

BIBLIOGRAPHIC DATA SHEET

PN-AAJ-912

REPORT ON THE ACCOMPLISHMENTS OF ERTS ZAIRE IN NORTH SHABA, 1980-81;
VOLUME II

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1981, 49P.

(VOL. II CONSISTS OF AN EVALUATION OF THE DFFORESTATION OF THE NYUNZU
AREA, DESCRIPTION AND MAPPING OF NORTH SHABA, AND EVALUATION OF THE
AGRICULTURAL ZONE OF MANONO; VOL. I: PN-AAJ-911; VOL. III: PN-AAJ-913)

ARC NUMBER -
CONTRACT NUMBER - AID/AFR-C-1493
PROJECT NUMBERS - 6600071
SUBJECT CLASS - AP000000G130

DESCRIPTORS -	REMOTE SENSING	ZAIRE
	NATURAL RESOURCES	DFFORESTATION
	MAPPING	AGRICULTURAL DEVELOPMENT
	SURVEYS	AGRICULTURE

VOLUME II

REPORT ON THE ACCOMPLISHMENTS OF ERTS ZAIRE IN
NORTH SHABA, 1980-1981

Jointly Sponsored by:

Bureau du President de la Republique
Programme ERTS-Zaire

and

United States Agency for International Development
(Under Contract No. AID/afr-C-1483 with Spectral Data Corporation)

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With the Assistance of the USAID Kinshasa

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June 1981

PART II

EVALUATION OF THE DEFORESTATION OF THE
NYUNZU AREA BY MEANS OF LANDSAT MSS IMAGERY

Conducted at ERTS ZAIRE
with the assistance of
United States Agency for International Development
(Contract No. AID/afr-C-1483 with Spectral Data Corp.)

by

BAKAJIKA B. Betu - Agronomist
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January 1981

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1. Aim of the study

The aim of the study was to satisfy the need of the Department of the Environment of the Government of Zaire to establish if deforestation was menacing the North Shaba region.

2. Choice of the study area

The Nyunzu-Kongolo region was chosen for the following reasons:

- The existence of the North Shaba Agricultural Development Project at Kongolo assured ERTS Zaire of logistical support.
- USAID and the Government of Zaire have been interested in any data related to the North Shaba project area.
- The North Shaba area has been a region of high agricultural productivity and has been known to be increasing its production.
- The region was covered by high quality Landsat imagery.

3. Location of project study area (see planche 2, Index Map)

The Landsat scene of Kongolo and Nyunzu (L-9) is located between 27° and 28°30' East longitude and between 5° and 6°30' South latitude. This scene covers 34,225 square km and includes the territories of Kongolo, Nyunzu and the eastern part of the territory of Kabalo.

4. Methodology

The classic multistage three phase visual interpretation technique was applied:

- A preliminary interpretation phase in the office.
- Ground truth and overflight phase.
- The final interpretation phase which includes the integration of data from the above phases.

The preliminary phase permitted the suggestion of certain hypotheses. The final phase allowed the confirmation or denial of these hypotheses after the comparison of field data with image interpretative data.

5. Preliminary Interpretation

a. Materials used:

Landsat Image	Type	Geographic Coordinates	Acquisition Date	Spectral Band	Scale
L-9	False color	Latitude	29-6-73	4,5,7	1:200,000
	Black & White	5° to 6° S	9-7-78	5,7	1:200,000
	False Colour	Longitude 27° to 28°30' E	29-6-73	4,5,7	1:1,000,000

The following was also used:

- Aerial photos (1957) from the Institute Geographique du Zaire (scale 1:40,000).
- The flight plans (lines) for Kongolo, Nyunzu and Lukuzwa.
- Joint Operations Graphic standard maps, produced by Dept of Defense of the U.S.A. in collaboration with the government of Zaire. These maps are at a scale of 1:250,000. Enlarged transparencies at a scale of 1:200,000 were used as a data base.
- Aerial photographs taken by the ERTS Zaire team in 1980 (Scale 1:5,000).
- A Pocket stereoscope and a mirror stereoscope.
- A calculator.
- A dot grid overlay sheet for estimating area.
- A light table.
- An additive colour viewer.

b. Interpretation

Various image characteristics such as tone were used in the interpretation which represented drainage, topography, rock structures, etc.

In developing an interpretation key, the following conclusions were made concerning vegetative response and tonal characteristics:

- dark red tone = dense forest
- light red tone = clear forest
- yellow and red mixed tones = thick forested savanna
- yellow tone = bush savanna
- black tone = water
- black and green tones = burned areas

The interpretation of image L-9 in channel 5 (date 9/5/78) and in false color yield the following information regarding the distribution of vegetation:

- The xerophyllic forested area on the left bank of the Lualaba in the area of Kongolo extends into the Nyumzu zone and beyond to Niemba and Kalemme.
- Bush savanna predominates in the Kalsalo zone.
- Forested savanna and bush savanna predominate on the right bank of the Lualaba in the Kongolo zone.

On Landsat image L-9 (see planche 5 showing trip itinerary) it was noted that the large dense forest northeast of Makutano, and encircled by villages (Bugana-Lumbu, Tulambo, Kiengo, Mundega, Kateha, Lungunda, Museke and Zongive) stretches northeastward toward Sulonga and thence southeastward toward Mushamba. It appears that in the area of Muselse and eastward there has been much deforestation. This appears to have taken place due to climatic conditions and not because of human interference. What remains of this forest are forested savannas, forest galleries and small dense patches of forest surrounded by savanna.

In the area of Nyunzu (between the Lukuga and the Luweyeye) two large classes of vegetation, savanna and forest can be recognized. In the areas of savanna we find a great deal of tonal homogeneity except where burning has taken place. In the forest there is less homogeneity which is due to deforestation. This is particularly noticeable along the railroad track from Kalimie to Kalsabo. Deforestation decreases with distance from Nyunzu.

c. Measuring deforestation

Visual and comparative methods to measure the deforestation.

The first method consists of estimating the area that is occupied by savanna tones yellow and green-black. These areas are calculated using a dot grid overlay sheet.

d. Use of the dot grid overlay

- Delineate the various "land use" types on a transparent overlay.
- Place the grid on the overlay.
- Count the number of dots in each category of forest.
- Convert the number of dots into the area they represent.
- Add all similar areas and determine total aerial count for each land use class'.

6. Ground Truth Analysis

Ground truth analysis was planned on the basis of:

- Landsat imagery (L-9 multiseason).
- Aerial photos (1957).
- Joint Operations Graphic maps at 1:200,000 scale
- Road maps from Institut Geographique du Zaire at 1:200,000 scale.

Field work was undertaken as shown on planches 11A through 11D, including the areas of Mbulula, Sola, Zola, Makutano, Nyunzu, Sentery Kabalo and Niemba.

a. Methodology

- By road and on foot: (see planche 5 for villages visited).
- Overflights (See overflight planche 5).

b. Materials

- Two Olympus 35mm cameras and darkroom.
- Cessna 206 Aircraft.
- Blazer (Chevrolet) four wheel drive vehicle.

In order to take scientifically valid overflight photography, the ERTS Zaire team, with the help of the North Shaba Program converted the Cessna 206 to take vertical aerial photographs. A hole of 80mm diameter was cut into the fuselage. Black-and-white and color photos were taken continuously in flight over specified areas of interest. In addition, various oblique photos were taken during these flights.

7. Final Interpretation (See planche 9)

By integrating Landsat, aerial photography and ground truth data, the ERTS Zaire team was able to establish the following facts concerning the Nyunzu area:

- North and west: bush savanna nearly unaffected by human activity.
- West: dense bush savanna not affected by human activity.
- South of this northern strip from east to west: a dense forest which has undergone deforestation from 10 to 90 percent.

The region in which deforestation has taken place (see planche 9) extends over an area of 12,829 square km. Deforestation has taken place over approximately 48 percent of this region.

Landsat and other data shows that the Kongolo area has not undergone deforestation at the level described above for Nyunzu. In fact, to the northeast of Kongolo it was found that between 1957 and 1978 approximately 6 percent of the forest was converted into agricultural land. This conclusion was made by comparing aerial photos from 1957 with Landsat imagery from 1978 and 1973.

In making a similar analysis in the Nyunzu area it was observed that between 1957 and 1978, 15 to 20 percent of the forest has been converted into agricultural land. During ground truth at Nyunzu it was also noticed that it is very rare to see an area 100 percent cleared of forest. It appears that about 25 percent of the large trees are left standing to create shade for the crops.

8. Problems during study

- Landsat imagery was taken during the dry season and the ground truth mission took place during the raining season.

- Insufficient multiseasonal/multiyear images were available.
- Ground truth time was limited.
- Funds were not available for the above and other tasks.
- 1980 Landsat imagery was not available.
- Photolab supplies in Kongolo had passed the expiration dates.
- No photolab in Kinshasa.

9. Conclusions

Classic "manual" photointerpretation methods permitted the evaluation of deforestation in the Nyunzu area. The integration of various available data helped the planning and execution of this project.

