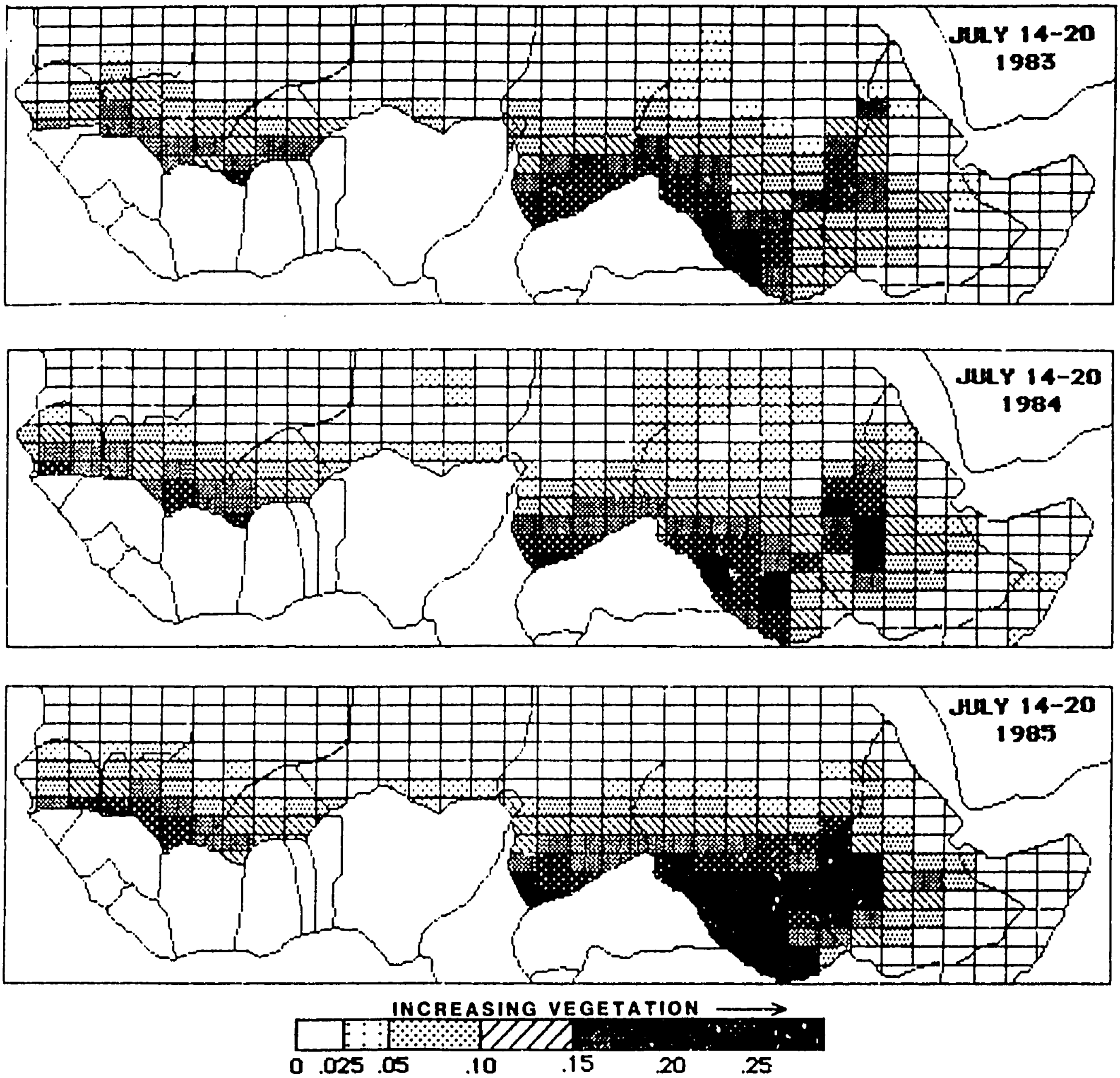


Figure 4

NOAA AVHRR IMAGE 1984

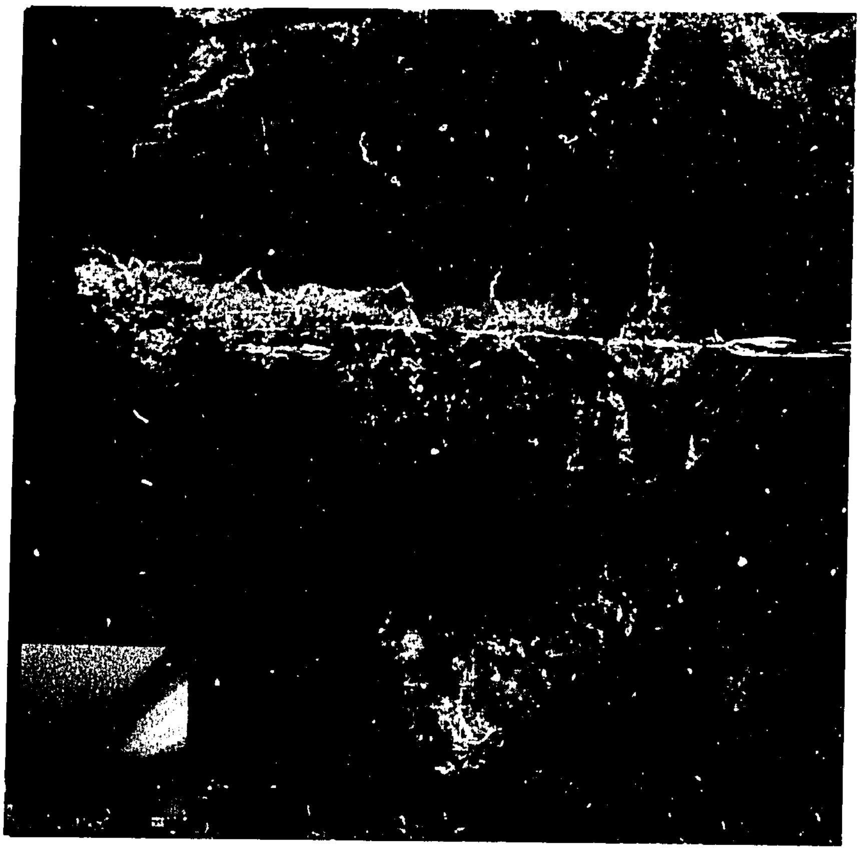


Figure 5

NOAA AVHRR IMAGE 1985

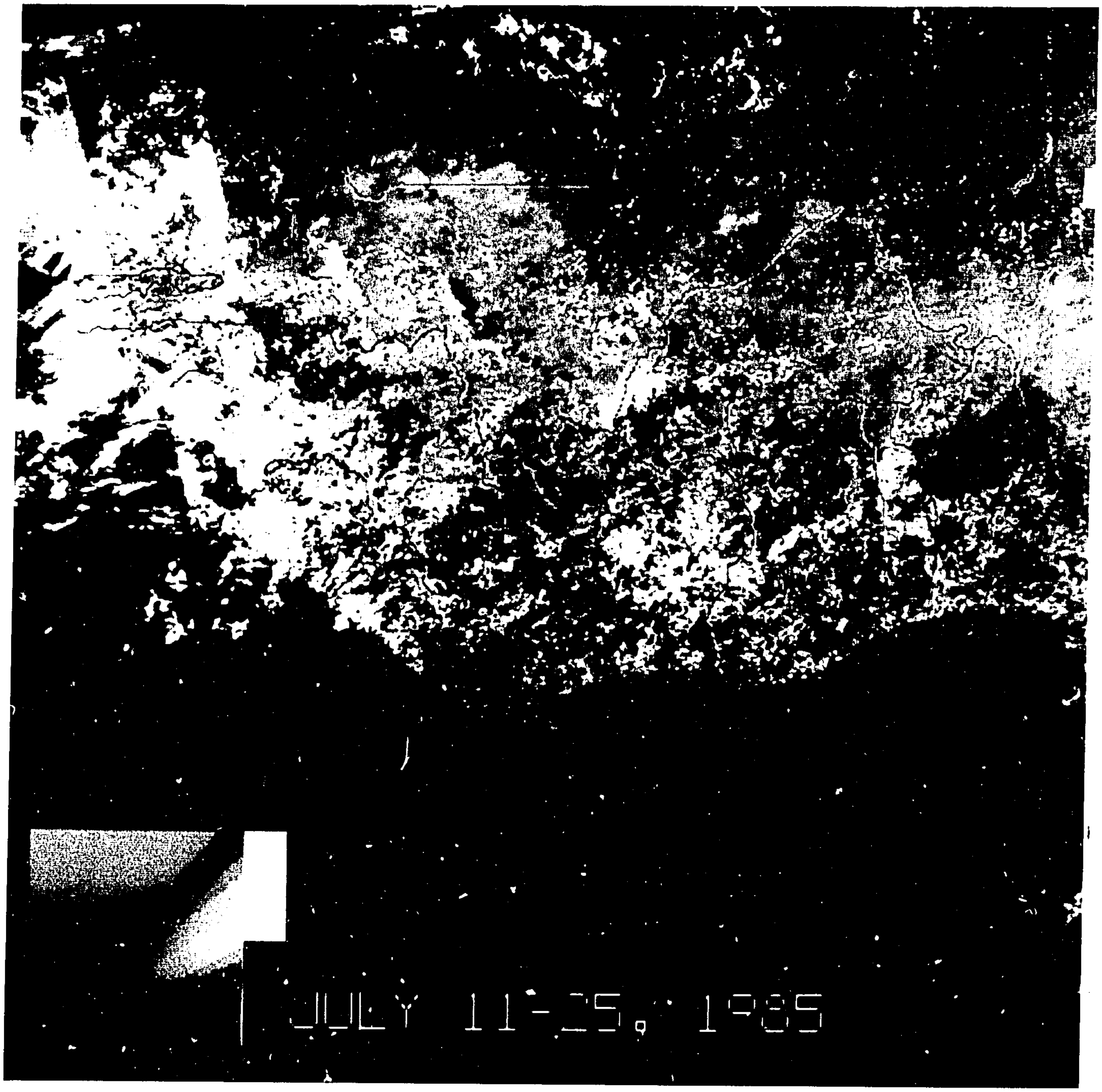


Figure 6

NOAA AVHRR IMAGE 1985

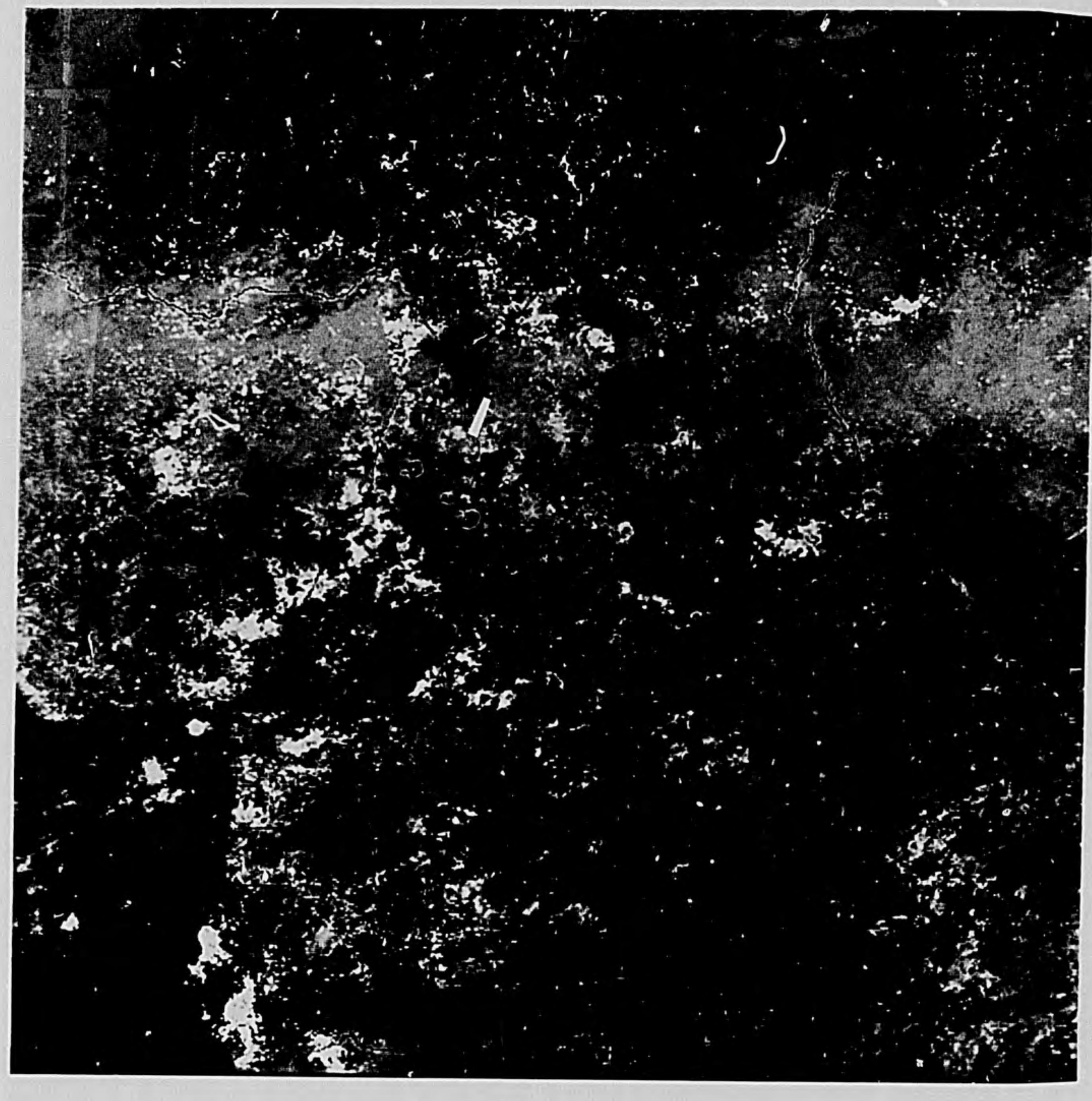


figure 6

1a

NOAA AVHRR IMAGE 1985

figure 6

BACKGROUND ON ASSESSMENT METHODS

DATA

The NOAA/NESDIS Assessment and Information Services Center (AISC) uses a combination of meteorological satellite products and weather data as the primary inputs for these Special Climatic Impact Assessments. Operational rainfall reports are received daily through the WMO Global Telecommunications System (GTS) and ten day reports are received from some host-countries and the Regional AGRHYMET Center in Niamey. AISC uses data from ESA's Geo-stationary Meteorological Satellite (METEOSAT) and the NOAA-9 daily polar orbiting satellite. METEOSAT photographs are used as one method to assess regional rainfall and to monitor large-scale weather patterns, e.g., the Inter-tropical Discontinuity (ITD). NOAA-9 data are used to assess vegetation/biomass patterns and to estimate rainfall.

NOAA SATELLITE ANALYSIS

The NOAA satellite provides daily data from the Advanced Very High Resolution Radiometer (AVHRR) which has a spatial resolution of one kilometer. The satellite receives radiation signals (e.g., from the ground and clouds) and immediately re-transmits one kilometer resolution data which can be received by local field stations as the satellite passes in the vicinity. The satellite can also record a limited amount of the one kilometer data; recorded data are termed LAC for Local Area Coverage. As they are received, the one kilometer radiation signals are sampled to obtain four kilometer resolution data (termed GAC for Global Area Coverage) which is stored internally.

The NOAA satellite products for 1985 in these special assessments are primarily based on 1985 GAC data (as available, AISC will include special LAC scenes). The 1984 and 1983 satellite images have a more coarse resolution on the order of 20 kilometers. Although these images have larger pixels, users can still compare 1985 conditions with those of previous years.

AISC obtains daily four kilometer resolution GAC data consisting of three radiation channels: Channel I (visible reflected solar radiation), Channel II (near infrared reflected solar radiation) and Channel IV (thermal infrared radiation). These three channels are composited over 10-15 day periods to remove most of the clouds from the image and produce the color-coded NOAA satellite images and vegetation/biomass index products contained in this report.

NOAA Satellite Images

The Ambroziak Color Coordinate System (ACCS), used to produce the satellite images in this assessment, shows the health of the vegetation using colors designed to maximize the information content and minimize the analysis time. Different hues (red-orange-yellow-green-cyan-blue) separate vegetation and water from soil and clouds using the visible and the infrared portions of the sunlight reflected from the surface. Saturation (red-pink-white) is used to identify clouds using the emitted thermal infrared radiation. Clouds are usually colder than the surface and they become white when the saturation of the colors is reduced for pixels with low temperatures.

