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PROGRESS REPORT

USE OF NOAA CLIMATIC IMPACT TECHNOLOGY BY COUNTRIES OF THE SAHEL AND HORN REGIONS OF AFRICA FOR OPERATIONAL CROP MONITORING AND RANGELANDS MANAGEMENT

and

GLOBAL CLIMATIC IMPACT ASSESSMENT TECHNOLOGY FOR DISASTER EARLY WARNING AND TECHNICAL ASSISTANCE IN THE DEVELOPING WORLD

to

AGENCY FOR INTERNATIONAL DEVELOPMENT
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STATUS REPORT AND PROJECT ACCOMPLISHMENTS FOR FY85 AND FY86

Although the Assessment and Information Services Center (AISC) of NOAA/NESDIS has made steady progress in improving drought early warning assessment for AID over the last seven years, the past two fiscal years have represented a quantum leap in the advancement of assessment technology. The increased commitment of both AID and NOAA to food production monitoring has improved reliability and efficiency of the assessments and lowered the cost of technology transfer to developing countries.

This report documents and explains the current status of the AISC assessment system developed for AID and reviews the accomplishments of the past two years. The first section provides an historical perspective on AISC's drought monitoring program. The second section describes AISC's technical capabilites and explains the methodologies used in making assessments. The final section is a summary of the products delivered by AISC to AID under the last two PASAs (fiscal years 1985 and 1986): "A Global Impact Assessment Technology for Disaster Early Warning and Technical Assistance in the Developing World (NOAA/AID PASA BOF-0000-P-CC-3062) and "Use of NOAA Climatic Impact Assessment Technology by Countries of the Sahel and Horn Regions of Africa for Operational Crop Monitoring and Rangelands Management" (NOAA/AID PASA BOF-0000-P-CC-5099-00). The final section reviews AISC's overall approach to assessment. Also included are six appendices that contain sample assessments, host country government flow charts, trip reports, the Sahel course syllabus, 1985 yield forecasts, and a group of cables commenting on the NOAA/AID program.

I.

BACKGROUND

The NOAA/NESDIS/AISC has developed an operational climatic impact assessment monitoring system for the developing countries. The Climate Impact Assessment Division (CIAD) is made up of multidisciplinary teams located in the Climate Assessment Branch in Washington and the Models Branch in Columbia, Missouri. These teams of experts address the meteorological, agricultural and economic aspects of the food problem.

From 1974 through 1985 AISC participated in LACIE (Large Area Crop Inventory Experiment) and AgRISTARS (Agricultural Resources Inventory Surveys Through Aerospace Remote Sensing). These were multi-agency research and development projects designed to improve the state-of-the-art of crop forecasting for the major grain producing areas of the world. As part of the AgRISTARS (1979-1985) effort a Joint Modeling Center for Crop/Yield Model Development was established in Columbia, Missouri by NOAA, USDA, NASA and the University of Missouri. In 1985 NOAA/NESDIS and the University of Missouri-Columbia formalized a continuing commitment to food monitoring and dedicated the Cooperative Institute for Applied Meteorology (CIAM) in Columbia, Missouri.

AISC has worked to improve early warning of drought induced food shortage disasters in the developing world since 1977 when the first assessment models were developed. Beginning with the Caribbean Basin in 1979, weekly and monthly assessments of the impact of weather on food security have been published and sent via cable to USAID Missions weekly and monthly. Since then the areas of coverage have been expanded to include nearly all of the tropics (80 countries) and the technology has steadily improved. These reports have also been provided to the US Department of Agriculture, the Central Intelligence Agency, Defence Intelligence Agency, and United Nations Agencies such as FAO, WMO, UNDP, and ESCAP. The qualitative assessment reports are based mainly on rainfall data and are designed to provide USAID Missions and American Embassies with the most current information possible on drought conditions, their possible impacts on subsistence crops and early warning of potential food shortages caused by drought.

Verification studies have shown that climate impact assessments issued 30 days before harvest can provide lead times of 3 to 6 months to the decision makers and planners who must develop food assistance strategies and other strategies to mitigate potential disruption. Because of the reliability and timeliness of these assessments the US Government has assisted interested

developing countries in implementing their own national operational assessment programs. Since 1981 AISC has assisted approximately 30 developing countries, including eight in the Sahel region, with implementation of national early warning programs based on operational rainfall reports to detect drought, assess the potential impact on crops and report the potential for food shortage to their governments. This international program was developed and operated by AISC and the Atmospheric Science Department of the University of Missouri with funding and other support from AID Office of Foreign Disaster Assistance (OFDA).

The Sahel region has been a focus of AISC efforts since the inception of the assessment reports in 1979. Severe drought conditions existed during the late summer and signs of dryness were detected and reported as early as June 1979. AISC projections of potential food shortages were issued during late August 1979 and were verified 3 to 6 months later when disasters were declared due to drought impact. Discussions with the Regional AGRHYMET Center were held during late 1983 for cooperative program development in the Sahel. These discussions led to a joint course on Rainfall/Agroclimatic Assessment Techniques which was jointly conducted for the Sahel countries during April 1985 in Niamey, Niger. Based on developments in the use of meteorological satellite data for agricultural assessment a new program was initiated during mid-1985.

Under the new program AISC is providing technical assistance services to the 8 Sahelian countries and the regional AGRHYMET Center under AID/OFDA sponsorship. The project is titled "Use of NOAA/NESDIS Climate Impact Assessment Technology by Countries of the Sahel and Horn Regions of Africa for Operational Crop Monitoring and Rangelands Management (July 1985 through September 1986". In addition to meeting many of the USG information needs, the project is designed to assist each country to improve their operational capability for early warning of potential drought impacts, real-time crop and rangelands monitoring, crop production forecasting and rangelands management.

As an integral part of the project AISC air-expresses to each country Special Climate Impact Assessments to further introduce the technology into the region. These assessments depend heavily on special analysis of daily data from the NOAA polar orbiting meteorological satellite as well as traditional weather station rainfall reports. These special assessments contain narrative analyses of status of crop and rangelands conditions within 48 hours of distribution time of the reports. Included with the analyses are the data sets used to produce them so that scientists in the field can better understand the assessments and make modifications if more local data become available. The data sets included are Advanced Very High Resolution Radiometer (AVHRR) color satellite imagery, AVHRR

derived vegetation index maps and time series plots, crop condition indexes and detailed spatial and seasonal rainfall analyses.

Quantitative yield forecasts were provided by AISC for the first time at the end of the 1985 growing season. This served as a test of the NOAA satellite indexes as an important indicator of crop yield in the Sahel zone. The NOAA AVHRR satellite products represented the key input to the written reports which included more detailed coverage than the brief cables provided in previous years. The entire satellite system went from research to operational status in less than 6 months to support this important project and the results justify the tremendous effort involved.

The Special Assessment Reports provide an opportunity for host-countries to learn first-hand how NOAA AVHRR satellite data represent a new tool for real-time crop and rangelands monitoring throughout the entire country during the crop growing season. For example, the in-country analyst can cross-check drought patterns (or exceptionally healthy conditions) detected by satellite with in-country rainfall reports and ground survey reports. In most cases the quantified yield forecasts represent at least a 30-60 day lead time over reports derived from conventional ground survey methods. By clearly identifying potential problems and providing these lead times, the assessment contribute to the crop yield forecasting process which is essential for agricultural policymaking and early warning relief planning.

II.

AISC CAPABILITIES

There are differences between research and operational groups which go beyond the immediate goals of the organization. Research organizations are interested in furthering science for the sake of science and in producing the most accurate explanation of the problem in the simplest possible terms. Operational organizations are interested in taking the results of research and applying them to the solution of immediate problems.

AISC is an operational organization which contains a large number of researchers in the crop monitoring sciences. AISC researchers are now doing development as well as pure research. In the past three years AISC research has lead to two Ph.D. dissertations, which have been accepted and degrees granted. A third dissertation has been begun and will lead to a degree within three years.

AISC has an operational mandate and must produce the best and most quantitative assessment of agricultural conditions on a fixed schedule. The perfect answer may not be affordable nor possible under such conditions. Research determines what is possible and development makes the practical parts of research work in a day-to-day operational environment. AISC development has taken the most advanced research available and made the changes necessary to produce routine operational products. In the case of imagery analysis for Africa the atmospheric interference during the growing season was an unsolved problem. The two dissertations which are now complete have used different attributes of the imagery to solve this problem and have been successful in producing operationally acceptable results from the satellite data.

The best possible approach for producing operational assessments requires the use of all available information. There is no single source of data which produces the "right answer". Each data source and analysis system has its strengths and weaknesses and different systems frequently give conflicting answers. When a number of experts in the individual systems bring their answers together the discussion of these differences leads to the best possible answer. Only experts in each system know the limits of the systems and can best decide which is the most reasonable answer.

AISC consists of a team of experts who have worked together for years doing crop condition assessments from the research through the production of assessments. The system is truly a

team effort for the complexities and volume of work necessary are too great for a single person. The development, operation and transfer of this team concept of crop condition assessment and early warning are the strengths of AISC. AISC products are not specific models or "black boxes" but a system of independent subsystems which can interact to produce the best possible assessment in the time alloted and at the times required.

THE NOAA DROUGHT EARLY WARNING SYSTEM -- QUESTIONS AND ANSWERS

A great deal of confusion remains about the use of meteorological satellite data by NOAA to monitor crops in real-time. This is an attempt to answer the most asked questions in a brief, nontechnical way so that information provided to the field can be put to the best possible use. The questions involve the use of the normalized vegetation index (NVI), the nature of the various images available, satellite sensor resolution, and the comparison of NOAA AVHRR (advanced very high resolution radiometer) with Landsat MSS (multi spectral scanner).

What is the NOAA real-time crop monitoring system?

Real-time crop monitoring cannot be done by a single component that stands alone, but rather requires at least three major components which work together with other existing systems to produce accurate and timely yield estimates possible. The NOAA early warning system is based on all of the research done to date on the subject of real-time estimation of crop conditions and uses two new developments which transform the research into an operational program. The nature of real-time crop assessment reduces the effectiveness of traditional remote sensing methods. The key is to quantify the satellite signal through the atmospheric interference and monitor the health of the vegetation over time and space. Assessments during 1985 and 1986 have successfully demonstrated that this can be done.

The NOAA system is composed of three parts, two of which are concerned with remote sensing and one which uses meteorological data. Normalized vegetation index (NVI) smoothed time series and specially designed color images are the basic satellite components. A commonly used water budgeting technique completes the system. The remote sensing portions of the system are the key elements (both vegetation indexes and color images) and will, therefore, be discussed in detail, especially the color images which are the most difficult to understand part of the system.

What is the NVI?

The NVI is based on the ratio of the visible sun light to the near infra red sun light reflected from the plants. The most common definition of this index is the difference of these two channels divided by their sum in such a way that plants have a

positive index value and water has a negative index value. Thermal infra red, which is related to the temperature of an object, plays no part in the NVI.

The satellite sees the NVI which is the rate of photosynthesis and can be thought of as the rate at which biomass is being created by the plant. It is related to, but not equal to, the status of the plants in question. If the atmosphere is ignored then the satellite sensors can determine the rate at which visible radiation is being used to produce biomass. It is the integral and shape of this NVI time series which is most important in determining total biomass and yield. The number of cells and their health (turgidity) are both related to the rate at which biomass is being produced and, therefore, related to the NVI which is sensed by the satellite. For field crops in particular the NVI can be the best tool available for estimating plant status.

Why not just use the NVI as final answer?

If the atmosphere could be removed crop monitoring would be reduced to the simple task of computing, recording and analyzing these single numbers (NVI) for each point of interest. This has not been successfully done. Many Landsat, as well as some meteorological based satellite systems have been successful research projects but have failed to produce operational assessments. Removing the atmosphere is not a trivial task for real-time crop assessment. The crop and the atmosphere are both changing on approximately the same time scale and when a change is detected there is no way in which the change can be partitioned between the two possible causes for a single pixel. The data necessary to drive a model to measure the atmospheric interference are not available. The complexity and computational burdens of running such a system, if it existed, would be overwhelming, if not impossible.

The NOAA system assumes that a single pixel on a single image cannot be quantified but by averaging over time and space or by using specially designed images to interpolate quantitative point source data, these data can be quantified. If, in the future, it does become possible to remove the effect of the atmosphere at a single pixel, then the NOAA system will work even better, but it does not require the removal of the atmosphere at the pixel level in order to operate.

Time and space averaging can be used to produce an index value viewed through a "normal" atmosphere which can then be used to compare various regions or times, or can be used in regression models to predict yield directly. If a large number of pixels are spatially averaged using a cloud filtering algorithm and their time series are smoothed with a specially designed filter, it has been shown that the results are stable, quantified NVI

values represent the integrated status of the vegetation over a large area (5000 km2) at a given point in time. As smaller areas are used the signal to noise ratio drops and the results become less quantitative. The data used in this process are available over the entire earth on a daily basis. The system has demonstrated itself to work considerably better than rainfall data for estimating crop yields in semiarid regions such as the African Sahel and the US Central Plains.

Why are there so many different types of satellite images and how are they used?

There are a number of images because the assumptions made in developing the images and the uses to which they are put are different. Basically there are three different types of images used in crop monitoring, each with its own uses. The pseudo color NVI image, the false color IR (infra red) and the ACCS (Ambroziak color coordinate system).

Pseudo color image

The dimensionality of an image is important to describe the amount of information which can be displayed. A pseudo color image of the NVI at each point is a 3-dimensional image. Each pixel contains three independent pieces of information. The pixel location (x and y) are two dimensions and the color coded NVI of the pixel gives the NVI value and, therefore, a third dimension. A pseudo color image contains only the ratio of the two channels and there is no way to retrieve the actual value of either channel.

Very few colors are needed to produce a pseudo color image, therefore, the colors can be chosen so that the color differences between them is great and NVI values can be individually identified. The resulting index is the best display image of the NVI which is possible and small NVI changes can be detected easily.

The false color IR image

The false color IR image is based on a photographic process of color film which is sensitive to near infra red radiation. It is the most commonly used image for real-time crop analysis in operational situations. Both aerial photography and satellite images can be displayed in this manner. Lush vegetation appears as bright red and becomes pink as vigor decreases.

The false color IR image adds a fourth dimension to the image by including scene brightness. The sign of the NVI is given by hue (red for positive and cyan for negative), the NVI by saturation of these hues and the distance from the origin by intensity or brightness. All of the information in the two channel image is displayed at each point making the false color

IR image a true 4-dimensional display.

The reason that the false color IR image has been so useful in vegetation analysis is two-fold. First, the false color IR image is a natural display of the NVI in the color coordinate system which is used by the brain to process color information, therefore, patterns of the NVI are clearly seen by the human mind as being independent of the other information in the image. Secondly, the human mind is the best processor of qualitative patterns which exists and is well suited to analyze satellite data which are qualitative and contain information in pattern form. The strong points of the false color IR image are:

1. its ability to display all of the spectral information of interest for analysis,

2. its display of the vegetation index on an axis of the mind's natural coordinate system,

3. its ability to provide information which allows distinction between land, water and surface features, and

4. its relative low cost for image creation.

The shortcomings of the false color IR image are:

1. the use of three color axes to display two dimensional data and

2. a lack of perceptual color resolution.

When the success of the image in crop monitoring is considered, these shortcomings may not be serious, but they do provide the possibility to improve image quality, and therefore, the value of the image.

The ACCS image

The ACCS is an improved version of the false color IR image with better color resolution and a fifth dimension in the form of thermal IR data. If the false color IR image is useful to an operation then the ACCS should be even more useful. If, however, there is no use for false color IR imagery there may be no use for the ACCS imagery either. Because of the increased color resolution and information content it is possible for the ACCS to be of use where false color IR is of limited value.

Color images are used to verify the time series results and to interpolate rainfall derived point source data. Although the space-time averaged NVI is a valuable stand alone tool, it becomes more valuable when combined with color images which are designed to maximize information content for a trained analyst.

The Ambroziak Color Coordinate System (ACCS) is based on advanced color theory and human perception theory as well as the physics and biology of the satellite-vegetation system.

The ACCS uses hue for NVI and uses intensity for distance from the origin just as the false color IR image does. The saturation axis is, therefore, not used and is free to be used to display thermal data. Clouds are cold and bright and sand and light colored soils are warm and bright. These targets can be separated by using a thermal channel but not by reflected sunlight alone. The addition of saturation to display thermal information makes the ACCS a 5-dimensional display.

The ACCS has all of the positive attributes of the false color IR image and removes both shortcomings. The ACCS is a 5-dimensional image with 3.5 times the color resolution of the false color IR image and allows analyses which cannot be done using false color IR. The ACCS image is designed to be an analytical tool not a final product. Several days of training are needed to use understand how and why the image works and to be able to use the image for analysis.

The ACCS image is used to evaluate the instantaneous situation in relative terms and to interpolate point data. Just as a farmer looks at his fields to get a general impression of what is going on and to SPOT hints of problems before they become serious, so can the crop condition assessor look at his region or country to see what is going on. Low NVI values can be caused by dying crops or by many forms of atmospheric interference. These types of interference are usually detectable on the images and can be used to correct the results of the smoothed NVI time series.

The second use of the ACCS is to spatially interpolate point source data. Any form of data can be used and tests on cumulative rainfall have been completed over Sudan. Rainfall amounts are only available at raingage locations and the spreading of these data are difficult at best. A simple model which predicts the status of the vegetation at these points can be used to calibrate the ACCS image and very detailed maps of crop vigor can be drawn with a minimum of effort.

How can the large AVHRR pixels be ground truthed?

Ground truthing of AVHRR seems difficult because of the size of the pixel but this is not the limiting factor. In actuality it is the use to which these data are put that makes ground truthing difficult and the problem is only slightly better with Landsat or spot. Traditional remote sensing techniques such as N-space classification can be used to identify vegetation cover but cannot be used to monitor real-time crop vigor or status. The reason is that the ground truth data cannot be obtained for

real time crop monitoring.

To classify a region by vegetation type on a Landsat scene a large number of points (on the order of 500) must be identified on the scene and used to build the scene classifier. The result is usually a classification which is 90 percent correct or better and can be a useful tool for vegetation type identification. The same cannot be done for crop status for two reasons. First, the measurement of vegetation status is not as easy as vegetation type. A minimally trained observer with a good map can quickly identify the type of vegetation at a point and the time required to gather these data is usually limited by the travel time between points. To measure the vigor at a point, a time consuming process must be followed such as detailed plant inspection or cutting of samples. The expense is at least ten times greater to collect crop status information than to collect crop type information. Secondly, the type of vegetation at any particular point does not change rapidly and can be assumed to be constant for weeks or months at a time. Data can, therefore, be collected over a relatively long period and can then be used to classify any image acquired during the crop season. The vigor of the vegetation changes daily and all ground truth data must be acquired within a few days of the image if it is to have any validity, and if several images are to be analyzed in a season (as they must be for real-time crop monitoring) the process must be repeated frequently. The cost of gathering these data is prohibitive and if an analyst were to have such data, the need for the imagery would be doubtful. It would be possible to do the job with the ground truth data alone if it could be collected.

The advantage of the AVHRR data is that it is available everywhere, every day and by using the NOAA method it can be quantified without the need for detailed ground truth data. The addition of Landsat analysis to determine the type of vegetation is extremely useful for converting potential yields into production figures and should be used when it is cost effective to do so and these data can be acquired in a timely manner. Any existing ground truth collection system can easily be incorporated into the NOAA system because no matter when the observation was made an image (subject to cloud conditions) is available and an accurate match of the two data sets can be made.

How can data with such low spatial resolution monitor small fields?

A great deal of discussion is directed towards the need for high resolution data. Resolution is normally thought of as spatial and occasionally spectral, but resolution is rarely described temporally. In the case of real-time crop monitoring the temporal resolution of the sensor becomes the limiting factor. Crops can change completely in a span of three days.

For example, emergence, flowering and senescence are three to five day events as well as green-up after a rain or severe stress from drought. A satellite which images less than daily cannot possibly monitor the real-time condition of the vegetation because several changes may have occurred between images which could not be recorded even if cloud cover was absent.

Frequently investigators make the assumption that because AVHRR pixels are vastly larger than the field size they cannot measure the vigor of the crops in small fields. Actually a case can be made that it is the size of the pixel that makes it work. Higher spatial resolution has not resulted in better crop yield estimates. At least one US government agency which regularly uses Landsat data for crop monitoring averages these data to a spatial resolution much lower than that of GAC for digital analysis.

The high resolution multispectral scanner (MSS) Landsat data were found to be of limited use in monitoring the status of crops in both LACIE and AgRISTARS in so far as traditional, digital image analysis techniques were used. Photo interpretation techniques using MSS data were found to be of value and are currently used by the US Department of Agriculture to monitor crops in parts of Asia. The procedure used is one of simple classification of status using comparison of field crops to native vegetation. Actual values of the MSS digital data are affected by the atmosphere and are unreliable but the visual comparison to native vegetation can be easily done by a trained analyst. The human mind is capable of looking through a dirty atmospheric window because of its power of pattern recognition and visual perception while a computer must first clean the window. Since the atmosphere cannot be removed from a single image the task becomes difficult for the computer.

A trained photo interpreter can quickly see badly stressed crops and very healthy crops by color and can estimate a status of crops in between these two extremes. The result is a three level visual classification of the status of crops in the image. A serious shortcoming of this system is that the dynamic range of the NVI (which is what the analyst is seeing on the MSS image) is less than the range of yield. A severely stressed field may be dead and not worth harvesting or it may fill grain and produce a low but useful harvest. On the other end a very healthy looking field may produce slightly above average yields or it may be a bumper crop -- the difference in signal between these two is nil. The native vegetation serves as not only a visual key for making the field estimate but it can be further used to expand the classification scale. Native grasses are the first plants in a scene to react to stress. At the first sign of stress they senesce. This stress is also present in the field crops even though they do not show it. Therefore, a region where both the field crops and native grasses appear healthy is a bumper crop

while one with healthy field crops and stressed native grasses is only above average. The shrubs and trees are used in a similar way on the low end of the scale since they are the last to feel stress. If shrubs and trees are showing signs of stress then the field crops are likely dead.

In the context of AVHRR pixels, the mix of trees, field crops and grasses serves to extend the dynamic range of the NVI signal. The presence of trees in the lower end of the scale and grasses in the upper end make the image and time series analysis more sensitive to the stresses which have been felt in the region. Drought and rain are not local phenomenon and a satellite with a spatial resolution of 1 or even 5 kilometers is more than sufficient for crop condition monitoring, provided that its temporal resolution is high.

Which is better -- Landsat (MSS) or Metsat (AVHRR)?

Landsat and Metsat cannot be directly compared because the uses for which each is suited are very different. Metsat AVHRR is the best single data set for real time monitoring of crop conditions for yield estimation, but it is of limited use for geological, geographical or land use applications. AVHRR data has a high temporal resolution and is ideal for monitoring things which change rapidly such as crops, rangelands, snow packs, flood waters, water temperature or water turbidity. Its low spatial resolution makes it unsuited for monitoring fine detail or things which change slowly such as crop type and area, roads, land forms, urban growth, etc. Landsat can be extremely useful for monitoring these slow changing targets but lacks temporal resolution for real-time crop monitoring.

III.

Chronological Listing of AISC Accomplishments for AID

Specific accomplishments by AISC in support of NOAA/AID PASAs BOF-0000-P-CC-3062 and BOF-0000-P-CC-5099-00 for FY85 and FY86

Final rainfall based micro computer climate assessment system

Done: October 31, 1984

Product: Software and user's guide

A complete Apple II based micro computer system for converting rainfall data into assessment products was developed, tested and transferred to the field. A complete set of tropical data is available for any country which wishes to use the system. The Apple II system is now the standard in South and Southeast Asia with all but one participating ASEAN country using it to produce operational assessments. The last country will implement the system when they can solve their internal administrative problems.

Copies of the Apple II assessment system have been in such demand that it has been reprogrammed into FORTRAN for the PDP-11 computers used by AGRHYMET in the African Sahel, as well as for use on the IBM and Wang microcomputers. It has served as the operational demonstration that weather data could be used in developing countries to improve food security. This program was critical to the operational implementation of the NOAA assessment system in Asia which would not have been possible without it.

Transfer historical meteorological data and agroclimatic indexes to the AISC VAX computer

Done: October 31, 1984

Product: AISC user's guide

Historical meteorological data for Africa, tropical west Africa, South America, South and Southeast Asia were transferred from the NMC IBM computers in Suitland, Maryland to AISC's VAX computer in April of 1985. Tapes for Central America and the Caribbean, subequatorial Africa and the South Pacific were also received at the Page complex. Programs for agroclimatic indexes for operation on the VAX were completed in July were used in special Africa assessments for FY85. The historical data base is important because it forms the meteorological basis for comparison with current conditions.

Use Apple microcomputer technology for preparation of special assessments

Done: November 1, 1984

Products: Special assessments

AISC used Apple II and Macintosh microcomputers to prepare special assessments requested by AID on the impact of the 1984 drought on food supplies in Mali, Niger, Chad and Sudan. The Apple IIe software was used to calculate agroclimatic crop condition and drought/food shortage indexes based on rainfall data from each country. The Macintosh was used to generate computer graphics (agroclimatic and NOAA AVHRR met-sat) and other portions of the assessment reports, which were provided to AID/Washington, USAID Missions and American embassies.

The Apple II software and data bases and the Macintosh graphics capabilities played a significant role in helping AISC meet critical needs of US Drought/Disaster Managers in AID. The USAID Mission in Mali used the AISC Special Assessment and noted that the AVHRR vegetation/biomass indexes represented the single most important piece of information contributing to assessment of food needs in Mali.

Prepare and distribute prototype refugee/displaced person assessments

Done: November 15,1984

Product: Monthly assessment

Monthly assessments of potential climatic impact on refugee/displaced person communities were issued for AISC review beginning in November of 1984. The summarize information derived from AISC's regular foreign assessment and various media reports (e.g., FBIS, JPRS, newspapers) and implications are drawn. AISC takes a very conservative approach in projecting climate impacts of refugee/displaced person communities because climate is only one factor of many which cause population migration and because refugee issues are highly sensitive and often political in nature. However, these assessments have provided a valuable information resource for the Center's assessors and contributed to the quality of AISC's Sahel Special Assessments for 1985.

These assessments provide a solid foundation for expanding the information content of the AISC Foreign Assessment and for initiating a dialogue with AID (i.e. African Task Force) and State Department officials involved with refugee affairs programs.

Develop 2-channel met-sat precipitation estimation capability

Done: November 28, 1984

Product: OFDA project report

As promised, in November 1984 AISC completed a study of the use of the visible and thermal-IR to improve satellite rainfall estimates over Africa, concluding that the 2-channel system as then formulated was of limited value over the 1-channel thermal IR system. In the process of the study it was found that a tremendous improvement in the assessment of rainfall could be made if the near-IR channel was used instead of the thermal-IR channel. By monitoring the status of the vegetation using reflected visible and near-IR sunlight the direct result of the rainfall could be seen in the vigor of the vegetation. This system, which was perfected in May 1985, became operational in mid-June and is now the backbone of the operational AISC drought monitoring system for sub-Saharan Africa.

Rainfall data are the key to monitoring crop conditions worldwide and are among the most difficult data to acquire. The solution of the problem in Africa was the single most important factor in development of the AISC operational real-time crop monitoring system.

Produce operational met-sat crop assessments

Done: November 30, 1984

Product: Operational assessments

In October and November of 1984, AISC successfully demonstrated an operational NOAA AVHRR met-sat capability for assessing crop and rangelands conditions in Africa. Specifically, the preparation of special assessments of the 1984 drought impacts in the Sahel countries was made possible by dramatic advances in the use of AVHRR data for agricultural assessment. The system was improved during May and June of 1985 (beginning of the crop season) and AISC special assessments for 11 project countries in the Horn and Sahel were air-expressed to USAID Missions, on schedule, by July 15, 1985. AISC met AID project commitments by developing procedures to process and use daily GAC data and by moving from weekly to 10-day assessment periods.

Complete study on refugee/displaced persons

Done: December 15, 1984

Product: Project report

AISC completed a refugee/displaced persons study entitled "Background Information and Proposed Procedures for assessment of

Potential Climate Impacts on Refugee/Displaced Person Communities". This report provides a useful ready reference for AISC assessors and includes details on camp locations, vulnerability to weather extremes and agroclimatic information for communities throughout Africa, Latin America and Asia. Proposed assessments are based on AISC operational assessment reports and relevant current media reports. Provisions have been made for keeping the basic report updated.

This report has helped AISC to address critical issues involving population migration in the Sahel as a result of the 1984 African drought and food emergency. It also embodies an expansion of the area of study beyond Africa to the rest of the developing world. It has made it possible for AISC to address major needs of AID and the State Department, particularly in sub-Saharan Africa. Climate variability, especially disastrous drought, a the key factor contributing to population migration and AISC assessments can now focus on drought as a potential trigger mechanism. Most of AISC's emphasis during FY85 was on Chad, Ethiopia and Sudan where the 1983-84 drought had disastrous effects. AISC assessments also provide information on climatic conditions which disrupt food supply efforts such as heavy rainfall which can cause transportation breakdowns. AISC's study on refugee/displace persons measurably improved AISC's assessment abilities.

Training for Latin America (Caribbean and South America)

Done: December 31, 1984

Product: Trainee Reports

AISC conducted six-week training courses for Peru, Haiti, Jamaica, the Dominican Republic, and Ecuador. Trainees were able to develop agroclimatic and crop condition assessment models, design prototype bulletins and, in some cases, country plans.

PERU: Eight Peruvian trainees from the national Meteorological Service and Ministry of Agriculture completed training in October, 1984 under the auspices of the NOAA/USAID Mission Lima and the Government of Peru Agroclimatic Assessment Project ($1 million total), with follow-up assistance in November 1984 and January-February 1985. Peru was able to refine and expand monthly assessment bulletins initiated under the project in January 1984, and USAID Lima has indicated that it is extremely pleased with the progress of this project.

HAITI: In January 1985 AISC installed the agroclimatic assessment software on the IBM PC at Port-au-Prince and trained USAID Mission officials in drought/food shortage assessment methods.

JAMAICA: U.S. based training courses were provided to agroclimatologists in February 1985. Jamaica began production of a national climatic assessment bulletin in March 1985 and reported weather impacts on commercial crops such (e.g. bananas) and tourism.

DOMINICAN REPUBLIC: U.S. based training courses were provided in April 1985. Training reports and monthly assessments were prepared.

ECUADOR: Ecuador began production of monthly bulletins in November 1984 and in January correctly assessed 1985 drought impacts. U.S. based training courses were provided in April 1985 fir two persons. A $500,000 USAID Project was revitalized in June.

AISC made major advances in implementation of operational national climatic impact assessment systems within Latin America and the Caribbean Basin. These advances will lead to improved drought early warning, food security management, and economic decision making within the region. As a result of these efforts the operational assessment prepared by AISC are now on much firmer ground because of the access to essential input data. The focus of the in-country technical assistance has been to implement a strong national program, an effort supported by policymakers in the host countries as well as by the USAID officials. Six countries are now issuing monthly bulletins which qualitatively assess weather impacts on agriculture. This program promotes major U.S. foreign assistance efforts such as the Peru Agricultural Policy Reform and the Caribbean Basin Initiative. It also supports our Administration's emphasis on strengthening the private sector in each country, through distribution of bulletins to the indigenous agricultural and business communities, and it increases the efficiency of national government operations by making better information available to decision makers.

Upgrade AISC soil moisture estimates and develop FAO method on AISC VAX computers

Done: January 31, 1985

Product: AISC user's guide

Various methods for estimating soil moisture were evaluated during November and December of 1984, leading to selection of the one-layer model used by the Food and Agriculture Organization (FAO) for further testing and evaluation. The chosen methodology was implemented on the AISC VAX computer system during January of 1985 in preparation for the technical assistance Missions to the AGRHYMET Regional Center in Niamey (February 1985). Completion

of work on this milestone in January 1985 allowed AISC to use FAO soil moisture indexes operationally during July of 1985 for African special assessments. It also moved the project closer to the long-range goal of developing a global data base to support soil moisture analysis for all AISC assessment regions.

Upgraded soil moisture estimates, based on 10 day analyses, along with other AISC assessment models, demonstrate AISC's responsiveness to requests from AID for more quantitative assessments of weather impacts on African food crops. They will permit an expansion of operational analysis such as detailed crop planting conditions and will provide a narrower focus on unusual crop weather problems such as short-term dry spells. Together these capabilities help provide the framework for operational assessment of quantified weather impacts on crop yield in Africa.

Complete Southeast Asia satellite image training sets

Done: January 31, 1985

Product: Published training sets

The NOAA AVHRR meteorological satellite training sets were complete on January 31, 1985 and distributed to policymakers at the Bangkok Seminar in February of 1985. These expensive training sets were produced in a limited quantity of 50, and 100 smaller briefing booklets were produced. These played a pivotal role in demonstrating the usefulness of the new AISC satellite technology for real-time crop assessment applications.

The training sets were a first step in documenting the AISC satellite technology and introducing the technology to policymakers who could use the technology. The satellite training sets introduced a totally new concept in real-time crop assessment technology which had been operationally tested in the African Sahel and was ready for expansion to wetter climates.

Develop microcomputer met-sat display capability

Done: February 28, 1985

Product: Software

The Personal Computer Image Processor (PCIP) is based on IBM-XT type hardware with the addition of a Number-Nine color board and an RGB color monitor. The system cost is under $6000 and it outperforms the Log-E image processor which costs $250,000 for image display for real-time crop monitoring. With the addition of a camera the system represents a complete image display devise which is suitable for technology transfer to the developing world. It is inexpensive and its components (except for the color board) are readily available worldwide. The PCIP

has been installed in Columbia, Missouri, Niamey, Niger and Nairobi, Kenya.

The PCIP is not an image processor in the generic sense in that it does not do the normal processes done for traditional remote sensing. It does however do all of the functions necessary for real-time crop monitoring from AVHRR met-sat data, most of which are not performed by traditional image processors.

The PCIP has the capability of bringing the benefits of NOAA AVHRR data to users whose limited funds previously put image processing beyond reach. Most importantly, this means that national technology transfer recipient countries can learn to use image processing technology and NOAA AVHRR data to improve crop monitoring programs. Additionally this new technology permits multiple image processing work stations within AISC, where large-system costs previously prohibited duplicate work stations.

Southeast Asia Evaluation Seminar

Done: February 28, 1985

Product: Report on seminar

Representatives from NOAA/NESDIS, UN/ESCAP and AID/OFDA successfully conducted the second annual Senior Policymaker's Seminar on Drought/Food Shortage Assessment in South and Southeast Asia in February of 1985 at the ESCAP headquarters in Bangkok, Thailand. Government officials (National Food Security Planning, Ministry of Agriculture and National Meteorological Service) from each of the nine participating countries reported the status of their national climatic impact assessment programs. Country Plans for implementation were updated. NOAA/NESDIS officials outlined the potential for incorporating NOAA AVHRR met-sat products into the technology transfer process. A case study for northeast Thailand was presented by AISC to illustrate the use of geographic information systems (GIS) to integrate agroclimatic and met-sat information as a means of improving agricultural assessments. All nine countries agreed to accelerate their assessment system implementation in order to conduct a test in 1985 and they offered their support for continuation of the project.

The February 1985 Seminar demonstrated the support of the South and Southeast Asian countries for implementation of national climatic impact assessment systems and underscored the participants' recognition of the benefits, such as improved food security management. Moreover, eight of the nine countries have issued their own operational test assessment bulletins, thereby directly demonstrating their commitment by investing their own resources in the project. If the project were not a success these bulletins would never have been produced.

Provide NOAA AVHRR satellite assessment training for Thailand and Malaysia

Done: February 28, 1985

Product: Trainee reports

Three Thai and two Malaysian scientists sere trained in the use of AVHRR for real-time monitoring of agriculture. The AISC system was developed in semiarid regions of the world and its use in humid tropical areas was uncertain. Both the Thai and Malaysian scientists prepared exceptional training reports describing the satellite analysis system and its possible applications for their countries. The training of these scientists was a critical first step toward an operational satellite crop assessment system in Asia. This is because climatic assessments in Southeast Asia are not as straightforward as in the arid African Sahel.

The use of NOAA AVHRR data for crop monitoring was shown to have great potential to improve the efficiency and accuracy of existing crop monitoring systems by providing a spatial and temporal continuum of relative crop vigor information which can be used to interpolate available quantitative point data obtained from other sources.

Coordinate NOAA/NWS in-country technical assistance on Peru radio network communication plan

Done: March 1, 1985

Product: NWS newsletter outlining plan

Joint assessment bulletins have been published since January 1984 and the agroclimatic assessment component of the Peru Agricultural Policy Project is ahead of schedule. The Peru radio network communications plan, developed in support of the USAID Lima and Government of Peru $1 million Agroclimatic Assessment Project, was prepared by the Peruvians following training provided by AISC in 1984. Subsequently, USAID Lima and the Government of Peru acted on NWS correspondence and determined locations for radios in key agricultural regions of Peru. NWS has agreed to assist USAID Lima and the Government of Peru in determining specifications for the radios.

The radio network for upgraded weather data reporting contributes to the USAID Lima and Government of Peru Agroclimatic Assessment Project not only by facilitating timely and reliable weather reports but also by furthering inter-agency cooperation between the Meteorological Service and the Ministry of Agriculture through procurement, installation and utilization plans for

the network. As of the completion date of this task the Project is now in its second year and the results have been outstanding.

Training for Southeast Asia Countries

Done: March 29, 1985

Product: Trainee reports

AISC conducted six-week agroclimatic impact assessment training courses for trainees from Bangladesh, India, Nepal and Sri Lanka. The trainees completed prototype assessment bulletins and updated country plans for national programs to be implemented with NOAA/NESDIS, UN/ESCAP and AID support. The trainees studied the uses of NOAA AVHRR met-sat as an assessment tool. These training courses furthered the objective of strengthening food security management in the South Asian region through implementation of operational national climatic assessment programs. Additionally the trainees learned more about the U.S. and acquired first-hand knowledge of the US desire to help their countries to use weather resources to save lives and to utilize funds effectively in drought emergencies such as those which occurred in 1982-83.

Develop user's guide on the preparation and use of agroclimatic assessments

Done: March 29, 1985

Product: Published user's guide

AISC developed a "User's Guide on Preparation and Use of Agroclimatic Assessments" which contains sample monthly assessment reports and describes the components which make up an assessment. The guide illustrates the various pertinent types of qualitative and quantitative information and emphasizes provision of clear and concise agricultural weather impact assessment. Sample reports include a detailed case study guide which will accelerate future training efforts, particularly in courses which focus on NOAA AVHRR met-sat analysis.

Conduct Sahel technical training course

Done: May 3, 1985

Products: Course agenda and trip reports

A two-week technical course sponsored by AID/OFDA was jointly conducted by NOAA/NESDIS and AGRHYMET at the AGRHYMET Regional Center in Niamey, Niger. Agrometeorologists and agricultural economists from each of the eight Sahel project countries were taught the use of agroclimatic models for monitor-

ing crop conditions and assessing the potential for drought food shortage situations, learning how to develop and use simple rainfall-based assessment models. Preliminary country plans were developed and provisions were made for test assessments during the 1985 rainfall and crop season. In working to achieve these results AISC overcame a great deal of sensitivity concerning the roles of the various international groups working in the region and successfully introduced the countries to the concepts and benefits of climatic impact assessment. Seven of the eight USAID Missions have endorsed the need for AISC special assessments and have welcomed AISC technical assistance. AISC used only a modest $75,000 in funding provided by AID/OFDA to accelerate the use of environmental data for drought/disaster early warning, agricultural policymaking and food security management. In the process AISC contributed to a major refocusing of the multimillion dollar AGRHYMET project. Emphasis moved from mere collection of the climate data to production of assessments which go beyond meeting the needs of the AGRHYMET community and provide the decision-making support for responsible policymakers in agricultural ministries. The need for climatic impact assessments now goes unquestioned and the technology is accepted.

Update AISC historical and operational weather data bases

Done: May 9, 1985

Product: Data inventory

Letters were sent to developing countries which AISC is monitoring for AID. Each country was requested to provide updated monthly precipitation and temperature data. Also included in each letter was a listing of the data in the AISC data base. The data sent in by respondents was entered into the AISC data files.

Incorporate operational procedures for upgrading rainfall assessments based on automated image processing of NOAA met-sat data

Done: May 15, 1985

Product: OFDA project report

Rainfall estimates for Africa which are derived from NOAA AVHRR data are now an operational part of the automated Comprehensive Area Rainfall Estimation System (CARES). In addition, the real-time monitoring of the vegetation using NOAA AVHRR data has been combined with CARES output to provide the assessors with a totally integrated system over sub-Saharan Africa. The two data sets together contain much more information than either one alone. Because the state of the vegetation in most grain growing regions of the world is extremely responsive to changes in soil moisture brought on by rainfall, the assessments produced from

this system have been a major breakthrough in providing up-to-date and useful information to the field.

Rainfall data, the key to monitoring crop conditions worldwide, are among the most difficult data to acquire. The solution to the problem in Africa was the single most important factor in producing the special assessments.

Develop an operational AISC climatic impact assessment capability for previously unassessed areas including the Middle East, Equatorial West Africa, Mexico and South America (Paraguay, Uruguay and northeast Brazil).

Done: May 31, 1985

Product: Three model development reports

AISC developed an operational climatic impact assessment capability for previously unassessed areas including the Middle East, Equatorial West Africa, Mexico and South America (Paraguay, Uruguay and northeast Brazil) in May. The model development reports are entitled "A Synopsis of Agroclimatic Conditions in the Middle East", "Agroclimatic Conditions and Assessment Methods for Drought/Food shortages in Tropical West Africa" and "Drought/Crop Condition Assessment Methods for Northeast Brazil, Mexico, Paraguay and Uruguay: An Agroclimatic Approach". The background agroclimatic analysis was done by contractors at the University of Missouri under the supervision of AISC staff. These reports will serve as a resource for future operational assessments for these areas.

Determine how geographic information system (GIS) can be used by impact assessors and disaster managers

Done: June 30, 1985

Product: Subcontractor report

Inputs and outputs for a geographic information system (GIS) approach to global drought/crop monitoring and food shortage assessment have been defined and AISC has determined that GIS techniques have the potential to promote a multi-disciplinary interaction of assessors to accelerate the development of improved modeling techniques and to improve the timeliness and accuracy of operational climate impact assessments. AISC assessors are currently using a "light-table GIS approach" to prepare special assessments for AFrica. Inputs include satellite data (vegetation indexes and color-coded images), rainfall data, resource maps (e.g., land use. soils, cropping patterns, climate) and current media reports (e.g. JPRS and FBIS). The data are integrated to produce AISC's African assessments. This original activity was preceded by major advances during October and

November 1984 in Sahel special assessments. Met-sat images and cumulative rainfall from weather stations were overlayed in a classic GIS approach to produce highly detailed rainfall analyses in the Sahel. AISC, working with Dr. H. Bloemer of Ohio University, has surveyed the wide range of GIS applications to determine which types of data bases may benefit the assessment process, evaluate computer GIS-related software and investigate the use of GIS approaches for AID disaster managers. AISC has also developed GIS concepts for marine fisheries assessment.

Incorporate Sea Surface Temperature (SST) large-scale analysis tools to improve CIAD assessments

Done: June 30,1985

Product: Assessments

Information from radiation, sea surface temperature (SST) and circulation maps is routinely incorporated into AISC assessment methodology to identify the extent and intensity of global weather anomalies. Products used include an analysis of the progression of Africa's intertropical discontinuity (ITD) as it penetrates the Sahel and moves the rainfall northward, Climate Analysis Center supplied SST maps and 700mb anomaly maps. The ITD analysis is a unique AISC product designed to show large-scale tendencies toward dryness in sub-Saharan Africa and to compare the seasonal rainfall patterns to other years by the use of a single number.

The SST analyses are useful in helping AISC identify potential drought areas and are especially important in the Caribbean Basin, southwest Pacific and Africa. Because these regions have little accurate rainfall data, large-scale circulation features and SST offer important clues for drought detection.

Improve USAID Mission awareness and understanding of AISC assessments

Done: June 30, 1985

Products: Mission cables

AISC has sent cables to USAID Missions in Africa, South and Southeast Asia and Latin America explaining how AISC assessments can be used by AID and host-country decision makers. This activity is linked directly to AISC technical assistance for more than 30 LDCs. AISC has worked with ESCAP and AID/OFDA to improve USAID Mission awareness of AISC assessments for South and Southeast Asia. In Africa, AISC microcomputer technology and assessment methods were adopted by AID/Food for Peace and incorporated into "Food Need Assessment Procedures". As a

result, AISC microcomputer software will be made available to 43 USAID Missions in Africa. AISC also assisted USAID Haiti in development of drought/food shortage assessment procedures using an IBM PC computer. AISC assessments were the key information resources used by USAID Mali to determine food needs due to the 1984 drought. This saved lives by contributing to effective famine relief.

The USAID Missions are the primary users of AISC assessments of drought and weather impacts on crops and food supplies. Keeping the missions informed on technology transfer activities and assessment utilization builds support for the Drought Early Warning Program.

Continue development and introduce digital imagery processing of multi-spectral meteorological satellite data into operational estimates and direct read-out of subsistence crop conditions.

Done: June 30, 1985

Product: OFDA project report

In May of 1985 an operational test of the Ambroziak Color Coordinate System (ACCS) was performed, producing a cumulative rainfall map of sub-Saharan Africa at a spatial resolution of approximately 5 km. The system is now in production and has been recognized as state-of-the-art by users of the information. Its revolutionary design permits it to function at least 10 times more efficiently than any other system in existence.

Integrate drought/food shortage technology transfer activities into AID/Host-country disaster coordination and agricultural development planning as required by overseas Missions

Done: July 31, 1985

Product: Cables from Missions

Twenty-four LDCs and associated AID Missions are actively participating in AISC/OFDA projects to improve drought/disaster coordination and preparedness planning through use of national climatic impact assessment systems. The participating countries include the nine South and Southeast Asian countries in the NOAA/ESCAP project, six countries in Latin America and the Caribbean Basin (Peru, Ecuador, Costa Rica, Jamaica, Haiti and the Dominican Republic), and the eight Sahelian countries. In addition, strong interest in the AISC drought/food shortage assessment and technology transfer program has been expressed by USAID Missions in Somalia, Kenya, Ghana and Burundi. To facilitate AID/Host-country disaster coordination, host-country assessments are provided to the USAID Mission Disaster Relief Officer and to USAID and host-country decision makers. Many of

the South and Southeast Asian, Latin American and Caribbean countries are now testing monthly climatic impact assessment bulletins and some of the Sahel countries will begin doing so during the 1985 crop season. Moreover, all of the Sahel and Horn of Africa countries will benefit from AISC special assessments. AID/Food for Peace has adopted AISC's assessment methods and more than 40 USAID Missions in Africa have been introduced to the technology.

This inexpensive and cost-effective activity has significantly expanded the use of operational weather information to mitigate disasters through preparedness and can become more effective through full utilization of NOAA avhrr met-sat data. Assessments by AISC and host countries, along with explanatory cables from AISC and the State Department to American embassies and ESCAP/NOAA Policymaker Seminar Reports all jointly contribute to increased USAID Mission awareness of the role which climate impact assessment plays in saving both lives and money.

In-Country Missions to Sahel to explain implementation and use of Special Assessments

Done: August 15, 1985

Product: Trip reports and improved assessments

During July and August of 1985 AISC scientists visited all eight Sahel countries spending an average of 10 work days per country explaining the SPecial Assessment project to USAID Mission personnel and host-country officials. The scientific methodologies used to create the assessments were explained in detail as required as well as the possible uses to which the assessment could be put. The latest version of the Special Assessment Reports were hand delivered to each country to ensure that the responsible parties in each Mission were aware of the product.

Needed 10-day rainfall data and administrative region crop statistics were collected for each country which greatly contributed to the development and operation of the AISC crop yield forecast system

Operational quantitative yield forecasts to the field

Done: September 10, 1985

Product: Department of State cables prepared by AISC

Quantitative yield forecasts were provided by AISC for the first time in early September, more than 30 days prior to harvest. This served as a test of the NOAA satellite indexes as a potential important yield indicator in the Sahel zone. The

NOAA AVHRR satellite products represented the key input to the written reports which included more detailed coverage than the brief cables provided in previous years. The entire satellite system went from research to operational status in less than 6 months to support this important project and the results justify the tremendous effort involved.

