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INTERAFRICAN COMMITTEE FOR HYDRAULIC STUDIES

**OUAGADOUGOU
UPPER VOLTA**

**SAVANNA REGIONAL WATER
RESOURCES AND LAND USE**

**VOLUME 6
EXISTING LAND USE**



CIEH-USAID

Grant Agreements
625-11-120-712
698-0415 and
629-0926

prepared under a
subcontract by

**EARTH
SATELLITE
CORPORATION**



Washington, D.C.

**TAMS
ADG**

345 Park Ave.
New York 10022

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INTRODUCTION

In the first three Volumes of the "Savanna Regional Water Resources and Land Use Project" report, an overview is given of the availability of both ground and surface water in West and Central Africa. The overview is intended to serve as a basis for future planning efforts in water resource development, both at CIEH and at other organizations in the region.

This Volume 6 and the accompanying map (at scale 1:5 million) provide a general assessment of existing land use and agricultural production in the Savanna Region. A larger scale edition of this map was produced at 1:2.5 million scale for use as a working document at CIEH. Two positive transparent masters of this map edition are available at CIEH for reproduction.

This report is intended to be used in conjunction with Volume 5, which deals with existing water use in the Savanna Region. The combined evaluation of existing use of the Savanna's land and water resources is an essential phase in CIEH's planning operations aimed at formulating new project proposals for the effective conservation and utilization of water and related land resources in the region.

Volume 6 provides information on current crop production in the region and leads the way to the identification of areas where agriculture production could be increased most readily.

Estimates of future food production under rainfed farming (see also Study Proposal TP 05 in Volume 4 of this report series) and estimates of future food demand are essential in determining to what extent food should be produced under irrigation and hence the water requirements for irrigation. Future water requirements for the Savanna Region are dealt with in Volume 7.

It should be recognized that this land use/land cover map represents the first attempt ever to map Western and Central Africa using satellite-acquired data. As a result of this mapping effort, an ecological framework has been established which relates directly to actual ground conditions at the regional level.

This satellite derived map was produced by Earth Satellite Corporation, Washington, D.C., under a subcontract to TAMS. Staff assigned to the preparation of this Volume are listed in Figure 1.

Scientists Assigned to Preparation of Volume 6 of the
"Savanna Regional Water Resources and Land Use" Report

Mr. M.G. Gagara	:	Secretary-General	C.I.E.H.
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Dr. John Buursink	:	Project Manager, TAMS	
Mr. Donald Garofalo	:	Project Manager, EarthSat	
Mr. Fred R. Weber	:	TAMS, Map unit classification	
Mr. Kodjo Ativon	:	CIEH Map unit classification	
Mr. Charles J. Dorigan	:	EarthSat, Map unit classification	
Mr. David Nichols	:	EarthSat, Map unit classification	
Mr. Edmund A. Schantz	:	EarthSat, Map compilation	
Mr. Michael M. Douglass	:	EarthSat, Legend design	
Mr. J. William Stohlman	:	EarthSat, Collateral data collection	
Dr. P. Ahn	:	TAMS, Land use	
Ms. Emily T. Candelmo	:	TAMS, Documentation	

Figure 1

1.0 METHODOLOGY

1.1 Mapping Procedures

The following methodology was used by EarthSat to produce the 1:5 million scale land use/land cover map (Map 1) of the Savanna Region.

Three-hundred forty-two (342) Landsat images were purchased from the U.S. Agricultural Stabilization and Conservation Service providing complete satellite coverage of the project area. Only those images with less than 20% cloud cover were selected. Of the total number of images obtained, approximately 70% were completely cloud-free, 92% had less than 10% cloud cover. Of the total number of Landsat images acquired, approximately 4% were taken in 1972; about 4% in 1973; about 15% in 1974; and the remaining 77% in 1975 and 1976. Approximately 80% of the image coverage is for the months of December and January. The remaining images were taken by the satellite during November, February, and March. The 70mm positive transparencies for Multispectral Scanner (MSS) bands 4, 5, 6, and 7 were obtained for each Landsat image. These transparencies are available for use at the CIEH Documentation Center in Ouagadougou.

On the basis of image quality, the best 230 images were selected and used to prepare a Landsat laydown (uncontrolled mosaic) of the project area at 1:2.5 million scale. Multispectral Scanner (MSS) band 5 was selected as the most suitable Landsat band for the preparation of this product. MSS band 5 is excellent for showing areas of agricultural activity and variations in natural vegetation.

A copy of the 1:2.5 million scale CIEH basemap of the Savanna Region was produced as a clear plastic overlay. This product was

suitable for overlaying and registering with the Landsat laydown. On the overlay, the project area was then sub-divided into 154 map units based on obvious tonal and textural differences as interpreted on the underlying Landsat band 5 laydown.

A "Delineation Documentation Sheet" (Figure 2) was developed which identifies each of the 154 delineated map units by number, size, location, and Landsat image coverage. The sheet is separated into four sections. The first three sections describe the agriculture and natural vegetation of the map unit based on:

1. Collateral data
2. Consultant input
3. Landsat analysis

The fourth section on the documentation sheet gives the final map unit classification based on the total integrated data input.

All collateral data are listed in the References section of this volume and are available for consultation at the CIEH Documentation Center. Data in map form on natural vegetation, agriculture, and national parks were transferred to a 1:2.5 million scale basemap of the project area using either:

1. Visual transfer which uses map detail, e.g., towns, boundaries, physical features, etc., to insure accurate transfer of information from the collateral map to the basemap.
2. Projection equipment which brings the collateral map to the same scale and map projection as the basemap and allows for direct transfer of information. Equipment used in this category were overhead and 35mm slide projectors and a Zoom Transfer Scope.

DELINEATION DOCUMENTATION SHEET

Area (Polygon) Number _____ Size _____ Square km.

Location _____

Image I.D. _____

Area description (collateral data)

Area description (consultant)

Area description (Landsat analysis)

Final classification

Figure 2

Information from reports was keyed to each area using geographically specific reference data, e.g., location of agricultural activity around a given town, or the natural vegetation occurring within a given mountainous area.

Each map unit was then described in terms of its agricultural activity and natural vegetation cover in Section 1 of the "Delineation Documentation Sheet."

The project consultant (Mr. Fred Weber), a staff member of CIEH (Mr. Ativon), and EarthSat scientists working on the Regional Onchocerciasis Area Planning (ROAP) project in the Upper Volta, Ghana, and Benin area, all familiar with actual ground conditions in the project area, provided information on agriculture and natural vegetation cover for each delineated map unit. This is recorded in Section 2 of the Delineation Documentation Sheet.

Landsat band 5 images were visually analyzed. For selected images which contained a variety of tonal and textural signatures indicative of varying ground conditions throughout the project area, color composites were prepared and analyzed. Color composites were useful for enhancing image information, thus improving upon interpretation accuracy. An Addcol color viewing system was used to produce color composite scenes. Information on natural vegetation cover and agricultural intensity were recorded in Section 3 of the Delineation Documentation Sheet.

Based on an integration of the information contained in Sections 1, 2, and 3, each Landsat delineated map unit was categorized according to agricultural crop type, cultivation intensity, and natural vegetation cover in Section 4. All 154 "Delineation Documentation Sheets" are available for reference at the CIEH

Documentation Center. The final legend of the map includes these three principal categories: 1) natural vegetation cover; 2) cultivation intensity; and 3) agricultural crop types.

Alpha-numerical map symbols identify these three categories for each map unit. For example, map symbol 76.4MiMsACT*3 indicates that the area concerned is map unit #76, lies in vegetation zone 4 (Wooded Savanna), with millet, maize, and groundnuts as the main crops and cotton at selected, relatively limited locations only, with a high intensity of cultivation (over 60% of the total land area cleared for cultivation). For ease of reference, the natural vegetation categories are color coded and the cultivation intensity is shown as differing zip-a-tone patterns.

1.2 Map Accuracy

In order to insure that produced maps were of the highest accuracy obtainable consistent with the scale of the maps produced and the data used, two categories of quality control procedures were employed:

1. Those dealing with the mechanics of data transfer and delineation.
2. Those relating to the accurate analysis of Landsat data.

1.2.1 Accuracy of Mechanical Procedures

The mechanics of data transfer involved the transfer of both point and area data in all categories of information mapped from either existing maps or Landsat images to the 1:2.5 million scale and 1:5 million scale basemaps. The accuracy of data transfer and placement depends on the accuracy

of existing maps, and the method used to transfer information from maps and images of varying scales to a consistent basemap scale.

It was assumed that existing maps used as data sources in this study were accurate with respect to information content as well as data location, unless otherwise indicated by Landsat interpretation.

Among the techniques and equipment used, a Bausch and Lomb Zoom Transfer Scope (ZTS) was employed which allows the operator to view an image and map in superimposition. The image can be optically magnified 1x to 14x with a continuous zoom system. It also has an optical stretch to compensate for image displacements. The ZTS is a precision device, capable of achieving United States National Map Accuracy Standards in transfer operations. Additional optical projection equipment also was used which enabled the transfer of collateral map data to the basemap.

As part of the quality control procedure, care was taken to insure that:

- The source (existing data, Landsat, etc.) for the mapping was documented.
- Map legends and border information were properly presented.
- Relevant data were transferred from existing maps or Landsat to the 1:2.5 million and 1:5 million scale basemaps.
- Delineated areas were classified with the correct identifying symbol, and delineated areas were closed.

- Available point data were properly identified.
- Area and point identifying symbols were readable.

1.2.2 Accuracy of Landsat Analysis

Landsat analysis was an interactive process intended to extend, update, and/or verify existing map data. In this respect, Landsat in some cases provided information for improving upon the accuracy of existing maps. Conversely, existing land use/land cover maps were required in order to enhance the accuracy of the Landsat image analysis. The degree to which data was extracted through image interpretation depended upon the land use/land cover category being interpreted, the adequacy of existing collateral data (since no field work was conducted), image season and overall image quality, and method of image interpretation.

Standard bulk processed Landsat images, black-and-white at 1:2.5 million scale and color composites at 1:1 million scale, were interpreted using manual interpretation methods. The subsequent reduction of the interpreted data to the 1:5 million scale further minimized possible inaccuracies.

Interpretation accuracy deals with the classification or identification of features on the ground from their appearance on imagery. Interpretation accuracy has two parts: the actual interpretation of the feature, and the classification of the feature. Landsat imagery showed new land use/land cover features heretofore unmapped or incorrectly mapped because of lack of ground control.

This mapping effort did not allow for in-field verification of the final map. The accuracy of the final map therefore is considered as accurate as the original available data sources.

As a test of accuracy, a comparison was made between map unit delineations for the map accompanying this report and those produced from computer-enhanced color composite Landsat scenes (at scale 1:200,000) for the Regional Onchocerciasis Area Planning project.

2.0 NATURAL VEGETATION COVER

The Savanna Region is divided into eight natural vegetation zones. Each vegetation zone is derived from a classification of African vegetation types created in 1956 by the Commission for Technical Cooperation in Africa, South of the Sahara/Scientific Council. This international meeting of specialists in phytogeography was held at Yangambi. The method of classification is based on Keay and Aubreville's "Vegetation Map of Africa," and several United Nations agencies and the FAO now apply the Yangambi classification (Weber, 1977).

The 1:2.5 million scale Landsat MSS band 5 laydown which was the principal data source for delineating the vegetation zones within the project area illustrates in both striking and subtle gray tones the natural vegetation zonation which occurs when moving from north to south across the area. The location of the boundaries between adjacent vegetation zones represents actual ground conditions and thus real changes in vegetation as viewed from 920 kilometers above the Earth's surface. The ground detail as viewed from the satellite has enabled the Landsat analyst to refine and greatly improve the vegetation boundary detail and locational accuracy which is frequently generalized in other regional, small scale, vegetation mapping efforts. In view of CIEH's aim to improve the utilization of water resources in the development of the entire region, the value of geographically accurate information at the regional level cannot be over-emphasized.

The legend of the map also contains a table which, for each vegetation category, lists those trees, bushes, and grasses which are most characteristic of that category (VITA, 1977). Grasses listed are taken from a map and publication by J.M. Rattray (1960) entitled "The Grass

Cover of Africa." The table also contains a series of phytosociological sketches representing a ground perspective of the vegetation habitat.

Six major east-west zones or belts of vegetation are identified in the West African Savanna Region. In addition, areas of Tropical Rainforest were found to exist north of the southern limit of the Savanna Region. This in fact constitutes a refinement of that limit. Also, areas of Mangrove forest are separately shown. The extent of each of the eight vegetation areas as measured on the 1:2.5 million scale map edition is shown in Table 1.

Table 1: Extent of Natural Vegetation Zones in the Savanna Region

Map Symbol	Vegetation Description	Extent (1000 ha)	Percentage of Savanna Area
1	Grass Steppe	10,687	2.3
2	Tree Steppe	49,055	10.8
3	Shrub Savanna	84,209	18.5
4	Wooded Savanna	88,124	19.4
5	Woodland	144,441	31.8
6	Mosaic	57,067	12.6
7	Tropical Rainforest	6,925	1.5
8	Mangroves	1,059	0.2
PN	National Parks	12,984	2.9
TOTAL	Savanna	454,549	100.0

Note: The total land area is slightly less than the area used in Volumes 1 to 3 (4,562,547 km²) as major surface water areas are excluded here.

It appears that in all zones, the natural vegetation is replaced to a varying degree by agriculture. The map provides information on how much land is currently cleared for cultivation. Calculations based on average values of cultivation intensity (resp. 15, 45, and 70 percent for categories

1, 2, and 3 of cleared land) allow for an estimate of the surface area cleared for cultivation. Table 2 indicates how much land in each vegetation area still has its natural cover of forest and range.

Table 2: Actually Existing Forest and Range Vegetation

Map Symbol	Vegetation Description	Estimated Area Not Cleared For Cultivation (1000 ha)	Percentage of Vegetation Zone Not Cleared For Cultivation
1	Grass Steppe	9,084	85
2	Tree Steppe	45,202	92
3	Shrub Steppe	54,766	65
4	Wooded Savanna	46,613	53
5	Woodland	79,230	55
6	Mosaic	28,242	49
7	Tropical Rainforest	4,907	71
8	Mangroves	848	80
PN	National Parks	12,984	100
TOTAL	Savanna Region	281,875	62

Even though it appears that about 62 percent of the Savanna Region is not cleared for cultivation, it should be noted that in vegetation zones 3, 4, 5, and 6, which constitute 80 percent of the Savanna Region, the forest and range vegetation only exists on slightly more than half of the land.

3.0 AGRICULTURAL LAND USE

3.1 Crop Type Identification

Because Landsat coverage of the project area was principally for the months of December, January, and February, most agricultural fields were fallow. Crop type identification for the project depended entirely upon collateral map data and the knowledge of project personnel familiar with actual ground conditions.

The reader should not be misled into believing, however, that had high quality Landsat imagery been available during the height of the agricultural growing season, it would have been possible to identify crop types using Landsat data alone. Any effort to identify crop types using Landsat would undoubtedly require, at a minimum, multi-temporal data (i.e., Landsat coverage for an entire growing season), high quality color enhanced images, and associated ground checking to establish and verify image signatures.

Selected color composite Landsat images of the project area were interpreted as a check on the black-and-white interpretation and to resolve questions which arose during the MSS band 5 image analysis. The color composites provided more detailed information on ground conditions than the black-and-white scenes. Because of the larger number of colors and subtle hues, the color composites did, therefore, improve the overall accuracy of the Landsat analysis.

Each map unit contains one or more letter codes, each code related to a specific crop type. From one to seven crop types may be listed for a given map unit. The order in which two or more crop type codes are listed for a map unit is unrelated to crop dominance or economic importance for that unit.

In general, the type of land use, i.e., the crops grown, and to some extent the methods employed, is adapted to and reflects the latitude and length of the growing season. In the wetter areas of the southern Savanna - the range of crops is greater, and with a relatively long growing season, higher yielding varieties are planted. Crops include maize and long season sorghum and millet. As growing seasons grow shorter progressively northwards, so do crops and the crop varieties change. In the northernmost cropping zones maize is not planted, and very short season sorghum and millet (able to grow in as little as 55 days) are the dominant grains.

3.2 Cultivation Intensity

Each map unit was delineated using the Landsat MSS band 5 laydown as the principal data source. The black-and-white band 5 prints show variations in gray tones and texture that are related to density and composition of natural vegetation cover, landform differences, and land use activity. For example, in an area of dense vegetation cover, the Landsat tonal signature is a medium to dark gray. Any efforts to clear the area of its natural vegetation cover in order to, for example, cultivate the area for crops would be noticeable on the Landsat image, especially during those times of year when the agricultural land is fallow and bare soil is exposed. Bare, fallow soil would image as a much lighter gray tone than the adjacent, undisturbed natural vegetation cover. Variations in image tone and texture alone cannot be used as the sole guide for identifying agriculture versus natural vegetation cover. Geographic location of a given land use activity is an important

consideration when arriving at a decision during Landsat analysis. For example, areas around major towns are frequently subjected to intensive cultivation and associating town location with a surrounding light gray tonal signature would be an important analytical criterion for identifying and mapping the area's land use activity. An analysis of the distribution of image tone and texture for a Landsat scene is useful for studying patterns of land use and land cover. In an area with a high population density, but with the population distributed among a large number of towns and villages within the area, a characteristic regional pattern would be displayed on the Landsat image. In this case, the pattern would include bright or light gray tonal dots in a darker gray matrix with the dots representing towns or villages with associated intensive subsistence cultivation, and the darker gray matrix being the hinterland with less intensive agriculture and a denser natural vegetation cover.

Because map units delineated during this study were based on Landsat image pattern recognition as well as gray level of tones and textures, it was possible to assign a quantitative value relating to the percentage of the map unit cleared for cultivation at the time of satellite overpass. Three arbitrary ranges were selected:

1. 0% to 30% of the area was cleared for cultivation at the time of satellite overpass.
2. 31% to 60% of the area was cleared for cultivation at the time of satellite overpass.
3. More than 60% of the area was cleared for cultivation.

The degree of accuracy of assigning a map unit to one of these three categories, and by which agricultural lands per se were

classified as such using Landsat analysis, is estimated by EarthSat to be high, i.e., 90% to 100% in the following vegetation zones where a good contrast between agricultural land and natural vegetation is shown on the Landsat imagery:

Zone 2 - Tree Steppe

Zone 3 - Shrub Savanna

Zone 4 - Wooded Savanna

Zone 5 - Woodland

Zone 6 - Mosaic

In the Grass Steppe (Zone 1) where rainfall is minimal, it was difficult to distinguish between fallow cropland and areas devoid of natural vegetation cover due to lack of sufficient precipitation. Also, in the Tropical Rainforest (Zone 7) where a dense forest canopy is present, many of the crops grown are tree crops. Rainfall is heavy in this zone and it was difficult to distinguish, using Landsat imagery alone, between agricultural areas and natural vegetation cover. In the Grass Steppe and Rainforest zones, map accuracy with respect to cultivation intensity depended more heavily on the knowledge and experience of the project consultant.

The three categories that indicate the intensity of cultivation relate the total area cleared for cultivation to the total map unit area. In a region where most cultivation is of the land rotation (shifting agriculture) type, a variable percentage of the land area is under fallow each year. Areas of fallow are, in West Africa, areas of regrowth vegetation, i.e., of the vegetation which springs up naturally when farm land is abandoned and no longer weeded.

Under present conditions of West African farming, extensive culture with little or no use of fertilizers, a relatively long fallow is needed to maintain soil productivity. The longer the fallows, the greater the percentage of the total area which is resting and the smaller the percentage under current cultivation. As population pressures increased during the last half century, and with increasing interest in the production of cash crops, both fallow periods and the percentage of land not currently cultivated tended to fall. For this study, it was not feasible to separate the land cleared for cultivation into areas that are farmed in a particular year, and the recently abandoned farm areas. However, data on areas farmed in 1976 were derived from the FAO Production Yearbook (FAO, '78). The total areas cleared for cultivation, arranged per vegetation zone, are shown in Table 3.

Table 3: Areas Cleared for Cultivation per Vegetation Zone
(In 1000ha)

Map Symbol	Vegetation	From 0 to 30 Percent of Area Cleared For Cultivation	From 31 to 60 Percent of Area Cleared For Cultivation	More Than 60 Percent of Area Cleared for Cultivation	Total Area Cleared For Cultivation
1	Grass Steppe	10,687	Nil	Nil	1,603
2	Tree Steppe	41,959	6,974	121	3,853
3	Shrub Savanna	43,836	21,574	18,798	29,443
4	Wooded Savanna	25,487	24,632	38,005	41,511
5	Woodland	17,160	105,838	21,443	65,211
6	Mosaic	6,119	31,026	19,922	28,825
7	Tropical Rain-forest	5,145	Nil	1,780	2,018
8	Mangroves	885	174	Nil	211
TOTAL	SAVANNA	151,278	190,218	100,070	172,674

Calculations based on average values of cultivation intensity (15, 45, and 70 percent respectively for categories 1, 2, and 3 of cleared land) give an estimated extent of the areas cleared for cultivation per vegetation zone (see Table 3). The total area cleared for cultivation in the Savanna Region covers 173 million hectares or 38 percent of the total land area.

According to land capability data developed in Chapter 6 of Volume 1 of this report series, about 80 million hectares are considered generally unsuited to cultivation. They include loose, shifting dune sands, shallow lithosols, and saline soils. Approximately 375 million hectares are arable.

With National Parks covering 13 million hectares, and assuming that most parks are in arable land, the total arable area is approximately 362 million ha. The area which is now cleared for cultivation constitutes almost half (48 percent) of this arable land, the remainder (189 million hectares) is forest or rangeland.

It is assumed that, in general (except in areas of river blindness), the farmers have selected the best lands of the Savanna for cultivation. The three best categories of land (Capability Class 1, 2, and 3) cover 227 million hectares. Poor land (Class 4) occurs in 149 million hectares. Generally, these lands with light textured soils dominate in the more northern, drier areas of the Savanna. It is considered likely that most of the arable land that is not cleared for cultivation yet is Class 4 land, of poor quality.

A relatively small area is actually cultivated each year for the production of cereals, root and tuber crops, and pulses. The extent of the area harvested each year in all of the Savanna countries is given in

Table 4: Estimated Percentage of Total Area Harvested
Per Country Located in Savanna Region

Country	Percentage of Country in Savanna Region	Percentage of Harvested Area in Savanna
Benin	94.5	94.5
Cameroun	53.6	53.6
Centr. Afr. Emp.	97.7	97.7
Chad	43.6	95.0
Gambia	100.0	100.0
Ghana	71.5	71.5
Guinea	95.0	95.0
Guinea Bissau	100.0	100.0
Ivory Coast	54.3	54.3
Mali	43.7	95.0
Mauritania	17.3	95.0
Niger	27.6	95.0
Nigeria	84.4	84.4
Senegal	100.0	100.0
Sierra Leone	38.4	38.4
Togo	100.0	100.0
Upper Volta	100.0	100.0

the FAO Production Yearbook (FAO, 1978). Many of these countries are only partially located in the Savanna Region (see Table 4).

In order to estimate the area harvested in the part of each country that is located in the Savanna Region, the harvested area was in most cases assumed to be divided in the same ratio as the total land area of each country. For example, 53.6 percent of Cameroun is in the Savanna Region; it is assumed also that 53.6 percent of Cameroun's harvested area is in the Savanna. For the Sahelian countries, Mauritania to Chad, it was assumed that 95% of their respective harvested areas are in the Savanna Region (see Table 4). On this basis, the areas that in 1976 were in cereals, roots and tubers, pulses, sesame seed and cotton seed were computed (see Table 5). The total area in the Savanna Region utilized to produce these crops, both irrigated and rainfed, is approximately 35 million hectares. About a 200,000 ha area is now under irrigation (see Table 6 of Volume 5 of this report series) . Thus, the area harvested each year represents 8 percent of the total Savanna area, some 10 percent of the total arable land of the Savanna area, and 20 percent of the area cleared for cultivation. This indicates that fallows last an average of four years per year of cultivation. For details on areas cultivated in Upper Volta, one is referred to a study by Remy (1970) based on aerial photography of the period 1950-56.

Of particular interest is the situation in Nigeria. This country constitutes 17.1 percent of the total Savanna area, yet half of the total harvested area of the Savanna (17.5 million hectares) is in Nigeria. As a result, the bulk of the agricultural production of the Savanna Region comes from Nigeria.

Table 5: Areas of Different Crops in 1976 Per Country
 In The Savanna Region
 (in 1000 ha)
 (derived from FAO, 1978)

Country	Cereals	Roots & Tubers	Pulses	Sesame Seed	Cotton Seed	Total
BENIN	445	123	49		51	668
CAMEROUN	423	299	79		32	833
C. AFR. EMPIRE	173	308	11	46	132	670
CHAD	1,076	34	134	27	303	1,574
GAMBIA	72	2	12			86
GHANA	583	458	90		4	1,135
GUINEA	979	78	48	2		1,107
GUINEA BISSAU	90	7	3			100
IVORY COAST	400	358	7	2	35	802
MALI	1,460	9	29		107	1,605
MAURITANIA	179	5	34			218
NIGER	3,035	31	337		12	3,915
NIGERIA	11,037	2,387	3,511	194	444	17,573
SENEGAL	1,084	24	50		44	1,202
SERRIA LEONE	165	13	19	1		198
TOGO	334	110	75	7	8	534
UPPER VOLTA	2,234	28	560	40	68	2,930
TOTAL	23,769	4,274	5,548	319	1,240	35,150

3.3 Crop Production

An estimate of the production of major crops is calculated from data provided by FAO (FAO, 1978). On the basis of areas of different crops as given in Table 5, the total production of these crops was computed for each portion of the countries concerned that is located in the Savanna Region, using 1976 yield data (in kg/ha) given by FAO.

Table 6 lists the total production in 1000 metric tons of cereal crops, roots and tubers, and pulses.

The main cereals in the area are millet, sorghum, maize and rice, taking up about 48, 32, 16, and 4 percent of the total area in cereals each year.

The most important tuber is cassava which takes up by far the largest portion of the roots and tubers area.

Of the pulses, groundnuts and beans are the most important.

Table 6 shows that in the Nigerian part of the Savanna Region about half of the total cereals and pulses are produced, and about 70 percent of the roots and tubers.

In addition, some 90,000 metric tons of sesame seed are produced in the Savanna Region, two-thirds of it in Nigeria, and lesser amounts in the Central African Empire, Chad and Upper Volta. Also, some 700 to 800,000 metric tons of cotton seed are produced in the region, primarily in Nigeria, Chad, Mali and Benin.

For data on the production of vegetables, fruits, fiber crops and rubber, one is referred to the statistics given by FAO for each country concerned (FAO, 1978).