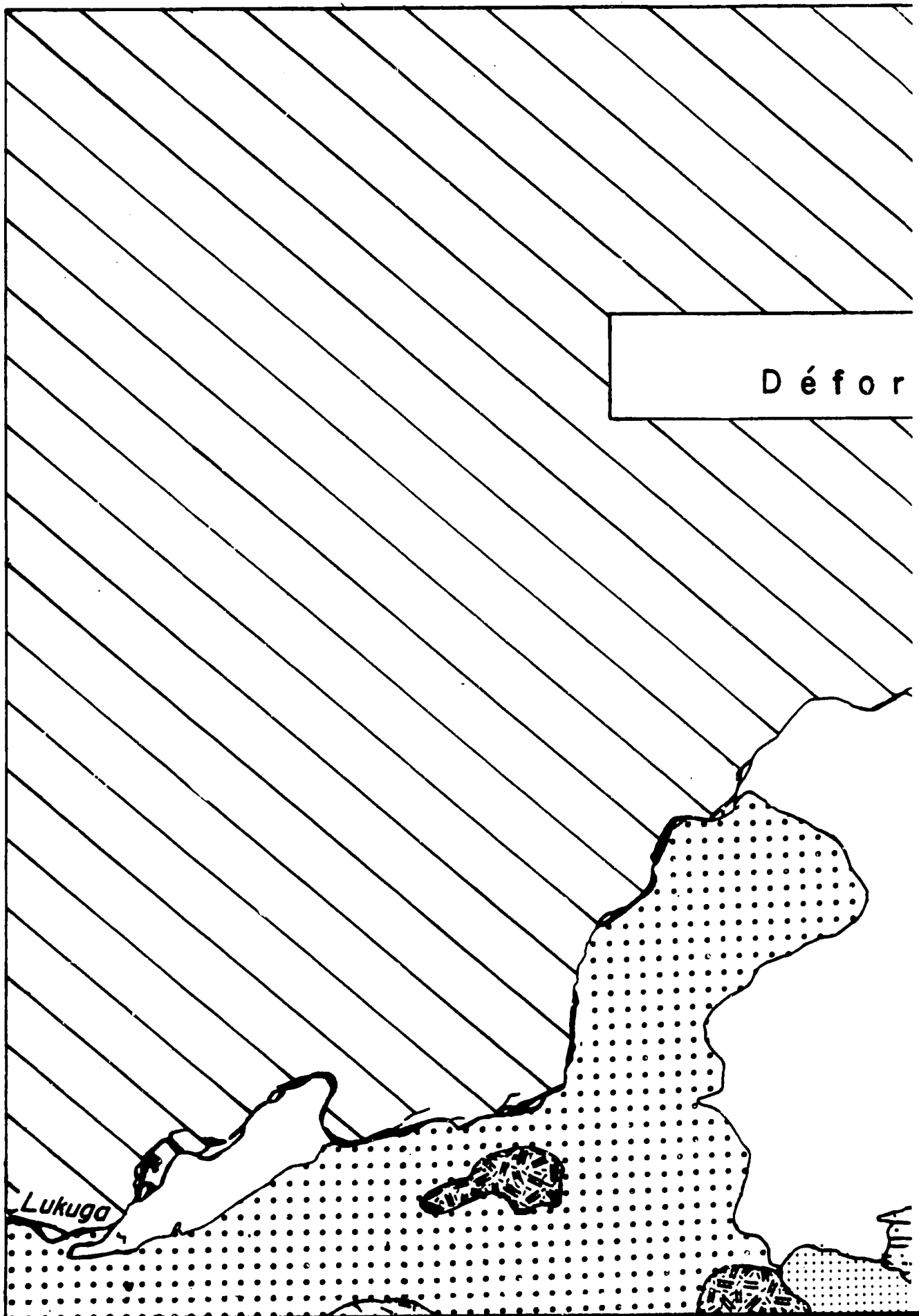
- . Major photogeographic units were recognized in spite of the fact that the imagery was obtained during the dry season and this work was done in the rainy season.
- . Recognition of the forested areas was relatively easy as significant change was not apparent from season to season.
- . The semi-deciduous guinecane savanna shows up as a grassy savanna on Landsat imagery during the dry season if there is less than 20 percent tree cover.
- . Burned areas during the dry season appear pink on the imagery and are covered by elephant grass in the wet season.

Landsat imagery permitted us the evaluation of the extent of deforestation in the North Shaba Project area. Little deforestation has taken place in the Kongolo area, while around Nyunzu between the Lukuya River and the railroad line 40 percent deforestation has taken place. This area, which owes its fertility to the potassium rich arkosic sediments which underlie it, should be carefully monitored in order to avert the consequences of heavy deforestation. The most effective monitoring method would be by use of Landsat imagery on an annual basis and a minimum of every two years. In addition, certain precautions can be taken now regarding the agricultural development of this area. Based on a soils map developed previously during our work in North Shaba (see planche 7), savanna regions where soil potential would permit good agricultural development has been suggested.

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27°32'30''
5°30'



D é f o r

Lukuga

Deforestation de Nyunzu, à partir de l'Image Landsat L9 1/200.000 Bande

D é f o r e s t a t i o n n é g l i g e a b l e

Lukuga

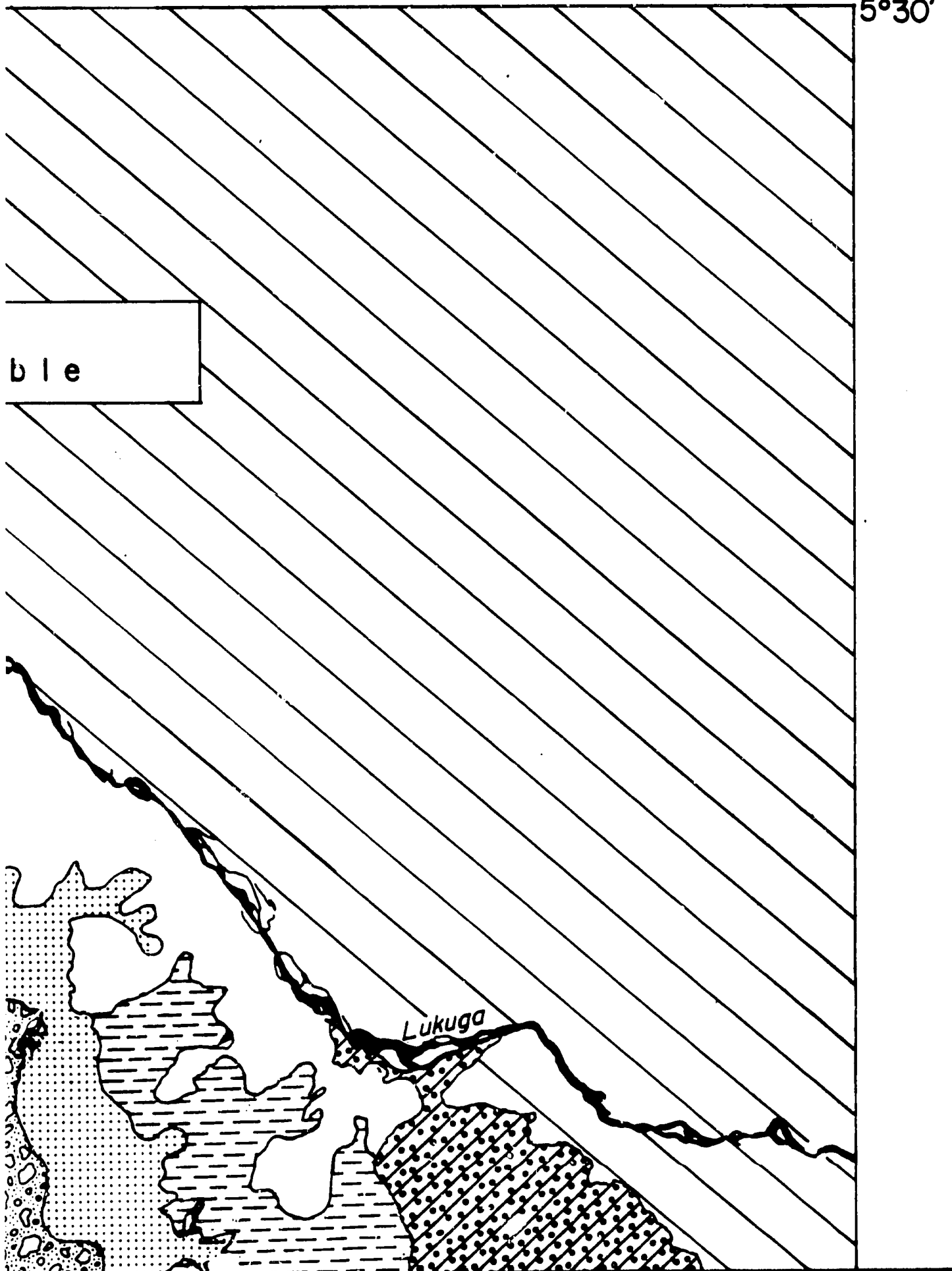


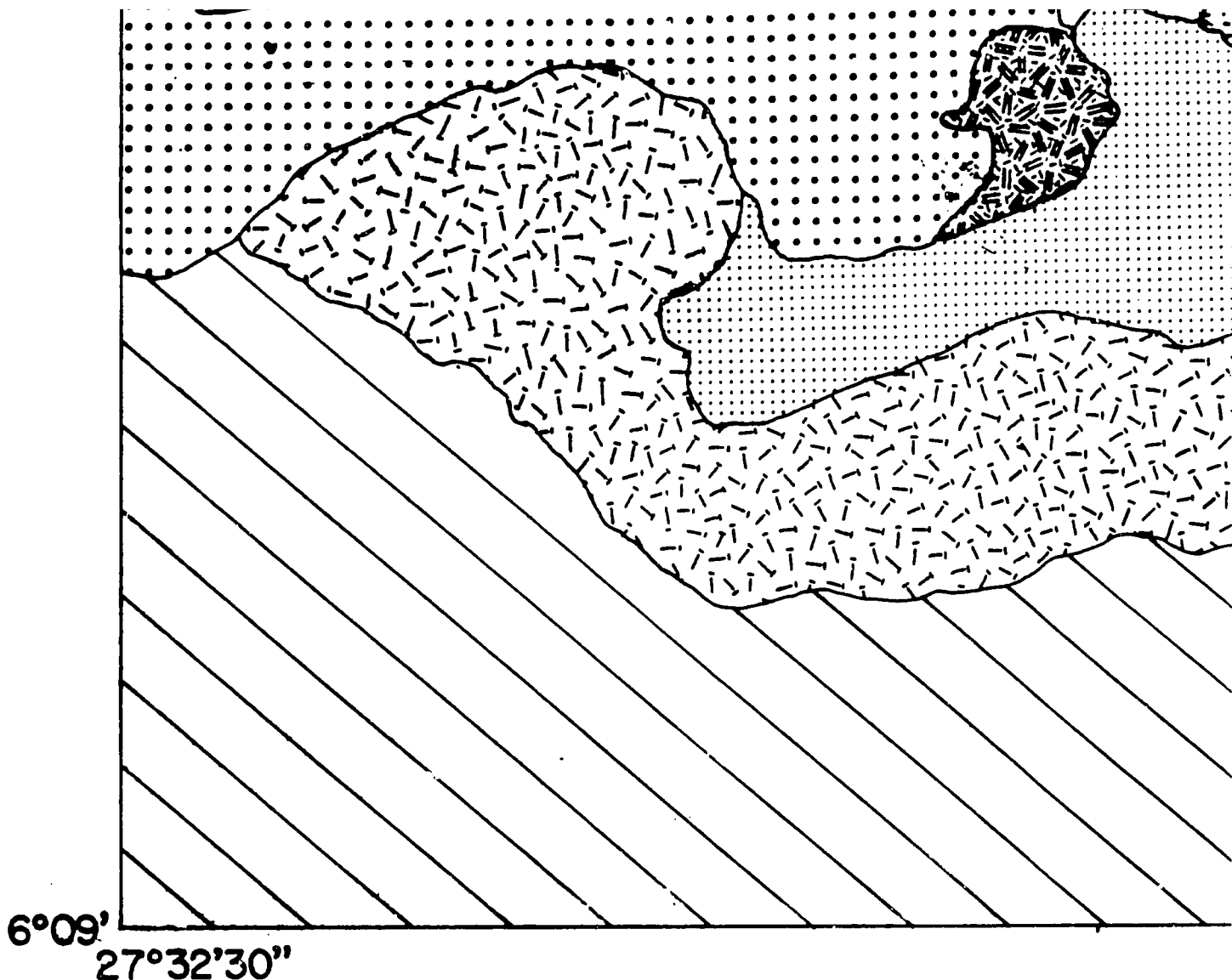
10 Bandes 4,5,7 du 29 Juin 1973

28°21'
5°30'

b l e

Lukuga







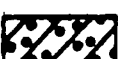
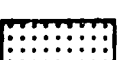
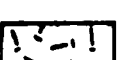