Operational Special Assessment for the African Sahel and Horn regions

Done: July - October 1985

Product: Special assessments and cables

A complete set of Special Assessments were developed, produced and distributed to more than 200 individuals throughout Washington and the developing world. Monthly cables with 10-day updates were provided to each USAID Mission throughout the growing season to provide the most timely summaries of current weather impacts on agriculture possible. The 10-day period was chosen over the weekly reporting system to match the agricultural reports of AGRHYMET and other agencies working in Africa.

These assessments depend heavily on special analysis techniques of daily data from the NOAA polar orbiting meteorological satellite as well as traditional weather station rainfall reports. These special reports contain narrative analyses of status of crop and rangelands conditions within 48 hours of distribution time of the reports. Included with the analyses are the data sets used to produce them so that scientists in the field can better understand the assessments and make local modifications if more local data become available. The data sets included are Advanced Very High Resolution Radiometer (AVHRR) color satellite imagery, AVHRR derived vegetation index maps and time series plots, crop condition indexes and detailed spatial and seasonal rainfall analyses.

Quantitative yield forecasts were provided by AISC for the first time in September of 1985 with final updates in October. This served as a test of the NOAA satellite indexes as a potential important yield indicator in the Sahel zone. The NOAA AVHRR satellite products represented the key input to the written reports which included more detailed coverage than the brief cables provided in previous years. The entire satellite system went from research to operational status in less than 6 months to support this important project and the results justify the tremendous effort involved.

Technical assistance Missions to Sahel, Horn and East African countries

Done: November 8, 1985

Product: Trip reports

During October and November of 1985 AISC scientists visited all eight Sahel countries Sudan, Somalia and Kenya to provide followup briefings on the Special Assessments, to provide information of the yield forecast cables, to obtain preliminary official country yield statistics for 1985, to plan joint AISC and regional AGRHYMET Center technical assistance for the Sahel, to meet with USAID REDSO/ESA and the Regional Center for Services in Surveying, Mapping and Remote Sensing (RCSSMRS), Remote Sensing Department in Nairobi, Kenya concerning AISC technical assistance for Eastern and Southern Africa, and to discuss the assessment process with the various users after they had a chance to use the products.

Technical Assistance to Asia

Done: November 20, 1985

Products: Cables of support from field

In November of 1985 Doctors Ambroziak and Johnson conducted Missions to the Philippines, Thailand, Malaysia and Bangladesh to review the progress of existing operational assessment systems and to evaluate the introduction of AVHRR satellite technology into these systems. A one day technical seminar was held in Bangkok, Thailand to review the work done by the Thai and Malaysian scientists in AVHRR applications. The seminar proved that AVHRR data could make a valuable contribution to real-time crop monitoring in the humid climates of Southeast Asia. Strong support for the project was expressed by three ministers of Thailand, several USAID Missions and the US Ambassador to Thailand. These visits followed up the technical training course for 5 scientists from Thailand and Malaysia conducted at Columbia, Missouri and Washington, DC.

Sahel professional training course in USA

Done: April 16, 1986

Product: Sahel participant briefing for AID and country training reports

A six week training course was held in Columbia, Missouri and Washington, DC by AISC and CIAM (Cooperative Institute for Applied Meteorology) with support from the Regional AGRHYMET Center for the eight Sahel countries. The course was conducted in both French and English to accommodate all trainees and instructors. The participants were shown how AISC uses all available data to prepare operational climatic impact assessment reports and were given hand-on experience in using the various

tools necessary to produce crop and rangelands assessments in their own country.

Crop modeling techniques were presented on both mini and micro computers to give the trainees experience in developing and using various forms of data to quantify potential yields in their countries as soon as possible in the crop season. Trainees were introduced to the AVHRR meteorological satellite technology and used hard copy photographic products in their assessment training. These images are to be supplied to them during the 1986 growing season.

Each country delegation prepared updated resource manuals containing background information for the assessments for use by both them and AISC to support AID requirements. They prepared individual country reports documenting the training and explaining how the various technologies could be used in their individual countries. AISC and the Regional AGRHYMET Center developed plan to introduce AVHRR technology into the AGRHYMET system during the 1986 crop season and designed a 5-year technology transfer project.

The Sahelians presented a half day seminar to AID Washington discussing the applicability of the AISC training to the solution of their individual problems. Without exception the students and AGRHYMET representatives stated that the course was useful and the technology showed great promise for their use in-country.

Installation of a NOAA Personal Computer Image Processing system in East Africa

Done: May 16, 1986

Product: Operational met-sat ability in Nairobi

AISC was successful in installing and making operational a NOAA Personal Computer Image Processor at the Regional Center for Services in Surveying, Mapping and Remote Sensing (RCSSMRS) in Nairobi, Kenya and training the staff of the Remote Sensing Department to operate it. Provisions were made to supply AVHRR data during their crop season and to assist in development of operational products for distribution to East Africa.

Professional Course in Remote Sensing for Drought Early Warning and Agricultural Monitoring for East Africa

Done: May 30, 1986

Product: Course material

From May 12 through May 30, 1986 AISC conducted a course in

conjunction with the Regional Center for Services in Surveying, Mapping and Remote Sensing (RCSSMRS), Remote Sensing Department in Nairobi, Kenya. The course was titled Professional Course in Remote Sensing for Drought Early Warning and Agricultural Monitoring. The countries sending representatives to the course were Kenya, Somalia, Djibouti, Sudan, Ethiopia, Uganda, Tanzania, Rwanda, Zimbabwe and Botswana. The course was scheduled for three weeks, but after the administrative days, field trips and report writing days were subtracted there were only 7 days of actual instruction of which NOAA was responsible for 4 1/2 days. The course was co-sponsored by RCSSMRS, USAID/REDSO/ESA and NOAA.

In such a short time it was impossible to teach the 30 students how to produce an assessment but, rather, they were taught how an assessment was made. The major subjects covered were AVHRR data and applications, integration with rainfall data, yield forecasting and the economic implications of the production estimates using geographic information systems. Their was a great deal of dialogue between AISC staff and the students, both in and out of class, and AISC learned about as much as they did from the experience.

Many of the students had some remote sensing training and had been briefed by other agencies on the validity of what we were doing and how well it worked -- not all of these perceptions of the NOAA system were favorable. As a result they asked very pointed questions which were successfully answered during the course. By the end of the course all participants were knowledgeable on the theory and had worked through all of the major components of the NOAA drought early warning system from the raw input data to the final economic estimate of impact. From their questions and class participation there was no doubt that most, if not all, students left with a complete and accurate understanding of the AISC system's operation and its application to their countries.

AISC country Missions to the Sahel and Somalia

Done: August 8, 1986

Product: Trip reports

AISC and regional AGRHYMET Center scientists conducted joint Missions to all eight Sahel countries to coordinate the 1986 assessments and introduce changes in the report made since last year, assist host-country assessor in the incorporation of AISC supplied AVHRR images and satellite vegetation indexes into their assessment programs. AISC provides operational digital satellite products to the Regional AGRHYMET Center and hard copy products to each participating country. The Regional Center incorporates these data into their regional early warning bulletins and, more importantly, AGRHYMET mulitdisciplinary working groups in each

country are using the technology for improved drought monitoring and crop and rangelands assessment.

IV.

The AISC Climate Impact Assessment System

AISC uses a combination of meteorological satellite products and weather data as the primary inputs to prepare Special Climatic Impact Assessment Reports. Operational rainfall reports are received daily through the WMO Global Telecommunications System (GTS) and, for the Sahel countries, 10-day rainfall reports are received from host-countries and the Regional AGRHYMET Center in Niamey, Niger. AISC uses data from ESA's Geostationary Meteorological Satellite (METEOSAT) and the NOAA-9 polar orbiting satellite. Hourly METEOSAT images are used as one method of assessing regional rainfall and monitoring large-scale weather patterns, such as the intertropical discontinuity (ITD) which marks the northward progress of the summer rains over the Sahel. NOAA-9 data are used to assess vegetation vigor patterns and to estimate rainfall.

Satellite analysis

The NOAA-9 polar orbiting meteorological satellite provides daily data from its advanced very high (by meteorological standards) resolution radiometer (AVHRR) which has a spatial resolution of one kilometer, spectral resolution which is compatible with Landsat data and temporal resolution of once per day. The satellite senses radiation coming from the earth (clouds, atmosphere and surface) and immediately transmits one kilometer resolution digital data in all 5 channels which can be received by any receiving station which is in sight of the satellite as the satellite passes over. These direct readout data are called high resolution picture transmission (HRPT) to distinguish them from automatic picture transmission (APT) which are low resolution analog data containing only visible and thermal infrared (IR) channels and are meant for meteorological applications only. The satellite records all five channels of digital low resolution (approximately 4 km) data and can also record a limited amount of the high resolution (1 km) data for transmission to the ground over the US. The high low resolution recorded data are called LAC (local area coverage) and the low resolution data are called GAC (global area coverage. GAC data are available worldwide each day while only limited areas are covered by LAC data.

AISC uses 3 of the 5 GAC channels to monitor crops. The visible (channel 1), the near IR (channel 2) and one of the thermal IR channels (channel 5) are specially processed to produce analysis tools for the use of AISC assessors. The main satellite products are NVI (normalized vegetation index) time series and cloud filtered composite images using a specially designed color coordinate system.

AISC Satellite Images

AISC uses the Ambroziak Color Coordinate SYSTEM (ACCS) to produce the satellite images used by analysts to produce the Special Assessments. The ACCS shows the vigor of the vegetation using colors designed to maximize the information content and minimize the analysis time. Different hues (red, orange, yellow, green, blue, cyan, blue and magenta) are used to separate vegetation and water from soil and clouds using the visible an infrared portions of sunlight as it is reflected from the earth. Saturation (red, pink and white) is used to identify clouds using the emitted thermal IR radiation. Clouds are usually colder than the surface and they become white on the image 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 mind's perception system. Sharp boundaries on the image, shown as large changes in hue, indicate sharp changes in surface vegetation. The colors can be generally interpreted as follows:

HUE	INTENSITY: Dark	INTENSITY: Bright
red	wet or dark soil*	sand of 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	dense forest	dense forest, maize or rice cover
magenta	clear, shallow or slightly turbid water	highly turbid, very shallow or partially cloud-covered water.
black	clear deep water or dark shadow	
white	clouds, snow or colder high terrain	

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

Vegetation Index Products

The vegetation index products contained in the assessment are derived from the following formula:

$$NVI = \frac{\text{channel 2 - channel 1}}{\text{channel 2 + channel 1}}$$

where: NVI = normalized vegetation image
channel = AVHRR sensors

Vegetation 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 half degree latitude by one degree longitude rectangles. The NVI is a measure of the combined amount and health of the biomass on the ground. The index ranges form 0 (no vegetation growth) to a possible +1 (intense vegetation growth). The actual upper limit is on the order of 0.7 since no vegetation is totally black in the visible channel. NVI values have different ranges in different geographic areas and can show the progress of the vegetation 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 value can be displayed on a map or weekly values can be graphed as a time series. During 1985 AISC assessments were significantly upgraded by incorporating yield analysis based on NVI yield models.

Crop Yield Models

Statistical crop yield models based on monthly rainfall and crop yield data obtained from host-country governments have been developed for the Sahel and Horn countries. Reliability of the models varies from country to country with the quality of the agricultural data. The models use the most recent data (usually five or more years) with only one predictor such as July-August total rainfall. The selection of that variable is determined by correlation analysis tempered with the agronomic importance of the variable in relation to the crop calendar. Baseline average yields (usually the past five years) were developed for all regions.

A second set of linear regression models were built relating the NVI to regional yield using the 1983 and 1984 data for the Sahel countries and Sudan. These relate the NVI over a 1° x 2o grid (at a selected period during the crop growing season) with the regional reported yields.

The yield projections from both models are compared with each other, with base line averages, and with every other

analysis tool available during the season. Regions of discrepancy are reconciled using color imagery and the final yields represent the best possible combination of all data sets and analytical techniques.

Assessment Process

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 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.

All available satellite products and weather station reports are used to assess the impact of rainfall on subsistence crops and rangelands. The assessment process involves the integration and evaluation of these data sources which are cross-checked. Ten day, monthly and seasonal rainfall amounts are analyzed for the current crop season and with respect to conditions during the previous 30 years. These data are also used as input to agroclimatic crop condition index models, e.g., ten day water balance and a crop index based on the FAO method. The newly developed color satellite images (daily 4 kilometer resolution with selected 1 kilometer LAC resolution) provide an overview of the surface vegetation conditions and are used to integrate and interpolate other data sets. NOAA satellite derived vegetation indexes are used to qualitatively assess the evaluation of current growing season conditions. Both color images and vegetation indexes are used to compare the current year with the previous years of 1983 and 1984. Integrated analyses based on these NOAA satellite and weather station data are used to assess crop and rangelands conditions for inclusion in the special climatic impact assessments.

Quantitative Crop Yield Forecasts

This crop condition analysis is also used in combination with statistical models and historical agricultural statistics to quantitatively assess the impact of rainfall on crop yields by administrative region in each country. These quantitative crop yield forecasts are initially issued 30 days before the beginning of crop harvesting.

The premise for using quantitative climatic impact assessment methods is that seasonal rainfall variability (i.e., changes in the total amount and distribution during the crop growing season) represents the dominant factor determining year-to-year changes in crop yield within the semiarid regions of Africa. Historical agricultural statistics are used to determine average yields (i.e., consensus baseline reference points) and as input for statistical analyses of two types to estimate yield variabil-

ity around the baseline average. First, various statistical rainfall yield models are investigated to isolate potentially useful relationships for each crop region.

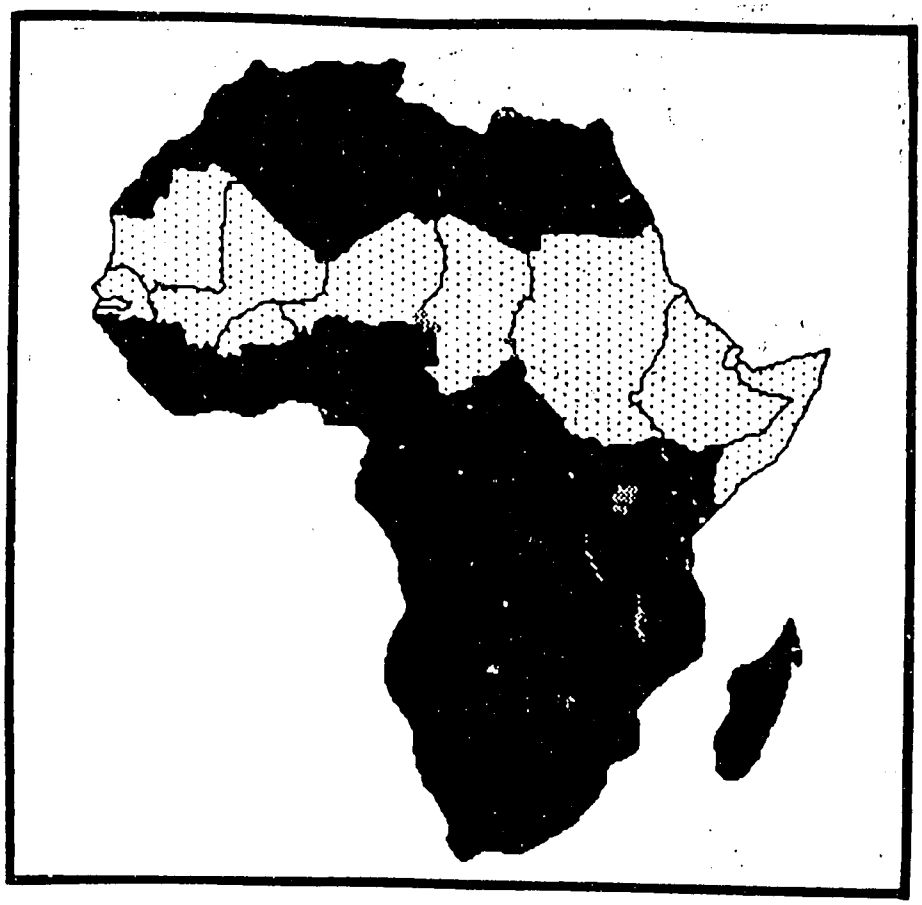
In the second approach (which is under test and evaluation), NOAA AVHRR derived normalized vegetation indexes (NVI) are statistically compared to regional crop yield. In this process, the vegetation is spatially averaged over the crop area for each week during the growing season and then the weekly time series is temporally smoothed through the crop season. Smoothed vegetation index values at the time of crop flowering (i.e., reproductive crop stage) are statistically compared with 1983 and 1984 crop yields to develop a potential predictive relationship, e.g., as one approach to forecast 1985 yield. Exceptionally strong NVI yield relationships for 1983 and 1984 millet and sorghum crops have been observed for most Sahelian countries. The hypothesis being tested is that rainfall in the Sahelian climate regime drives the biomass (detected by the NOAA AVHRR satellite) and the biomass is a physically meaningful indicator of crop yield.

The final yield forecast is based on analysis of the crop conditions, statistical rainfall yield models, satellite vegetation index yield models and the historical agricultural statistics. Although these yield forecasting procedures are promising, they require further investigation (e.g., with ground-truth studies). The methodology could prove to be a useful early warning tool in the semi-arid climate regime; however, it does not replace the need for reliable ground survey yield estimates. As a final note, improved yield data from ground surveys are necessary to upgrade the entire process.

APPENDIX A

SPECIAL CLIMATE IMPACT ASSESSMENT

SUB-SAHARAN AFRICA



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 DEVELOPMEN

MAY - SEPTEMBER 1985

ISSUED ON OCTOBER 21, 1985 VOLUME I, NUMBER 4

ASSESSMENT AND INFORMATION SERVICES CENTER
National Environmental Satellite,
Data and Information Service
Federal Building, 608 E. Cherry St.
Columbia, MO. 65201

39

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			////	----	----	0000	0000			250 - 600 mm
II. Soudan			////	----	----	----	00000	00000		600 - 1,000 mm
III. Soudano Guinean			////	----	----	----	----	00000	00000	>1,000 mm
IV. Ethiopia[1]			////	////	////	----	----	----	00000	400 - 1,800 mm
V. Somalia[2]		////	----	----	----	00000	00000			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 when 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

	Page
Introduction	i
Regional Analysis	1
NOAA AVHRR Images	6
Background on Assessment Methods	8
Country Analyses	11
Cape Verde	12
Gambia	19
Senegal	14
Mauritania	25
Mali	32
Burkina Faso	38
Niger	44
Chad	51
Sudan	58
Ethiopia	63
Somalia	69

Notice: This is the last in the series of special African assessments for 1985. Brief reports for Cape Verde and Somalia will continue to be published through year-end, and coverage for Ethiopia's "belg" season will begin in March. The next complete series of Sahel/Horn reports will resume July, 1986, with coverage of May-June rainfall and resultant growing conditions.

INTRODUCTION

This is one 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 millet and sorghum yields (by major administrative region) are provided by cable in September and October.

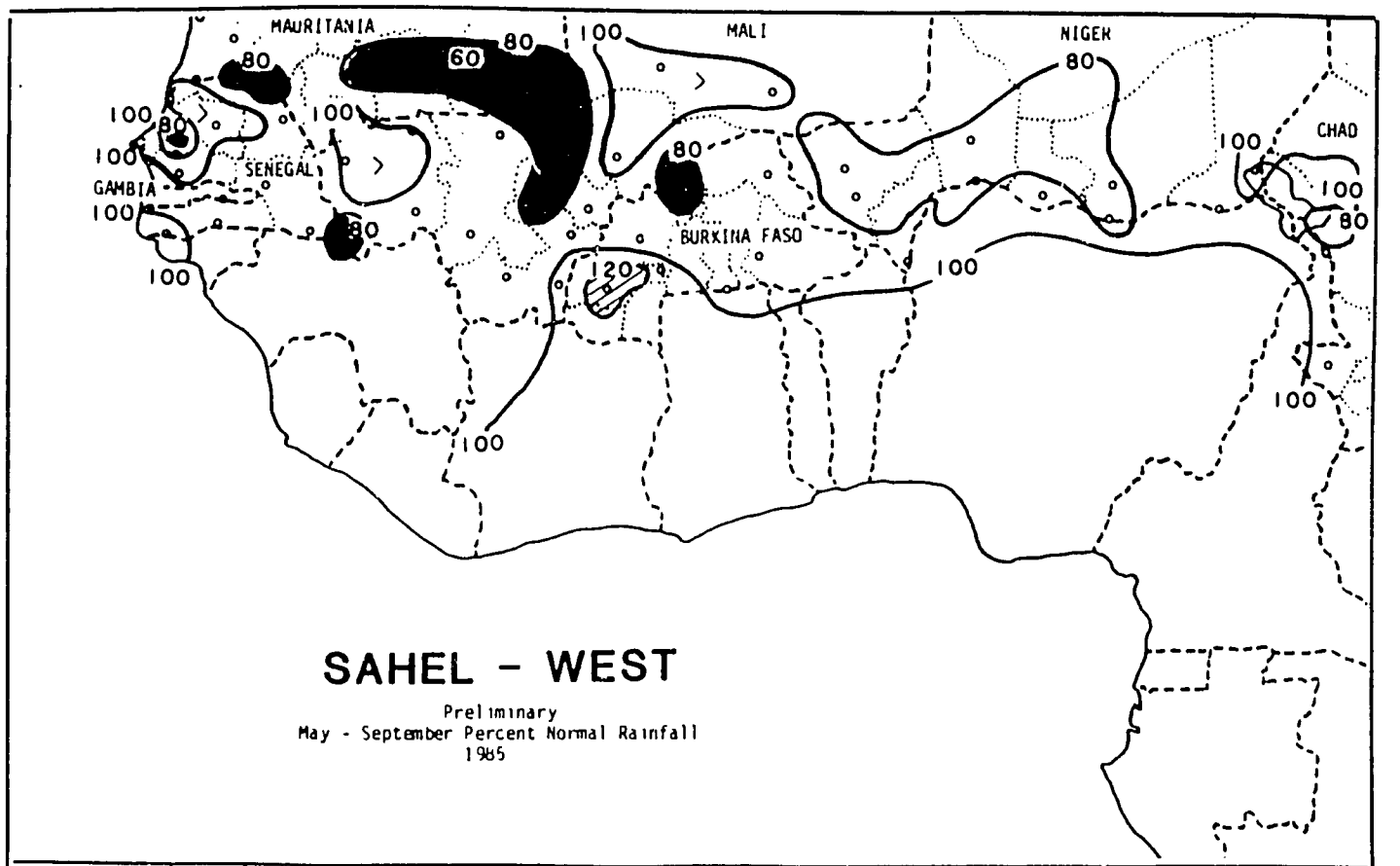
This assessment represents the synthesis and evaluation of all available data. Although some of the pertinent input data are included for use by other analysts, all data sets are modified in some way by AISC and no single data set can be used alone. Apparent discrepancies between data sets or between 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. II, Room 130, 3300 Whitehaven St., NW, Washington, D.C. 20235, Phone (202) 634-1822.

42

REGIONAL ANALYSIS

OVERVIEW



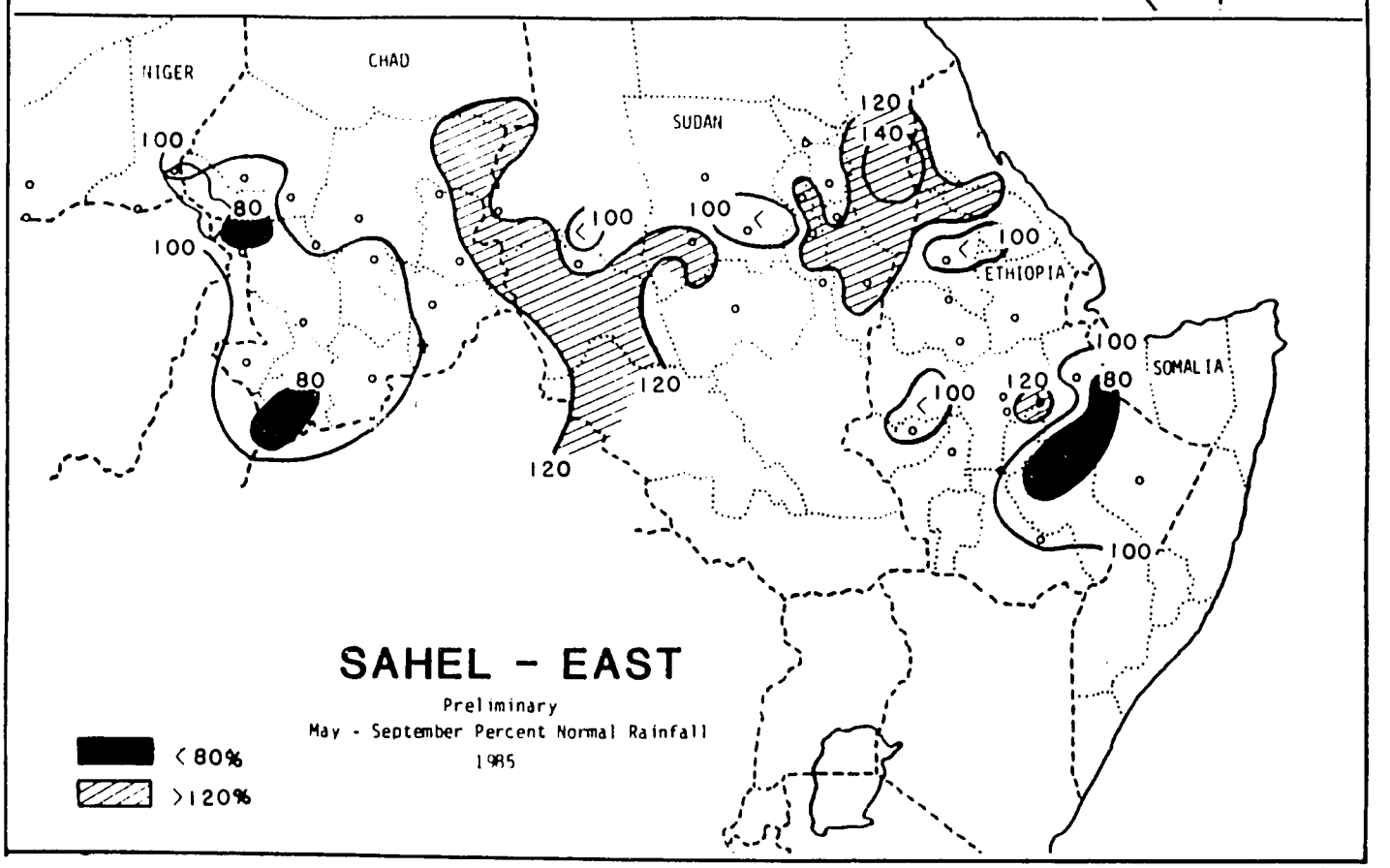


Figure 1

Season rainfall in percent of the 1951-'83 mean. Based on rainfall reports and satellite data. Rainfall in most countries was near or above normal this year. Exceptions included Niger and Mauritania, where large areas had rainfall 60 to 80 percent of normal.

44

Highlights

The 1985 growing season was the best since at least 1981, and far better than the preceding two drought-affected years. Continuation of rains well into September across the region assured at least average cereal yield potential in each country. Total seasonal rainfall (see Figure 1) was near or above normal in most countries, providing hope for relief from food shortages. Problems tended to be limited to small "pockets" of dryness within each country. The reason for much higher rainfall amounts this year can be seen from Figure 2. The leading edge of the moisture-carrying air mass, as denoted by the Intertropical Discontinuity (ITD), stayed well north of last year's location throughout the crucial June through early September growing period.

Rangeland Vegetation Conditions

The greater rainfall measured this season significantly improved rangeland growth. Figure 3 shows that satellite-inferred vegetation conditions were better in 1985 than in 1984 throughout the region. In most areas, conditions were better than in 1983, as well. Marked improvement also occurred during this year while the rainy season progressed. June vegetation imagery (Figure 4) showed most growth limited to southern areas of Mali, Burkina Faso, Sudan, Somalia, and the mountains of Ethiopia. Following ample rains in July, August, and September, imagery for September (Figure 5) showed that grassland growth had advanced far northward into the Sahel zone, with unfavorable conditions primarily limited to small pockets within each country.

Crop Conditions

Yields of cereals being harvested across the region during the autumn of 1985 are near or above the five-year average. Sorghum and millet weather-adjusted yields are above average in Senegal, Gambia, Mauritania, Mali, Burkina Faso, Chad and Sudan. Improvement is especially great in the Sahelian portions of Chad and Sudan, which were hit hard by drought in 1983-84. In Sudan, sorghum yields are expected to be the best since 1981, when record high yields were measured. In Ethiopia, potential yields are average or better except in the southeast, where dryness, particularly in northern Harar Province, likely hurt crops. Niger rainfall, though late and below normal, was well spaced, resulting in conditions far better than in 1984, when dryness and heat were more intense. In Cape Verde, growing conditions for maize and beans have been the best in several years.

Weather Analysis

With May-September cumulative rainfall averaging nearly 100 percent of the 1951-'83 mean, 1985 must be considered one of the better years since the drier climate began in the late 1960's. The contrast is especially great with 1984, when Sahelian zones in Chad and Sudan reported rainfall less that 50 percent of normal. Much of this area had rainfall well over 100 percent of normal during 1985 (Figure 1), according to satellite rainfall estimates. Indeed, flooding damaged crops, roads, and railways. The problem was especially acute in food shortage areas of western Sudan, where floodwaters halted ground transport of relief supplies on numerous occasions. Nevertheless, the rainfall for the entire Sahel/Horn region, though abundant by the standards of recent years, was still below the 1941-'70 average and the 1931-'60 average. It is, therefore, premature to assume that the long string of dry years that began in 1968 has ended.

45

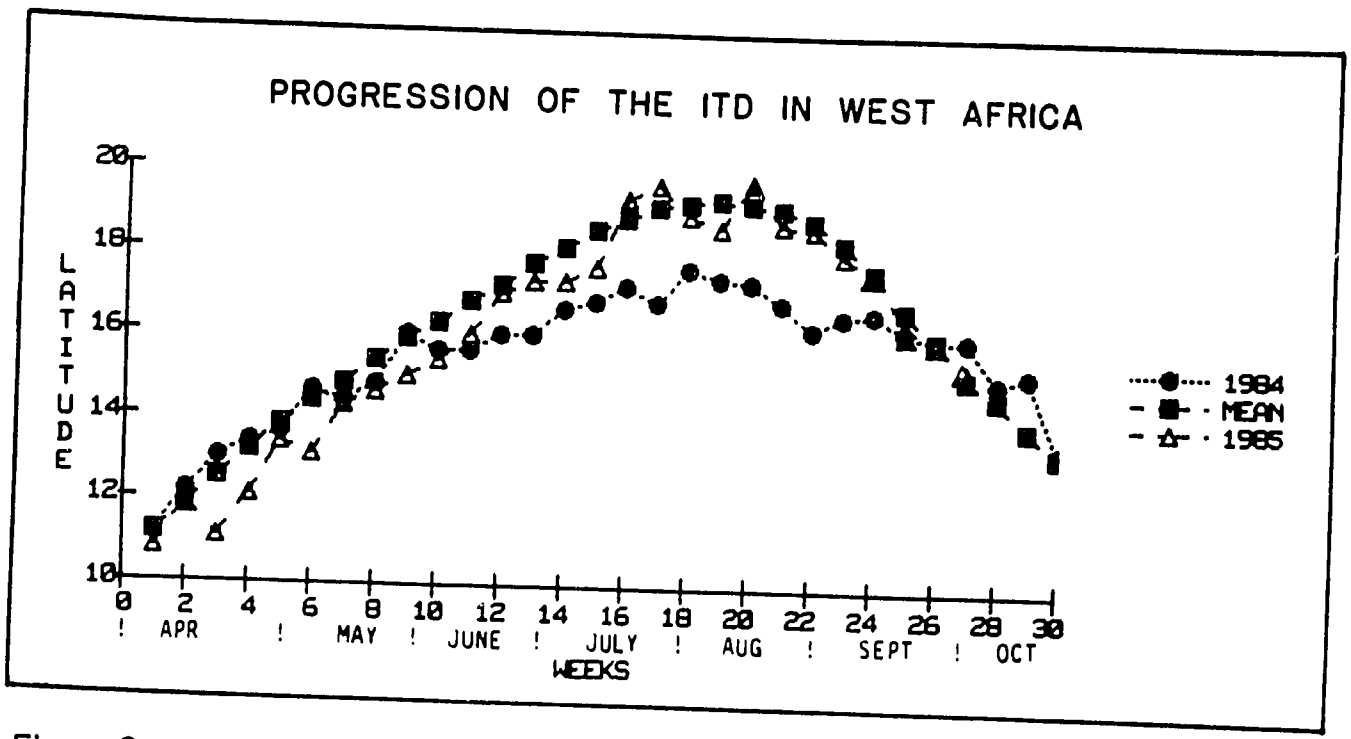
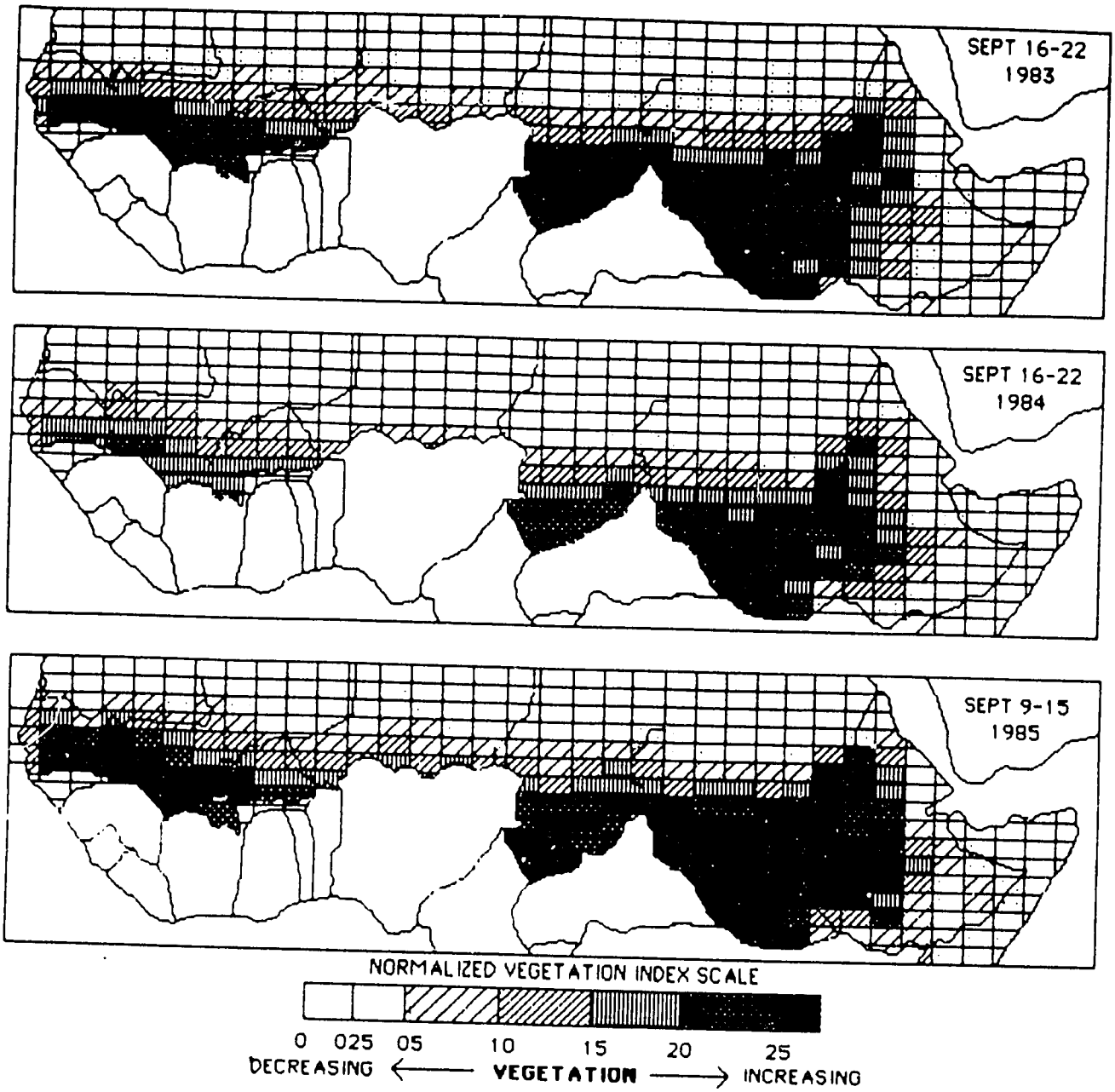

PROGRESSION OF THE ITD IN WEST AFRICA
LATITUDE
20
18
16
14
12
10
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
WEEKS
1984
MEAN
1985

Figure 2

46

NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA



1985 VS. 1984 (FOURTH WEEK OF SEPTEMBER)

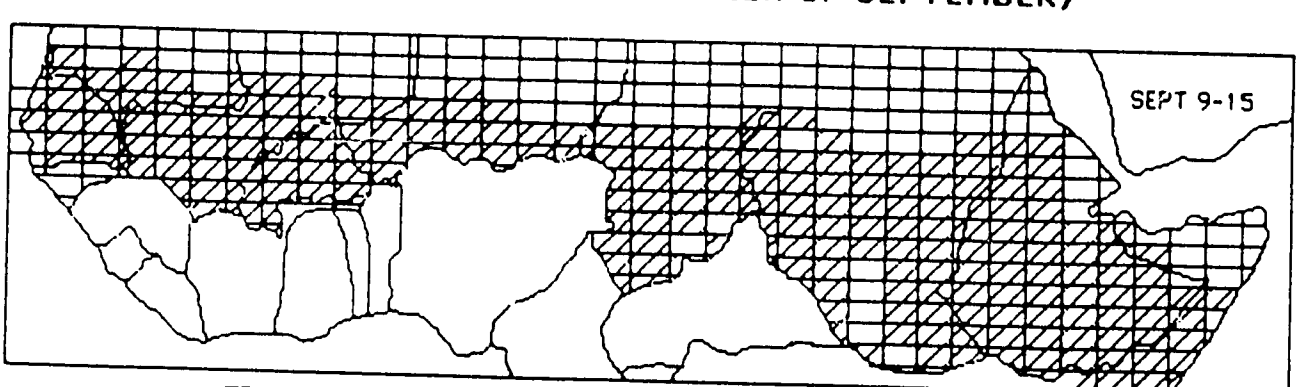


Figure 3 — 1985 GREENER — NO DEFFERENCE — 1984 GREENER

NOAA AVHRR IMAGE JUNE 1985

(IMAGE NOT AVAILABLE)

Figure 4

48

NOAA AVHRR IMAGE SEPTEMBER 1985

(IMAGE NOT AVAILABLE)

Figure 5

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

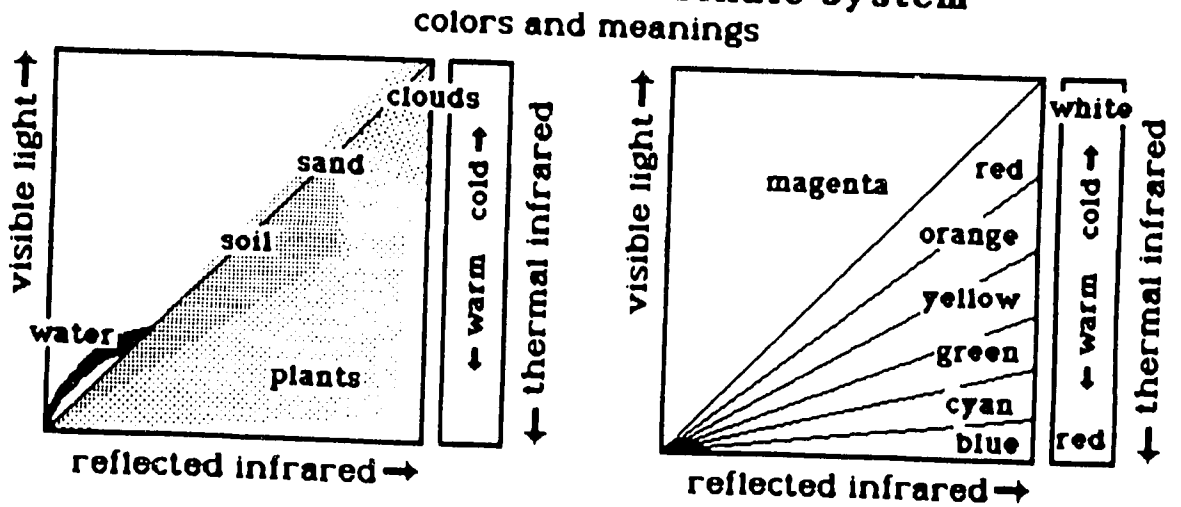
COLORS WITHOUT HUE

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



-51

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.

52

COUNTRY ANALYSES

CAPE VERDE ASSESSMENT

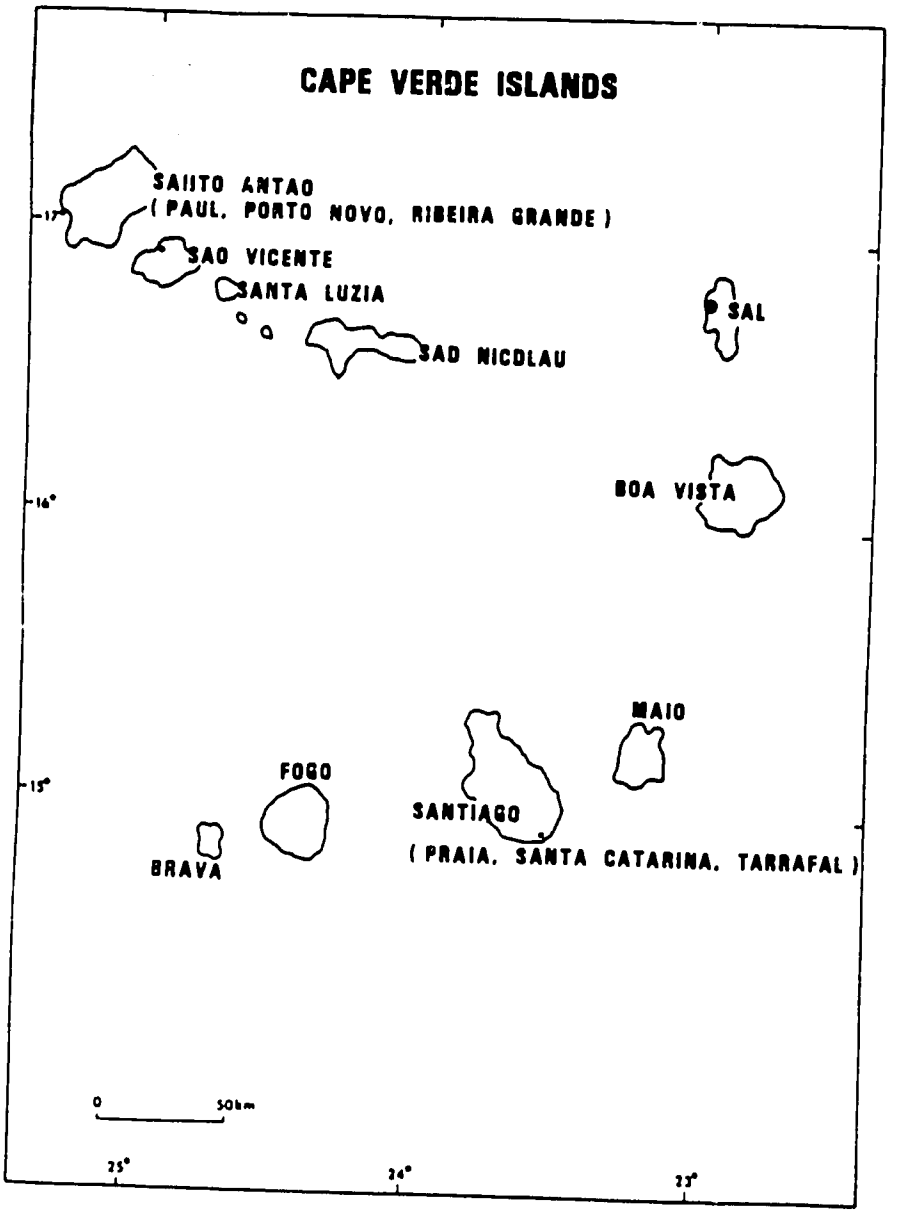


Figure 1

Overall growing conditions remained favorable compared with recent years, as heavy rains from a tropical disturbance on September 16-17 provided needed moisture for maize and corn crops near their critical growth stage.

The center of the tropical disturbance - which later became Hurricane Gloria - passed just to the south of Cape Verde, bringing heavy rains to the growing areas of Santiago, Fogo, and Brava during September 16. Showers from the system ended early on September 17. Rainfall amounts probably totaled about 50 to 100 mm at Santiago, Maio, and Boa Vista, and somewhat less on other islands. Coincidentally, the storm hit exactly one year after Tropical Storm Fran crossed the islands; Fran left up to 400 mm of rain and caused major flood damage. As rainfall amounts appeared to be less this year, flood damage should have been minor.

54

Rains from Gloria may have prevented significant crop damage from dryness, especially on Santiago, where little rain fell from August 18- September 1 and again September 5-15. Both dry spells reduced yield potential, but the rainfall on the 16th prevented additional losses (except where flooding occurred).

Rainfall after September 17 was light, with scattered showers on September 21, 22, and 28. With periodic rains through mid-October, yields of the two principal subsistence crops - maize and beans - could be the best since 1978. This would be in spite of damage due to dry spells in late August and early September, and excessive rains in mid-September.

The favorable comparison with prior years is not due to a bumper yield outlook this year, but poor growing conditions during the 1970's and early 1980's, when Cape Verde agriculture was plagued by persistent drought occasionally interrupted by damaging floods.

GAMBIA ASSESSMENT

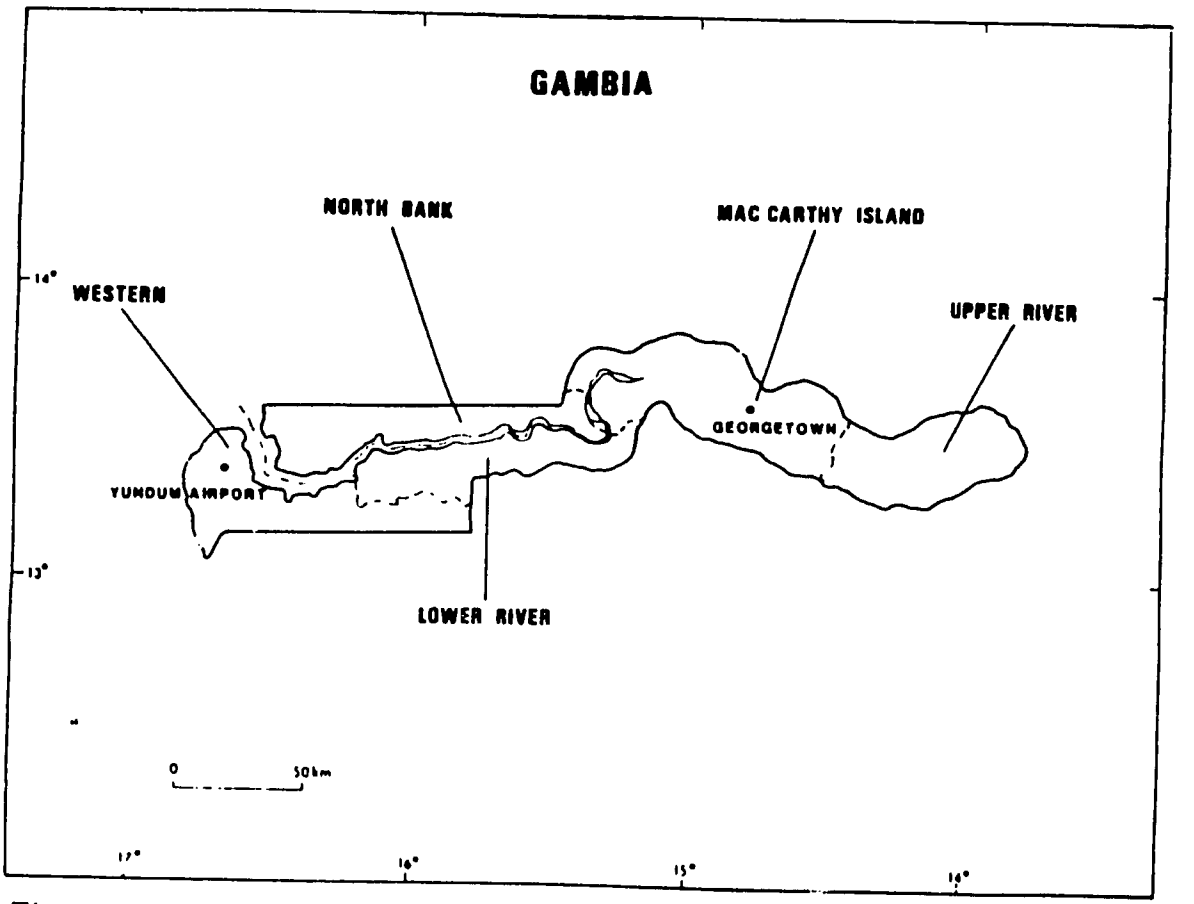


Figure 1

Overview

Prospects for the 1985 crops are average to above average in the Gambia. September rainfall was above normal and improved crop prospects and rangeland conditions. Crop water requirements were met in September and satisfactory crop conditions are indicated throughout the country.

