A CHARACTERIZATION OF THE SOIL RESOURCE OF THE RESEARCH STATION AT FERKESSEDOUGOU (NORTHERN COTE D'IVOIRE) WITH RESPECTS TO SUITABILITY OF IITA'S MAIZE SAVANNA SUBSTATION.

Consultancy report for IITA, IBADAN, NIGERIA

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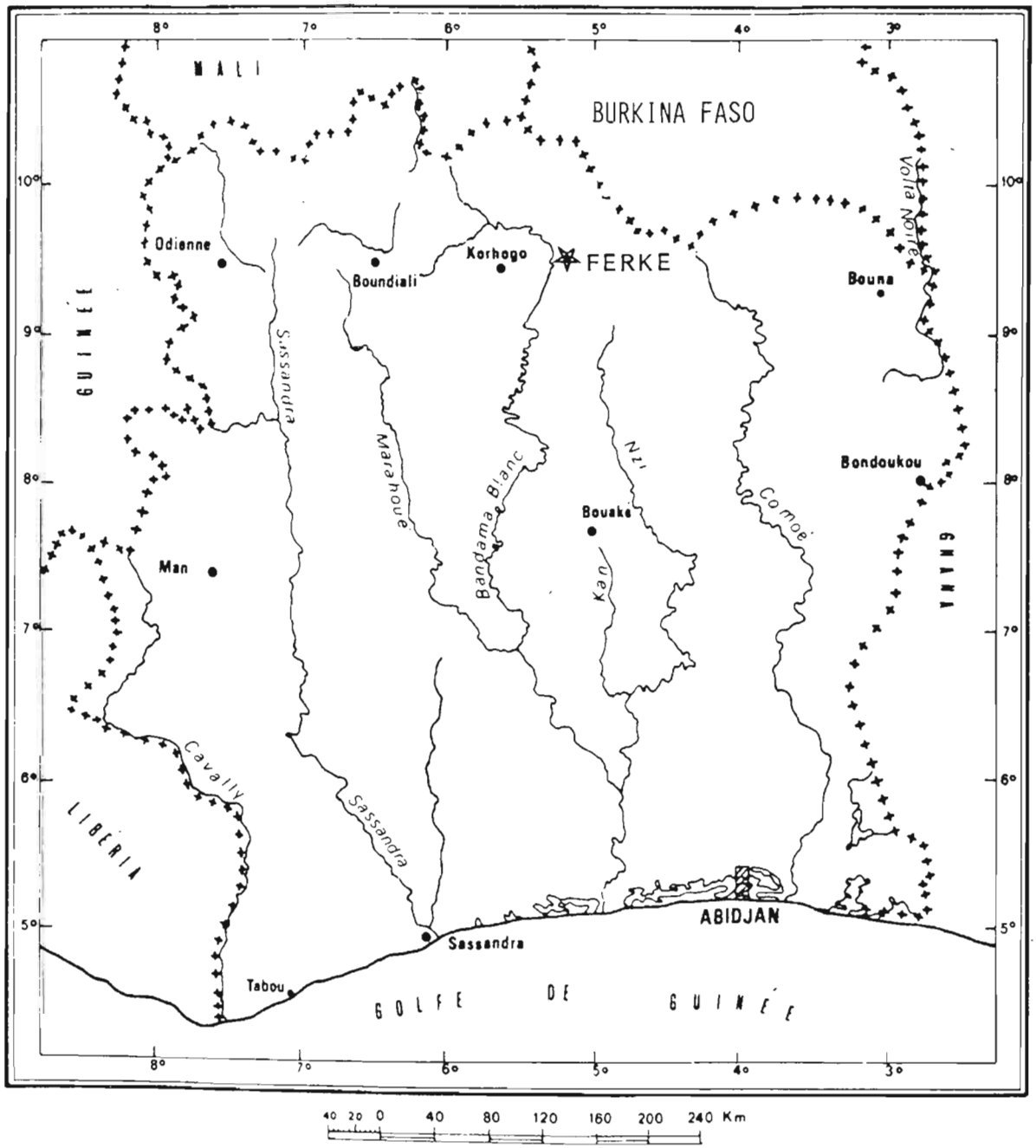
I. INTRODUCTION

In 1982, maize was the first cereal cropped in Côte d'Ivoire in terms of production (470,000 metric tons), before paddy (420,000 tons) (MOYAL, 1988a). Due to the rapid growth of population, this production will have to be doubled before the end of the century. Research must therefore be strengthened for increased maize production. This meets the mandate of IITA (International Institute of Tropical Agriculture) which conducts research in partnership with the National Agricultural Research Services. One of its recently developed program strategies is to establish small research substations in the key ecological zones of West and Central Africa such as the moist savanna zone which includes almost 45 percent of the coastal West Africa, but only 30 percent of the population of the region. With a growing period ranging from 150 to 240 days, intense solar radiation during the growing season, this well-endowed region is supposed to have the greatest potential for future maize production.

In order to deal adequately with the research priorities of this environment and to produce technological advances that are appropriate to the farming systems of the region, a research substation will have been established in this region by 1989. The essential of the program will give high priority to the maize breeding and improvement and resource management research. Studies will be carried out as well on the soils which require careful management to sustain production. The loss in productivity, by the invasion of grass and other weeds, is also a high priority issue in these savanna areas.

IITA staff have had several preliminary meetings with the Ministre de la Recherche Scientifique, and Director of IDESSA and his maize staff to discuss possible locations for IITA substation in the "corn belt" of Côte d'Ivoire. It came out that the major thrust of the work for the savanna ecosystem will be at Ferkéssédougou station, even though some activity is developed in, or near Bouaké.



MAP 1 : Location map

The objectives of this report are :

1. To provide a general classification of the soils of the Ferké station and an estimation for the land area suitable for maize breeding and maize production research.

2. To indicate the suitability of this site for more detailed research work on soil and crop management, especially to be representative of maize systems in the region.

3. To outline any particular advantages and disadvantages of the site to meet IITA objectives.

4. To highlight the opportunities at any other sites, to have an access to more diverse soil and land use system.

II. GENERAL FEATURES THE FERKESSEDOUGOU AREA

A. Location of the area (Map 1)

Ferkéssédougou (or "Ferké") is located in northern Côte d'Ivoire along the main tarred road and the railway that link Abidjan to Ouagadougou (Burkina Faso). The coordinates of the town are :

- 9° 36' N
- 5° 12' W

Distances from Korhogo (main city of northern Côte d'Ivoire), Bouaké and Abidjan are 53 km, 231 km and 584 km, respectively.

Senoufo People form the major ethnic group of the Ferkéssédougou area which is densely populated, yet less than the Korhogo area (Map 2). Their traditional agricultural practices are fairly advanced.