The colors of the ACCS display a continuum of hue and intensity which matches both the data and the mind's perception system. Sharp boundaries on the image, shown as large changes in hue, indicate actual sharp changes in surface vegetation. The colors can be generally interpreted as follows:

HUE	INTENSITY: Dark	INTENSITY: Bright
red	wet or dark soil*	sand or low clouds
yellow	emerging or sparse plant cover over wet or dark soil*	emerging or sparse plant cover over sand or under scattered clouds
green	very healthy plants combined with standing water or forest	healthy field crops or similar plants
cyan (greenish-blue)	dense forest	dense forest, maize, or rice cover
magenta (purplish-red)	clear shallow or slightly turbid water	highly turbid, very shallow, or partially cloud covered water

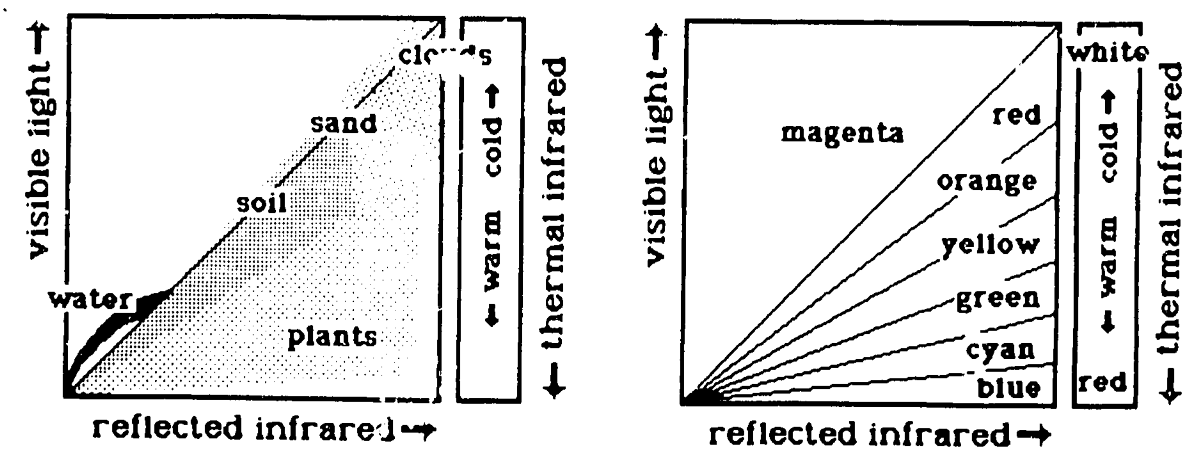
COLORS WITHOUT HUE

black	clear deep water or dark shadow
white	clouds, snow, or colder high terrain

*Dark reds, oranges, and yellows are shades of brown.

Ambroziak Color Coordinate System

colors and meanings



Vegetation/Biomass Index Products

The Vegetation/Biomass Index products contained in this assessment are derived from the following formula:

$$NVI = \frac{\text{Channel II} - \text{Channel I}}{\text{Channel II} + \text{Channel I}}$$

where: NVI stands for the Normalized Vegetation Index

Vegetation/biomass index values are calculated for each day of the week and cloud-free pixels are averaged to produce a weekly mean vegetation index. Weekly values are further averaged for one degree latitude and two degree longitude areas. The NVI is a measure of the amount of vegetation or biomass on the ground. The index ranges from 0 (no vegetation) to +1 (intense vegetation); however, for areas assessed in this report, the highest NVI value was +.365. These indexes can show the progress of vegetation/biomass conditions through the growing season. Conditions at any one time within the season can be compared to those at the same time in previous years. The index can be placed on a map or graphed as a time-series.