Table 6: Production of Major Crops in the Savanna Region in 1976

Country	Cereals		Roots & Tubers		Pulses	
	Yield Kg/Ha	Production 1000 MT	Yield Kg/Ha	Production 1000 MT	Yield Kg/Ha	Production 1000 MT
BENIN	658	293	7,201	886	373	18
CAMEROUN	968	410	3,607	1,078	599	47
C. AFR. EMPIRE	531	92	2,891	890	505	6
CHAD	502	540	2,915	99	402	54
GAMBIA	936	67	4,000	8	233	3
GHANA	560	327	6,911	3,165	95	8
GUINEA	747	732	8,049	628	540	26
GUINEA BISSAU	1,184	106	4,615	30	600	2
IVORY COAST	838	335	4,495	1,609	625	4
MALI	748	1,092	9,228	83	1,123	33
MAURITANIA	367	66	1,087	5	278	9
NIGER	482	1,463	7,636	237	284	238
NIGERIA	649	7,164	9,982	23,827	224	787
SENEGAL	659	714	5,010	120	326	16
SIERRA LEONE	1,427	236	3,287	43	537	10
TOGO	850	284	8,096	891	300	23
UPPER VOLTA	495	1,106	4,464	125	321	180
TOTAL SAVANNA		15,027		33,724		1,464

SUMMARY

A summary of the land cover, land use and agricultural production of the Savanna Region is given in tabular form (Table 7).

Table 7: Savanna Land Cover, Land Use and Crop Production

Land Use/Land Cover	10 ⁶ hectares	10 ⁶ metric tons
Total Land Area	455	
Natural Vegetation (Forest and Range)	269	
National Parks	13	
Arable Land	375	
Non-Arable Land	80	
Area Cleared for Cultivation	173	
Arable Land not Cleared for Cultivation	189	
Area Harvested 1976	35	
Area Harvested and Production of Cereals 1976	24	15
Area Harvested and Production of Roots and Tubers 1976	4	33
Area Harvested and Production of Pulses 1976	6	1

The accompanying map shows areas where there are obvious agricultural pressures on the land. The map thus sub-divides the region into areas where potential problems exist, and identifies areas requiring more detailed analyses. More detailed studies of smaller areas can be accomplished, using field checking and larger scale (e.g., 1:250,000) Landsat images which have been enhanced to show maximum information on land cover and land use.

Should a Landsat data ground receiving station be built in Ouagadougou in the near future, the usefulness of Landsat data as a regional planning tool would increase dramatically. A seasonal monitoring capability would then exist. This has important implications for identifying and managing water resources throughout West Africa. Seasonal changes in surface water bodies could be monitored as well as the process of

desertification. Using Landsat, maps showing areas undergoing severe stress due to, for example, agricultural pressures, could be prepared and used as management tools.

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BOUTILIM

2. (1)X1

1. (1)X1

AOUN-EL-ATROUSS

ST LOUIS

LAC DE GUIERS 37. 4RSoMIMc3

23. 3M11

54. 4A3

LINGUITE

52. 4MiSoA1

SENEGAL

55. 4MiSoA2

KOULACK

53. 4X1c

GAMBIA

56. 4RHAMcE2

97. 5X1c

152. 8R*2

56. 4RHAMcE2

GUINE BISSAU

153. 8R*H*E*1

99. 5CfHAF2

102. 5HFPCf2

101. 5HF2

SONARRI

FREETOWN

GUINEE

103. 5ACf*MiSo2

104. 5CfAMsSo3

105. 5MiSoACtR1

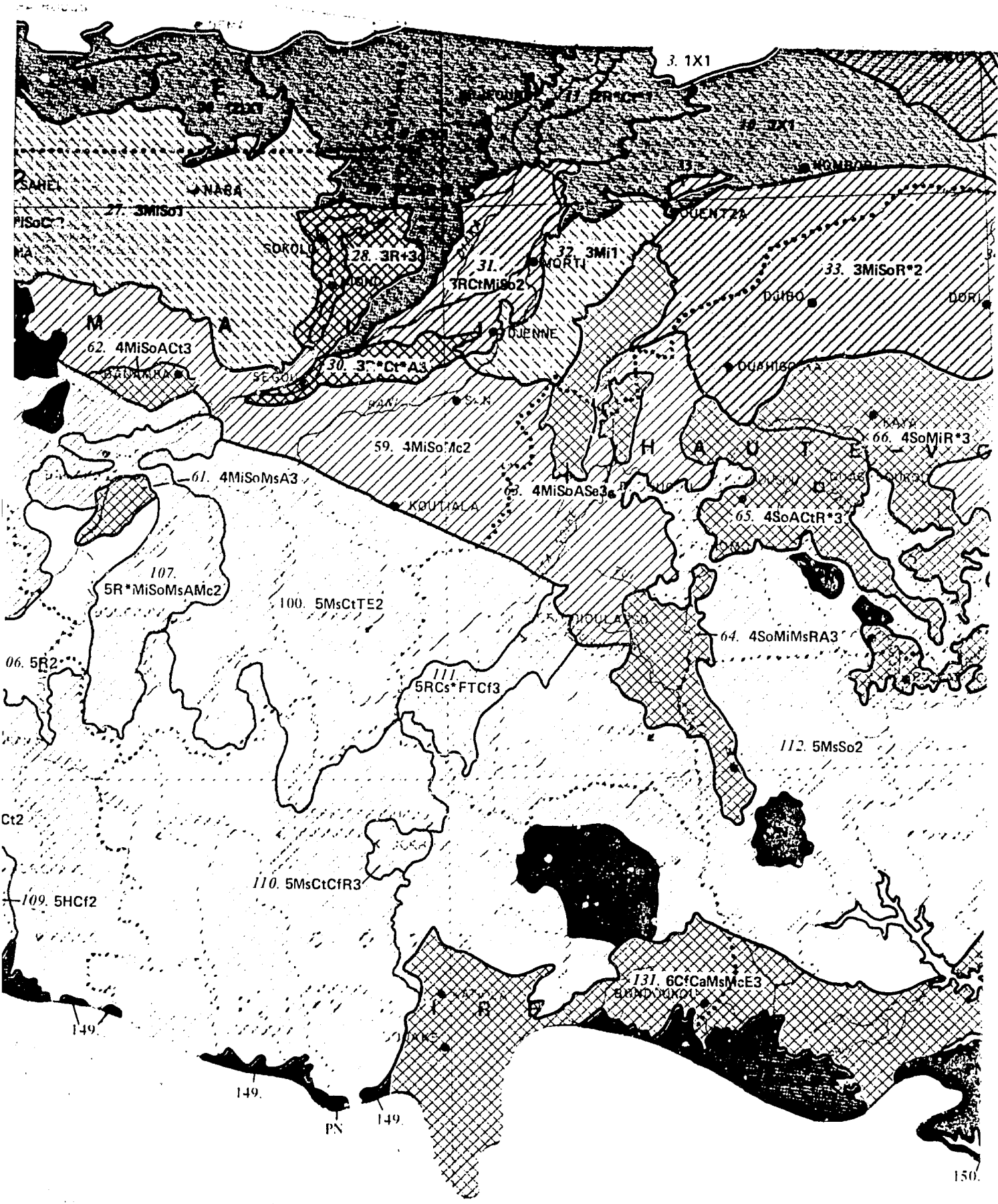
106. 5R2

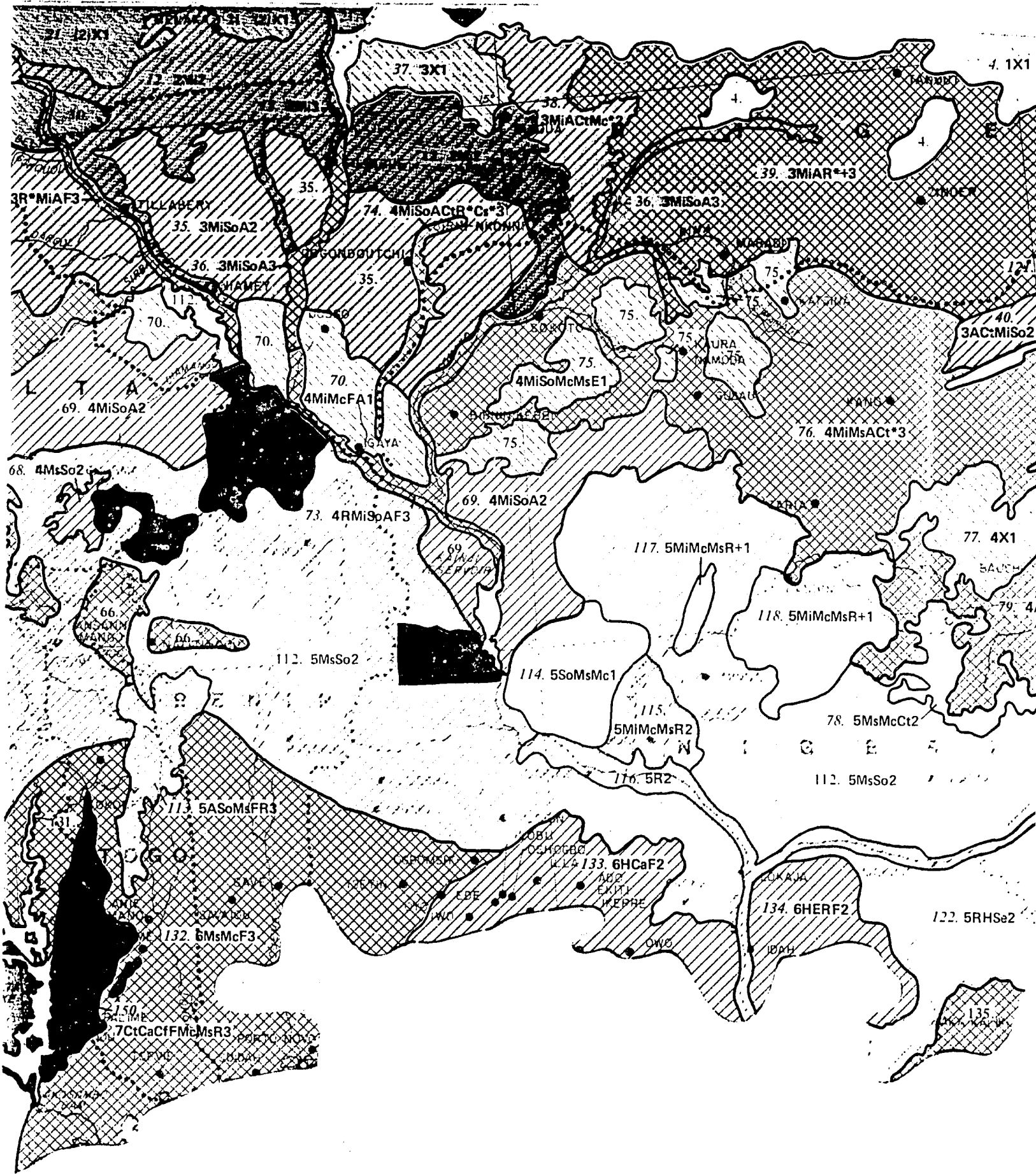
108. 5HRCfCt2

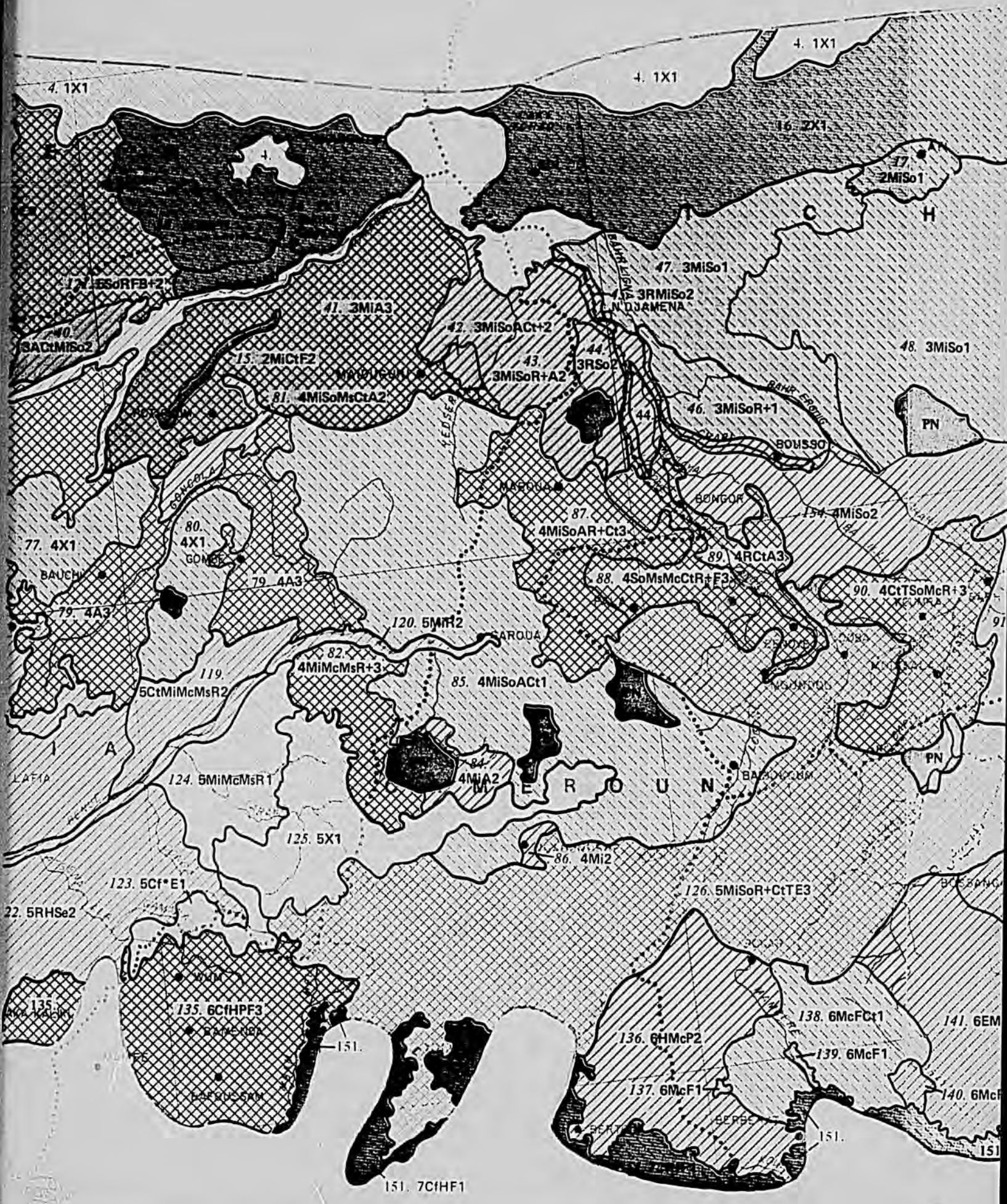
109. 5HCf2

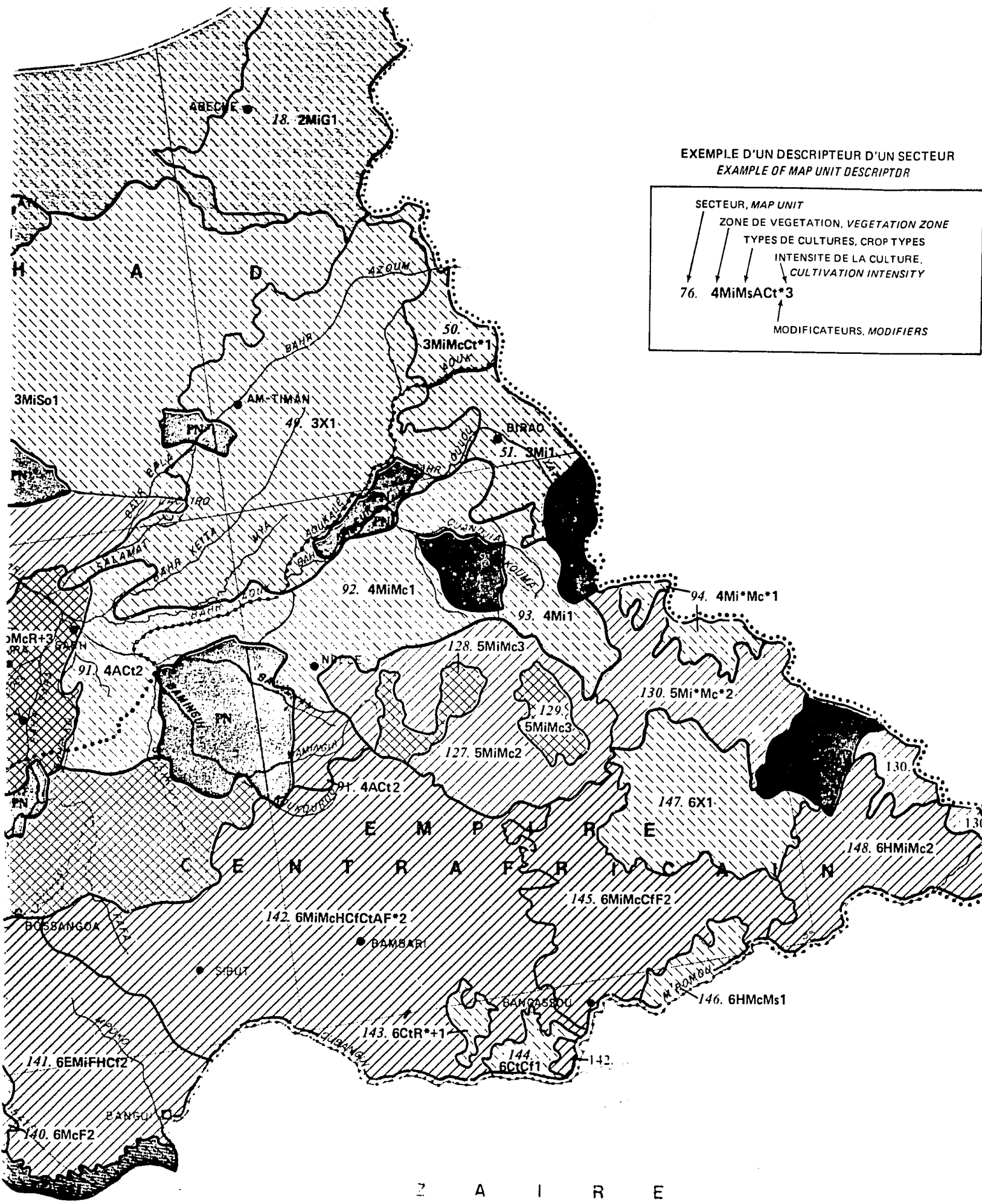
SIERRA LEONE

149.

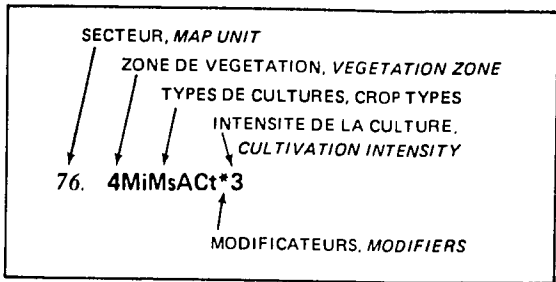








EXEMPLE D'UN DESCRIPTEUR D'UN SECTEUR
 EXAMPLE OF MAP UNIT DESCRIPTOR



LEGENDE

VEGETATION DE FORET ET DE PARCOURS¹ FOREST AND RANGE VEGETATION¹

TYPES DE CULTURES CROP TYPES

ECTEUR
?

IN ZONE
PES
RE,
ITY

ERS



1. Steppe herbacée, *Grass Steppe*



2. Steppe arborée, *Tree Steppe*



3. Savane arbustive, *Shrub Savanna*



4. Savane arborée, *Wooded Savanna*



5. Savane boisée, *Woodland*



6. Mosaïque, *Mosaic*



7. Forêt dense humide, *Tropical Rainforest*



8. Mangliers, *Mangroves*

Mi Millet, *Millet*

So Sorgho, *Sorghum*

Ms Maïs, *Maize*

B Blé, *Wheat*

R Riz, *Rice*

Mc Manioc, *Cassava*

E Autres plantes à racines,
Other Root Crops

A Arachides, *Ground Nuts*

P Plantains, *Plantains*

F Arbres fruitiers, *Fruit Trees*

Cs Canne à sucre, *Sugar Cane*

Ca Cacao, *Cocoa*

Cf Café, *Coffee*

T Tabac, *Tobacco*

Se Sésame, *Sesame*

H Palmier à huile, *Oil Palm*

G Gomme arabique, *Gum Arabic*

Ct Coton, *Cotton*

X Aucune culture, *No Crops*

* uniquement en des endroits sélectionnés
et d'étendue relativement limitée
at selected, relatively limited locations only

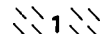
+ terre irriguée, *irrigated land*

() indique la présence de terre stérile;
indicates the presence of barren land

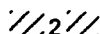


Parcs nationaux et réserves,
National Parks and Reserves

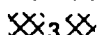
INTENSITE DE LA CULTURE CULTIVATION INTENSITY



0% - 30%



31% - 60%



>60%

du secteur défriché à des fins
agricoles à l'époque du
survol Landsat.
*of area cleared for cultivation at
the time of Landsat overpass.*

0 50 100 150 200 250 Km.

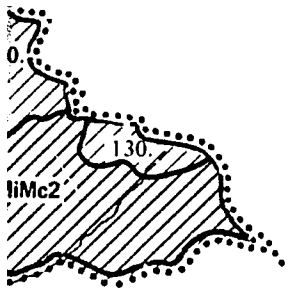
¹ Les Associations de Végétation par
Zone sont présentées en Annexe à
la Carte No. 1.
*Vegetation Associations by Zone
shown in attachment to Map No. 1.*

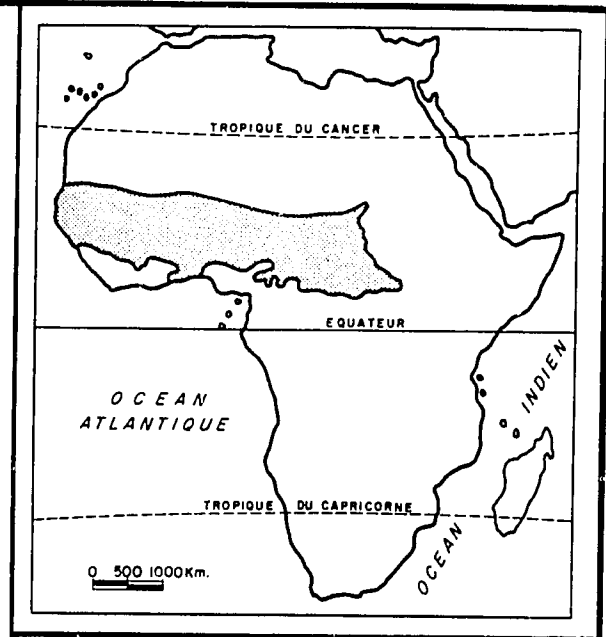
La carte a été établie en octobre 1978 par Earth Satellite Corporation, Washington, D.C. Les unités cartographiques représentées ont été délimitées à partir d'un levé Landsat MSS bande 5 à l'échelle 1:2.500.000 (assemblage de photographies non-redressées) de l'ensemble de la zone à l'étude. La classification des unités cartographiques a été basée sur diverses sources de renseignements, notamment: (1) les données de cartes existantes; (2) l'interprétation Landsat; et (3) les consultations d'experts familiers avec les conditions du terrain. Les images Landsat ont été obtenues par satellite entre 1972 et 1976 au cours de la période allant de novembre à mars.

Avec l'autorisation de Michelin, les parcs nationaux et les réserves ont été reportés de la carte Michelin no. 153 publiée en 1975 à l'échelle 1:4.000.000.

The map was prepared by Earth Satellite Corporation, Washington, D.C., in October, 1978. The map units shown were delineated from a 1:2,500,000 scale Landsat MSS band-5 laydown (uncontrolled mosaic) of the entire project area. Map unit classification was derived through the use of multiple data sources: (1) collateral map data; (2) Landsat interpretation; and (3) experts familiar with actual ground conditions. Landsat imagery was acquired by the satellite between 1972 and 1976 during the November to March time frame.

With permission from Michelin, National Parks and Reserves were transferred from Michelin Map No. 153, published in 1975 at a scale of 1:4,000,000.





SITUATION GEOGRAPHIQUE
GEOGRAPHIC LOCATION



**PROJET D'UTILISATION DES RESSOURCES
EN EAU ET DES TERRES DES REGIONS DE
SAVANE**

COMITE INTERAFRICAIN D'ETUDES HYDRAULIQUES

**SAVANNA REGIONAL WATER RESOURCES
AND LAND USE PROJECT**

INTERAFRICAN COMMITTEE FOR HYDRAULIC STUDIES

VOLUME 6

CARTE No. **1**
MAP No.

UTILISATION ET COUVERTURES DES TERRES

LAND USE / LAND COVER

ASSOCIATIONS DE VEGETATION PAR ZONE¹

VEGETATION ASSOCIATIONS BY ZONE

PHYTOSOCIOLOGIE²

PHYTOSOCIOLOGY

BUISSONS ET ARBRES

BUSHES AND TREES

HERBES

GRASSES

Steppe herbacée
Grass Steppe



Acacia raddiana Savi.
Balanites aegyptiaca
Leptadenia spartium Wright

Aristida pungens Desf. & plumosa L.
Panicum turgidum Forsk. 3
Eragrostis tremula Hochst.

Steppe arborée
Tree Steppe



Acacia raddiana Savi.
Acacia senegal (L.) Willd.
Acacia seyal Del.
Boscia senegalensis Lam.
Commiphora africana (Rich.) Engl.
Euphorbia balsamifera Ait.
Salvadora persica L.

Aristida mutabilis Trin. & Rupr.
Schoenefeldia gracilis Kunth
Cenchrus biflorus Roxb.
Eragrostis tremula Hochst.

Savane arbustive
Shrub Savanna



Combretum micranthum G. Don.
Combretum nigricans Leprieur
Combretum glutinosum Perr.
C. glutinosum var. *passargei* Aubr.
Gutera senegalensis Pers.
Cassia sieberiana D.C.
Annona senegalensis Pers.
Bauhinia rufescens Lam.
Ziziphys sieberiana
Ziziphys mauritiaca Lam.
Sclerocarya bircea (A.Rich.) Hochst.
Prosopis africana Taub.

Cenchrus ciliaris L.
Andropogon gayanus Kunth 4
Brachiaria spp. Griseb.
Loudetia hordeiformis (Stapf) C.E.Hubbard

Savane arborée
Wooded Savanna



Acacia scorpioides (L.) var. *nilotica* (L.) A.Chev.
Acacia ataxacantha D.C.
Acacia caffra Willd. var. *campylacantha* Aubr.
Anogeissus leiocarpus Guill. & Perr.
Bauhinia reticulata D.C.
Hyphaene thebaica (L.) Mart.
Mitragyna inermis O.Kuntze

Andropogon spp., e.g., *gayanus* Kunth, *chevalieri* Reznik, *tectorum* Schumach.
Loudetia togoensis (Pilger) C.E.Hubbard
Pennisetum pedicellatum Trin.
Hyparrhenia spp. Anders. ex Fourn. 6
Schizachyrium spp. Nees

Savane boisée
Woodland



Acacia caffra Willd. var. *campylacantha* Aubr.
Acacia macrostachya Reichenb.
Acacia scorpioides (L.) var. *nilotica* (L.) A.Chev.
Adansonia digitata L.
Anogeissus leiocarpus Guill. & Perr.
Bombax costatum Pellegr. & Vuillet.
Borassus aethiopicum Mart. 7
Butyrospermum parkii Kotschy
Detarium senegalense Gmel.
Ficus spp. L.
Isobertinia dalzielii Craib & Stapf
Isobertinia doka Craib & Stapf
Terminalia avicennioides Guill. & Perr.
Lannea acida A.Rich.
Parkia biglobosa Benth.
Pterocarpus erinaceus Poir.
Tamarindus indica L.