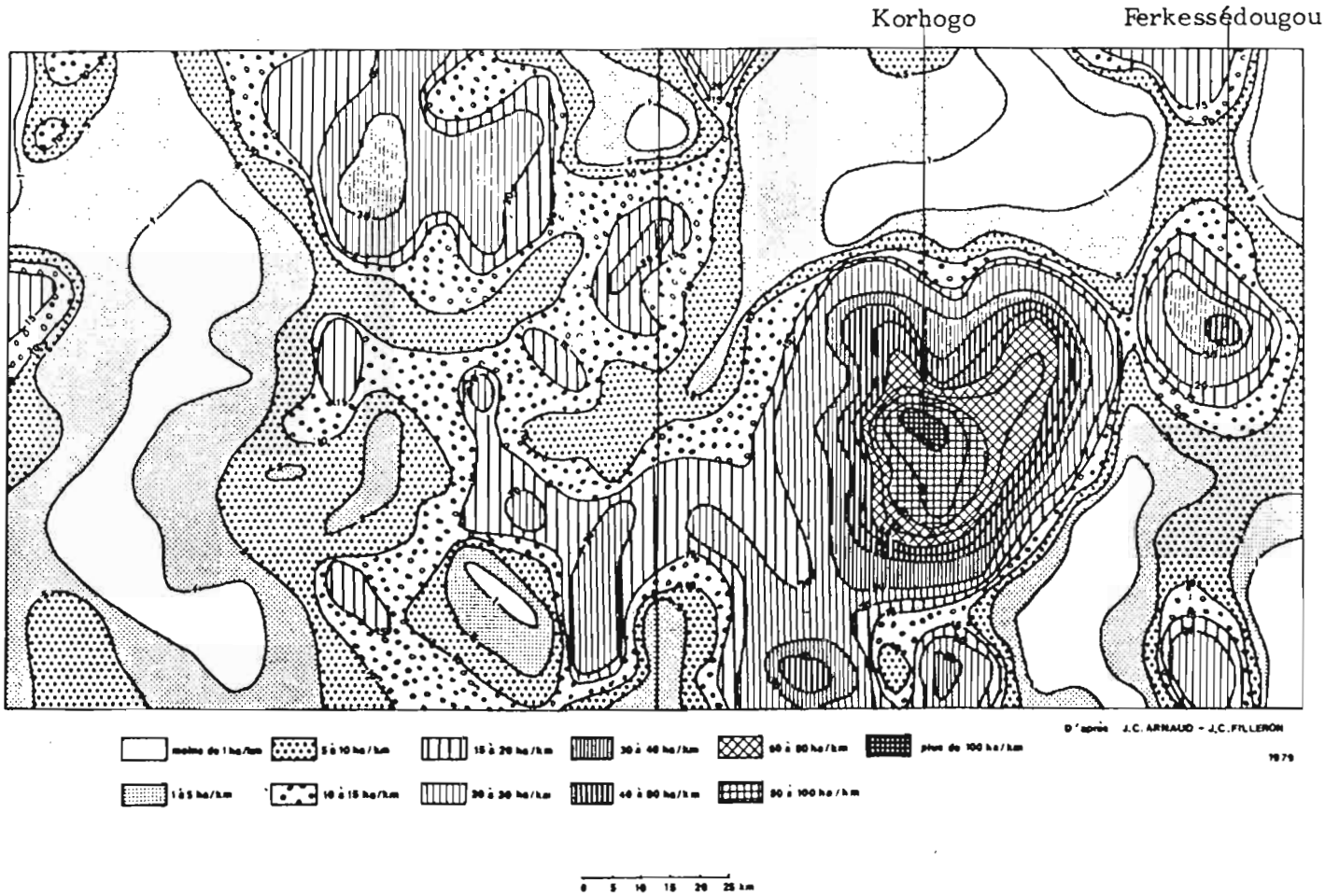
The area considered here is the geographical square degree located between the 9th and the 10th northern parallels and between the 5th and the 6th western meridians.

B. Climate

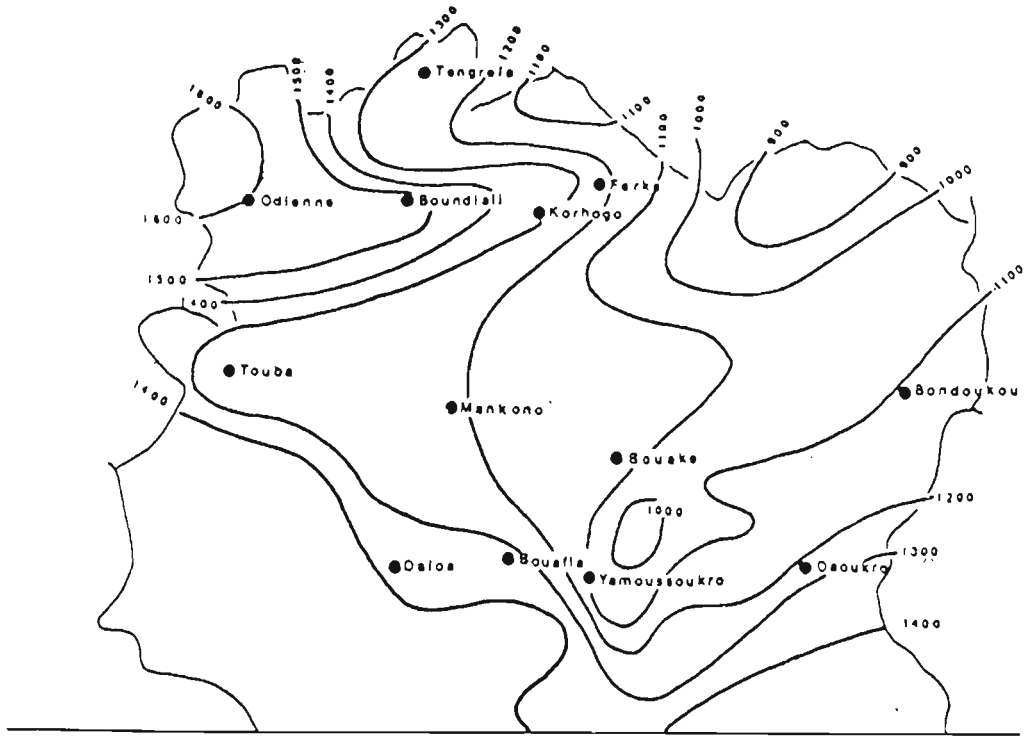
Whereas Bouaké belongs, as Ibadan, to a climatic zone with two rainy seasons, in Ferkéssédougou most the rain falls during one well-defined wet season from June to October. Mean annual rainfall (Map 3) ranges from 1129 mm in Tafire to 1496 mm in Boundiali, with 1332 mm in Ferkéssédougou (BEAUDOU and SAYOL, 1980). Since rainfall is rather well distributed, Ferkéssédougou does not seem the best location for studying resistance to drought stress . This risk is higher in Bouaké due to the erratic climate (Map 4). Mean annual temperature is 27.1° C in Ferkéssédougou. Potential evapotranspiration reaches 1847 mm.