ASSESSMENT PROCESS

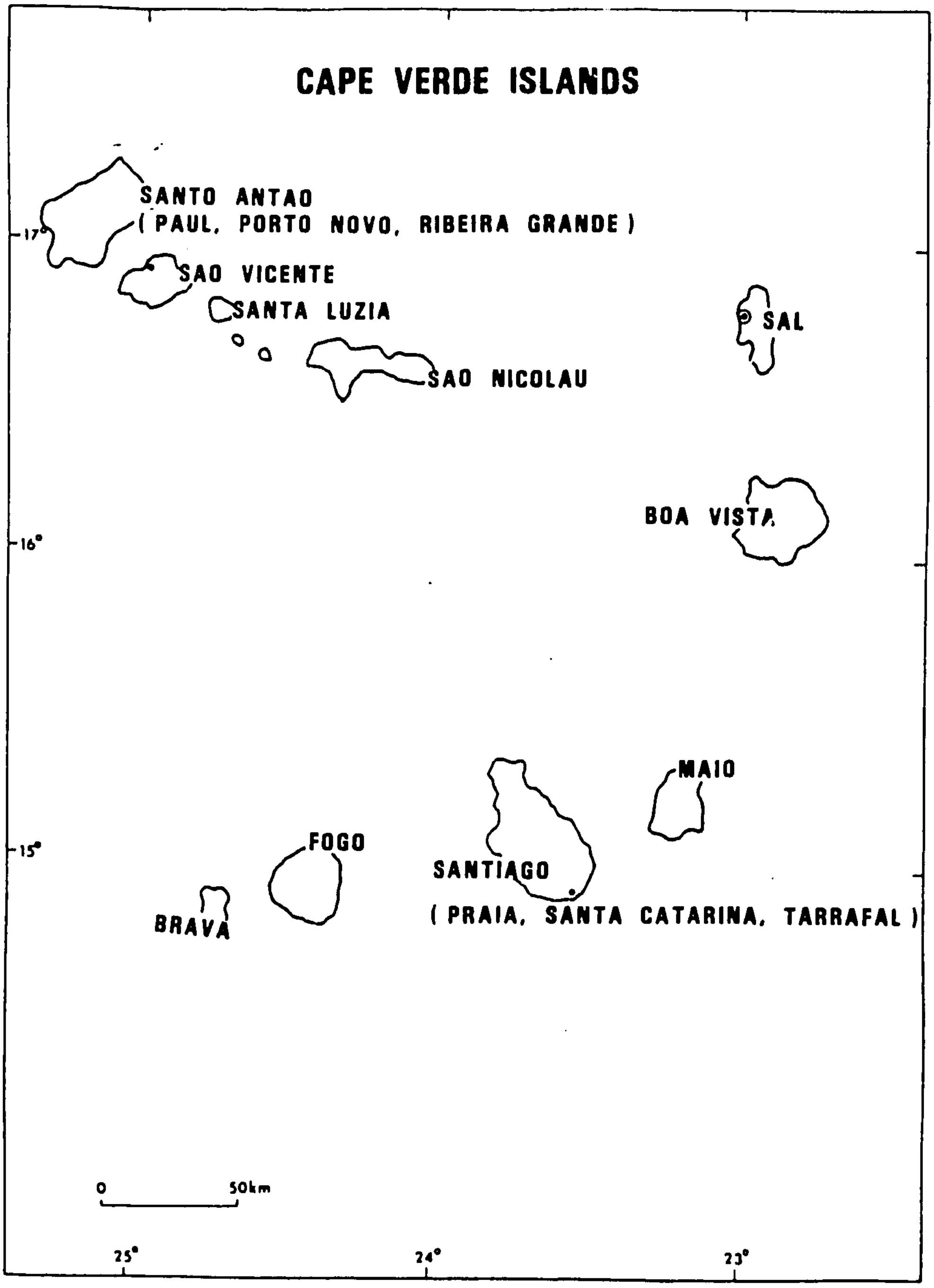
NOAA/NESDIS AISC uses all available satellite products and weather station reports to assess climatic impacts on agriculture (crops and rangelands). AISC focuses on the weather factors which affect crop yield, not non-weather factors that may also be important such as effects of fertilizer or losses due to pests and disease. AISC does not measure planted or harvested crop area.

The AISC Assessment Process involves: 1) estimation of daily rainfall, 2) analysis of rainfall patterns, and 3) assessment of weather impacts on crops and rangelands. Rainfall assessments are based on daily weather reports, METEOSAT photographs, NOAA-9 photographs and AISC/ACCS color-coded satellite images. Ten day and monthly rainfall amounts are determined for weather reporting stations and crop regions. Ten day, monthly and seasonal rainfall are analyzed for the current crop season and with respect to conditions during the previous 30 years. AISC uses various agroclimatic and satellite models to assess the impact of rainfall on crops and rangelands. These include ten day, monthly and seasonal agroclimatic/crop condition models used in combination with each other; the NOAA satellite images; and vegetation/biomass index products.

The assessments in this report are subdivided into four components: 1) Overview, 2) Rangeland Vegetation/Biomass Conditions, 3) Agricultural Crop Conditions and 4) Rainfall Analysis.

COUNTRY ANALYSIS

CURRENT ASSESSMENT



The first significant rains fell on July 20, 1985, followed by additional rains several days later. As precipitation was not widespread, corn and bean crops need additional moisture for favorable development.

Last year maize was damaged by a combination of dry weather in July and August and torrential rains in mid-September.

Though rainfall conditions have not been especially favorable so far this season, periodic, moderate rainfall from now into October would produce a much better harvest in November than during the preceding two years. During recent years, the growing season has been characterized by the absence of regular rainfall.