Hyparrhenia spp. Anders. ex Fourn., e.g., *chrysoxyrea* (Stapf), *subplumosa* Stapf
Chasmopodium caudatum (Hack.) Stapf
Andropogon pseudapricus Stapf
Echinochloa pyramidalis (Lam.) Hitchcock & Chase
Pennisetum purpureum Schumach. 8

Mosaïque
Mosaic



Dichrostachys glomerata (Forsk.) Hutch. & Dalz.
Azelia africana Smith
Lophira alata Banks
Entandrophragma spp. C.DC.
Elaeis spp. Jacq.

Chasmopodium spp. Stapf
Panicum maximum Jacq.
Cenchrus lappacea (L.) Desv.
Pennisetum spp. L. Rich. e.g., *purpureum* Schumach., *subangustum* (Schumach) Stapf & C.E.Hubbard, *hordeoides* (Lam.) Steud.

Forêt dense humide
Tropical Rainforest



Une large diversité et un grand nombre d'arbres, de buissons et de plantes rampantes (avec un abondant sous-étage qui forment une couverture végétale très dense de plusieurs étages) se rencontrent dans les zones de forêt tropicale humide.
A large variety and number of trees, bushes, and vines (with a profuse understory forming a very dense vegetation cover of several layers) occur in tropical rainforest areas.

Dans les zones de forêt tropicale humide, les arbres constituent essentiellement la voûte de verdure, tandis que la couverture du sol par des plantes herbacées ne se rencontre que là où le défrichement a été effectué. Cette situation est caractéristique de la zone en mosaïque.
In dense rainforest areas the tree canopy is dominant, thus the grass groundcover occurs only where clearings exist. This is characteristic of the mosaic area.

Mangliers
Mangroves



Rhizophora spp. L.

¹ Les catégories de végétation naturelle se conforment à celles établies à la conférence de Yangambi tenue en juillet-août 1956. *The natural vegetation categories conform to those established at the Yangambi Conference held in July-August, 1956.*

² Les croquis phytosociologiques représentés se rapportent à l'habitat de la végétation, tel qu'observé sur le terrain. *The phytosociological sketches shown relate to the vegetation habitat as seen in the field.*

³ Dans des cours d'eau non permanents. *In dry washes.*

⁴ Cette espèce avait été abondante dans le passé mais elle a disparu par suite des pressions exercées par l'élevage. *This was formerly abundant but has disappeared due to grazing pressures.*

⁵ Sols plus lourds et lieux plus humides. *Heavier soils and more moist locales.*

⁶ Aux endroits favorables. *At favorable locations.*

⁷ Dans les plaines d'inondation. *In floodplains.*

⁸ Dans les lieux humides. *In wet locations.*

ANNEXE A LA CARTE
ATTACHMENT TO MAP

VOLUME 6
CARTE No. 1
MAP No. 1

UTILISATION ET COUVERTURES DES TERRES
LAND USE / LAND COVER

TIPPETTS · ABBETT · McCARTHY · STRATTON · ENGINEERS AND ARCHITECTS

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 1 SIZE 28,119 Sq. km.
Northwestern part of project area in Mauritania. North of Aioun-
LOCATION el-Atbuss and Nema

IMAGE I. D. Path 220, 221, 222 Row 48

Area description (collateral data)

Desert vegetation area (CIA Map of Mauritania, 1967). Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958). Sahelian zone predominantly livestock, Basic food crop - millet and sorghum (Atlas of Africa, 1973). Scattered date palm (oasis) (CIA Map of Mauritania, 1967). Non-agricultural rough grazing land (World Atlas of Agriculture, 1976)

Area description (consultant)

Desert; sand

Area description (Landsat analysis)

Light gray signature indicative of sandy minimal vegetation area. This is judged to be the southern limit of the desert region and the polygon is principally desert and desert vegetation.

Final classification

Grass steppe & Barren land
No crops
0 - 30% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 2 SIZE 7,210 Sq. km.

LOCATION Northeast of Kiffa; West and Northwest of Aioun-el-Atrouss

IMAGE I. D. Path 221 Row 48-49

Area description (collateral data)

Acacia savanna (CIA Map of Mauritania, 1967); Sahelian zone-predominantly livestock (Atlas of Africa, 1973). Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958). Basic food crops-millet and sorghum (Atlas of Africa, 1973); Afolle' plateau area and raw mineral soils of non-climatic origin (International Atlas of West Africa, 1971). Scrub grasses and acacia dominate, occasional baobab-trees (Area Handbook for Mauritania, 1972).

Area description (consultant)

May be rock outcrop; parent material; lateritic-capped plateau with steep escarpments

Area description (Landsat analysis)

Landsat shows polygon to be plateaus with associated escarpments and some erosional outliers. Vegetation, probable Acacia and scrub types occur here.

Final classification

Grass steppe and Barren Land
No crops
0 - 30% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 3 SIZE 2,523 Sq. km.

LOCATION Southeast of Tombouctou

IMAGE I. D. Path 215 and 216, Row 48 and 49

Area description (collateral data)

Acacia savanna and desert vegetation (CIA Maps of Mauritania and Mali, 1967 and 1970 respectively); Wooded steppe with abundant Acacia and Commiphora (Keay and Aubreville, 1958); Non-intensive subsistence agriculture (Millet)- predominantly pastoral. Isohumic soils-reddish brown subarid soils over apollan sands (International Atlas of West Africa, 1971).

Area description (consultant)

Grass steppe; grazing activity; submarginal farming; livestock grazing; nomadic herding.

Area description (Landsat analysis)

Vegetation is sparse in this area which is a transitional area from Steppe to Desert, agricultural activity is minimal; Grazing is probably the dominant agricultural activity.

Final classification

Grass steppe
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 4 SIZE 69,019 Sq. km.

LOCATION Along northern border of project area in Niger

IMAGE I. D. Path 205-211; Row 49-50

Area description (collateral data)

Woodlands, savannas and steppes with abundant Acacia and Commiphora (Keay & Aubreville); Desert vegetation (CIA Map of Niger, 1962); Above the northern limit of cultivation (CIA Map of Niger, 1962); Non-agricultural rough grazing land (World Atlas of Agriculture, 1976).

Area description (consultant)

Grass steppe area; practically no trees; drought - resistant bushes. Annual pasture dependent on rainfall; undeveloped soils - sandy - wind erosion & over grazing; no cropping; all water for animal & people is ground water for short periods. No intermittent streams. Extensively travelled by nomads and their herds. Turegs - desert nomads.

Area description (Landsat analysis)

The light tonal signature of Landsat band 5 indicates an area of minimal natural vegetation and low soil moisture.

Final classification

Grass steppe
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 5 SIZE 10,291 Sq. km.

LOCATION Northwesternmost part of area north of Rosso & Senegal River

IMAGE I. D. Path 225 & 224 Row 48

Area description (collateral data)

Acacia savanna (CIA Map, 1972); Sahelian zone - predominantly livestock (Atlas of Africa, 1973); Wooded Steppe with abundant Acacia & Commiphora (Keay and Aubreville, 1958). Reddish brown subarid soils over aeolian sands (International Atlas of Africa, 1971). Scattered gum arabic (CIA Map, 1971).

Area description (consultant)

Blotches are towns; Dark areas Acacia Senegal (gum); Typical tree steppe. Millet raising between the dunes; some grazing.

Area description (Landsat analysis)

Landsat band 5 has mottled signature - white splotches in a dark-toned matrix. This area is transitional to desert. Northeast to southwest trending dunes exist over area. Steppe vegetation - Acacia & Commiphora probably dominate and the area is principally non-agricultural grazing land. Gum arabic is the dominant commercial crop (Area Handbook for Senegal, 1974).

Final classification

Tree steppe
Millet
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 6 SIZE 15,075 Sq. km.

LOCATION Northeast of Boghe in Mountania

IMAGE I. D. Paths 223 & 224 Row 49

Area description (collateral data)

Acacia savanna (CIA Map of Mountania, 1967) Sahelian zone - predominantly livestock (Atlas of Africa, 1973). Non-agricultural - rough grazing land (World Atlas of Agriculture, 1976), Raw mineral soils of non-climatic origin, raw-mineral erosion soils over various rocks and immature hydromorphic deposit soils over clay-sandy to sandy clay materials; (International Atlas of West Africa, 1971).

Area description (consultant)

Some topographic relief; small escarpments, rolling hills; some pronounced water sheds; occasional flooding & alluvial. Some date palms - oasis type agriculture; minor millet & sorghum. Localized grazing around intermittent water sources - sheep, goats, cover.

Area description (Landsat analysis)

Band 5 shows northeast/southwest trending dunes with sharp linear interface between lowland and plateau. Clouds obscure part of area. Area is drained by intermittent channels at scarp base. Agricultural activity not observed. Probably a livestock area.

Final classification

Tree Steppe
Millet and sorghum, and oases at selected relatively limited locations only.
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 7 SIZE 37,646 Sq. km.

LOCATION Northwest part of project area. Area surrounds Bakel, Senegal; Kiffa, Aioun-el Atrouss and Nema, Mauritania.

IMAGE I. D. Path 222, 223, 221 Row 48 & 49

Area description (collateral data)

Acacia savanna area (CIA Map of Moutania, 1967). This is a gum producing (Acacia) area (Area Handbook for Mauritania 1972). Wooded Steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958). Sahelian zone predominantly livestock (Atlas of Africa 1974). Scattered date palm (CIA Map of Moutania, 1967). Non-agricultural, rough grazing land (World Atlas of Agriculture, 1976). West of Kiffa; Isohumic reddish-brown subarid soils. East of Kiffa - raw mineral erosion soils over various rocks; also desert soils (International Atlas of West Africa, 1971).

Area description (consultant)

Tree steppe; annuals; Acacia; grazing; little farming except near the river in the south

Area description (Landsat analysis)

Light gray-white tonal signature indicates area of minimal vegetation. O'Ghorfa and Karakors Rivers drain the area. Plateaus and associated escarpments occur here.

Final classification

Tree steppe
Millet and sorghum
0 - 30% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 8 SIZE 40,867 Sq. km.

LOCATION Northwestern part of project area in Mauritania. Surrounding Kiffa Aroun-el-Atrouss.

IMAGE I. D. Path 220, 221, 222 Row 49 & 50

Area description (collateral data)

Sahelian zone-predominantly livestock; non-intensive subsistence (millet) - (Atlas of Africa, 1973). Acacia savanna with scattered gum arabic production (CIA Map of Mauritania, 1967); Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958). Non-agricultural rough grazing land (World Atlas of Agriculture, 1976). Raw mineral soils of non-climatic origin over various rocks or isohumic reddish brown subarid soils over aeolian sands (International Atlas of West Africa, 1971).

Area description (consultant)

Not familiar with area; tree steppe ; Hilly or mountain area. Peanuts & subsistence (Millet and sorghum).

Area description (Landsat analysis)

Landsat band 5 shows light gray tones indicative of an area of sparse natural vegetation cover. Northeast-southwest trending longitudinal dunes cross the area. Permanent streams are non-existent over most of the area. Area is transitional to desert.

Final classification

Tree Steppe
Millet, Sorghum, Peanuts
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 9 SIZE 39,884 Sq. km.

LOCATION West of Niafounke; northern limit of project area

IMAGE I. D. Path 217 & 218, Row 49

Area description (collateral data)

Acacia savanna and desert vegetation (CIA Maps of Mauritania & Mali, 1967 and 1970 respectively); Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Non-intensive subsistence (Millet)-predominantly pastoral. Desert soils over aeolian sands (International Atlas of W. Africa, 1971).

Area description (consultant)

Unknown area (Fred Weber, August 21, 1978).

Area description (Landsat analysis)

Vegetation is sparse in this area which is a transitional area from Steppe to desert. Agricultural activity is minimal. Grazing is probably the dominant agricultural activity.

Final classification

Tree steppe

No crops

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 10 SIZE 40,736 Sq. km.

LOCATION North of Hombori; South of Niger River

IMAGE I. D. Path 214, 215, 216; Row 49

Area description (collateral data)

Predominantly pastoral; non-intensive subsistence (millet) (Atlas of Africa, 1973); Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Reddish-brown subarid soils over aeolian sands (International Atlas of W. Africa (1971).

Area description (consultant)

Tree steppe; Submarginal farming (Fred Weber, August 21, 1978); Livestock grazing area; nomadic herding.

Area description (Landsat analysis)

Light gray Landsat band 5 tones indicative of minimal natural vegetation and grading into a desert environment. Agriculture is minimal with grazing being the principal agricultural activity. Longitudinal sand dunes occur within the area.

Final classification

Tree steppe

No crops

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 11 SIZE 15,862 Sq. km.

LOCATION South of Tomboutou along Niger River at Niafounke

IMAGE I. D. Paths 216 and 217 Row 49 and 50

Area description (collateral data)

Marsh grass & crops (CIA Map of Mali, 1968); Acacia savanna (CIA Map of Mali, 1968); Wood Steppe with Abundant Acacia and Commiphora (Keay & Aubreville, 1958). Rice and cotton (CIA Map, 1968); soils with pseudo-gley (International Atlas of West Africa, 1970).

Area description (consultant)

Tree steppe area (Fred Weber; August 21, 1978).

Area description (Landsat analysis)

The inland delta of the Niger River is flooded at the time of this Landsat scene. Longitudinal east-west trending dunes have their swales flooded. Marsh grasses, rice and cotton are the principal crops here.

Final classification

Tree steppe
Rice and cotton at selected relatively limited locations only.
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 12 SIZE 67,773 Sq. km.

LOCATION Northern part of project area around Gao and Menaka

IMAGE I. D. Paths 212-213; Row 50-51

Area description (collateral data)

Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Acacia savanna and desert vegetation (CIA Map of Mali, 1970). Rice (Atlas of Afric, 1973); Rice and cotton; nomadic herding (CIA Map of Mali, 1970); Reddish - brown subarid soils over aeolian sands (International Atlas of W. Africa, 1971).

Area description (consultant)

Tree steppe - good pasture - and annarals; Acacia Maddiana; Balonytes; some subsistence millet in southern portion, but mainly is rangeland. In north alurral system - serious wind erosion.

Area description (Landsat analysis)

Landsat band 5 shows this to be an area of sparse natural vegetation cover. It is difficult, using band 5 alone, to distinguish between areas under intensive agricultural activity such as the rice/cotton area adjacent to the Niger River and the nomadic herding area south of Menaka.

Final classification

Tree steppe
Millet
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 13 SIZE 1,213 Sq. km.

LOCATION Adjacent to and north of Filingue

IMAGE I. D. Path 211; Row 50

Area description (collateral data)

Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Miller and sorghum (CIA Map of Niger, 1962); Multicrop subsistence farming with sedentary livestock breeding (Atlas of Africa, 1973). Isohumic brown subarid vertic soils over clay alluvium (International Atlas of W. Africa, 1971).

Area description (consultant)

Valley bottom of ancient river system; favorable hydrology - deeper, richer soils; shallow water table - intermittently. Good millet, cow peas (rich in protein) niebe areas - high yield. Natural vegetation - shrub savanna and tree steppe but species found in Wooded savanna are here - Baurinia reticulata; Baobab; Acacia nilotica. Dense population; large livestock population.

Area description (Landsat analysis)

A strip of medium gray tones adjacent to the north-south flowing stream is shown on Landsat band 5. This could be an indicator of higher soil moisture and cropping practices associated with such soils - eg rice or cotton.

Final classification

Tree steppe
Millet
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 14 SIZE 9,996 Sq. km.

LOCATION North central section of study area; Niger & Nigeria

IMAGE I. D. Path 205, 206; Row 50, 51

Area description (collateral data)

Veg. Wooded Steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958). Short grass savanna; sudan savanna (CIA Map).
Ag. Multi-crop subsistence & sedentary livestock; peanuts (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land (World Atlas of Agriculture, 1976); Millet & sorghum (CIA Map).
Soils Mineral hydromorphic soils with deep gley.

Area description (consultant)

Tree steppe with gum arabic; livestock; submarginal millet subsistence mainly nomadic; Agriculture assoc. with Mares is date palm, onion, tomatoes, some wheat. Traditional garden crops.

Area description (Landsat analysis)

Many scattered small circular dark tonal signatures indicative of lakes (about 1 sq. km. ea. - from ONC chart); over entire map unit. These lakes are often surrounded by an area of light gray tonal signature indicative of sparse vegetation (grass) or possible farming.

Final classification

Tree steppe
Gum arabic, millet
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 15 SIZE 1,966 Sq. km.

LOCATION Northern east central section of study area; N.E. Nigeria, Komadugu; Gambi Rivers

IMAGE I. D. Path 205, 206; Row 51, 52

Area description (collateral data)

Veg. Wooded Savannas & Steppes (Keay & Aubreville, 1958); Sudan savanna (CIA Maps).

Ag. Subsistence crops with commercial (Atlas of Africa, 1973); Non agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976).

Soils Little leached gray ferruginous soils - hydromorphic facies over sandy material (International Atlas of W. Africa, 1971).

Area description (consultant)

Tributary of the channel in 145. Probably some remnant tree appears & agricultural activity. No peanuts.

Area description (Landsat analysis)

Minor interior drainage system (incomplete). Dark tonal signature indicative of trees and/or standing water; medium gray tonal signature indicative of grass. No evidence of sand dunes.

Final classification

Tree steppe
Millet, cottons, fruit trees
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 16 SIZE 128,757 Sq. km.

LOCATION North Central section of study area; N. central Nigeria

IMAGE I. D. Path 199-209; Row 50, 51

Area description (collateral data)

Veg. Wooded steppe with abundant Acacia & Commiphora; Woodland savanna & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1976).

Ag. Non-agriculture & Rough Grazing Land (World Atlas of Agriculture, 1976); Non-agriculture & Rough Grazing Land with trees; Traditional subsistence; Multi-crop subsistence & sedentary livestock; irrigated rice; gum arabic (Atlas of Africa, 1973). Grazing to some subsistence; Millet & Sorghum; peanuts (CIA Maps)

Soils Brown & reddish-brown isohumic subarid soils with sesquioxides (International Atlas of W. Africa, 1971). No data east of Lake Chad.

Tree steppe; nothing but grazing; Minor wheat in Lake Chad area with polders - dunes pumped with water. Too small for Landsat resolution detecting.

Area description (Landsat analysis)

Only drainage present is interior, and not well defined. Over most of the area are light gray tonal signatures with north west - southwest dunes indicative of sand & desert environment. There are some light gray tonal signatures indicative of farming. East of Lake Chad is a wadi of southwest - northeast direction (Bahr el Ghazal). (Darker gray tonal signature)

Final classification

Tree steppe
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 17 SIZE 5,080 Sq. km.

LOCATION North eastern section of study area; Ati, Central Chad

IMAGE I. D. Path 201; Row 51

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958).

Ag. Traditional subsistence (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land; Rough Grazing Land (World Atlas of Africa, 1976); Grazing to some subsistence; Mixed subsistence/Grazing (CIA Map).

Soils No data

Area description (consultant)

Tree steppe (Atlas of Chad, 1972)

Millet/sorghum - minor amount.

Heavy grazing area

Area description (Landsat analysis)

Low density drainage; some medium gray tonal signatures indicative of grass; Mostly lighter gray tonal signatures indicative very sparse vegetation or possible farming.

Final classification

Tree steppe

Millet, sorghum

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 18 SIZE 41,359 Sq. km.

LOCATION Northeastern section of study area; West of Sudan, contains city of Abeche

IMAGE I. D. Path 199, 198; Row 50, 51

Area description (collateral data)

Veg. North section - Wooded steppe with abundant Acacia & Commiphora South section Woodlands, Savannas & Steppes, undifferentiated relatively dry types (Keay & Aubreville, 1958).

Ag. North Section - Non-ag. & Rough Grazing Land; South Section Non Ag. & RGL with trees (World Atlas of Agriculture, 1976). Traditional - subsistence Millet, sorghum, peanuts (Atlas of Africa, 1973). Grazing to same subsistence (CIA)

Soils No data

Area description (consultant)

Tree steppe. Some basic millet (Subsistence); gum arabic area. North of farming; Much gum arabic; tree steppe; camels & cattle & sheep & goats.

Area description (Landsat analysis)

Sahel region in north - smooth light gray tonal signatures indicative of scattered & sparse scrub vegetation: transition between vegetative south & vegetation free areas north. Part of Azoum River drainage area in south (dendritic pattern) is in an area of scattered medium gray tonal signatures (grass) and a few light tonal signatures (farming) and a few dark regular shaped tonal signatures (burns). A few dark gray tonal signatures in extreme south indicate forest vegetation.

Final classification

Tree steppe

Millet, gum arabic

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 19 SIZE 5,145 Sq. km.

LOCATION West of Kiffa. Between O'Chorfa and Karakoro Rivers

IMAGE I. D. Paths 221 & 222 Rows 50 & 49

Area description (collateral data)

Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958). Acacia savanna (CIA Map of Mauritania, 1967). Sahelian zone-predominantly livestock; basic food crops-millet and sorghum (Atlas of Africa, 1973). The El Assaba Plateau with raw mineral soils of non-climatic origin (International Atlas of West Africa, 1971). Some millet, maize and sorghum (Area Handbook for Mauritania, 1972).

Area description (consultant)

May be rock outcrop; parent material

Area description (Landsat analysis)

This is a plateau and associated escarpment region. Vegetation is sparse and any cropping is probably scattered millet and sorghum. Acacia is probably dominant natural vegetation.

Final classification

Tree steppe and Barren land
No crops
0 - 30% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 20 SIZE 12,673 Sq. km.

LOCATION South of Nema

IMAGE I. D. Path 219 Row 49 & 50

Area description (collateral data)

Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Acacia savanna (CIA Map of Mauritania, 1967); Some date palm (CIA Map of Mauritania, 1967); Principally non-agricultural rough grazing land (World Atlas of Agriculture, 1976); Basic food crops - millet and sorghum (Atlas of Africa, 1973); Raw mineral soils of non-climatic origin over various rocks and Isohumic reddish-brown subarid soils (International Atlas of West Africa, 1971); Low-yield dates (Area Handbook for Mauritania, 1972).

Area description (consultant)

Rock outcrop; no agriculture; grass steppe - Acacia, Balonytes

Area description (Landsat analysis)

Area consists principally of erosional outliers and dunes trending north-east/southwest. Area is dissected by several large intermittent streams. Area is bounded on the east by a steep escarpment; livestock migration area probable. Vegetation (natural) unknown. Dark to black tones could be exposed rock.

Final classification

Tree steppe and Barren land
No crops
0 - 30% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 21 SIZE 14,125 Sq. km.

LOCATION Northern most part of project area east and west of Menaka, Mali

IMAGE I. D. Path 212, 213; Row 49

Area description (collateral data)

Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Desert vegetation or Acacia savanna (CIA Map of Mali, 1970); Predominantly pastoral non-intensive subsistence (millet) and nomadic herding (Atlas of Africa, 1973 and CIA Map of Mali, 1970). Reddish - brown subarid soil over aeolian sands (International Atlas of W. Africa, 1971). Ancient basement rock outcrops between Ansongo and Tillabere (Church, 1974).

Area description (consultant)

Rock outcrop area - granites; Vegetation is tree steppe; Trees and bushes influence by shallow soils and constant overgrazing. No agriculture - area of nomadic grazing.

Area description (Landsat analysis)

Landsat band 5 shows the area with alternating northeast-southwest trending black and white bands indicating hills or parallel dune ridges and swales. The dark gray to black tonal signature is most probably related to the low reflectance of soil, or rock outcrops on the area.

Final classification

Tree steppe and Barren land
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 22 SIZE 2,097 Sq. km.

LOCATION Along northernmost boundary of project area northwest of Kiffa

IMAGE I. D. Path 222 & 223; Row 48 & 49

Area description (collateral data)

Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958) Acacia Savanna (CIA Map of Mauritania, 1967); Isohumic reddish-brown subarid soils over aeolian sands (International Atlas of West Africa, 1971). Tagant plateau area drained by intermittent streams (International Atlas of West Africa, 1971). Springs and wells provide good pasturage and permit raising of some crops. Large date palm plantations present (Area Handbook for Mauritania, 1972).

Area description (consultant)

Not familiar with this area

Area description (Landsat analysis)

The distinctive interface between the desert and the plateau show up well on the Landsat band 5. The plateau escarpment stands out well on the imagery. Erosional outliers of the plateau also are striking. Vegetation on the plateau appears to be sparse.

Final classification

Barren land
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 23 SIZE 48,241 Sq. km.

LOCATION Northeast of Dakar; south of Senegal River. Southernmost limit approximately at Bakel.

IMAGE I. D. Paths 223, 224, 225 Rows 50 & 51

Area description (collateral data)

Wooded Steppe with abundant Acacia and Commiphora. Southern part of area within Woodlands, Savanna, Steppe - Undifferentiated dry types; (Keay & Aubreville, 1958). Acacia savanna (CIA Map of Senegal & Gambia, 1972). Peanut/Millet association and non-intensive grazing (Atlas of Africa, 1973). Isohumic soils - reddish-brown subarid types over aeolian sands and other sandy material; some raw mineral soils over various rocks (desert ablatrin soils (International Atlas of West Africa, 1971). Gray ferruginous soils in western portion.

Area description (consultant)

Open rangeland - tree steppe - good grass growth. Acacia sial A. Senegal, Balanites egyptiaca
No peanuts! Only little millet. Too dry

Area description (Landsat analysis)

Cloud cover in western portion prevents good delineation of area differentiation. In eastern portion of polygon agricultural activity appears to be minimal. While the western cloud - obscured portion may be dominated by peanut/millet cropping, the eastern portion appears to be a grazing area. A few major trails (migration-transhumance) cross the area toward the Senegal River.

Final classification

Shrub savanna
Millet
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 24 SIZE 1,934 Sq. km.

LOCATION East of Matam outside of Senegal River Valley

IMAGE I. D. Path 223, Row 50

Area description (collateral data)

Wooded Steppe - abundant Acacia & Commiphora (Keay & Aubreville, 1958). Acacia savanna (CIA Map of Senegal & Gambia, 1972). Date palm area (CIA Maize (Atlas of Africa, 1973). Isohumic soils; brown sub-arid vertic soils over clay material insuing from marls (International Atlas of West Africa, 1971).

Area description (consultant)

Not familiar with this area

Area description (Landsat analysis)

Landsat band 5 shows medium gray tonal signature surrounded by lighter area. Tonal difference may be a soil difference rather than a land cover/use difference

Final classification

Shrub savanna
Millet, maize
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 25 SIZE 22,908 Sq. km.