C. Geology

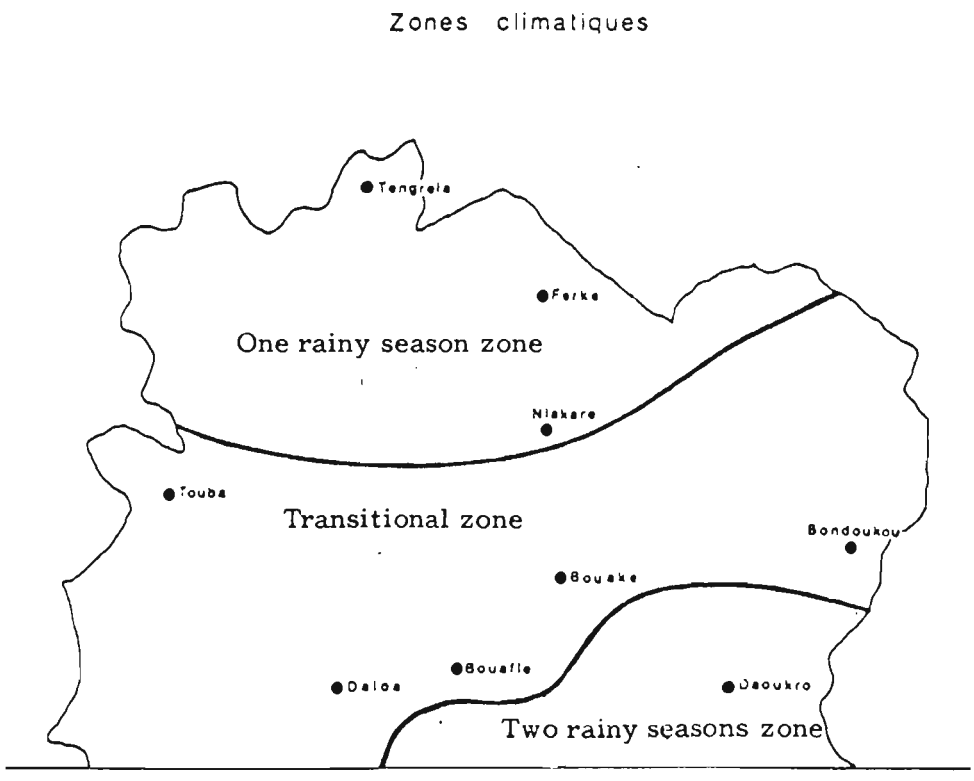
Most of the soils are derived from felsic or intermediate rocks (granites, gneisses, phyllites, schists) of the underlying Precambrian



MAP 2 : Population density . Square degrees of Boundiali (left) and Korhogo (right).



MAP 3 : Isohyets in central and northern Côte d'Ivoire. *(after MOYAL, 1988a).*



MAP 4 : Major climatic zones in central and northern Côte d'Ivoire. *(after MOYAL, 1988a).*

continental shield. Five main rocks occur in the square degree including Ferké (Map 5). Granite is the dominant geological formation of northen Côte d'Ivoire (Map 6).

D. Landform

Elevation ranges from 300 m to 400 m. Relief corresponds to the old, extensive plateaus of the Gondwana. Most frequently remnants of cuirassed plateaus are scrapped with concave slopes. The upper slope segment is generally rectilinear with a gentle slope (1^{o}). A slope break occurs midslope or downslope where indurated layers, together with an iron pan, outcrop locally. Downslope segments are convex-concave. Most often, the valley floor is almost flat.

E. Soils

On the regional scale, the soils are moderately to highly weathered and leached. Kaolinitic clays, iron and aluminium oxides are the main secondary minerals. Gravelly layers are common in most soils. Due to erosion, soils are rather shallow and the weathering zone may be often reached before 2m depth. As a result, these soils may have some reserve of weatherable minerals but the predominance of non-expanding 1:1 lattice clays and iron and aluminium oxides results in low effective cation exchange capacity and small amounts of total exchangeable bases. The levels of available P are also frequently very low. Furthermore, soils with an abundance of sesquioxides often have a high capacity of fixing phosphorus. The amount of organic matter is the main determinant of cation exchange capacity.

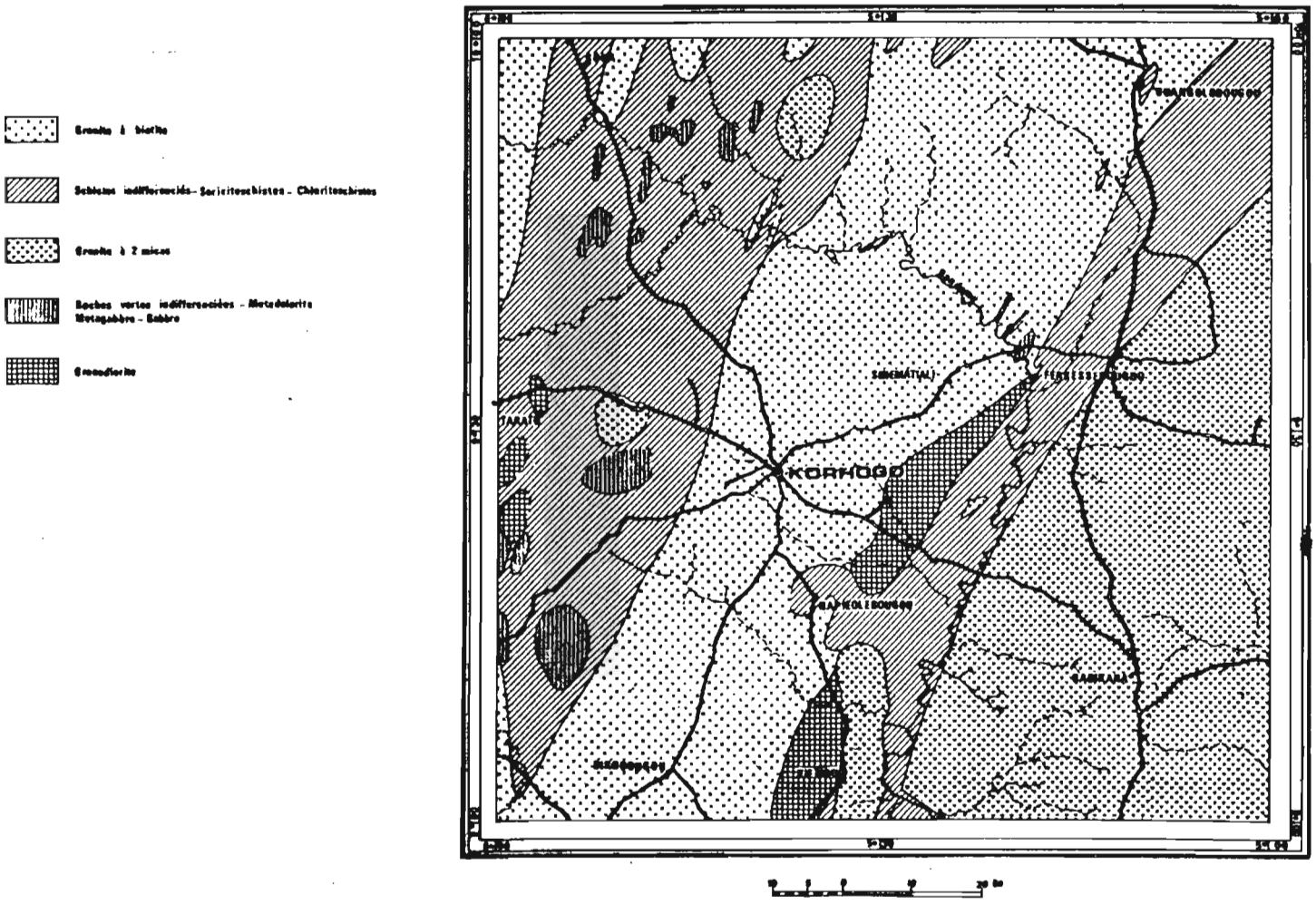
Usually, three main pedological domains can be differentiated along the toposequence (PLANCHON, FRITSCH and VALENTIN, 1987) :

- In upper slope, the red ferrallitic soils are commonly well structured and vertically drained. Laterite is often present and may form massive sheets.