Rangeland Vegetation/Biomass Conditions

Satellite derived vegetation/biomass indices through September 15 suggest that conditions for 1985, while lagging behind 1983 and 1984 due to the late arrival of rainfall, generally exceed or equal index values for the two previous years for most of the country (Figures 2 and 3). The only exception to this trend is in the Western Department, where the index is slightly below that of the two previous years.

Crop Conditions

Crop conditions appear generally favorable for most of Gambia. Due to a delayed start of the rainy season, crop development is approximately three weeks behind normal. Crop water requirements have been met in September and soil water reserves are adequate.

Weather Analysis

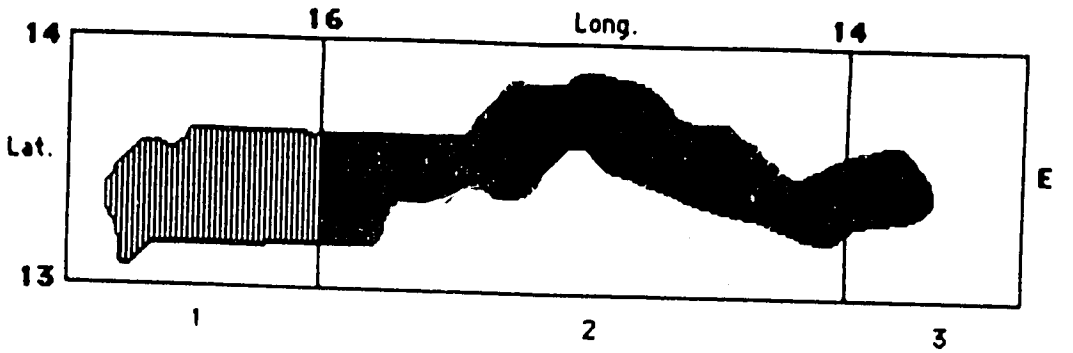
Rainfall conditions in September were generally good in Gambia (Tables 1 and 2). September rainfall was 294 mm at Yundum (102 percent of normal) and 237 mm at Georgetown (106 percent of normal). Cumulative rainfall through September at Georgetown, however, stands at 83 percent of normal.

56

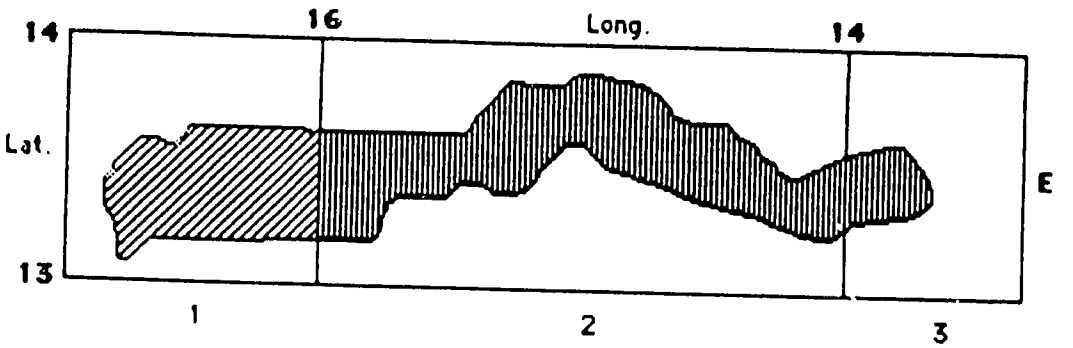
NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

GAMBIA

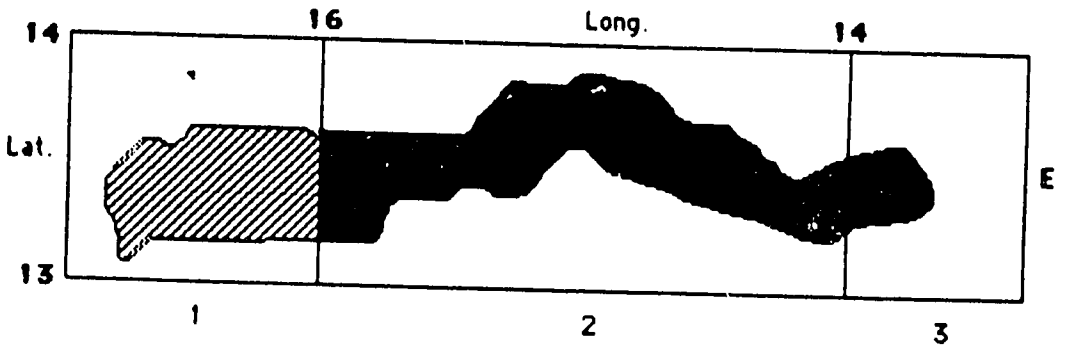
THIRD WEEK OF SEPTEMBER, 1983



THIRD WEEK OF SEPTEMBER, 1984



SECOND WEEK OF SEPTEMBER, 1985



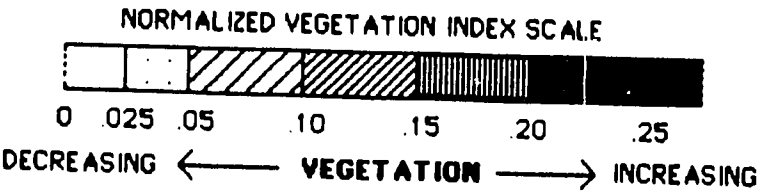


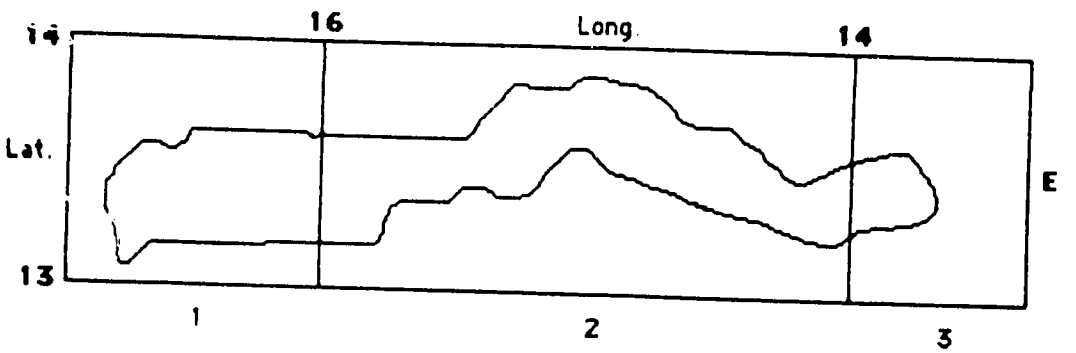
Figure 2

COMPARATIVE NOAA VEGETATION/BIOMASS INDEX NORMALIZED AVHRR DATA

SECOND WEEK OF SEPTEMBER

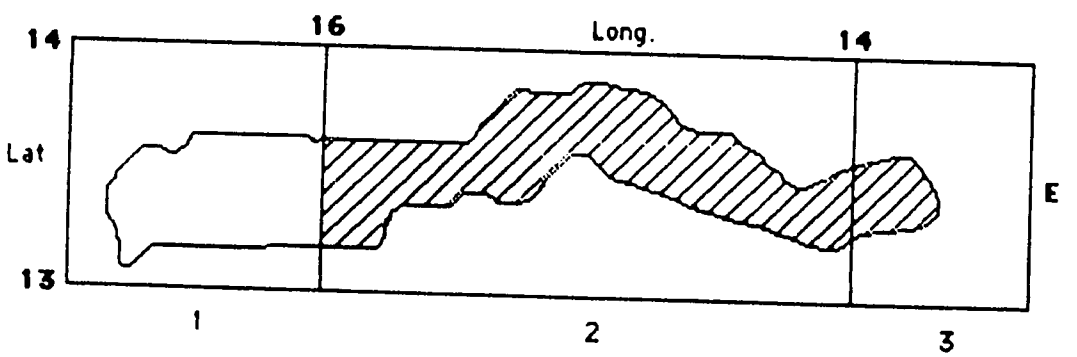
GAMBIA

1985 VS. 1983



NO INFORMATION AVAILABLE

1985 VS. 1984



1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

58

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: GAMBIA Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Bathurst/Yundum	0	0	3	29	44	25	370	143	83	332	83	36	297	103	56
Georgetown	0	0	3	48	49	22	175	87	39	195	75	25	225	101	56

Table I

54

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: GAMBIA Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Bathurst/Yundum	0	0	3	29	41	25	399	122	78	731	100	58	1028	101	47
Georgetown	0	0	3	48	45	17	223	72	25	418	73	25	643	81	33

Table 2

60

SENEGAL ASSESSMENT

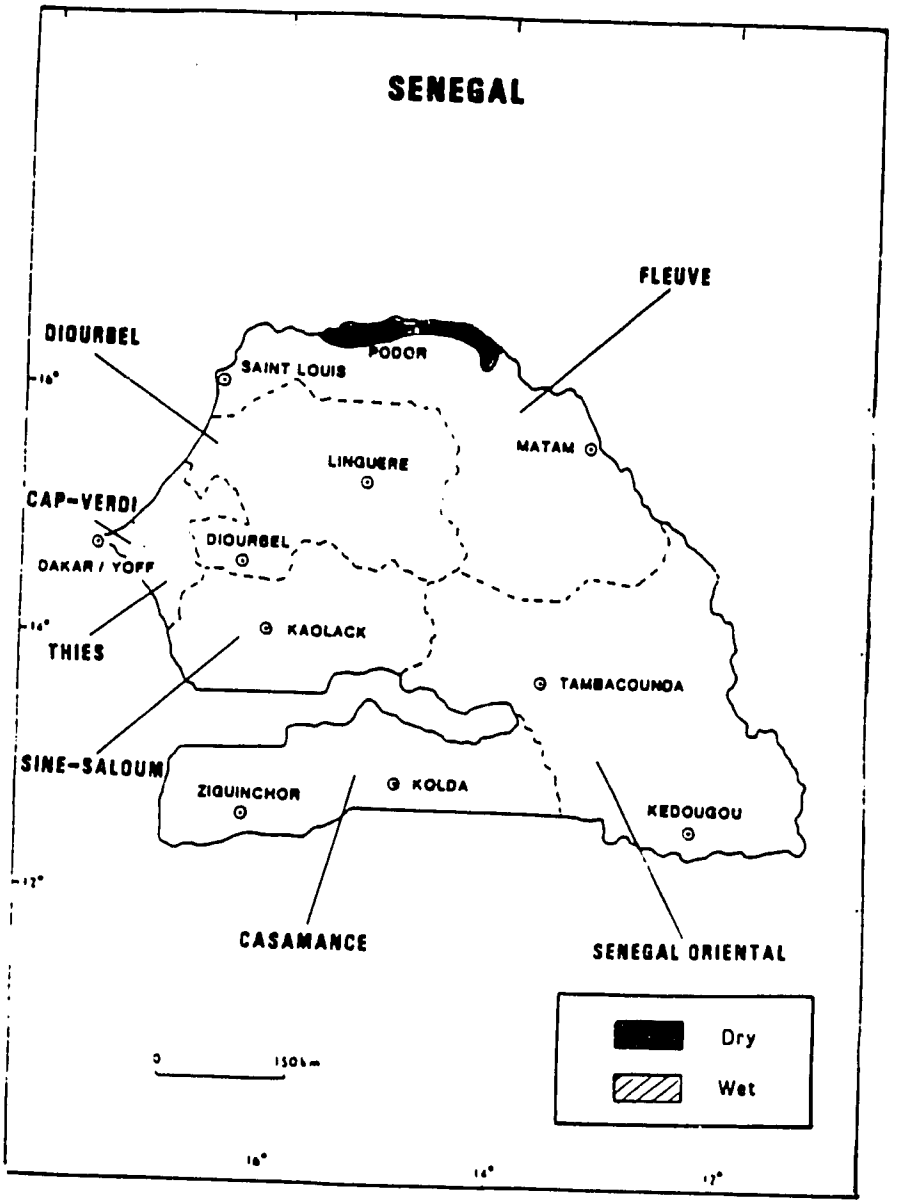


Figure 1

Overview

September rainfall was near normal to above normal throughout most of Senegal, improving crop yield prospects and rangeland conditions. Yield levels may be expected to equal or exceed the 1980-1984 average. The exception is in the north (Figure 1) around Podor and in the Fleuve Department, where rainfed millet and sorghum yields will be slightly below average.

Rangeland Vegetation/Biomass Conditions

Satellite derived vegetation/biomass indices through September 15 suggest that conditions in 1985, while lagging behind 1983 and 1984 due to the late arrival of rainfall, generally exceed or equal index values of the two previous years for most of the country (Figures 2 and 3). An exception to this pattern is in the southwest around Ziguinchor in the western part of Casamance Department, where conditions are worse than in 1983. Normal to above normal rainfall in the last 20 days of September, not reflected in these indices, improved conditions there.

Crop Conditions

Prospects for 1985 crops are exceptionally good with above average yields throughout the country except in the Fleuve Department, where yields of millet/sorghum are expected to be below average.

Weather Analysis

September rainfall was near normal to above normal throughout Senegal with the exception of the north, where Podor, Linguere, and Matam reported 81, 82 and 86 percent of normal precipitation respectively (Table 1). Cumulative seasonal rainfall to date remains below normal in this same area with 59, 73 and 81 percent of normal respectively (Table 2). An area extending from Kolda to Tambacounda in the south central portion of the country also lags in seasonal rainfall, but is near normal for September. Overall rainfall appears to be the highest since 1978, when record millet/sorghum yields were established.

-62'

NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

SENEGAL

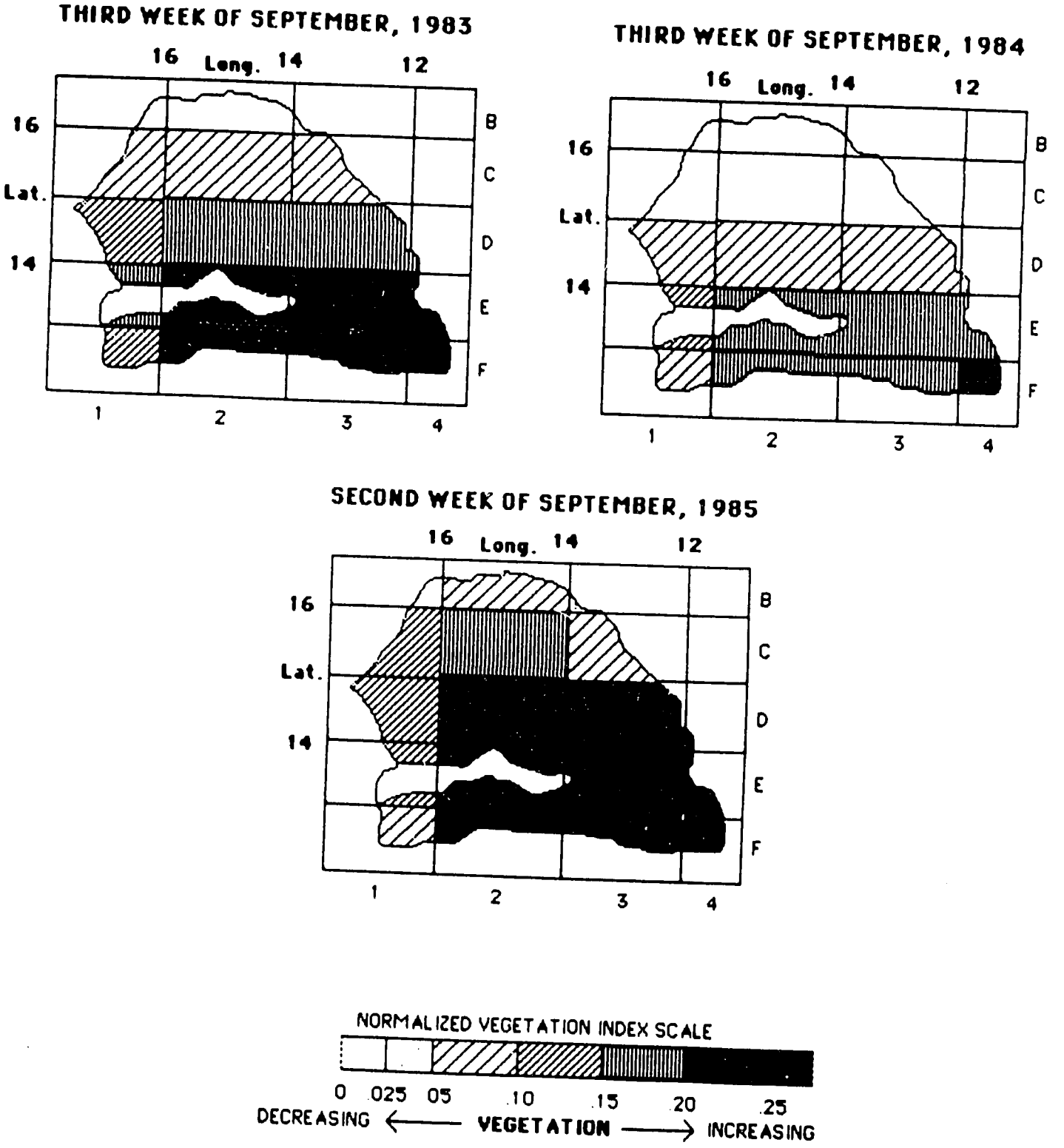


Figure 2

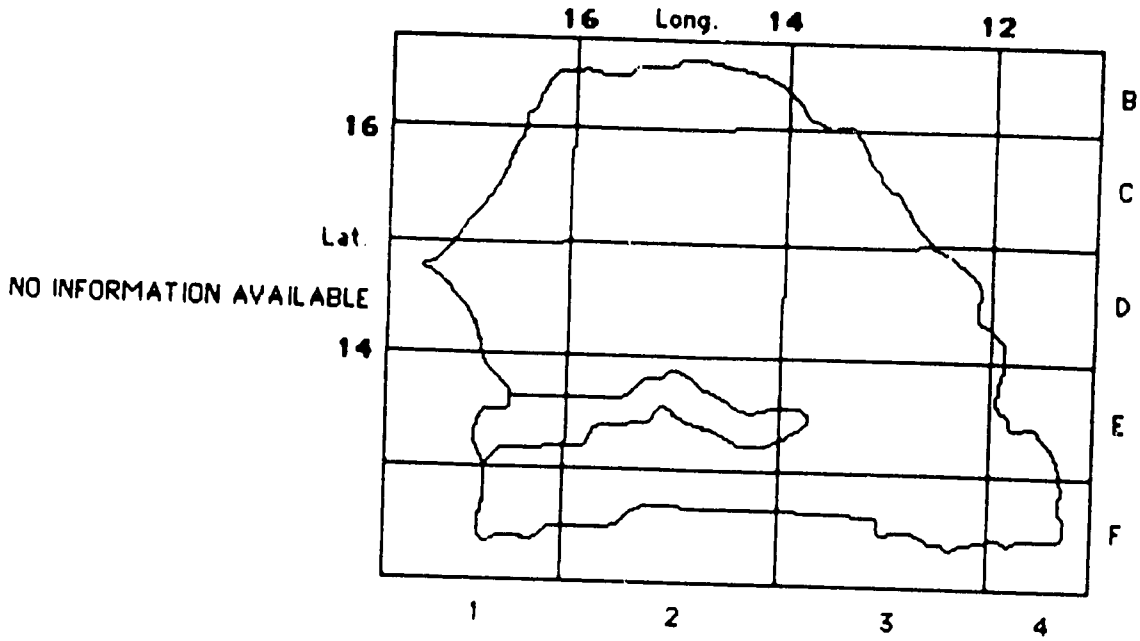
63

COMPARATIVE NOAA VEGETATION/BIOMASS INDE NORMALIZED AVHRR DATA

SECOND WEEK OF SEPTEMBER

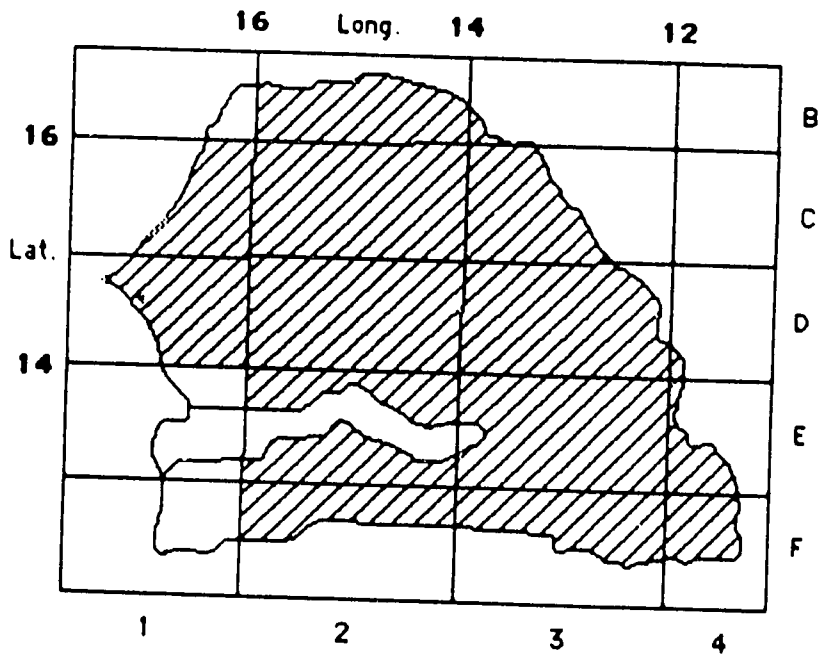
SENEGAL

1985 VS. 1983



NO INFORMATION AVAILABLE

1985 VS. 1984



1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

-64'

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: SENEGAL Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Dakar/Yoff	0	0	3	14	140	78	71	90	58	256	103	78	155	105	61
Diourbel	0	0	3	20	56	33	60	48	19	168	80	44	161	89	44
Kaolack	1	20	75	31	63	42	240	169	86	274	110	69	177	99	53
Kedougou	4	9	6	188	104	56	338	124	83	357	111	56	273	94	42
Kolda	0	0	3	104	86	47	123	44	6	271	68	36	248	89	47
Linguere	0	0	3	18	67	50	103	105	61	113	54	33	97	84	50
Matam	0	0	3	20	69	39	102	94	47	149	74	67	89	82	50
Podor	0	0	3	0	0	3	42	81	47	57	43	36	63	75	50
Saint Louis	0	???	3	4	57	58	30	68	50	138	86	75	100	110	69
Tambacounda	0	0	3	21	21	3	107	53	8	224	93	53	206	104	58
Ziguinchor	0	0	3	51	46	22	390	122	69	396	74	31	425	118	78

Notes:

" " = No data for calculations.

"???" = Percent of normal not calculated because average rainfall is zero.

"***" = Percentiles not calculated because less than 15 years of historical data exist on file.

Table I

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: SENEGAL Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Dakar/Yoff	0	0	3	14	127	75	85	94	61	341	101	69	496	102	64
Diourbel	0	0	3	20	50	33	80	48	14	248	66	22	409	73	28
Kaolack	1	20	75	32	59	36	272	139	81	546	123	75	723	116	64
Kedougou	4	9	6	192	85	33	530	106	58	887	108	69	1160	105	61
Kolda	0	0	3	104	77	39	227	55	8	498	61	17	746	68	17
Linguere	0	0	3	18	62	44	121	95	50	234	70	39	331	73	39
Matam	0	0	3	20	65	39	122	88	39	271	79	42	360	80	42
Podor	0	0	3	0	0	3	42	62	31	99	49	31	162	57	31
Saint Louis	0	???	3	4	57	56	34	67	47	172	81	64	272	90	64
Tambacounda	0	0	3	21	17	3	128	40	3	352	62	6	558	73	19
Ziguinchor	0	0	3	51	43	17	441	101	53	837	86	36	1262	95	58

Notes:

" " = No data for calculations.

"???" = Percent of normal not calculated because average rainfall is zero.

"***" = Percentiles not calculated because less than 15 years of historical data exist on file.

Table 2

.66

MAURITANIA ASSESSMENT

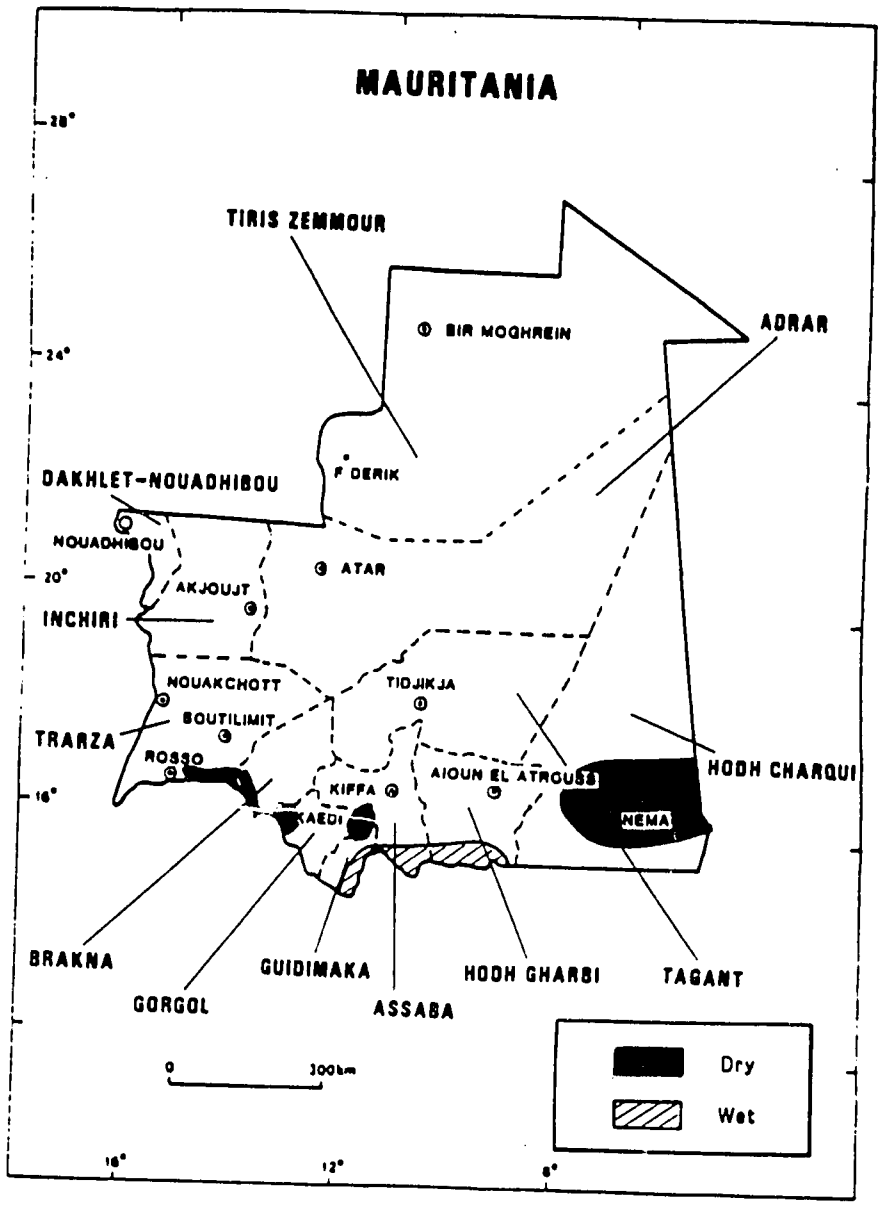


Figure 1

Overview

Overall the 1985 crop and rangeland conditions throughout agriculturally important regions of southern Mauritania are much improved over those for 1983 and 1984. Maize, millet and sorghum yields are expected to be slightly under the long-term average but above the 1980-84 average.

Rangeland Vegetation/Biomass Conditions

Satellite imagery and derived vegetation/biomass indices suggest that rangeland conditions continue to be good for 1985 and much improved over those of 1983 and 1984 (Figure 2, 3 and 4). Good rangeland conditions compared to 1983 and 1984 are indicated in southern Trarza, northern Brakna, Assaba, and the extreme south of Hodh Gharbi and Hodh Charqui. Conditions are below normal in the southeast (Figure 1). Nema's cumulative rainfall was only one-half the long-term mean.

Crop Conditions

In general, the available precipitation and satellite data indicates overall crop conditions above the 1983 and 1984 level. In the southwest of Mauritania, the maize, millet and sorhgum crops planted in July received favorable amounts of rain in September and should be in better condition than in 1983 and 1984. The 1985 soil moisture index analysis suggests slight moisture stress in isolated areas of Trarza, Brakna, Gorgol and the Assaba region (Figure 1). Nevertheless, yields will greatly exceed the 1983 and 1984 levels for all regions. This is also supported by the satellite vegetation indices.

Weather Analysis

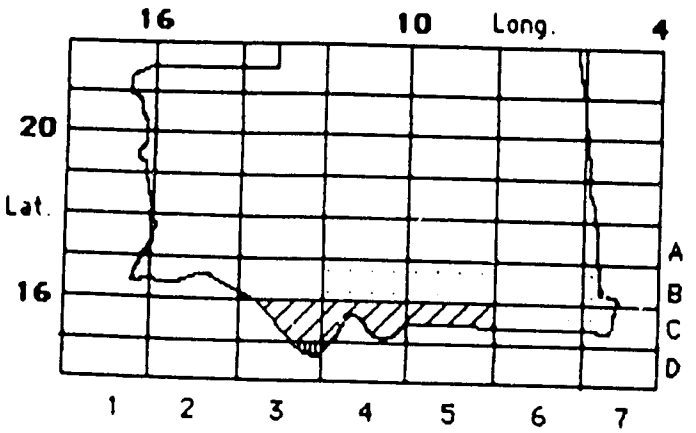
In Mauritania, September rainfall was rear normal in most areas. Exceptions included Boutilimit, where reported rainfall was twice normal (Table 1), and Kiffa, where rainfall was less than half normal. The May-September seasonal rainfall (Table 2) ranged from half normal near Nema to near normal in extreme southern areas adjacent to Mali. Major cropping zones had rainfall averaging near 80 percent of the long-term means for the highest rainfall totals since 1981.

68

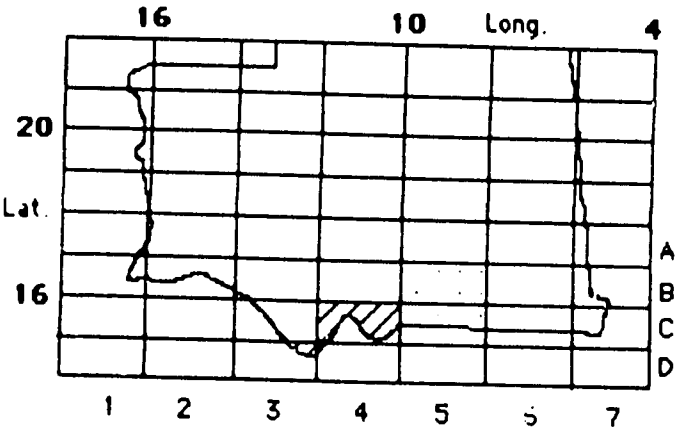
NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

MAURITANIA

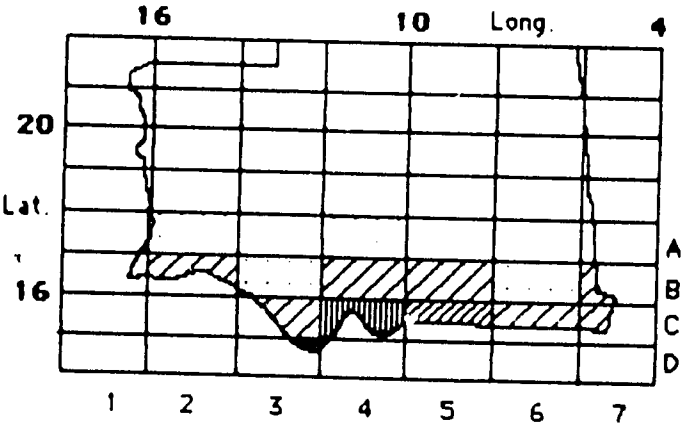
THIRD WEEK OF SEPTEMBER, 1983



THIRD WEEK OF SEPTEMBER, 1984



SECOND WEEK OF SEPTEMBER, 1985



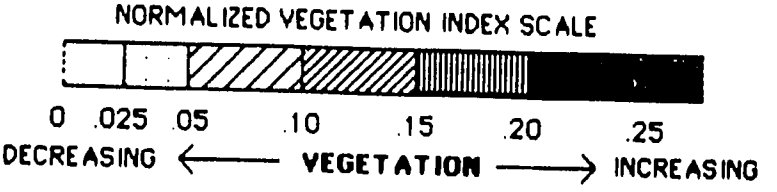


Figure 2

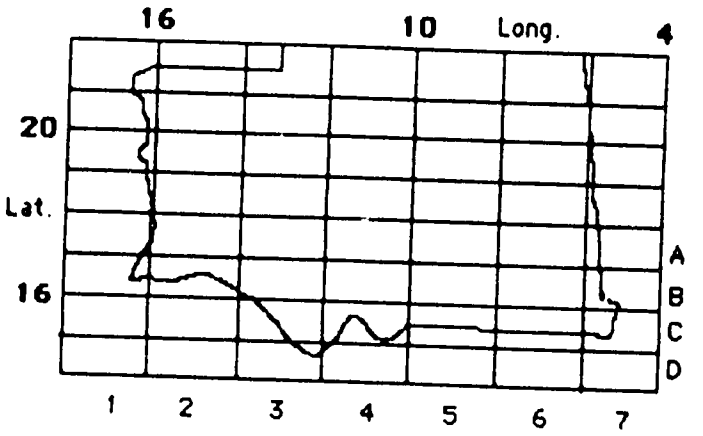
69

COMPARATIVE NOAA VEGETATION/BIOMASS INDEX NORMALIZED AVHRR DATA

SECOND WEEK OF SEPTEMBER

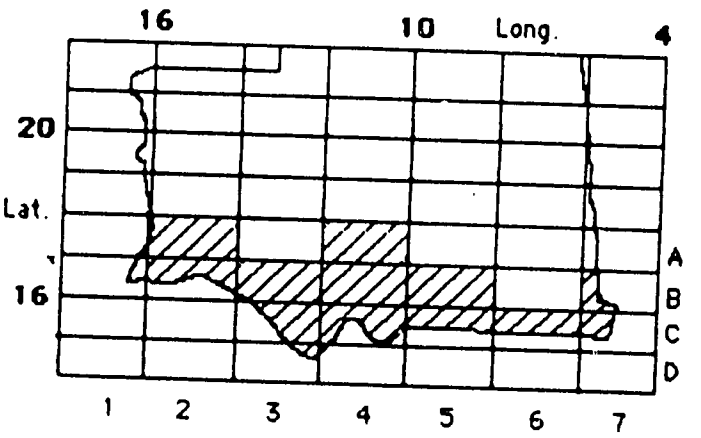
MAURITANIA

1985 VS. 1983



NO INFORMATION AVAILABLE

1985 VS. 1984



1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

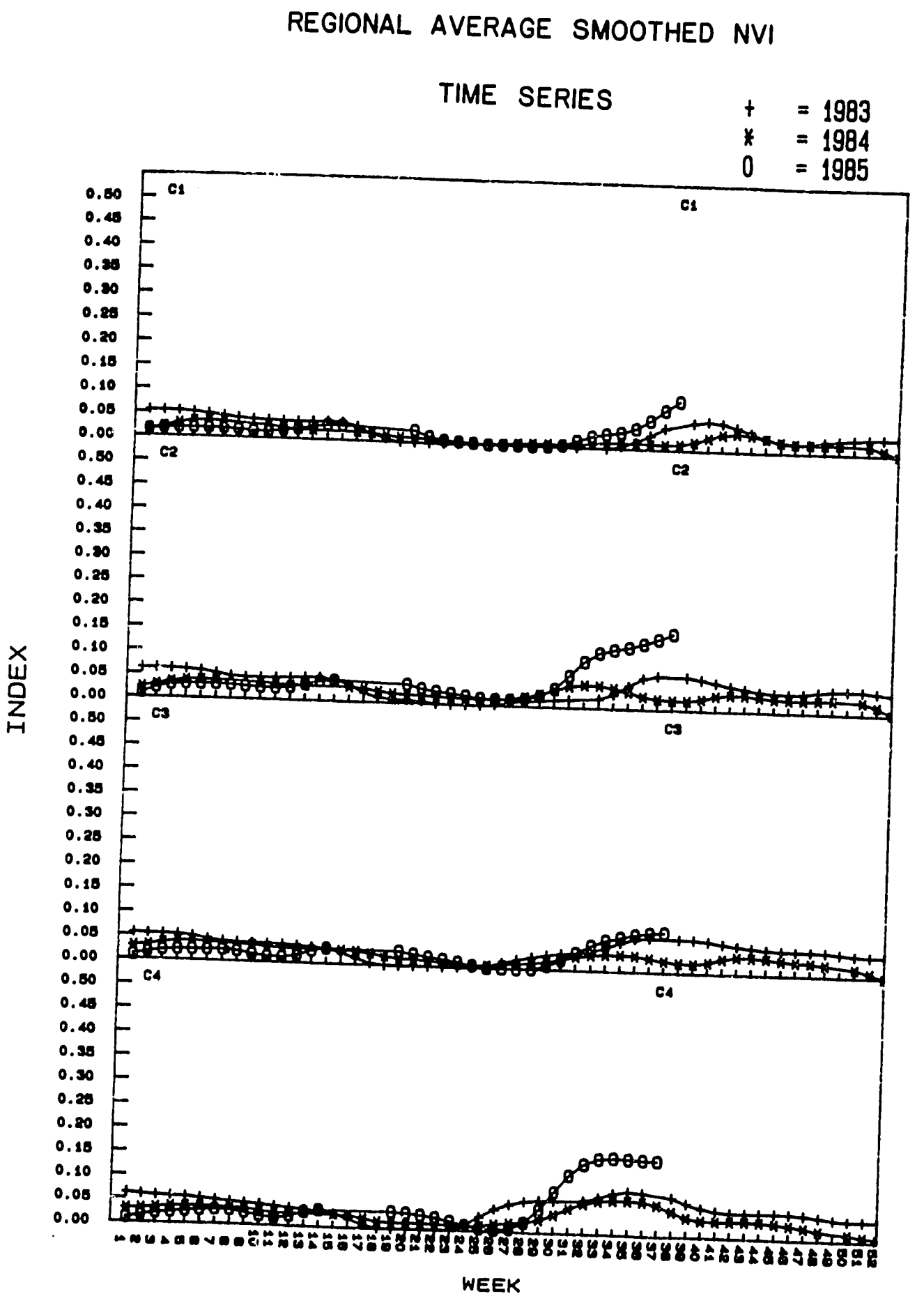

REGIONAL AVERAGE SMOOTHED NVI
TIME SERIES
+ = 1983
* = 1984
0 = 1985
C1
C2
C3
C4
INDEX
WEEK

Figure 4

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: **MAURITANIA** Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Boutilimit	0	0	3	0	0	3	3	11	25	45	79	50	109	242	92
Kaedi	0	0	3	1	4	11	61	75	47	89	72	33	85	104	54
Kiffa	0	0	3	14	58	42	46	67	42	99	85	47	22	29	19
Nema	0	0	3	4	15	8	18	26	6	47	51	14	51	89	50
Nouakchott	0	???	3	0	0	3	7	50	44	27	69	53	2	6	18
Rosso	0	0	3	0	0	3	44	94	61	63	75	36	83	114	54

Notes:

" " = No data for calculations.

"???" = Percent of normal not calculated because average rainfall is zero.

"***" = Percentiles not calculated because less than 15 years of historical data exist on file.

Table I

-72-

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: MAURITANIA Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Boutilimit	0	0	3	0	0	3	3	9	14	48	53	31	157	116	67
Kaedi	0	0	3	1	4	11	62	59	22	151	66	22	236	76	33
Kiffa	0	0	3	14	54	36	60	63	31	159	75	39	181	63	28
Nema	0	0	3	4	13	8	22	22	6	69	36	8	120	48	8
Nouakchott	0	???	3	0	0	3	7	47	44	34	63	47	36	40	24
Rosso	0	0	3	0	0	3	44	77	53	107	76	38	190	89	44

Notes:

" " = No data for calculations.

"???" = Percent of normal not calculated because average rainfall is zero.

"***" = Percentiles not calculated because less than 15 years of historical data exist on file.

Table 2

-73

MALI ASSESSMENT

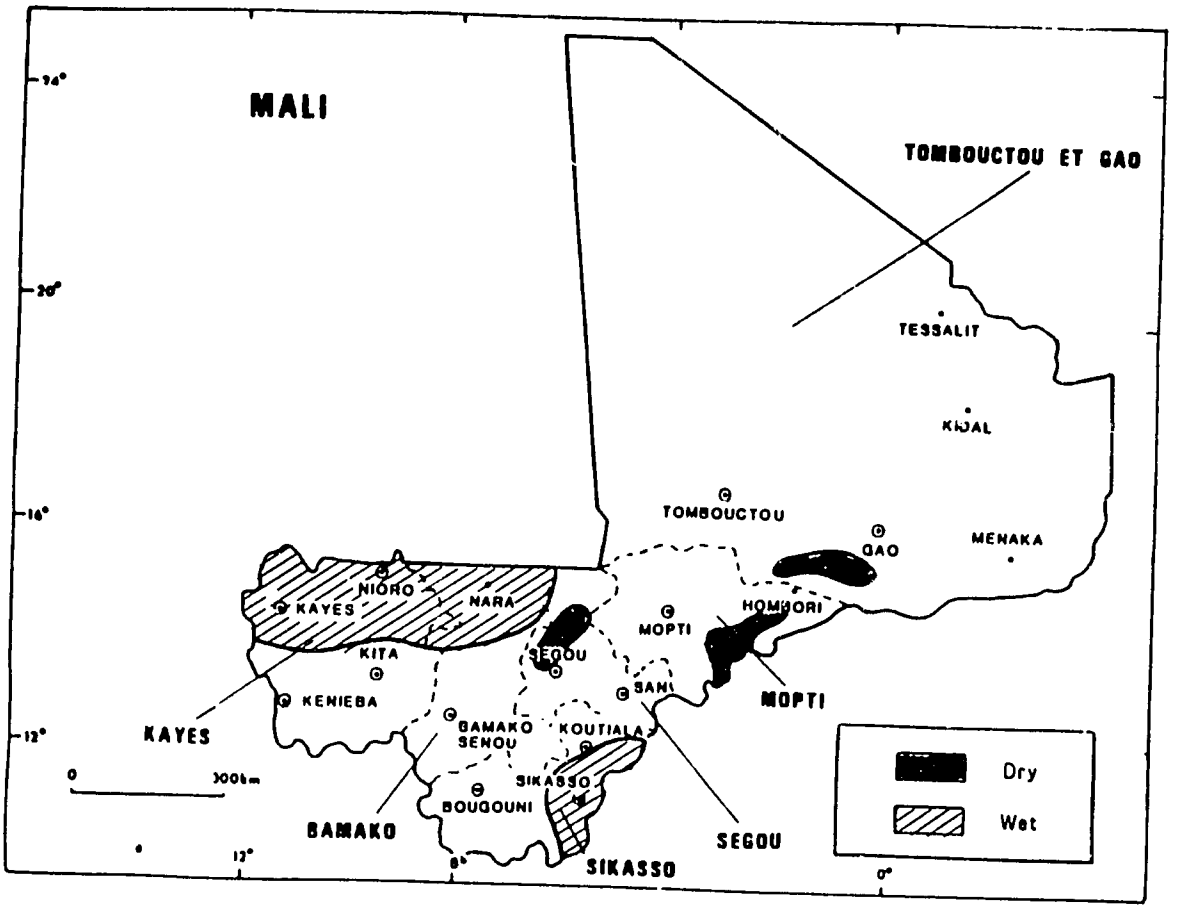


Figure I

Overview

The crop and rangeland outlook for Mali is very optimistic. Most areas of the country show normal to above normal field conditions which are much improved over the two previous years. Crop and rangeland in the Segou and Mopti Departments have improved since the last assessment and appear to be comparable to 1983. However, 1985 rangeland/biomass conditions to the north and south of Hombori appear to be relatively unfavorable.

Rangeland Vegetation/Biomass Conditions

Satellite derived vegetation/biomass indices suggest better vegetation conditions in 1985 than either 1983 or 1984 for most of the country (Figures 2 and 3). Improved biomass production is indicated for Kayes, Koulikoro, and Sikasso Departments over 1983 and 1984 (Figure 1). The 1985 vegetation/biomass conditions in Mopti are about the same as in 1983. The 1985 vegetation conditions in some areas north and south of Hombori appear unfavorable (Figure 1). Below-average rainfall near the town of Segou has also worsened rangeland conditions there.

Crop Conditions

The crop outlook is very optimistic throughout most of Mali and rainfed crop yields should be well above average. Timely and adequate rainfall during the water-sensitive crop growth stages enhanced the prospects for sorghum and millet planted in late June and July.

Weather Analysis

Rainfall during September (Table 1) was near normal to above normal at most stations with the exception of Nara, Nioro, San, and Koutiala. Seasonal rainfall (May-September) was below normal at Segou (Table 2). In general, soil water reserves increased considerably during the second and third decades of September.