LOCATION West of Diema; East of Kaves; North of Bafoulable

IMAGE I. D. Paths 220, 221 Row 50 & 51

Area description (collateral data)

Polygon bisects Wooded Steppe with Abundant Acacia and Commiphora and Woodlands, Savannas and Steppes (undifferentiated relatively dry types) (Keay & Aubreville, 1958); Subsistence agriculture (millet and sorghum) with peanuts and cotton (Atlas of Africa, 1973); Acacia savanna (CIA Map of Mali, 1970; Raw mineral soils of non-climatic origin over ferruginous crusts and concretionary leached gray ferruginous soils (International Atlas of West Africa, 1971). Non agricultural and rough grazing land with trees (World Atlas of agriculture, 1976).

Area description (consultant)

Not familiar with area; Shrub savanna subsistence are millet/sorghum.

Area description (Landsat analysis)

Landsat shows a plateau area with steep westward facing escarpment and gradually sloping toward the east. Agricultural activity appears to be concentrated around villages. Area not as intensively farmed as areas to the east and west.

Final classification

Shrub savanna
Millet sorghum, cotton
31 - 60% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 26 SIZE 3,376 Sq. km.

LOCATION Surrounding Niore du Sahel

IMAGE I. D. Path 220, Row 50

Area description (collateral data)

Intensive cotton growing area (Atlas of Africa, 1973). Wooded Steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958); Acacia savanna (CIA Map of Mali, 1970); Scattered gum arabic (CIA Map of Mali, 1970).

Area description (consultant)

Not familiar with area. Shrub savanna; subsistence is millet/sorghum.

Area description (Landsat analysis)

Intensively cleared area around Niore du Sahel/White tonal signature. Correlates with collateral data; cotton area.

Final classification

Shrub savanna
Millet, sorghum, cotton
31 - 60% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 27 SIZE 77,113 Sq. km.

LOCATION From Kayes northeast to Nioro du Sahel and eastward to Sokolo

IMAGE I. D. Paths 218, 219, 220, 221 Rows 50 & 51

Area description (collateral data)

Subsistence agriculture (millet & sorghum) with peanuts and cotton (Atlas of Africa, 1973); (CIA Maps of Mauritania and Mali, 1967 and 1970 respectively). Polygon - principally in Wooded Steppe with Abundant Acacia and Commiphora area (Keay & Aubreville, 1958); Acacia savanna (CIA Map of Mali, 1970). Scattered gum arabic (CIA Map of Mali, 1970).

Area description (consultant)

Not familiar with area; getting into shrub savanna; Subsistence agriculture - millet and sorghum

Area description (Landsat analysis)

Village and trails characterize this area. Much of the natural vegetation is gone in the western portion of the area. Most probably due to intensive subsistence agriculture. In the eastern portion of the area, villages and trails dot the landscape with subsistence agriculture concentrated around the villages. Natural vegetation is a medium gray tone characteristic of wooded steppe with Acacia and Commiphora.

Final classification

Shrub savanna
Millet, sorghum
0 - 30% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 28 SIZE 2,294 Sq. km.

LOCATION In the Sokola and Niono area of Mali

IMAGE I. D. Path 218, Row 50

Area description (collateral data)

Rice and cotton (CIA Map of Mali, 1970); Wooded Steppe with abundant Acacia and Commiphora (northern part); Woodlands, savannas and steppes-undifferentiated relatively dry types (Keays & Aubreville, 1958); (southern part). Acacia savanna (CIA Map of Mali, 1970); Vertisols with no external drainage; non-grumusolic topographic vertisols over clay alluvium (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with the area.

Area description (Landsat analysis)

Area receives internal drainage. Large regularly shaped agricultural area - probably rice paddies (intensively cropped area).

Final classification

Shrub savanna
Irrigated rice
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 29 SIZE 8,849 Sq. km.

LOCATION In the Sokalo and Niono areas of Mali

IMAGE I. D. Path 218, Row 50

Area description (collateral data)

Rice and Cotton (CIA Map of Mali, 1970); Irrigated Cotton (Atlas of Africa, 1973). Wooded Steppe with abundant Acacia & Commiphora (northern part); Woodlands Savannas and Steppes - undifferentiated relatively dry types (Keay & Aubreville, 1958); Acacia savanna (CIA Map of Mali, 1970). Vertisol soils with no external drainage; non-grumosolic topomorphic vertisols over clay alluvium (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with the area

Area description (Landsat analysis)

Distinctive white to light gray tonal signature. This correlates well with the soil type and the cropping practices (e.g.) irrigated cotton in this area.

Final classification

Shrub savanna
Irrigated cotton, rice at selected relatively limited locations only
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 30 SIZE 6,128 Sq. km.

LOCATION Around and east of Segou, Mali

IMAGE I. D. Path 217-218; Row 50-51

Area description (collateral data)

Woodlands, savannas, and steppes - undifferentiated relatively dry types (Keay & Aubreville, 1958); Tallgrass savanna, brush and cultivated vegetation (CIA Map of Mali, 1970); Rice, cotton are dominant (Atlas of Africa, 1973; CIA Map of Mali, 1970). Mineral hydromorphic soils with pseudo-gley and leached gray ferruginous soils (International Atlas of W. Africa, 1971). Marsh grass and crops (CIA Map of Mali, 1970).

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

White tonal Landsat signature with mottled medium gray tones. This indicates an intensively cultivated area. Along the Niger highly reflective tonal signatures are indicative of possible rice cultivation.

Final classification

Shrub savanna
Rice and cotton at selected relatively limited locations only; peanuts
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 31 SIZE 17,500 Sq. km.

LOCATION Around and west of Mopti

IMAGE I. D. Path 216-217; Row 49-50

Area description (collateral data)

Woodlands, savannas and steppes - undifferentiated relatively dry types; Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Marsh grass and crops (CIA Map of Mali, 1970); Mineral hydromorphic soils with pseudo gley (International Atlas of W. Africa, 1971); Rice and cotton (Atlas of Africa, 1973; CIA Map of Mali, 1970).

Area description (consultant)

Sand marsh, scrub brush observed from airplane. Marsh areas. Good reclamation potential. Collateral data may not be accurate.

Area description (Landsat analysis)

The dark gray to black tonal Landsat signature indicates extensive flooding within the Niger Inland Delta. Marsh grasses characterize the area and rice and cotton are the dominant crops.

Final classification

Shrub savanna
Rice, cotton, millet, sorghum
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 32 SIZE 14,649 Sq. km.

LOCATION Norrrh of Douerza; East of Mopti

IMAGE I. D. Path 216, Row 49

Area description (collateral data)

Wooded steppe with abundant Acacia & Commiphora (Keay and Aubreville, 1958); Acacia savanna (CIA Map of Upper Volta, 1968); Predominatly pastoral (north-ern part). Non-intensive subsistence - Millet; Bandiagara plateau and out-liers - non agricultural on the plateaus (R. J. Harrison Church, 1974). Raw mineral soils of non-climatic origin over various rocks (International Atlas of W. Africa, 1971).

Area description (consultant)

Shrub savanna; Use above description

Area description (Landsat analysis)

The Bandiagara Plateau and its steep escarpments show up well on the Land-sat band 5. Agricultural activity on the plateaus is minimal due to the poor soils and water supply.

Final classification

Shrub savanna
Millet
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 33 SIZE 81,800 Sq. km.

LOCATION In Upper Volta and Mali at Djibo, Dori, Hombori and Douentya area

IMAGE I. D. Path 213, 215, Row 49, 50

Area description (collateral data)

Wooded Steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958). Millet, sorghum, fundi; peanuts, beans and sesame; Indian butter trees around Djibo and Ouahigouiga (Atlas of Africa, 1973). Reddish-brown sub-arid soils, leached gray ferruginous soils; brown sub-arid modal soils (International Atlas of West Africa, 1971).

Area description (consultant)

Grass steppe; No farming; Rangeland; A little millet & sorghum.

Area description (Landsat analysis)

The light gray tonal signature on Landsat band 5 indicates a sparse natural vegetative cover. Clearing for agriculture appears difficult to determine since the white tones coalesce with the sparsely vegetated bare areas.

Final classification

Shrub savanna
Millet and sorghum; Rice at selected relatively limited locations only.
Some irrigated land at selected relatively limited locations only.
31 - 60% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 34 SIZE 3,671 Sq. km.

LOCATION Along Niger River Floodplain northwest and southeast of Tallalfray and Niamey.

IMAGE I. D. Path 212, 213,; Row 51,52

Area description (collateral data)

Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); north of Niamey; Woodlands, savannas and steppes with undifferentiated dry types - south of Niamey (Keay and Aubreville, 1958); Acacia savanna (CIA Map of Niger, 1962); Irrigated rice and peanuts (Atlas of Africa, 1973, and CIA Map of Niger, 1962); Non or little leached gray ferruginous soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Floodplain; recent large scale rice development; typical riparian vegetation, large trees - Tamarindus, stands of Doum palm; Acacia milotica; large dense stands of Acacia Albida. Deep sandy soils productive for millet, some peanuts, fruit or chard - mango, guava, papaya, citrus. Feeding and watering area. So important ecologically that remnants of original population are there.

Area description (Landsat analysis)

Intensive agricultural activity along the Niger River flood plain. White tonal signatures. Probably rice signature and intensive peanut production.

Final classification

Shrub savanna
Rice at selected relatively limited locations only; millet; peanuts, fruit trees
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 35 SIZE 55,058 Sq. km.

LOCATION East of Tillaberry, Niger

IMAGE I. D. Path 211-212; Row 50-51

Area description (collateral data)

Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Acacia savanna (CIA Map of Niger, 1962); Peanuts, millet and sorghum (CIA Map of Niger, 1962); Multicrop subsistence and sedentary livestock (Atlas of Africa, 1973). Non or little leached gray ferruginous soils over aeolian sands (International Atlas of W. Africa, 1971). Level plains of soft sandstones and clays with some laterite crossed by wide relic river valleys known as dallols. Acacia and borassus palms line banks. Myrrh (Church, 1974).

Area description (consultant)

Wooded savanna; fair amount of shallow soils over thick laterite; hard to get water; millet and locally owned livestock. Escape area for herds in north during dry time. Cash crop - peanuts. Some mango, mango, and fruit trees (citrus). Moderate cultivation except for low lying farm areas. 50% of area under cultivation.

Area description (Landsat analysis)

Agricultural activity appears spotty in this area. Toward the north the wide relic river channels appear to be filled with sandy soils unsuitable for large scale agricultural production.

Final classification

Shrub savanna
Millet, sorghum, peanuts
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 36 SIZE 8,062 Sq. km.

LOCATION Along Niger and Sokoto Rivers

IMAGE I. D. Path 208 Row 51; Path 209 Row 51; Path 210 Row 52

Area description (collateral data)

Wooded steppe with abundant Acacia and Commiphora and Woodlands, Savannas and Steppes with undifferentiated dry types (Keay and Aubreville, 1958). Irrigated rice, peanuts and cotton (Atlas of Africa, 1973; CIA maps of Niger and Nigeria, 1962, 1972). Little leached gray ferruginous soils over aeolian sands or mineral hydromorphic soils with deep gley (International Atlas of West Africa, 1971).

Area description (consultant)

Rice irrigation schemes and sugar cane in southern part; good irrigation potential; grass- thick perennials; good Borassus area.

Area description (Landsat analysis)

A band of light gray to white tones adjacent to the Niger and Sokoto Rivers indicates intensive cultivation. The white, highly reflective tones are believed to be rice while the bright or light gray tones are probably peanuts and cotton cultivation.

Final classification

Shrub savanna
Millet, sorghum, peanuts
Greater than 60% of the area was under cultivation at the time of Landsat overpass

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 37 SIZE 9,635 Sq. km.

LOCATION North central section of study area; S.W. Niger

IMAGE I. D. Path 210/211 Row 49

Area description (collateral data)

Veg. Wooded Steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958). Sudan Savanna (CIA)

Ag. Semi-desert (Atlas of Africa 1973) Non-agricultural Rough Grazing Land (World Atlas of Agriculture 1976) Grazing (CIA)

Soils Reddish brown subarid isohumic soils-modal facies over eolian sands (International Atlas of West Africa 1971)

Area description (consultant)

Shrub savanna; has grazing pressure throughout 67 & 71, non-agricultural; good grazing area.

Area description (Landsat analysis)

Little to no drainage. Mostly medium gray tonal signatures indicative of grass. Some evidence of dunes. Only one small area of light tonal signature indicative of farming detected.

Final classification

Shrub savanna
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 38 SIZE 14,649 Sq. km.

LOCATION North central section of study area; S.W. Niger

IMAGE I. D. Path 209/210 Row 50/51

Area description (collateral data)

Veg. Wooded steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958). Sudan Savanna (CIA)

Ag. Semi-desert; cotton; Rice-irrigated (Atlas of Africa 1973) Non-agriculture & Rough Grazing Land; Non-ag. & RGL with trees (World Atlas of Agriculture 1976) Cotton; Grazing (CIA)

Soils Reddish-brown sub arid isohumic soils-modal facies, over eolian sands; little leached gray ferruginous soils-modal facies over sandy materials (International Atlas of West Africa 1971)

Area description (consultant)

Mountains - dark areas on Landsat are ridges; light areas agriculture - good alluvial soil; basic staple crop - millet, much peanuts, little cotton, manioc, cassava. Very intersected valley agriculture systems; Relatively agricultural area; livestock - domestic & nomadic. The Majya*; Shrub savanna.

Area description (Landsat analysis)

Evidence of moderate density dendritic interior drainage, indicative of some relief. In many instances, medium gray tonal signatures indicative of grass appear in conjunction with the drainage network, surrounded by a narrow band of dark tonal signatures indicative of forest vegetation. Some light striations indicative of blowing sand. Not many light tonal signatures indicative of farming.

Final classification

Shrub savanna
Millet, peanut, cotton, cassava
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 39 SIZE 102,348 Sq. km.

LOCATION North Central section of study area; N. central Nigeria

IMAGE I. D. Path 199-209; Row 50, 51

Area description (collateral data)

- Veg. Wooded steppe with abundant Acacia & Commiphora; Woodland savanna & Steppe-undifferentiated relatively dry types (Keay & Aubreville, 1976).
- Ag. Non-agriculture & Rough Grazing Land (World Atlas of Agriculture, 1976); Non-Agriculture & Rough Grazing Land with trees; Traditional subsistence; Multicrop subsistence & sedentary livestock; irrigated rice; gum arabic (Atlas of Africa, 1973). Grazing to some subsistence; Millet & Sorghum; Peanuts (CIA Maps).
- Soils - Brown & reddish-brown isohumic subarid soils with sesquioxides (International Atlas of W. Africa, 1971). No data east of Lake Chad.

Tree steppe; nothing but grazing; Minor wheat in Lake Chad area with polders-dunes pumped with water. Too small for Landsat resolution detecting.

Area description (Landsat analysis)

Only drainage present is interior, and not well defined. Over most of the area are light gray tonal signatures with north west - southwest dunes indicative of sand & desert environment. There are some light gray tonal signatures indicative of farming. East of Lake Chad is a wadi of south-west - northeast direction (Bahr el Ghazal), (Darker gray tonal signature)

Final classification

Shrub savanna
Millet, peanuts, irrigated rice
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 40 SIZE 5,866 Sq. km.

LOCATION North central section of study area, N. Central Nigeria

IMAGE I. D. Paths 206, 207; Row 51

Area description (collateral data)

- Veg. Woodland, Savanna & Steppe undifferentiated relatively dry types (Keay & Aubreville, 1958); Sudan Savanna (CIA Maps)
- Ag. Subsistence crops with commercial (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land; Non Ag. & RGL (World Atlas of Agriculture, 1976). Ground nuts (CIA Maps)
- Soils Little leached gray ferruginous soils - modal facies over eolian sands (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area.
Shrub savanna

Area description (Landsat analysis)

Light gray tonal signature indicative of farming. A few striations in south indicative of sand dunes. Scattered circular shaped dunes through area. Evidence of braided stream channels, perhaps now dry.

Final classification

Shrub savanna
peanuts, cotton, millet, sorghum
30 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 41 SIZE 56,631 Sq. km.

LOCATION Eastern central section of the study area; N.E. Nigeria; S.W. of Lake Chad

IMAGE I. D. Path 204, 205, 206, 207; Row 50, 51, 52, 53

Area description (collateral data)

Veg. Wooded Steppe with abundant Acacia & Commiphora; Woodland Savanna & Steppe-undifferentiated relatively dry types (Keay & Aubreville, 1958); Short grass savanna; Sudan savanna; Tallgrass savanna (CIA Maps).

Ag. Subsistence crop with commercial; cotton; rice (Atlas of Africa, 1973); Non-agriculture & rough grazing land; Non-Ag. & RGL with trees; Arable land - 10,000 hectares (World Atlas of Agriculture, 1976)

Soils Little leached gray ferruginous soils; topomorphic vertisols (International Atlas of W. Africa, 1971).

Area description (consultant)

Wooded savanna; Peanuts, sandy soils

Area description (Landsat analysis)

No defined drainage network detected in northeastern section adjacent to Lake Chad. Here, light to medium gray tonal signatures with some N.E. - S.W. direction striations indicative of sand dunes and some areas of farming or grass vegetation. In the southern sections are predominantly light tonal signatures indicative of rather intensive farming, such as rice & ground nuts.

Final classification

Shrub savanna
Millet, peanuts

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 42 SIZE 1,478 Sq. km.

LOCATION East central section of study area; N.E. Nigeria; S.W. of Lake Chad

IMAGE I. D. Path 204; Row 52

Area description (collateral data)

Veg. Woodland Savanna & Steppe undifferentiated relatively dry types (Keay & Aubreville, 1958). Sudan savanna (CIA Map).

Ag. Non-agriculture & Rough Grazing Land & Trees (World Atlas of Agriculture, 1976); Subsistence crops & Commercial (Atlas of Africa, 1973).

Soils Modal facies - mineral hydromorphic soils with pseudo-gley & with spots and concretions; little leached gray ferruginous soils with sesquioxides modal facies over eolian sands (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

No drainage network detected. Predominately medium gray tonal signature indicative of grass vegetation. Small amounts of light tonal signatures indicative of farming.

Final classification

Shrub savanna
Millet, sorghum, peanuts, irrigated cotton

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 43 SIZE 22,285 Sq. km.

LOCATION East central section of study area; Cameroun & Nigeria; Babakoum, & Kelo

IMAGE I. D. Path 204, 205; Row 52, 53, 54, 55

Area description (collateral data)

Veg. From south to north: Woodland Savannas & Steppe - undifferentiated relatively moist types; Northern area - with abundant Isoberlinia doka & I. dalzeilii; Woodland, Savanna & Steppe - undifferentiated relatively dry types; Wooded Steppe with abundant acacia & Commiphora (Keay & Aubreville, 1958).

Mixed Savanna & Scrub, grassland, & crops; some swamp or marsh; savanna; tall-grass savanna (CIA Maps).

Ag. Mostly millet & subsistence farming; some cotton & cotton seed, peanuts (Atlas of Africa, 1973); Rough grazing land & Rough Grazing Land with Trees

Area description (consultant) (World Atlas of Agriculture, 1976); Cotton (CIA Maps).

Soils - Mineral hydromorphic soils with pseudo - gley nodal facies along Benue River; Topomorphic & Lithomorphic medium desaturated ferallitic soils & Halomorphic soils.

Shrub savanna; little agriculture - subsistence millet; some Niche beans some peanuts. Good grazing potential grazing land now.

Area description (Landsat analysis)

Low density drainage; Mostly medium gray tonal signatures indicative of grass; scattered light tonal signatures (farming) & a few dark tonal signatures (burns). Very few significant forest signatures (Dark gray). Small relatively evenly distributed light area on darker background indicative of sand dunes.

Final classification

Shrub savanna
Millet, sorghum, irrigated rice, peanuts

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 44 SIZE 7,013 Sq. km.

LOCATION East central section of study area; N. Cameroun; South of Lake Chad

IMAGE I. D. Path 203; Row 52

Area description (collateral data)

Veg. Wooded Steppe with abundant Acacia & Commiphora; Woodlands, Savanna, & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958); Marsh or swamp; savanna (CIA Map).

Ag. Rough Grazing Land; Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976); Association of traditional and Commercial crops (Atlas of Africa, 1973); Mixed subsistence/grazing (CIA Map).

Soils No data

Area description (consultant)

Dense riparian vegetation along rivers; Flood plain grassland with marsh vegetation & other grasses. Rice cultivation.

Area description (Landsat analysis)

Area of major braided stream drainage into Lake Chad. Mostly dark tonal signatures indicative of flooded land, wet soils, as indicated on ONC charts. Some medium to dark tonal signatures some distance from major channels could indicate grass.

Final classification

Shrub savanna

Rice, sorghum

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 45 SIZE 6,718 Sq. km.

LOCATION East central section of study area; Chari River

IMAGE I. D. Path 201, 202, 203; Row 52

Area description (collateral data)

Veg. Woodland, Savanna, & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958).

Ag. Non-agriculture & Rough Grazing Land with Trees; Rough Grazing Land (World Atlas of Agriculture, 1976); Traditional & Commercial (Atlas of Africa, 1973); Grazing (CIA Maps).

Soils No data

Area description (consultant)

Rice or open grass along riparian systems.

Area description (Landsat analysis)

Portion of Chari River system. Scattered light tonal signatures along river indicative of intensive farming. Medium gray tonal signatures indicative of grass mixed with some darker gray. Tonal signatures indicative of forest vegetation or moist soil, as indicated on ONC charts.

Final classification

Shrub savanna

Rice, millet sorghum

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 46 SIZE 12,617 Sq. km.

LOCATION East central section of study area; S.E. of Lake Chad

IMAGE I. D. Path 201, 202; Row 52

Area description (collateral data)

Veg. Woodland, Savanna, & Steppe - undifferentiated relatively dry types; Wooded Steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958).

Ag. Non-agriculture & Rough Grazing Land with Trees; Rough Grazing Land (World Atlas of Agriculture, 1976); Traditional subsistence & commercial (Atlas of Africa, 1973); Mixed subsistence & grazing (CIA Maps).

Soils No data

Area description (consultant)

Dense shrub savanna; Rice along river. Minimal subsistence - millet and sorghum. Local goats and sheep.

Area description (Landsat analysis)

Low density drainage. Some scattered light tonal signatures indicative of farming, especially along river. Medium gray tonal signatures indicative of grass and dark gray tonal signatures indicative of forest vegetation, or possible wet soils, as indicated on the ONC charts.

Final classification

Shrub savanna

Millet, sorghum, irrigated rice

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 47 SIZE 36,017 Sq. km.

LOCATION East central section of study area; S.E. of Lake Chad

IMAGE I. D. Path 201, 202, 203; Row 51, 52, 53

Area description (collateral data)

Veg. Woodland Savanna & Steppe - undifferentiated relatively dry types; Wooded Steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958).

Ag. Rough grazing land (World Atlas of Agriculture, 1976); Traditional subsistence & some commercial (Atlas of Africa, 1973); Mixed subsistence & grazing (CIA Maps)

Soils No data

Area description (consultant)

Shrub savanna; marginal millet; mainly livestock. Recession agriculture - some sorghum. Heavy brush - similar to 127A except a little drier.

Area description (Landsat analysis)

Moderate density drainage - undefined pattern - internal drainage into Lake Chad. Mostly light tonal signatures indicative of farming and medium gray tonal signatures indicative of grass; these two signatures are very complexly intermingled, especially along the Bahr Erguig. In the northern section of the map unit; these signatures have more generally defined domains; however, cloud cover obscures it somewhat. Flooding indicated on IGN map in area adjacent to Bahr Erguig.

Final classification

Shrub savanna

Millet, sorghum

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 48 SIZE 107,264 Sq. km.

LOCATION North eastern section of study area; S. Chad

IMAGE I. D. Path 198, 199, 200, 201, 202; Row 51, 52, 53

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958).

Ag. Non-agriculture & Rough Grazing Land with Trees; Rough Grazing Land (World Atlas of Agriculture, 1976). Traditional Subsistence; Traditional & Commercial (Atlas of Africa, 1973); Grazing with some subsistence; Mixed Grazing & Subsistence; Subsistence (CIA Maps).

Area description (consultant)

Not familiar with area. Southern part wooded savanna aided by high water. Shrub savanna in north. Burns. Marginal millet, nomadic grazing area. Millet and sorghum do exist as far north as Lake Chad (Atlas Pratique du Tchad, 1972).

Area description (Landsat analysis)

Medium density drainage of dendritic variety. Mostly medium gray tonal signatures, indicative of grass; some darker gray tonal signatures indicative of forest or moist soils, as indicated by swamp symbols on ONC charts; occupy some areas; some mountain features in northeast.

Final classification

Shrub savanna

Millet and sorghum

0 - 30% of area under cultivation at the time of Landsat overpass

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 49 SIZE 81,603 Sq. km.

LOCATION North eastern section of study area; S.W. of Sudan; contains Am-Timan

IMAGE I. D. Path 200, 199, 198; Row 52, 53

Area description (collateral data)

Veg. Woodlands, Savannas, Steppes - undifferentiated relatively dry types (Keay & Aubreville, 1958).

Ag. Traditional subsistence (peanuts, sorghum, & manioc) & commercial (cotton, rice) (Atlas of Africa, 1973). North section Non Ag. & Rough grazing land & trees. Most of map unit. Rough grazing land (World Atlas of Agriculture, 1976). Grazing & some subsistence in north & subsistence in south (CIA)

Soils No data Some area of cotton (Area Handbook for Chad, AU, 1972). Much of area is marsh according to International Atlas & ONC charts.

Area description (consultant)

Flooded during rainy season; black areas are burns; burned for grazing. Might be brush. Shrub savanna, maybe tree steppe in north, much livestock nomadic movement.

Area description (Landsat analysis)

Pattern of medium gray tonal signatures indicative of grass, along some tributaries of Bahr Azoum. Much scattered light tonal area (Cleared land for farming) and dark area (burns). Lack of well defined drainage network other than few major streams. Lac Iro is white tonal signature - possible salt. Medium gray tonal signature may indicate some forest vegetation.

Final classification

Shrub savanna

No crops

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 50 SIZE 10,094 Sq. km.

LOCATION Eastern section of study area; west of Sudan

IMAGE I. D. Path 197; Row 52

Area description (collateral data)

Veg. Woodlands, Savannas, & Steppes - undifferentiated relatively dry types (Keay & Aubreville, 1958).

Ag. Non-Agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976). Traditional - peanuts, sorghum, manioc/commercial - cotton, rice (Atlas of Africa, 1973) Mixed subsistence/Grazing (CIA)

Soils No data

Area description (consultant)

Not familiar with area

Shrub savanna, basic millet, not much livestock; marginal cotton.

Area description (Landsat analysis)

Light tonal signatures along Azam River indicative of cleared land for farming, also scattered dark areas here indicative of burns. Medium gray tonal signatures indicative of grass present from river to higher elevations to south & east, where dark gray tonal signatures indicate forest vegetation.

Final classification

Shrub savanna

Millet, cassava; cotton at selected relatively limited locations only
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 51 SIZE 16,288 Sq. km.