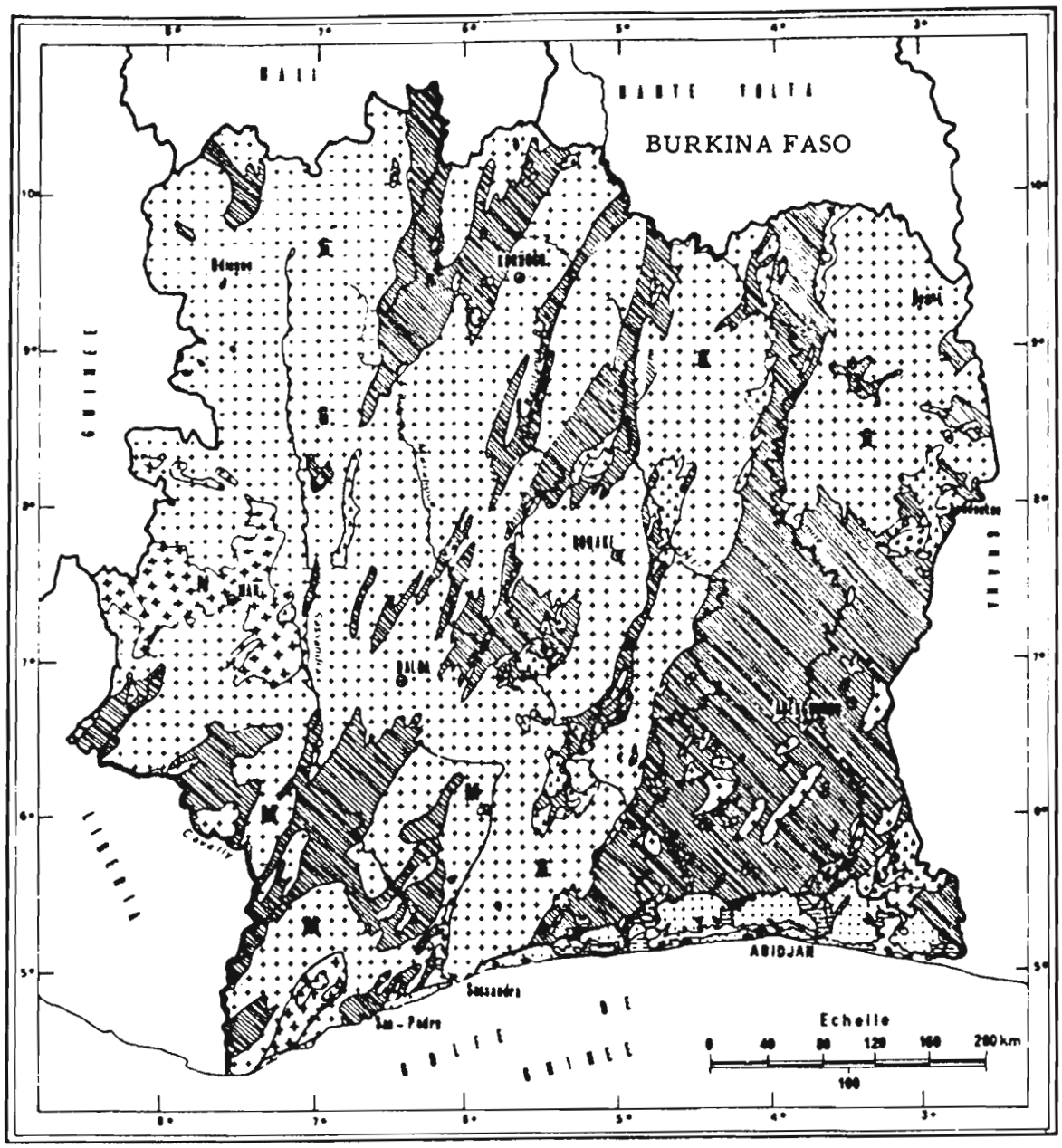
- Midslope, the soils often show a colour, textural and structural gradient, gradually becoming ochric, brown and yellow, more sandy and massive. Drainage is often hampered. From a classifying viewpoint, these soils may be considered as ferrallitic soils grading into ferruginous soil due to the topsoil characters. They are affected by two main processes :
  - impoverishment in iron and clay that originates from the topsoil,
  - accumulation of iron in the deeper layers which results in the development of indurated layers that outcrop locally midslope or downslope.

- Downslope, the hydromorphic domain is related to the watertable. In the valley bottom, soils are mainly built up with colluvial and alluvial deposits.

Some textural variations may occur due to the parent material : when derived from granite, the soils are sandy at the surface and become clayey with depth whereas on schists, the soils are generally more loamy.



MAP 5 : Geological map of the geographical square degree of Korhogo. *(after ARNOULD, 1963).*



MAP 6 : Geological map of Côte d'Ivoire.

F. Vegetation

Attention must be drawn on the difference among terminologies used by IITA and UNESCO regarding vegetation and climatic zone : according to the UNESCO terminology, Ferkéssédougou area is located in the "Sudanian woodland with abundant *Isoberlinia*" unit, whereas for IITA this area is included in the Guinean zone. In the classification usually used in Côte d'Ivoire, the Ferkéssédougou area is referred as belonging to the "Subsudanian zone" (Map 7, GUILLAUMET and ADJANOHOUN, 1971).

G. Farming systems

Ferkéssédougou is located in the Ivorian "corn belt". Maize, which is the staple commodity, is sown in late May and harvested in late September (one cycle). Maize-groundnut is the major mixed cropping. A high correlation exists between the degree of mechanization and the size of the maize field. These criteria may be used for a typology of farms (Table 1).

Table 1 : Typology of the farming households (after MOYAL, 1988a).