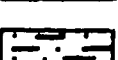


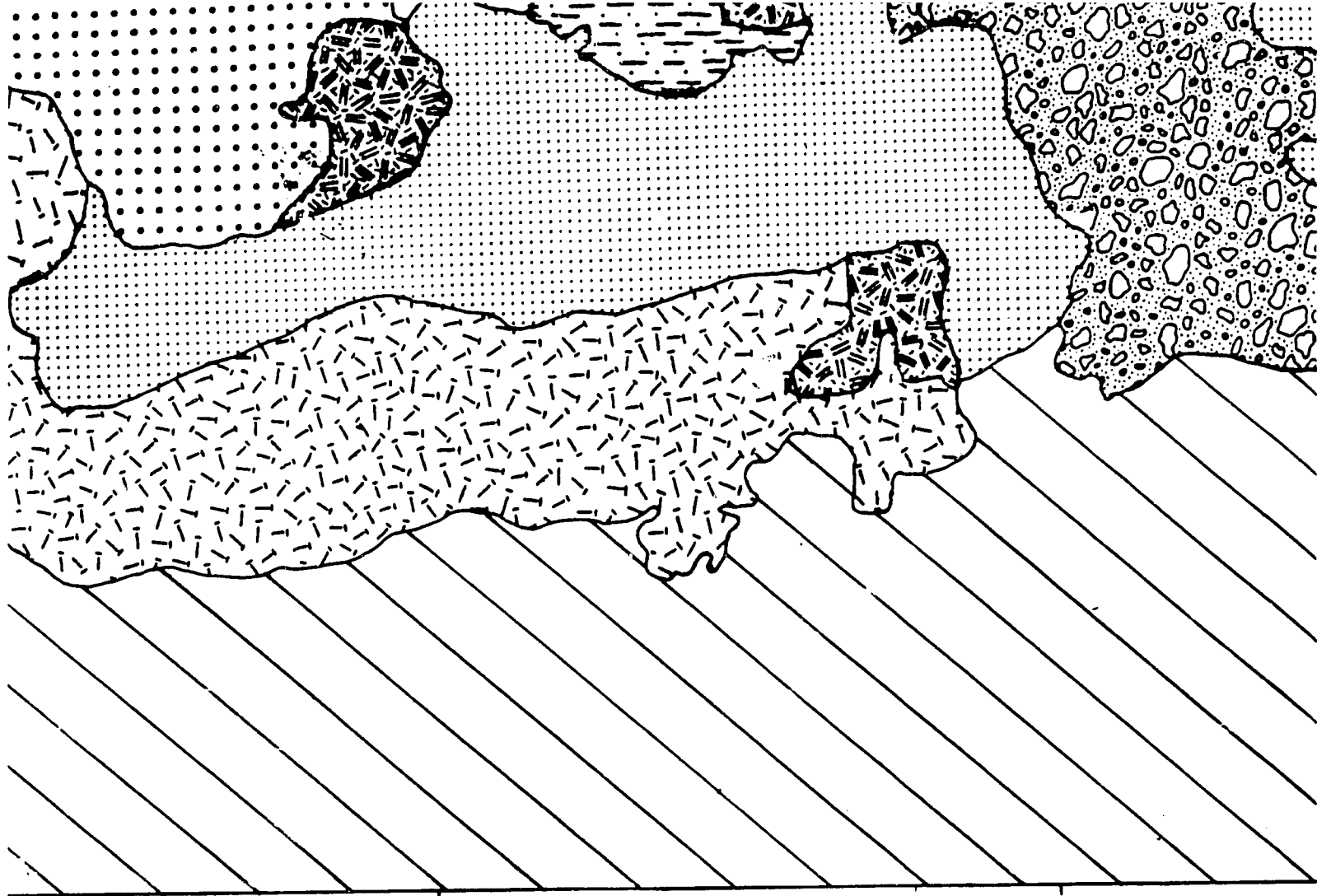
6°09'

27°32'30''

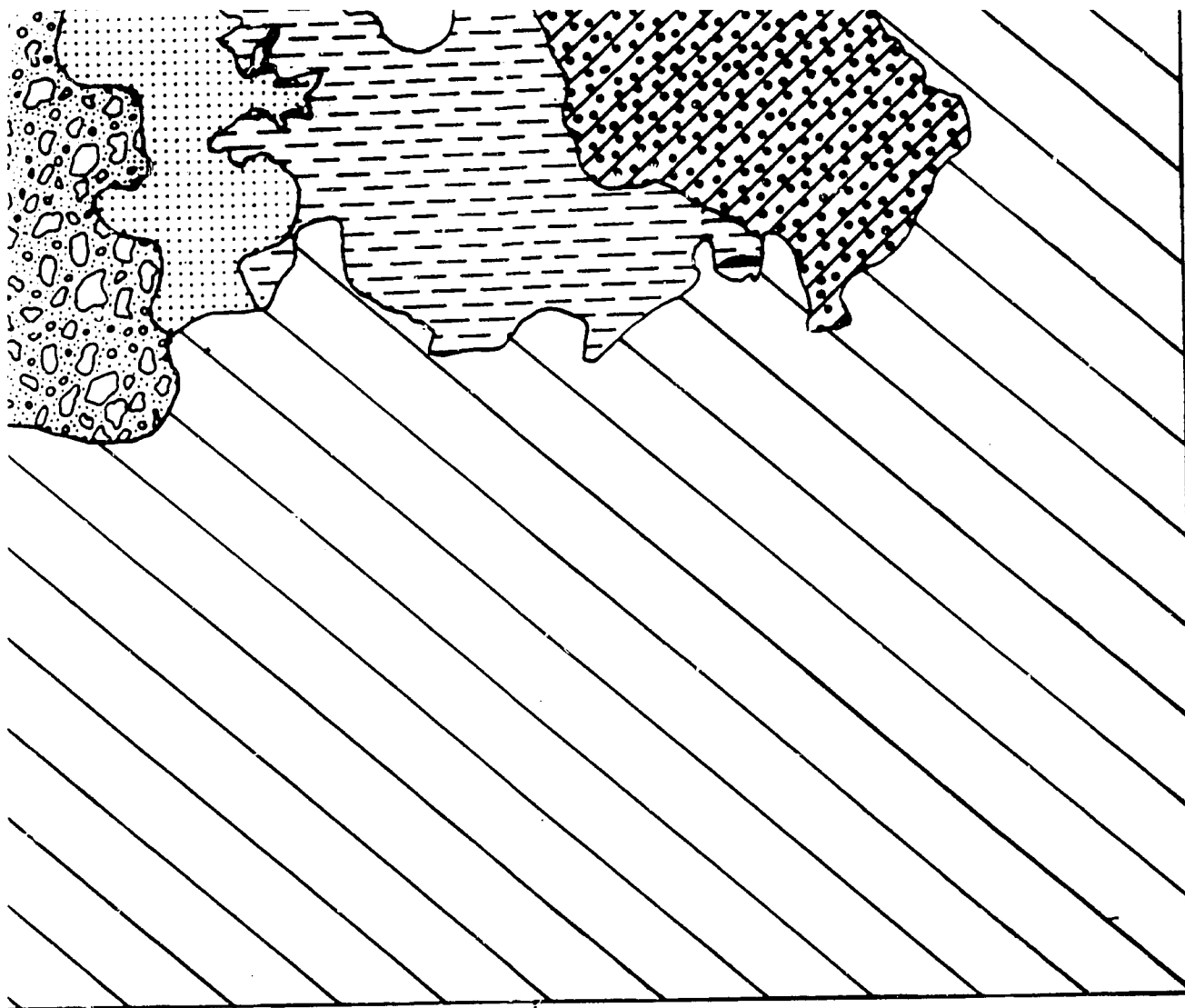
LEGENDE

SU

-  Savane arbustive
-  Savane arbustive remaniée
-  Savane arbustive dense
-  Savane arbustive dense remaniée
-  Forêt claire remaniée (30 - 50)
-  Forêt claire remaniée (50 - 80)
-  Forêt claire remaniée & Lambeaux de forêts denses
-  Forêt dense remaniée (10 - 30)
-  Forêt dense remaniée (<10)



	<u>SUPERFICIES EN Km²</u>	<u>TAUX DE</u>
	265	
	921	
	4.740	
maniée	5.300	8
- 50)	191	3
- 80)	573	5
Lambeaux de forêts denses	586	3
- 30)	190,2	1
<10)	63,3	
	<hr/>	
TOTAL :	12.829,5	



6°09'
28°21'

IX DE DEFORESTATION

SURFACES DEFORESTÉES

> 90%	> 829
80-90%	4.240-4770
30-50%	57-85
50-80%	286-458,4
30-50%	175-293
10-30%	19-53
<10%	< 6,33

TOTAL : 6.083,53

PART III
DESCRIPTION AND MAPPING OF THE
PHYTOGEOGRAPHIC
UNITS OF NORTH SHABA BY LANDSAT MSS IMAGERY

Conducted at ERTS ZAIRE
with the support of
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by

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LUMBU Lwa Muyumba - Draftsman

March 1981

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1. Goal

Certain authors such as Georges Laclavere (1978), Germain R., Croegaert J. et al (1955) have made general descriptions of the Zairian vegetation as it relates to climate and soils. The object of this study was to produce a more detailed document of an area in North Shaba where LANDSAT data was available.

2. The choice of area

Imagery was available for the area chosen which was close to areas of interest to the Department of Agriculture and the GOZ/USAID North Shaba Project area.

3. The Area

The area is in North Shaba. The northern limit is the Kivu border and the Lomami River makes up its western border. Lake Tanganika is the eastern border and the Shaba boundary the southern border. The area is covered by the following LANDSAT scenes (see planches 1,2,3 and 4):

Lubunda - K-9

Kongolo - L-9

Mwanza - K-10

Manono - L-10

These images cover an area of approximately 125,000 square km.