LOCATION Eastern section of study area; S.W. of Sudan; surrounds Birao

IMAGE I. D. Path 198, 197; Row 53

Area description (collateral data)

Veg. Woodland Savanna & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958);

Ag. Millet (Atlas of Africa, 1973).

Soils No data

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Other than the Yata River flowing S.E. to N.W. thru map unit, there are very few drainage patterns. Some foothills evident in south, with dark tonal signatures indicative of forest vegetation. Some along river. Rest of map unit mostly light gray tonal signature indicative of grass. Two areas adjacent to river have black tonal signatures that may indicate recent burns. One area is not even dark on Landsat image to east. Little to no light tonal signatures indicative of cleared land for farming.

Final classification

Shrub savanna

Millet

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 52 SIZE 426 Sq. km.

LOCATION Senegal - east of Dakar

IMAGE I. D. Path 225 Row 51

Area description (collateral data)

Forest Area (Republique du Senegal - IGN, 1:500,000)

Peanuts/Millet Assoc. (CIA Map, Senegal & Gambia, 1972)

Plateau with surrounding escarpments (International Atlas of West Africa 1971)

Raw mineral erosion soils over feruginous crusts (International Atlas of West Africa, 1971)

Area description (consultant)

Upland, rocky outcrop, brush - lateritic outcrop Acacia sial baobob.

Not used much for agriculture - drainage too porous. Good baobob habitat - leaves for sauce; fruit eaten (Fred Weber, personal communication, August 2, 1978)

Area description (Landsat analysis)

Band 5 - dark tonal signature - smooth texture - indicative of forested areas. Minimal land cleared.

Final classification

Wooded Savanna

Millet, Sorghum, Peanuts

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 53 SIZE 2,851 Sq. km.

LOCATION Along coast 100 km. southeast of Dakar

IMAGE I. D. Path 225 Row 51

Area description (collateral data)

Marsh or swamp (CIA Veg. Map of Senegal & Gambia, 1972)

Halomorphic soils - acidified salt soils and with incrustations (International Atlas of West Africa, 1971)

Area description (consultant)

Salt flats, much tidal brackish intrusion; freshwater only during heavy precip. Sparse vegetation, tumeric of salt tolerant plant - alkalai flats - salt even in water table; too salty for rice, northern limit for mangrove.

Area description (Landsat analysis)

Band 5 image signature - coastal (tidal) drainage system; meandering channels with adjacent marsh vegetation. Characteristic estuarine area.

Final classification

Wooded Savanna
No Crops

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 54 SIZE 18,189 Sq. km.

LOCATION Area bounded on north by Linguere, on west by Banjul and on east approximately by Tambacounda

IMAGE I. D. Path 224 and 225; Row 51

Area description (collateral data)

Polygon transects several mapped vegetation zones - deciduous forest; brush and cultivated vegetation; Acacia savanna (CIA Maps of Senegal and Gambia, 1972). Wooded steppe with abundant Acacia and Commiphora in northern part; Woodland, savanna and steppes - undifferentiated, relatively dry types in central portion and woodlands, savannas and steppes in southern portion (Keay and Aubreville, 1958). Agriculture is dominated by peanut farming (CIA Maps of Senegal and Gambia, 1972; Atlas of Africa, 1973). Gray ferruginous soils over aeolian sands - little leaching (International Atlas of West Africa, 1971).

Area description (consultant)

Very difficult area - possible forest reserve within large polygon. See revised line -- green for peanut basin -- remainder of polygon #9 bush steppe principally with millet. Sandy soils of low pH. Dry land farming. Erratic rainfall.

Area description (Landsat analysis)

Medium gray tone signature (Band 5). Forest is minimal. Acacia savanna is probable. This dominates with tall grasses and brush. Uncleared land (forest) occurs along interflaves in eastern part of area. Area overall is poorly dissected by drainage. Broad areas appear to have been cleared for agriculture -- probably peanuts associated with millet.

Final classification

Wooded savanna
Peanuts

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 55 SIZE 31,330 Sq. km.
LOCATION Area bounded on north by Linguere, on west by Banjul and on east
approximately by Tambacounda
IMAGE I. D. Path 224 and 225; Row 51

Area description (collateral data)

Polygon transects several mapped vegetation zones - deciduous forest; brush
and cultivated vegetation; Acacia savanna (CIA Maps of Senegal and Gambia, 1972).
Wooded steppe with abundant Acacia and Commiphora in northern part; Woodland,
savanna and steppes - undifferentiated, relatively dry types in central portion
and woodlands, savannas and steppes in southern portion (Keay and Aubreville, 1958).
Agriculture is dominated by peanut farming (CIA Maps of Senegal and Gambia, 1972;
Atlas of Africa, 1973). Gray ferruginous soils over aeolian sands - little leach-
ing (International Atlas of West Africa, 1971).

Area description (consultant)

Very difficult area - possible forest reserve within large polygon. See revised
line -- green for peanut basin -- remainder of polygon #9 bush steppe principally
with millet. Sandy soils of low pH. Dry land farming. Erratic rainfall.

Area description (Landsat analysis)

Medium gray tonal signature (Band 5). Forest is minimal. Acacia savanna is
probable. This dominates with tall grasses and brush. Uncleared land (forest)
occurs along interfluvies in eastern part of area. Area overall is poorly dissected
by drainage. Broad areas appear to have been cleared for agriculture -- probably
peanuts associated with millet.

Final classification

Wooded Savanna
Millet, sorghum, peanuts
31-60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 56 SIZE 11,929 Sq. km.
LOCATION Adjacent to Bintanz and Casamance Rivers; 25-250 Km inland from
Atlantic Coast. SE of Banjul, Ziguinchor and Kolda are within the area
IMAGE I. D. Paths 224-225 Row 52

Area description (collateral data)

Landsat polygon transects area identified as marsh or swamp broadleaf ever-
green forest Deciduous forest brush and cultivated vegetation (CIA Map of
Gambia & Sengal, 1972) Also within broader Woodlands, Savanas Steppes with
abundant Isoberlinia doka and I. dalzielii (Keay and Aubreville, 1958)
within peanut, millet, rice area (CIA 1972; atlas of Africa, 1973)

Area description (consultant)

Looks like rice along river, not familiar with area. Fairly heavy agricul-
ture - rice, sweet potatoes, oil palm, peanuts, much manioc heavy clay soils.

Area description (Landsat analysis)

Band 5 show area to be one of intensive agriculture along the valleys and
tributaries of the Gambie, Casamance and Bintang Rivers. Highly reflective
white - toned areas nearest to stream banks believed to be rice cultivation
areas. Further back from channels intensive peanut and millet cultivation
likely. 95% of area under cultivation.

Final classification

Wooded Savanna
Rice, other root crops, oil palms, peanuts, cassava
31% - 60% of area has been cleared for cultivation at the time of Landsat
overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 57 SIZE 10,520 Sq. km.

LOCATION Valley of the Senegal River

IMAGE I. D. Path 223, 224, 225; Row 48 & 49

Area description (collateral data)

Marsh or Swamp (CIA Map of Senegal & Gambia, 1972); Wooded Steppe, Abundant Acacia & Commiphora (Keay & Aubreville, 1958); Rice, cotton area and subsistence - millets and maize cultivated with rainfall and river ebb; also millet and sorghum (Sahelian zone) (Atlas of Africa, 1973) Halomorphic soils with incrustations along Senegal River near coast & mineral hydro-morphic soils with pseudo-gley up river (International Atlas of W. Africa, 1971).

Area description (consultant)

Riparian - natural veg. - dense Acacia Nilotica - dominant; extensive flood plain, heavy land use; some large rice schemes. See revisions;
Flood recession agriculture-sorghum & a little millet and corn in parallel bands as water recedes.

Area description (Landsat analysis)

Dark tonal signature separates Senegal River Valley, which is under intensive cultivation, from adjacent minimally cultivated higher elevations. Highly reflective light toned signature adjacent to stream channel as well as darker toned saturated areas probably support rice cultivation. Cannot separate out subsistence millet and sorghum and maize from cotton.

Final classification

Wooded savanna
Rice, sorghum, millet, maize
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 58 SIZE 29,135 Sq. km.

LOCATION Region of Koussanar, Sandougou and Nicrike rivers; near Tambacounda

IMAGE I. D. Path 223, Row 51

Area description (collateral data)

Woodlands, Savanna and Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958); Acacia Savanna (CIA Map of Gambia and Senegal, 1972). Peanut/Millet assoc. west of Tambacounda; Non-intensive grazing east of Tambacounda. Some cotton within Tambacounda area. (CIA Map, 1972); (Atlas of Africa, 1973). Immature soils of non-climatic origin (over gravelly material) and indurated leached gray ferruginous soils (International Atlas of West Africa, 1971).

Area description (consultant)

Bush savanna; Combretum; not much grass; brush; some millet, subsistence agriculture.

Area description (Landsat analysis)

Band 5 shows area to be criss crossed with trails connecting villages. Cleared agricultural areas are associated with villages, but intensive agricultural seems to be minimal! Appears to be more of a grazing - cattle movement area with associated subsistence agriculture.

Final classification

Wooded savanna
Millet, sorghum, maize
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 59 SIZE 89,141 Sq. km.
From approximately Diema in the west, southeastward to Bobo-Dioulasso
LOCATION and eastward to Dedougou.

IMAGE I. D. Path 218 to 224; Rows 51 to 53

Area description (collateral data)

Woodlands, savannas and steppes - undifferentiated relatively dry types in the north. With abundant *Isobertinia doka* and *I. Dalzielii* (Keay and Aubreville, 1958). Tallgrass savanna in the southern part and *Acacia* savanna in the northern portions (CIA Maps of Mali and Upper Volta, 1968). Subsistence agriculture (millet and sorghum) with peanuts and cotton (Atlas of Africa, 1973). Peanuts (CIA Maps listed above). Principal soils are immature soils of non-climatic origin over gravelly material and leached gray ferruginous soils (concretionary). (International Atlas of West Africa, 1971).

Area description (consultant)

Wooded Savanna - Shea butter; Parkia; Borassus; Agriculture -- solid subsistence agriculture - millet and sorghum with occasional root crops - manioc. Relatively intense agriculture. More than 50% of available land under cultivation.

Area description (Landsat analysis)

A medium gray tonal signature is characteristic of the Landsat imagery of this area. Indicative of relatively dry vegetation types. Area is under moderate agricultural activity. Drainage density is also moderate with major rivers characteristic of low slope flow, i.e. meandering for the most part with minimal structural control. Occasional dark splotches may indicate sites of burns. Most intensive cropping occurs around villages. Cropping is of the subsistence variety.

Final classification

Wooded Savanna

Millet, sorghum, cassava

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 60 SIZE 1,606 Sq. km.

LOCATION Surrounding Kita

IMAGE I. D. Path 220; Row 51

Area description (collateral data)

Tallgrass savanna, brush and cultivated vegetation (southern part); Woodlands, savannas and steppes - relatively undifferentiated dry types (Keay & Aubreville, 1958). Peanuts (Atlas of Africa, 1973; CIA Map of Mali, 1970); Subsistence agriculture with peanuts and cotton (Atlas of Africa, 1973); Immature erosion soils of non-climatic origin over gravelly material (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with the area

Area description (Landsat analysis)

Landsat band 5 shows this area to be intensively cultivated. Peanuts probably dominate as the commercial crop with millet and sorghum being the subsistence types.

Final classification

Wooded savanna

Millet, sorghum, peanuts

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 61 SIZE 2,720 Sq. km.

LOCATION Area adjacent to and southeast of Bamako, Adjacent to Niger River

IMAGE I. D. Path 219, Row 51-52

Area description (collateral data)

Woodlands, savannas and steppes - northern areas with abundant Isoberlinia doka and I. dalzielii (Keay & Aubreville, 1958). Tallgrass savannas, brush and cultivated vegetation (CIA Map of Mali, 1970); Subsistence agriculture - millet and sorghum with peanuts and cotton (Atlas of Africa, 1973); some fruit trees (World Atlas of Agriculture, 1976); arable land (millet, sorghum, manioc, sorn and sweet potatoes (CIA Map of Mali, 1970). Leached gray ferruginous soils (conditionary) (International Atlas of W. Africa, 1971).

Area description (consultant)

River terrace: much like 40 & 41 except heavier use. Wooded savanna: millet, sorghum, maize, peanuts.

Area description (Landsat analysis)

Landsat band 5 shows this area to be cleared of natural vegetation along the Niger River and in the nearby river valleys. Somewhat regularly shaped cleared area suggest intensive agricultural activity with natural vegetation growing along the interfluves. Natural vegetation images a medium to dark gray tonal signature suggestive of savanna mixed with wooded steppe.

Final classification

Wooded savanna

Millet, sorghum, maize, peanuts

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 62 SIZE 3,048 Sq. km.

LOCATION Around Banamba, Mali

IMAGE I. D. Path 219 Row 50-51

Area description (collateral data)

Tallgrass savannas and steppes (Undifferentiated dry types)(Atlas of Africa, 1973); Subsistence agriculture (millet and sorghum) both peanuts and cotton (Atlas of Africa, 1973). Raw mineral erosion soils over various rocks (International Atlas of W. Africa, 1971).

Area description (consultant)

Intensive agriculture

Area description (Landsat analysis)

Landsat Band 5 shows this to be an area with intensive cultivation in the stream valleys. More than 80% of the area under cultivation.

Final classification

Wooded Savanna

Millet, sorghum, peanuts, cotton

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 63 SIZE 13,011 Sq. km.

LOCATION North of Dedougou, Upper Volta;

IMAGE I. D. Path 216, Row 51

Area description (collateral data)

Millet, sorghum, fundi, peanuts, beans, sesame (Atlas of Africa, 1973);
Intensive peanut growing area (Atlas of Africa, 1973); Woodlands, savannas,
and steppes; indifferntiated relatively dry types (Keay & Aubreville, 1958);
Acacia savanna (CIA Map 1968). Mineral hydromorphic soils with pseudo-
gley and vertisols with no external drainage; non-grumosolic topomorphie
vertisols (International Atlas of W. Africa, 1978).

Area description (consultant)

Intensive agriculture - Wooded savanna

Area description (Landsat analysis)

Intensively cultivated intermittent drainage channels, Sourou River flows
through the area. Area likely an intensively cultivated commercial peanut
region. More than 80% of the area under cultivation.

Final classification

Wooded savanna
Millet, sorghum, peanuts, sesame seed
Greater than 60% of area has been cleared for cultivation at the time of
Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 64 SIZE 13,207 Sq. km.

LOCATION South of Boromo and 100 east of Bobo Dioulasso

IMAGE I. D. Path 215; Row 52 & 53

Area description (collateral data)

Woodlands, savanna and steppes - northern area with abundant Isoberlinia
doka and I. Dalzielii (southern portion); Woodlands, savannas and steppes-
undifferentiated relatively dry types (Keay & Aubreville, 1958). Millet,
manioc, peanuts, and rice - subsistence (Atlas of Africa, 1973). Mineral
hydromorphic (International Atlas of W. Africa, 1971).

Area description (consultant)

Wooded savanna; sorghum, millet, maize, upland rice, peanuts; some veg-
etable crops. Heavy cultivation and population pressure. Cut and burned.
Sedentary livestock ownership.

Area description (Landsat analysis)

This area is drained by and centered on the Black Volta. A medium density
dendritic drainage pattern characterizes the area. Light gray tonal
signatures indicate an area under intensive agriculture. Highly reflectance
white tonal signatures are most probably related to rice production and
intensively cultivated peanuts and millet. Area is 70 - 90% cultivated.

Final classification

Wooded savanna
Sorghum, millet, maize, rice, peanuts
Greater than 60% of area has been cleared for cultivation at the time of
Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 65 SIZE 21,630 Sq. km.

LOCATION Upper Volta-area of Koudougou and Ouagadougou

IMAGE I. D. Path 214 - 215 Row 51

Area description (collateral data)

Woodlands, savannas and steppes - undifferentiated relatively dry types (Keay and Aubreville, 1958); Peanuts, cotton, market gardening (Atlas of Africa, 1973); Millet, sorghum, fundi, peanuts, beans and sesame (Atlas of Africa, 1973); Fruit trees near Bororulo (World Atlas of Agriculture, 1976); Peanuts (Church, 1974); hydromorphic leached gray ferruginous soils, concretionary leached gray ferruginous soils and immature erosion soils of non-climatic origin (International Atlas of W. Africa, 1971).

Area description (consultant)

Massi plateau southern portion; Wooded savanna, park type, Shea butter, sorghum, peanut, cotton, irrigated rice in lowland, farmers and live-stock owners. Koudougou area; lack of water in northern part - less extensive use.

Area description (Landsat analysis)

Landsat indicates that 80 - 90% of the area is cleared or cultivated. Spotty natural vegetation occurs throughout the area especially along drainages and in area of forest reserves.

Final classification

Wooded savanna
Sorghum, peanuts, cotton; rice at selected relatively limited locations only.
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 66 SIZE 50,469 Sq. km.

LOCATION East of Ouagadougou centered on Kaya and east to the Niger River

IMAGE I. D. _____

Area description (collateral data)

Woodlands, savannas and steppe - undifferentiated relatively dry types (Keays & Aubreville, 1958); Indian butter trees around Kaya (Atlas of Africa, 1973); Millet sorghum funds, peanuts, beans and sesame (Atlas of Africa, 1973). Immature soils of non-climatic origin and concretionary leached gray ferruginous soils; some mineral hydromorphic soils with pseudo-gley (International Atlas of West Africa, 1975).

Area description (consultant)

Rel. intensive agriculture/park farming landscape. Shea butter trees, Parkia; Dry land sorghum and millet; in depressions substantial flooding - some rice. Essentially a sedentary ag. area. Some animals - every farmer a livestock owner. Darker spots-tree savanna. Lateritic outcrops. Higher rainfall eastward.

Area description (Landsat analysis)

Alternating dark and light tonal signatures indicate woodland and savanna areas with intensive agriculture indicated by geometrically-shaped lighter tones in a dark natural vegetation matrix.

Final classification

Wooded savanna
Sorghum; Rice at selected relatively limited locations only.
Greater than 60% of area cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 67 * SIZE 1875 Sq. km.

LOCATION Adjacent to and east of the Pendjari River in Upper Volta just west of Atacora Mountains.

IMAGE I. D. Path 212, Row 53

Area description (collateral data)

Woodlands, savannas and steppes - undifferentiated relatively dry types (Keay & Aubreville, 1958); Deciduous forest brush and cultivated vegetation (CIA Map of Benin, 1970); Millet, sorghum, fundi; peanuts, beans and sesame. Indian butter trees (Atlas of Africa, 1973); Mineral hydromorphic soils with psuedo-gley and leached gray ferruginous soils (International Atlas of W. Africa, 1971).

Area description (consultant)

This is probably a burn area. Difference between 60 is that this is in the mountains. Millet fields and sorghum are the dominant crops in the area. Wooded savanna (Fred Weber, August 23, 1978).

Area description (Landsat analysis)

Dark gray to black tonal signature indicates wide stream channels with dense forest canopy and adjacent upland areas also with a dense forest canopy. Geometrically shaped clearing within the area suggest intensive agricultural activity-perhaps large commercial operations.

* This map unit has been incorporated into a National Park/Reserve.

Final classification

Wooded savanna
Millet, sorghum
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 68 SIZE 2,425 Sq. km.

LOCATION Southeast of Fada N'Gourma

IMAGE I. D. Path 213 Row 53

Area description (collateral data)

Woodlands, Savannas and Steppes (Keay and Aubreville, 1958) Deciduous forest, brush and cultivated vegetation (CIA map of Upper Volta, 1968). Peanuts, millet, maize, beans.

Area description (consultant)

Wooded savanna. Cereal crops like maize and sorghum.

Area description (Landsat analysis)

Dark tonal Landsat signature indicative of a fairly dense natural vegetation cover with scattered agricultural activity. Most intensive agricultural activity is surrounding towns and villages

Final classification

Wooded savanna
Maize and Sorghum
31-60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 69 SIZE 59,416 Sq. km.

LOCATION Area adjacent to, east and north of the Kainji Reservoir; Also north of Fada N'Gourma.

IMAGE I. D. Path 215; Rows 54 and 55

Area description (collateral data)

Northern part - Woodland, Savannas and Steppes - areas with abundant Isoberlinia doka and I. Dalzielli; Tallgrass Savanna; Deciduous Forest, Brush and cultivated vegetation in the southern portion (CIA Maps of Upper Volta, and Nigeria, 1968 and 1972 respectively). Crops - peanuts, millet, maize, beans; predominantly subsistence - millet, manioc, maize and rice (Atlas of Africa, 1973). East of Kainji Reservoir -- tobacco, and large peanut and cotton area (Atlas of Africa, 1973).

Area description (consultant)

Wooded Savanna with shea butter, Parkia, sorghum, millet, maize, peanuts. 50% of area under cultivation.

Area description (Landsat analysis)

Dark tonal Landsat signature indicative of a fairly dense natural vegetation cover with scattered agricultural activity. Most intensive agriculture is surrounding towns and villages.

Final classification

Wooded Savanna

Millet, sorghum, peanuts

31-60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 70 SIZE 18,582 Sq. km.

LOCATION East of Tillaberry, Niger

IMAGE I. D. Path 211-212; Row 50-51

Area description (collateral data)

Wooded steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Acacia savanna (CIA Map of Niger, 1962); Peanuts, millet and sorghum (CIA Map of Niger, 1962); Multicrop subsistence and sedentary livestock (Atlas of Africa, 1973). Non or little leached gray ferruginous soils over aeolian sands (International Atlas of W. Africa, 1971). Level plains of soft sandstones and clays with some laterite crossed by wide relic river valleys known as dallols. Acacia and borassus palms line banks. Myrrh (Church, 1974).

Area description (consultant)

Shrub savanna - Combretum brush or shrub. Subsistence niebebeans, millet farming. People are farmers & livestock raisers. Some peanuts. Considerable land pressure due to extensive need for shifting cultivation; some lowland intensified farming. Little manioc. Bisected peneplain with laterite outcrops. Shallow, poor soils; millet. Ancient rivers.

Area description (Landsat analysis)

Agricultural activity appears spotty in this area. Toward the north the wide relic river channels appear to be filled with sandy soils unsuitable for large scale agricultural production.

Final classification

Wooded savanna

Millet, cassava, fruit trees, peanuts

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 71* SIZE 1250 Sq. km.

LOCATION 150 Km south of Dosso on Mekrou and Alibori Rivers

IMAGE I. D. Path 211; Row 52-53

Area description (collateral data)

Woodlands, savannas and steppes - undifferentiated relatively dry types (Keay & Aubreville, 1958); Peanuts (CIA Map of Benin, 1970); Isohumic brown subarid vertic soils over clay alluvium (International Atlas of W. Africa, 1971).

Area description (consultant)

Park area - no agriculture; Wooded savanna, densely covered. Maybe heavy grazing during extreme drought years.

Area description (Landsat analysis)

Dark black tonal signature indicative of highly absorbent materials in Landsat band 5. These are likely forested areas. No evidence of agriculture exists within these areas.

Final classification

Wooded savanna
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

* This map unit has been incorporated into a National Park/Reserve

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 72* SIZE 1250 Sq. km.

LOCATION Adjacent to Niger River 125 Km south of Dosso

IMAGE I. D. Path 211; Row 52-53

Area description (collateral data)

Woodlands, savannas and steppes - undifferentiated relatively dry types (Keay & Aubreville, 1958); Peanuts (Atlas of Africa, 1971); Peanuts (CIA Map of Benin, 1970); Concretionary leached gray ferruginous soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Could be wide-open grassland - marshy area during rainy season within the national park. Check to see if it is within the boundary.

Area description (Landsat analysis)

Landsat band 5 shows this to be a heavily cleared and probably cultivated area with a well developed dendritic drainage pattern. This is likely a peanut growing area.

Final classification

Wooded savanna
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

* This map unit has been incorporated into a National Park/Reserve

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 73 SIZE 9,275 Sq. km.

LOCATION Along Niger and Sokoto Rivers

IMAGE I. D. Path 208; Row 51; Path 209; Row 51; Path 210; Row 52; Path 211; Row 52-53; Path 212; Row 51-52; Path 213; Row 50-51

Area description (collateral data)

Wooded steppe with abundant Acacia and Commiphora and Woodlands, savannas and steppes with undifferentiated dry types (Keay & Aubreville, 1958); Irrigated rice, peanuts, and cotton (Atlas of Africa, 1973; CIA Maps of Niger and Nigeria, 1962, 1972); Little leached gray ferruginous soils over aeolian sands or mineral hydromorphic soils with deep gley (International Atlas of W. Africa, 1971).

Area description (consultant)

Rice irrigation schemes and sugar cane in southern part. Good irrigation potential. Grass - thick perania; good Borassia area. 83A - northern portion - like 75

Area description (Landsat analysis)

A band of light gray to white tones adjacent to the Niger and Sokoto Rivers indicates intensive cultivation. The white highly reflective tones are believed to be rice fields. The bright or gray tones are probable peanuts and cotton.

Final classification

Wooded savanna
Rice, millet, sorghum, peanuts, sugar cane, fruit trees.
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 74 SIZE 3,638 Sq. km.

LOCATION Adjacent to and north and south of Dogondoutchi

IMAGE I. D. Path 211; Row 51-52

Area description (collateral data)

Wooded, steppe with abundant Acacia and Commiphora (Keay & Aubreville, 1958); Peanuts (CIA Map of Niger, 1962 and Nigeria, 1972); Non or little leached gray ferruginous soils over aeolian sand (International Atlas of W. Africa, 1971).

Area description (consultant)

Ancient river valley extensively cultivated millet, sorghum, peanuts, cotton, development schemes, rice, sugar cane; natural vegetation - low lying grass area; Borassia/ethiopian palm. Extensive vegetable gardening - tomatoes and onions in waterhole area (MARS) or ponds - small permanent lakes.

Area description (Landsat analysis)

Light gray to white tonal signature indicative of intensive cultivation. Likely an intensively cultivated peanut area.

Final classification

Wooded savanna
Millet, sorghum, peanuts, cotton, rice and sugar cane at selected relatively limited locations only
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 75 SIZE 23,137 Sq. km.

LOCATION North Central section of study area; N.W. Nigeria

IMAGE I. D. Path 208, 209; Row 51

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958). Sudan Savanna (CIA)

Ag. Non-agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1976); Peanuts; Cotton (Atlas of Africa, 1973); Peanuts; Cotton (CIA)

Soils - Little leached gray ferruginous soils - nodal facies over eolian sands. (International Atlas of W. Africa, 1971)

Area description (consultant)

Area not as heavily utilized as 103. Reasons not certain. Hilly region. Shallow soils. Access to water difficult. Wooded savanna; millet sorghum, maize, a little yams in favorable area; small livestock. Manioc.

Area description (Landsat analysis)

Moderate density drainage of the dendritic variety. Mostly medium gray tonal signatures indicative of grass, vegetation. Not much light tonal signatures indicative of farming. Evidence of a fair amount of relief.

Final classification

Wooded savanna
Millet, sorghum, cassava, maize, other root crops.
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 76 SIZE 89,632 Sq. km.