Degree of mechanization	Mean size of the maize fields	Percent of the whole
No	1	70.0
Animal traction	5-10	25.3
Light	4	3.3
Conventional	>50	1.4

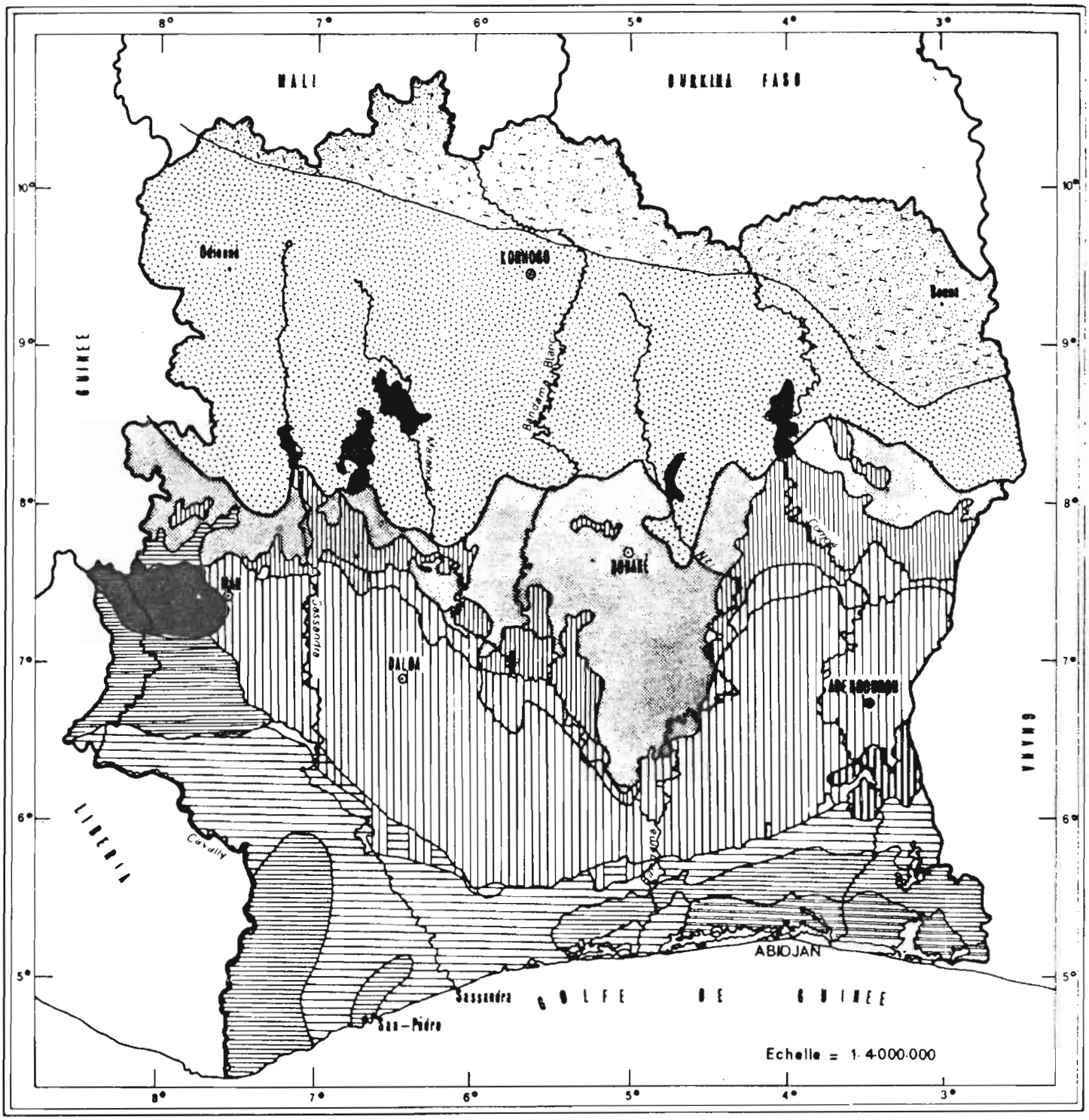
In the valley bottoms nearby the main towns, as Korhogo and Ferké, rice grows in the rainy season where the soils are normally flooded. Using the groundwater still available in early dry season, a second crop is locally possible.

Millet, sorghum, yams, upland rice, groundnut, cotton are also greatly cultivated. Furthermore, two large estates of sugarcane are located in the vicinity of Ferké.

Some trees are left in the fields since they are used for food production : *Butyrospermum paradoxum*, *Parkia biglobosa*, *Adansonia digitata*. Others are planted : *Mangifera indica*, *Psidium guyava*, *Annacardium occidentale*,...

H. Weeds

According to MARNOTTE (person.comm.), senior weed scientist in IDESSA, about 60 main species are responsible for weed infestation in northern Côte d'Ivoire. *Rottboellia cochinchinanensis* (ex *exaltata*), *Digitaria horizontalis* - with a 30 days cycle - and *Imperata cylindrica* belong to the most noxious weeds group. At present, *Striga* (most probably *Striga hermonthica*) represents a real risk for sorghum and maize only north of the line Odienné-Boundiali-Korhogo-Ferkéssédougou.



DOMAINE GUINEEN

SECTEUR OMBROPHILE (dense humide sempervirente)

- type à Eremospatha africana et Diospyros mannii
- type à Turraeanthus africanus et Heisteria parvifolia
- type à Diospyros Spp et Mapania Spp.
- type à Uapaca esculenta, U.guineensis et Chidlowia sanguinea
- type à Tarrietia utilis et Chrysophyllum perpulchrum

SECTEUR MESOPHILE (dense humide semi decidue)

- type à Celtis Spp et Triplochiton Scleroxylon
- variante à Nesogordonia papaverifera et Khaya ivorensis
- type à Aubrevillea kerstingii et Khaya ivorensis
- Savane Guinéenne

DOMAINE SOUDANAIS

SECTEUR SUB SOUDANAIS

- Forêt dense sèche
- Savane boisée, arborée ou arbustive et/ou forêt claire

SECTEUR SOUDANAIS

- Savane boisée, arborée ou arbustive et/ou forêt claire

MAP 7 : Vegetation map of Côte d'Ivoire.

However, since nutrients deficiency is often considered as a factor of infestation, this form of parasitism is likely to be encouraged in the short run, due to the demographic pressure leading to the scarcity of the land. For instance, in southern Togo where locally the population density exceeds 200 inhabitants per km^2, a yield decrease due to *Striga* may reach 50% (AGBOLI and HUGUENIN, 1987).

I. Pests

MOYAL (1988b) presented the crop losses due to insects in the savanna area of Côte d'Ivoire during the past few years for the main crops. For maize and cotton, as well as for stored products, the entomological risk decreases northwards and westward. The main problems are maize borers (MOYAL, 1988a).

Table 2 : Maize losses due to insects in the savanna area of Côte d'Ivoire (after MOYAL, 1988b)

Location	Yield of the highly protected field (kg/ha)	Yield of the poorly protected field (kg/ha)	Percentage of yield loss
North of the 9th parallel	3,550	3,335	6,0
West	3,863	3,725	3,6
South center	3,227	2,214	31,4
South-south-east	2,205	950	56,9

Maize streak virus is another problem of insect origin (MOYAL 1988b; Table 3).

Table 3 : Percentage of maize plants attacked by maize streak virus at 60 days after emergence in the savanna area of Côte d'Ivoire (maize sown in June).

Location	Year	
	1983	1984
North (Tingrela)	5	3.6
North-Center (Niakara)	5	13.5
West (Touba, Dianra)	0	0
Southwest (Seguela)	12.5	2.4
South-Centre (Bouaké)	37	14.5
Southeast (Daoukro)	-	30.8

Losses observed on stored maize and yams are presented in Table 4.

Table 4 : Percentage of weight loss due to insects during storage of maize in the savanna are of Côte d'Ivoire.