The coordinates for the four corners of this area are:

29°-00 E and 5°-00 S; 28°-00 E and 8°-00 S

26°-00 E and 5°-00 S; 25°-00 E and 8°-00 S

Overflights were conducted by bush plane over all four LANDSAT scene areas during which photos were taken. Field work was conducted on only two image areas: Kongolo-Nyunzu L-9, and Manono K-10.

4. Methodology

A purely visual multistage interpretative method was used which has been previously described in Part II of this document. (Evaluation of the deforestation of the Nyunzu area by means of LANDSAT MSS imagery.)

5. Preliminary Interpretation

a. Materials used

<u>LANDSAT Image</u>	<u>Spectral Band</u>	<u>Date of Image</u>	<u>Types of Image</u>	<u>Scale</u>	<u>Centers of Image</u>
K-9	4,5,7	4.6.78	False Color	1:1,000,000	5°46'S & 26°25'E
L-9	4,5,7	29.6.73	False Color	1:1,000,000	5°41'S & 27°45'E
K-10	4,5,7	24.6.78	False Color	1:1,000,000	7°12'S & 26°05'E
L-10	4,5,7	9.7.78	False Color	1:1,000,000	7°12'S & 26°05'E

The following were also used:

- Aerial photos from the Geographic Institute of Zaire at a scale of 1:40,000.
- Flight plans for the above aerial photos.
- Joint Operations Graphic standard maps (JOG) at a scale of 1:250,000 produced by the Zairan Defense Dept. and the U.S. Defense Mapping agency.
- Enlargements of the above maps to a scale of 1:200,000.
- Aerial photos taken by the ERTS Zaire flight crew in January, February and March of 1980 at a scale of 1:5,000.
- One pocket stereoscope.
- One calculator.

b. Overflight observations

- The area around Nyunzu is composed of savannah and deforested clear forest in which small patches of agriculture, burn areas and patches of savanna exist.
- Deforestation is taking place along the railroad tracks east and west of Nyunzu and north and south of that town (see Part II of this document).

Lubunda Scene K-9(planche 10A)

On this scene the following distribution of vegetation was recognized:

- On the left bank:a succession of dense free covered savanna was noted,dense reworked forests, clear forests interspersed with bush savanna and cut by forest galleries and flood plains.
- On the right bank:dense forest and reworked dense forest,clear forest,forest savanna,dense bush covered savanna and bush covered savanna

Each of these types is interspersed by forest galleries and flood plains.

Manono Scene L-10 (planche 10C)

Along the Luvua and to the northwest along the Lualaba a bush savanna is noted. To the north of the Luvua from east to west the following are recognized: a dense forest, a clear forest, a clear forest on mountain slopes, small areas of clear forest on mountain slopes, bush savannah,heavy bush savannah as well as vegetation typical of flood plains such as along the following rivers; Balai, Niemba, Lukulu.

South of the Luvua on the right bank of the Lualaba from east to west the following are identified : bush savanna,dense bush savanna, clear forest on mountain slopes,dense forest and clear forest.

On the left bank of the Lualaba: forest galleries bush savanna and dense bush savanna are found.

To the southeast along the Lualaba extensive broad flood plains are noted.

Mwanza Scene K-10 (planche 10 D)

On this scene located entirely on the left bank of the Lualaba River, two major vegetative types, bush savanna and dense bush savanna, are recognized. From west to east a mosaic of dense reworked forest with wooded savanna, mountain gleus are recognized. All these units are traversed by forest galleries and flood plains.

6. Ground Truth Studies

This portion of the work was planned and accomplished with.

- LANDSAT imagery
- Aerial photographs from the Institute Geographique du Zaire
- Joint Operations Graphic charts
- Zaire National road maps

a. Methodology

Field work was conducted in the Kongolo and the Manono scene areas. Overflights were conducted for all four Landsat scene areas.

b. Materials & Equipment

- Cessna 206 - aircraft with camera mounted in the bottom of the plane
- Chevrolet Blazer four wheel drive vehicle
- Two Olympus, OM-2 35mm cameras

7. Final Interpretation

a. Materials

- LANDSAT imagery
- Aerial photos from 1957
- Aerial photos taken by ERTS
- Ground truth data

Interpretation and Conclusion

By integrating LANDSAT, aerial and ground truth data, the maps 10 A through 10 D were produced.

Units recognized on LANDSAT were identified on aerial photos from 1957, on 1980 aerial photos taken by ERTS Zaire and in ground truth data.

Observations of these data led the ERTS Zaire team to conclude that certain photogeographic units such as dense and clear forests have decreased in size and have become wooded savannah or bush savanna especially in areas inhabited by man.

Within the limits of the North Shaba Project area cultivated area has increased from 1957 to 1980: in Kongolo by 51.20 percent at Kitengitenge by 120 percent, at Luizi by 100 percent at Niemba by 65 percent. In other portions of the North Shaba project area cultivated areas have remained unchanged or decreased.

Encroachment by man has been primarily at the expense of plateau forests and thinly forested slopes. Dense bush savanna, which on the imagery appear to have the same tones as dense forests were recognized on the ground and in overflights. The necessary changes were made to the final interpretation after the initial incorrect interpretation.

Certain forested savannas which were identified as grassy savannas on the imagery were easily distinguished on the aerial photos which also permitted corrections to be made to our original maps.

8. Problems

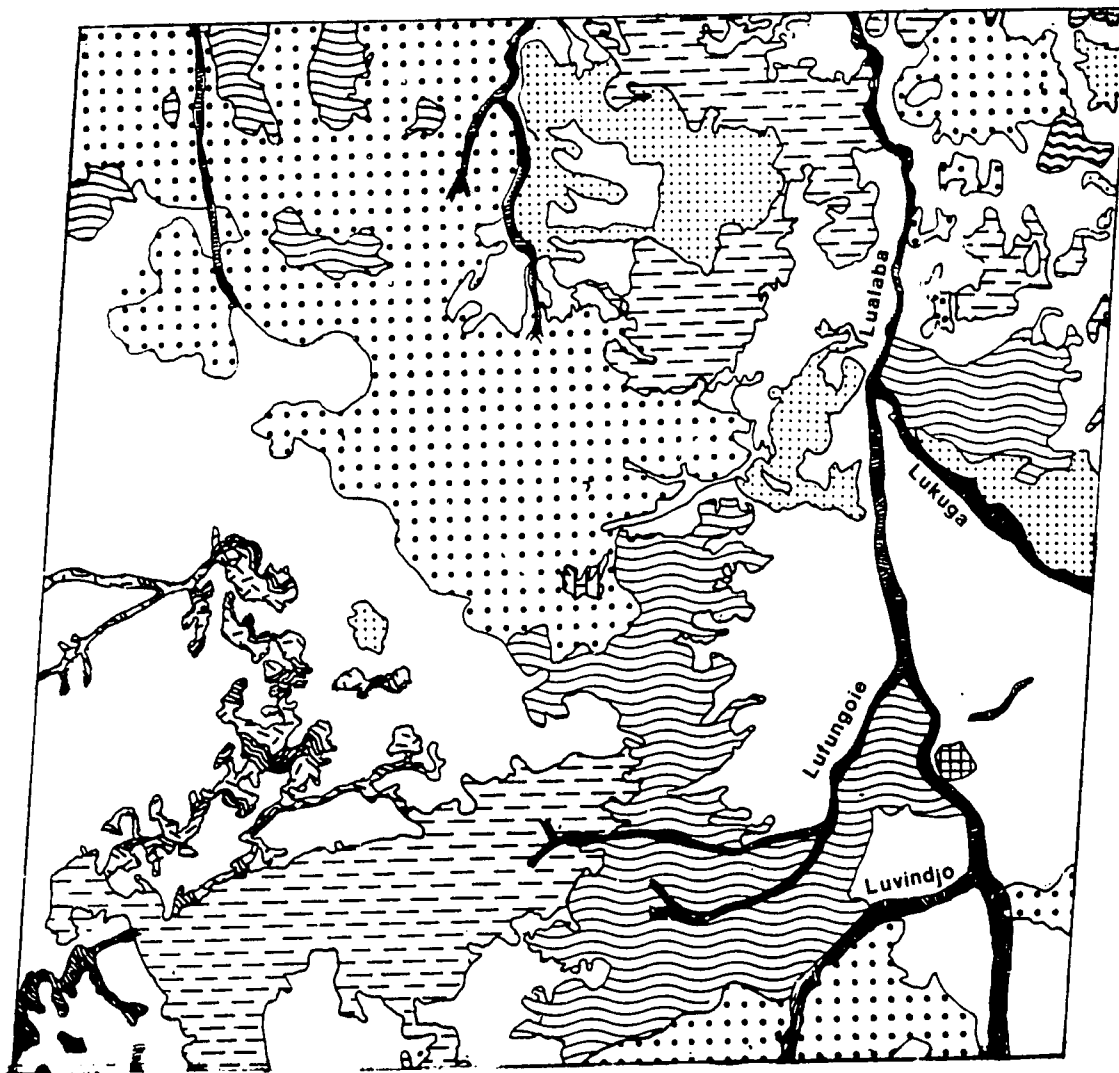
During interpretation of the imagery each scene was worked on separately. When superposing all the imagery an obvious lack of continuity was found except for the largest forests and water bodies. There was little or no correlation between images. This difference in interpretation was due to differences in the basic data on the LANDSAT imagery, such as date of acquisition, or photo processing.

As an example we may note that one scene (Kongolo) may have predominantly light tones, and that in the next scene (Manono) taken the same day, dark tones predominate. Because of these differences an object on the Kongolo scene will have a clearer tone than the same object on the overlapping portion of the Manono scene. To compensate for these problems an integrated, qualitative interpretation was produced by combining multitoneal, multiseasonal data as well as data from aerial photos and ground truth.