LOCATION Central section of study area; N. Nigeria; Kano, Sokoto

IMAGE I. D. Paths 206 - 210; Row 51, 52

Area description (collateral data)

Veg. Woodlands, savannas & Steppe - undifferentiated relatively dry types; Woodlands, savannas & Steppe - northern areas with abundant Isoberlinia doka & I. dalzielii (Keay & Aubreville, 1958); Sudan savanna; tallgrass savanna (CIA Maps).

Ag. Arable land and 10,000 ha.; Non-ag. & Rough Grazing Land with trees (World Atlas of Ag., 1976). Subsistence crops with commercial; cotton (Atlas of Africa, 1973). Ground nuts (CIA Maps).

Soils - Soils with sesquioxides: gray & leached gray ferruginous; immature erosion (lithosols) soils of non-climatic origin (International Atlas of W. Africa, 1971).

Very important area: Wooded savanna (Sudan savanna); heavy agriculture - more than 75% of land in permanent use - millet & maize are staples; peanuts - heavy; some cotton. Peanuts are the major crop. Much locally - owned livestock.

Area description (Landsat analysis)

Only drainage patterns seem to be interior. Almost entire area is dominated by light tonal signatures indicative of intensive farming. Some medium gray tonal signatures indicative of grass or less intensive farming. Small area in N.E. - light gray tonal signature has striations indicative of sand dunes.

Final classification

Wooded savanna
Millet, maize, peanuts, irrigated cotton
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 77 SIZE 16,878 Sq. km.

LOCATION Central section of study area; central Nigeria

IMAGE I. D. Paths 206, 207; Row 52, 53

Area description (collateral data)

Veg. Woodland, Savanna & Steppes - undifferentiated relatively dry types;

Woodland, Savanna & Steppes - northern area, with abundant Isoberlinia doka & I. dalzielii (Keay & Aubreville, 1958); Sudan Savanna; Tallgrass Savanna (CIA Maps).

Ag. Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976); Subsistence crops with commercial (Atlas of Africa, 1973).

Soils Raw mineral erosion soils (lithosols) of Non-climatic origin over various rocks; hydromorphic, leached gray ferruginous soils (International Atlas

Area description (consultant) of W. Africa, 1971).

Not familiar with area

Wooded savanna

Area description (Landsat analysis)

Mixed presence of light gray tonal signatures indicative of farming and medium gray tonal signatures indicative of grass. A few small regularly shaped dark tonal signatures indicative of burns.

Final classification

Wooded savanna

No crops

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 78 SIZE 8,160 Sq. km.

LOCATION central section of study area; Jos, Nigeria

IMAGE I. D. Path 206, 207 Row 53-54

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - northern areas with abundant Isoberlinia doka & I. dalzielii (Keay & Aubreville 1958) Woodland, Savanna & Steppe-undifferentiated relatively moist types. Tallgrass Savanna (CIA)

Ag. Predominantly subsistence; subsistence crop with commercial (Atlas of Africa 1973) Arable land 710,000 ha. (World Atlas of Agriculture 1976)

Area description (consultant)

Mountain area. Woodland altered by mining and cultivation. Little maize & manioc; sparsely settled; grazing good. JOS plateau. Due to tin mining & cultivation pressure. The original woodland has practically disappeared. The plateau is open and woodless. Hyparrhenia rufa.

Area description (Landsat analysis)

Little to no drainage evident. Series of plateau peaks, as indicated by rough tonal texture. Light tonal signatures indicative of farming in center portion of map unit; mostly medium gray tonal signatures indicative of grass.

Final classification

Woodland

Maize, cassava, cotton

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 79 SIZE 45,980 Sq. km.

LOCATION Eastern central section of the study area; N.E. Nigeria; S.W. of Lake Chad

IMAGE I. D. Path 204, 205, 206, 207; Row 50, 51, 52, 53

Area description (collateral data)

Veg. Wooded Steppe with abundant Acacia & Commiphora; Woodland Savanna & Steppe-undifferentiated relatively dry types (Keay & Aubreville, 1958); Short grass savanna; Sudan savanna; Tallgrass savanna (CIA Maps)

Ag. Subsistence crop with commercial; cotton; rice (Atlas of Africa, 1973); Non-agriculture & rough grazing land; Non-Ag. & RGL with trees; Arable land - 10,000 hec (World Atlas of Agriculture, 1976).

Soils Little leached gray ferruginous soils; topomorphic vertisols (International Atlas of W. Africa, 1971).

Area description (consultant)

Wooded savanna; Peanuts, sandy soils

Area description (Landsat analysis)

No defined drainage network detected in northeastern section adjacent to Lake Chad. Here, light to medium gray tonal signatures with some N.E. - S.W. direction striations indicative of sand dunes and some areas of farming or grass vegetation. In the southern sections are predominantly light tonal signatures indicative of rather intensive farming, such as rice & ground nuts.

Final classification

Wooded savanna

Peanuts

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 80 SIZE 13,076 Sq. km.

LOCATION Central section of study area; central Nigeria, West of Gambi.

IMAGE I. D. Path 205, 206; Row 53

Area description (collateral data)

Veg. Woodland, Savanna, & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958); Sudan Savanna (CIA Maps).

Ag. Subsistence crop with commercial; cotton (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976).

Soils Impoverished medium desaturated ferallitic soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area

Wooded savanna

Area description (Landsat analysis)

Portion of a minor drainage system. Mostly medium gray tonal signature indicative of grass. Scattered small light tonal signatures indicative of cleared land for farming. A few dark tonal signatures indicative of burns. A sizable area of farming at south is indicated by lighter tonal signature and perhaps because the stream diminishes dramatically even though this area is not arid or subarid.

Final classification

Wooded savanna

No crops

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 81 SIZE 5,145 Sq. km.

LOCATION East central section of study area; Nigeria

IMAGE I. D. Path 205, 206; Row 51, 52

Area description (collateral data)

Veg. Woodland Savanna & Steppe (Keav & Aubreville, 1958); Sudan Savanna (CIA Maps).

Ag. Subsistence crops with commercial (Atlas of Africa, 1973); Non agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976).

Soils Immature erosion soils of non-climatic origin over gravelly material; ferrallitic soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area
Wooded savanna

Area description (Landsat analysis)

Medium gray tonal signatures indicative of grass; some dark gray tonal signatures indicative of trees. Location of this map unit in relation to neighboring drainage & sand dunes (no dunes in this map unit) suggests this is higher elevation.

Final classification

Wooded savanna

Millet, sorghum, maize, cotton, peanuts

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 82 SIZE 13,404 Sq. km.

LOCATION East central section of study area; E. Nigeria & W. Cameroua

IMAGE I. D. Path 204, 205; Row 54, 55

Area description (collateral data)

Veg. S. section - Montaine communities undifferentiated; central section - Woodland, Savanna, & Steppe; Northern areas: with abundant Isoberlinia doka & I. dalzielii; N. section - Woodland, Savanna, Steppe - undifferentiated relatively dry types (Keav & Aubreville, 1958); Savanna; scrub, grasslands & crops; montaine vegetation; tallgrass savanna; Sudan savanna

Ag. (CIA maps); subsistence agriculture (Atlas of Africa, 1973); Non-agriculture & Rough Grazing land with trees (World Atlas of Agriculture, 1976).

Soils Mineral hydromorphic (modal); over clay alluvium - non-grumosolic modal Area description (consultant) topomorphic vertisols; concretionary, leached gray ferruginous (leached); desert ablation soils (International Atlas of W. Africa, 1971).

Not familiar with area

Area description (Landsat analysis)

Low density drainage network other than major tributaries. Mostly medium gray tonal signature indicative of grass. A fair amount of light tonal signatures indicative of cleared land for farming and a few dark tonal signatures indicative of burns. Little dark gray tonal signatures indicative of forest vegetation.

Final classification

Wooded savanna

Millet, cassava, maize, irrigated rice

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 83* SIZE 750 Sq. km.

LOCATION East central section of study area; N. Cameroun

IMAGE I. D. Path 204; Row 54

Area description (collateral data)

Veg. W. Section - montain communities - undifferentiated; E. Section - Woodland,

Savanna & Steppe - northern areas - with abundant Isoberlinia doka & I.

dalzielii (Keay & Aubreville, 1958); Tallgrass Savanna (CIA Maps)

Ag. Non - agriculture Rough Grazing Land with Trees (World Atlas of Agriculture,

1976); subsistence agriculture; Millet (Atlas of Africa, 1973).

Soils Mineral hydromorphic with pseudo - gley (modal facies); impoverished and

leached gray ferruginous soils (International Atlas of West Africa, 1971).

Area description (consultant)

Could be burns. Not familiar with area

Area description (Landsat analysis)

Coarse texture tonal signature indicative of mountain features; dark gray

tonal signature indicative of forest vegetation. Little to no drainage

network observable.

Final classification

Wooded savanna

Millet

0 - 30% of area has been cleared for cultivation at the time of Landsat

overpass.

* This map unit has been incorporated into a National Park/Reserve.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 84 SIZE 4,424 Sq. km.

LOCATION East central section of study area; W. Cameroun

IMAGE I. D. Paths 203, 204; Row 54, 55

Area description (collateral data)

Veg. Woodland Savanna & Steppe, northern areas 0 with abundant Isoberlinia

doka & I. dalzielii (Keay & Aubreville, 1958); Savanna & Scrub, grassland

crops (CIA Maps)

Ag. Millet, some peanuts (Atlas of Africa, 1973); Non - agriculture, rough

grazing land with Trees (World Atlas of Agriculture, 1976); Cotton (CIA)

Soils impoverished & medium desaturated ferralitic soil & concretionary, leached

gray ferruginous soils (International Atlas of West Africa, 1971).

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Moderate density drainage of dendritic variety. Medium gray toanl signatures

indicative of grass; some dark gray tonal signatures indicative of forest

vegetation; a few light tonal signatures indicative of farming.

Final classification

Wooded savanna

Millet, peanuts

31 - 60% of area has been cleared for cultivation at the time of Landsat

overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 85 SIZE 103,462 Sq. km.

LOCATION East central section of study area; Cameroun & Nigeria; Eabakoum, & Kelo

IMAGE I. D. Path 204, 205; Row 52,53, 54, 55

Area description (collateral data)

Veg. From south to north: Woodland Savannas & Steppe - undifferentiated relatively moist types; Northern areas - with abundant Isobacrinia doka & I. dalzeilii; Woodland, Savanna & Steppe - undifferentiated relatively dry types; Wooded Steppe with abundant acacia & Commiphora (Keay & Aubreville, 1958). Mixed Savanna & Scrub, grassland, & crops; some swamp or marsh; savanna; tall-grass savanna (CIA Maps).

Ag. Mostly millet & subsistence farming; some cotton & cotton seed, peanuts (Atlas of Africa, 1973); Rough grazing land & Rough Grazing Land with Trees

Area description (consultant) (World Atlas of Agriculture, 1976); Cotton (CIA Maps).
Soils: Mineral hydromorphic soils with pseudo - gley

(modal facies) along Benue River; Topomorphic & Lithomorphic medium desaturated ferallitic soils & Halomorphic soils.

More cultivation - millet, niebe beans, peanuts (some); sorghum toward south; Wooded savanna, some cotton

Area description (Landsat analysis)

Low density drainage; Mostly medium gray tonal signatures indicative of grass; scattered light tonal signatures (farming) & a few dark tonal signatures (burns). Very few significant forest signatures (Dark gray). Small relatively evenly distributed light area on darker background indicative of sand dunes.

Final classification

Wooded savanna
Millet, peanut, sorghum, cotton
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 86 SIZE 1,049 Sq. km.

LOCATION East central section of study area; contains N. Gaoundere, Camerouna

IMAGE I. D. Path 203; Row 55

Area description (collateral data)

Veg. Woodland, Savanna, Steppe - undifferentiated relatively moist types (Keay & Aubreville, 1958). Savanna (CIA Map)
Ag. Rough Grazing Land (World Atlas of Agriculture, 1976). Millet (Atlas of Africa, 1973).

Area description (consultant)

More intensive agriculture around town.

Area description (Landsat analysis)

Moderate density drainage of the dendritic variety. Much light tonal signature indicative of cleared land for farming; medium gray tonal signatures indicative of grass.

Final classification

Wooded savanna
Millet
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 87 SIZE 27,103 Sq. km.

LOCATION East central section -- study area; North central Cameroun, Maroula

IMAGE I. D. Path 202, 203; Row 52, 53, 54

Area description (collateral data)

- Veg. Woodland, Savanna & Steppe - undifferentiated relatively dry types; Wooded Steppe with abundant Acacia & Commiphora (Keay & Aubreville, 1958). Sudan Steppe & Scrub, grasslands & crops (CIA Map)
- Ag. Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976). Traditional & Commercial; Cotton (Atlas of Africa, 1973).
- Soils Salt soils with incrustations (non-degraded); solonetz with a columnar B horizon (degraded); concretionary, leached gray ferruginous soils. (International Atlas of W. Africa, 1971).

Area description (consultant)

Very important area: Wooded savanna (Sudan savanna), heavy agriculture - more than 75% of land in permanent use - millet and maize are staples; peanuts - heavy; some cotton. Peanuts are the major crop; much locally owned livestock.

Area description (Landsat analysis)

Very low density drainage. Scattered coarse signature features indicative of mountains in north; considerable light tonal signatures indicative of cleared land for farming, as well as some dark tonal signatures indicative of burns; moderate amount of medium gray tonal signatures indicative of grass. Very few dark gray tonal signatures indicative of forests.

Final classification

Wooded savanna
Millet, sorghum and irrigated rice
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 88 SIZE 16,222 Sq. km.

LOCATION East central section of study area; Cameroun & Nigeria; Babakoum, & Kelo

IMAGE I. D. Path 204, 205; Row 52, 53, 54, 55

Area description (collateral data)

- Veg. From south to north: Woodland Savannas & Steppe - undifferentiated relatively moist types; Northern area - with abundant Isoberlinia doka & I. dalzeilii; Woodland, Savanna & Steppe - undifferentiated relatively dry types; Wooded Steppe with abundant acacia & Commiphora (Keay & Aubreville, 1958). Mixed Savanna & Scrub, grassland, & crops; some swamp or marsh; savanna; tall-grass savanna (CIA Maps).
- Ag. Mostly millet & subsistence farming; some cotton & cotton seed, peanuts (Atlas of Africa, 1973); Rough grazing land & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976); Cotton (CIA Maps).

Area description (consultant)

Soils - Mineral hydromorphic soils with pseudo - gley modal facies along Benue River; Ropomorphic & Lithomorphic medium desaturated ferallitic soils & Halomorphic soils.

Wooded savanna relatively rich soils, cotton & animal traction, sorghum, millet, manioc, rice along water. Rich farm area.

Area description (Landsat analysis)

Low density drainage; Mostly medium gray tonal signatures indicative of grass; scattered light tonal signatures (farming) & a few dark tonal signatures (burns). Very few significant forest signatures (Cark gray). Small relatively evenly distributed light area on darker background indicative of sand dunes.

Final classification

Wooded savanna
Sorghum, maize, cassava, cotton, irrigated rice, fruit trees
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 89 SIZE 5,244 Sq. km.

LOCATION Eastern section of study area; S. Chad; Logone River

IMAGE I. D. Path 201, 202; Row 53, 54

Area description (collateral data)

Veg. Woodland Savanna & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958).

Ag. Rough Grazing Land; Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976). Traditional & Commercial; Cotton seed (Atlas of Africa, 1973); Mix subsistence & Grazing; Cotton (CIA Maps).

Soils No data

Area description (consultant)

Dark signature - dense growth of small trees & bushes; periodic flooding; extensive rice along rivers; some cotton; area is a floodplain; subsistence farming with peanut, cotton, rice as cash crop; newly habitated area. Wooded savanna.

Area description (Landsat analysis)

Portion of Logone River Valley system (major river). Narrow band of light tonal signatures along river indicative of intensive farming. Narrow bands of medium gray tonal signatures indicative of grass. Most of remainder, very dark gray tonal signatures, indicative of high moisture content in soil or even marsh. Some areas of green water, etc. Marsh & Flooding symbols on ONC charts.

Final classification

Wooded savanna

Rice, cotton, peanuts

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 90 SIZE 28,076 Sq. km.

LOCATION East section of study area; S. Chad; Doumra, Sahr, & Moissala

IMAGE I. D. Path 200, 201; Row 59

Area description (collateral data)

Veg. Woodland, Savanna & Steppe: Northern areas with abundant Isoberlinia doka & I. dalzielii; WSS undifferentiated relatively dry types (Keay & Aubreville, 1958)

Ag. Traditional & commercial; cotton seed (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture (1976).

Soils No data

Area description (consultant) (Fred Weber personal communication, August, 1978)
Heavy agriculture - cotton, tobacco, sorghum, monioc, lowland rice; wooded savanna. Area under periodic flooding.

Area description (Landsat analysis)

Moderate to high drainage density of dendritic variety. Scattered area of light tonal signature indicative of intensive farming. Some medium gray tonal signatures indicative of grass. A few dark signatures indicative of burns. Some smooth dark gray tonal signatures indicative of moist soils; swamp symbols indicated on ONC charts.

Final classification

Wooded savanna

Cotton, tobacco, sorghum, cassava, irrigated rice

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 91 SIZE 5,244 Sq. km.

LOCATION Eastern section of study area; Chad, Centrafrican

IMAGE I. D. Path 200, 199; Row 53, 54

Area description (collateral data)

Veg. Woodland, Savannas & Steppe - undifferentiated relatively dry types; north; abundant Isoberlinia doka & I. dalzielii in south. (Keay & Aubreville, 1958).

Ag. Traditional subsistence & commercial crops (Atlas of Africa, 1975); Non-Ag. Rough Grazing land with trees (World Atlas of Agriculture (1978); Possible cotton (CIA).

Soils No data Some river flooding indicated by ONC charts

Area description (consultant)

Getting into peanut, cotton growing area; See Atlas of Chad.

Area description (Landsat analysis)

Mostly medium gray tonal signature indicative of grass vegetation scattered dark tonal signatures indicative of burns & a few light tonal signatures indicative of cleared land for farming.

Final classification

Wooded savanna
Peanuts, cotton
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 92 SIZE 29,004 Sq. km.

LOCATION Eastern section of study area; North Central Africa

IMAGE I. D. Path 198, 197; Row 53, 54

Area description (collateral data)

Veg. Woodland, Savanna & Steppe (Northern Areas: with abundant Isoberlinia doka & I. dalzielii (Keay & Aubreville, 1958).

Ag. Millet in north, millet & manioc in south, some cotton around in south (Atlas of Africa, 1973). Non-agriculture & Rough grazing & trees (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Not familiar with area.
Wooded savanna

Area description (Landsat analysis)

Moderate density dendritic drainage network (some major streams)-medium gray tonal signatures along streams may indicate marsh vegetation. Light gray signature (cleared land for farming) & dark tonal signature

Final classification

Wooded savanna
Millet, cassava
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 93 SIZE 12,027 Sq. km.

LOCATION Eastern section of study area; southwest of Sudan

IMAGE I. D. Path 197; Row 54

Area description (collateral data)

Veg. Northern areas of Woodlands, Savanna & Steppe with abundant Isoberlinia doka & I. dalzielii (Keay & Aubreville, 1958).

Ag. Millet (Atlas of Africa, 1973).

Soils No data

Area description (consultant)

Maybe burns

Area description (Landsat analysis)

Sparse to moderate density drainage of dendritic variety. Gray to light Gray tonal signatures indicative of grass; very few light tonal signatures indicative of cleared land for farming.

Final classification

Wooded savanna

Millet

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 94 SIZE 6,292 Sq. km.

LOCATION Eastern section of study area; south of Sudan

IMAGE I. D. Path 196, 195 Row 54, 55

Area description (collateral data)

Veg. - northern areas of Woodland, savannas and steppes with abundant Isoberlinia doka and I. dalzielii; southern section- Woodlands, savannas and steppes- undifferentiated relatively moist types (Keay and Aubreville, 1958);

Aq. - Millet and manioc (World Atlas of Agriculture, 1976).

Area description (consultant)

May be burns

Area description (Landsat analysis)

Very dark gray tonal signature of regular shape (virtually no infrared reflectance) suggests either rock outcrops or burns. Medium density drainage of dendritic variety

Final classification

Wooded savanna

Millet and cassava are found at selected, relatively limited locations only

0 - 30% of area had been cleared fro cultivation at the time of Landsat overpass

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 95 SIZE 7,079 Sq. km.

LOCATION Eastern portion of Gambie River south of Tambacounda and north-east of Kolda

IMAGE I. D. Path 223 Row 52

Area description (collateral data)

Woodlands savannas and steppes; northern area with abundant Isober-
linia doka and I. Dalzielii (Keay & Aubreville, 1958). Tall grass
savanna brush and cultivated vegetation; some marsh/swamp and deciduous
forest and scrub (CIA Map of Gambia and Senegal, 1972). Peanut and rice
area with some cotton (Atlas of Africa, 1971 and CIA Map of Gambia and
Senegal, 1972). Mineral hydromorphic soils with pseudo gley along
river; slightly desaturated ferralitic soils; immature soils non-clima-
tic origin; and concretionary leached gray ferruginous soils (Inter-
national Geobotanical West Africa, 1971).

Area description (consultant)

Wooded savanna; diversified farming - corn, manioc, fruit trees, some
rice area; Terminalia, Parkia;

Area description (Landsat analysis)

Landsat shows this to be an intensively cropped area. Bright highly-
reflective signatures adjacent to stream probably cultivated rice.
Farther away from the channel cropped areas probably intensive peanut
and cotton farming. More than 90% of the polygon is cropped.

Final classification

Wooded savanna

Maize, cassava, rice

Greater than 60% of area has been cleared for cultivation at the time of Land-
sat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 96 SIZE 1500 Sq. km.

LOCATION Along Gambie River east of Gambul

IMAGE I. D. Path 225 Row 52

Area description (collateral data)

Marsh or swamp (CIA Map of Gambia & Senegal 1972)
only near coast, Halomorphie soils - acidified salt soils and with incrusta-
tions (International Atlas of West Africa, 1971)

Area description (consultant)

More rainfall here. Almost tropical rainforest; Oil palm grows in tropical
clay soils. Oil palm in the Gambie River Valley. High population pressures.
Remnant of tropical vegetation. Label - Nat. veg. - rigarian trop. forest
belts along water courses; land use - heavily farmed for root crops - not
much rice.

Area description (Landsat analysis)

Band 5 - dark (black) tonal signature adjacent to Gambie River and trib-
utaries. Characteristic marsh signature.

Final classification

Woodland

Manioc, Maize, Sorghum, Penauts, Oil Palm

Greater than 60% of the area has been cleared for cultivation at the time of
Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 97 SIZE 623 Sq. km.
LOCATION 25-50 km. southeast of Banjul
IMAGE I. D. Path 225 Row 52

Area description (collateral data)

Deciduous forest brush and cultivated vegetation area
(CIA Map of Gambia/Senegal, 1972)
Uncultivated area (Atlas of Africa, 1973)
Reworked ferralitic soils (Int. Atlas of West Africa, 1971)

Area description (consultant)

Not familiar with this area. Maybe secondary tropical forest

Area description (Landsat analysis)

Landsat band 5 - smooth gray tonal area-no indication of agricultural activity.
Likely a forested/brush area.

Final classification

Woodland
No Crops
0 - 30% of area has been cleared for cultivation at the time of Landsat
overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 98 SIZE 25,562 Sq. km.
LOCATION Several of these occur in Senegal, Gambia and Guine Bissau
IMAGE I. D. Paths 224 & 225 Row 52 & 53

Area description (collateral data)

These Landsat-delineated polygons transect a Forest-Savanna Mosaic and
Woodlands, Savannas and Steppes Region(Keay and Aubreville, 1958); Peanuts
and millets are the dominant crops in the region where the polygons are
located (Atlas of Africa, 1973). Soils are leached gray, ferruginous-
modal concretionary or indurated (International Atlas of West Africa, 1971).

Area description (consultant)

Less land pressure More natural vegetation - tropical forest - heavy timber-
large trees - slash & burn shifting ag.--- upland rice - monkey country;
Oil palm

Area description (Landsat analysis)

Landsat band 5 shows dark gray areas with smooth texture. Minimal indica-
tion of agricultural activity. Areas appear to be dominantly forest with
less than 10% of the areas in agriculture.

Final classification

Woodland
Rice, Oil Palm
0 - 30% of area has been cleared for cultivation at the time of Landsat
overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 99 SIZE 43,325 Sq. km.

LOCATION Large area in Guinea Bissau and Guinea north and east of Boko

IMAGE I. D. Path 222, 223 Row 53

Area Description (collateral data)

Deciduous forest, brush and cultivated vegetation; lowland evergreen forests (CIA Map of Guinea, 1973); Forest-savanna mosaic; Woodlands, savannas and steppes-undifferentiated relatively moist types (Keay and Aubreville, 1958); Pineapples, Kola nuts, oil palm, peanuts (Atlas of Africa, 1973); Fruit trees (World Atlas of Agriculture, 1976); Oil palm, coffee, banana (CIA Map of Guinea, 1973). Raw-mineral erosion soils over various rocks (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area (Fred Weber, 1978)

Area description (Landsat analysis)

Medium gray tonal signature on band 5. Dense dendritic drainage network with forest above stream channels; No outstanding evidence of agricultural activity.

Final classification

Woodland
Coffee, oil palm, peanuts, fruit trees
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 100 SIZE 183,558 Sq. km.

LOCATION From approximately Kolda in the west, northeastward to Keyes, and eastward to Banamba.

IMAGE I. D. Path 218 to 224; Rows 51 to 53.

Area description (collateral data)

Woodlands, savannas and steppes - undifferentiated relatively dry types in the north -- with abundant Isoberlinia doka and I. Dalzielii (Keay and Aubreville, 1958). Tallgrass savanna in southern part and Acacia savanna in northern portions (CIA Maps of Senegal and Gambia, 1970). Subsistence agriculture (millet and sorghum) with peanuts and cotton (Atlas of Africa, 1973). Peanuts (CIA Maps listed above). Principal soils are immature soils of non-climatic origin over gravelly material and leached gray ferrugencous soil (concretionary) (International Atlas of West Africa, 1971).

Area description (consultant)

Woodland - Isoberlinia doka; Kapok; Silk cotton tree; Some slash and burn agriculture; Staples - maize, root crops, cotton, tobacco, rice in lowlands, fruit trees, mangos, papaya.

Area description (Landsat analysis)

A medium gray tonal signature is characteristic of the Landsat imagery of this area. Indicative of relatively dry vegetation types. Area is under moderate agricultural activity. Drainage density is also moderate with major rivers characteristic of low slope flow, i.e. meandering for the most part with minimal structural control. Occasional dark splotches may indicate sites of burns. Most intensive cropping occurs around villages and is of the subsistence variety.

Final classification

Woodland
Maize, cotton, tobacco, rice and other root crops
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 101 SIZE 5,244 Sq. km.