- 15

NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

MALI

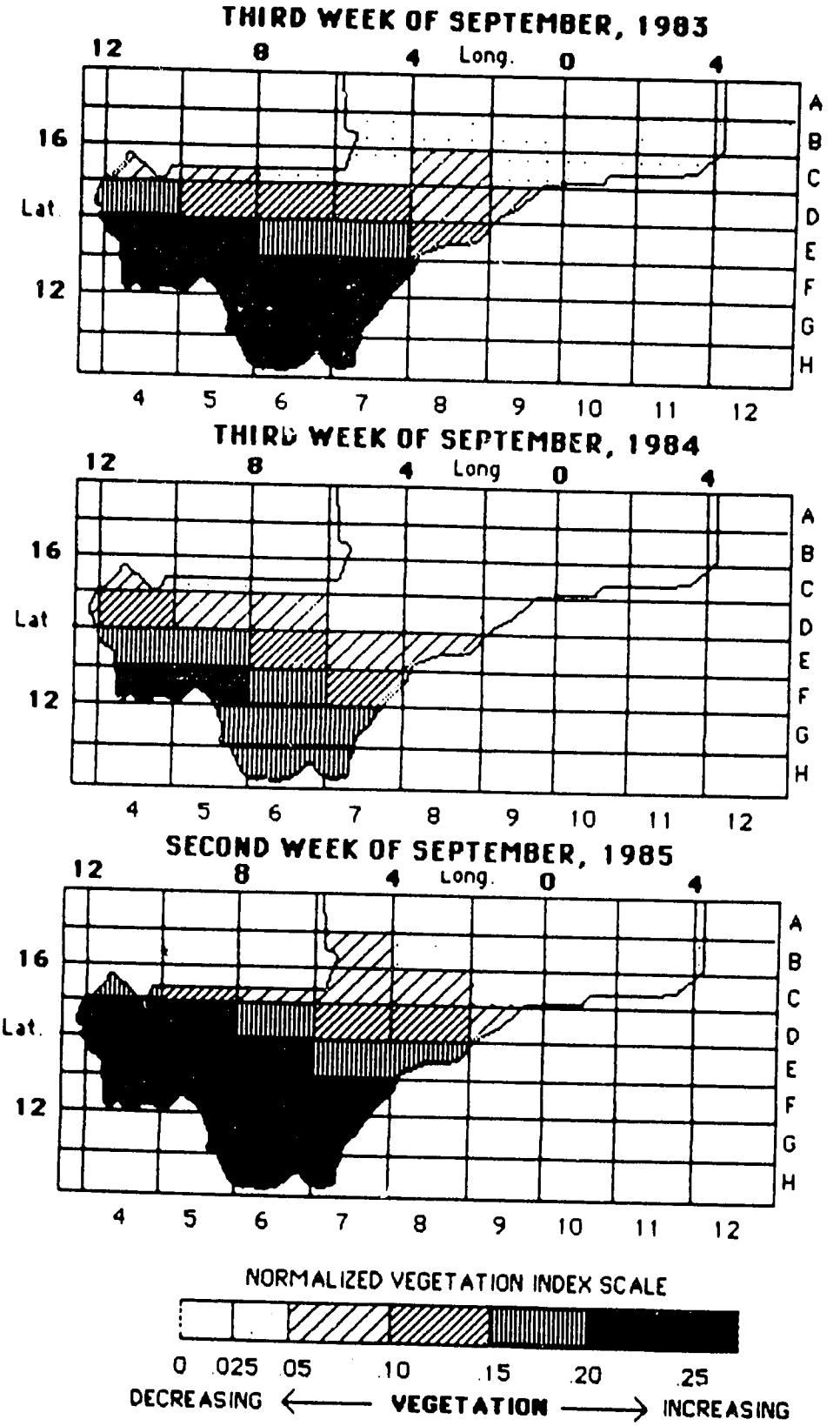


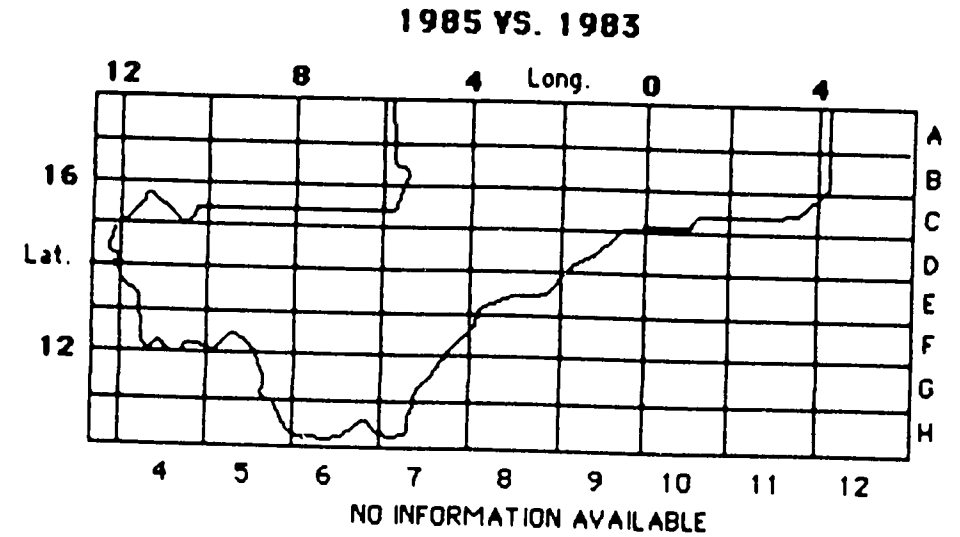
Figure 2

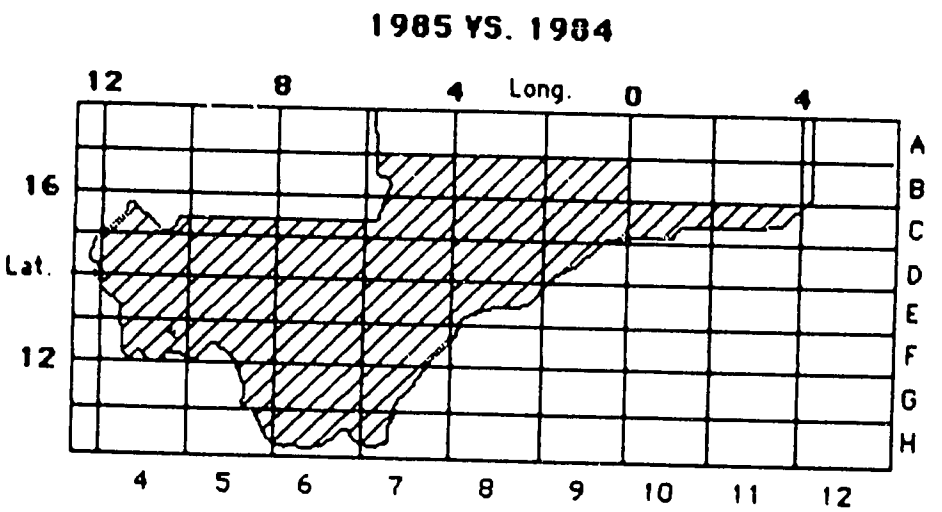
76

COMPARATIVE NOAA VEGETATION/BIOMASS INDEX NORMALIZED AVHRR DATA

SECOND WEEK OF SEPTEMBER

MALI





1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: MALI Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Bamako/Senou	25	52	22	135	109	64	194	80	28	217	68	36	182	99	53
Bougouni	60	56	14	123	84	39	210	79	33	121	32	3	342	134	92
Gao	0	0	3	62	248	89	91	132	78	45	47	14	43	134	61
Hombori	0	0	3	60	128	78	105	88	44	95	50	22	99	150	81
Kayes	2	15	22	57	67	31	262	156	94	216	100	53	190	132	81
Kenieba	15	29	19	103	61	19	234	88	47	244	67	31	297	106	64
Kidal	0	0	3	0	0	3									
Kita	25	54	25	131	90	46	200	91	39	191	54	14	230	109	57
Koutiala	45	62	19	73	56	8	345	155	97	230	84	39	115	63	14
Menaka	0	0	3	0	0	3	80	103	56	85	82	44	45	113	64
Mopti	0	0	3	52	83	36	86	59	19	209	131	81	96	104	56
Nara	2	18	33	40	82	48	163	135	81	200	127	70	54	64	26
Nioro du Sahel	2	20	28	65	135	75	197	130	75	162	73	42	80	66	36
San	20	43	17	94	98	47	252	141	81	116	50	3	100	73	31
Segou	12	39	17	36	44	6	118	65	14	146	64	17	121	98	56
Sikasso	60	57	17	128	85	33	344	137	83	400	125	81	195	91	33
Tombouctou	0	0	4	23	177	75	59	144	75	21	22	17	27	108	54

Table I

-78

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: MALI Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Bamako/Senou	25	52	22	160	93	47	354	86	28	571	78	22	753	82	33
Bougouni	60	56	14	183	72	11	393	76	14	514	57	3	856	74	19
Gao	0	0	3	62	188	86	153	150	86	198	101	61	241	105	64
Hombori	0	0	3	60	102	61	165	92	53	260	70	25	359	82	42
Kayes	2	15	22	59	60	19	321	121	78	537	112	67	727	116	78
Kenieba	15	29	19	118	53	6	352	72	11	596	70	14	893	79	22
Kidal	0	0	3	0	0	3									
Kita	25	54	25	156	81	25	356	86	36	547	71	11	777	79	29
Koutiala	45	62	19	118	58	3	463	109	67	693	99	58	808	92	47
Menaka	0	0	3	0	0	3	80	72	36	165	77	33	210	82	36
Mopti	0	0	3	52	57	14	138	58	8	347	88	39	443	91	50
Nara	2	18	33	42	70	44	205	113	67	405	119	78	459	108	63
Nioro du Sahel	2	20	28	67	116	61	264	126	72	426	98	58	506	91	58
San	20	43	17	114	80	39	366	114	72	482	87	33	582	84	17
Segou	12	39	17	48	43	6	166	56	3	312	60	3	433	67	8
Sikasso	60	57	17	188	74	14	532	105	64	932	113	75	1127	108	69
Tombouctou	0	0	4	23	144	71	82	144	75	103	68	46	130	73	42

Table 2

19

BURKINA FASO ASSESSMENT

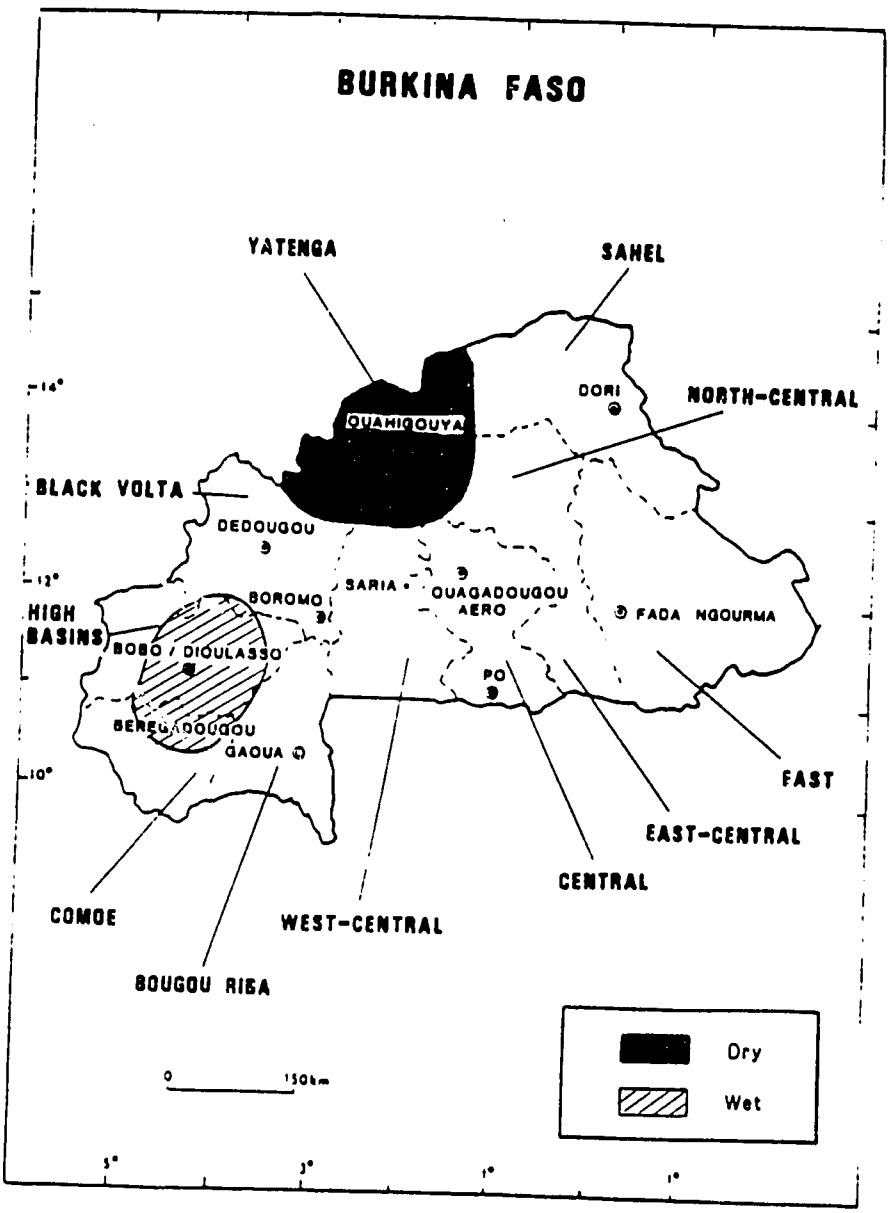


Figure I

Overview

Prospects for grassland areas and crops in Burkina Faso continue to be good for most of the country. The outlook for crop yield has improved in the Sahel and Centre Nord regions since August. Satellite imagery indicates better vegetation in 1985 than in 1984 and in many areas better than 1983.

-80

Rangeland Vegetation/Biomass Conditions

Satellite data through September 15 indicate more biomass this year than in 1984 for the entire country (Figures 2 and 3). In the Sahel region, biomass conditions appears to be similar to 1983. In the East the biomass in August-September is similar to 1983. However, biomass early in the season was not as high as in 1983. Current conditions for rangeland areas in the East are much improved over the same time last year. In the Central, North-central and East-central regions, biomass is much improved over 1984, but has only recently increased to the 1983 level. The West-central, High Bassins, Black Volta, Camoe, and Bougou Riba regions all appear to have much more biomass this year than in either 1983 or 1984 in spite of the late start.

Rangeland conditions as of mid-September are favorable for livestock except in some northern and northwestern areas. Below-normal rainfall in Yatenga and adjacent areas of Sahel and Black Volta has led to below-average conditions (Figure 1).

Crop Conditions

Conditions for millet, sorghum and maize continued to improve. Late crops in particular should have good yields. Crops in the North-central, Sahel, and Yatenga regions had moderate stress (Figure 1) but the yield should be better than in either 1983 or 1984. Prospects for crop yields around Ouagadougou appear to have improved slightly since the last assessment. Crops near Fada N'Gourma in the East had good rainfall in September and crop yield prospects are good. Crop yields of sorghum and maize are expected to be especially good in the southwest portion of the country.

Weather Analysis

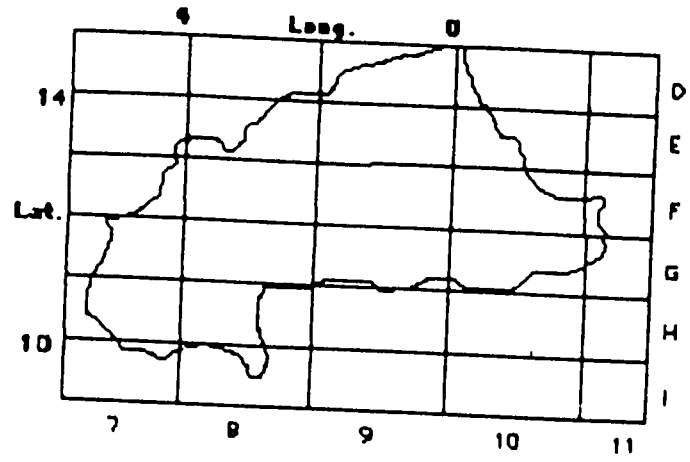
Cumulative precipitation has generally been good across the country. However, Ouahigouya appears to have the lowest percentile ranking for the season, but seasonal precipitation there has been better than in 1983 and 1984. September rainfall was also below normal at Ouahigouya, Dedougou and Bobo Dioulasso.

COMPARATIVE NOAA VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA
SECOND WEEK OF SEPTEMBER

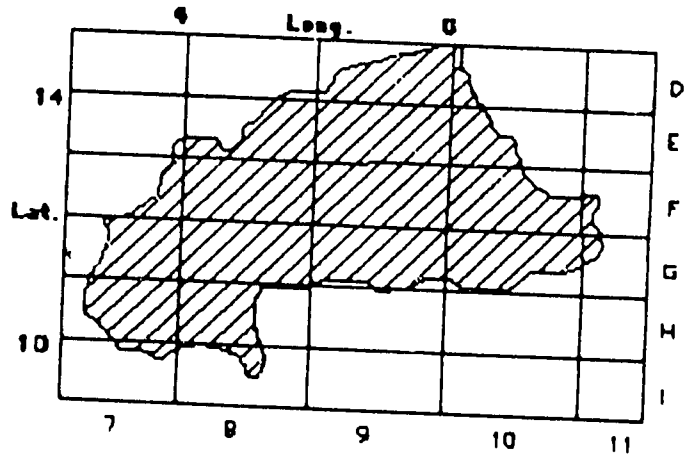
BURKINA FASO

NO INFORMATION AVAILABLE

1985 VS. 1983



1985 VS. 1984



1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

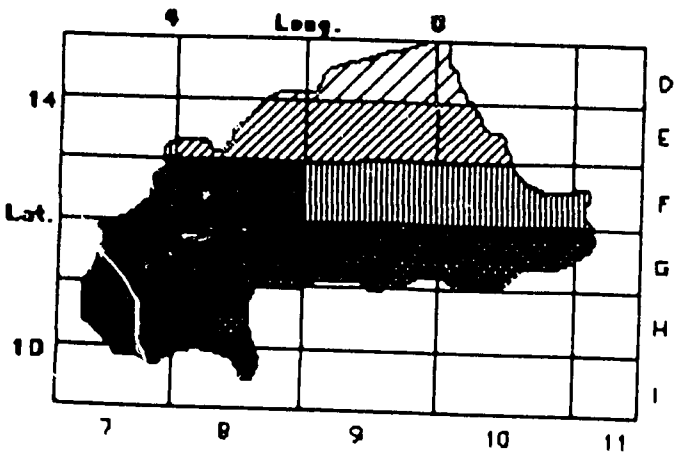
Figure 2

82

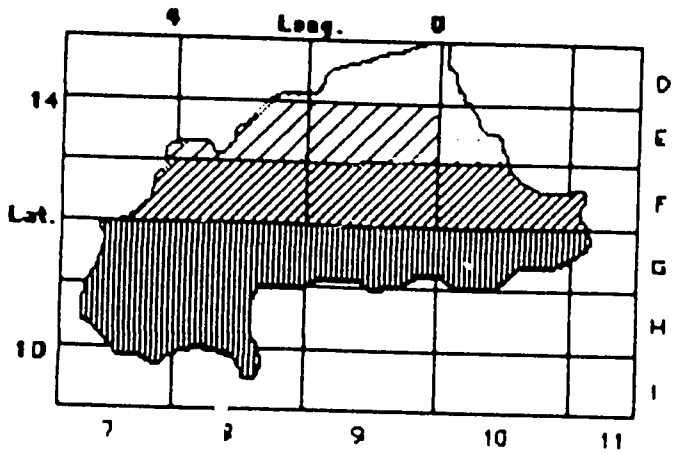
NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

BURKINA FASO

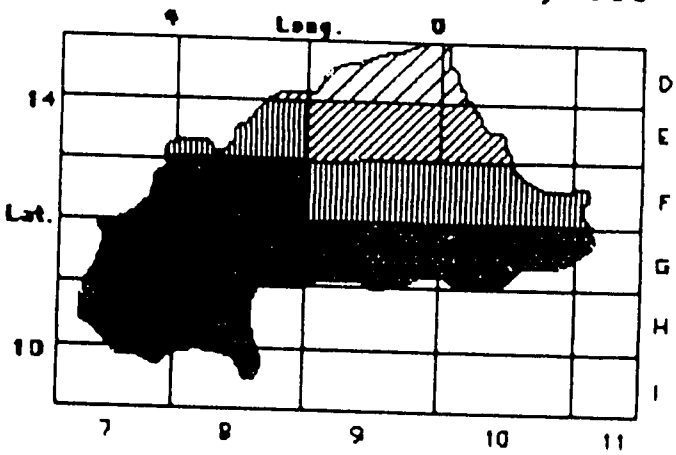
THIRD WEEK OF SEPTEMBER, 1983



THIRD WEEK OF SEPTEMBER, 1984



SECOND WEEK OF SEPTEMBER, 1985



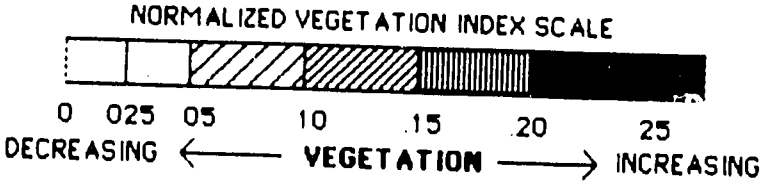


Figure 3

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: **BURKINA FASO** Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Bobo-Dioulasso	140	128	75	203	161	97	273	121	78	428	139	83	201	98	50
Boromo	33	37	8	167	145	89	215	113	75	226	89	36	182	101	50
Dori	31	129	69	35	46	22	61	41	8	300	164	94	57	66	25
Fada-N'Gourma	49	58	17	176	144	81	185	90	44	188	72	25	185	103	56
Gaoua	81	69	25	214	156	94	157	86	47	266	127	78	235	121	75
Ouagadougou Aeroport	86	101	50	89	76	33	193	104	56	157	65	8	157	105	56
Ouahigouya	11	31	25	74	84	44	138	80	42	134	65	22	89	75	22

Table I

-84

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: BURKINA FASO Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Bobo-Dioulasso	140	128	75	343	146	92	616	134	86	1044	136	89	1245	128	81
Boromo	33	37	8	200	98	47	415	105	58	641	99	50	823	99	50
Dori	31	129	69	66	66	36	127	51	8	427	99	58	484	93	50
Fada-N'Gourma	49	58	17	225	109	64	410	100	56	598	89	33	783	92	39
Gaoua	81	69	25	295	116	69	452	103	53	718	111	69	953	113	83
Ouagadougou Aeroport	86	101	50	175	37	47	368	95	50	525	84	31	682	88	33
Ouahigouya	11	31	25	85	69	28	223	75	28	357	71	17	446	72	11

Table 2

NIGER ASSESSMENT

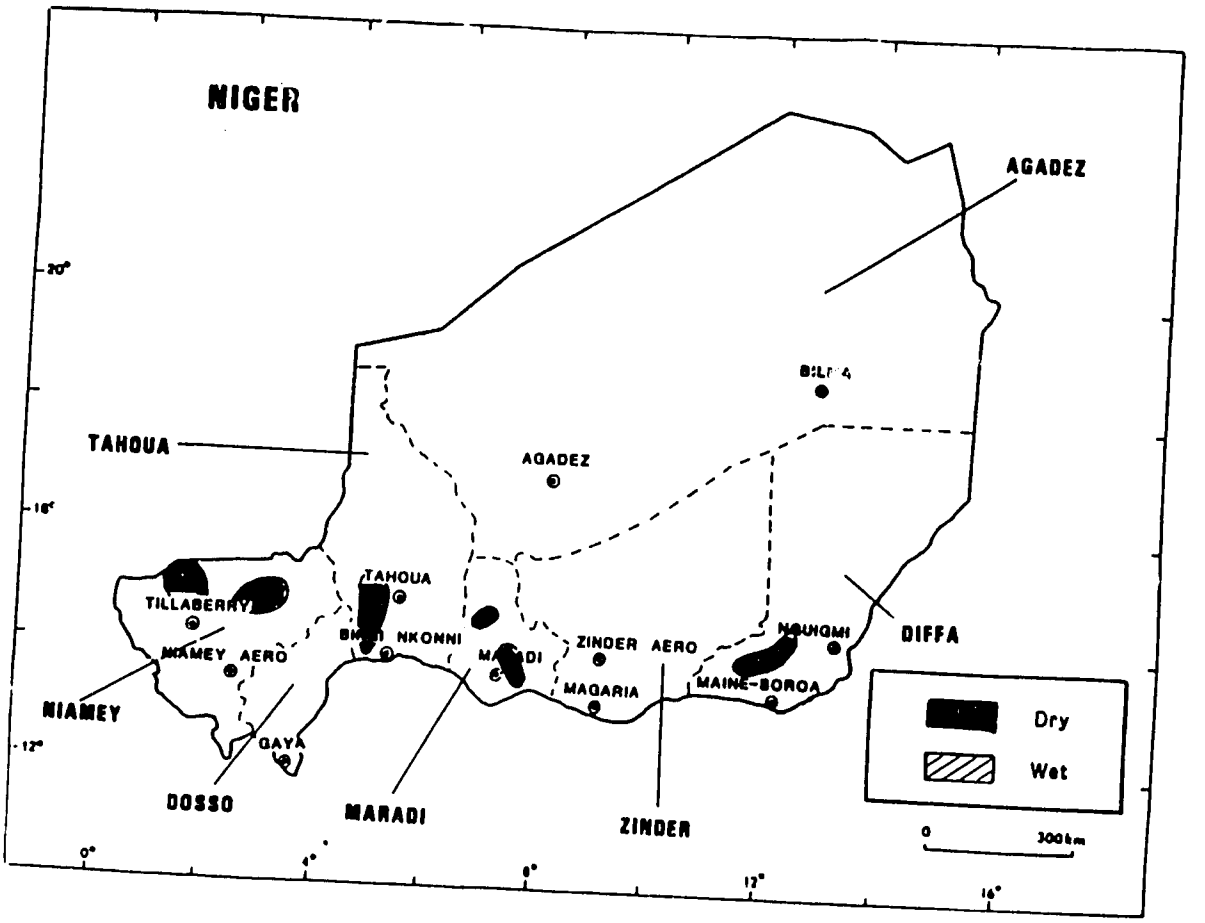


Figure 1

Overview

Growing season rainfall was below normal, but satisfactory crop yields are anticipated due to the beneficial timing of the rains. Rangeland and crop conditions have improved since August in portions of Niamey, Tahoua and Zinder Departments. In general, rangeland and crop conditions are much improved over 1984 throughout the country and the outlook is for average to above average millet and sorghum crops. Rangeland conditions throughout Niger are at least as good as 1983 and in many areas they are considerably better. Good September rainfall has improved crop prospects.

Rangeland Vegetation/Biomass Conditions

In all areas of Niger, the biomass conditions as of mid-September were better than in 1984 (Figures 2 and 3). In the Agadez area, the August-September biomass was much improved over 1983 as well; grazing conditions for livestock in September were good. The area around Tahoua also improved, but only slightly.

In the Niamey area biomass conditions by mid-September appeared to be similar to conditions in mid-September of 1983. The rangeland conditions prior to this were not as good as 1983. The availability of adequate rangeland areas should favor movement of livestock into northeastern areas.

Vegetation north of Zinder and Maradi appears to have improved through mid-September, and is much better than in 1984 and also improved over 1983. Conditions for livestock in Dosso and southern Niamey Departments appear to be good, similar to 1983. Rangeland conditions should continue to be in good condition with the September rains.

Figure 1 indicates areas where satellite vegetation imagery suggests rangeland conditions are relatively poor. Areas in northern Niamey Department north of Tillaberi have the highest potential for unfavorable grazing.

Crop Conditions

Prospects for crop yields of sorghum and millet have improved throughout Niger since August. September rains have benefitted late planted crops in Tahoua Department. Crops planted early were affected by delayed development and are expected to have lower yield. Crops planted later were in better condition and yields should be higher. The NVI time series (Figure 4) show that vegetation growth began late this year but reached 1983 levels by September.

Weather Analysis

Precipitation amounts in September were near or above normal with the exception of Maradi (Table 1). May-September rainfall (table 2) averaged about 80 percent of the long-term mean, with lower values near Maradi, Tahoua, Tillaberi, and Birni N'Konni.

NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

NIGER

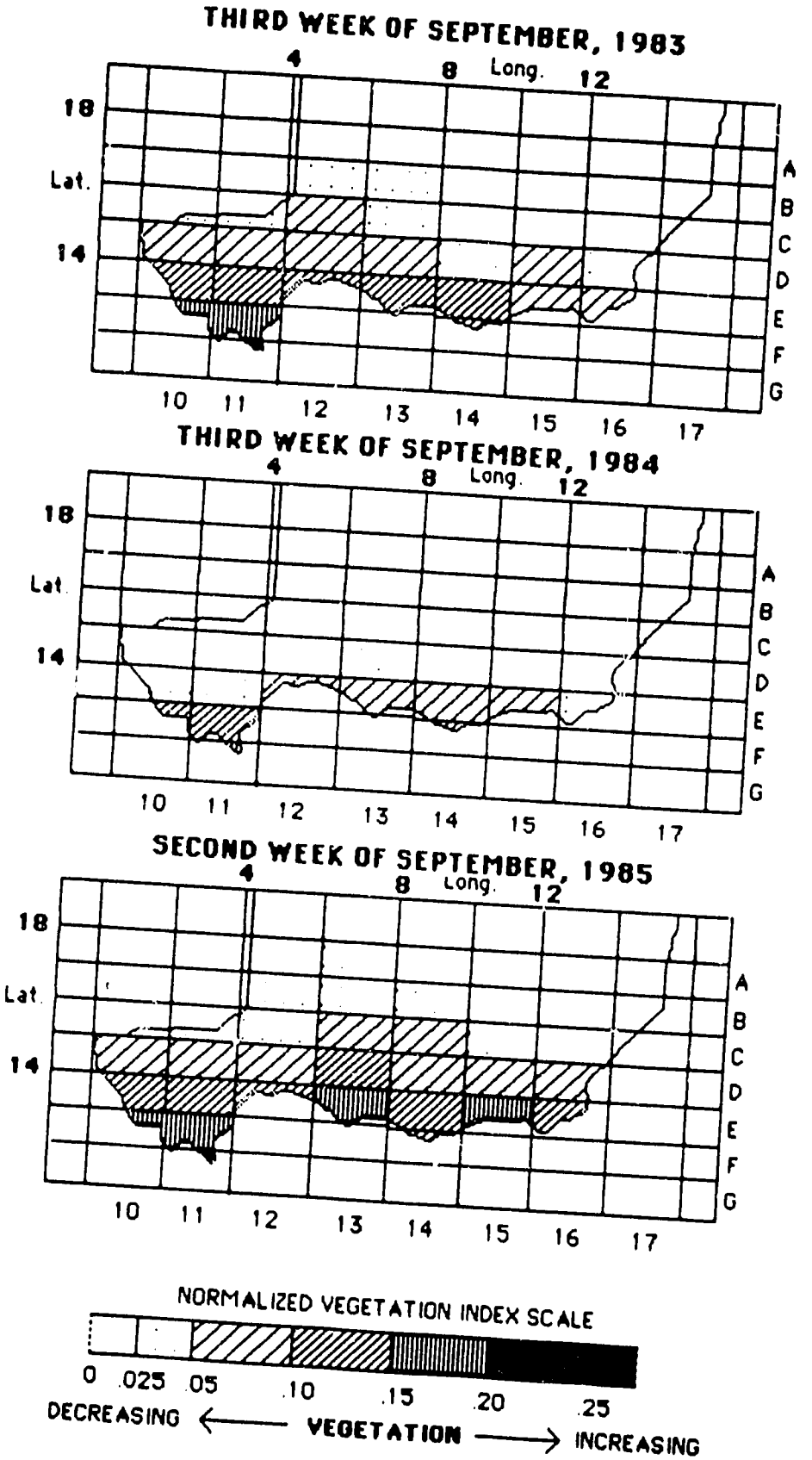


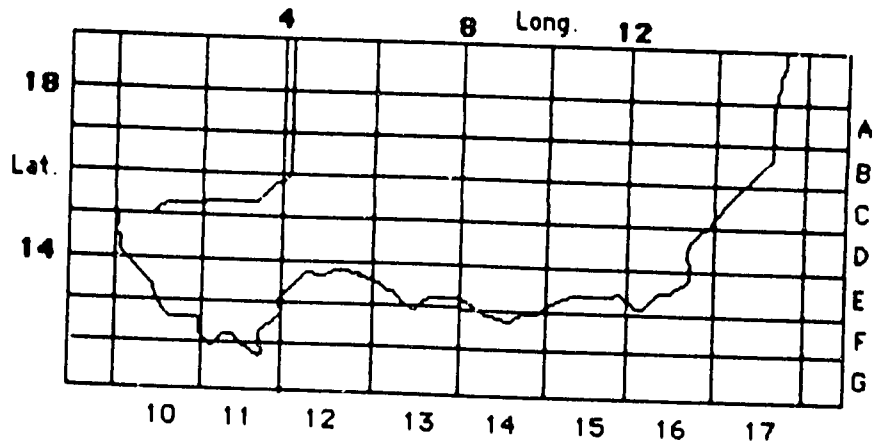
Figure 2

COMPARATIVE NOAA VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

SECOND WEEK OF AUGUST

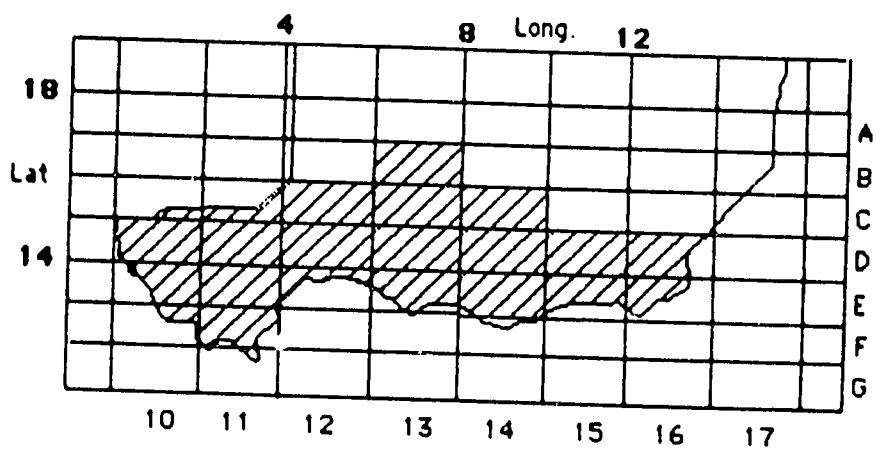
NIGER

1985 VS. 1983



NO DATA AVAILABLE

1985 VS. 1984



1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

89'

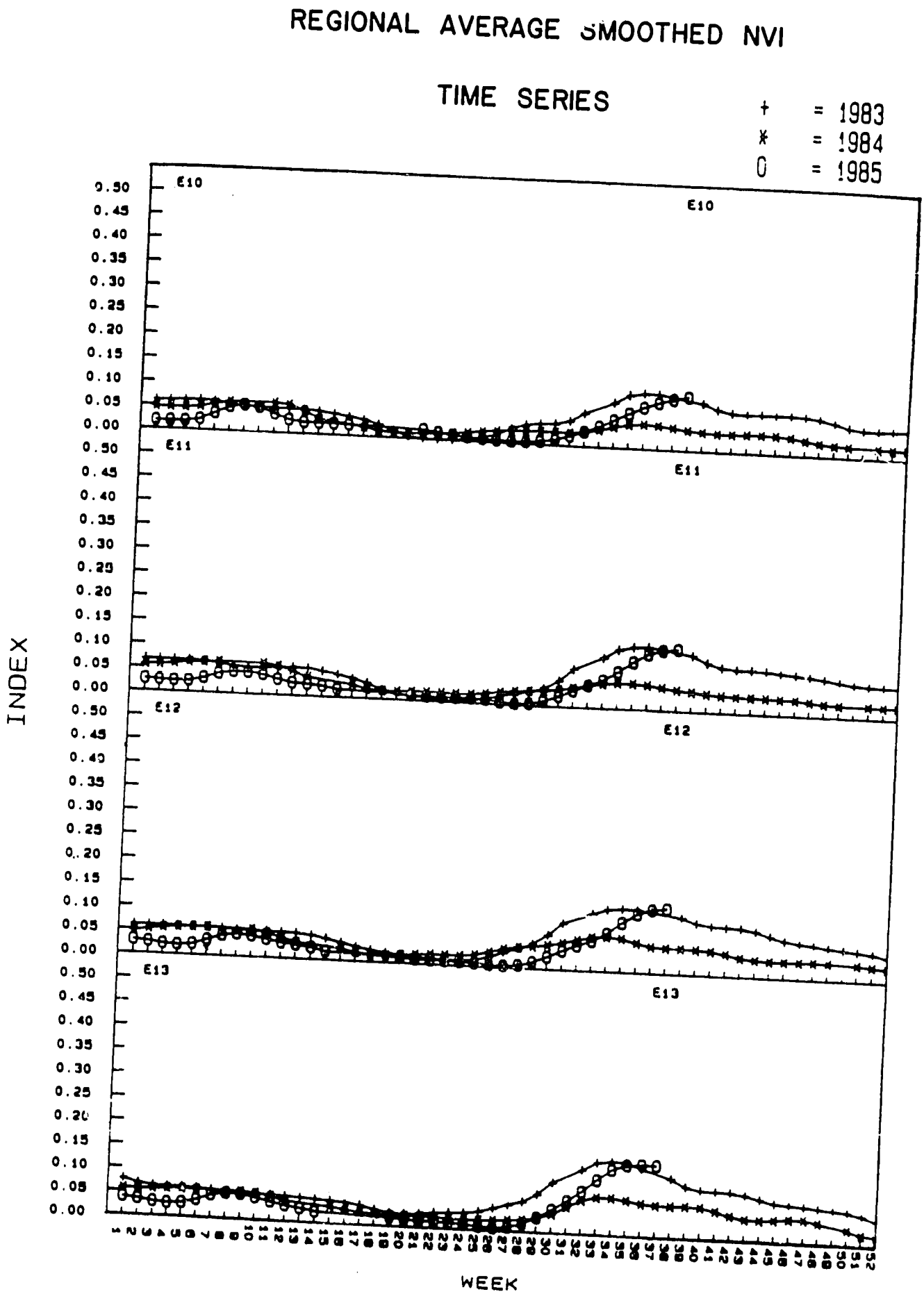

REGIONAL AVERAGE SMOOTHED NVI
TIME SERIES
+ = 1983
* = 1984
O = 1985
E10
E11
E12
E13
INDEX
WEEK

Figure 4

90

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: NIGER Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Agadez	0	0	3	11	92	67	10	24	11	35	51	26	12	92	66
Birni N'Konni	1	3	6	12	18	3	57	40	8	183	96	47	99	106	64
Gaya	59	82	42	85	67	22	214	111	64	314	111	86	122	73	28
Magaria	7	25	22	58	95	53	95	54	17	162	74	33	87	96	50
Maine-Soroa	0	0	3	34	103	61	79	75	31	119	72	42	58	102	56
Maradi	5	21	17	71	108	61	126	82	44	149	57	28	32	38	17
N'Guigmi	5	71	69	32	320	92	65	107	67	93	69	44	57	317	92
Niamey Aeroport	0	0	3	69	91	53	109	65	31	115	60	19	102	111	75
Tahoua	0	0	3	33	58	22	62	53	17	81	59	19	71	116	61
Tillaberi	0	0	3	21	42	21	109	87	41	90	44	17	49	72	31
Zinder Aeroport	36	157	81	20	43	28	110	83	33	172	86	50	129	208	94

Table I

91

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: NIGER Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Agadez	0	0	3	11	55	44	21	34	11	56	43	6	68	48	9
Birni N'Konni	1	3	6	13	13	3	70	29	3	253	58	6	352	67	11
Gaya	59	82	42	144	73	31	358	92	44	672	100	64	794	95	53
Magaria	7	25	22	65	73	42	160	60	17	322	66	8	409	71	19
Maine-Soroa	0	0	3	34	79	47	113	76	36	232	74	22	290	78	25
Maradi	5	21	17	76	84	50	202	83	42	351	70	28	383	65	22
N'Guigmi	5	71	69	37	218	81	102	131	69	195	92	53	252	110	67
Niamey Aeroport	0	0	3	69	61	22	178	63	19	293	62	11	395	70	19
Tahoua	0	0	3	33	44	17	95	50	8	176	54	3	247	63	11
Tillaberi	0	0	3	21	30	7	130	67	21	220	55	14	269	58	10
Zinder Aeroport	36	157	81	56	81	56	166	82	33	338	84	36	467	100	53

Table 2

92

CHAD ASSESSMENT

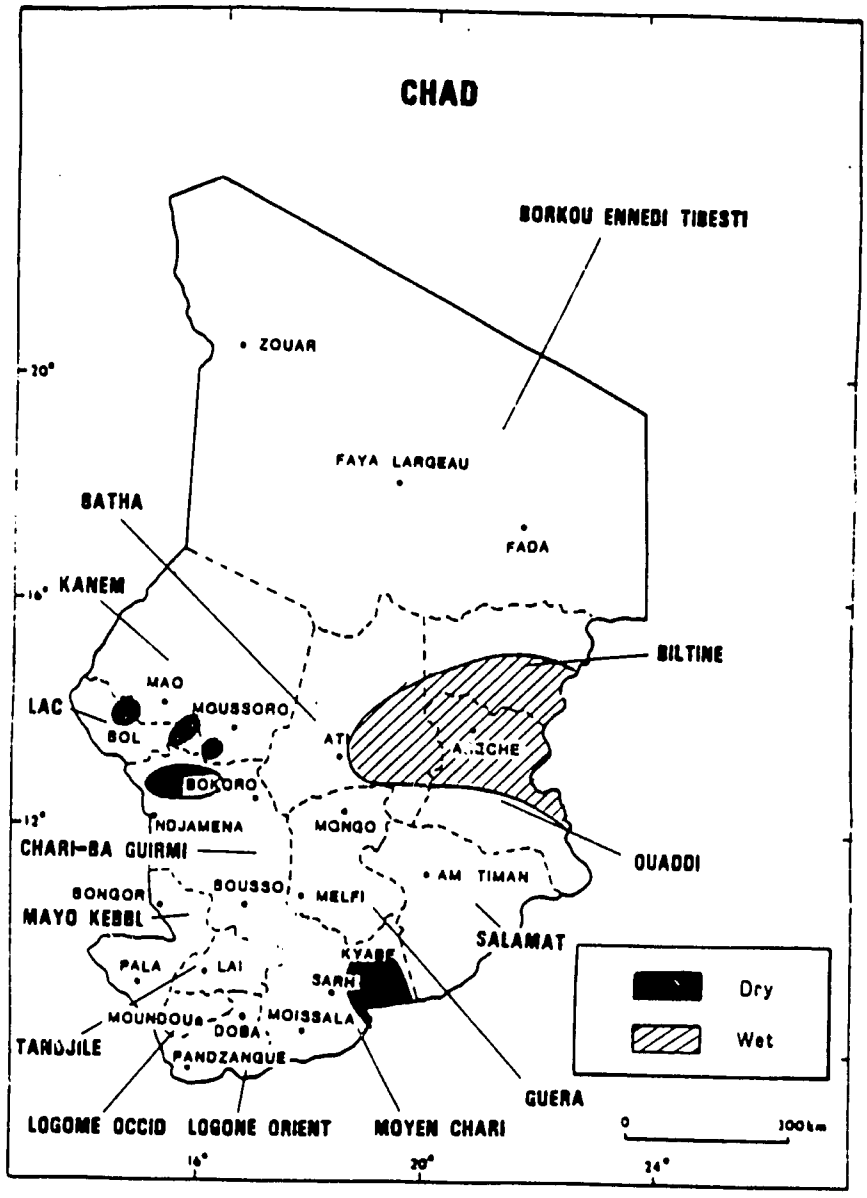


Figure I

Overview

Near normal rainfall during September improved overall rangeland and crop conditions throughout Chad. The outlook for agricultural production is very optimistic. The rangeland conditions in south Biltine, southeast Batha and north Ouaddai (Figure 1) are much better than those in 1983 and 1984. Potential problem areas are in Kanem (the areas around Mao and Moussoro), Lac, northern Chari-Baguirmi and east Moyen-Chari, where conditions appear to be similar to 1983.

Rangeland and Vegetation/Biomass Conditions

The satellite imagery and derived vegetation/biomass indices suggest that overall 1985 rangeland conditions continue to be good compared to 1983 and much improved over 1984 (Figure 2, 3 and 4). Detailed grid analysis shows that, with few exceptions, the rangeland areas of Chad have sufficient biomass to support livestock. The areas of south Biltine, southeast Batha and north Ouaddai (grid cells D18, D19, D20, D21, E19 and E20) are in particularly good shape in terms of biomass production. The amount of biomass is expected to be significantly higher than 1983 and vastly improved over 1984. The area showing improvement has increased since the previous assessment. There are pockets of low biomass east of Lake Chad (grid cell E17) where conditions are better than 1984, but not as good as 1983. However, rangeland conditions north of 15° N are substantially better than 1984 or 1983. Vegetation is less robust (compared with surrounding areas) in eastern Moyen Chari -- an area of potential problems.

Crop Conditions

In general, analysis of satellite data and rainfall patterns indicate crop yields are above averages of recent years. The prospects for the 1985 crop yields continue to be good throughout most of the country.

In the north, where crops such as groundnuts, sorghum and millet were planted in June, favorable amounts of rain occurred during critical reproductive growth stages in September. The crops should be in very good condition.

Ten-day and monthly agroclimatic crop condition indices indicate that crop water needs have been met throughout most of the country. Exceptions are at Moussoro and N'Djamena.

Weather Analysis

In western and north central Chad, estimated September rainfall (Table 1) was about 120 to 180 percent of normal and in southwest, south and east, the rainfall was about 70-85 percent of normal. The May-September seasonal rainfall (Table 2) is reported to be below normal for the station N'Djamena. For the rest of Chad the May-September seasonal rainfall is normal to above normal. (Due to lack of reports, most rainfall amounts are estimates based on satellite imagery).

NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

CHAD

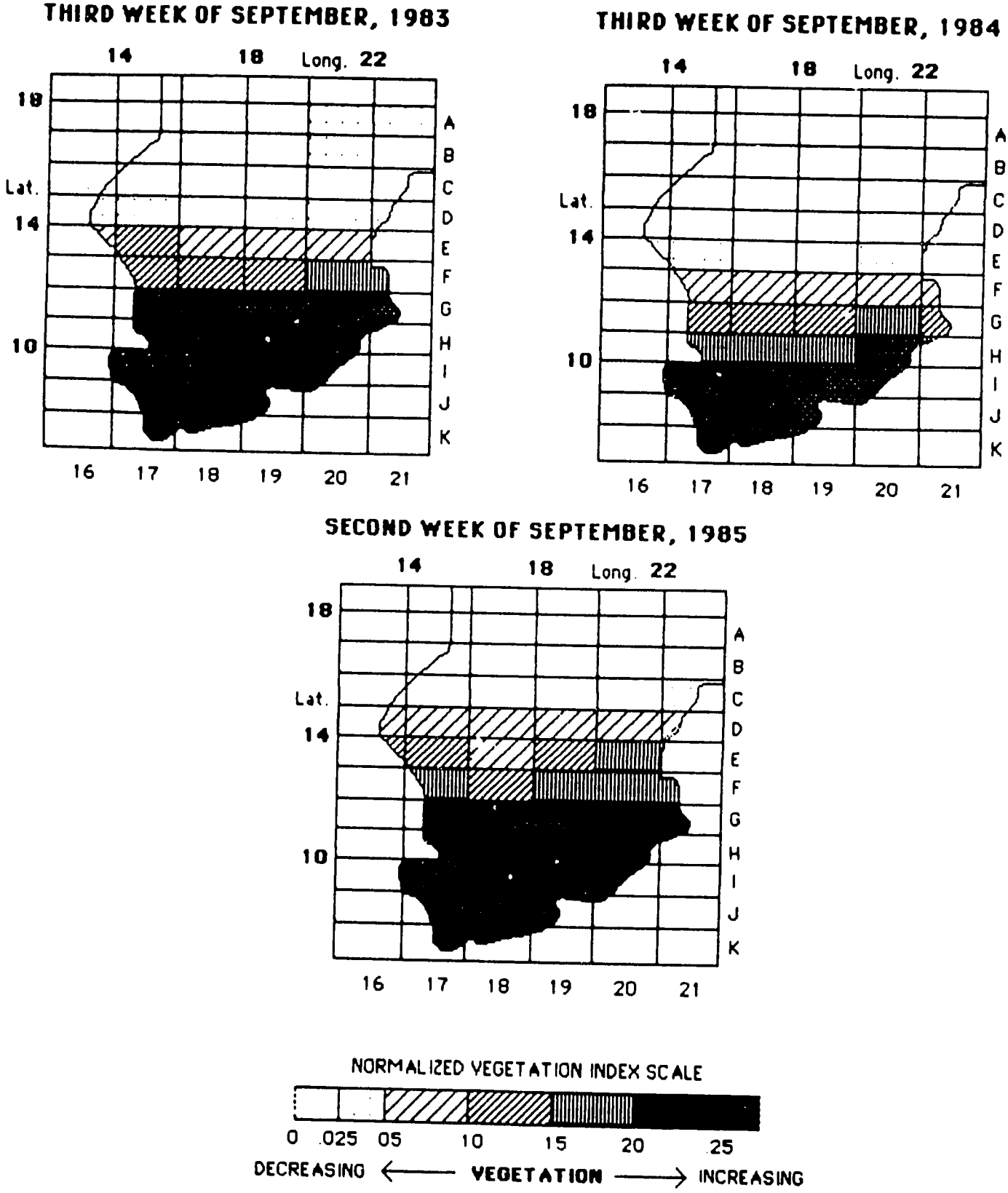
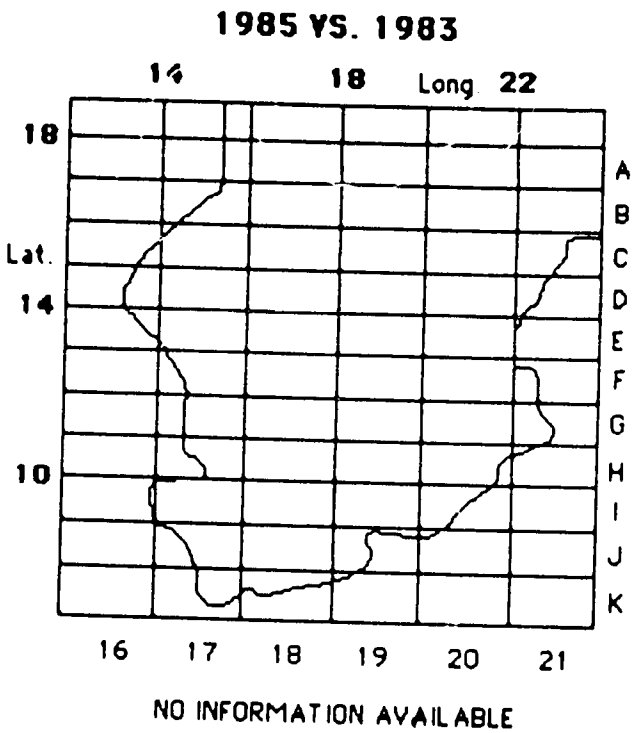


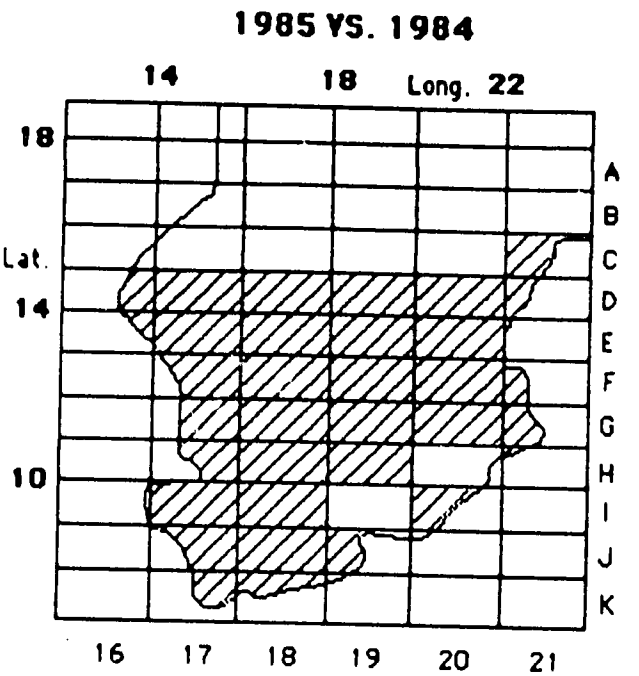
Figure 2

9

COMPARATIVE NOAA VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA
SECOND WEEK OF SEPTEMBER

CHAD





1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

96

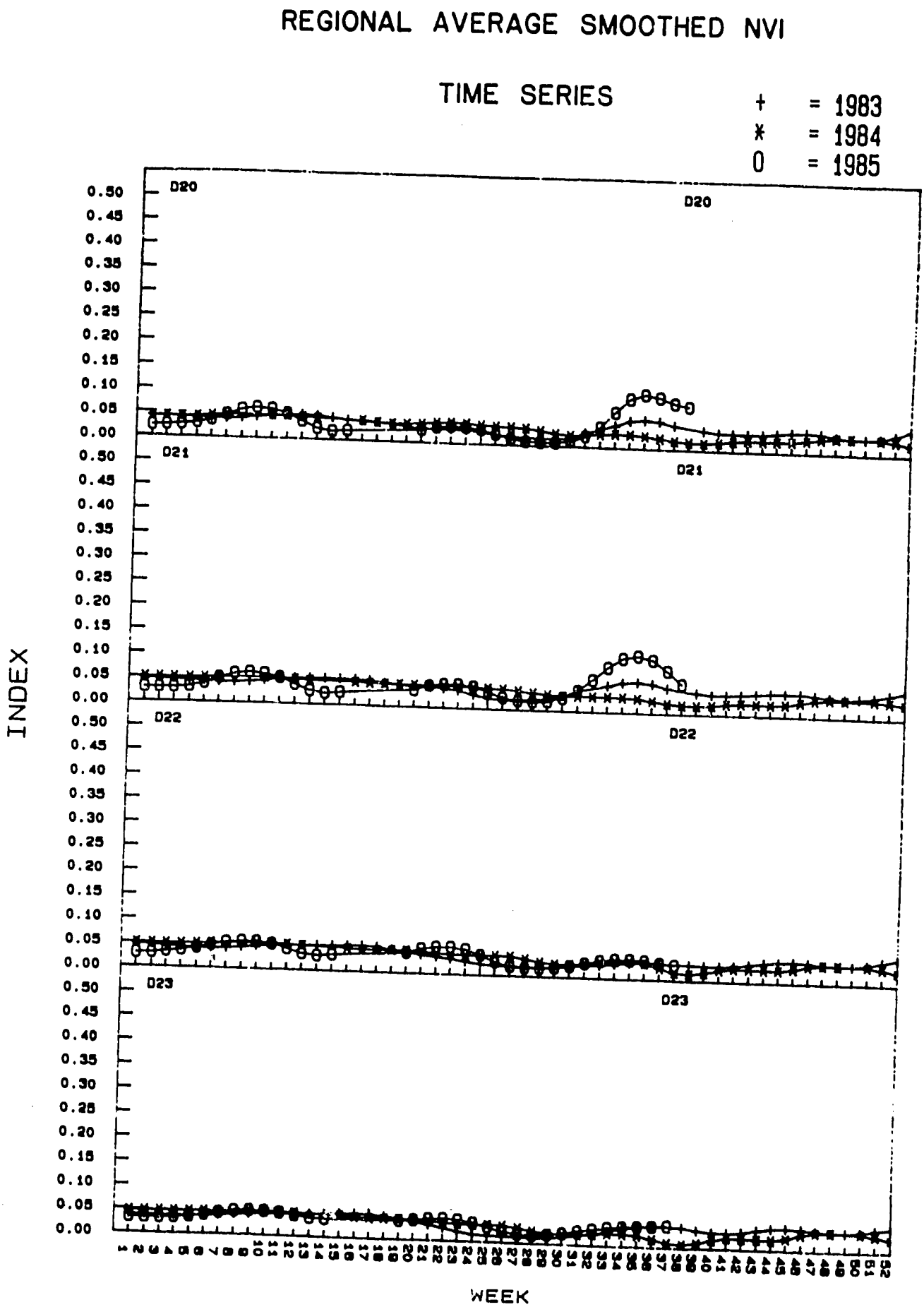

REGIONAL AVERAGE SMOOTHED NVI
TIME SERIES
+ = 1983
* = 1984
0 = 1985
D20
D21
D22
D23
INDEX
WEEK

Figure 4

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: CHAD Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Abeche	5	26	43	30	83	43	185	159	83	175	88	40	49	78	43
Am-Timan	70	100	53	125	102	60	245	125	77	255	88	30	125	91	47
Ati	5	29	47	25	93	63	155	135	77	145	79	37	70	121	60
Bokoro	20	87	60	63	107	57	154	105	57	149	68	30	95	122	77
Bol															
Bousso	63	100	63	125	106	63	215	98	63	205	72	23	125	74	33
Faya-Largeau															
Mao	3	33	38	18	86	50	100	105	63	90	54	17	67	181	79
Mongo	20	45	27	78	104	63	136	74	10	240	79	37	140	109	63
Moundou	89	90	47	164	109	60	347	142	83	186	61	7	116	53	7
Moussoro	3	25	48	26	81	41	105	114	63	125	76	30	95	194	89
N'Djamena	9	27	23	19	30	7	92	59	13	161	73	33	77	73	30
Pala	100	100	50	140	92	37	250	113	63	160	65	10	135	68	17
Sarh	104	120	63	114	86	37	197	89	43	174	61	7	145	73	30

Table I

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: CHAD Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Abeche	5	26	43	35	64	30	220	129	77	395	106	63	444	102	57
Am-Timan	70	100	53	195	101	60	440	113	73	695	102	60	820	100	57
Ati	5	29	47	30	68	47	185	116	63	330	96	50	400	100	50
Bokoro	20	87	60	83	101	63	237	103	63	386	86	37	481	92	40
Bol															
Bousso	63	100	63	188	104	57	403	100	57	608	89	30	733	86	27
Faya-Largeau															
Mao	3	33	38	21	70	38	121	97	58	211	72	25	278	84	29
Mongo	20	45	27	98	82	37	234	77	23	474	78	10	614	84	20
Moundou	89	90	47	253	101	53	600	121	83	786	98	53	902	89	23
Moussoro	3	25	48	29	66	44	134	99	48	259	86	41	354	101	56
N'Djamena	8	27	23	27	29	10	119	48	7	280	59	10	357	62	7
Pala	100	100	50	240	95	50	490	103	67	650	90	30	785	85	10
Sarh	104	120	63	218	99	57	415	94	50	589	81	20	734	80	10

Table 2

.99

SUDAN ASSESSMENT

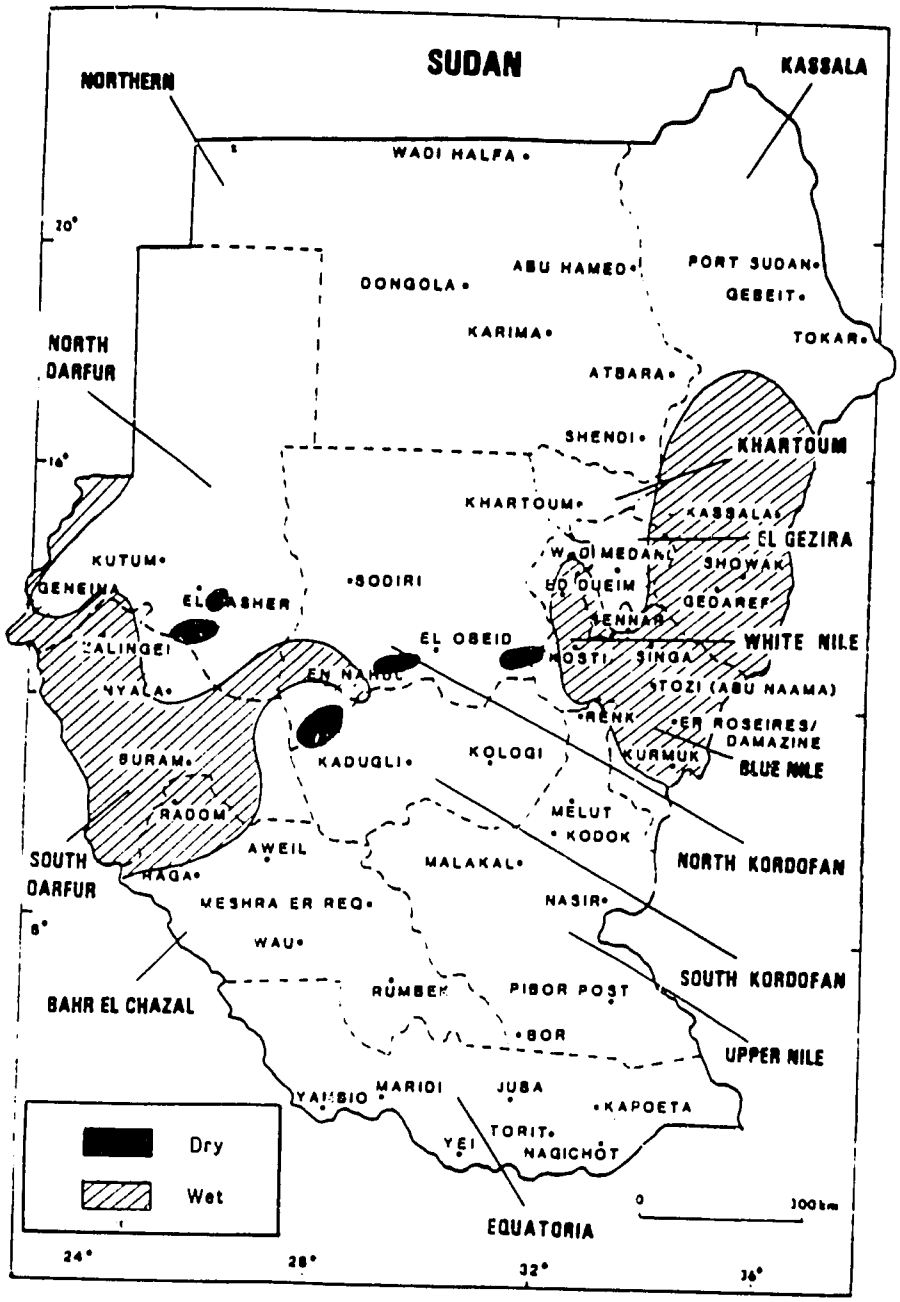


Figure 1

Overview

Crop prospects and rangeland conditions continue to be favorable and are much better than in 1983 and 1984.

Rangeland Vegetation/Biomass Conditions

Analysis of time series and maps of vegetation indices (Figures 2, 3, and 4) shows that the biomass far exceeds 1984 levels and, in most cases, 1983 levels as well. Satellite imagery suggests there are several pockets of dryness and potential grazing problems in Northern Darfur and Northern Kordofan (Figure 1). On the other hand, heavy rains favored grasslands over most of Sudan, particularly in Southern Darfur and eastern areas.

Crop Conditions

Crop conditions in 1985 are significantly improved over 1983 and 1984 throughout the country. Prospects for millet and sorghum in the Darfur and Kordofan regions are very favorable and are projected to be above average to near average. In the major sorghum areas of Kassala and Blue Nile, the 1985 vegetation index indicates production potential up to 30 percent above the 1979-83 average and about 30 to 60 percent above 1983. Other areas are also showing conditions that are favorable and much better than in 1984.

Most areas are now showing decreasing soil moisture reserves. Satellite imagery shows signs of crop maturation. Seed shortages at planting will limit overall production. Additionally, vegetation imagery suggests several "pockets" of dryness (Figure 1) where cereal yields may be below average.

Weather Analysis

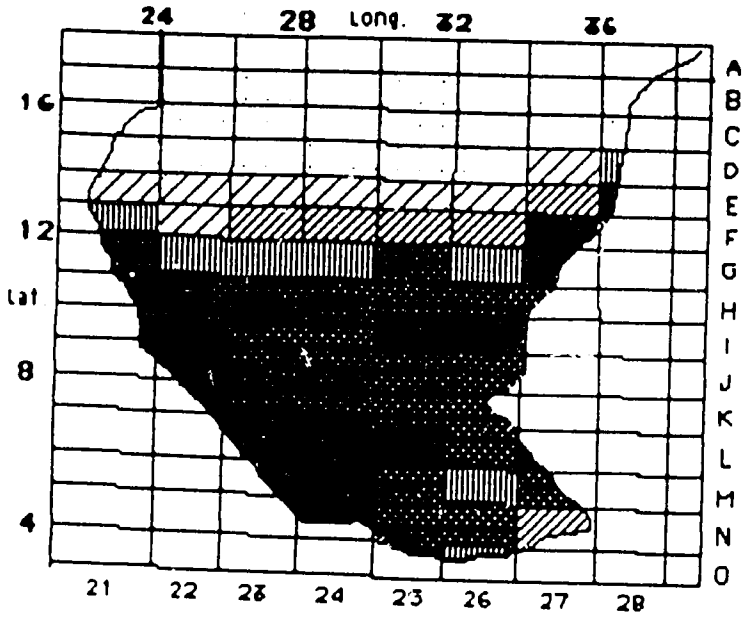
September rains show high variability, but were sufficient for most growing areas. Heaviest rainfalls (above normal) were reported in the Nile Basin and Kassala regions. Further west in Kordofan and Darfur, rainfall was near to above normal in September. May-September rainfall was generally the highest since 1981, when record sorghum yields were established. Estimated totals in the Kassala and Nile regions (Figure 1, Regional Overview) exceeded 120 percent of normal.

-101-

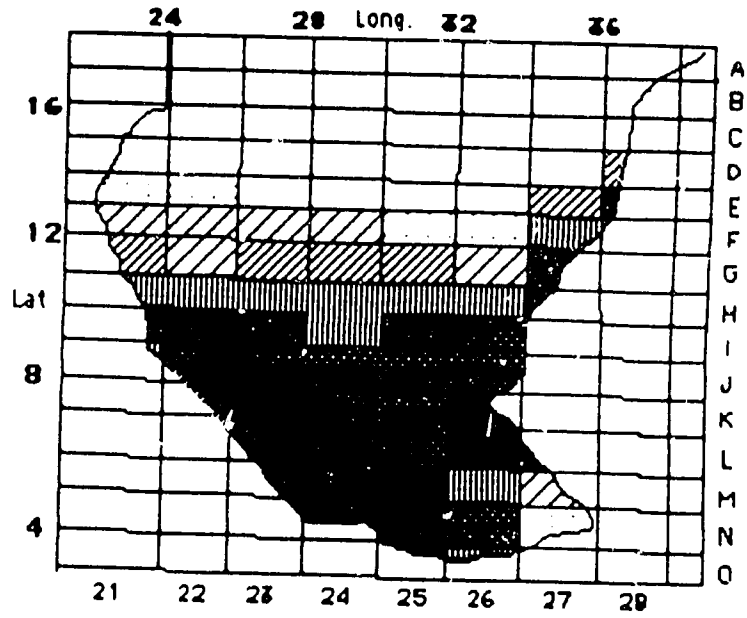
NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

SUDAN

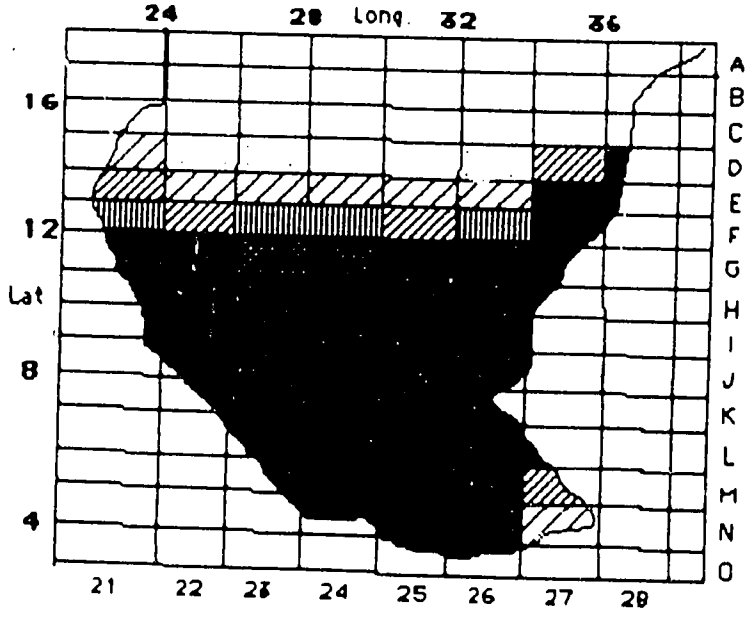
THIRD WEEK OF SEPTEMBER, 1983



THIRD WEEK OF SEPTEMBER, 1984



SECOND WEEK OF SEPTEMBER, 1985



NORMALIZED VEGETATION INDEX SCALE

0 025 05 10 15 20 25

DECREASING ← VEGETATION → INCREASING

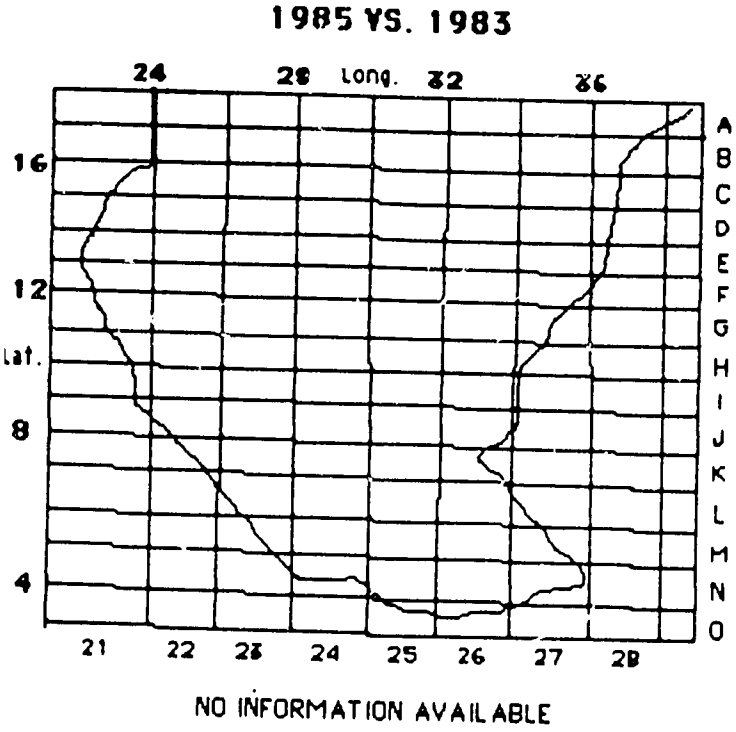
Figure 2

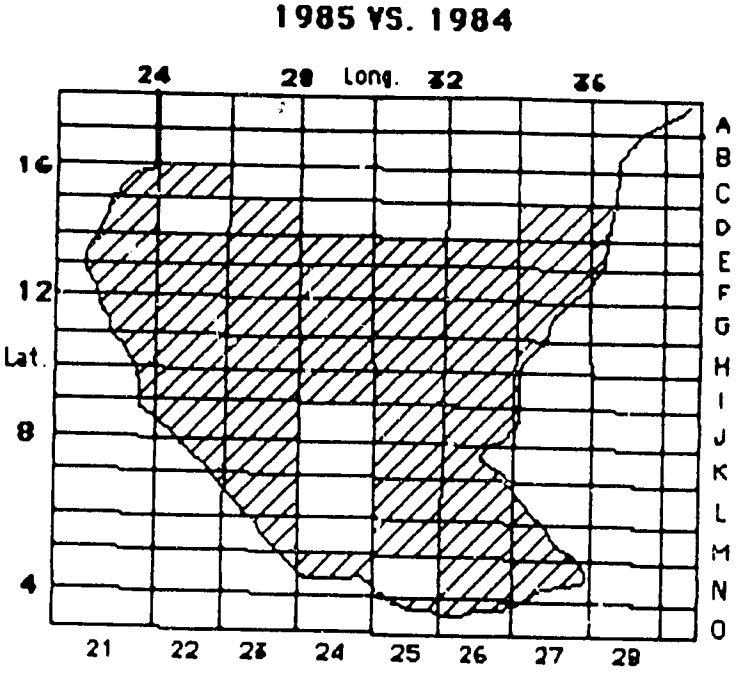
102.

COMPARATIVE NOAA VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

SECOND WEEK OF SEPTEMBER

SUDAN





1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

103

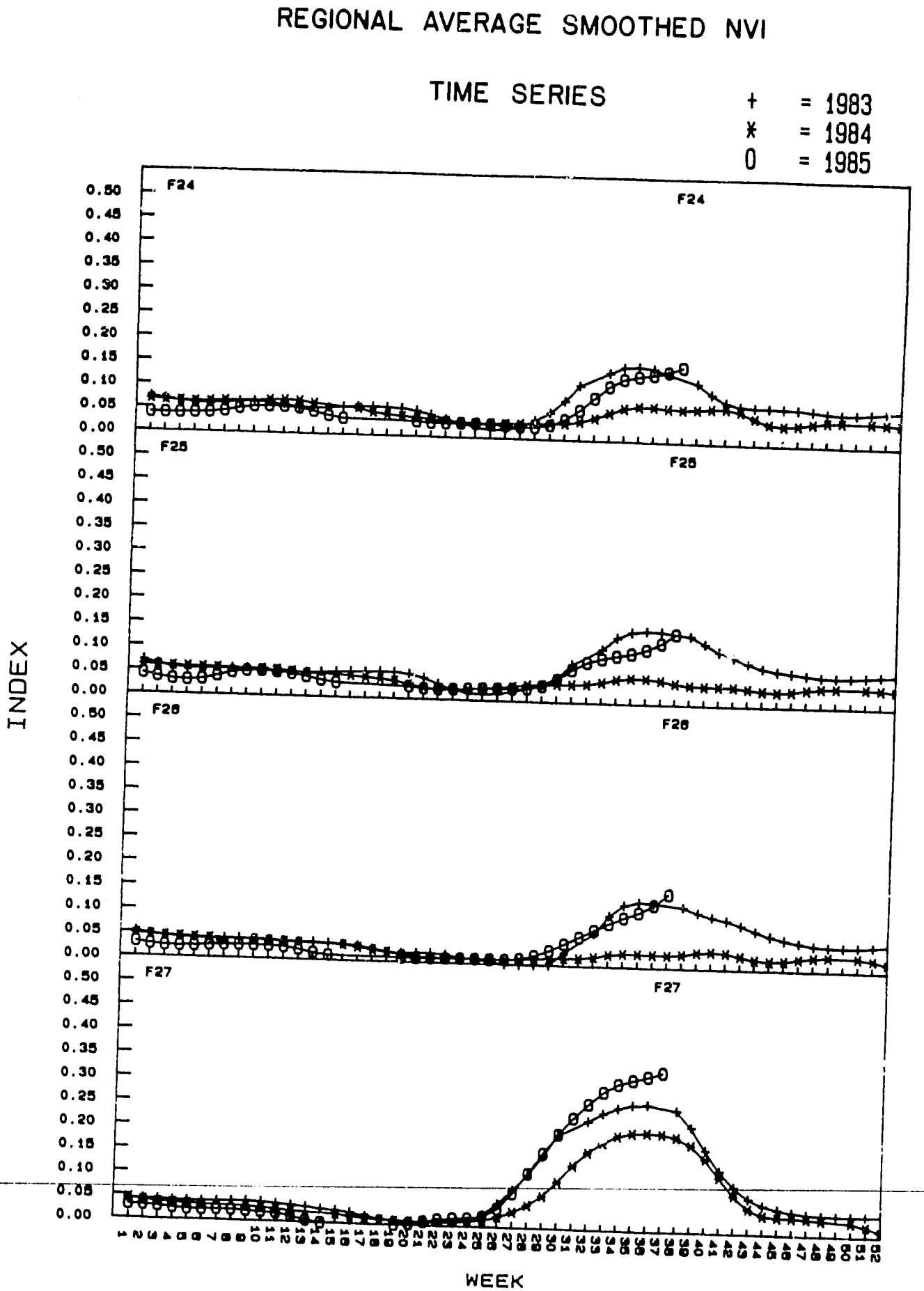

REGIONAL AVERAGE SMOOTHED NVI
TIME SERIES
+ = 1983
* = 1984
0 = 1985
F24
F25
F26
F27
INDEX
WEEK

Figure 4

ETHIOPIA ASSESSMENT

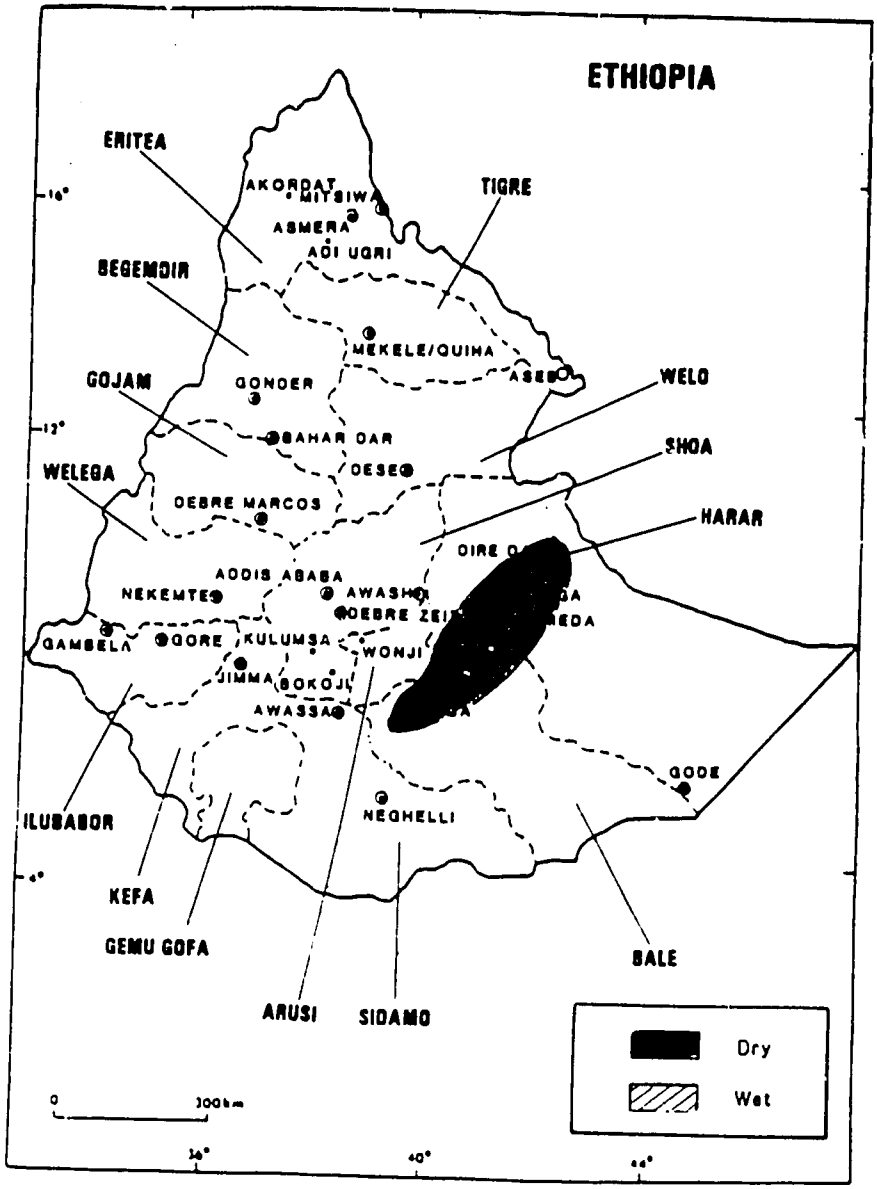


Figure I

Overview

The outlook for the 1985 main season crops continues to look favorable following near optimal rainfall conditions from July through September over most of the country. Exceptions to this include portions of eastern Hararge (near Dire Dawa and Jijiga) and Bale (near Goba) Provinces. September rainfall was generally adeqate for good rangeland conditions over the entire country.

105

Rangeland Vegetation/Biomass Conditions

Satellite vegetation imagery (Figure 5, regional overview) and indices (Figures 2 and 3) show generally improved rangeland conditions over much of the country compared to earlier this year and in both 1983 and 1984.

September rainfall was generally adequate for sustaining good rangeland conditions in areas of concern (portions of Tigre, Wollo, Harage and Bale Provinces) identified in the previous assessment. In fact, images show biomass extending into southeastern Bale and eastern Hararge Provinces for the first time in over two years.

Crop Conditions

Optimal rainfall conditions during September generally benefitted crops such as millet, sorghum, maize, teff, barley and wheat. July-August rainfall was sub-optimal for millet and sorghum crops in northwestern Hararge (near Dire Dawa and Jijiga) and northwestern Bale (near Goba) Provinces (Figure September rainfall was above normal at both Dire Dawa and Jijiga, but remained sub-optimal for crops at Goba. Cumulative agroclimatic crop condition indices for millet and sorghum suggest below average yields at Dire Dawa, Jijiga and Goba.

Weather Analysis

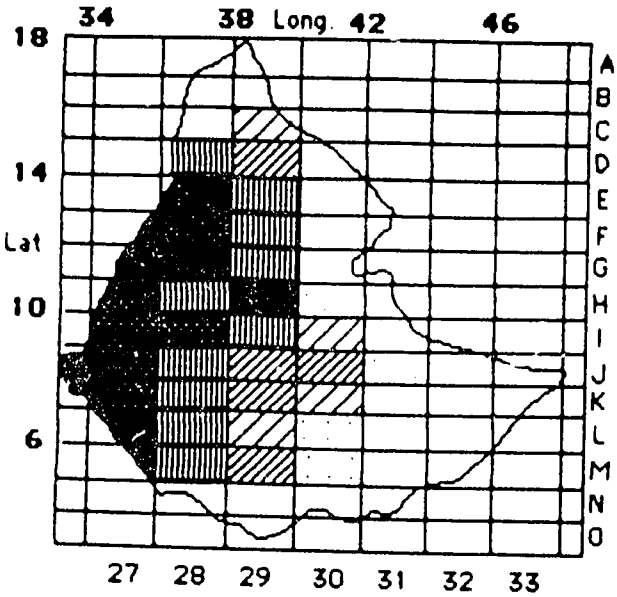
September rainfall was generally normal to above normal for most of the country except for portions of Shoa (Awash) and Bale (Goba) Provinces, where it was 65-80 percent of normal. Cumulative May-September 1985 rainfall was generally normal to above normal for most areas except at Goba (66 percent of normal) and Jijiga (78 percent of normal).

106

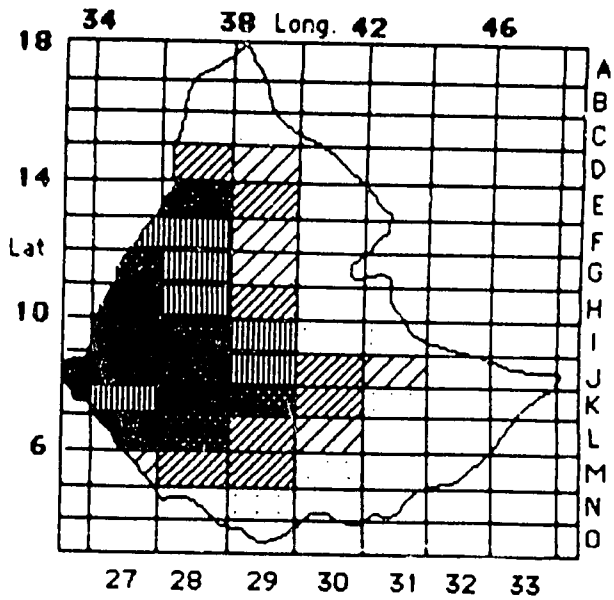
NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

ETHIOPIA

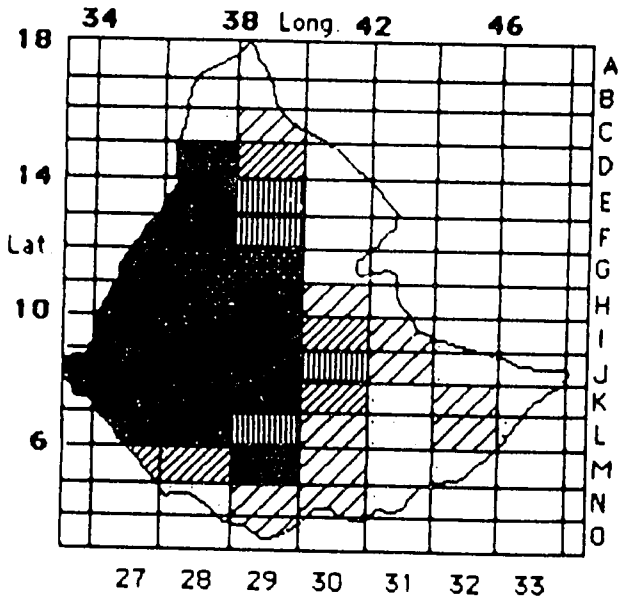
THIRD WEEK OF SEPTEMBER, 1983



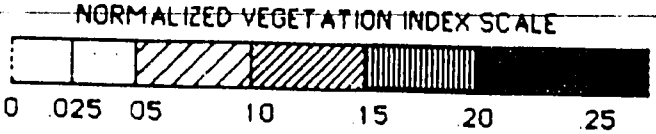
THIRD WEEK OF SEPTEMBER, 1984



SECOND WEEK OF SEPTEMBER, 1985



NORMALIZED VEGETATION INDEX SCALE

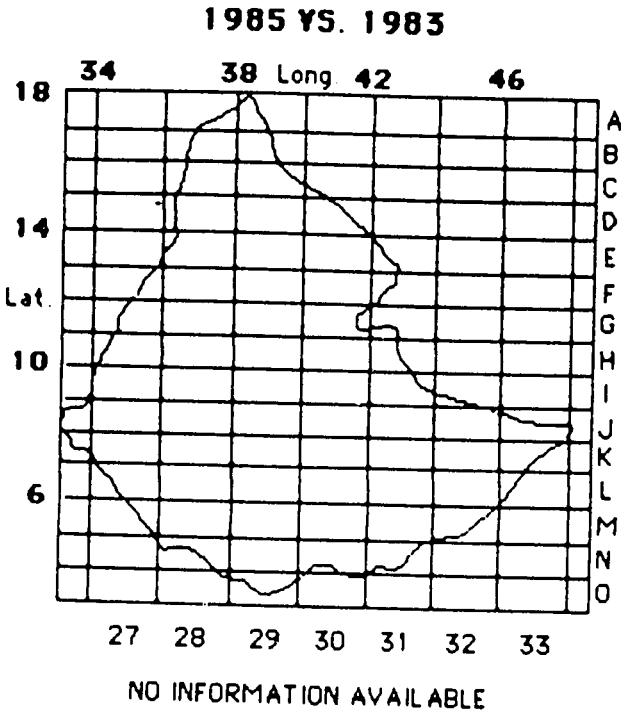


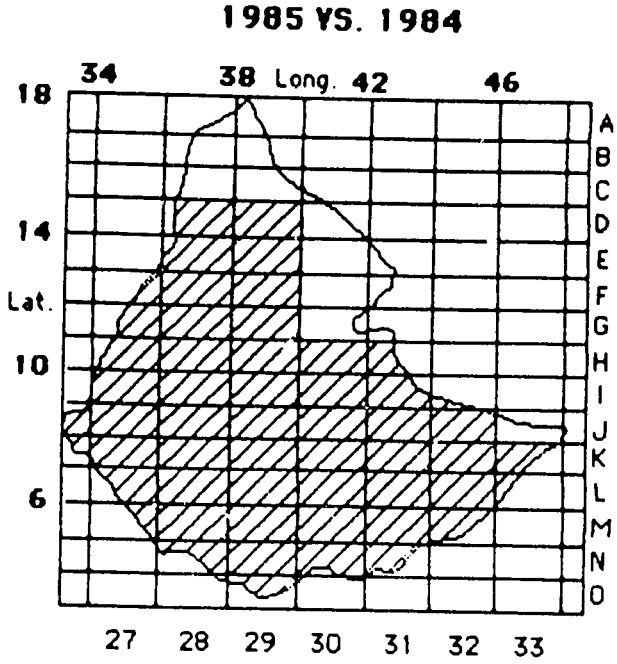
DECREASING ← VEGETATION → INCREASING

Figure 2

107

COMPARATIVE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA
SECOND WEEK OF SEPTEMBER
ETHIOPIA





1985 LESS GREEN THAN PREVIOUS YEAR

NO DIFFERENCE FROM PREVIOUS YEAR

1985 GREENER THAN PREVIOUS YEAR

Figure 3

108

MONTHLY RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: ETHIOPIA Year: 1985

Station	May (5)			June (6)			July (7)			August (8)			September (9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Addis Ababa	117	156	78	155	138	83	235	94	44	253	94	39	193	113	67
Akordat															
Asmara	92	236	89	94	235	86	166	86	47	181	110	69	25	114	64
Awash	117	325	97	35	97	52	165	140	84	149	104	61	24	44	16
Awassa	82	67	***	125	136	***	137	104	***	107	78	***	145	115	***
Bahar Dar	145	181	85	120	67	23	452	99	46	389	97	50	185	92	46
Debre Marcos	175	192	94	200	128	79	368	122	82	355	119	79	326	155	97
Dese (Dessie/Combolc	56	100	57	32	100	63	236	88	37	326	123	83	166	137	80
Dire Dawa	45	115	60	25	104	63	53	58	23	73	51	11	129	205	94
Goba	100	95	42	38	64	25	56	57	25	40	34	4	103	81	21
Gode	43	67	61	2	200	74	2	???	95	0	???	5	0	0	5
Gonder	121	141	79	121	77	33	199	61	6	382	128	85	182	160	88
Gore	274	120	72	322	100	56	293	91	36	258	82	25	243	73	14
Harar Meda (Debre Ze	114	278	89	77	96	50	327	149	78	272	115	72	91	83	39
Jijiga	58	60	32	67	103	68	45	52	18	104	75	26	135	130	76
Jima	193	120	67	218	100	52	258	122	79	177	83	30	248	137	82
Lekemti	216	89	***	320	87	***	344	86	***	419	111	***	287	101	***
Massawa (Mitsiwa)															
Neghelli	166	103	65	13	118	71	1	13	21	0	0	3	26	68	46
Quiha (Mekele)	46	184	81	33	100	55	145	67	16	172	80	35	145	392	97

Notes:

" " = No data for calculations.

"???" = Percent of normal not calculated because average rainfall is zero.

"***" = Percentiles not calculated because less than 15 years of historical data exist on file.

Table I

109

CUMULATIVE RAINFALL TABLE

Expressed in Millimeters (mm), Percent of Normal (%) and Percentiles (Rnk, on Scale of 0 to 100)

Country: ETHIOPIA Year: 1985

Station	May (5)			May - Jun (5-6)			May - Jul (5-7)			May - Aug (5-8)			May - Sep (5-9)		
	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk	mm	%	Rnk
Addis Ababa	117	156	78	272	145	83	507	116	67	760	108	61	953	109	61
Akordat															
Asmara	92	236	89	186	235	97	352	129	86	533	122	81	558	122	78
Awash	117	325	97	152	211	97	317	167	94	466	140	90	490	127	87
Awassa	82	67	***	207	96	***	344	99	***	451	93	***	596	98	***
Bahar Dar	145	181	85	265	103	54	717	101	50	1106	99	46	1291	98	50
Debre Marcos	175	192	94	375	152	97	743	136	91	1098	130	91	1424	135	97
Dese (Dessie/Combolc	56	100	57	88	100	51	324	91	37	650	105	57	816	110	71
Dire Dawa	45	115	60	70	111	57	123	80	40	196	66	17	325	90	43
Goba	100	95	42	138	84	25	194	74	17	234	62	4	337	66	8
Gode	43	67	61	45	69	61	47	72	61	47	72	61	47	65	56
Gonder	121	141	79	242	100	55	441	77	26	823	95	48	1005	102	65
Gore	274	120	72	596	108	72	889	102	58	1147	97	44	1390	92	33
Harar Meda (Debre Ze	114	278	89	191	158	89	518	152	89	790	137	78	881	128	78
Jijiga	58	60	32	125	77	47	170	69	35	274	71	29	409	83	41
Jima	193	120	67	411	108	64	669	113	76	846	105	70	1094	111	73
Lekemti	216	89	***	536	88	***	880	87	***	1299	94	***	1586	95	***
Massawa (Mitsiwa)															
Neghelli	166	103	65	179	104	65	180	100	62	180	96	56	206	92	53
Quiha (Mekele)	46	184	81	79	136	61	224	82	35	396	81	29	541	103	58

Notes:

" " = No data for calculations.

"???" = Percent of normal not calculated because average rainfall is zero.

"***" = Percentiles not calculated because less than 15 years of historical data exist on file.

Table 2

110

SOMALIA ASSESSMENT

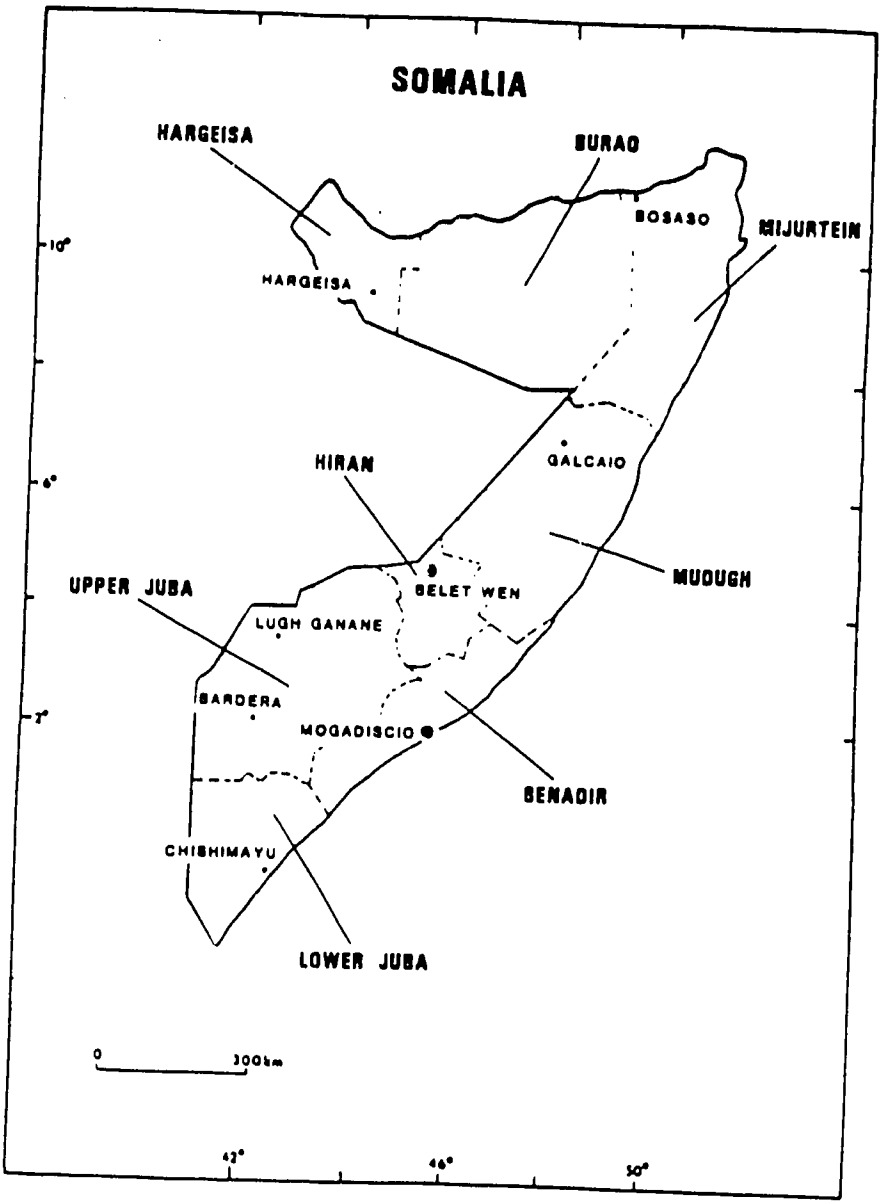


Figure 4

Overview

Prospects for the main season crops harvested in August and September are much better than in 1984 or 1983. Satellite vegetation/biomass indices for the period through mid-September continue to indicate improved vegetation conditions in the millet, sesame and groundnut area in southern Somalia. Rangeland conditions have also improved over the 1984 season.

The vegetation indices (Figures 5 and 6) indicate favorable early greenup for the secondary crop season much ahead of the 1984 season. This suggests adequate soil moisture and possible early planting for the secondary cropping season which usually begins in October.

Some flooding and crop losses were reported in the Juba and Shebelle Rivers in August.