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Carte de la végétation Scène de LUBUNDA K9, à partir de l'Image Landsat 1/1.000.000
Bandes 4.5.7 du 04-05-78



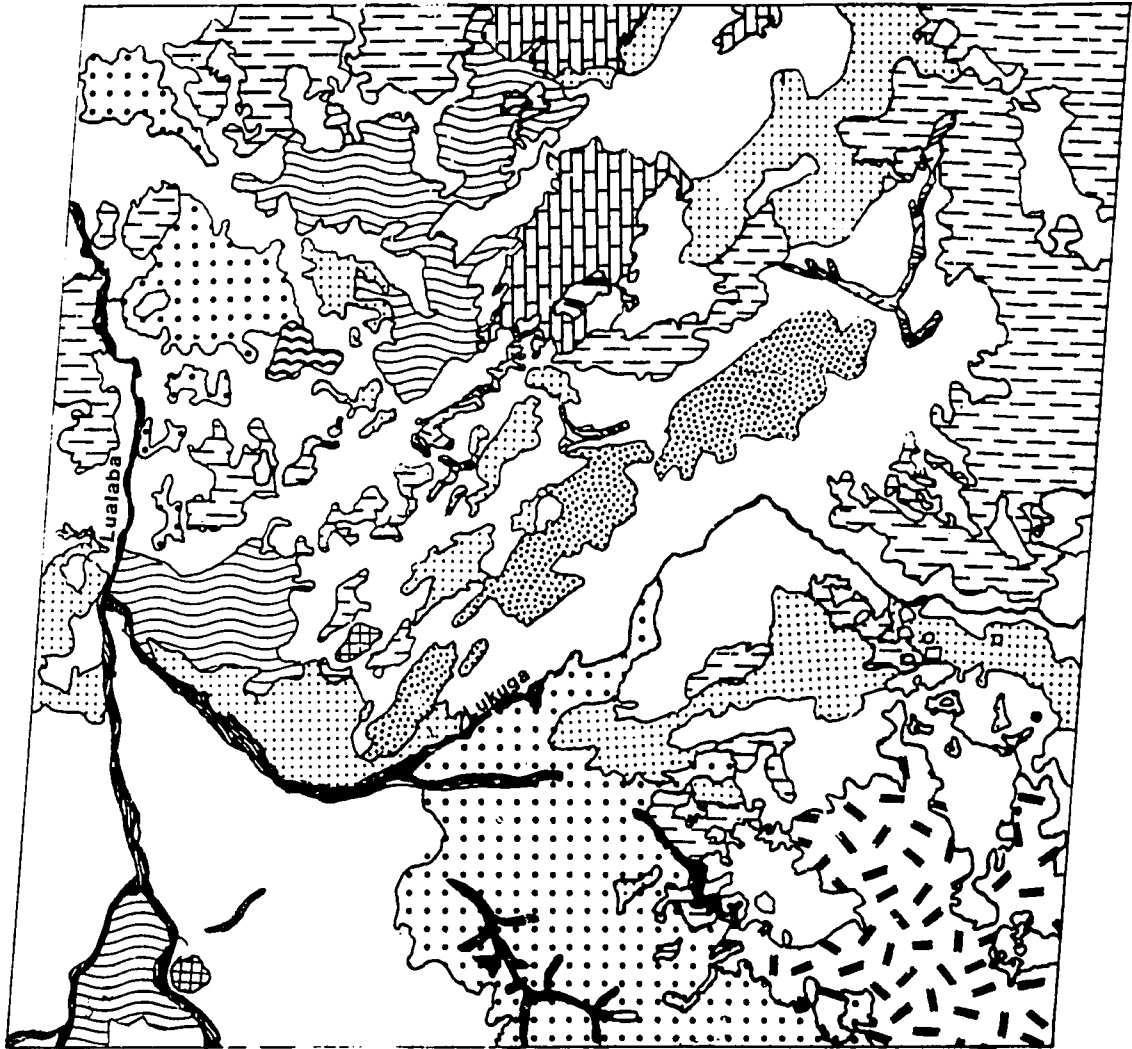
LEGENDE

- Savane arbustive
- Savane arbustive dense
- Savane boisée
- Savane boisée sur montagne
- Forêt claire
- Forêt dense remaniée
- Forêt dense
- Forêt claire sur montagne
- Galerie forestière
- Végétation des plaines d'inondatio
- Marais Herbeux

SUPERFICIES EN Km²

7047
10598
4590
43.75
2616
663
2397
415
1524
1809
2199

Carte de la végétation Scène de Kongolo L9, à partir de l'image Landsat
1/1.000.000 bandes 4.5.6 du 29-Juin-1973

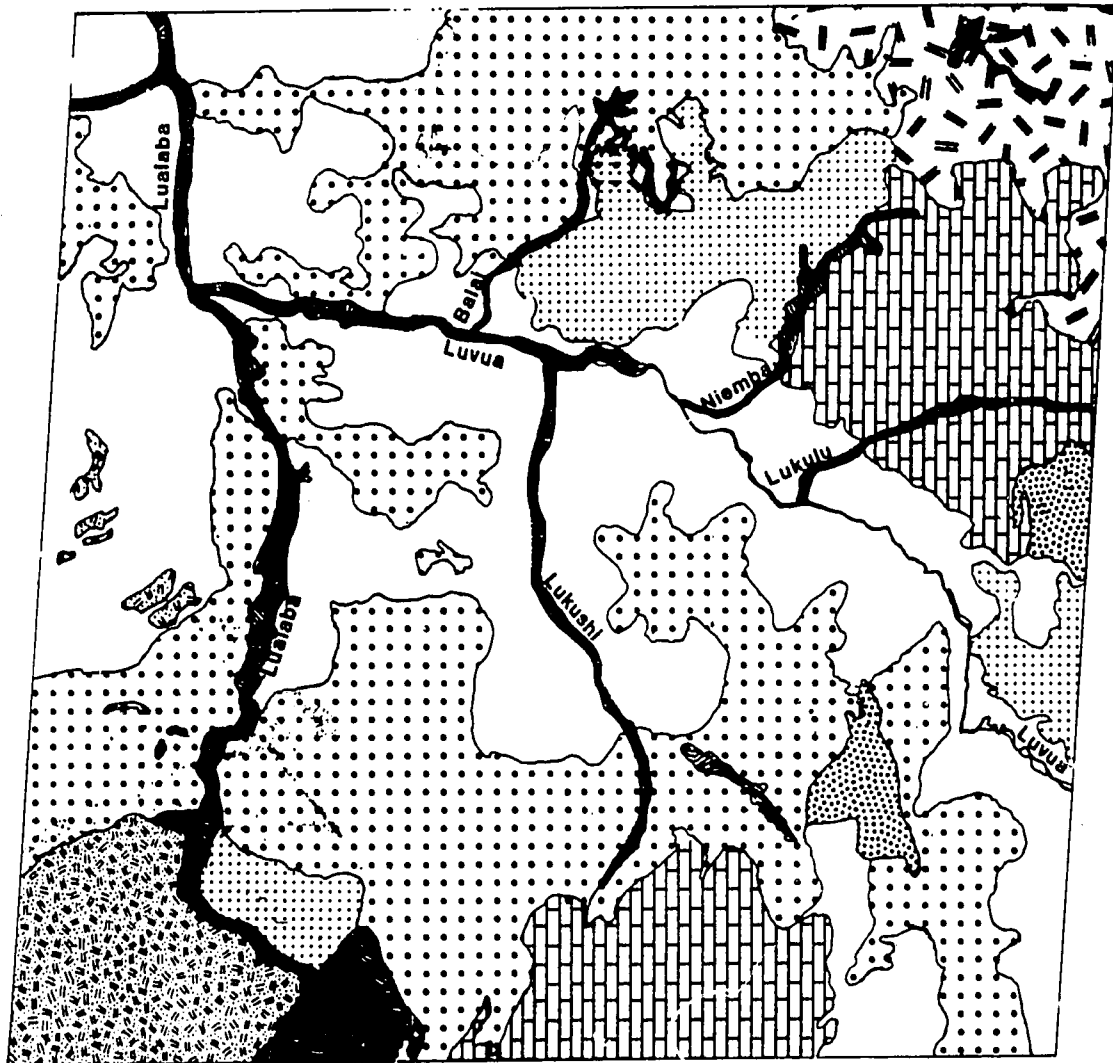


LEGENDE









SUPERFICIES EN Km²

	Savane arbustive	12.038
	Savane arbustive dense	834
	Savane arbustive sur montagnes	69
	Marais herbeux	3.254
	Galeries forestières	375
	Javane boisée	1.933
	Végétation des plaines d'inondation	1.3 5
	Lambeaux forestiers dans la savane	1.752
	Forêts denses remaniées	5.562
	Forêt gense	1.112
	Forêt claire	2.642
	Forêt claire sur montagnes	1.026

Carte de la végétation Scène de MANONO LIO à partir de l'image Landsat 1/1.000.000 bandes 4.5.7 du 09-Juillet-78



LEGENDE

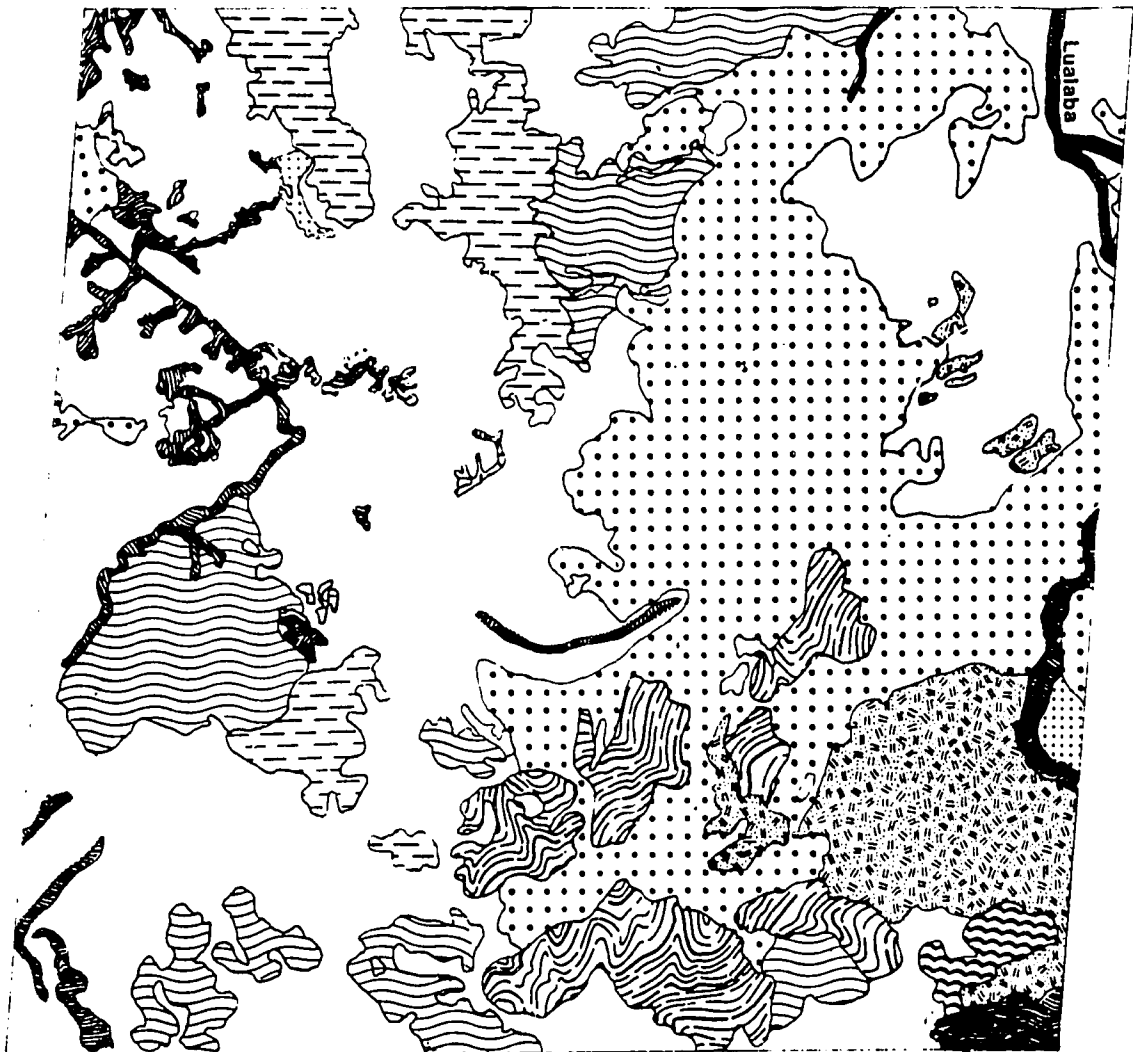
-  Savane arbustive
-  Savane arbustive dense
-  Forêt claire
-  Forêt claire sur montagne
-  Forêt dense
-  Lambeaux estiers sur montagnes
-  Veg a on des plaines d'inond on
-  Lam e- x ore tiers d n- a s vana