LOCATION Around Friguiafoe, Guinea

IMAGE I. D. Path 222 Row 53-54

Area description (collateral data)

Hooded, open savanna woodland bush (Area Handbook for Guinea, 1973); Savanna & lowland evergreen forest (CIA Map of Guinea, 1973); Forest savanna mosaic (Keay & Aubreville, 1958); Savanna, oil palm, pineapple, citrus fruits (CIA Map of Guinea, 1973; Atlas of Africa, 1973). Yellow strongly desaturated ferrallitic soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area (Fred Weber, 1978).

Area description (Landsat analysis)

Smooth dark gray tonal signature on Landsat band 5; The Foutadialon slopes to the coastal plain. Fruit cultivation occurs at the higher coastal elevations. No evidence of cultivation is seen on the image.

Final classification

Woodland
Oil palm, fruit trees
30 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 102 SIZE 4,162 Sq. km.

LOCATION Northeast and southeast of Frea, Guinea

IMAGE I. D. Path 222; Row 53-54

Area description (collateral data)

Lowland evergreen forest; deciduous forest, brush and cultivated vegetation (CIA Map of Guinea, 1973); Forest-Savanna mosaic (southern part); Woodlands, savannas and steppes - undifferentiated relatively moist types (Keay & Aubreville, 1958); Bananas, coffee, pineapples, citrus fruits, oil palm (CIA Map of Guinea, 1973); Raw mineral soils of non-climatic origin over various rocks and ferruginous crusts (International Atlas of W. Africa, 1971).

Area description (consultant)

Woodland (Fred Weber, August 21, 1978).

Area description (Landsat analysis)

The dark gray to black signature on Landsat band 5 indicates a forested area. Agricultural activity is not detectable, yet collateral data indicates this to be a fruit producing area. Dense fruit and coffee trees would image as a natural forest area.

Final classification

Woodland
Oil palm, fruit trees, plantains, coffee
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 103 SIZE 13,240 Sq. km.

LOCATION South of Kédougou; Centered on Lake Guinea

IMAGE I. D. Path 221 & 222 Row 54 & 53

Area description (collateral data)

Woodlands savannas and steppes - undifferentiated relatively moist types (Keay & Aubreville, 1958); Montane communities - undifferentiated (Keay & Aubreville, 1958); Deciduous forest, brush and cultivated vegetation: (CIA Map of Guinea, 1973); Coffee (Atlas of Africa, 1973); Peanuts (CIA Map of Guinea, 1973); Subsistence agriculture (Millet and sorghum with peanuts and cotton) (Atlas of Africa, 1973). Raw mineral erosion soils over various rocks or ferruginous crusts (International Atlas of W. Africa, 1971). The Fouta Djallon highland mass - complex of elevated relatively level plateaus; agriculture is difficult; coffee cultivation near Lobe (Area description (consultant) Handbook for Guinea, 1975).

Not familiar with area (Fred Weber, August 21, 1978).

Area description (Landsat analysis)

Landsat band 5 shows an area of rugged terrain in the vicinity of Labe. This is an area of hills and plateaus. Agriculture on the hills and plateaus is sparse as indicated by a medium-gray tonal signature. Lighter gray tones in the valleys indicate more intensive agricultural production in these areas.

Final classification

Woodland
Peanuts, coffee at selected relatively limited locations only, Millet, sorghum.

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 104 SIZE 8,193 Sq. km.

LOCATION Area surrounding Labe, Guinea

IMAGE I. D. Path 221-222; Row 52-53

Area description (collateral data)

Upland evergreen forest, grassland, and cultivated vegetation (CIA Map of Guinea, 1973); Montane communities undifferentiated and woodlands, savannas and steppes - undifferentiated relatively moist types (Keay & Aubreville, 1958); Coffee and peanuts (CIA Map of Guinea, 1973); Subsistence agriculture (Atlas of Africa, 1973); Raw mineral soils of non-climatic origin over various rocks and ferruginous crust, (International Atlas of W. Africa, 1971). The Fouta Djallon Plateau and adjacent Plains (Area Handbook for Guinea, 1975).

Area description (consultant)

Not familiar with area. Relatively heavy agricultural use.

Area description (Landsat analysis)

Landsat band 5 indicates that much of the area has been cleared for agriculture. Area around Labe appears to be a hilly region, probably suitable for coffee cultivation.

Final classification

Woodland
coffee, peanuts, maize, sorghum
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 105 SIZE 59,968 Sq. km.

LOCATION Near headwaters of Gambie River; east past Dinguiraye and Siguiri then north to Bamako

IMAGE I. D. Path 219, 220, 221, 222; Row 51, 52, 53

Area description (collateral data)

Upland evergreen forest, grassland and cultivated vegetation in the eastern portion; (CIA Map of Guinée, 1973); Woodlands savannas and Steppes - northern areas with abundant Isoberlinia Doka and I. Dalziellii (Keay & Aubreville, 1971); tallgrass savanna brush and cultivated vegetation (CIA Map of Guinea 1973). Subsistence agriculture (millet and sorghum) with peanuts and cotton (Atlas of Africa, 1973); Peanuts (CIA Map of Guinea 1973).

Rice along Milo and Niger Rivers (CIA Map of Guinea, 1973); Lowland evergreen forest also along these rivers (CIA Map of Guinea, 1973). Raw mineral

Area description (consultant) erosion soils over various rocks or ferruginous crusts (International Atlas of W. Africa, 1971). Swamp rice,

dryland rice, other dryland food grains, stockraising, cotton (Area Handbook for Guinea, 1975).

Not familiar with area (Fred Weber, August 21, 1978).

Area description (Landsat analysis)

Medium gray tonal signature on Landsat band 5. Area does not appear to be intensively cultivated except along stream valleys. Smooth signature suggests more of a grassland type situation. In western portion of polygon dark mottled tone in western part are hills with trees.

Final classification

Woodland

Millet, sorghum, peanuts, cotton, rice

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 106 SIZE 1,868 Sq. km.

LOCATION South of Siguiri along Milo and Niandan Rivers

IMAGE I. D. Path 219-220; Row 52-53

Area description (collateral data)

Lowland, evergreen forest (CIA Map of Guinea, 1-73); Woodlands, savanna and steppes - northern areas with abundant Isoberlinia doka and I. Dalziellii (Keay & Aubreville, 1958); Rice (Atlas of Africa, 1973); Mineral hydro-morphic soils with pseudo-gley (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

A bright gray to white tonal signature show the Milo and Niandan Rivers is indicative of rice cultivation.

Final classification

Woodland

Rice

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 107 SIZE 25,005 Sq. km.

LOCATION In Bamako area and south toward Bougounis

IMAGE I. D. Path 219, Row 51, 52, 53

Area description (collateral data)

Woodlands, savannas and steppes (Northern area with abundant Isoberlinia Doka and A. Dalzielii (Keay & Aubreville, 1958); Tallgrass savanna, brush and cultivated vegetation (CIA Maps of Guinea and Mali, 1973 and 1970 respectively). Subsistence agriculture (Millet and Sorghum) with peanuts and cotton (Atlas of Africa, 1973); Peanuts near Bamako (Atlas of Africa, 1973; CIA Map of Mali, 1970); Arable land (millet, sorghum, manioc, corn, and sweet potatoes) (CIA Map of Mali, 1970). Leached gray ferruginous soils (Concretionary) International Map of Mali; 1971).

Area description (consultant)

Not familiar with area (Fred Weber, August 21, 1978). Latertic plateaus around Bamako. Relatively high unproductive with wooded savanna. Heavy agriculture in river valley. Sorghum, corn, peanuts, manioc, canova.

Area description (Landsat analysis)

Dark to black tonal signature suggests a wooded area and lighter toned signature intermixed with darker tones indicates clearing and cultivation. Tree canopies line the stream banks in this area.

Final classification

Woodland

Rice at selected relatively limited locations only.

Millet, sorghum, maize, peanuts, cassava

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 108 SIZE 214,495 Sq. km.

LOCATION Southwestern part of project area from Kindia Guinea in the west to Ferkessedougoa, Ivory Coast

IMAGE I. D. Path 219 to 222, Row 54-55

Area description (collateral data)

Forest-savanna mosaic (southern part); Woodlands, savannas and steppes-undifferentiated relatively moist types; Woodland, savannas and steppes (Atlas of Africa, 1973); Savanna Upland evergreen forest; grassland and cultivated vegetation; Deciduous forest (CIA Maps of Guinea, Ivory Coast, Sierra Leone (1973, 1972 1969 respectively); Western portion bananas, oil palm; Middle portion - subsistence agriculture and rough grazing land; coffee and oil palm; Eastern portion - cotton, tobacco, peanuts, millet and maize (Atlas of Africa, 1973). Coffee and oil palm near Beyl. (CIA Map of Guinea, 1973); Raw mineral soils of non-climatic origin; impoverished and leached strongly desaturated ferallitic soils (International Atlas of W. Africa, 1971).

Woodland - savanna mosaic; oil palm; coffee; cotton; slash-burn agriculture; inland rice; natural vegetation becomes a nuisance (Fred Weber, August 21, 1978).

Area description (Landsat analysis)

Dark gray to black tonal signature indicative of dense vegetation within a humid zone. Outliers of the southern forest are indicated with black spotty signatures extending into the more moist savanna areas.

Final classification

Woodland

Oil palm, rice, coffee, cotton

31 - 60% of area has been cleared for cultivation as the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 109 SIZE 2,458 Sq. km.

LOCATION Around and south of Kerouane along Milo, River

IMAGE I. D. Path 219; Row 53-54

Area description (collateral data)

Upland evergreen forest, grassland and cultivated vegetation (CIA Map of Guinea, 1973); Woodlands, savannas and steppes - undifferentiated relatively moist types (Keay & Aubreville, 1958); Oil palm, coffee, peanuts (Atlas of Africa, 1973 and CIA Map of Guinea, 1973); Raw mineral soils of non-climatic origin over various rocks (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

The medium to dark gray tonal signature indicates the Simandou Mountains. This is a lightly forested area with dominant crops being oil palm and coffee.

Final classification

Woodland

Oil palm, coffee

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 110 SIZE 2,523 Sq. km.

LOCATION Around Korhogo, Ivory Coast

IMAGE I. D. Path 217 Row 53

Area description (collateral data)

Woodlands, Savannas and Steppes - northern areas with abundant Isoberlinia doka and I. dalzielii; Cotton area (Atlas of Africa, 1973); Cotton with peanuts - millet and maize. Reworked slightly desaturated ferrallitic soils and impoverished yellow medium desaturated ferrallitic soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Heavy agriculture. Corn, cotton, coffee, rice in lowland. Heavy cotton and rice area. Woodland-natural vegetation. Great variety of tree species - some commercial. Heavy grass cover with limited palatability.

Area description (Landsat analysis)

Landsat band 5 shows the area around Korhogo to be cleared of natural vegetation cover and under cultivation. Principal crops are most likely cotton.

Final classification

Woodland

Maize, cotton, coffee, rice

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 111 SIZE 10,389 Sq. km.

LOCATION Surrounding and southwest of Bobo Dioulasso

IMAGE I. D. Path 216 Row 52 and 53

Area description (collateral data)

Woodlands, savannas and steppes - northern areas with abundant Isoberlinia doka and I. dalzielii (Keay and Aubreville, 1958); Tallgrass savanna and brush (CIA Map of Mali, 1970); Cotton, Marker gardening; peanuts (Atlas of Africa, 1973); Impoverished medium desaturated ferallitic soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Heavy land use; rice, sugar cane, cotton, tobacco, cashew, citrus. Staple-tubers - manioc, cassava, maize, sorghum. Limited grazing. Commercial plantational - service wood (teak, eucalyptus), firewood.

Area description (Landsat analysis)

The light tonal Landsat band 5 signature indicates an area under intensive cultivation in the Bobo Dioulasso region. Principal drainage is outward from the area along the Kou. Volta Noire; Bougouriba and Komoe Rivers. 80 - 90% of the area is under cultivation.

Final classification

Woodland
Rice; sugar cane at selected relatively limited locations only; fruit trees, tobacco, coffee.
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 112 SIZE 403,133 Sq. km.

LOCATION Southern part of project area from Korhogo, Ivory Coast in the west to just east of Lafia, Nigeria

IMAGE I. D. Path 208 to 217; Rows 53 to 56.

Area description (collateral data)

Woodlands, Savannas and Steppes - undifferentiated, relatively moist types (Keay and Aubreville, 1958); Deciduous forest, brush and cultivated vegetation (CIA Maps of Ivory Coast, Upper Volta, Benin, Togo and Nigeria, 1972, 1968, 1970, 1970, 1972 respectively). Crops - peanuts, millet, maize, beans, and predominantly subsistence millet, manioc, maize and rice (Atlas of Africa, 1973). Sesame seed occurs around Lafia (CIA Map of Nigeria, 1972).

Area description (consultant)

Woodland Savanna. Staple crops - more cereal crops like maize than root crops. A little more than 50% of area is under cultivation. Some livestock grazing occurs during the drought season.

Area description (Landsat analysis)

Dark tonal Landsat signature indicative of a fairly dense natural vegetation cover with scattered agricultural activity. Most intensive agriculture is surrounding towns and villages.

Final classification

Woodland
Maize, sorghum
31-60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 113 SIZE 9,930 Sq. km.

LOCATION In Togo and Benin from about Anie Mano in the south to about Sanjanna Mango in the north, Atacora Mountain region

IMAGE I. D. Path 212, Row 52, 53, 54

Area description (collateral data)

Woodlands, savannas and steppes (northern areas with abundant Isoberlinia doka and I. Dalzielii (Keay & Aubreville, 1958). Tallgrass savanna, brush and cultivated vegetation (CIA Map of Benin, 1970); Low yield subsistence crops (millet, manioc, yams, with peanuts and cotton; Coffee, manioc, maize and yams in southern part (Atlas of Africa, 1973); Cocoa and cotton southern part (CIA Map of Benin, 1970). Raw mineral erosion soils over various rocks and leached gray ferruginous soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Woodland originally; heavy land pressure, peanuts, sorghum, maize, some fruit trees; some rice. No livestock; Heavy pacellated land use; No coffee here!

Area description (Landsat analysis)

The light to medium gray Landsat band 5 and forested areas tonal signature suggests clearing of wooded savannas for agricultural purposes. The area is relatively intensively cultivated - 60-70% of the area.

Final classification

Woodland
Peanuts, sorghum, maize, fruit trees, rice
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 114 SIZE 13,928 Sq. km.

LOCATION Central section of study area; S.W. Nigeria

IMAGE I. D. Path 209,210 Row 53-54

Area description (collateral data)

Veg. Woodland, Savanna & Steppes northern areas with abundant Isoberlinia doka & I. dalzielii; WSS - undifferentiated relatively dry types (Keay & Aubreville 1958) Tall grass Savanna (CIA)

Ag. predominantly subsistence (Atlas of Agriculture 1973) Non-agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1975)

Soils humiferous strongly desaturated ferallitic soils; impoverished slightly desaturated ferallitic soils (International Atlas of West Africa, 1971).

Area description (consultant)

May be like 50A only denser vegetation.

Maybe slash & burn - sorghum, maize, cassava, etc.

Woodland

Area description (Landsat analysis)

Moderate density drainage of the dendritic variety. Mostly medium dark tonal signature indicative of natural vegetation that is more dense than the surrounding area. Some lighter tonal signatures near some of the drainage network could indicate farming.

Final classification

Woodland
Sorghum, maize, cassava
0 - 50% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 115 SIZE 7,702 Sq. km.

LOCATION South central section of study area; southern Nigeria, Bida

IMAGE I. D. Path 208, 209; Row 53, 54

Area description (collateral data)

Veg. Woodland Savanna & Steppe - undifferentiated relatively moist types
(Keay & Aubreville, 1958); Tallgrass savanna (CIA)

Ag. Predominantly subsistence; Rice; Forest (Atlas of Africa, 1973); Non-
agriculture & Rought Grazing Land with Trees (World Atlas of Agriculture,
1975).

Soils Impoverished medium desaturated ferallitic soils; mineral hydromorphic
soils with pseudo-gley - modal facies (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area

Woodland

Area description (Landsat analysis)

Moderate density drainage network of dendritic variety indicative of
slight relief. Mixed areas of light gray tonal signature indicative of
farming and medium gray tonal signature indicative of grass. Narrow band
of very light tonal signature along Kaduna River indicative of intensive
farming and/or sand dunes.

Final classification

Woodland

Millet, cassava, maize, rice

31 - 60% of area has been cleared for cultivation at the time of Landsat
overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 116 SIZE 15,239 Sq. km.

LOCATION South central section of study area; portion of Niger-Benue River

IMAGE I. D. Path 206,207,208,209 Row 54-55

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - Undifferentiated relatively moist types;
Forest - Savanna Mosaic (Keay & Aubreville 1958) Tallgrass savanna (CIA)

Ag. Rice; Forest (Atlas of Africa 1973) Non-agriculture & Rough Grazing Land
with trees (World Atlas of Africa 1976) Sesame Seed (CIA)

Soils mineral hydromorphic soils with gley over the whole (International Atlas
of West Africa 1971)

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Portion of Niger-Benue system. Narrow band of very light tonal signatures
indicative of intensive farming along river. Along the river are medium
gray tonal signature indicative of either grass or possible rice and dark
gray tonal signatures indicative of forest

Final classification

Woodland

Rice

31 - 60% of area has been cleared for cultivation at the time of Landsat
overpass..

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 117 SIZE 1,770 Sq. km.

LOCATION Center of study area; central Nigeria

IMAGE I. D. Path 208; Row 53

Area description (collateral data)

Veg. Woodland, Savanna & Steppe; northern areas with abundant Isoberlinia doka and I. dalzielii; Woodland, Savanna, & Steppe - undifferentiated relatively moist types (Keay & Aubreville, 1958); Tallgrass savanna (CIA) Ag. Tobacco; Predominantly subsistence (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1976). Soils- Raw mineral erosion soils of non-climatic origin over various rocks (International Atlas of W. Africa, 1971).

Area description (consultant)

Same as 159; Hilly area

Area description (Landsat analysis)

Moderate density drainage of dendritic variety. Area of considerable relief. Mostly dark gray tonal signatures indicative of forest vegetation. Some medium gray tonal signatures indicative of grass vegetation.

Final classification

Woodland
Millet, cassava, maize, irrigated rice
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 118 SIZE 18,090 Sq. km.

LOCATION Center of study area; central Nigeria

IMAGE I. D. Path 207, 208; Row 53

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - northern areas - with abundant Isoberlinia doka & I. dalzielii; Woodland, Savanna & Steppe - undifferentiated relatively moist types (Keay & Aubreville, 1958); Tallgrass savanna (CIA) Ag. Predominantly subsistence; Tobacco; Forest; Cotton (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976); Cotton (CIA).

Soil impoverished slightly desaturated ferrallitic soils; concretionary leached gray ferruginous soils (International Atlas of W. Africa, 1971).

Area description (consultant)

Woodland; Slash and burn; Little agriculture

Area description (Landsat analysis)

Low density drainage. Some relief features. Mostly medium gray tonal signatures indicative of grass and dark gray tonal signatures indicative of forest vegetation. Some areas of light gray tonal signatures indicative of farming.

Final classification

Woodland
Millet, cassava, maize, irrigated rice
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 119 SIZE 11,765 Sq. km.

LOCATION Central section of study area; S.E. Nigeria

IMAGE I. D. Paths 205, 206; Row 53, 54

Area description (collateral data)

Veg. Woodland, Savanna & Steppes - undifferentiated relatively dry types; Woodland, Savanna & Steppes - with abundant Isoberlinia doka & I. dalzielii; Woodland, Savanna & Steppes - undifferentiated relatively moist types (Keay & Aubreville, 1958) sudan savanna; tallgrass savanna (CIA Maps).

Ag. subsistence crops with commercial ; predominantly subsistence; cotton (Atlas of Africa, 1973). Non-agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1976).

Area description (consultant)

Soils Raw mineral erosion soils (lithosols) of non climatic origin over various rocks; lithomorphc vertisols over clay alluvium; little leached gray ferruginous soils - modal facies over eolian sands; hydromorphic leached gray ferruginous soils (International Atlas of W. Africa, 1971).

Not familiar with area

Woodlands

Area description (Landsat analysis)

Little drainage detected. Some scattered relief features in north. Much medium gray tonal signatures indicative of grass. Some light gray tonal signatures indicative of farming. A number of dark tonal signatures in south indicative of burns.

Final classification

Woodland

Cotton, millet, cassava, maize, rice

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 120 SIZE 3,474 Sq. km.

LOCATION Eastern central section of study area; upper Benine River in Nigeria

IMAGE I. D. Path 203, 204, 205; Row 53, 54

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively dry types (Keay & Aubreville, 1958). Sudan Steppe (CIA Map)

Ag. Forest (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land with Trees (World Atlas of Agriculture, 1976).

Soils Mineral hydromorphic soils pseudo-gley & with spots and concretions (modal facies); (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area.

Area description (Landsat analysis)

Portion of Benue River Valley system (major River). Narrow band of light tonal signatures along river indicative of intensive farming. Some dark tonal signatures adjacent indicative of burns. Rest of unit is medium gray tonal signatures indicative of grass; a dark gray tonal signatures indicative of forest or moist soils, as indicated on ONC charts.

Final classification

Woodland

Rice, millet

31 to 60% of area cleared for cultivation at the time of Landsat overpass

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 121 SIZE 9,832 Sq. km.

LOCATION Northern east central section of study area; N.E. Nigeria, Komaduguo River.

IMAGE I. D. Path 204, 205, 206; Row 50, 51, 52

Area description (collateral data)

Veg. Woodland, Savannas, & Steppe - undifferentiated relatively dry types;

Woodland, Savannas, & Steppe with abundant acacia & Commiphora (Keay & Aubreville, 1958). Sudan savanna (CIA Map)

Ag. Non-agriculture & Rough Grazing Land; Non ag. & PGL with trees (World Atlas of Agriculture, 1976). Multicrop subsistence & sedentary livestock also peanuts (Atlas of Africa, 1973); Rice (CIA Map)

Soils Little leached gray ferruginous soils - hydromorphic facies over sandy materials; mineral hydromorphic soils with pseudo gley-modal facies (Inter-

Area description (consultant) national Atlas of W. Africa, 1971).

Remnant natural vegetation cover - dense - numerous large tree species which are found much farther southeast. Influence of central Africa species. Much local irrigation - tomatoe, onion, rice and wheat; local vegetable areas. Lower half of the river system only (toward Lake Chad). No peanuts.

Area description (Landsat analysis)

Major interior drainage system - dark tonal signature indicative of possible trees & wet soil and or standing water. In southern portion some light gray tonal signatures of linear shape indicative of sand dunes. Some medium gray tonal signatures indicative of grass.

Final classification

Woodland
Sorghum, rice, fruit trees, irrigated wheat
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 122 SIZE 42,670 Sq. km.

LOCATION S. Central section of study area; S. Nigeria, Abaka Kaliki

IMAGE I. D. Path 205, 206, 207; Row 54, 55

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated, relatively moist types;

Forest - savanna mosaic; (Keay & Aubreville, 1958); Tallgrass savanna (CIA)

Ag. Forest; Rough Grazing Land; Non-agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1976); Bananas, Millet & fruit trees (World Atlas of Agriculture, 1976); Manioc; Oil Palm; Forest (Atlas of Africa, 1973).

Soils. Humiferous strongly desaturated ferralitic soils leached & unleached
Area description (consultant) types; penavolved medium desaturated ferralitic soils (International Atlas of W. Africa, 1971).

Woodlands and forest mosaic

Der ived savanna - or Mosaic

Woodland - trees and grasses

Area description (Landsat analysis)

Adjacent to Benue River, no relief features detected. Mostly light gray tonal signatures indicative of farming. Cloud cover in southern section of map unit.

Final classification

Woodland
Rice, oil palm, sesame seed
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 123 SIZE 6,260 Sq. km.

LOCATION S. Central Section of study area; S.E. Nigeria

IMAGE I. D. Path 205; Row 55

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively moist types
Woodland, Savanna & Steppe - with abundant Isoberlinia doka & I. dalzielii
(Keay & Aubreville, 1958). Tall grass savanna (CIA Maps)
Ag. Forest; Rice (Atlas of Africa, 1973); Non-agriculture & Rough Grazing
Land with Trees (World Atlas of Agriculture, 1976); Rice (CIA Maps).
Soils Mineral hydromorphic soils with pseudo-gley - modal facies (International
Atlas of W. Africa, 1971).

Area description (consultant)

Cameroun Mountains
Woodlands

Area description (Landsat analysis)

Major river system (Benue, the major tributary of the Niger). Band of
light tonal signature along river indicative of intensive farming or
riverine sand bars. Rest of map unit is medium to dark gray tonal sig-
natures indicative of grass and trees and/or forest.

Final classification

Woodland
Coffee at selected relatively limited locations only; root crops
0 - 30% of area has been cleared for cultivation at the time of Landsat
overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 124 SIZE 16,484 Sq. km.

LOCATION South central section of study area; S.E. Nigeria

IMAGE I. D. Path 205; Row 54

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively moist types
Woodland, Savanna & Steppe - with abundant Isoberlinia doka & I. dalzielii
(Keay & Aubreville, 1958). Tallgrass savanna (CIA Maps)
Ag. Predominantly subsistence (Atlas of Africa, 1973) Non-agriculture & Rough
Grazing Land with Trees (World Atlas of Agriculture, 1976)
Soils Concretionary, leached gray ferruginous soils; Mineral hydromorphic soils
pseudo-glei - modal facies (International Atlas of W. Africa, 1971).

Area description (consultant)

Not familiar with area
Woodlands

Area description (Landsat analysis)

Narrow band of light tonal signatures along major tributary indicative
of intensive farming. Mostly medium gray tonal signatures indicative of
grass. Few light tonal signatures indicative of farming. A few small
dark tonal signatures indicative of burns. Medium to darker gray tonal
signatures indicative of trees in south. South of map unit are mountains.

Final classification

Woodland
Millet, cassava, maize, rice
0 - 30% of area has been cleared for cultivation at the time of Landsat
overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 125 SIZE 28,971 Sq. km.

LOCATION East central section of study area; Nigeria & Cameroun

IMAGE I. D. Path 205, 204, 203; Row 54, 55

Area description (collateral data)

Veg. N. & E. - Woodland Savanna & Steppe - undifferentiated relatively moist type;

W. - Forest savanna mosaic; rest is montane communities undifferentiated (Keay & Aubreville, 1958). Savanna & Tall Grass Savanna; some scrub, grassland, & crops and Montane vegetation (CIA Map).

Ag. Subsistence & commercial (Atlas of Africa, 1973). Non agriculture & Rough Grazing with Trees in north; South - Rough Grazing Land (World Atlas of Agriculture, 1976).

Soils Strongly desaturated ferrallitic soils, some leached also; raw mineral soils (International Atlas of West Africa, 1971).

Area description (consultant)

Mountainous grassland area. All grazing.

Area description (Landsat analysis)

Little drainage network other than Taraba River; Most of this map unit is occupied by the Adamoua Plateau (1600 - 2000 Feet), minor mountain ranges within this area. Mostly medium gray tonal signatures indicate grass; a few dark tonal signatures indicate forest vegetation.

Final classification

Woodland
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 126 SIZE 172,415 Sq. km.