Location	Percentage of loss	Duration of storage (months)
North	0.6	7
South-Centre	5.9	7

These results indicate that yield losses due to insects are often very important, reaching about 60% for cotton and maize in the southern part of the savanna area.

III. MAIN CHARACTERS OF THE IDESSA STATION AT FERKESSEDOUGOU

A. Location and size

The IDESSA station is located 3 km from Ferké on the right side of the tarred road to Korhogo. It covers 220 ha.

B. Geology

Schists form the parent materials of the soils of the station. Undoubtedly, a site on granite would be more representative since granitic rocks cover 60% of the area. But schists which represent 35% of the square degree are far from being insignificant (Map 5).

C. Landform

Eleven landform-and-soil units were discriminated within the square degree of Korhogo which includes the Ferkéssédougou area (BEAUDOU and SAYOL, 1980). On the 1/200.000 landform map, the station is located in the unit n 2 : "landform with dismantled plateau". This unit covers 29 % of the map. Since the soils are very similar to those of the unit n 1 which covers 33% of the map, the site may be considered as highly representative, at this regional scale, of the landform and the associated soils of the area.

Five main segments may easily be differentiated along a transect set across the station (Fig.1). Land use is associated with toposequence position :

- A narrow, slightly convex plateau on the top. Oldest trials have been laid out in this unit which is more or less limited by the ancient track and the new road (Fig.2).

- A moderate hill-slope leading SSE to a small thalweg. New sugarcane trials are located in this unit which is also intensively, yet privately, cultivated by the staff of the station and other neighbouring farmers .

- A more pronounced and irregular hillslope NNW. A large part of this unit is occupied by the station buildings, the compound and woodland (*Tectona grandis* and fruit trees). Remaining land is cultivated.

- A broad and flat valley bottom covered with paddy fields.

- A short section of a long and gentle hillslope, almost completely cultivated.

D. Exploratory soil survey

1. Basic information

The only available information consists in a 12 years old general plan of the station representin buildings and main paths. The new road is not mentioned.

Neither were found topographical map more detailed than 1/50.000, nor earlier soil studies of the station's premises. The low-quality 1/50.000 aerial photographs, from the 50's, were not very helpful.

2. Methods

Ten soil profiles, 1,7 m deep - without iron pan- were described along a transect which cuts perpendicularly through the above mentioned land units. In addition, 13 routine augerings were made at 100 m intervals in the plateau to form a cross with the transect.

The landscape-soils correlations were subsequently used for extrapolation of the data to the whole station. Obviously, the observation density is not sufficient to draw an acceptable soil map. In this respect, detailed survey is absolutely necessary. The sketch which is presented was drawn only to provide some insight on the estimated extension of each unit. **The reader must keep in mind that the exact location of boundaries is somehow arbitrary** and should be ascertained after a detailed soil survey.

The French classification was used (C.P.C.S., 1967).

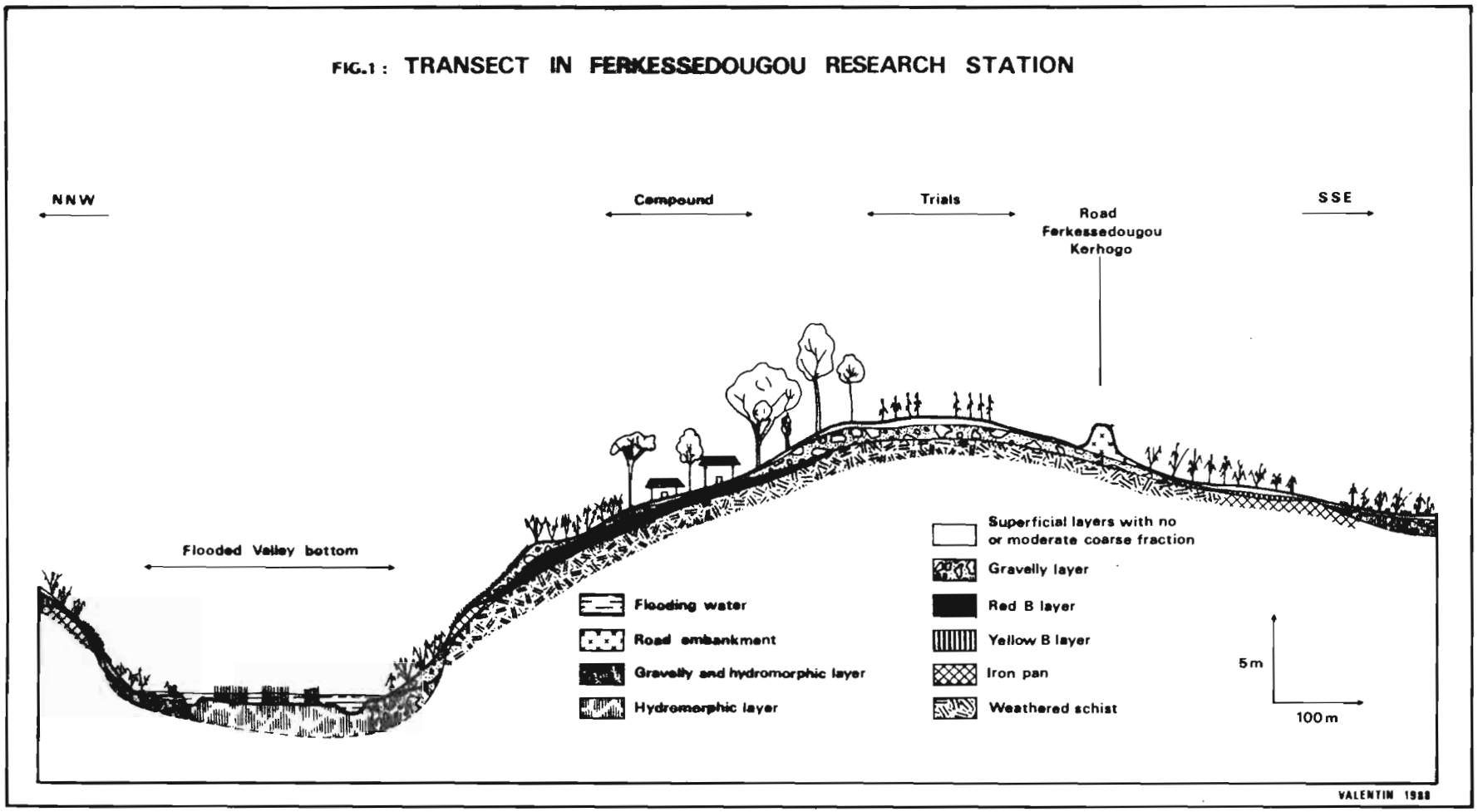
3. Main soil units

Eight soil types and seven mapping units were distinguished (Table 5)

Table 5 : Classification of the mapping units (Map 8).