SUPERFICIES EN Km²










10.500
7.350
5.987
525
3.050
2.525
2.962

PLANCHE N° IOC

Carte de la végétation Scène de Mwanza KIO, à partir de l'Image Landsat
1/1.000.000 Bandes 4.5.7 du 04-06-78



LEGENDE

-  Savane arbustive
-  Savane arbustive dense
-  Savane boisée
-  Savane boisée sur montagnes
-  Végétation des plaines d'inondation
-  Lambeaux forestiers sur les montagnes
-  Formation herbacée sur montagnes
-  Forêts denses remaniées
-  Galeries forestiers

SUPERFICIES EN Km²

17.603,50
7.187,50
2.750
1.806,25
121,50
2.493,75
206,25
1.762,50
293,75

PART IV
EVALUATION OF THE AGRICULTURAL ZONE
OF MANONO BASED ON MULTITEMPORAL REMOTE SENSING
MENSURATION FROM 1957, 1973 and 1980

Conducted at ERTS ZAIRE
with the assistance of
United States Agency for International Development
(Contract No. AID/afr-C-1483 with Spectral Data Corp.)

Andrew STANCIOFF - Consultant, Spectral Data Corp.

BAKIJIKA Betu - Agronomist, Dept. of Agriculture

LUMBU Lwa Muyumba - Draftsman

January 1981

1. Aim.

The aim of this effort was to establish the number of hectares under cultivation in the Manono region in 3 separate years using LANDSAT imagery, 35 mm aerial photography from 1978, 1979 and 1980 and conventional 9x9 inch black-and-white aerial photography from 1957.

2. Summary.

Although controls were not as good as one would have wished, this study showed that agricultural areas increased by 14,732 hectares. In 1957 there were 4,559 hectares under cultivation and in 1978 there were 19,291 hectares under cultivation. Agricultural area decreased by 3,516 hectares from the 19,291 hectares in 1978 to 15,775 hectares in 1980.

The reasons for these changes are difficult to ascertain but may be attributed to the following reasons:

The increase from 1957 to 1978 can probably be attributed to: 1) the decontrol of population migration after the departure of the Belgians (independence); 2) the fact that peoples tended to move to the cities during this period; 3) Zairian ownership of the Manono mine meant the hiring of a larger number of Zairian personnel.

The decrease of agricultural area from 1978 to 1980 is probably due to the fact that the Manono mines have deteriorated rapidly in this same period (from about 2,000 tons tin a year to 600 tons tin a year) and no salary increases have been given in 4 to 5 years. (The average wage was 31.5 zaires per month -source-B.R.G.M at Bureau of Mines in Kinshasa) such wages could not provide sufficient money to buy food in quantities and therefore the total agricultural production capacity dropped as a result of a decrease in demand.

3. Choice of Area.

The Manono area was chosen for the following reasons:

- a. The ERTS Zaire field team was working in the area.
- b. Good imagery was available.
- c. Aerial photography was available.
- d. This area is of interest because of migrating populations. Migrating populations are related to current socio-political phenomena such as; political independence, collapse of export agricultural base, decline of the industrial base of the mines at Manono, decrease in white population, etc.

4. Method.

The method used was simple as has been explained previously herein (Parts I,II,and III). The LANDSAT/aerial photo/ground truth multilevel sampling system was used as the best means of making comparative analysis. The arrival of 1979 RBV and LANDSAT MSS imagery permitted the authors to arrive at the 1980 cultivation figures by combining the MSS information with aerial overflights photos (see planche 12D).

5. Results.

The results are contained on maps 14 A,B,C and D.

1957-The area of Manono sustained relatively little agricultural activity in 1957 (Map 14 A). A total of 4,559 hectares were under cultivation in 1957 of which a significant amount (estimated at 1/8) was under cultivation under the control of whites near the Ketotolo mine. Most of the area under cultivation was found in and near Manono. A small amount of agriculture, less than 10 percent, took place beyond 7 km from Manono. Most of this was in the area south of Manono at Munene, to the North at Katutu and Westward near Punjive.

1978 -By 1978 (planche 14B) agricultural activity in the area had increased more than four fold. Most of this activity was concentrated in a 20 km zone around the towns of Manono and Kitotolo. Significant increases in cultivated land were noted along the Lukushi both north and south of Manono. Very little activity is noted in other outlying sectors; a few patches are noted between the Luvua and the village of Katutu.

1980 -By 1980 (planche 14C) agricultural activity had decreased considerably in the outermost areas surrounding Manono and Kitotolo whereas many more small agricultural areas were being cultivated along the Luvua, and in the south east quadrant of the map area. South of Manono the Likushi valley is supporting more agriculture whereas along this river to the north there has been a very great decrease. Decreases are also especially noticeable near Punjive where 1979-1980 Satellite imagery and current photos show much rock and/or flooded ground. Flooding or ground wetness may also be the reason for some decreases along the Lukushi north of Manono.

The 20 percent decline of total area since 1978 cannot all be attributed to climatic conditions and wet ground. This decrease and the large number of new small areas under cultivation along the Luvua and Lukushi south of Manono suggest a new agricultural pattern in this region.

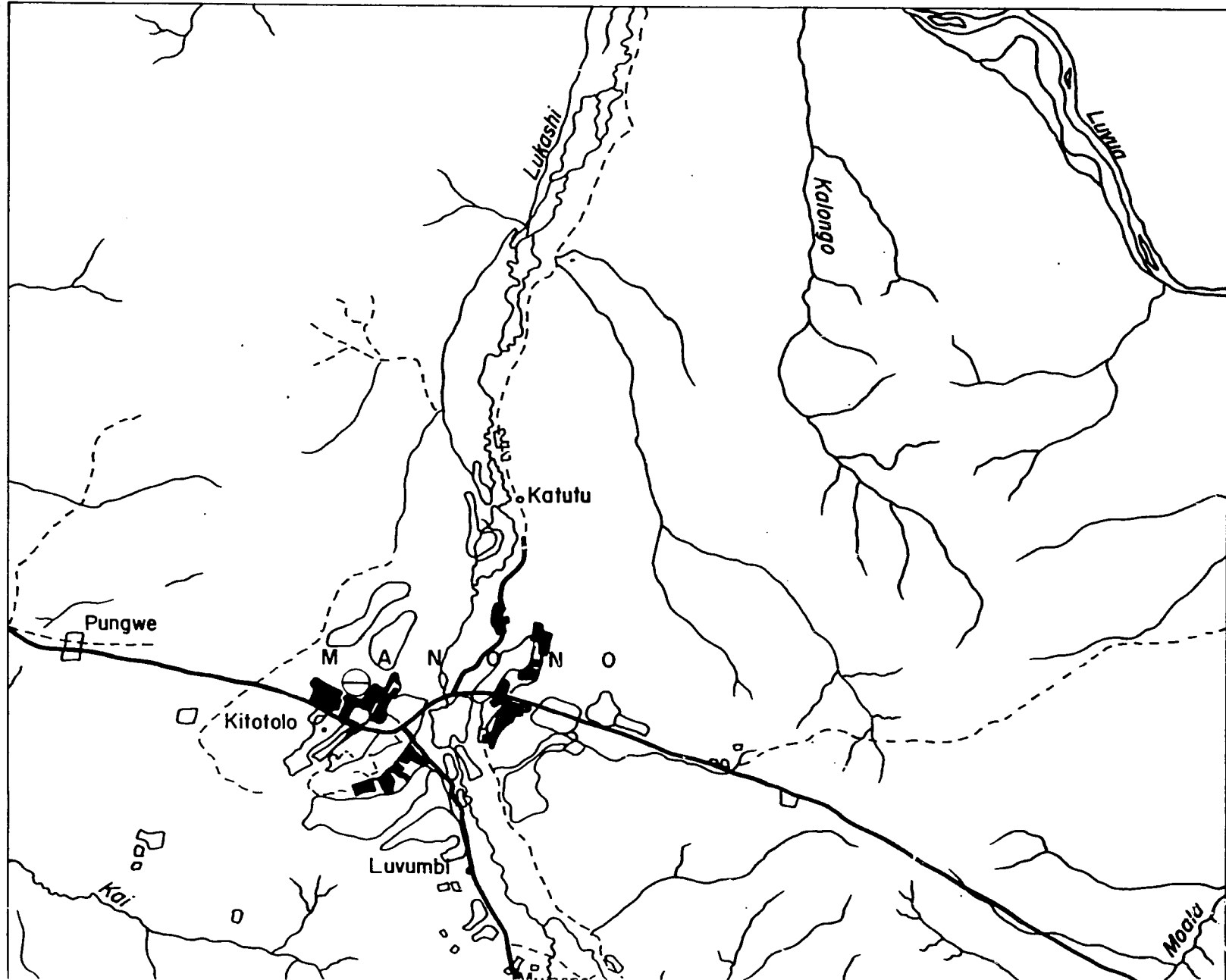
6. Conclusion.