LOCATION Southern portion of east central portion of study area; north of Congo; Contains cities of Lai, Moundou, Doba, Bossangoa, Mbaiki, & Bangui

IMAGE I. D. Path 204, 203, 202, 200, 199; Row 54, 55, 56, 57

Area description (collateral data)

Veg. North to south; Woodlands, Savannas, & Steppe, undifferentiated relatively dry types; Northern area of W.S.S. - with abundant Isoberlinia doka & I. dalzielii; WSS undifferentiated relatively moist types; Forest Savanna

mosaic (Keay & Aubreville, 1958); East - non agriculture & Rough Grazing Land with Trees; some forest in south; rough grazing land & scattered forest in west (World Atlas of Agriculture, 1976). Mostly millet & manioc with peanuts along N'Gui & M'Poko Rivers, scattered cotton area in east, & some coffee & fruit trees near Bangui (Atlas of Africa, 1973). Savanna North Cameroun. Mixed broadleaf deciduous & Evergreen forest-South Cameroun, small

Area description (consultant) marsh or swamp in central Cameroun under vegetation

(CIA Maps).

Soils Strongly desaturated ferrallitic soils - yellow & reworked strongly desaturated ferrallitic soils - modal & yellow; some raw mineral erosion soils (International Atlas of W. Africa, 1971).....

Staple crops - millet & sorghum & grass savanna; Cameroon portion;

Collateral data is poor. Mr. Guizonis with the French Tropical Forest Research Service (CTFT) knows the area well. He is in Paris. Plateau high-land in Cameroon - good volcanic soils by highland grazing. Natural veg.- tall grassland, scattered short trees. Some subsistence millet & sorghum.

Area description (Landsat analysis)

Medium density drainage of dendritic variety. Mostly medium gray tonal signatures indicative of grass; scattered small areas of darker gray tonal signatures indicative of forest vegetation. No coverage for Bangui frame; Cloud cover over 199-55 in center of map unit.

Final classification

Woodland
Millet, sorghum, irrigated rice, cotton, tobacco, root crops
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 127 SIZE 32,543 Sq. km.

LOCATION Eastern section of study area; southwest of Sudan; S.E. of Chad

IMAGE I. D. Path 198, 197; Row 54,55

Area description (collateral data)

Veg. South Section Woodlands, Savanna & Sreppe - undifferentiated relatively moist types North section - Northern area of above, with abundant Isoberlinia doka & I. dalzielii (Keay & Abreville, 1958).

Ag. Millet & Manioc; (Atlas of Africa, 1973). Non-agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1976).

Soils No data (Small area of cotton in west

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Dark tonal signatures indicative of forest vegetation, mostly on inter-fluves of dendritic drainage which has wide alluvial plains, as indicated by light tonal signatures. Medium gray tonal signatures indicative of grass vegetation. Drainage density is moderate. Geomorphically influenced (Bongo Massif).

Final classification

Woodland

Millet, cassava

31 -60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 128 SIZE 5,735 Sq. km.

LOCATION Eastern section of study area; southwest of Sudan, Southeast of Chad

IMAGE I. D. Path 198, 197; Row 54, 55

Area description (collateral data)

Veg. Northern area of Woodland, Savanna, Steppe, with abundant Isoberlinia doka & I. dalzielii (Keay & Abreville, 1958).

Ag. Millet & Manioc (Atlas of Africa, 1973). Non agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Medium gray tonal signatures indicative of grass. Very few darker gray tonal signatures (forest) or light tonal signatures (cleared land for farming). Medium density drainage of dendritic variety.

Final classification

Woodland

Millet, cassava

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 129 SIZE 5,244 Sq. km.

LOCATION Eastern section of study area; southwest of Sudan; S.E. of Chad

IMAGE I. D. Path 197; Row 55

Area description (collateral data)

Veg. South section - Woodlands, Savanna, Steppe undifferentiated relatively moist type Northern section - Northern area of above with abundant Isoberlinia doka & I. dalzeilii (Keay & Aubreville, 1958).

Ag. Millet & Manioc (Atlas of Africa, 1973). Non agriculture & Rough Grazing land with trees (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Medium gray tonal signatures indicative of grass vegetation; few scattered dark tonal signatures indicative of forest vegetation; Sparse density drainage of the dendritic variety.

Final classification

Woodland

Millet, cassava

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 130 SIZE 30,511 Sq. km.

LOCATION Eastern section of study area; south of Sudan

IMAGE I. D. Path 196, 195; Row 55

Area description (collateral data)

Veg. North section - Northern area of Woodlands, Savannas, & Steppes with abundant Isoberlinia doka & I. Dalzielii; South section - Savannas & Steppes-undifferentiated relatively moist types (Keay & Abreville, 1958).

Ag. Non-agricultural Rough Grazing Land with Trees (World Atlas of Agriculture, 1976); North section - Millet, South Section - Millet, Manioc (Atlas of Africa, 1973).

Soils No data

Area description (consultant)

Not familiar with area. More info savanna.

Area description (Landsat analysis)

Gray & limited light gray tonal signature indicative of grasses and limited cleared land for farming; medium density drainage of dendritic variety.

Final classification

Woodland

Millet at selected relatively limited locations only; Cassava at selected relatively limited locations.

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 131 SIZE 69,477 Sq. km.

LOCATION Southern part of project area from Korhogo, Ivory Coast in the West to just west of Lafia, Nigeria

IMAGE I. D. Path 208 - 217; Row 53 - 56

Area description (collateral data)

Northern part - Woodlands Savannas and Steppes - northern areas with abundant Isoberlinia doka and I. Dalzielii. Southern portion - Woodlands, savannas and steppes - undifferentiated relatively moist types (Keay & Aubreville, 1958); Tallgrass savanna - northern part; Deciduous forest, brush and cultivated vegetation - southern part (CIA Maps of Ivory Coast, Upper Volta, Venin, Togo, and Nigeria, 1972, 1968, 1970 - 1972, crops

peanuts, millet, maize, beans; predominantly subsistence - millet, manioc, maize, rice (Atlas of Africa, 1973); east of Kainji Reservoir - tobacco, large peanut and cotton area west of Zaria, (Atlas of Africa, 1973); Sesame seed around Lafia

(CIA Map of Nigeria, 1972).

Tropical forest influenced greatly by slash and burn agriculture; coffee and cocoa. Staple crops - root crops, yams and some maize. 6CF,Co,RC,N 3 Cs Ativon Kodgo (August 22, 1978).

Area description (Landsat analysis)

Dark tonal Landsat signature indicative of a fairly dense natural vegetation cover with scattered agricultural activity. Most intensive agriculture is surrounding towns and villages.

Final classification

Mosaic

Coffee, cocoa, maize, cassava, root crops.

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 132 SIZE 87,404 Sq. km.

LOCATION Southern part of project area from Korhogo, Ivory Coast in the west to just west of Lafia, Nigeria

IMAGE I. D. Path 208 - 217; Row 53 - 56

Area description (collateral data)

Northern part - Woodlands Savannas and Steppes - northern area with abundant Isoberlinia doka and I. Dalzielii. Southern portion - Woodlands, savannas and steppes - undifferentiated relatively moist types (Keay & Aubreville, 1958); Tallgrass savanna - northern part; Deciduous forest, brush and cultivated vegetation - southern part (CIA Maps of Ivory Coast, Upper Volta, Benin, Togo, and Nigeria, 1972, 1968, 1970 - 1972, crops;

peanuts millet, maize, beans; predominantly subsistence - millet, maize, rice (Atlas of Africa, 1973); East of Kainji Reservoir - large peanut and Cotton area west of Zaria, (Atlas of Africa, 1973); Sesame seed around Lafia (CIA Map of Nigeria, 1972).

Mosaic with maize, manioc, and bananas as main staple veg., kapok; 5 MGF3 silk cotton; tall, dense grass. No livestock grazing.

Area description (Landsat analysis)

Dark tonal Landsat signature indicative of a fairly dense natural vegetation cover with scattered agricultural activity. Most intensive agriculture is surrounding towns and villages.

Final classification

Mosaic

Maize, cassava, fruit trees

Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 133 SIZE 27,234 Sq. km.

LOCATION South central section of study area; S.W. Nigeria

IMAGE I. D. Path 208 209 210 Row 54 55

Area description (collateral data)

- Veg. Forest savanna mosaic; Moist forest at low & medium altitudes (Keay & Aubrey-Je, 1958).
Ag. Rough Grazing Land with Forest; Fruit trees (World Atlas of Agriculture, 1958) Subsistence with commercial (Atlas of Agriculture 1973) Cocoa; Oil Palm (CIA) (International Atlas of West Africa 1971)

Area description (consultant)

Mosaic

Area description (Landsat analysis)

Low density drainage. Mostly medium gray tonal signatures indicative of grass. A few scattered light tonal signatures indicative of farming, particularly along drainage.

Final classification

Mosaic
Oil palm, cocoa; fruit trees
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 134 SIZE 14,158 Sq. km.

LOCATION South central section of polygon - southern Nigeria, Makurdi & Abaka Kaliki

IMAGE I. D. Path 205, 206, 207; Row 54, 55

Area description (collateral data)

- Veg. Woodland, Savanna & Steppe - undifferentiated relatively moist types; Forest - savanna mosaic (Keay & Aubreville, 1958); Tallgrass savanna (CIA Maps).
Ag. Nonagriculture & Rough Grazing Land with Trees; Rough Grazing Land with forest; Forest (World Atlas of Agriculture, 1976); subsistence crops (manioc, yams, rice/maize) with commercial (cocoa, coffee, oil palm, rubber & spices); oil palm; rice (Atlas of Africa, 1973); Sesame Seed (CIA)

Soils Mediumdesaturated ferallitic soil; impoverished and strongly desaturated
Area description (consultant) ferallitic soils (International Atlas of W. Africa, 1971).

Mosaic - forest and woodlands

Area description (Landsat analysis)

Substantial cloud cover; moderate density drainage of dendritic variety indicative of some relief. Dark gray tonal signatures indicative of forest vegetation. Little to no agricultural activity detected.

Final classification

Mosaic
Oil palm, root crops, rice, fruit trees
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 135 SIZE 42,342 Sq. km.

LOCATION Southwestern Cameroun

IMAGE I. D. Path 205, 206; Row 56

Area description (collateral data)

Coffee, oil palm, bananas, fruit trees (Atlas of Africa, 1973; CIA Map of Cameroun, 1970; World Atlas of Agriculture, 1976.) Coastal forest - savanna mosaic (Keay & Aubreville, 1958).

Area description (consultant)

Unfamiliar with the area

Area description (Landsat analysis)

Landsat cloud - free imagery was not available for this area

Final classification

Mosaic
Coffee, oil palm, plantains, fruit trees;
Greater than 60% of area under cultivation at the time of
Landsat overpass

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 136 SIZE 38,503 Sq. km.

LOCATION Southern east central section of study area; contains Cameroun, Bouar, & Central African.

IMAGE I. D. Path 201, 202; Row 56, 57

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively moist types; Forest - Savanna mosaic (Keay & Aubreville, 1958); Savanna, Mixed Broadleaf Deciduous & Evergreen forest; Broadleaf Evergreen Forest (CIA Maps).
Ag. Millet & Manioc; Manioc & bananas; oil palm (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land with trees; Rough Grazing Land with Forest; Forest (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Mosaic -

Area description (Landsat analysis)

Extremely high density dendritic drainage of the pinnate variety, which may indicate unusually steep slopes upon which tributaries have developed. Much light gray tonal signatures indicative of grass & some medium gray tonal signatures indicative of trees. Little dark gray tonal signatures indicative of dense forest vegetation. Little evidence of agriculture.

Final classification

Mosaic
Oil palm, cassava, plantain
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 137 SIZE 197 Sq. km.

LOCATION Southern portion of east-central section of study area; S.W. Central African Empire

IMAGE I. D. Path 202; Row 57

Area description (collateral data)

Veg. Forest Savanna Mosaic (Keay & Aubreville, 1958).

Ag. Rough Grazing Land & Forest (World Atlas of Agriculture, 1976); Manioc & Bananas (Atlas of Africa, 1973).

Soils No Data.

Area description (consultant)

Not familiar with area. Forest

Area description (Landsat analysis)

Relatively high density drainage of dendritic variety. Mostly very dark tonal signature indicative of dense forest vegetation.

Final classification

Mosaic

Cassava, fruit trees

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 138 SIZE 23,137 Sq. km.

LOCATION Southern portion of east central section of study area; north of Congo.

IMAGE I. D. Path 201, 200; Row 56, 57

Area description (collateral data)

Veg. Woodland Savanna & Steppe - undifferentiated - relatively moist types in north; forest - Savanna mosaic in south (Keay & Aubreville, 1958).

Ag. Manioc & Bananas; some cotton (Atlas of Africa, 1973). Mostly no agriculture & Rough Grazing Land with Trees; Some Rough Grazing Land with Forrest in south (World Atlas of Agriculture, 1976)

Soils No Data.

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Moderate to high density drainage of dendritic variety; Mostly dark gray tonal signature indicative of forest vegetation in south; Medium gray tonal signatures indicative of grass also.

Final classification

Mosaic

Cassava, fruit trees, cotton

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 139 SIZE 459 Sq. km.

LOCATION Southern portion of east - central section of study area; along Mambere River.

IMAGE I. D. Path 201; Row 57

Area description (collateral data)

Veg. Forest Savanna Mosaic (Keay & Aubreville, 1958).

Ag. Manioc & Bananas (Atlas of Africa, 1973); Non-agriculture & Rough Grazing Land with trees (World Atlas of Agriculture, 1976).

Soils No Data

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Dark tonal signature indicative of dense forest vegetation.

Final classification

Mosaic

Cassava, fruit trees

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 140 SIZE 1,639 Sq. km.

LOCATION Southern portion of east central section of study area; north of Congo

IMAGE I. D. Path 200; Row 57

Area description (collateral data)

Veg. Forest savanna mosaic in south; Woodlands, Savanna & Steppe-undifferentiated relatively moist types in north (Keay & Aubreville, 1958).

Ag. Manioc & bananas (Atlas of Africa, 1973); Nonagriculture & Rough Grazing Land with Trees in north; Rough Grazing Land & Forests in south (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Wooded savanna from highland grass savanna surrounds highland grass savanna
Not familiar with area

Area description (Landsat analysis)

Medium density drainage of dendritic variety; medium gray tonal signatures indicative of grass & darker gray tonal signatures indicative of forests; some dark tonal signatures indicative of burns.

Final classification

Mosaic

Cassava, fruit trees

20 - 50% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 141 SIZE 46,209 Sq. km.

LOCATION Southern part of east central portion of study area; north of Congo

IMAGE I. D. Paths 204, 203, 202, 200; Rows 54, 55, 56, 57

Area description (collateral data)

Refer to description shown for map unit 126

Area description (consultant)

Refer to description shown for map unit 126

Area description (Landsat analysis)

Refer to description shown for map unit 126

Final classification

Mosaic

Root crops, millet, fruit trees, oil palm, coffee

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 142 SIZE 120,176 Sq. km.

LOCATION Eastern section of study area; North of Oubangi River, South central central Africa, surrounds Bambari & Sibut.

IMAGE I. D. Path 200, 199, 198, 197; Row 55, 56, 57

Area description (collateral data)

Veg. South to north (1) Forest-Savanna Mosaic, (2) Woodlands, Savannas & Steppes - undifferentiated relatively moist types, (3) Northern areas (of #2) with abundant Isoberlinia doka & I. dalzielii (Keay & Abreville, 1958).

Ag. Millet & Manioc, scattered coffee, cotton, peanuts (Atlas of Africa, 1973). Non agriculture & rough grazing land with trees; scattered fruit trees & forest in south (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Relatively high density dendritic drainage (some pinnate) throughout most of map unit. Scattered light tonal signatures indicative of cleared land for farming; medium gray tonal signature indicative of grass; few dark tonal signatures indicative of forest vegetation. Light cloud cover over center of map unit.

Final classification

Mosaic

Millet, cassava, oil palm, coffee, peanuts; fruit trees at selected relatively limited locations only.

31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 143 SIZE 2,294 Sq. km.

LOCATION Eastern section of study area; north of Oubangi River

IMAGE I. D. Path 197; Row 57

Area description (collateral data)

Veg. Forest Savanna Mosaic (Keay & Aubreville, 1958).

Ag. Rough grazing Land/RGL with trees (World Atlas of Agriculture, 1976).

Soils No

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Very high density dendritic drainage. Medium gray tonal signature indicative of grass. Some light tonal signatures indicative of cleared land for farming. Small regularly shaped dark tonal signatures may indicate burns. Little to no dark tonal signatures indicative of forest.

Final classification

Mosaic

Cotton; irrigated rice at selected relatively limited locations

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 144 SIZE 4,097 Sq. km.

LOCATION Eastern section of study area; North of Oubangui River

IMAGE I. D. Paths 197, 196; Row 57

Area description (collateral data)

Veg. Forest - Savanna Mosaic (Keay & Aubreville, 1958).

Ag. Forest/Rough Grazing Land with forest (World Atlas of Agriculture, 1976)

Cotton & Coffee (Atlas of Africa, 1973).

Soils No data.

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Dark gray tonal signatures adjacent to river indicative of forest vegetation; some small dark areas may be burns; Medium gray tonal signatures indicative of grass; low to moderate density drainage; very little light tonal signatures indicative of farming.

Final classification

Mosaic

Cotton, Coffee

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 145 SIZE 31,822 Sq. km.

LOCATION Eastern section of study area; north of M'bomou River

IMAGE I. D. Paths 196, 195; Row 56

Area description (collateral data)

Veg. N. section - Woodlands, Savannas (and Steppes) undifferentiated relatively moist types; S. Section - Forest savanna Mosaic (Keay & Aubreville, 1958).
Ag. Millet and manioc; coffee plantations in south (Atlas of Africa, 1973); Mixture of forest and rough grazing land; scattered coffee plantations and fruit trees (World Atlas of Agriculture, 1976).

Soils no data.

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Dark gray to black tonal signature in much of map unit indicative of forest vegetation; gray tonal signatures indicative of grasses; relatively high density drainage of the dendritic - pinnate variety which may indicate steep slopes; a major river flows south thru middle of the map unit.

Final classification

Mosaic
Millet, cassava, coffee, fruit trees
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 146 SIZE 5,506 Sq. km.

LOCATION Eastern section of study area; north of M'bomou River

IMAGE I. D. Path 195; Row 57

Area description (collateral data)

Veg. Northern section - Woodlands, Savanna, and Steppe - undifferentiated relatively moist types; Southern section - forest savanna Mosaic (Keay & Aubreville, 1958)
Ag. Mixture of forest and rough grazing land (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Light gray tonal signatures indicative of grasses and limited cleared land for farming; very high density drainage of the dendritic - pinnate variety may indicate steep slopes; characteristic of loess areas of high silt content.

Final classification

Mosaic
Oil palm, cassava, maize
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 147 SIZE 25,497 Sq. km.

LOCATION Eastern section of study area; north of M'bomou River

IMAGE I. D. Path 195; Row 56

Area description (collateral data)

Veg. Woodland, Savanna, Steppe - indifferntiated moist types (Keay & Aubreville, 1958).

Ag. Non-Agricultural Rough Grazing land and trees (World Atlas of Agriculture, 1976).

Soils No data

Area description (consultant)

Not familiar with area. Mosaic type vegetation pattern

Area description (Landsat analysis)

High density drainage of the dendritic - pinnate variety may indicate steep slopes characteristic of loess areas of high silt content; dark tonal signatures along much of drainage indicative of forest vegetation; much gray tonal signature indicative of grasses; some scattered light gray tonal signature indicative of cleared land for farming.

Final classification

Mosaic
No crops
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 148 SIZE 30,511 Sq. km.

LOCATION Eastern tip of study area; mouth of M'bomou River

IMAGE I. D. Paths 195, 194, 193; Row 56

Area description (collateral data)

Veg. Woodlands, Savannas and Steppes, undifferentiated - relatively moist types (Keay & Aubreville, 1958);

Ag. Millet, manioc (Atlas of Africa, 1973); Rough grazing land with forest along river (World Atlas of Agriculture, 1976).

Soils no data.

Area description (consultant)

Not familiar with area
Oil palm

Area description (Landsat analysis)

Dark gray to black tonal signature indicative of forest vegetation; high density drainage of the dendritic-pinnate variety. This may indicate presence of unusually steep slopes upon which the tributaries have developed. Lighter gray tonal signature characteristic of interfluvial areas. Evidence of agricultural activity minimal. Characteristic of loess areas of high silt content.

Final classification

Mosaic
Oil palm, millet, cassava
31 - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 149 SIZE 24,841 Sq. km.

LOCATION Along southern boundary of project area

IMAGE I. D. Path 215-222 Row 54-55

Area description (collateral data)

Secondary brush; tropical forest; secondary growth; lowland evergreen forest (CIA Maps of Sierra Leone, Guinea, Ivory Coast, Ghana, 1969, 1973, 1972, and 1971); Coffee; Tobacco, Oil Palm, Rough grazing land and forest (CIA Maps, 1969, 1973, 1972, 1971 respectively; Atlas of Africa, 1973; World Atlas of Agriculture, 1976). Yellow, strongly desaturated ferralitic soils; other desaturated ferralitic soils, (International Atlas of W. Africa-1971).

Area description (consultant)

Tropical rainforest (Fred Weber, August 21, 1978).

Area description (Landsat analysis)

Black, smooth Landsat tonal signature shown in band 5. Indicates a heavily vegetated forested area.

Final classification

Tropical rainforest
Rice and peanuts at selected relatively limited locations only.
0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 150 SIZE 17,795 Sq. km.

LOCATION Area around Atakpame, Togo

IMAGE I. D. Path 212; Row 56

Area description (collateral data)

Cotton, cocoa and coffee as cash crops with manioc, maize and rice (Atlas of Africa, 1973); Fruit trees (World Atlas of Agriculture, 1976); Cocoa area (CIA Maps of Togo and Benin, 1970). Woodlands, savannas, and steppes (Keay and Aubreville, 1958).

Area description (consultant)

Mountain forest area. Tropical forest influenced by mountains (Weber, August 21, and Ativon, August 22, 1978).

Area description (Landsat analysis)

The black tonal signature on Landsat band 5 is indicative of a densely forested area. Band 5 and 7 shown in color composite confirm this analysis by showing the forest as a deep dark red.

Final classification

Tropical rainforest
cotton, cocoa, coffee, fruit trees, cassava, maize, rice.
Greater than 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 151 SIZE 26,611 Sq. km.

LOCATION Along southern edge of east-central section of study area; north of Congo

IMAGE I. D. _____

Area description (collateral data)

Veg. Forest Savanna Mosaic (Keay & Aubreville, 1958); Broadleaf Evergreen forest & mixed broadleaf deciduous Evergreen Forest (CIA Maps).

Ag. Mostly Forest, some Rough Grazing Land with Forest, Coffee plantation

Soils No data

Area description (consultant)

Not familiar with area

Area description (Landsat analysis)

Very dark tonal signature indicative of dense forest vegetation.

Final classification

Tropical rainforest

Coffee, oil palm, fruit trees

0 - 30% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 152 SIZE 1,737 Sq. km.

LOCATION Due South of Banjul along coast in strip 125 km long and 50 km wide South to Cachen River

IMAGE I. D. Path 225 Row 52

Area description (collateral data)

Marsh and swamp characterize the area (CIA Map of Senegal and Gambia, 1972).

Polygon also occurs in area described as Deciduous forest brush and cultivated vegetation (CIA Map of Senegal and Gambia, 1972). In region known as Woodlands Savannas and Steppes with abundant Isoberlinia Doka and I. dalyi-ellii coastal mangrove region (Keay & Aubreville, 1958). Peanuts, millet, and rice cultivation dominate the area (Atlas of Africa, 1973). Soils in the area are acidified halomorphic soils and impoverished slightly disaturated ferallitic soils (International Atlas of West Africa, 1971).

Area description (consultant)

Brackish and getting into mangroves. Probable not much farming.

Area description (Landsat analysis)

Band 5 shows dark black signature in coastal and estuarine areas of Casamance and Cachen Rivers interspersed with white toned highly reflective return. Dark signature believed to be indicative of saturated soils and dense network of estuarine channels as well as coastal mangrove. White signature indicates highly reflective marsh vegetation and probable rice cultivation areas.

Final classification

Mangrove

Rice at selected relatively limited locations only.

30% - 60% of area has been cleared for cultivation at the time of Landsat overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 153 SIZE 8,849 Sq. km.
 Estuarine and delta area along coast West of Bissau, Fiquinchor,
 LOCATION Boke, Boffa, Conakry

IMAGE I. D. Path 224, Row 52 & 53
Path 224, Row 54; Path 223, Row 54,55

Area description (collateral data)

Coastal mangrove region (Keay & Aubreville, 1958) Oil palm and rice cul-
tivation area (Atlas of Africa, 1973). Acidified halomorphie soil dominate
(International Atlas of West Africa, 1971). In Forest-Savanna Mosaic area
(Keay and Aubreville, 1958).

Area description (consultant)

Not familiar with area. Possible manioc and large yams. Tuber crops
possible. Onions, Tomatoes, Oil palm.

Area description (Landsat analysis)

Band 5 light - toned gray area shows dense network of coastal stream chan-
nels adjacent to Corubal River estuary. High sediment load in these channels
principally responsible for gray tone. Dark gray to black signature near
coast indicates mangrove vegetation. Agricultural activity in this area
difficult to detect. No striking rice signatures (a highly reflective
white) Mangrove appears to dominate this region.

Final classification

Mangroves
Rice at selected relatively limited locations only.
Oil Palm at selected relatively limited locations only.
Other root crops at selected relatively limited locations only.
0 - 30% of area has been cleared for cultivation at the time of Landsat
overpass.

DELINEATION DOCUMENTATION SHEET

AREA (POLYGON) NUMBER 154 SIZE 36,213 Sq. km
 LOCATION North eastern section of study area; S. Chad

IMAGE I. D. Path 198, 199, 200, 201, 202; Row 51, 52, 53

Area description (collateral data)

Veg. Woodland, Savanna & Steppe - undifferentiated relatively dry types (Keay
& Aubreville, 1958).
Ag. Non-agriculture & Rough Grazing Land with Trees; Rough Grazing Land (World
Atlas of Agriculture, 1976). Traditional Subsistence; Traditional & Com-
mercial (Atlas of Africa, 1973); Grazing with some subsistence. Mixed
Grazing & Subsistence; Subsistence (CIA Maps).
 Soils No data

Area description (consultant)

Not familiar with area. Southern part - wooded savanna aided by
high water. Shrub savanna in north. Burns. Marginal millet
Nomadic grazing area. Millet and sorghum do exist as far north
as Lake Chad (Atlas Pratique du Chad, 1972).

Area description (Landsat analysis)

Medium density drainage of dendritic variety. Mostly medium gray tonal
signatures, indicative of grass; some darker gray tonal signatures indica-
tive of forest or moist soils, as indicated by swamp symbols on ONC charts;
occupy some areas; some mountain features in northeast.

Final classification

Wooded savanna
Millet, sorghum
31 - 60% of area has been cleared for cultivation at the time of Landsat
overpass.