NOAA SATELLITE VEGETATION/BIOMASS INDEX
NORMALIZED AVHRR DATA

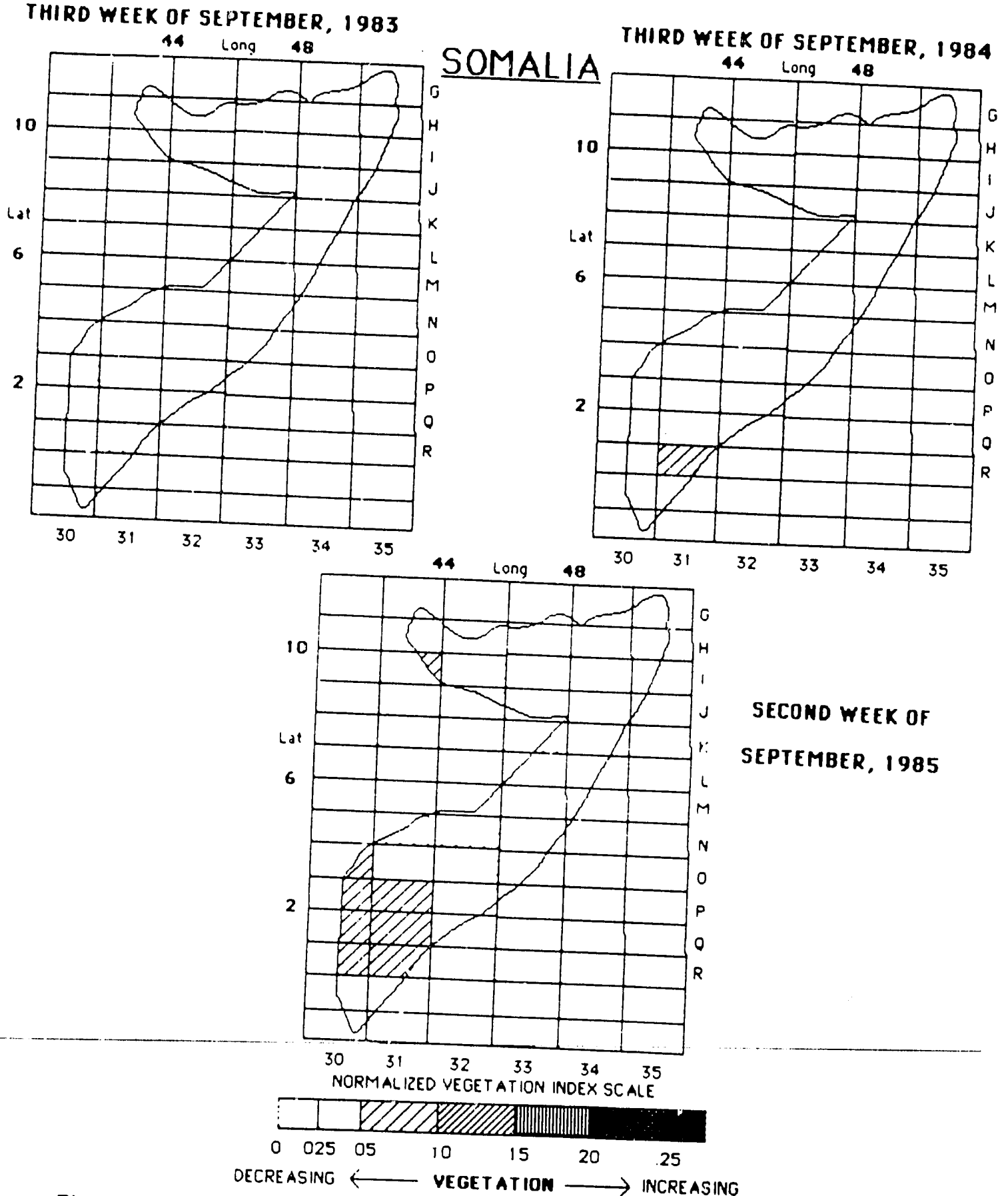
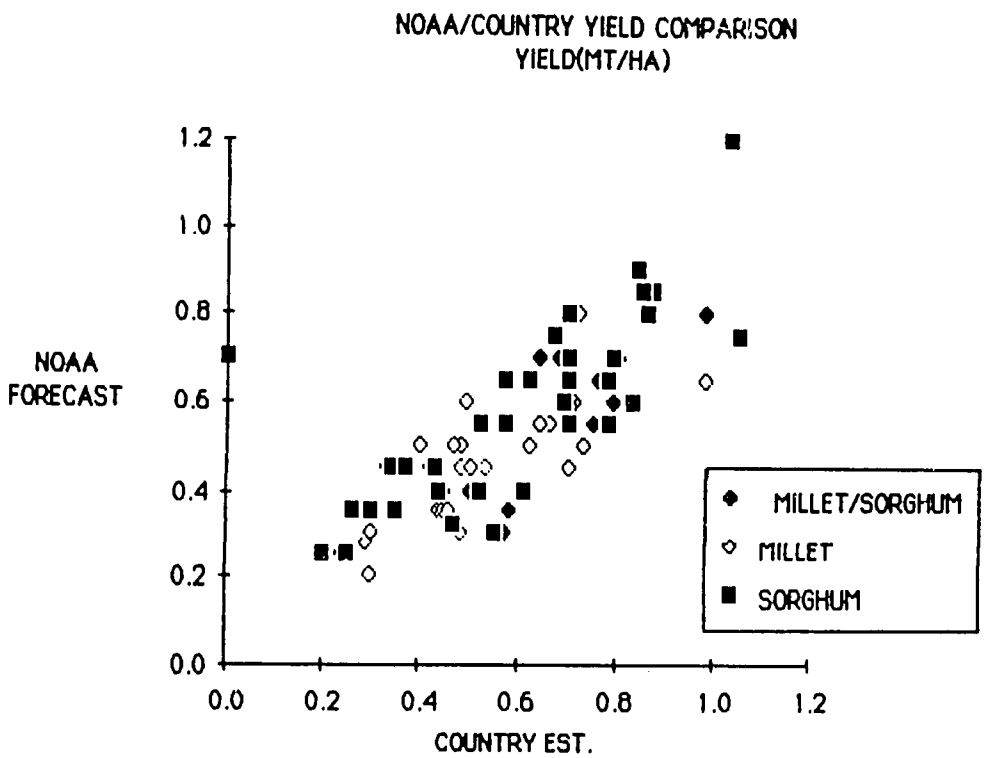
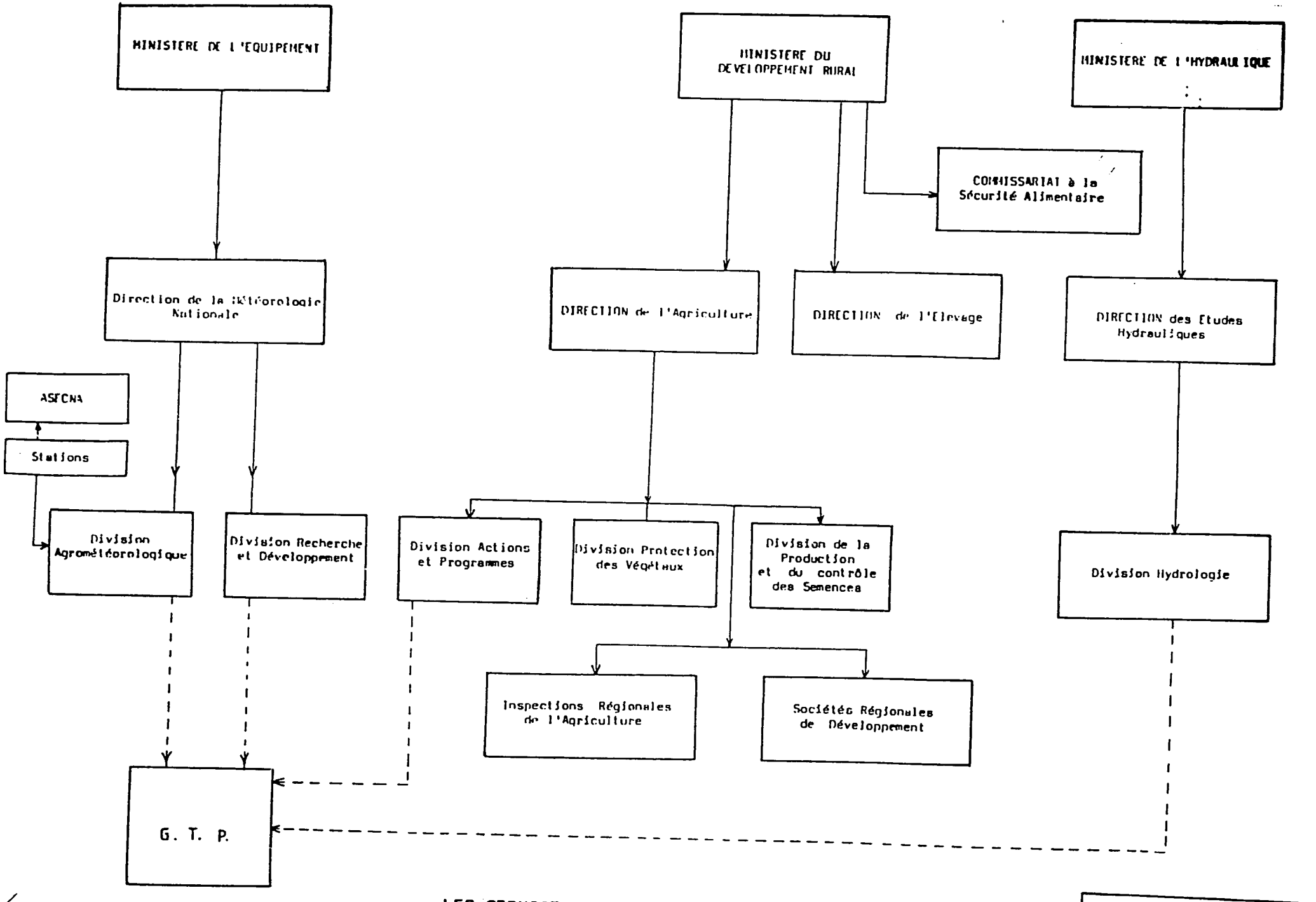


Figure 5

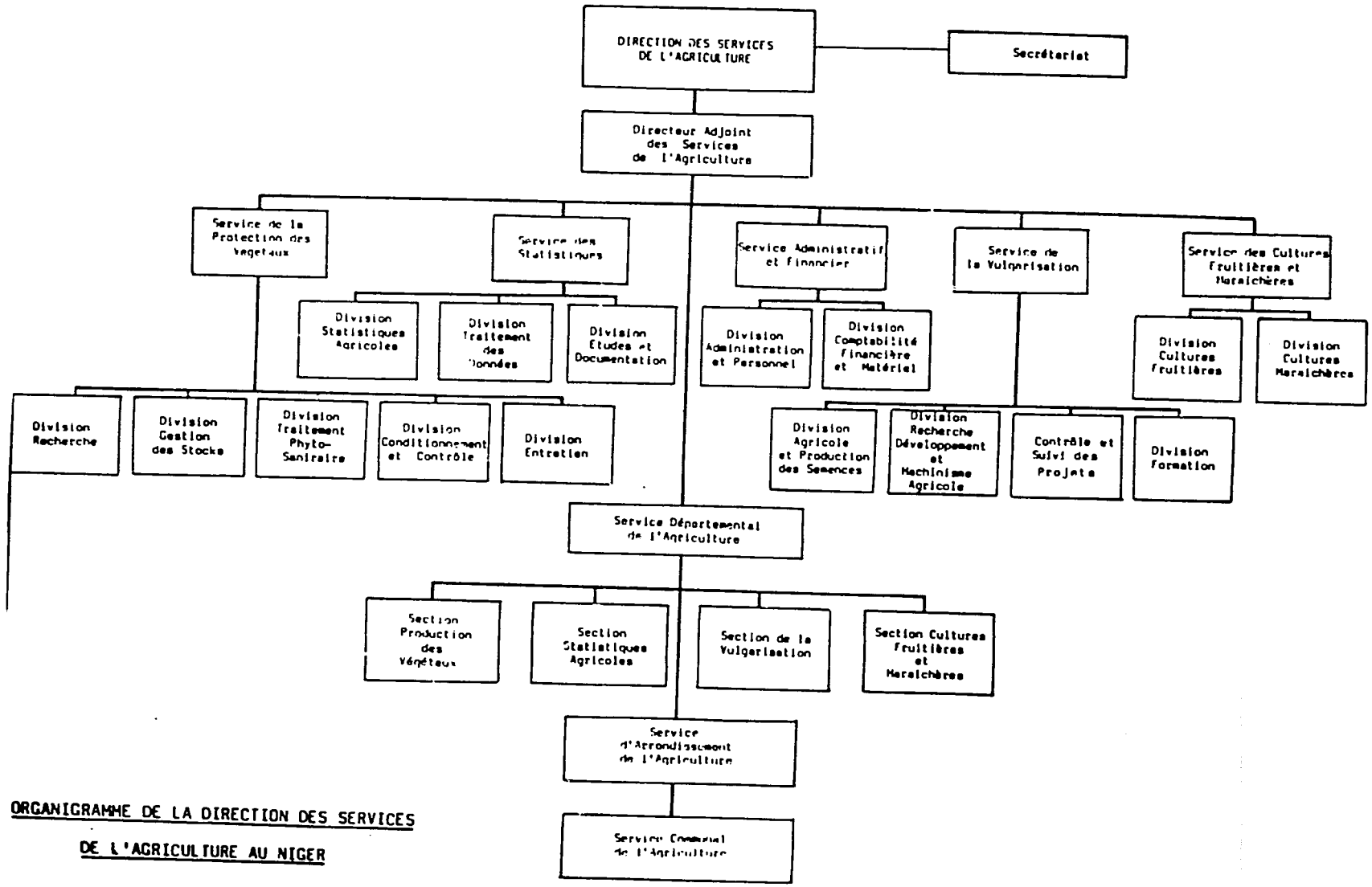
112


NOAA/COUNTRY YIELD COMPARISON
YIELD(MT/HA)
NOAA
FORECAST
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
COUNTRY EST.
MILLET/SORGHUM
MILLET
SORGHUM

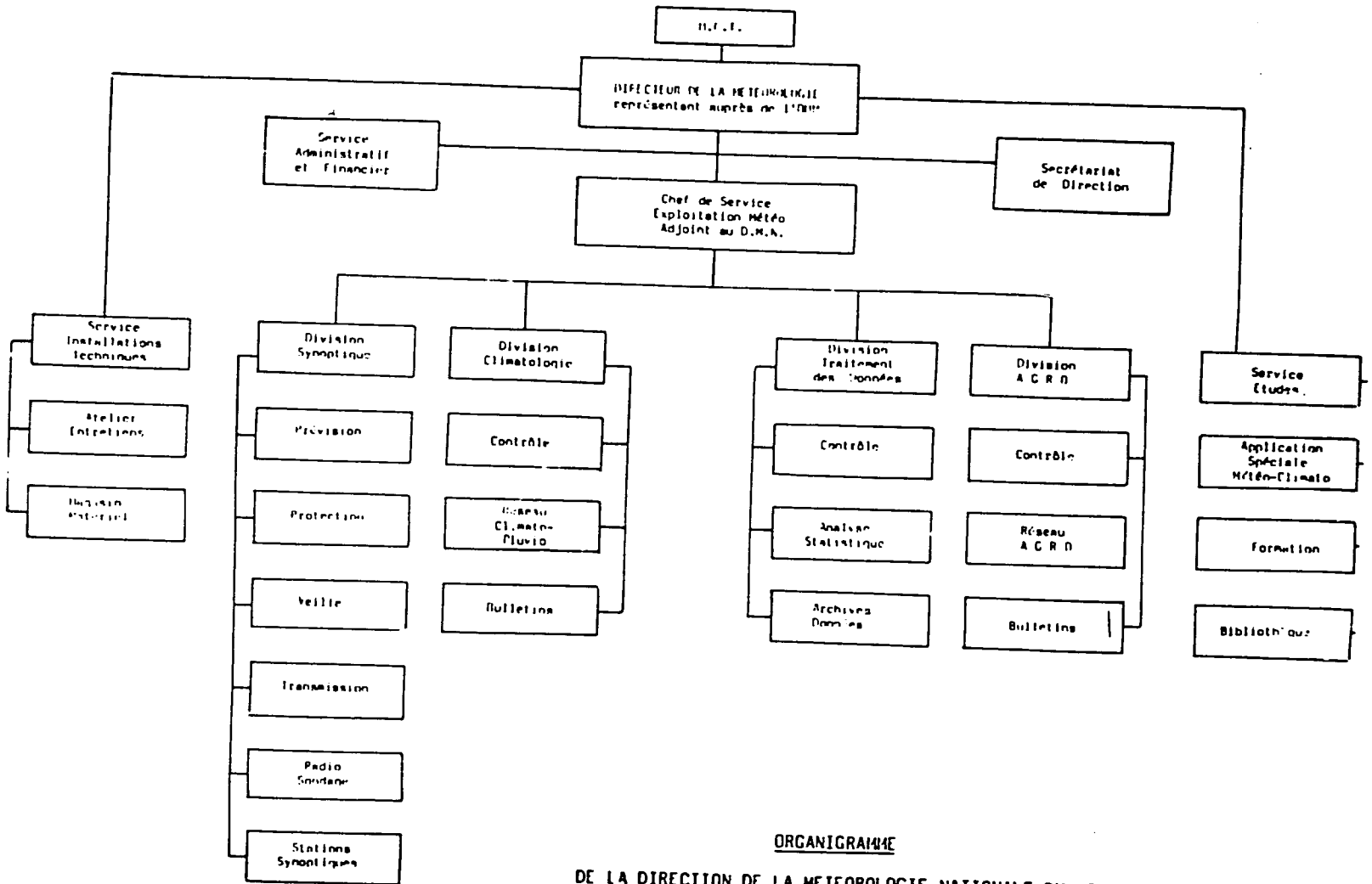
APPENDIX B



LES SERVICES PARTICIPANT AU G.T.P. AU SENEGAL



ORGANIGRAMME DE LA DIRECTION DES SERVICES DE L'AGRICULTURE AU NIGER

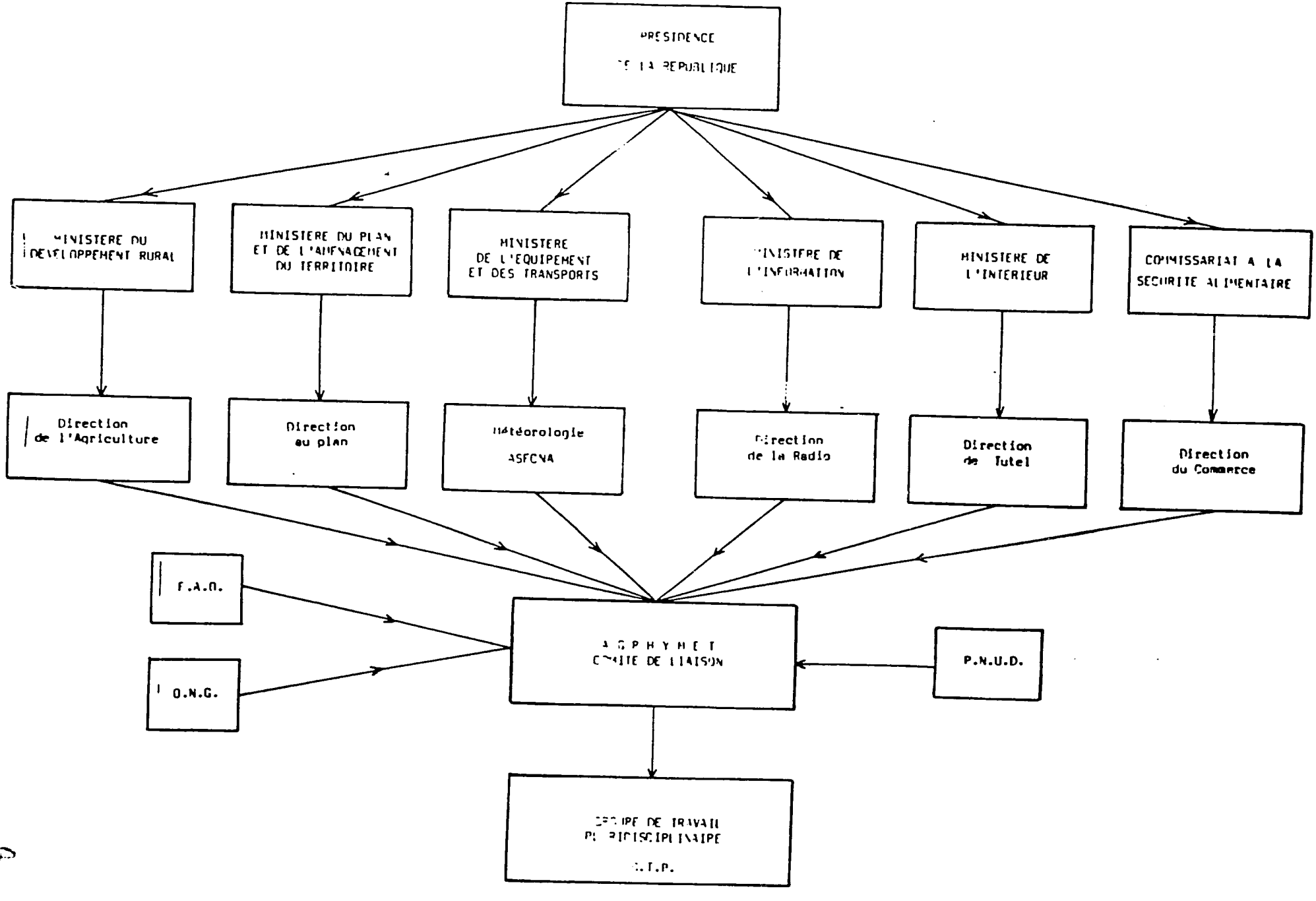


ORGANIGRAMME

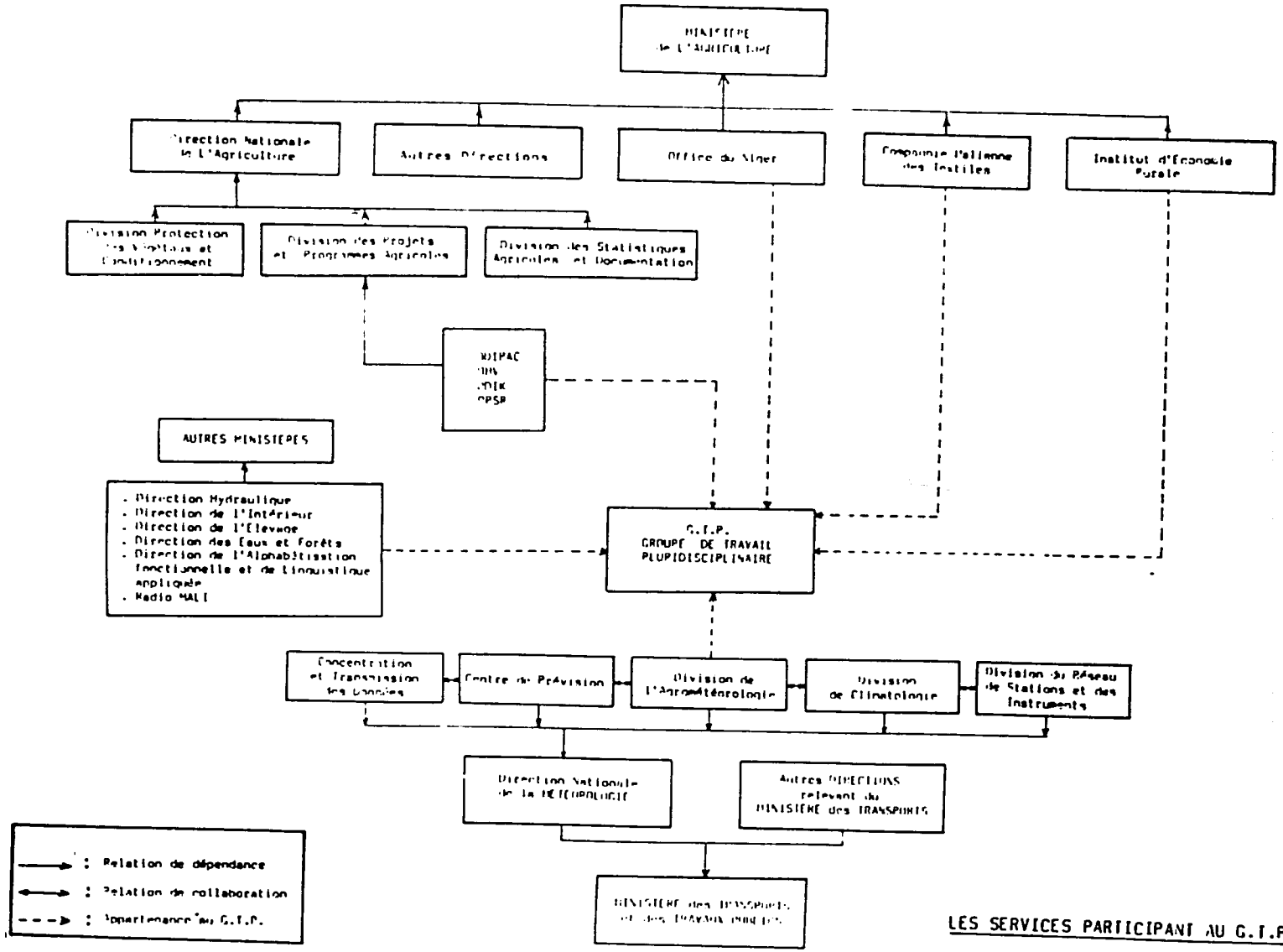
DE LA DIRECTION DE LA METEOROLOGIE NATIONALE DU NIGER

117

LES SERVICES PARTICIPANT AU G.T.P. EN MAURITANIE



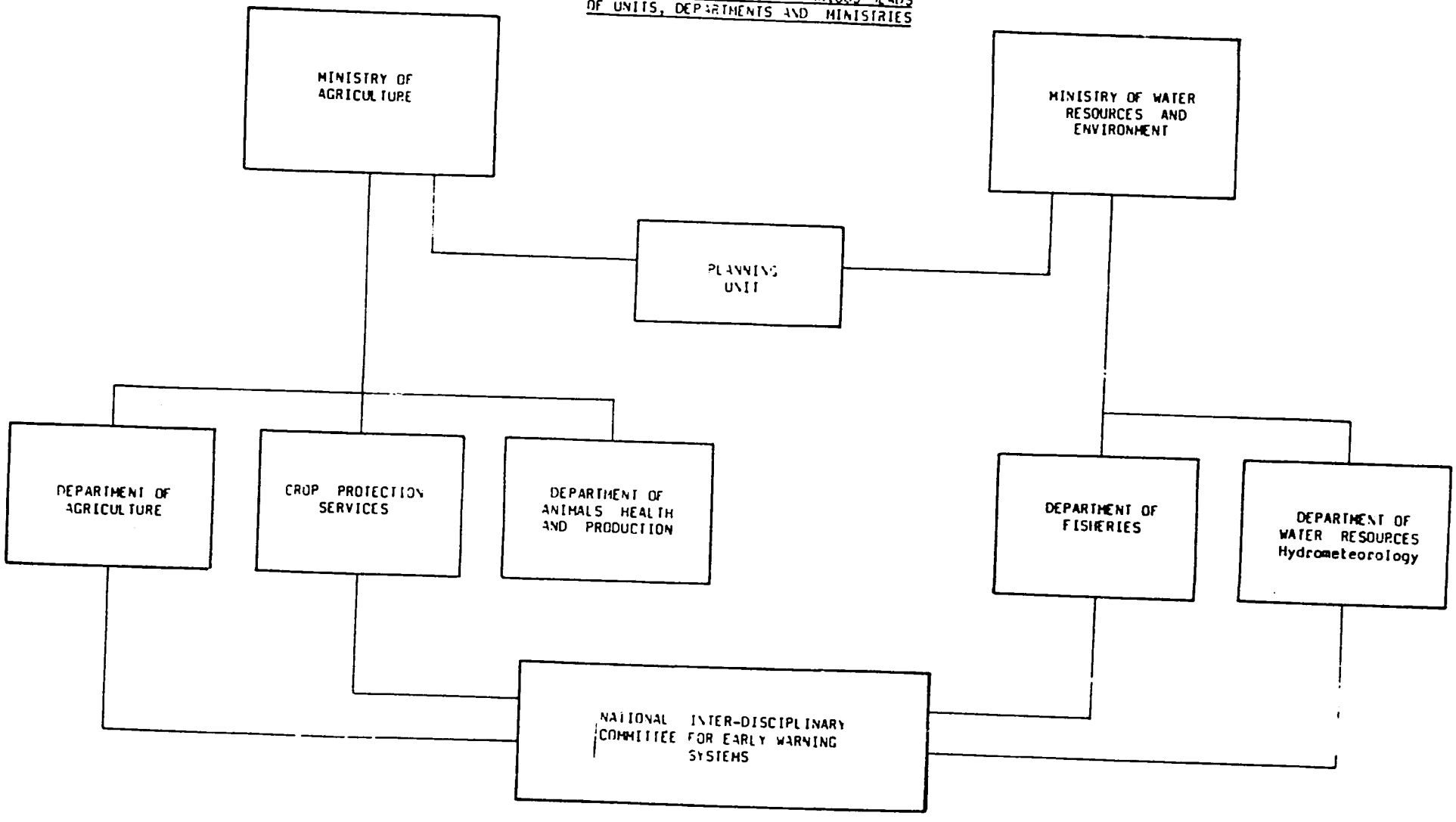
115

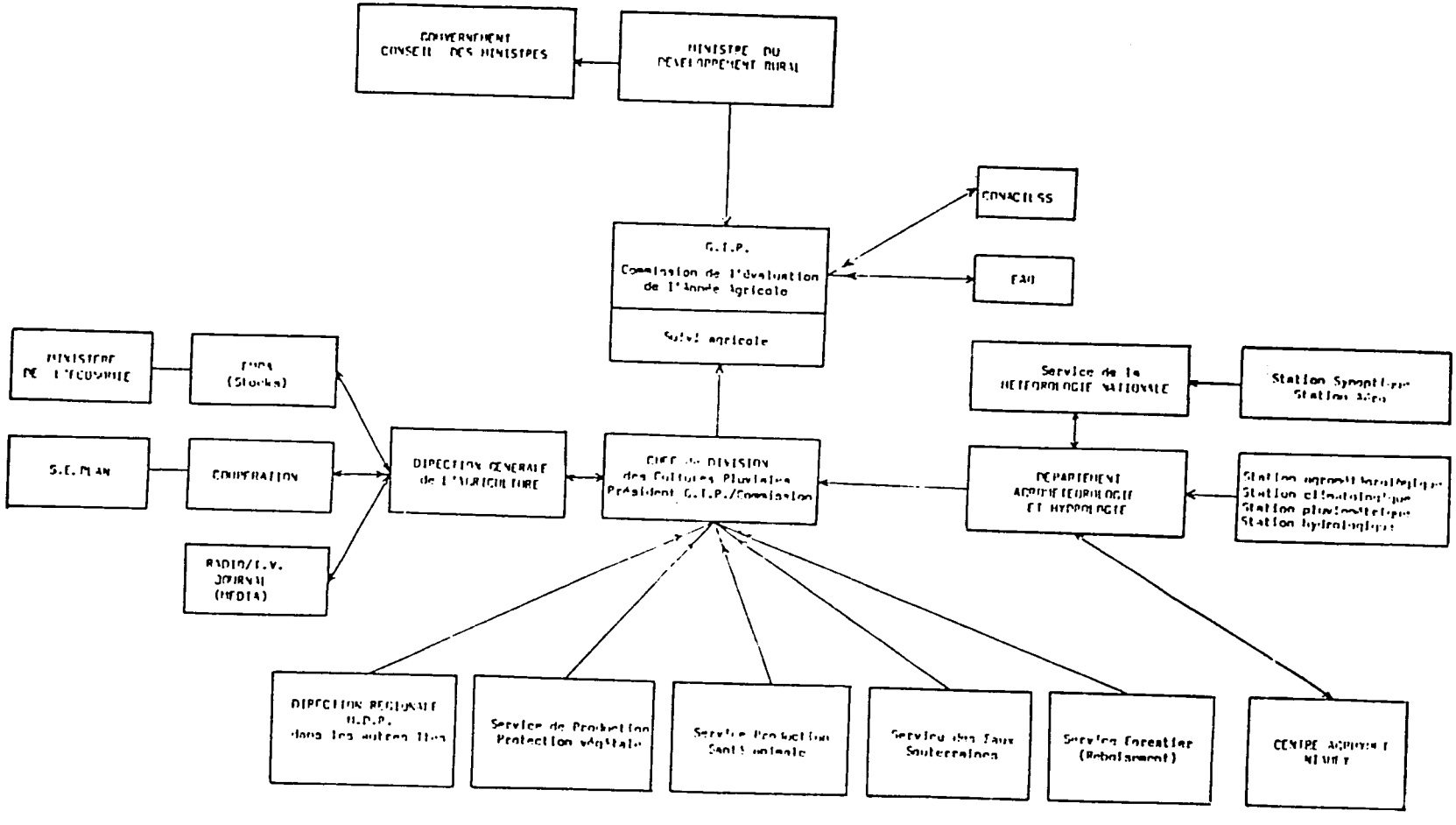


LES SERVICES PARTICIPANT AU G.T.P. AU MALI

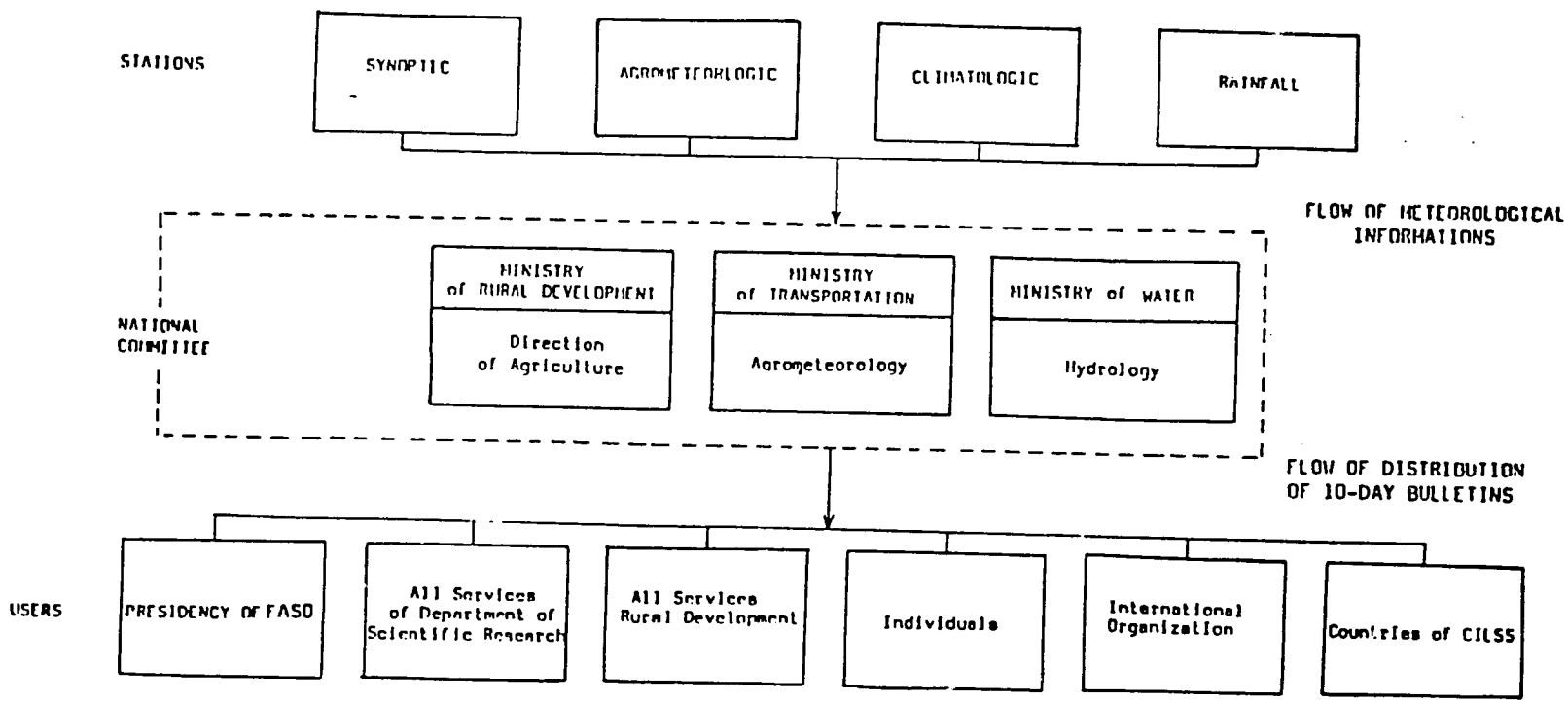
THE GAMBIA

NATIONAL FLOW CHART AND VARIOUS HEADS OF UNITS, DEPARTMENTS AND MINISTRIES





LES SERVICES PARTICIPANT AU G.I.P AU CAP-VERT



BURKINA FASO

NATIONAL FLOW CHART

APPENDIX C

BURKINA FASO

Alan Karnovitz, Albert Van Dyk October 28-31, 1985

Contacts

Lee Hall	Development Officer, USAID
Herbert Miller	Director, USAID
Ambassador Neher	American Embassy
Pierre Ouedraogo	Meteorological Service
J. Parnot	Centre Regional de Teledection de Ouagadougou
Issa Dabo Ndiaye	CILSS
Charles Kelly	USAID

Highlights

Obtained historical agricultural data and 1985 crop forecasts for selected areas.

Briefed USAID, U.S. Ambassador, government officials.

Assessments had not been distributed, but interest expressed in them by all the government officials contacted.

Charles Kelly requested an AISC special assessment on the Yatenga region to determine the extent of the 1985 drought in the north central area.

Recommendations

Assessments (in French) should be addressed to individuals.

CILSS should receive assessments.

CAPE VERDE

Alan Karnovitz, Albert Van Dyk October 14-18, 1986

Contacts

A. Hartman	Agricultural Officer, USAID
Duy Nguyen	Administrative Assistant, USAID
Horacio da Silva Soares	Director General, Center for Agrarian Studies
Ms. Logo	Center for Agrarian Studies
Luis Alves	AGRHYMET Counterpart Project
Jose Moreno	AGRHYMET Counterpart Project
Pierre Hijmams	FAO Representative
Carlos Silva	Director of Agricultural Statistics, Ministry of Rural Development
Manual Toletino	Direction General de Cooperation
Jose Luis Rocha	Direction General de Cooperation

Highlights

Obtained data on rainfall and information on cropping patterns and other agricultural practices and an overview of the year's outlook.

Briefings with AID and at Center for Agrarian Studies, the Ministry of Rural Development and the Direction General de Cooperation.

Five assessment issues were received by the Agricultural Development Officer and distributed to government officials, including the Director of Agrarian Studies and his subordinates.

Recommendations

Directorate for General Cooperation, the food security agency, should receive assessment.

LAC images would make assessments more specific for the crop area.

CHAD

Larason Lambert October 15-18, 1985

Contacts

Ralph Graner	Charge d'Affairs, U.S. Embassy
John Woods	Director, Aid Mission
Larry Harms	Agriculture Development Officer
Haroun Kabadi	Assistant to Harms
Neasmiangodo Betoloum	Director, Direction de Ressources an Eau et de la Meteorologie(DREM)
Les McBride	Food for Peace, USAID
Ronald Kurt Schafer	Program Officer, USAID
Bijan Yazdani	Chief Accountant
Mei Sakaoua Abba	MEADR
Guirbaye Ngaradedji	Meteo-National
Nelngar Younane	Meteo-National
Kimandissei Ngondiri	DREM
Langtangar Yemangar	DREM
Gabsoubo Hinnene	DREM
Mahamat Bimba	DREM
Djidina Magongue	DREM
Mohe Ngabo	DREM
Mianodji Maindoleaou	DREM
Meidjingue Bawe	DREM
Nougabe Lotard	MEADR
Alkhalil Adoum	DREM
Mbaihasra Rinodji	Projet Lutte Integree
Bedingam Le Diambo	Div. de la Protection des Vegetaux
Ahmed Sedick	DREM
Vaimbi Gao	MTO
Nadji Tellro Wai	DREM
Romnelngar Nadingar	DREM
N. Allarabaye	BIEP/MEADR
Ngaromillet	ONDR
Mouhyddine Mahamat S.	DREM
Oumar Patcha	CONA CILSS/MEADR
Cibrail Mikail	ONDR
Youssouf Hunwanou	ONDR
Abdel Madjit	ONDR

Highlights

Obtained: photocopies of maps showing distribution of soils, orography, people, natural vegetation, and agricultural activities; data on precipitation; accurate list of weather stations; crop and weather data; crop calendars; and detailed information on how Multidisciplinary Committee works.

Briefed USAID and Government of Chad professional and technical personnel.

126

Assessments had been distributed to Met Service and DG of Agriculture. Wanted additional copies to go to the Ministry of Planning, the Ministry of National Disasters, the National Office of Rural Development, the Ministry of Waters and Forests and the Ministry of Finance.

AID Mission director expressed desire to continue receiving products.

Received favorable comments on improvement and accuracy of assessment from USAID agriculture development officer.

Definite interest in and enthusiasm for AISC products and methodology.

Recommendations

Assessments should be in French.

More detail needed, e.g., just Chad, not all of Africa.

Training course next spring should have simultaneous translation into French.

THE GAMBIA

Alan Karnovitz, Albert Van Dyk October 21-25, 1985

Contacts

Ralph Conley	Development Officer, USAID
Mr. Kinteh	Director, Planning and Programming Ministry Unit (PPMU)
Mr. Saho	Director, Water Resources
Sampo Ceessay	Deputy Director, Agriculture
Scott Deffendale	Mixed Farming Project
John Rogers	Peace Corps
Byron Ball	Director, USAID

Highlights

Obtained data on cropping patterns, agricultural practices, regional production, and rainfall; rangeland data to be sent in April or May 1986.

Briefing to USAID.

Assessments not distributed, but great interest in them expressed by Mr. Saho and Mr. Ceessay.

Recommendations

Better distribution process for assessments. Recipients should be the Planning and Programming Unit, Water Resources Department, Agricultural Ministry and the Gambia Marketing Produce Board.

Need cooperation from AGRHYMET to obtain rainfall data on a real-time basis.

MAURITANIA

Sghaier Labiadh November 4-7, 1985

Contacts

Gandega Yelli	AGRHYMET-Nouakchott
Lane Wilson	Agriculture Officer, USAID
Kenneth Lizzio	Ag., USAID
Director	ACHRAM Project (SONADER)
Director of Agriculture	Ministry of Rural Development
Commissaire Agricole	Rosso
Salikou ould. Aghoub	SONADER
Mohamed Valldetfill	Production de vegetaux
Youssouf Elimane sy	Svce. AGRHYMET
A. Dia	FAO Stat. Agri.
De Robiano L.	Assistant FAO
Abdel Maleck	ASGCNA
Grand Jean	SONADER
Joseph C. Guardiano	USAID/ P.D.O.
Jill Leviten-Hilbert	Prog./USAID
W. J. Lane	Agr./USAID
John Zirus	Survey Consultant/USAID

Highlights

Obtained AGRHYMET Decadal Assessment Bulletins, GTP Proceedings, Ag. Statistics Projections, and information on current crop and livestock conditions.

Briefed USAID and G.T.P. staff.

Assessments received and apparently distibuted to desired government officials.

SONADER representative expressed interest in NOAA monitoring river irrigated recess crops.

Enthusiasm for spring training course expressed by Director of Agriculture in the Ministry of Rural Development.

Agricultural Statistics representative from G.T.P. interested in NOAA monitoring a fixed area on a regular basis; desired letter from NOAA outlining possibilities for coordination.

Recommendations

At least six copies of monthly assessment bulletin should be sent, in French, rather than just one.

NIGER

Lou Steyaert, Sghaier Labiadh October 21-24, 1985

Contacts

Dayton Maxwell	General Development Office/USAID
Dennis Panther	General Development Office/USAID
R. Vasic	AGRHYMET
J. L. Domergue	AGRHYMET
D. Lambergeon	AGRHYMET
Tom Olson	Agricultural Development Office/USAID
Also Idrissa	National Meteorological Service
Alfari Issifou	National Meteorological Service
Alio Maidonkia	National Meteorological Service
Mme. Ousseini M.	Ministry of Agriculture/Statistics
Bruce Wiley	Integrated Livestock Project
C. B. Coley	AGRHYMET

Highlights

Obtained preliminary yield forecast information, historical decadal rainfall data, and background information on data collection and processing system. Also obtained promise from ICRISAT for results of crop trials.

Seminars at AGRHYMET Center and USAID.

All of special assessments were extremely well received by AID Mission and AGRHYMET. Both organizations support the work and are looking forward to further cooperation. The Deputy Director of Agriculture and the Director of Statistics had not seen the reports but the latter government official saw the October yield cable. The Meteorological Service did receive the reports.

Plans completed for AGRHYMET to jointly conduct professional training course in Columbia, MO and Washington, D.C. March-April 1986.

AGRHYMET and AISC to independently evaluate assessments for 1985 crop season.

Recommendations

Install TELEX communications at AISC/Washington.

~~Determine how satellite images and index~~ products can be provided to GON and AGRHYMET in addition to regular 1986 assessments.

Improve AISC distribution assessment distribution through direct mailing to host-country officials and AGRHYMET.

Establish dialogue with Tahoua Rangeland/ILP project.

SENEGAL

Sharon LeDuc, Doug LeComte, Sghaier Labiadh October 28-November 1, 1985

Contacts

Barnabas Mosley	USAID/ENG
Daby Diallo	USAID/ADO
John Balis	Agriculture Development Officer
Ndene Ndiaye	Direction Meteo Nationale/ME
Mamadou A. Thiaue	Direction de Etude Hydraulique M/H
Teni Goudiaby	Direction de Etude Hydraulique M/H
Jerzy Szkutnicki	OMM
Cheikh Tidaiane Lo	Direction de l'Agriculture/MDR
Abdallah Samba	Direction de l'Agriculture/MDR
Mohammed Diallo	Direction de l'Agriculture/MDR
Jean-Yves Gac	ORSTOM
Carole Tyler	USAID/Deputy Director
Jean Le Bloas	USAID/RBDO
Abdou Karim Cisse	Dion Amenagement du Territore
Mr. Dewispelaere	Institute d'Elevage Tropical

Highlights

Obtained: preliminary agricultural statistics from GOS; 1979-1984 ag data; new crop districts; historical Senegal River flow data; new administrative district maps; pasture project papers.

Briefings: Working Group for Agrometeorology, USAID.

August and September assessments had not been received.

Mr. Dewispelaere at Institute d'Elevage Tropical requested image and digital data (Channel 1, 2, 4) on floppy disk for the pasture project in Niger.

System used to obtain yield estimates for 1985 different than previously used.

Jerzy Szkutnicki of OMM very interested in working with NOAA.

LAC images from September 10-October 15 requested by LeBloas.

Recommendations

Assessment bulletins for 1986 should be sent to the AID engineer, ADO, and to members of the Working Group for Meteorology.

Put confidence boundaries on yield estimates.

B1

SOMALIA

Larason Lambert October 23-27, 1985

Contacts

Roy Carpenter	Agriculture Development Officer/USAID
Ray Fox	Economist/USAID
Dr. Nur	GOS Vice Minister of Agriculture
Ali Abdi Odawa	Director, Early Warning System Department
Mohamoud Mohamed Ali	Director of Irrigation
Flynn Fuller	University Project Coordinator
Rodger Garner	AID International Development Intern
H. Habbad	
Phil Warren	Livestock Program Coordinator
Paula Tavrow	Food for Peace
William Hargus	Central Rangelands Development
Dennis Herlocker	Ecologist
Gordon McLean	World Bank
Mark Winters	AID/W
Mohamad Said	Director, Meteorological Service

Highlights

Obtained 1984-85 monthly rainfall data, soils and general crop region maps, and a list of weather stations reporting daily.

Briefed GOS officials and USAID Agriculture staff and visitors.

Assessments started in mid-season and were well received and in high demand by government officials.

Recommendations

Desire for more detailed satellite photos of Somalia and Ethiopia.

132

SUDAN

Doug LeComte November 3-7, 1985

Contacts

Tom Eighmy	USAID
Joe Goodwin	USAID
George I. Ghobrial	USAID
Fadlalla Elkhider El Sayem	Deputy Director, Meteorological Department
Abdal Rahman	USAID

Highlights

Obtained daily historical rainfall data, 10-day rainfall amounts for first order stations, 1984 crop statistics and preliminary data for 1985, and information on the location of millet, sorghum and other crop areas; agricultural notes.

Briefed personnel from AID, I.E.S., the Meterological Service and the Ministry of Agriculture at the Institute for Environmental Studies.

Assessments were well disseminated but arrived late because of poor DHL service. Those who knew of the assessments were enthusiastic, but need to reach more key people.

AISC model estimates close to government estimates.

Recommendations

Assessments should sent by Skypak to Joe Goodwin, a minimum of six copies.

Indicate method to convert to kg/Fed in cable. Omit Khartoum province.

Send assessment booklets earlier in the month.

Work more closely with USDA/FAS on Sudan.

Stress sorghum first, then millet, since it is the more important crop.

Indicate type of farming after each province.