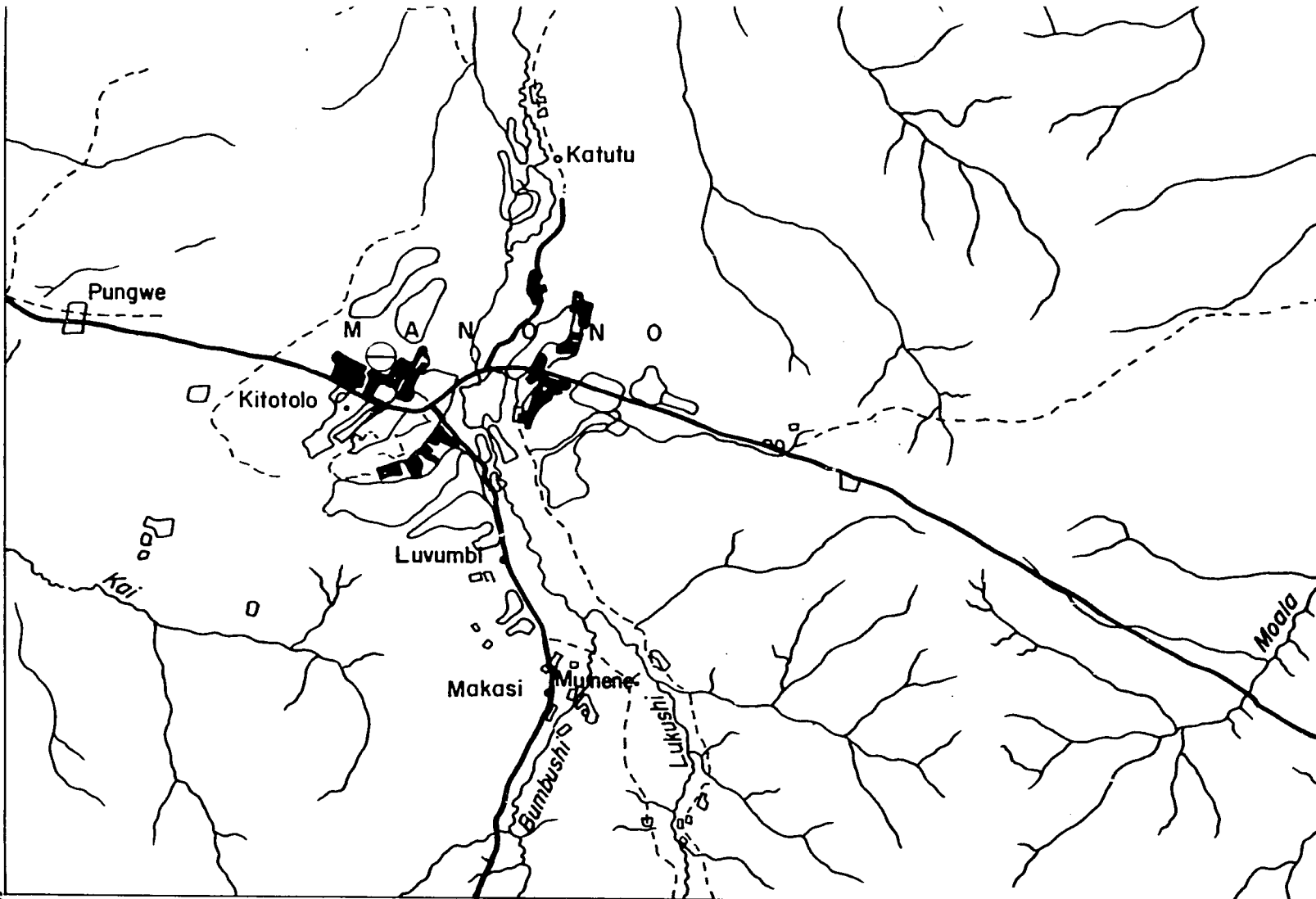
It appears that this decrease in cultivated land near Manono and migration away from the town is due to the deterioration of the Manono mines and the lack of financial and social stability for agricultural workers in this area.

VILLE DE MANONO

27°15'E
7°00'S

27°45'E
7°00'S





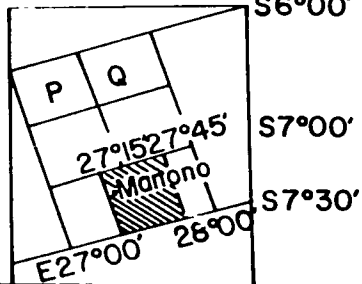
7°30'S

27°15'E

7°30'S

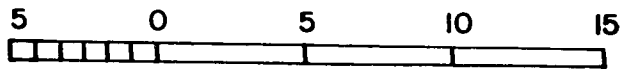
27°45'E

INDEX



CARTE D'UTILISATION AGRICOLE DES TERRES
1957

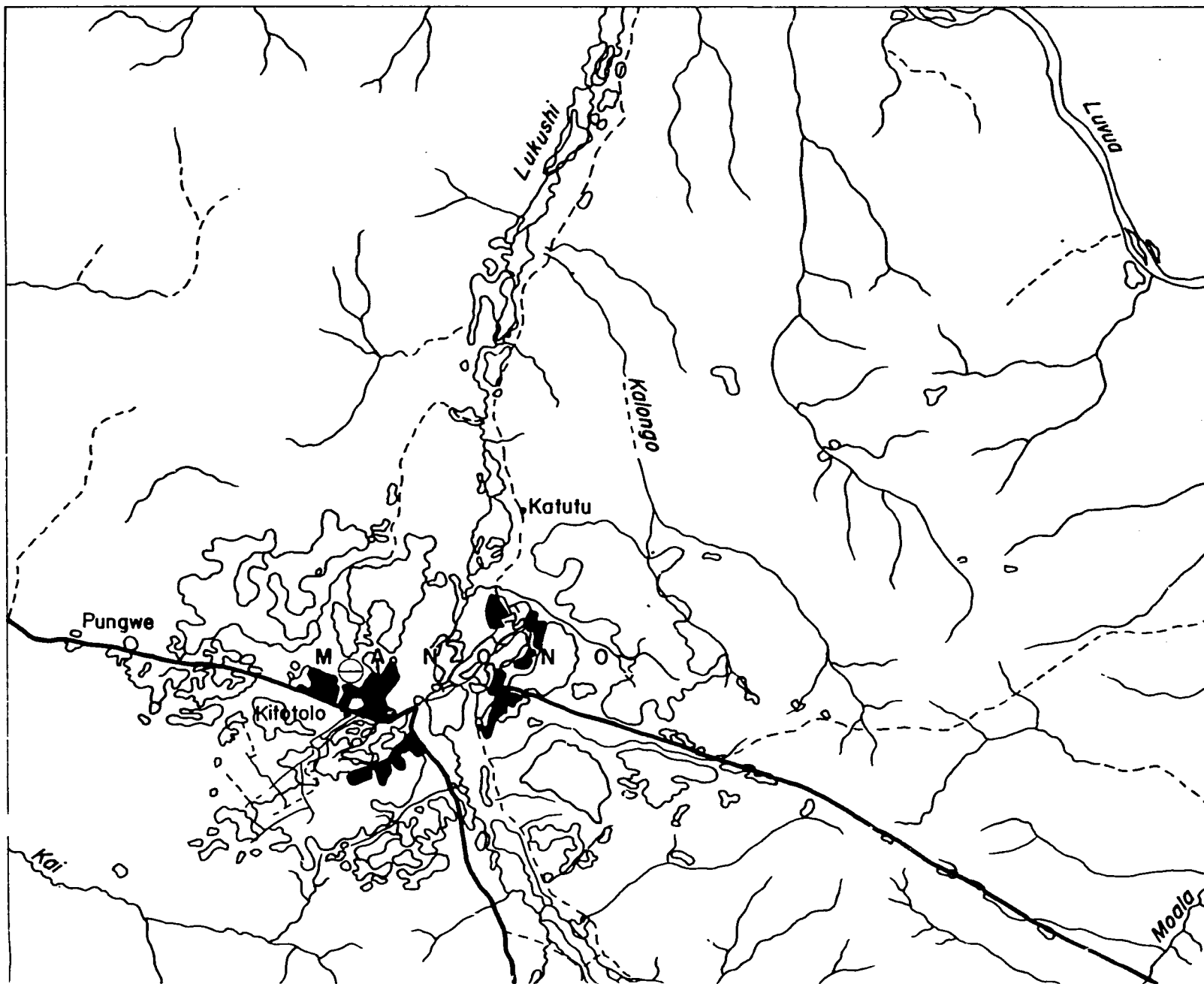
Echelle : 1/200.000

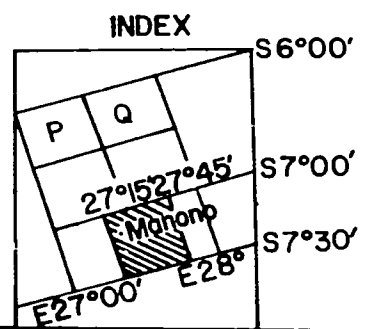
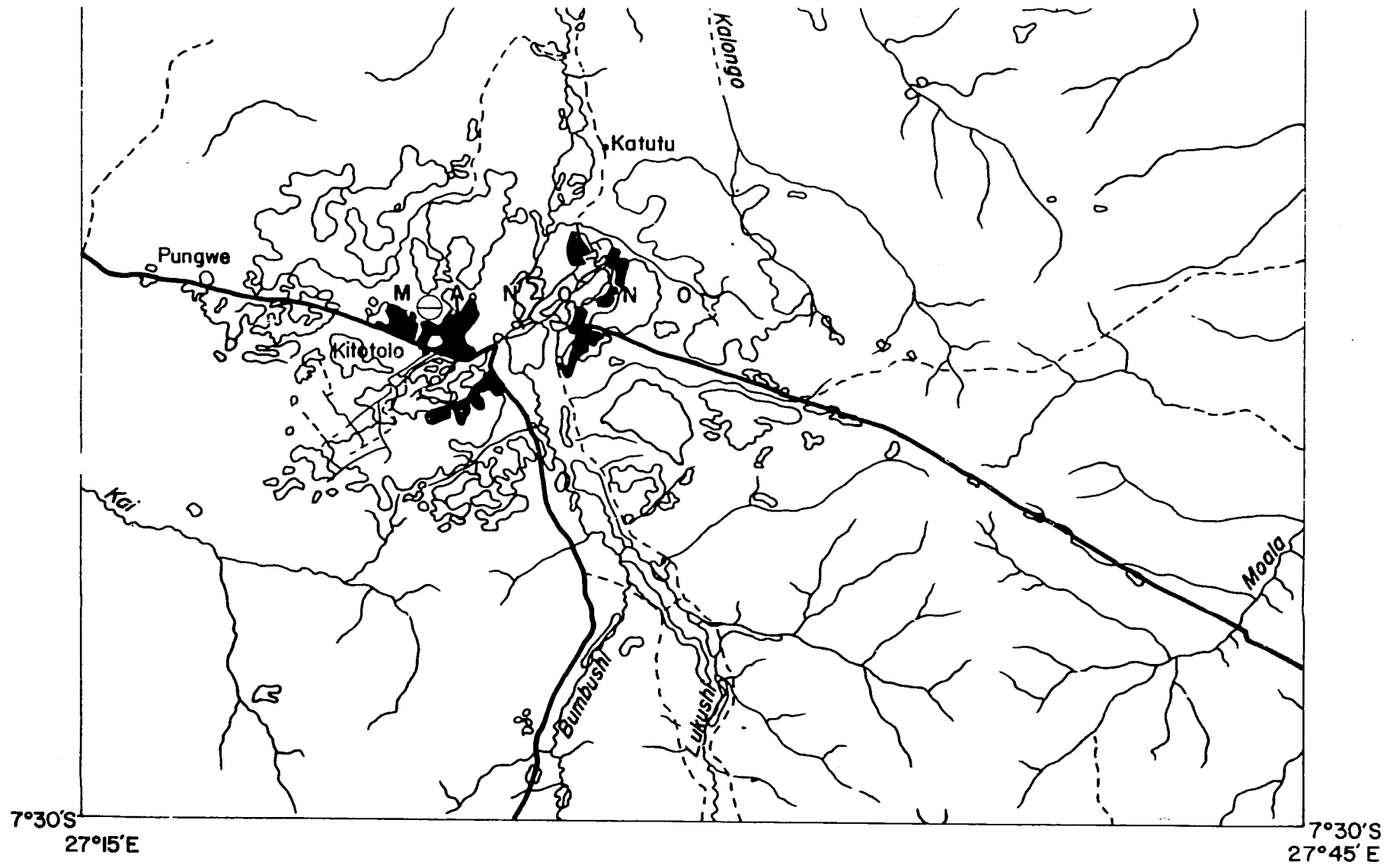