Class	Subclass	Group	Subgroup	Facies	Mapping unit
Sols peu évolués	D'origine non climatique	D'érosion	Lithiques	Sur cuirasse	3
Sols ferrallitiques	Moyennement à fortement désaturés	Indurés			3
	Remaniés	Modaux			2
		Rajeunis			1
		Hydromorphes			5
		Typiques	Jaunes	Indurés	4
Sols hydromorphes	Minéraux	A pseudogley			6
		A gley			7

FIG.1 : TRANSECT IN FERKESSEDOUGOU RESEARCH STATION



Only the most relevant criteria in terms of maize production are listed hereafter. Soil moisture availability which is largely a function of soil texture and depth, and soil nutrient status are the key factors.

a) Unit 1 : Gravelly red ferrallitic soils on shallow weathered schists

Top soil : dark reddish brown (5 YR 3/2) moist, sandy clay loam, fairly stony - small iron concretions, fine subangular blocky structure, soft, many fine roots.

Deep soil : B gravelly layers, between 40 cm and 120 cm, red (2.5 YR 5/6) moist, clayey, very stony - concretions, soft overlay C weathering layers of schist, dusky red (10 R 3/3) and yellow (10 YR 6/8), clayey, soft, moist.

Undoubtedly, the roots can reach the weathering zone which is likely to be rather rich in minerals. Drainage is not hampered. The significant siltiness causes structural collapses and therefore capping of the surface soil especially where cultivation over a long period of time has induced a decrease in organic matter content.

Consequently these almost flat soils offer favourable conditions to crop maize and trials have been mainly located in this soil unit. When they have been cultivated for a long period of time, these soils are most probably the best of the station, but they cannot be really considered as fully representative of northern Côte d'Ivoire. This well endowed soils are responsible of the surprisingly high yields recorded by CYMMIT.

These soils covered an estimated area of 23 ha of which at least 8 ha are already occupied by the existing trials, the ancien track, the road and the weather station. The unit is not uniform. The depth of the gravelly layers, and their thickness vary, as well as the depth the weathering layer. But this type of variation occurs all over the station. Despite its heterogeneity, this tophill unit appears as the most suitable to identify small differences among genetic materials, provided a very detailed soil mapping is carried out prior to the laying out of the trials.

b) Unit 2 : Deep gravelly ferrallitic soil

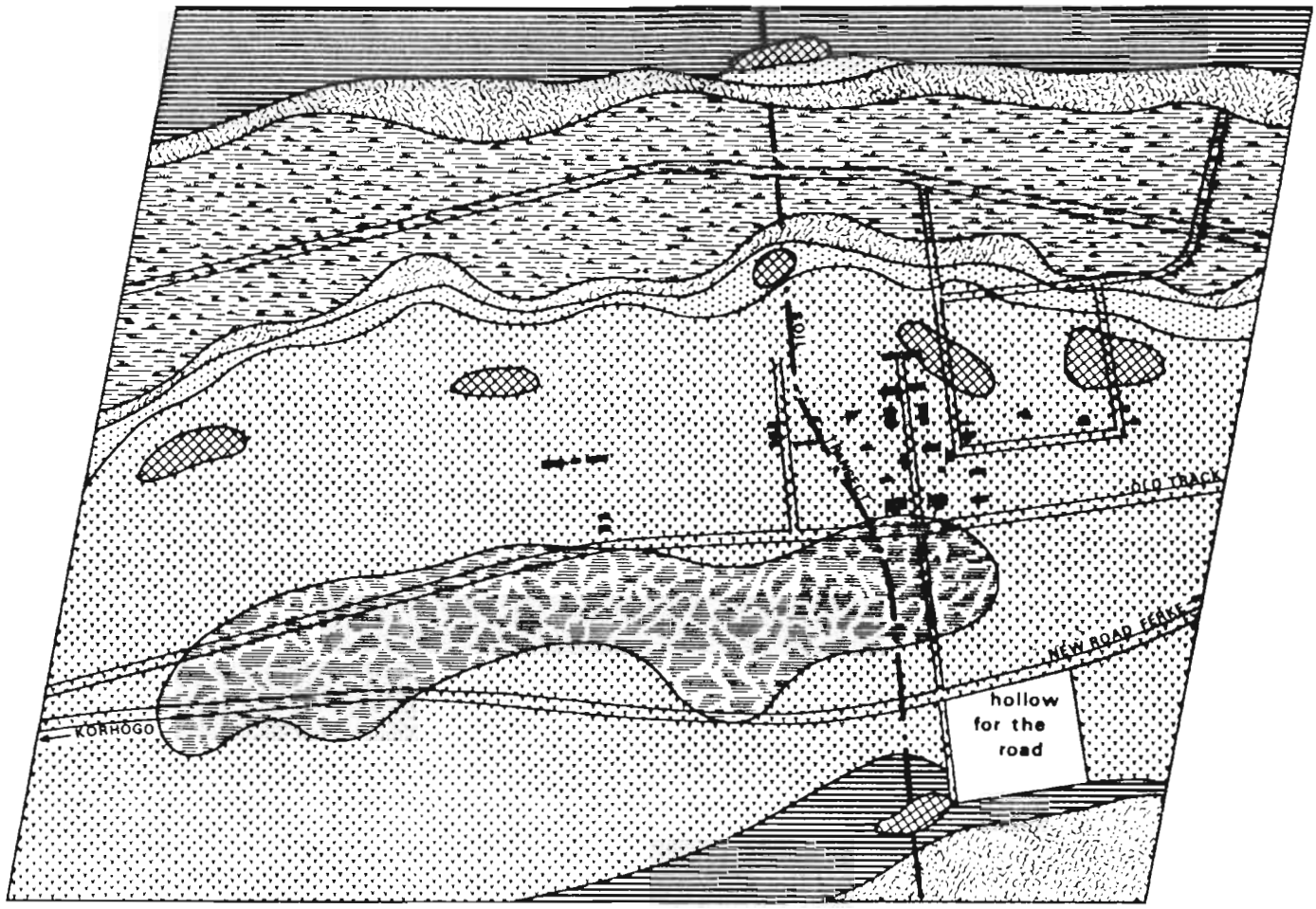
The main difference with the previous unit consists in the occurrence below the gravelly layers of a few decimeters thick ferrallitic horizon (what was called "hypostructichron" by BEAUDOU and SAYOL, 1980). As result, the weathering zone is deeper (Fig.1) and minerals are likely to be less abundant. These soils are freely drained. Good aeration and a low mechanical resistance to root penetration in moderate well-structured soils enables deep-rooting woody plants.

Besides the stoniness, slope inclination may be a limiting factor. However, in northern Côte d'Ivoire conditions, these soils are most suitable for cultivation.

Among the 100 ha of this largest unit, more than 60 are occupied by new sugarcane trials, wood, station offices and compound. As for the previous unit, large variations may occur in the depth and the thickness of

MAP 8 :

PROVISIONAL SOIL UNITS AS REFERRED TO THE FRENCH CLASSIFICATION. (FERKESSEDOUGOU STATION)



Sols ferrallitiques :

- remaniés rajeunis
- remaniés modaux
- remaniés indurés
- jaunes indurés
- remaniés hydromorphes

Sols hydromorphes :

- à pseudogley
- à gley

0 100 200 m

gravelly layers. Note that extremely gravelly layers may outcrop associated to quartz vein. In addition, the topsoil texture becomes locally more sandy.

These deep red gravelly soils may be used for trials since they are representative of the upperslope soils in northern Côte d'Ivoire, but the part they cover in the station is exaggerated compared with their usual occurrence in a more typical catena.

c) Unit 3 : Shallow soils and outcropping of ironstone

Where the profiles contain laterite there is often a noticeable break of slope occurring midslope or downslope.