BURKINA FASO

Sharon LeDuc, Sghaier Labiadh August 6-7, 1985

Contacts

Lee Hall	USAID
Emerson Melaven	Mission Director
Baudouin de Marcken	Director of Regional Projects
Jean-Pierre Ouagadougou	Director General, National Meteorological Service
Bill Weinhold	USIS, Public Affairs Officer
Roger Bloom	Agricultural Project Officer
Diall Adama Alhassane	Meteorological Service
Quattara N. Frederic	Meteorological Service
Sanou I. Florent	Meteorological Service
Herb Ohm	USAID
Joe Nagy	USAID
Linda Ames	USAID
Anne Jeton	Usaid
Charles Kelly	Food for Peace
Bonaventure B. Traore	Prog. Specialist Agriculture

Highlights

Obtained agricultural statistics through 1983 and preliminary estimates for 1984 production.

Briefed USAID and National Meteorological Service.

Visited Center (Regional) for Teledection at Ouagadougou (CRTO).

Request had been made to NOAA to support Hama Kontagombe to rewrite software for indices for AGRHYMET Regional Center.

CAPE VERDE

Albert Van Dyk July 31-August 3, 1985

Contacts

A. Hartman	Agricultural Development Officer/USAID
Duy NGuyen	Administrative Assistant/USAID
Horacio da Silva Soares	Center for Agrarian Studies
Luis Alves	Meteorological Service

Highlights

Obtained Meteorological Situation Reports for July and September 1984, Meteorological data for 40 stations from 1860-July 1985, and a report on desertification.

Briefed all of above contacts.

CHAD

Albert Van Dyk July 20-25, 1985

Contacts

Larry Harms	Agricultural Development Officer/USAID
Mr. Bougar	Director of Agriculture
Betoloum Neasmiangodo	Director of Meteorology
John Woods	Director, USAID Mission

Highlights

Obtained agrometeorological bulletin for July, crop yield predictive models for Chad based on the average of three rainfall stations, acreage and yield data for every major crop, data on animal traction, major implements, livestock and population on secteurs and sous-secteurs for 1976, 77, 78, 80, 81, 83, 84, evaporation data for six stations 1951-1984, decadal precipitation data for about 35 stations (1972-77, 1980-81, 1982-83, and 1983-84), soil maps, temperature maps, wind direction maps, vegetative maps, population maps, land use maps and animal location maps.

Briefed Departments of Agriculture and Meteorology and USAID Mission staff. All responded positively and felt project was constructive. Presented seminar on vegetation and crop condition assessment methods.

Attended AGRHYMET meeting and observed preparation of Agrometeorological Bulletin. Was impressed with high technical level of meeting.

GAMBIA

Albert Van Dyk July 25-29, 1985

Contacts

S. Norton	AID Representative
Ralph Conely	Agricultural Development Officer/USAID
Momadou Sahor	Department of Water Resources
Victor Bahoum	Statistical Division
Sampo Ceesay	Director of Agriculture
Glen D. Fulcher	Mixed Farming Project
Scotty Deffendale	Mixed Farming Project

Highlights

Obtained monthly rainfall data for 1951-1984, daily rainfall data May to July 1985, decadal agrometeorological bulletin 1, 2, 3 June, planted area and production of major crops for 1976-1984.

Briefed all of above contacts.

Department of Water Resources will send bulletins to the Models Branch.

MALI

Sharon LeDuc, Sghaier Labiadh July 29-August 2, 1985

Contacts

Mama Konate	Chief, Agrometeorology Division
Demba Coucoure	AGRHYMET
Kalilou Traore	AMN
Mahamama Coulibaly	Agricultural Engineer, Division of Agrometeorology
Mamadou Fafana	USAID
Boubacar Macalou	Direction de l'Elevage
Rebecca L. Niec	Acting DO, USAID
Yolanda Takesian	Food Aid
Dr. Sarah Brett-Smith	Consultant-Relief, Famine
Abdoul Diallo	AGRHYMET Project Officer
Christian Remy	UNDRP/UNDP
Peter Bisacia	FFP
Roger J. Simmons	Program Office and Drought Relief Officer, USAID
Jim Anderson	Drought Relief
Ben Hoskins	Meteorological Service
Dasuda L. Diarra	Assistant, Samanko Pilot Project
Mamad Tofana	Recherche d'Accomp, ODIPA
Aboubacar S. Trouffo	CHDT
Diegue Cienka dit David	OHV
Karin Taugaro	Protection des Vegetare
Yawuber Kone	Direction Hydrauloque
Abdoulaye Sudibe	Direction Hydrauloque
Balbay Camara	Bureau ODIK
Namake Kamissoko	Direction de l'Agriculture
Bandiougou Camara	Agrometeorologist
Birama Diarra	Project to Inventory Resources (Terrestial)
Nazirou Sacko	

Highlights

Obtained agricultural statistics and made arrangement to obtain daily precipitation data for 1981-84 and 17 stations. Obtained data on biomass measurements.

Briefings to AGRHYMET team, USAID, Government of Mali employees, and USAID Mission Directors.

Visited Airport to see receiving station, etc. Trip to Samanko Pilot Project. Visit to AGRHYMET station at Katibougou, PIDT, and PADEM.

Were asked if river flow data could be incorporated to assess natural flooded area.

MAURITANIA

Sghaier Labiadh July 18-23, 1985

Contacts

Gandega Yelli	AGRHYMET
Hann	Agricultural Statistics
Dr. Angel Diaz	Agricultural Statistics
Dr. Gueye Melik	Livestock
Kabe	SONADER
Joussouf E. Sy	AGRHYMET
Talebor Taleb Siddon	Protection Vegetation
Oumas Samls Thiam	Direction Genie Rural
De Koliano Lionel	FAO
Baye ould Mohamed Abdallali	Chief, Agrometeorology
Mr. Gordon D.	ASECNA
Mr. Abdul Maleck	Chief, Center
Anne Mamoudou	Agricultural Statistics
Don Miller	Director/USAID
Walter Boehm	Deputy Director/USAID
Steve Grant	D. Director, Peace Corps
Bud Lane	Director, Agriculture
Ken Lizzio	Agriculture
Richard Hough	Food for Peace

Highlights

Obtained decadal rainfall data and a map of stations from regional AGRHYMET Center.

NOAA assessment method described to trainees at seminar sponsored jointly by AGRHYMET UNDP and FAO.

Briefings at Department of Agriculture, the GTP permanent working group in meteorology, and USAID.

Help requested to monitor biomass production on rangeland.

SONADER wants assessment to include impact on flood irrigated rice.

A permanent network to report statistics on agricultural production is being designed by Agricultural Statistics Division.

NIGER

Sharon LeDuc, Sghaier Labiadh August 8-15, 1985

Contacts

Dennis Panther	USAID
Kathy Panther	USAID
Jessie Snyder	USAID
Mike Kurst	Drought Relief
Elizabeth McDavid	Drought Relief Assistant
Jim Loventhal	Assistant ADO
Abbie Fessinnden	Program Officer
Jess Arenda	USAID
Caille Maujonne	Consultant Meteorologie
Caille Philippe	Meteorologist/AGRHYMET
Tongerius Wilfried	Assistant Expert FAO, AGRHYMET
Aridouana Ibrahim	OPVN
Amadou Gologo	Conseiller Technique AGRHYMET
Quedraogo Idrissa	Meteorologist/AGRHYMET
Gnoumou k. Faustin	Agrometeorologist/AGRHYMET
C.B. Coly	DG AGRHYMET
J.L. Domergue	DAD AGRHYMET
R. Morel	Agrometeorologist/AGRHYMET
C. Dancette	Consultant AGRHYMET
C.C. Jacobsen	AGRHYMET Expert FAO
F. Braun	OPVN, Coop RFA
M. Bonifazi	OPVN, Coop RFA

Highlights

Obtained 1984 agriculture data and data from AGRHYMET Center in digital form and atlas from a pasture project near Agadez.

Briefings at USAID and AGRHYMET Regional Center.

Land use maps being developed.

Worked on software at AGRHYMET Regional Center.

Participated in ICRISAT Pre-Symposium Training Workshop.

Met with Gerard De Wispelaere and Bernard Payre de Fabreques of Institute d'Elevage Tropical, Paris, France. They desire satellite information for pasture project in Niger and want to cooperate with NOAA.

SENEGAL

Sharon LeDuc, Sghaier Labiadh July 24-27, 1985

Contacts

Daby Diallo	USAID, ADO
Olga Cague guy	FFP
Kemo Balajo	USAID, ENG
Campbell McClusky	USAID, Program Office
Abdou Karim Cisse	Dion Amenagement du Territore
Abdoulay M'Baye	SODESP 46 Zone A
Jerzy Szkutnicki	OMM
Abasse Diouf	DMN/ME, Director General
Aliou Faye	DA/MDR
Lerir Goudiary	DEH/MH
Cheikh Tiduane Lo	DA/MDR
Ndene NDiaye	DMN/ME
Harouna Soumare	DAG/MDR, Director General
Fred Weldon	NOAA
Amadou Moustapha Kamar	Director General, Agricultural Production
Ibrahima NDiaye	Agricultural Statistician
Idrissa Sadio	Agricultural Statistician
Omer Gomez	SODESP (livestock)
Dr. Nalick Faye	SODESP
Abdoullarif Thiam	SODESP
Sarah Jane Littlefield	AID Mission Director
Kemo Botajo	AID

Highlights

Obtained agricultural statistics at Agricultural Production Department. Arrangements made for current 10 day precipitation information to be sent by cable.

Briefings to AID, Meteorological Service, Agricultural Production Department and SODESP.

Great deal of interest in assessments expressed at briefing for AID.

Interest in being more active in display, processing and possibly acquisition of NOAA-9 data.

Assessment procedure in Senegal discussed. Ten-day bulletins and a weekly bulletin that covers conditions the previous week (issued on Tuesday morning) are produced.

Victor Meyers at S.D. State just completing land use maps from LANDSAT.

APPENDIX D

SAHEL PROFESSIONAL COURSE

ON

SPECIAL CLIMATIC IMPACT ASSESSMENTS
FOR CROPS AND RANGELANDS:
AGROCLIMATIC AND REMOTE SENSING TECHNIQUES
USED BY NOAA/NESDIS/AISC

COURSE DESCRIPTION

This six week course provides an opportunity for Sahelian professionals to learn more about Special Climatic Impact Assessment procedures used by the NOAA/NESDIS Assessment and Information Services Center. Course participants will be introduced to the agroclimatic and remote sensing techniques used by AISC to assess rainfall impacts on crop/rangeland conditions and to forecast millet/sorghum crop yields in the Sahel. The technical focus of the course is on the integrated use of NOAA AVHRR satellite color-imagery/vegetation indexes, agroclimatic/crop condition indexes and statistical climate/crop yield forecast modeling procedures to prepare special assessments.

The format for the course (in French and English) is based on prepared presentations and practical exercises for applying and evaluating the methods introduced. Participants will have the opportunity to apply various "user friendly" micro-computer software packages to analysis of satellite images, satellite vegetation indexes, agroclimatic indexes, and statistical modeling techniques, based on data for the 1984 and 1985 crop seasons. Each participant (or country team) will be encouraged to prepare a concise report relating the technology potential to their country.

This professional course is being sponsored under an AID funded project, "Use of NOAA/NESDIS Climatic Impact Assessment Technology by Countries of the Sahel and Horn Regions of Africa for Operational Crop Monitoring and Rangelands Management" (BOF-0000-P-CC-3062-02). Under this project, the NOAA/NESDIS Assessment and Information Services Center in cooperation with the University of Missouri-Columbia provided Special Climatic Impact Assessment Reports and in-country technical assistance during the 1985 crop season. Similar assessments will be provided by NOAA/NESDIS during the 1986 season.

OTHER INFORMATION

DATE OF ARRIVAL

The course is scheduled from March 11, 1986 to April 18, 1986. Participants are advised to be in Missouri by Monday, March 10. Some participants may need to arrive earlier because of travel connections. The first meeting is scheduled for Tuesday, March 11.

CLASS SCHEDULE AND LOCATION

The course will be taught in an intensive five week session at the facilities of the NOAA/NESDIS Assessment and Information Services Center, Room 200 Federal Building, 608 E. Cherry (corner 7th and Cherry Sts.), Columbia, Missouri. The sessions will be held in the basement conference room. The course will terminate at the NOAA/NESDIS AISC Climatic Impact Assessment Division, Page Bldg. # 2, 3300 Whitehaven St. N.W., Washington, D.C., after a one week (April 14-18) orientation and seminar period. City maps of both Columbia, Missouri and Washington, D.C. will be issued upon arrival.

Theory sessions will be held mornings, practical exercises afternoons, requiring a total of eight hours of effort, five days a week.

CERTIFICATION

A certificate will be awarded after satisfactory completion of all the requirements in the training program.

CLIMATE

Because the course will take place during the late part of the Winter season, the days and nights will be chilly and snow could be encountered. Clothing for cold weather should be included. In Columbia, Missouri the March and April respective mean maximum temperatures are 11°C and 19°C; the mean minimum temperatures are 0°C and 7°C. In Washington D.C. the normal April temperatures are mean maximum 19°C and mean minimum 8°C.

TRAVEL AND VISAS

Participants will be provided with airline tickets from their host-country to Columbia, Missouri, Washington, D.C. and return. The airline tickets will be available from the host-country airline ticket office a week before the training course begins. A positive form of identification such as a passport is needed to pick up the ticket. Further details will be sent from this office (or from AGRHYMET through the USAID Mission in each country).

Participants are requested to obtain visas for entering the U.S.A. Assistance and other supporting documents for visa application are available from each USAID Mission office.

SUBSISTENCE ALLOWANCE

Each participant will receive funds to cover costs of meals, lodging, and incidentals while in the United States. Approximately one-half of the total amount will be available during the first week of training. Please note that personal preferences, as well as eating habits, will play a major role in the amount required for personal expenses.

HOUSING AND TRANSPORTATION

The official transportation needs for the course will be the responsibility of AISC and CIAM. Transportation needs of the common group can be considered on a case by case basis.

In Columbia, Missouri, a limousine service (B.E.S.T. Limousine) is available at the airport. The cost is $9 from the airport to the University of Missouri campus where participants will be housed. Accommodations will be reserved by the Center at the Mark Twain Residence Hall, 515 S. 5th St., Columbia, Missouri (Tel. 449-7211) at the following rate:

> U.S. $125 per week in double rooms. This includes 18 meals per week - breakfast, lunch and dinner Monday thru Friday, brunch and dinner on Saturday and brunch only on Sunday.

For Washington, D.C. the rate will differ. Arrangements are being negotiated.

MEALS

Meals ("take all you can eat") are served at the Mark Twain Residence Hall Cafeteria.

Note: Due to spring recess no meals will be served the week of March 15 to March 23 (last meal to be served is lunch on March 14 and first meal to be served after recess will be breakfast on March 24). However, meals can be obtained at other nearby facilities and restaurants.

Housing rate per week during spring recess will be reduced to U.S. $100.

HEALTH AND ACCIDENT INSURANCE COVERAGE

Each participant will also be provided with free health and accident insurance coverage for the duration of the training program. Coverage begins immediately on the date of departure for the U.S. and will continue until the participant returns directly to his/her country of origin or is released from NOAA/AID responsibility, whichever comes first.

For purposes of processing health and accident insurance coverage, participants should send a cable to the AISC Models Branch, Room 200 Federal Bldg., 608 E. Cherry St., Columbia, Missouri 65201 indicating their Full Name (First, Middle & Last); Date of Birth; Title or Position; Name and Address of their Agency. This information is required at least a month before the beginning of the course.

SELECTION OF PARTICIPANTS

The Regional AGRHYMET Center at Niamey, Niger has been requested to assist with the selection of two professionals (one an agro-meteorologist, the other an agricultural economist/agricultural statistician) from each of the following countries: Burkina Faso, Cape Verde, Chad, Gambia, Mali, Mauritania, Niger and Senegal. List of participants follow.

In general, a professional agrometeorologist and professional agricultural economist/agricultural statistician who are in national service and in working level positions will be designated to participate in the training course. Selected candidates should have at least two years professional experience, preferably at a B.S. degree level, and a working knowledge of agricultural practices in their country.

RESOURCE MATERIALS

Participants are requested to hand-carry the following supplemental data and information:

1. Major crop data: yield, area production (by region) and meteorological data (by stations) for 1984 and 1985.

2. Current land-use maps (cultivated areas for major crops; range and forest areas).

3. Rangeland maps (showing percent wooded area, percent annual vegetation area).

4. Livestock information (number and types of animals, animal units, grazing practices, etc.).

This process is highly encouraged to ensure that adequate data are available for successful training.

LECTURE STAFF

The course will be taught by the staff of the Cooperative Institute for Applied Meteorology (CIAM), Atmospheric Science Department, University of Missouri-Columbia and the NOAA/NESDIS Assessment and Information Services Center-Models Branch, Columbia, Missouri and staff members of the NOAA/NESDIS AISC Climatic Impact Assessment Division in Washington, D.C. The majority of the staff have had extensive international experience with expertise in Agroclimatology, Meteorology, Statistics, Remote Sensing and Computer Science. Guest lectures are also scheduled by the staff of AGRHYMET (Niamey, Niger) and the Statistical Reporting Service (SRS) of the U.S. Department of Agriculture. List of lecturers and staff members follow.

LIST OF PARTICIPANTS

Country	NR No.	Name	Agency
Mauritania	1	GANDEGA Yelli	Ingenieur Agrometeorologiste Chef Service AGRHYMET Direction de Agriculture Nouakchott
	2	DIAKITA Hamala Kaba	Ingenieur Agroeconomiste Division Etude et Developpement Direction de Agriculture Nouakchott
Senegal	3	N'DIAYE Ndene	Ingenieur Agrometeorologiste Chef Division Agrometeologie Direction Meteorologio Nationale Dakar
	4	ABDELLAH Samba	Ingenieur Agronome Coordinateur Direction d l'Agriculture Dakar
Niger	5	ALSO Idrissa	Ingenieur Agrometeorologiste Chef Exploitation Meteo Direction de la Meteorologie Nationale Niamey
	6	MME OUSSEINI Mariama	Ingenieur Agronome/Service Statistique Agricoles Niamey
Chad	7	BETOLOUM Neasmiangodo	Ingenieur Agrometeorologiste Directeur Ressources N'Djamena
	8	NOUGABE Lotard	Ingenieur Statisticien Agricole Chef Division Statistique Direction Agriculture Agricole N'Djamena
Mali	9	TRAORE Kalilou	Ingenieur de la Meteorologie Direction Nationale de la Meteorologie Bamako
	10	CAMARA Bandiougou	Ingenieur de Travaux Agricole Minister l'Agriculture Bamako

147

Participants (Continued) p/2

Cape Verde	11	ALVES Luis	Ingenieur Agrometeorologiste Directeur Departement, Agro-Meteo-Hydro Institut National Recherche Agraire Praia
Gambia	12	DARBOE Mounir	Agrometeorologist Dept. of Water Banjul
	13	SANNEH Mohamed	Agricultural Economist Ministry of Agriculture Banjul
Burkina F.	14	FOFANA Sanoussi	Ingenieur Agronome Ministree Agriculture Ouagadougou
	15	DIALLO Adama Alhassane	Ingenieur Meteorologie Chef Service Agromet Direction Meteo Nat Ouagadougou
Haiti	16	Mr. Adolphe	Meteorological Technician Meteorological Service

LECTURERS AND STAFF MEMBERS
Columbia, Missouri

Name	Title	Affiliation
Dr. Rao Achutuni	Agrometeorologist, CIAM	UMC
Mr. Mike Benzinger	Computer/Program Analyst, CIAM	UMC
Ms. Susan Callis	Meteorologist	NESDIS/AISC
Dr. Wayne Decker	Director, CIAM	UMC
Ms. Mildred Grissum	Field Services Assistant	NESDIS/AISC
Mr. Chris Hord	Meteorologist, CIAM	UMC
Dr. Gary Johnson	Remote Sensing Scientist	NESDIS/AISC
Ms. Anne Marie Kaylen	Agricultural Economist, CIAM	UMC
Dr. Sharon LeDuc	Senior Statistician	NESDIS/AISC
Mr. George Lozano	Training Associate, CIAM	UMC
Dr. Thomas Phillips	Computer Specialist	NESDIS/AISC
Dr. Clarence Sakamoto	Chief, AISC Models Branch (Agroclimatologist)	NESDIS/AISC
Dr. Louis Steyaert	Program Manager (Meteorologist)	NESDIS/AISC
Ms. Rita Terry	Writer/Editor, Librarian	NESDIS/AISC
Ms. Virginia Thompson	Physical Scientist	NESDIS/AISC
Ms. Judy Trujillo	Sr. Research Lab. Tech., CIAM	UMC
Mr. Albert van Dijk	Remote Sensing Scientist, CIAM	UMC
Ms. Sandra Weisman	Computer Programmer, CIAM	UMC
Mr. Gerry Wright	Graphic Artist, CIAM	UMC

Washington, D.C.

Dr. Joan Hock	Director, NOAA/AISC (Economist)	NESDIS/AISC
Mr. Russell Ambroziak	Chief, CIAD (Remote Sensing)	NESDIS/AISC
Mr. Douglas LeComte	Chief, Climatic Impact Assessment Branch (Meteorologist)	NESDIS/AISC
Dr. Larason Lambert	Assessor (Agrometeorologist)	NESDIS/AISC
Mr. Jake Robinson	Assessor (Meteorologist)	NESDIS/AISC

VISITING LECTURERS

Dr. J. L. Domergue	Chief, Data Analysis Div.	AGRHYMET/Niamey
Mr. I. Ouedraogo	Meteorologist	AGRHYMET/Niamey
Mr. F. Gnoumou	Agrometeorologist	AGRHYMET/Niamey
Mr. Don Bay	State Statistician	SRS/USDA
Dr. Merritt Padgitt	Agricultural Economist	SRS/USDA
Mr. Arno Behlau	Meteorologist	WMO

AGRHYMET - Agricultural, Hydrology and Meteorology/Niamey Regional Center
AISC - Assessment and Information Services Center
CIAD - Climatic Impact Assessment Division/AISC
CIAM - Cooperative Institute for Applied Meteorology
NESDIS - National Environmental Satellite, Data and Information Services
SRS/USDA - Statistical Reporting Service/U.S. Department of Agriculture
UMC - University of Missouri-Columbia
WMO - World Meteorological Organization

Horaire
Cours Professional

Matin 8:30 - 11:30
Aprés midi 1:30-4:30
Les Heures

Le premier jour - 11 mars Mardi

8:30 A.M. Introduction

Chair: Clarence Sakamoto
Resource Persons:
Wayne Decker
Lou Steyaert
Tom Phillips
George Lozano
AGRHYMET

Les remarques d'overture

Sommaire du cours

Introduction des Partic ts

Distribution des Materiaux de Cours

Rapport de Stage et Plan d'Evaluation

Renseignements Administratifs

PAUSE

Le Programme de NOAA/AID d'Evaluation de l'Impact

Agroclimatique: Un Sommaire (L. Steyaert)

Tour du Centre des Modèles Désignation des Bureaux

1:30 P.M. Developpement du Manuel des

Chair: Judy Trujillo
Resource Persons:
Chris Hord
Sue Callis
Clarence Sakamoto

Ressources de Pays

o Les Données de Base

- Les données disponibles
- Préparation des données pour l'ordinateur

o le Manuel

- Les régions administratives
- La géographie
- Utilisation des sols, distributions des cultures vivrières et parcours
- Calendier agricole
- Type de sol
- Le réseau des stations
- Histograms representatives de la pluviométrie
- Isohyètes de la pluviométrie

Réception

SCHEDULE OF ACTIVITIES

PROFESSIONAL COURSE ON
SPECIAL CLIMATIC IMPACT ASSESSMENTS
FOR CROPS AND RANGELANDS:
AGROCLIMATIC AND REMOTE SENSING TECHNIQUES
USED BY NOAA/NESDIS/AISC

Hours
Morning Session: 8:30 - 11:30
Afternoon Session: 1:30 - 4:30

DAY 1 - MARCH 11, 1986 (TUESDAY)

8:30 A.M. Introduction and Orientation

Chair: Clarence Sakamoto
Resource Persons:
Wayne Decker
Lou Steyaert
Tom Phillips
George Lozano
AGRHYMET

- o Opening Remarks
  - NOAA Assessment and Information Services Center (AISC) representative
  - Director, Cooperative Institute for Applied Meteorology (CIAM)
  - AGRHYMET Regional Center representative
- o Overview of the Course
- o Introduction (Trainees and Staff)
- o Distribution of Course Materials
- o Training Report and Assessment Plan
- o Administrative Announcements

B R E A K

NOAA/AID Agroclimatic Impact Assessment Program: An Overview (L. Steyaert)

Tour of Facilities

Office Space Assignments

1:30 P.M. Development of Resource Manual

Chair: Judy Trujillo
Resource Persons:
Chris Hord
Sue Callis
Clarence Sakamoto

- o Crop and climate data base
  - Discussion of available data for course exercises
  - Preparation of data for computer entry
- o Resource Manual Contents
  - Administrative Regions
  - Geography
  - Land Use, Crop Distribution
  - Crop Calendar
  - Soil Type
  - Station Network
  - Representative Rainfall Histogram
  - Rainfall Isohyets

7 - 8:30 P.M. Reception (Place: Mark Twain Res. Hall, 4th Floor)

Jour 2 - 12 mars Mercredi

8:30 A.M. Climat du Sahel

Chair: I. Ouedraogo
AGRHYMET

PAUSE

Les Principales Cultures Sahéliennes
- Facteurs affectant la croissance des cultures
- Le calendrier cultural

Chair: F. Gnoumou
AGRYMET

1:30 P.M. Exercice-Achever les Inputs du Manuel des Ressources

Chair: Judy Trujillo
Resource Persons:
Chris Hord
Sue Callis

Jour 3 - 13 mars Jeudi

8:30 A.M. Introduction a la Télédétection

- Définition
- Besoins
- Les Systèmes Représentatifs de la Télédétection

Chair: Gary Johnson
Resource Person:
Albert van Dijk

PAUSE

La Base Physique de la Télédétection

Exercice

1:30 P.M. Revue d'exercice

Examen

Discussion

Chair: Gary Johnson
Resource Person:
Virginia Thompson

DAY 2 - MARCH 12, 1986 (WEDNESDAY)

8:30 A.M. Climate of the Sahel — Chair: I. Ouedraogo, AGRHYMET

B R E A K

Major Crops in the Sahel — Chair: F. Gnoumou, AGRHYMET

- o Factors Affecting Crop Yield
- o Crop Calendar

1:30 P.M. Exercise: Complete Inputs to Resource Manual — Chair: Judy Trujillo; Resource Persons: Chris Hord, Sue Callis

DAY 3 - MARCH 13, 1986 (THURSDAY)

8:30 A.M. Satellite Overview: Introduction to Remote Sensing — Chair: Gary Johnson; Resource Person: Albert van Dijk

- Definition
- Requirements
- Representative Remote Sensing Systems

B R E A K

- o Physical Basis of Remote Sensing (slide/tape set) Exercise

1:30 P.M. Exercise Review — Chair: Gary Johnson; Resource Person: Virginia Thompson

- o Self Test (from slide/tape set)
- o Discussion

153

Jour 4 - 14 mars Vendredi

8:30 A.M. Les Caractèristiques des Satellites

Chair: Gary Johnson
Resource Person:
Albert van Dijk

Les paramètres orbitales

Les caractèristiques du capteur
- Types des capteurs
- Longuer d'onde

PAUSE

Orientation à l'ordinateur -
Introduction à IBM/PC

Chair: Tom Phillips

- Les composants de micro-ordinateur
- Logging on
- Imagerie de Satellite

1:30 P.M. Exercice: Orientation à l'ordinateur -
Introduction à IBM/PC (Continued).

16 mars 1986 - 6:30 P.M
Dinner - Dr. Sharon LeDuc Residence

Jour 5 - 17 mars Lundi

8:30 A.M. Les Méthodes d'Estimation des
Productions Culturals

Chair: Don Bay
Resource Person:
Merritt Padgitt
SRS/USDA

- L'enquête de probabilité
- Echantillonage
- Procédé objectif de rendement

1:30 P.M. Orientation à l'ordinateur - VAX 11/730

Chair: Mike Benzinger
Resource Person:
Tom Phillips
Sharon LeDuc
Doug Botner
Virginia Thompson

Composants du Système

DAY 4 - MARCH 14, 1986 (FRIDAY)

8:30 A.M. Satellite Overview: Satellite and Sensor Characteristics

Chair: Gary Johnson
Resource Person: Albert Van Dijk

- o Orbital Parameters
- o Sensor Characteristics
  - Types of Sensors
  - Wavelengths

B R E A K

Orientation with Computers Introduction to IBM/PC

Chair: Tom Phillips
Resource Persons: Sharon LeDuc, Gary Johnson, AGRHYMET

- o Components of Microcomputer
- o Logging On
- o Hands on Familiarity
- o Viewing Satellite Imagery

1:30 P.M. Exercise: Orientation with Computers Introduction to IBM/PC (Continued)

MARCH 16, 1986 (SUNDAY) 6:30 P.M.

DINNER - DR. SHARON LEDUC RESIDENCE

DAY 5 - MARCH 17, 1986 (MONDAY)

8:30 A.M. Methods to Estimate Crop Production: An Overview

Chair: Don Bay
Resource Person: Merritt Padgitt SRS/USDA

- o Probability Survey
- o Sampling Frames
- o Objective Yield Procedure

1:30 P.M. Orientation with Computers - Introduction to VAX 11/730

Chair: Mike Benzinger
Resource Persons: Tom Phillips, Sharon LeDuc, Doug Botner, Virginia Thompson

- o Components of System
- o Logging On
- o Hands-on Familiarity

155

Jour 6 - 18 mars Mardi

8:30 A.M. Mèthodes d'Estimation des Rendements

Chair: Clarence Sakamoto
Resource Persons:
Doug Botner
Albert van Dijk

La transmission des données météorologiques et les modèles de recolte appliqué à temps réel

PAUSE

IBM/PC et VAX 11/730

Chair: Sharon LeDuc
Resource Persons:
Tom Phillips
Mike Benzinger
AGRHYMET

Tracement des Données

1:30 P.M. IBM/PC et VAX 11/730 (Continuation)

Jour 7 - 19 mars Mercredi

8:30 A.M. Traitement des Données Météorologiques et Culturales

Chair: Rao Achutuni
Resource Person:
Chris Hord
Sue Callis

o Les Données Météorologiques

Regulation de qualité
Homogenité
Les données très variables
Estimation des valeurs manquées

Les échelles temporelles et spatiales

Establissement des procédés opératifs pour

mettre au courant les données météorologiques

o Les Données Culturales
- Les statistiques de superficie, production et rendement
- Contrôle de qualité
- Estimation régional

PAUSE

Preparation des Données de Base: Satellite

Chair: Albert van Dijk
Resource Person:
Gary Johnson

o Les données de satellite
- La couverture Locale (LAC)
- La couverture globale (GAC)
- Stéréographique polaire (PSG)

1:30 P.M. Exercice d'AVHRR

Chair: Gary Johnson
Resource Person:
Virginia Thompson
Albert van Dijk

DAY 6 - MARCH 18, 1986 (TUESDAY)

8:30 A.M. Methods to Estimate Crop Yield: Overview

Chair: Clarence Sakamoto
Resource Persons:
Doug Botner
Albert van Dijk

- o Operational Yield Modeling and Meteorological Data Flow

B R E A K

Further Familiarity with IBM/PC and VAX 11/730

Chair: Sharon LeDuc
Resource Persons:
Tom Phillips
Mike Benzinger
AGRHYMET

- o Plotting and Reviewing of Data

1:30 P.M. Further Familiarity with IBM/PC and VAX 11/730 (Continuation)

DAY 7 - MARCH 19, 1986 (WEDNESDAY)

8:30 A.M. Preparation of Data Base: Meteorological and Crop

Chair: Rao Achutuni
Resource Person:
Chris Hord
Sue Callis

- o Meteorological Data
  - Quality Control
    - Acquiring homogeneous data sets
    - Detecting and evaluating outlyers
    - Estimating missing values
  - Spatial and Temporal Scales
  - Establishing Operational Procedures for Updating Data Base
- o Crop Data
  - Area Producton and Yield Statistics
  - Quality Control
  - Regional Estimation

B R E A K

Preparation of Data Base: Satellite

Chair: Albert van Dijk
Resource Person:
Gary Johnson

- o Satellite Data
  - Local Area Coverage (LAC)
  - Global Area Coverage (GAC)
  - Polar Steographic (PSG)

1:30 P.M. AVHRR Exercise

Chair: Gary Johnson
Resource Person:
Virginia Thompson
Albert van Dijk

- o Familiarity with AVHRR digital data

157

Jour 8 - 20 mars Jeudi

8:30 A.M. Les Principles de l'Interprétation des Images	Chair: Gary Johnson Resource Persons: Albert van Dijk Virginia Thompson
Les Elements d'Interprétation d'Image	
Exercice d'Interprétation	
PAUSE	
Continuation d'Exercice	
1:30 P.M. Système de Couleur Coordonnée d' Ambroziak (ACCS)	Chair: Gary Johnson Resource Persons: Russ Ambroziak Virginia Thompson Albert van Dijk
L'ACCS Interprétation des images d'ACCS Montage à IBM-PC	

6:00 P.M. Dinner: Pot Luck Party - Judy Trujillo Residence

Jour 9 - 21 mars Vendredi

8:30 A.M. l'Imagerie avec l'IBM-PC	Chair: Gary Johnson Resource Person: Virginia Thompson
Achèvement du Manuel des Ressource Pour les Evaluations	Chair: Judy Trujillo
Termination des Données Culturales et Climatiques à l'ordinateur	Chair: Chris Hord Resource Person: Sue Callis

22 mars Samedi
Voyage à St. Louis

DAY 8 - MARCH 20, 1986 (THURSDAY)

8:30 A.M. Satellite Overview: Principles of Image Interpretation

Chair: Gary Johnson
Resource Persons:
Albert van Dijk
Virginia Thompson

- o Elements of Image Interpretation
- o Interpretation Exercise

B R E A K

- o Continue Interpretation Exercise

1:30 P.M. Satellite Overview: Ambroziak Color Coordinate System (ACCS)

Chair: Gary Johnson
Resource Persons:
Russ Ambroziak
Virginia Thompson
Albert van Dijk

- o The ACCS
- o Interpretation of ACCS Images
- o Display of ACCS on IBM PC

6:00 P.M. Dinner: Pot Luck Party - Judy Trujillo Residence

DAY 9 - MARCH 21, 1986 (FRIDAY)

8:30 A.M./ 1:30 P.M. Hands-On Experience Viewing and Producing Imagery Copy from IBM PC

Chair: Gary Johnson
Resource Person:
Virginia Thompson

Completion of Resource Manual for Assessment

Chair: Judy Trujillo

Completion of Crop and Climate Data Sets in Computers

Chair: Chris Hord
Resource Person:
Sue Callis

MARCH 22, 1986 (SATURDAY)

TOUR OF USDA/ARS WATERSHED
ST. LOUIS, MISSOURI

159

Jour 10 - 24 mars Lundi

8:30 A.M. Les Concepts de Statistiques — Chair: Sharon LeDuc

- o Utilisation des données météorologiques et climatiques
- o Suppositions des prédicitons climatologiques
- o Les séries climatologiques
- o Règlement des séries climatologiques
- o Distribution empirique
- o Distribution théoretique - gamma, normale

Exercice: Distribution Empirique

1:30 P.M. Discussion de Raport de Stage (Parties A et B) — Chair: Clarence Sakamoto

Jour 11 - 25 mars Mardi

8:30 A.M. Les Concepts Statistiques: Corrélation — Chair: Sharon LeDuc

- o Diagrammes dispersés
- o Triangle de corrélation

Exercice: Corrélation

PAUSE

Comment on choisit le modèle de rendement — Chair: Sue Callis

1:30 P.M. Discussion du Rapport de Stage (Partie D) — Chair: Sharon LeDuc

Jour 12 - 26 mars Mercredi

8:30 A.M. Concept Statistique: Analyse de Régression — Chair: Sharon LeDuc; Resource Person: Rao Achutuni

- o Matrice de dessein pour les régressions
  - Variables de 'dummy
  - Variables linèaires
  - Covariance

PAUSE

- o Exercice

1:30 P.M. Exercise - Analyse de Regression à VAX 11/730 — Chair: Sharon LeDuc; Resource Person: Mike Benzinger

DAY 10 - MARCH 24, 1986 (MONDAY)

8:30 A.M. Statistical Concepts: Overview — Chair: Sharon LeDuc

- o Use of Weather and Climate Data
- o Assumptions for Climatological Predictions
- o Climatological Series
- o Adjustment of Climatological Means
- o Empirical Distributions
- o Theoretical Distribution: Normal, Gamma

Exercises: Empirical Distribution (Percentile Rank)

1:30 P.M. Discussion of Training Report (Sections A and B) — Chair: Clarence Sakamoto

DAY 11 - MARCH 25, 1986 (TUESDAY)

8:30 A.M. Statistical Concepts: Correlation — Chair: Sharon LeDuc

- o Scatter Diagram
- o Correlation Triangle

Exercise: Correlation

B R E A K

Factors Affecting Crop Yield Model Selection — Chair: Sue Callis

1:30 P.M. Discussion of Training Report (Section D) — Chair: Sharon LeDuc

DAY 12 - MARCH 26, 1986 (WEDNESDAY)

8:30 A.M. Statiscical Concept: Regression Analysis — Chair: Sharon LeDuc; Resource Person: Rao Achutuni

- o Design Matrix for Regression
  - Dummy variables
  - Linear variables
  - Covariance

B R E A K

- o Exercise

1:30 P.M. Exercise: Regression Analysis on VAX 11/730 — Chair: Sharon LeDuc; Resource Person: Mike Benzinger

Jour 13 - 27 mars Jeudi

8:30 A.M. Indice de Biomasse Verte — Chair: Albert van Dijk

Rationale
Calcule de NVI
Series Chronologique de NVI

PAUSE

Lissement des Données
Interprétation des Données

1:30 P.M. Exercice de NVI — Chair: Albert van Dijk

Jour 14 - 28 mars Vendredi

8:30 A.M. Développment de NVI et le Rendement — Chair: Albert van Dijk

Procédés
Exercice

PAUSE

Développement de NVI pour L'Evaluation de Parcours — Chair: Albert van Dijk

Procédés
Développement de NVI
Exercice

1:30 P.M. Exercise: Imagerie du Pays et Séries Chronologiques de NVI — Chair: Albert van Dijk
Resource Persons:
Gary Johnson
Virginia Thompson

DAY 13 - MARCH 27, 1986 (THURSDAY)

8:30 A.M. Satellite Overview: Normalized Vegetation Index — Chair: Albert van Dijk

- o Rationale of Vegetation Index
- o Calculation of NVI
- o NVI Time-Series

B R E A K

- o Smoothing NVI Data
- o Interpretation of NVI Data

1:30 P.M. Satellite Overview: Exercise on NVI — Chair: Albert van Dijk

DAY 14 - MARCH 28, 1985 (FRIDAY)

8:30 A.M. Satellite Overview: Development of NVI and Crop Yield — Chair: Albert van Dijk

- o Procedures
- o Exercise

B R E A K

Satellite Overview: Development of NVI for Rangeland Assessment — Chair: Albert van Dijk

- o Procedures
- o Development of NVI for Rangeland Assessment
- o Exercise

1:30 P.M. Exercise: Country Imagery and NVI Time-Series — Chair: Albert van Dijk
Resource Persons:
[illegible]ary Johnson
V[illegible]rginia Thompson

163

Jour 15 - 31 mars Lundi

8:30 A.M.	Construction d'un Modèle Statistique de Culture	Chair: Sharon LeDuc Resource Persons: Rao Achutuni Mike Benzinger AGRHYMET
1:30 P.M.	Exercice de VAX 11/730 et IBM/PC	

Jour 16 Premier Avril Mardi

8:30 A.M.	Construction d'un Modèle Statistique (Continuation)	Chair: Sharon LeDuc Resource Persons: Rao Achutuni Mike Benzinger AGRHYMET
1:30 P.M.	Exercice de VAX 11/730 et IBM PC	

Jour 17 - 2 Avril Mercredi

8:30 A.M. Les indices des conditions agroclimatiques

Chair: Rao Achutuni
Resource Person:
AGRHYMET

Rationale
Indice du Bilan Hydrique
Analyse Spatiale
Analyse Temporelle

PAUSE

Le Bon sens et l'Absurdité en Modèlant les cultures

Chair: Clarence Sakamoto
Resource Person:
Sharon LeDuc

1:30 P.M. Exercice - calcule, analyse de traceur et interprétation de l'indice du Bilan Hydrique à IBM PC/VAX

Chair: AGRHYMET
Resource Person:
Sharon LeDuc

- o Evaluation de l'indice pour 1985
- o Analyse spatiale
- o Analyse temporelle
- o SUIVI

DAY 15 - MARCH 31, 1986 (MONDAY)

8:30 A.M.	Exercise: Building a Statistical Crop Model	Chair: Sharon LeDuc Resource Persons: Rao Achutuni Mike Benzinger AGRHYMET
1:30 P.M.	Exercise with Use of VAX 11/730; IBM PC	

DAY 16 - APRIL 1, 1986 (TUESDAY)

8:30 A.M.	Building a Statistical Crop Model (Continued)	Chair: Sharon LeDuc Resource Persons: Rao Achutuni Mike Benzinger AGRHYMET
1:30 P.M.	Exercise with Use of VAX 11/730; IBM PC	

DAY 17 - APRIL 2, 1986 (WEDNESDAY)

8:30 A.M. Agroclimate Crop Condition Indices

Chair: Rao Achutuni
Resource Person:
AGRHYMET

- o Rationale for Indices
- o Water Balance Index (FAO)
- o Spatial Analysis
- o Temporal Analysis

BREAK

Sense and Non-sense in Crop Modeling

Chair: Clarence Sakamoto
Resource Person:
Sharon LeDuc

1:30 P.M. Exercise: Calculating, Plotting Analysis and Interpretation of Water Balance on the IBM PC/VAX

Chair: AGRHYMET
Resource Person:
Sharon LeDuc

- o Evaluation of Index for 1985
- o Spatial Analysis
- o Temporal Analysis
- o SUIVI

165

Jour 18 - 3 Avril Jeudi

8:30 A.M. Utilité des Données Supplimentaires dans les Evaluations — Chair: Rao Achutuni; Resource Person: Rita Terry

les Données Episodiques
- la sécheresse
- l'inondation
- la maladie
- Autres

Utilisation des Données

PAUSE

10:30 A.M. Evaluation des conditions culturales — Chair: Rao Achutuni

Objectif
Identification des utilisateurs et leurs besoins
Fréquence
Présentation

1:30 P.M. Intégration des Données et l'Information pour les Evaluations: Etude de Soudan 1985 — Chair: Rao Achutuni; Resource Person: Staff AGRHYMET

Analyse Pluviométrique
Indice de FAO
Résultats des Modèles Culturals
Imagerie de Satellite
Tracement de NVI
Information de Calendrier Cultural
Analyse des Données Supplementaires

Jour 19 - 4 Avril Vendredi

8:30 A.M. Les strategies pour mettre en place Evaluations Operationalles d'Alerte Precoce dans le Sahel — Chair: J.L.Domergue, C. Sakamoto

PAUSE

11:00 A.M. Critique du Course

1:30 P.M. Etude de Soudan (cont.)
Exercise: Ecrire une évaluation — Chair: Rao Achutuni

DAY 18 - APRIL 3, 1986 (THURSDAY)

8:30 A.M. Utility of Ancillary Data in Assessment — Chair: Rao Achutuni; Resource Person: Rita Terry

- o Episodic Event Data Base
  - Drought
  - Floods
  - Pests and Disease
  - Others
- o How to Use these Data

B R E A K

Crop Condition Assessment Reports — Chair: Rao Achutuni

- o Purpose
- o Identifying Users and User Needs
- o Frequency
- o Format

1:30 P.M. Integrating Data and Information for Assessment: 1985 Case Study of Sudan — Chair: Rao Achutuni; Resource Persons: Staff AGRHYMET

- o Rainfall Analysis
- o FAO Index
- o Crop Model Results
- o Satellite Imagery
- o NVI Plots
- o Crop Calendar Information
- o Ancillary Data Analysis

DAY 19 - APRIL 4, 1986 (FRIDAY)

8:30 A.M. Strategies for Implementing Operational Early Warning Assessment in the Sahel — Chair: J. L. Domergue; C. Sakamoto

B R E A K

11:00 A.M. Critique of Course

1:30 P.M. 1985 Case Study of Sudan (Con't.)

Exercise: Writing Assessment — Chair: Rao Achutuni

167

Jour 20 à 23 - 7 à 10 Avril
(Lundi, Mardi, Mercredi, Jeudi)

8:30 A.M. à 4:30 P.M. Exercice d'Evaluation des Pays Chair: Gary Johnson
Rao Achutuni

6:00 P.M. 10 Avril, Jeudi
Diner - Malachi's Restaurant, Stadium Blvd.

Jour 24 - 11 Avril Vendredi

8:30 A.M. Critique de Cours Chair: Clarence Sakamoto

Discussion

8:30 A.M./1:30 P.M. Exercice d'Evaluation Chair: Gary Johnson
Resource Persons: Staff

DAYS 20 to 23 - APRIL 7-10, 1986
(MONDAY, TUESDAY, WEDNESDAY, THURSDAY)

8:30-4:30	Individual Country Assessment Exercise	Chair: Gary Johnson Rao Achutuni
6:00 P.M.	Dinner and Awards April 10, Thursday Location: Malachi's Restaurant, Stadium Blvd. Social Hour: 6:00 P.M. - Dinner: 7:00 P.M.	

DAY 24 - APRIL 11, 1986 (FRIDAY)

8:30 A.M.	Critique of Course Follow-Up Discussions	Chair: Clarence Sakamoto
8:30 A.M./ 1:30 P.M.	Individual Country Assessment Exercise Final Report (See attached Trainee Report and Assessment Plan)	Chair: Gary Johnson Resource Persons: Staff

Horaire des Activites à Washington D.C.

Jour 25 - 14 Avril Lundi

8:30 A.M.	Introduction - Remarques par Joan C. Hock, Directrice, AISC	Chair: Russ Ambroziak Troducteur: Jean-Louis Domergue
	PAUSE	
10:30 A.M.	Estimation de la précipitation au Sahel	Chair: Doug LeComte Troducteur: Jean-Louis Domergue
12-1	Déjeuner	
1-3 P.M.	Exercice de'Estimation des Nuages	Chair: Doug LeComte Troducteurs: Larason Lambert, Jean-Louis Domergue
	PAUSE	
3:30 P.M.	Les Evaluations Préparation Mettre au courant les Procédés de Communications	Chair: Doug LeComte Resource Person: Jake Robinson Troducteur: Jean-Louis Domergue

Jour 26 - 15 Avril Mardi

9:00 A.M.	Les réunions informalles, Réunion des participants du cours de Sahel	Chair: Jean-Louis Domergue
	Déjeuner	
1:00 P.M.	Seminaire d'AID par les participants	Chair: Louis Steyaert Troducteur: Sandy Weisman, Jean-Louis Domergue

Jour 27 - 16 Avril Mercredi

9:00 A.M.	Visite à World Weather Building	Chair: Doug LeComte

Jours 28 et 29 - 17, 18 Avril Jeudi et Vendredi

Temps Libre

Jour 30 - 19 Avril Samedi = Départ

SCHEDULE OF ACTIVITIES IN WASHINGTON, D.C.

PAGE BUILDING #2
3300 WHITEHAVEN AVENUE, N.W.
WASHINGTON, D.C.

DAY 25, APRIL 14 (MONDAY)

9:00-10:00 A.M.	Introduction: Remarks by Joan C. Hock, Director, AISC	Chair: Russ Ambroziak Translator: Jean-Louis Domergue
	B R E A K	
10:30 A.M.	Estimating Precipitation in the Sahel	Chair: Doug LeComte Translator: Jean-Louis Domergue
12-1 P.M.	L U N C H	
1:00-3:00 P.M.	Cloud Estimate Exercise	Chair: Doug LeComte Translators: Larason Lambert, Jean-Louis Domergue
	B R E A K	
3:30 P.M.	Assessment Reports o Preparation and Mailing o Updating Communication Procedures	Chair: Doug LeComte Resource Person: Jake Robinson Translator: Jean-Louis Domergue

DAY 26, APRIL 15 (TUESDAY)

9:00 A.M.	Informal Meetings; Sahel Course Participants Meeting	Chair: Jean-Louis Domergue
	L U N C H	
1:00 P.M.	AID Seminar by Participants - Wrap Up at State Department (21st St. Entrance)	Chair: Lou Steyaert Translators: Sandy Weisman, Jean-Louis Domergue

DAY 27, APRIL 16 (WEDNESDAY)

9:00 A.M.	Visit to World Weather Building	Chair: Doug LeComte

DAY 28-29, APRIL 17-18 (THURSDAY & FRIDAY)

Tour of City - Free Time

DAY 30, APRIL 19, (SATURDAY) = DEPART FOR HOME - BON VOYAGE!