VILLE DE MANONO

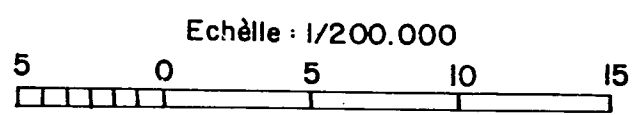
27°15'E
7°00'S

27°45'E
7°00'S





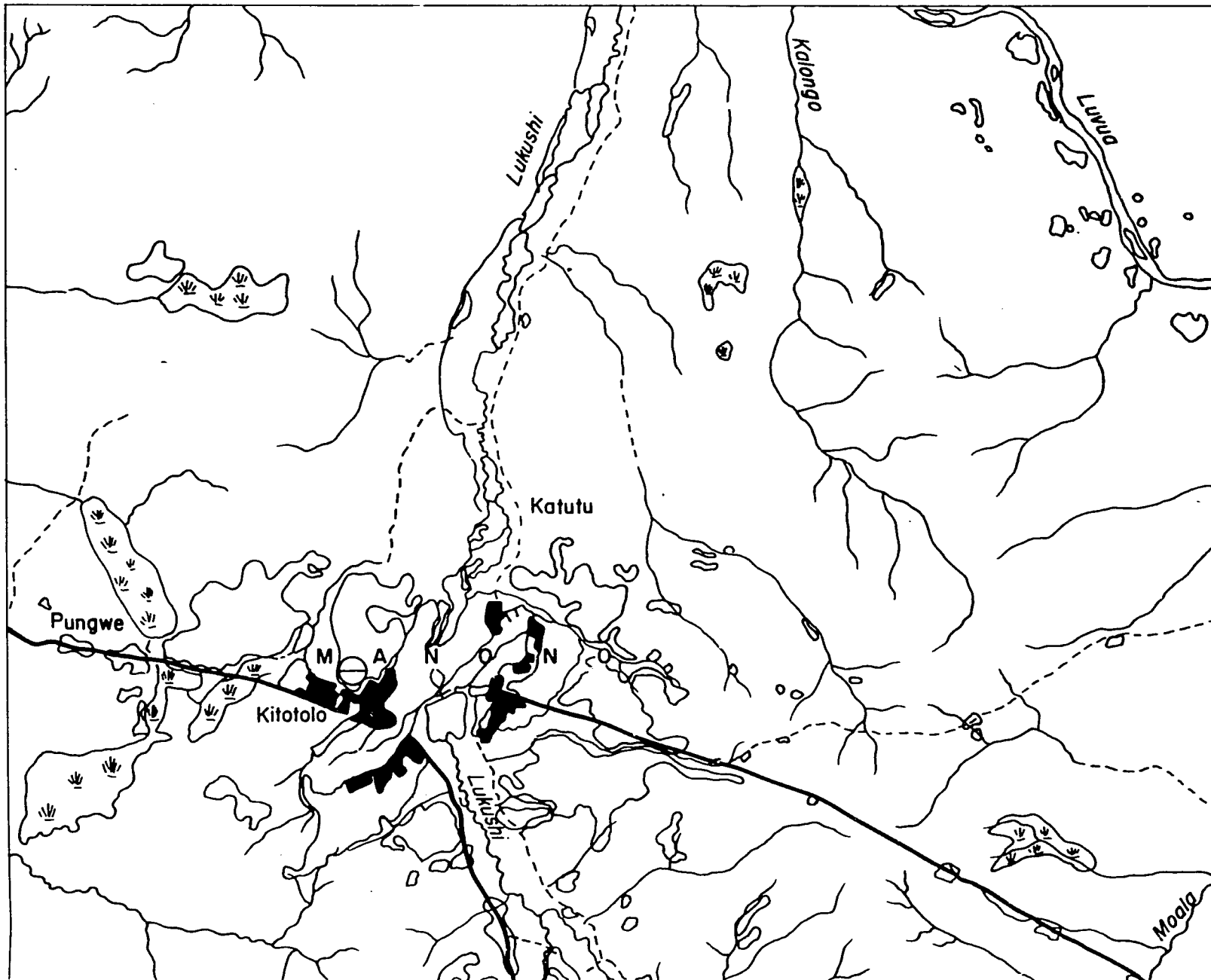
CARTE D'UTILISATION AGRICOLE DES TERRES
1978

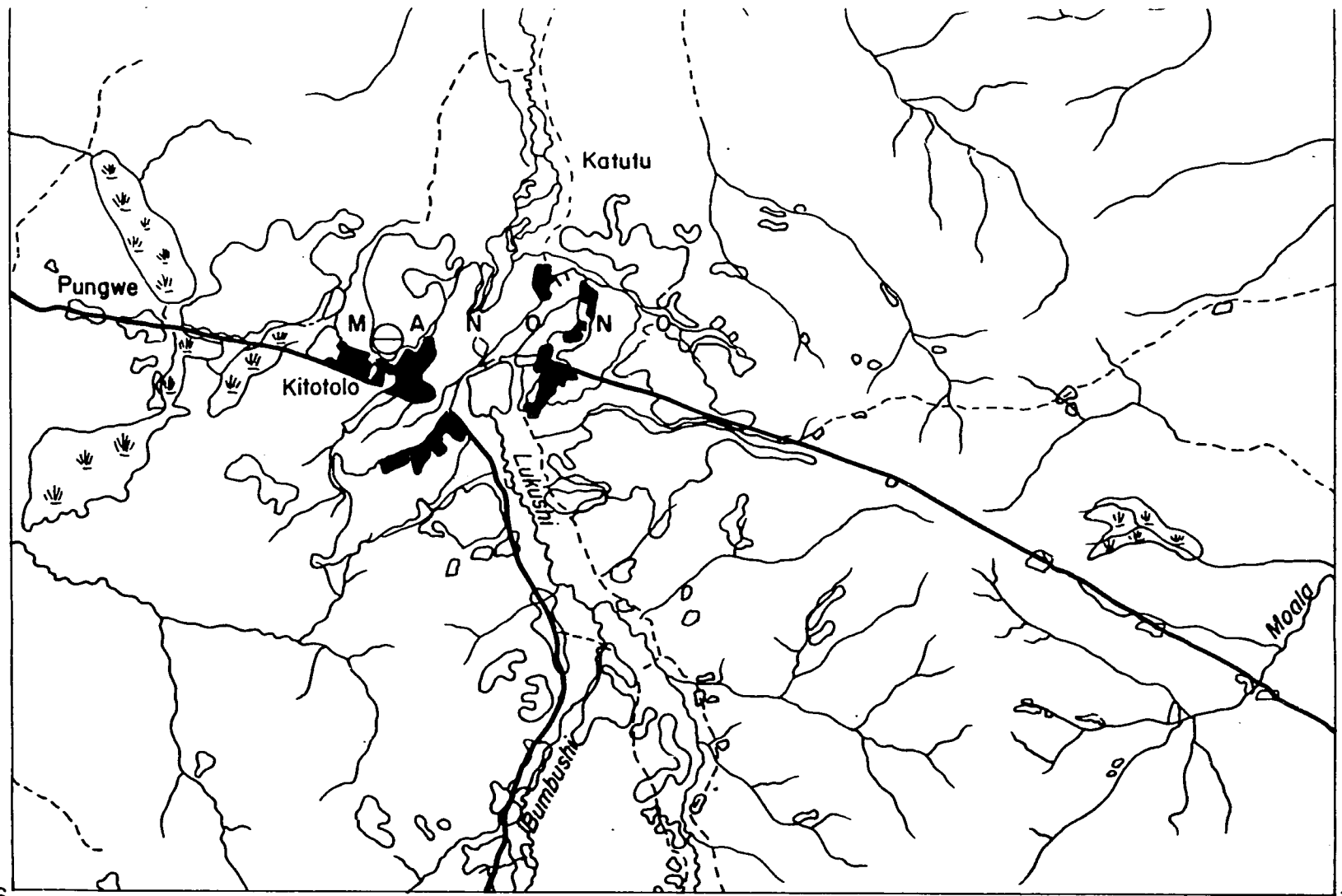


VILLE DE MANONO

27°15'E
7°00'S

27°45'E
7°00'S





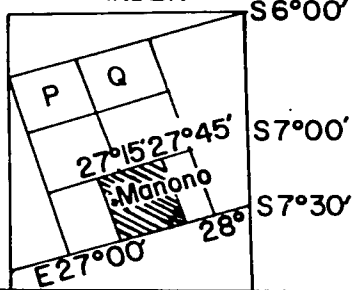
7°30'S

27°15'E

7°30'S

27°45'E

INDEX



CARTE D'UTILISATION AGRICOLE DES TERRES
1980

Superficie Cultivée : 15.775 Has

Echelle : 1/200.000

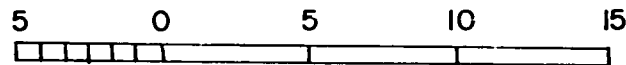


PLANCHE 14-C-1980