171

Le Rapport des Stageaires et le Plan d'Evaluation

Gary E. Johnson

mardi, le 8 avril 1986 - 08:30 - 16:30
mercredi, le 9 avril 1986 - 08:30 - 16:30
jeudi, le 10 avril 1986 - 08:30 - 16:30

Ce cours professionel va conclure avec la préparation d'un évaluation agroclimatique de la saison agricole de 1985. Les stageaires de chaque pays se rencontront en équipe et s'appliqueront leurs talents à la préparation d'un évaluation agroclimatique pour 1985.

Il y a trois jours désignés à cette activité, avec un jour en plus pour le rapportage des résultats d'évaluation à l'équipe du Bureau de Modéle et à vos collègues. Il n'y a que un tout petit peu de temps pour cette activité; donc il est très important qu'on commence la préparation de rapport au début de stage.

En plus que les techniques appris, les stageaires auront à leur disponibilité, les manuels de ressources, les données qu'ils ont apporté, les données archivées par le Centre de Service d'Evaluation et de l'Information et les services techniques et sténographiques du Bureau.

On peut organiser le rapport comme suivant:

COUVERTURE (dessiné par le Bureau)

PREFACE (écrit par le Bureau)

REMERCIEMENTS (fournit par les stageaires)

LISTE DES TABLES

LISTE DES ILLUSTRATION

I. Introduction (écrit par le Bureau)

Objectifs du stage

Etendue

II. Les Techniques d'Evaluations (écrit par les stageaires)

A. Agroclimat

1. Pluviométrie

2. Modéles d'indices des conditions culturales

B. Satéllite

1. Satéllite de NOAA

2. Images ACCS

TRAINEE REPORT AND ASSESSMENT PLAN

Gary E. Johnson

This Professional Course will conclude with the preparation of a climatic impact assessment of crop and rangeland conditions for the 1985 cropping season. Participants from each country attending the course will form a team and apply their skills to the preparation of a 1985 agroclimatic assessment of their country.

Three days are scheduled for this activity, with an additional day devoted to the reporting of assessment results to the Models Branch staff and Professional Course colleagues. With a minimal amount of time devoted specifically to this activity, it is imperative that course participants begin to plan for the preparation of this report early in the training.

In addition to the knowledge gained in the course, participants will have available to them Resource Manuals which have been prepared for their use; data which they have brought with them; data archived by the Assessment and Information Services Center; and some technical and secretarial services of the Models Branch.

A suggested outline for the concluding training report follows:

COVER (designed by Models Branch, in French and English)

PREFACE (to be written by Models Branch)

ACKNOWLEDGEMENTS (provided by trainees)

LIST OF TABLES

LIST OF ILLUSTRATIONS

I. Introduction (to be written by Models Branch)

Purpose of Training Course
Scope
Objectives

II. Assessment Techniques (written by trainees based upon lecture material)

A. Agroclimate

1. Precipitation Data
2. Crop Conditions Index Models

B. Satellite

1. The NOAA Satellite
2. ACCS Images
3. Normalized Vegetation Index
   a. Time-Series
   b. Spatial Analysis
   c. NVI Biomass/Rangeland Models

173

3. Indice de Biomasse Verte

a. Temps Chronologique

b. Analyse Spatiale

c. NVI Modèle de Biomasse/Parcours

C. Système d'Information Géographique Pour Déscriptions des Conditions et l'Analyse des Cultures/Parcours

1. Analyse de Biomasse/Précipitation

2. Combinaison des Eléments d'Evaluations Agroclimatiques

D. Techniques de Prédicton les Rendements

1. Analyse des Statistiques Agricoles

2. Analyse du Modèle Statistique de Pluviométrie/Rendements

3. Analyse du Modèle Statistique de NVI/Rendement

4. Evaluation des Rendements

III. Evaluation par Pays (écrit par les stageaires; avec la soutenance des cartes, graphes et images fabriqués pendant le stage)

A. Introduction

B. Résumé d'évaluation pour 1985

C. Végétation de Parcours - 1985

D. Conditions Culturales - 1985

E. Analyse de Climat - 1985

IV. Appendices

A. Statistiques des Cultures

B. Statistiques Météorologiques

C. Autres par Références

REFERENCES

APPENDIX E

12 June 1986

PRELIMINARY EVALUATION OF NOAA/NESDIS/AISC SAHEL AND HORN YIELD FORECASTS FOR 1985 BASED ON AISC's SPECIAL CLIMATE IMPACT ASSESSMENTS

These yield forecasts were provided as part of the NOAA/NESDIS Special Climatic Impact Assessment Program for the Sahel/Horn countries of Africa. This program is being conducted by the NOAA/NESDIS Assessment and Information Services Center with support from the U.S. Agency for International Development and includes monthly crop/rangeland condition assessment reports, cereal crop yield forecasts, and in-country technical assistance and training programs.

NOAA provided yield forecasts for millet and sorghum for eight countries in the Sahel and Horn of Africa during the 1985 growing season. Forecasts were provided for the administrative regions in Sudan, Senegal, Mali, Burkina Faso, Niger and Chad. National level forecasts were provided for Mauritania and the Gambia. These estimates were delivered by cable to the USAID Missions. The first forecast was provided to each country on September 10, with an update cable on October 11. The cables in English were followed by cables in French. The yield forecasts are compared to official estimates from the respective countries.

The crop situation in the Sahel and Horn countries of Africa during 1985 was much better this year than in preceding years. The need to determine early indications of food shortages was critical, but not as desperate as in the preceding years. However, the quantitative assessments were useful in several countries. Most of the feedback on the use of these assessments was verbal. A preliminary comparison is made between NOAA yield forecasts and subsequent official reports from the countries of Senegal, Niger, Mali, Chad and Sudan.

176

SUDAN

The September 10 and October 17 forecasts were based entirely on satellite data, because Sudanese meteorological observations were not being transmitted during the summer. Satellite data were used to estimate rainfall amounts and vegetation conditions, and the information was used as input for the NOAA crop yield forecast models for rainfed crops. NOAA yield forecasts reflect only weather impacts; non-meteorological factors (e.g., seed availability, insect and disease damage, migration) are not considered. Traditional farming methods are used in Sudan except for the sorghum in Kassala and in Blue, White and Upper Nile.

The NOAA January 1986 update was a special report based on post-analysis of Sudanese rainfall data provided by the Sudan Meteorological Department during the NOAA TDY of November 1985. Satellite vegetation data were revised. The only major changes from earlier estimates (more than .10 mt/ha) were in Kassala, where the yield forecast for sorghum was increased to .90 mt/ha from 0.65 mt/ha, and Gezira, which was lowered to .45 mt/ha from .60 mt/ha.

The final column provides yield estimates based on Government of Sudan data issued on December 19, 1985. In several cases, yields for individual provinces were not published, so yields for combined provinces were apportioned to individual provinces according to historical relationships.

The average yields for the base period 1979-83 are presented to provide a frame of reference along with the 1984 yield. Severe drought caused yields and production to decline sharply during 1984. The NOAA yield forecasts and Sudan yield estimates for 1985 are substantially increased over those for 1984.

The data presented in the tables indicate that 1985 yields were high in eastern Sudan, especially in such important sorghum-producing areas as Blue Nile and Kassala provinces. Yields were mostly 20 to 30 percent above the base period in eastern Sudan. In the west, in Kordofan and Darfur, 1985 yields were closer to the 5-year mean. Throughout the cereal-producing region, 1985 yields were substantially higher than in 1984.

Wide variation of yields exist within the province, forecast yield is the average for the entire province. Within North Darfur, for example, where both Sudan Government and NOAA millet yields equal .35 mt/ha, actual yields likely range from .45 or higher in several wetter areas in the west to nil in dry pockets near El Fasher to the east. Similarly in North Kordofan, where overall millet yields average near .25, growing-season rainfall under 250 mm resulted in virtual crop failure in many northern marginal growing areas.

Conditions in irrigated areas, which are not included within NOAA yield estimates were favorable as abundant summer rains fell in the Nile Basin. Irrigated sorghum comprises about 10 percent of Sudan's cereal production.

Sudan Preliminary Yield Evaluation: 1985

NOAA/AISC Forecast vs. Official Estimate

Millet (metric tons/hectare, hectare = 2.38 feddans)

Province	1979-83 Avg.	Sudan 1984	NOAA Sept. 1985 Fcst.	NOAA Oct. 1985 Fcst.	NOAA Jan. 1986 Fcst.	Sudan Est. 1985
N. Darfur	.32	.09	.35	.35	.35	.35
N. Kordofan	.24	.03	.30	.30	.25	.24
S. Darfur	.44	.19	.45	.50	.45	.33
S. Korodfan	.46	.19	.55	.50	.50	.48
S. Region	.39	.33	.45	.55	.50	.40
Gezira	.46	.04	NA	.60	.45	.43
White Nile	.45	.16	.50	.50	.50	.47
Blue Nile	.39	.19	.50	.50	.50	.40

Sorghum (Metric tons/hectare, hectare = 2.38 feddans)

Gezira	.59	.14	NA	.75	.75	.67
Blue Nile	.68	.26	.90	.85	.85	.87
Kassala	.70	.19	.60	.65	.90	.84
N. Darfur	.31	.05	.40	.40	.40	.44
N. Kordofan	.35	.06	.35	.35	.35	.26
S. Darfur	.54	.32	.50	.55	.55	.57
S. Kordofan	.59	.21	.70	.70	.65	.62
S. Region	.45	.32	.45	.50	.45	.43
White Nile	.54	.19	.55	.65	.65	.57
Upper Nile	.76	.22	NA	.80	.80	.86

NIGER

Niger's October yield estimates compared very well with the yield forecasts of NOAA. The greatest discrepancy between the Niger estimates and NOAA's forecast was for sorghum in Niamey. For October millet in Niamey the discrepancy was the other direction.

Niger Preliminary Yield Evaluation: 1985

NOAA/AISC Forecast vs. Official Estimate

Millet/Sorghum (Metric tons per hectare)

Department	1980-84 Avg.	Niger 1984	NOAA Sept. Fcst.	NOAA Oct. Fcst.	Niger Oct. Est.	Niger Mar. 86 Est.
Millet						
Niamey	.36	.24	.30	.35	.42	.44
Dosso	.39	.27	.40	.40	.44	.45
Tahoua	.41	.23	.30	.35	.40	.45
Maradi	.41	.27	.45	.45	.44	.48
Zinder	.43	.28	.45	.45	.45	.48
Diffa	.29	.02	.40	.30	.32	.48
Sorghum						
Niamey	.47	.33	.40	.45	.33	.34
Dosso	.39	.34	.40	.40	.40	.44
Tahoua	.49	.35	.40	.45	.46	.37
Maradi	.20	.15	.25	.25	.21	.20
Zinder	.28	.16	.30	.35	.29	.30
Diffa	.85	.01	.85	.70	.64	.00

MALI

USAID/Mali in January 1986 provided NOAA with preliminary yield estimates for the 1985 growing season. The agriculture statistics for administrative regions were aggregated from the agricultural statistics for operations within the country. Boundaries of operations do not coincide with political divisions. The agricultural statistics from Mali for previous years are for combined millet and sorghum. There is one known discrepancy in the statistics reported in the following. One of the operations, OPSS, is included in the Koulikoro region in NOAA's forecast while OPSS is included in the Segou region in the preliminary estimates from Mali. Fortunately, the area planted to millet and sorghum in OPSS is very small. The estimates of millet and sorghum from Mali were combined to provide a yield for millet and sorghum together.

The biggest difference is for the region of Mopti where NOAA's forecast is low compared to Mali's estimate. Conditions were still improving in mid-September when last input was obtained for NOAA's yield forecast. A later analysis with data through mid-Ocotber would have helped in this type of situation.

Mali Preliminary Yield Evaluation: 1985

NOAA/AISC Forecast vs. Official Estimate

Millet/Sorghum (Metric tons per hectare)

Region	1980-84 Avg.	Mali 1984	NOAA Sept. Fcst.	NOAA Oct. Fcst.	Oct. Mali Est.	Mar. 86 Mali Est.
Kayes	.52	.63	.70	.70	.51	.68
Koulikoro	.56	.57	.60	.65	.72	.76
Sikasso	.69	.69	.80	.80	.75	.98
Segou	.33	.36	.35	.40	.43	.50
Mopti	.42	.21	.40	.45	.69	.42

CHAD

The yield estimates from Chad were obtained during the October TDY. Large discrepancies for millet and sorghum yield existed for Tandjile where NOAA's forecast was much lower than the estimate from Chad. NOAA's forecast of sorghum yield in Chari-Baguirmi was also considerably below the government estimate.

Chad Preliminary Yield Evaluation: 1985

NOAA/AISC Forecast vs. Official Estimate

Millet/Sorghum (Metric tons per hectare)

Department	1981-83 Avg.	FAO 1983-4	Chad 1983	NOAA Sept. Fcst.	NOAA Oct. Fcst.	Chad Oct Est.
Millet						
Batha		.25	.07	.30	.30	.30
Chari-Baguirmi		.40	.19	.35	.45	.50
Guera		.52	.40	.60	.60	.49
Kanem		.11	.02	.10	.20	.30
Logone Occidental	.57		.50	.60	.60	.70
Logone Oriental	.63		.66	.70	.70	.70
Mayokhebbi	.54		.54	.60	.60	.70
Moyen Chari	.63		.65	.70	.70	.70
Salamat		.43	.44	.50	.45	.50
Tandjile	.50		.45	.50	.45	.70
Sorghum						
Batha		.29	.48	.35	.35	.35
Chari-Baguirmi		.17	.11	.15	.30	.55
Guera		.43	.40	.45	.55	.52
Logone Occidental	.59		.54	.65	.65	.70
Logone Oriental	.75		.74	.80	.80	.70
Mayo Khebbi	.61		.55	.65	.65	.70
Moyen Chari	.64		.55	.70	.70	.70
Salamat		.20	.24	.25	.25	.25
Tandjile	.50		.50	.60	.55	.70

SENEGAL

In Senegal, the NOAA yield forecasts were examined closely at USAID/Dakar. They were compared to the October estimates of the government of Senegal. the purpose was to determine the best estimate of national production for input to the trade balance sheet. NOAA's forecasts were being examined by USAID at the time of NOAA's October visit.

The forecasts of millet and sorghum provided by NOAA were not as high as the preliminary estimates from the government of Senegal and raised some flags that the government estimates may have been overly optimistic. This was documented in a December 4, 1985 cable from Dakar regarding the 1985/86 Crop Report. An additional need for the NOAA's independent forecast this year was the fact that the methods used this year by the government for arriving at the estimates were different than previous years.

NOAA forecasts of yields were lower than government estimates except in Sine-Saloum and Casamance. All estimates and forecasts were above the five-year average and except for Casamance above the 1984 yield.

Senegal Preliminary Yield Evaluation: 1985

NOAA/AISC Forecast vs. Official Estimate

Millet/Sorghum (Metric Tons per Hectare)

Regions	1980-84 Avg.	Senegal 1984	NOAA Sept. Fcst.	NOAA Oct. Fcst.	Senegal Oct. Fst.
Cap-Vert	.54	.08	.55	.55	.70
Casamance	.81	1.04	.85	.85	.85
Diourbel	.42	.38	.50	.55	.75
Fleuve	.33	.30	.35	.30	.57
Louga	.27	.03	.35	.35	.58
Oriental	.65	.57	.60	.70	.80
Sine-Saloum	.61	.59	.75	.70	.64
Thies	.52	.40	.70	.60	.79

BURKINA FASO

The yield estimates for Burkina Faso were provided by the participants in the U.S. training course.

Burkina Faso Preliminary Yield Evaluation: 1985

NOAA/AISC Forecast vs. Official Estimate

Millet/Sorghum (Metric Tons per Hectare)

Sorghum

Regions	1980-83 Avg.	B.F. 1983	NOAA Sept. Fcst.	NOAA Oct. Fcst.	NOAA Dec. Fcst.	B.F. Mar. Est.
Bougou Riba	.60	.56	.65	.65		.78
Centre	.52	.49	.60	.60		.83
Centre Est	.53	.74	.55	.55		.78
Centre Nord	.41	.31	.35	.40		.52
Centre Quest	.49	.54	.60	.60		.69
Comoe	.71	.50	.75	.75		1.05
Est	.58	.58	.70	.70		.79
Hauts Bassins	1.12	1.08	1.20	1.20		1.03
Sahel	.02	.25	.25	.30	.32	.47
Volta Noire	.78	.78	.85	.85		.85
Yatenga	.42	.40	.45	.45	.40	.61

Millet

Bougou Riba	.48	.38	.55	.55		.66
Centre	.48	.43	.50	.50		.73
Centre Est	.48	.53	.55	.55		.64
Centre Nord	.43	.38	.40	.45		.53
Centre Quest	.46	.45	.50	.50		.62
Comoe	.62	.49	.65	.65		.98
Est	.51	.60	.60	.60		.71
Hauts Bassins	.75	.70	.85	.80		.72
Sahel	.26	.17	.20	.25	.28	.29
Volta Noire	.67	.66	.70	.70		.70
Yatenga	.39	.31	.45	.45	.35	.46

APPENDIX F

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

MEMORANDUM

April 18, 1986

TO: AFR/TR, Donald Reilly

FROM: AFR/TR, Richard Suttor

SUBJECT: Recent Field Comments on NOAA Climate Impact Assessments

On March 28 a telegram was sent to all USAID missions in Africa soliciting comments on the NOAA climate impact assessments. To date, I have found responses from eight countries. There may be other responses that have eluded me or that will arrive later. In any event, the following is my interpretation of the eight responses now available.

The telegrams are generally favorable in their approval of the NOAA products. This seems to be consistent with the telegrams received last year.

The telegram from Zimbabwe describes what appears to be a very effective national reporting system. Similarly, the Botswana telegram refers to "excellent work by local agrometeorology department." These comments, plus the lack of response from neighboring countries, indicate that there is not much demand for U.S. based climate impact assessments of southern Africa.

In contrast, the NOAA reports are highly prized in countries where information is very scarce. The Mission in Ethiopia "found the NOAA reports to be extremely valuable as a monitoring device in the implementation of the drought emergency program." In Chad, "the periodic special telegram reports were on the leading edge of providing the most up to date climate information" and "the host country meteorological service was very appreciative of the reports."

In countries with better, although far from adequate information systems, NOAA also received some high marks. The Sudan Mission reports that "the upgraded special climate impact assessment reports which were air expressed to the Mission were particularly useful and in retrospect seemed to provide an accurate appraisal of the situation." The AID office in the Gambia "finds that NOAA climatic impact assessments have a high degree of accuracy, are timely, and are accepted by GOTG."

Several countries offered suggestions for improving the service. A mundane but important point is the need to get

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185

information to the right people faster; improvement on this score will require continuing attention. Other points may be amenable to research and development in the next few years.

1. Ethiopia suggests that NOAA reports distinguish among highland, mid-altitude and lowland areas. To do this might require development of new techniques to distinguish micro-climates, and an obvious question is whether it is worth the cost. Burundi recommends development of "productivity norms or indicators relative to climatic rather than politically defined regions," but apparently is thinking in terms of larger "macro" climate areas.

2. Mauritania suggests more work on the development of "normal" benchmarks for rainfall. The 1981-83 period now used is thought to be an unusually dry period.

3. Related to the previous points are suggestions for incorporating more variables into a more broadly defined model of agriculture. Mauritania suggests including plant diseases and pest infestation variables. SUdan would like to integrate the analysis of ongoing field production survey data with meteorological data. Such modeling efforts would require advancement in the state-of-the-art which might pay off in the long term.

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186

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C. 20523

APR 11 5 04

OFDA

MEMORANDUM

April 9, 1986

TO: AFR/TR, Donald Reilly

FROM: AFR/TR, Richard Suttor Richard E. Suttor

SUBJECT: Earlier Comments on Usefulness of NOAA Climate Impact Assessments

I reviewed a rather large number of 1984 and 1985 telegrams from NOAA's files in search of mission comments on the NOAA products. Seven missions (Burkina Faso, Chad, Ethiopia, Mali, Mauritania, Senegal and Sudan) commented specifically on the products. Several other missions commented on a NOAA proposal but not on the outputs of the ongoing project.

All seven of the missions found the NOAA products to be useful. At least two missions used the NOAA data in determining food aid needs. It appears that several missions use the NOAA reports in conjunction with other sources of information to assess crop conditions in their countries. These missions seem to have had both the need and the capability to search out various sources of information, analyze data and come up with their own conclusions on crop conditions and food aid needs. They seem to be the major clients for NOAA's services. Other missions that do not perceive the need or lack the analytical capability probably will not effectively use this or related information.

It is difficult to determine from the telegrams precisely which aspects of the NOAA reports are most useful. Chad was impressed with the "cables on weather conditions and rainfall." Ethiopia commended the reporting on weather conditions and yield estimates. Mali found the vegetative index and the graphical presentation of data particularly praiseworthy.

Following are quotes extracted from telegrams from the seven missions.

Burkina Faso

We have found NOAA climate impact assessments to be very useful for interpreting local rainfall data and field reports into appropriate responses on the part of the U.S. Government to allay stress of local populations caused by extreme weather conditions (Ougadougou 04251, dated 9 July 1985).

197

Chad

Concerning monitoring, USAID/Chad has been impressed with the accuracy of the NOAA cables on weather conditions and rainfall. The NOAA project, the ten day reports of AGRHYMET and the National Weather Service, and field trips and consultations of USAID staff with GOC technical ministries provide the best means for monitoring development of crop season (Ndjamena 4441, dated 7 August 1985).

Ethiopia

AID/Addis wants to commend NOAA/AISC for the fine reporting they have been doing on farm weather conditions in Ethiopia via the special climate impact assessments, and for their timely estimates of climate effects on yield, provided in reftel. NOAA work has been very useful in assisting AID/Addis food need assessment for 1986 (Addis Ababa 05332, dated 9 September 1985).

Mali

USAID/Bamako finds NOAA impact assessments useful each month as confirmation of general field level information and analysis (Bamako 6658, dated 1 November 1984).

Your note and report of December 10, 1984 concerning Mali was highly appreciated. It was important to the USAID mission as it gives empirical satellite confirmation of much evidence coming to light here. It also gave excellent graphic portrayals of statistical information that is very meaningful for general managers (Bamako 0079, dated 4 January 1985).

In December last year we received one report from NOAA which included a vegetative index, moisture index and graphics. The report was greatly appreciated and was of considerable aid in our drought calculations for Mali. This year it is essential that we receive such reports at least on a monthly basis and as quickly as possible, particularly the vegetative index. Such information on a timely basis is necessary, indeed critical, to our planning (Bamako 3947, dated 25 June 1985).

The mission found the NOAA reporting on moisture and vegetative indices, and especially the computer graphics to be the single most important set of objective indicators of the Malian situation. It confirmed the diverse and less systematic information we had been receiving through field reports by our staff, special studies of consultants, from TA personnel, missionaries, PVOs, Malian colleagues, et. al.; and led directly to a doubling in our request for food aid (Bamako 4392, dated 16 July 1985).

Mauritania

AISC assessment comments: Mission appreciated thoroughness of Mauritania climate impact assessment (Nouakchott 04155, dated 11 August 1985).

Senegal

Mission and GOS generally impressed with contents of initial AISC assessment (Dakar 08168, dated 2 August 1985).

Sudan

Above document [Special Climate Impact Assessment: Sudan Vol. 1, No. 2 (8/9/85)] extremely useful in drought/rehabilitation planning and in assuring that USAID/Sudan, GOS, other donors and AID/W are talking about the same data with regard to crop conditions (Khartoum 13908, dated 30 September 1985).

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Department of State

TELEGRAM

PAGE 01 STATE 097318
ORIGIN AID-00

9117 0:9866 [illegible]

ORIGIN OFFICE AFTR-05
INFO AFRA-03 AFFW-04 AFCW-03 STAG-02 STFN-02 SAST-[illegible] AGRI-01
NAS-01 COM-02 RELO-01 AFCA-01 /026 A1 729
INFO LOG-00 EUR-00 AF-00 /000 R

DRAFTED BY: AID/AFR/TR: DREILLY: MRN: 18290
APPROVED BY: AID/AFR/TR: DREILLY

P 282210Z MAR 86 ZEX ----------133105 282212Z /38
FM SECSTATE WASHDC
TO USAID MISSIONS IN AFRICA PRIORITY
AMEMBASSY PARIS PRIORITY
AMEMBASSY ROME PRIORITY

UNCLAS STATE 097318

AIDAC

REQUEST FOR COMMENTS

E.O. 12356: N/A
TAGS:
SUBJECT: NOAA SPECIAL CLIMATE IMPACT ASSESSMENTS

REF: STATE 196061 JUNE 1985

1. NOAA/NESDIS/AISC HAS PREPARED CLIMATE IMPACT ASSESSMENTS SINCE 1978. MONTHLY CABLES WITH WEEKLY UPDATES HAVE REPORTED ON DROUGHT SITUATIONS AND NOAA'S ANALYSES OF RAINFALL IMPACTS ON CROPS AND RANGELAND. BEGINNING IN THE 1985 CROP SEASON, NOAA USED DAILY METEOROLOGICAL SATELLITE DATA TO PREPARE UPGRADED SPECIAL CLIMATE IMPACT ASSESSMENT REPORTS WHICH WERE AIR EXPRESSED TO MISSIONS IN THE SAHEL, SUDAN, ETHIOPIA, AND SOMALIA. THESE REPORTS CONTAINED EXTENDED, MORE DETAILED NARRATIVE ANALYSES. IN ADDITION, NOAA ISSUED EARLY SEASON CROP FORECASTS BY ADMINISTRATIVE REGION FOR MOST OF THE AFOREMENTIONED COUNTRIES DURING SEPTEMBER/OCTOBER 1985.

2. OFDA HAS FUNDED THE NOAA CLIMATE IMPACT ASSESSMENTS SINCE THE INCEPTION OF THE PROJECT IN 1978. OFDA FUNDING WILL TERMINATE AT THE END OF FY86 AND AFRICA BUREAU WILL FUND THE FUTURE NOAA INPUTS TO CLIMATE ASSESSMENT ACTIVITIES.

3. IN ORDER TO REFINE THE FUTURE NOAA INPUTS, AN EVALUATION OF THE PAST NOAA ACTIVITIES IS BEING DEVELOPED WITH THE ASSISTANCE OF THE NATIONAL ACADEMY OF SCIENCES. VITAL TO A SUCCESSFUL EVALUATION ARE CANDID COMMENTS FROM THE FIELD ON THE TIMELINESS, CREDIBILITY AND USEFULNESS OF THE NOAA PRODUCTS. PLEASE SEND COMMENTS TO AFR/TR UNDER HEADING OF NOAA EVALUATION. FYI ALL COMMENTS RECEIVED EARLIER, INCLUDING RESPONSES TO REFTEL, ARE BEING TABULATED FOR EVALUATION TEAM USE. COMMENTS REQUESTED HEREIN WILL BE USED TO SUPPLEMENT EARLIER DATA AND SHOULD ENHANCE OR REVISE EARLIER COMMENTS AS NEEDED TO GIVE OBJECTIVE ASSESSMENT OF NOAA INPUTS.
WHITEHEAD

190

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Department of State

INCOMING TELEGRAM

PAGE 01 NDJAME 01817 0908302 0107 036803 AID6720
ACTION AID-00

ACTION OFFICE AFTR-05
INFO AAAF-02 AFFW-04 STEN-02 SAST-01 AFDA-02 STEN-01 COM-02
RELO-01 /020 A4 89

INFO LOG-00 EUR-00 AF-00 EB-08 .008 W
023430 0908542 /38

R 0906252 APR 86
FM AMEMBASSY NDJAMENA
TO SECSTATE WASHDC 2278
INFO AMEMBASSY PARIS
AMEMBASSY ROME

CHAD

UNCLAS NDJAMENA 1817

AIDAC

STATE PASS TO AF/C, AF/EPS AND EB
AID/W FOR AFR/TR

E.O. 12356: N/A
TAGS: EAGR, EAID, CD
SUBJ: NOAA SPECIAL CLIMATE INPUT ASSESSMENTS

REF: (A) STATE 97318 (B) 85 NDJAMENA 4066

1. NOTED IN REFTEL B, USAID/CHAD OPINES THAT THE CLIMATE IMPACT ASSESSMBDTS OF NOA
MADE A QUANTUM
ADVANCE THIS PAST SEASON FOR ACCURACY AND TIMELINESS. THE NOAA REPORTS IN PREVIOUS YEARS WERE USEFUL TO CORROBORATE OTHER HOST COUNTRY GENERATED CLIMATE DATA. HOWEVER, THIS PAST YEAR THE PERIODIC SPECIAL TELEGRAM REPORTS WERE ON THE LEADING EDGE OF PROVIDING THE MOST UP TO DATE CLIMATE INFORMATION.

2. THE NEW, IN DEPTH MONTHLY ANALYSIS OF WEATHER AND CROP CONDITIONS WERE EXTREMELY USEFUL FOR SUMMARIZING CUMULATIVE WEATHER CONDITIONS AND COMPARING THEM TO PREVIOUS SEASONS THE HOST COUNTRY METEOROLOGICAL SERVICE WAS VERY APPRECIATIVE OF THE REPORTS. TIMELINESS OF THSE REPORTS, HOWEVER, NEEDS TO BE IMPROVED FOR MAXIMUM USEFULNESS AS EARLY WARNING ASSESSMENTS.

3. CONCERNING ACTUAL CROP YIELD ASSESSMENTS BY REGION AT LEAST ANOTHER AGRICULTURAL SEASON WILL BE REQUIRED BEFORE USAID/CHAD IS PREPARED TO OFFER AN OPINION, BUT IT DEFINITELY THINGS THIS PREDICTION EFFORT SHOULD CONTINUE. PART OF USAID'S PROBLEMS IN ASSESSING THE YIELD INFORMATION IS THE INCOMPATIBILITY BETWEEN PRODUCTION INFORMATION ACCUMULATED BY THE MISSION AND THE FORM IN WHICH NOAA ESTIMATES ARE PRESENTED. ANOTHER SEASON OF INFORMATION WILL HELP RESOLV THIS PROBLEM AT WHICH TIME USAID WILL HAVE FORMULATED A MORE DEFINITIVE OPINION OF THE CROP YIELD ESTIMATES. BLANE

191

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Department of State

INCOMING TELEGRAM

PAGE 01 BANJUL 01102 080810Z

ACTION AID-00

3511 035966 AID5528

ACTION OFFICE AFTR-05

INFO AFFW-04 STAG-02 STFN-02 SAST-01 AGRI-01 NAS-01 COM-02 RELO-01 /019 A2 1208

INFO LOG-00 AF-00 /000 W

R 080804Z APR 86 332426 080813Z /38

FM AMEMBASSY BANJUL

TO SECSTATE WASHDC 2245

UNCLAS BANJUL 01102

the GAMBIA

AIDAC

E.O. 12356 N/A

SUBJECT: NOAA EVALUATION

REF: STATE 097318

OAR FINDS THAT NOAA CLIMATIC IMPACT ASSESSMENTS HAVE A HIGH DEGREE OF ACCURACY, ARE TIMELY, AND ARE ACCEPTED BY GOTG. THE USEFULNESS OF THE DATA TO PLANNERS, WILL DEPEND TO A LARGE EXTENT ON GOTG OBJECTIVES, LEVELS OF CAPABILITY, AND AVAILABLE RESOURCES. HENNEMEYER

192

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ACTION COPY

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INCOMING TELEGRAM

PAGE 01 ADDIS 01786 0108442 8198 030752 AID8750
ACTION AID-00

ACTION OFFICE AFTD-01
INFO AFEA-03 AMAD-01 STHE-01 SAST-01 PELO-01 012 AC

INFO LOG-06 AF-08 /000 W

R 010839Z APR 86 257254 0109062 38
FM AMEMBASSY ADDIS ABABA
TO SECSTATE WASHDC 4899

UNCLAS ADDIS ABABA 01786

AIDAC

FOR AFR/TR

E.O. 12356: N/A

SUBJECT: NOAA EVALUATION

REF: STATE 97318

ETHIOPIA

1. AID/ADDIS HAS FOUND THE NOAA REPORTS TO BE EXTREMELY VALUABLE AS A MONITORING DEVICE IN THE IMPLEMENTATION OF THE DROUGHT EMERGENCY PROGRAM IN ETHIOPIA.

2. WE DO HAVE ONE SUGGESTION. THE NOAA REPORT FOR MAY-SEPTEMBER 1985, PAGE 13, SAYS THAT THE SEPTEMBER 1985 RAINFALL WAS QUOTE GENERALLY NORMAL TO ABOVE NORMAL FOR MOST OF THE COUNTRY. UNQUOTE. THIS STATEMENT WAS NOT TRUE FOR THE LOWLANDS IN ETHIOPIA. THE RAINS IN THOSE AREAS STOPPED AT THE END OF AUGUST, RESULTING IN SEVERE DAMAGE TO MAIZE AND SORGHUM CROPS IN THE LOWLAND AREAS OF ETHIOPIA. IF AT ALL POSSIBLE, THEREFORE, WE SUGGEST THAT THE NOAA REPORTS DISTINGUISH AMONG HIGHLAND, MID-ALTITUDE AND LOWLAND AREAS IN ETHIOPIA. CHEEK

193

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PAGE 01 ADDIS 01828 021044Z 5432 031

ACTION AID-00

ACTION OFFICE AFTR-05

INFO AFEA-03 COM-02 RELO-01 /011 A4 82

INFO LOG-00 AF-00 /000 W

R 021044Z APR 86 351235 021052Z /38

FM AMEMBASSY ADDIS ABABA

TO SECSTATE WASHDC 4923

UNCLAS ADDIS ABABA 01828

AIDAC

E.O. 12356: N/A

ETHIOPIA

SUBJECT NOAA SPECIAL CLIMATE IMPACT ASSESSMENTS

REF: STATE 97318

THE LAST SUBJECT REPORT AID/ADDIS HAS RECEIVED IS DATED MAY - SEPTEMBER 1985. PLEASE ADVISE WHEN WE WILL BE RECEIVING FURTHER REPORTS AND WHAT TIME FRAME THEY WILL COVER. CHEEK

194

ACTION COPY

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Department of State

INCOMING TELEGRAM

PAGE 01 KHARTO 04896 03 2422 251 [illegible] /IC1611
ACTION AID-03

ACTION OFFICE AFTR-15
INFO AAAF-02 AFEA-03 STAG-02 SAST-01 AFDA-02 COM-02 STFA-01
RE_O-01 /019 A4 8.1

INFO LOG-00 AF-00 .000 W

R 031239Z APR 86 047204 031347Z /38
FM AMEMBASSY KHARTOUM
TO SECSTATE WASHDC 9541

UNCLAS KHARTOUM 04896

AIDAC

SUDAN

E.O. 12356: N/A
SUBJECT: NOAA EVALUATION OF SPECIAL CLIMATE IMPACT ASSESSMENTS.

REF: STATE 097318

1. THE BI-WEEKLY UP-DATES ARE USEFUL BUT ONLY AS ROUGH INDICATORS OF POTENTIAL SURPLUS/DEFICIT FOOD PRODUCTION AREAS THROUGHOUT EAST AND SOUTHERN AFRICA. THEIR USEFULNESS WOULD BE GREATLY ENHANCED IF THE METEOROLOGICAL (METI) DATA COULD BE LINKED WITH DOMESTIC FIELD OBSERVATIONS ON AREA PLANTED AND ESTIMATED YIELDS. LAST YEAR PESTS SERIOUSLY REDUCED YIELDS IN PARTS OF SUDAN, ESPECIALLY IN MECHANIZED AREAS OF EASTERN SUDAN WHERE PRODUCTION IS GENERALLY QUITE HIGH. OFTEN WHEN CLIMATIC CONDITIONS ARE FAVORABLE FOR CROPS THEY ARE ALSO FAVORABLE FOR PESTS, BUT NOAA'S REPORTS ALONE CANNOT REFLECT THIS. SUDAN HAS INSTITUTED FIELD PRODUCTION SURVEYS THAT IF EVALUATED IN CONJUNCTION WITH MET DATA WOULD MAKE BOTH MORE MEANINGFUL. THE NATIONAL MET CENTER IN SUDAN HAS SOPHISTICATED ANALYTICAL EQUIPMENT WHICH IT IS UNABLE TO USE FOR LACK OF A FEW COMPONENTS. SUPPLIES AND T.A. SOME FUNDS COULD BE WELL SPENT PUTTING THE NATIONAL MET CENTER IN BUSINESS AND ESTABLISHING/STRENGTHENING ITS TIES WITH MINAG'S STATISTICS DEPT. THE STAT. DEPT. IS IN THE FIELD DURING THE AGRICULTURAL SEASON COLLECTING AREA/YIELD DATA.

2. THE UPGRADED SPECIAL CLIMATE IMPACT ASSESSMENT REPORTS WHICH WERE AIR EXPRESSED TO THE MISSION WERE PARTICULARLY USEFUL AND IN RETROSPECT SEEMED TO PROVIDE AN ACCURATE APPRAISAL OF THE SITUATION. WE WOULD HOPE THAT THESE WOULD CONTINUE. THE MISSION IS CONTINUING TO WORK WITH THE GOS TO DEVELOP ACCURATE CROP CONDITION AND PRODUCTION FORECASTS AND BELIEVE THE NOAA DATA WOULD BE A USEFUL COMPLEMENT TO THAT WORK. HORAN

195

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Department of State

INCOMING TELEGRAM

PAGE 01 NOUAKC 01551 00 OF 02 0922362 3637 037239 A107345
ACTION AID-00

ACTION OFFICE AFYR-05
INFO AFPA-03 AFTU-04 FPA-02 FYA-01 OFDA-02 STAG-02 STFN-02
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E.O. 12356: N/A
SUBJECT: NOAA SPECIAL CLIMATE IMPACT ASSESSMENTS

REF: STATE 97318

1. AS REQUESTED REFTEL, FOLLOWING ARE MISSION COMMENTS ON TIMELINESS, CREDIBILITY AND USEFULNESS OF NOAA/NESDIS/AISC PRODUCTS. WE WISH TO NOTE THAT THESE ARE OUR TENTATIVE CONCLUSIONS BASED ON AISC'S FIRST YEAR OF OPERATION PENDING FURTHER FINE TUNING OF NOAA PRODUCTS TO WHICH WE HOPE OUR COMMENTS WILL CONTRIBUTE.

2. FOR THE MOST PART, NEITHER DECADAL CABLES NOR MONTHLYQTRIES PRESENTLY PROVIDE ANY NEW INFORMATION OR ANALYSIS TO THE FIELD ON RAINFALL OR CROP CONDITIONS. DECADAL CABLES TEND TO DUPLICATE FAO REPORTING (SAHEL WEATHER AND CROP SITUATION REPORT) WHICH DOES PROVIDE TIMELY, USEFUL DATA ON CROPS, CATTLE AND PEST INFESTATION FROM OUTPOSTED FAO REPS. WEATHER AND RAINFALL DATA COMPILED BY AGRYMET/MAURITANIA COMBINED WITH PERIODIC FIELD REPORTING FROM MAURITANIAN GOV'T AND USAID SOURCES ALLOW US TO FORECAST HARVESTS AT LEAST 60 DAYS IN ADVANCE WITH A 10-20 PERCENT DEGREE OF ERROR.

3. MOREOVER, FIELD MISSIONS ARE IN A MORE ADVANTAGEOUS POSITION FOR MAKING HARVEST ESTIMATES THAN THEIR NOAA COUNTERPARTS AS THEIR ANALYSIS IS BASED ON THE MOST CURRENT DATA AVAILABLE. THE TIME FACTOR IS PARTICULARLY IMPORTANT IN THE SAHEL WHERE ABRUPT CHANGES IN CLIMATE OR CROP CONDITIONS ARE THE NORM AND CAN UNDO THE BEST-LAID ESTIMATES. GENERALLY, NOAA DECADAL CABLES AND MONTHLY SUMMARIES ARRIVE THREE WEEKS AND ONE MONTH RESPECTIVELY AFTER REFERENCED PERIOD; AT WORST, THEY ARE OF HISTORICAL INTEREST ONLY; AT BEST, A CORROBORATION OF WHAT THE FIELD ALREADY KNOWS.

4. AS FOR CREDIBILITY OF NOAA REPORTING, WE QUESTION VALIDITY OF THE 1951-83 TIMEFRAME USED AS BASIS FOR 30-YEAR RAINFALL AVERAGE. BY INCLUDING ALMOST THE ENTIRE DROUGHT PERIOD, THE MEAN INDEX IS LOPSIDEDLY DRAWN DOWN AND CAN LEAD TO GROSSLY MISLEADING CONCLUSIONS. IN THEIR HYDROLOGICAL MONOGRAPH OF THE SENEGAL RIVER (OSTOM) BRUNET-MORET SUGGEST USING THE SIXTY-YEAR (1921-80) AVERAGE TO AVOID THE DISPROPORTIONATE INFLUENCE

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OF THE DROUGHT PERIOD.

5. IN THIS CONNECTION, WE FEEL NOAA/NESDIS'S CONCLUSIONS OF 1985 RAINFALL IN MAURITANIA WERE UNDULY SANGUINE. RAINFALL WAS NOT JUST BELOW AVERAGE BUT BELOW DROUGHT AVERAGES. IN FACT, OF ONLY TWO OF 13 REPORTING STATIONS WAS RAINFALL GREATER THAN 200 MM. NAEDI STATION, WHICH REPORTED FOURTH HIGHEST RAINFALL, RECEIVED ONLY 163 MM. ONLY ONE YEAR (1981) BETWEEN 1978-84 WAS RAINFALL LESS, ACCORDING TO THE ORSTOM STUDY. WHAT ACCOUNTED LARGELY FOR THE IMPROVED SOIL MOISTURE/PRODUCTION LAST YEAR WAS THE IDEAL SPATIAL/TEMPORAL DISTRIBUTION OF RAINFALL.

6. FINALLY, RELIABLE HARVEST ESTIMATES SHOULD INCLUDE SUCH FACTORS AS PLANT DISEASE AND PEST INFESTATION. THIS YEAR ALONE, GRASSHOPPERS AND BIRDS ACCOUNTED FOR SOME 25-30 PERCENT LOSSES IN RAINFED CROPS. ALSO, PRODUCTION ESTIMATES ARE FOR SORGHUM/MILLET ONLY AND WOULD INCLUDE RICE AS ANOTHER IMPORTANT CEREAL CROP IN MAURITANIA WHICH PROVIDES ROUGHLY 20 PERCENT OF THE OVERALL CEREAL PRODUCTION.

7. SUCH SHORTCOMINGS NOTWITHSTANDING WE BELIEVE SATELLITE CAPABILITIES OF NOAA/NESDIS OFFER SOME USEFUL APPLICATIONS. SATELLITE INFERRED DATA ON RANGELAND CONDITIONS IN EACH REGION COULD BE REFINED FOR USE BY HERDERS IN ADVISING THEM ON DRY AREAS TO AVOID, HOW FAR NORTH VEGETATION EXTENDS, ETC.
SUCH DIRECTIVES TO HERDERS COULD ALSO HELP PROTECT SPARSELY COVERED AREAS WHERE FURTHER GRAZING MIGHT LEAD TO LOSS OF VEGETATIVE COVER. SECONDLY, SHOULD NOAA DEVELOP A RELIABLE STATISTICAL RELATIONSHIP BETWEEN BIOMASS INDEXES AND YIELDS (WHICH, IN MAURITANIA CAN DIFFER DRAMATICALLY FROM ONE REGION TO ANOTHER) IT COULD BE USED TO IDENTIFY AREAS OF MOISTURE STRESS WHERE EXTREMELY LOW YIELDS MIGHT CREATE LOCALIZED FOOD SHORTAGES.

8. IN THIS MATTER REGARD, WE WILL IN ONE COURSE PROVIDE UPDATED STATISTICS ON AREA CULTIVATED, PRODUCTION AND YIELDS FOR THE 1985-86 AGRICULTURAL SEASON.
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196

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INCOMING TELEGRAM

PAGE 01 GABORO 01110 040546Z

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FOR: AFR/TR

E.O. 12356 N/A

TAGS:

SUBJECT: NOAA EVALUATION

BOTSWANA

REF: STATE 097318

1. NOAA/NESDIS/AISC CLIMATE ASSESSMENTS FOR BOTSWANA HAVE CONSISTENTLY TRACKED LOCAL METEREOLOGICAL REPORTS. EXCELLENT WORK BY LOCAL AGROMETEREOLOGY DEPARTMENT HAS GIVEN TIMELY SEASON CROP FORECASTS TO USAID/BOTSWANA EVERY MONTH OF GROWING SEASON. BELLOCCHI

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191

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INCOMING TELEGRAM

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E.O. 12356: N/A
TAGS: TPHY, GH
SUBJ: NOAA SPECIAL CLIMATE IMPACT ASSESSMENTS

GHANA

REF: STATE 97318

1. AMBASSADOR, US/AID MISSION AND EMBASSY ECONOMIC-COMMERCIAL SECTION HAVE FOUND THE NOAA SPECIAL CLIMATE IMPACT ASSESSMENTS EXTREMELY USEFUL AS APOLITICAL HAND-OUTS SENT REGULARLY TO THE FOLLOWING CONTACTS:

-- VOLTA RIVER AUTHORITY (VRA - OPERATORS OF THE AKOSOMBO DAM AND POWER STATION, WHICH PROVIDE VIRTUALLY ALL OF GHANA'S ELECTRIC POWER, AND THUS HAS A VITAL INTEREST IN INFORMATION BEARING ON RAINFALL IN THE VOLTA CATCHMENT AREA).

-- THE KAISER/REYNOLDS-OWNED VALCO SMELTER (THE LARGEST ALUMINUM SMELTER IN ALL OF AFRICA, AND THE VRA'S MOST IMPORTANT CUSTOMER, TAKING WELL OVER HALF OF VRA'S POWER OUTPUT).

-- GHANA METOROLOGICAL DEPARTMENT.

2. WITH THE SEVERE DROUGHT OF 1982-83 STILL FRESH IN THEIR MINDS (EMERGENCY FOOD IMPORTS; SCHEDULED POWER OUTAGES AND COMPLETE CLOSURE OF VALCO'S SMELTER FROM LATE 1983 TO EARLY 1985), RECIPIENTS OF THE NOAA CLIMATE ASSESSMENTS TELL US THEY FIND THESE REPORTS INVALUABLE FOR PLANNING PURPOSES.

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196

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FOR AFR/TR

E.O. 12356: N/A
SUBJECT: NOAA EVALUATION

ZIMBABWE

REF: STATE 097318

1. THE DIRECTOR OF METEOROLOGICAL SERVICES IN ZIMBABWE PREPARES A WEEKLY RAINFALL SUMMARY EACH WEDNESDAY. THIS SUMMARY PROVIDES RAINFALL DATA FROM APPROXIMATELY 100 STATIONS AS OF 0800 HOURS ON THAT WEDNESDAY. SUMMARY PROVIDES (A) WEEKLY RAINFALL TOTAL, (B) TOTAL TO DATE, AND (C) NORMAL TO DATE FOR EACH OF THE 100 STATIONS. IN ADDITION, TWO MAPS ARE PROVIDED SHOWING WEEKLY RAINFALL IN 25MM ISOHYETS AND DEPARTURE FROM NORMAL RAINFALL IN 100MM GRADATIONS. THE MINAG EXTENSION SERVICE PROVIDES A FORTNIGHTLY REPORT BY PROVINCE OF THE CROPPING CYCLE FOR ALL MAJOR FOOD AND EXPORT CROPS AS WELL AS PASTURE GRASSES.

2. WITH THIS EXCELLENT AND TIMELY RAINFALL AND CROP DATA AVAILABLE IN COUNTRY THE NOAA IMPACT ASSESSMENTS ARE NOT USEFUL. MILLER

199