Since this unit comprises several limited tracks of land scattered over the station, it is likely that some of them were not identified during the survey. As a result, the evaluation of 4 ha is probably underestimated. This unit is generally covered with low grass. Obviously, site selection will have to delineate this unit carefully in order to exclude it.

d) Unit 4 : Yellow ferrallitic soils

Top soil : light brown (7.5 YR 6/6) to brownish yellow (10 YR 6/6), moist, sand to sandy loam, coarse subangular blocky structure, many fine roots.

Deep soil : below a brownish yellow (10 YR 6/6), sandy clay, massive, ferrallitic horizon which may be mottled, indurated layers occurs at 75 cm.

These soils are located lower in the catena than the red ferrallitic soils. They are underlain by an indurated ironpan layer. The internal drainage of these soils is poor and, because of the reduce effective depth of the profile, they also have a low water storage capacity. Usually these soils are chemically poor. Due to these constraints, no trial has been so far implemented in this unit. However, maize breeding trials should not neglect these soils which may interact with genotype. Furthermore, these soils which approximately cover 23 ha, extensively cultivated, even in the station, are representative of northern Côte d'Ivoire and, to some extent, of southern Burkina Faso and Mali.

e) Units 5 and 6 : Lower slope hydromorphic soils

Topographically, these soils lie just a little higher in the catena than the valley bottom soils, and in the small thalweg located SSE of the station. Subjected to the variations of the groundwater level, their profiles contain significant mottling. They are alternately waterlogged and dry. Since maize is cropped even under these conditions, some plots, if necessary, may be used to test these specific conditions.

f) Units 7 : Seasonally flooded soils

Primarily, one the main objective of the Ferké station was to study the improvement of paddy cultivation in northern Côte d'Ivoire. As a result, the waterlogged "paddy soils" cover a large part of the station, approximately 42 ha, which does not seem to be very suitable for maize cultivation since surface water to a depth of 20 cm may lie on the surface for several months in the year.

E. Land use

Of particular relevance to the study of the traditional cropping system are the fields which , more or less legally, occupy at least two thirds of the station. Undoubtedly, the 17 staff members find the present situation beneficial and no really effective action has been so far undertaken to combat this occupancy even though *Eucalyptus spp* and *Azidarachta indica* (Neems) are planned to be planted to delineate more clearly the limits of the station. At present only 15 ha out 220 ha are really used for trials. The extension of new plots will be made on the expense of these fields. Political power should be strong enough to make it accepted.

Maize is the dominant crop, mixed with groundnut, yam, upland rice, sorghum and millet. Paddy is cultivated in the valley bottom. Because of the shortage of land nearby Ferkéssédougou, fallow periods between cultivation phases have been greatly reduced. Consequently, fertilizers are required for maize production and even small holders use some quantity. From this viewpoint, the Ferkéssédougou research station provides an interesting field for testing improved management practices to help restore soil fertility.

Trials concern maize, millet and sugarcane. Sugar plots have been implemented in the station for one year. They had to be fenced owing to the hazards of degradation caused by cattle passing along the road.

The steepest slopes are covered with wood (see unit 2).

Note that according to the official agreement of 1968 with IRAT (replaced nowadays by IDESSA), about 20 ha located in unit 2 are still owned by the Ministry of Agriculture. Actually, this piece of land was formerly allocated to an agricultural school that no longer exists.

F. Weeds

Although *Striga* may be found in the sorghum and maize fields of the station, infestation by this parasitic weed remains insignificant at present. *Cyperus* spp is more noxious.

IV. NOTE ON OTHER SITES :

The sugarcane substation

A substation completely devoted to sugarcane research is located at 4 km from the main station, near the Lokpoho river. Soils mainly belong to the units 3, 4, and 5 above mentioned. The soil map of this sub-station is available but no free land remains for new trials.

A. The CIDT observation spots

Compagnie Ivoirienne de Développement Textile (CIDT) has a dense network of observation spots (briefly called by the acronym P.O. "Points d'Observation") all over northern Côte d'Ivoire. Provided a special agreement is made with this important company in charge of the development of the savanna zone, trial plots in these observation spots would be very beneficial to have access to more diverse soil especially on granite.

B. The FORO-FORO substation

Located 20 km north from Bouaké, the Foro-Foro substation is mainly used to study irrigated crops and market gardening. The Director of IDESSA would have liked to regroup all the institutes of Bouaké in one site, at Foro-Foro. Due to the lack of funding to build a completely new research complex, apparently this project has been abandoned.

According to LENEUF (1956), the soils which are gravelly and derived from granito-gneiss are very similar to those of Bouaké. Since no particular climatic variation distinguishes either this site, initiating maize experiments in Foro-Foro would not provide more information than those already collected in Bouaké or Ibadan.

V. CONCLUSION

1. Three main soil units of the Ferkéssédougou station are suitable to meet the objectives of IITA. However, even though these soils are representative at a region scale, especially units 2 and 4, one must keep in mind that the best soils are over-represented. Unit 1 may offer too favourable conditions to extrapolate experiments results to the whole moist savanna ecosystem. Anyhow, detailed soil survey must be undertaken to select an uniform track of land so that small differences among genetic materials may be identified. Soil variation along the catena provide suitable conditions to test soil factor x genotype interactions.

2. At present, only one tenth of the available land is used for experiments. Two-thirds are traditionally cropped by the staff and neighbouring farmers. As a result, the station itself yields an interesting sample of a maize system which has to cope with an increasing pressure on land.

3. Besides the fact that agreement was already made between IITA and IDESSA about the selection of Ferkéssédougou station, this site presents several advantages :

- It is located in a very active region in terms of maize production.
- Its climatic conditions largely differ from those of Bouaké or Ibadan.
- It offers some facilities such as a permanent staff, some air-conditioned offices, a small laboratory, telephone and an easy access by road (2.5 hours from Bouaké), by train, or by air (from Korhogo).

The main disadvantages result from geology. Schists are not the most representative rocks of northern Côte d'Ivoire. As already mentioned, the soils that derived from this parent material tend to be richer than usual. Consequently, in addition to the Ferké station, some other experimental spot will have to be selected.

4. In order to access more diverse and representative soils, and land use systems, discussion should be implemented with some institutions dealing with development such as CIDT (Compagnie Ivoirienne de Développement Textile) which has a dense network of observations points associated to a qualified staff. The format of collaboration with this institution, along with IDESSA, has still to be clearly defined.

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APPENDIX

MET PERSONS :

Dr.Ouayogode BAKARY, Director of Research and Training, Ministry of Scientific Research, Abidjan.

Dr.KOFFI GOLI, Director of IDESSA, Bouaké

Dr.MARNOTTE, Director of the Department of food production, IDESSA, senior weed scientist, Bouaké

Dr.MOYAL, senior entomologist, IDESSA, Bouaké

Dr.BENINGA, millet breeder, IDESSA, Ferkéssédougou.

OTHER PERSONS TO BE MET BY THE IITA STAFF :

MM. KONE DOFFANGUI, *SOUMAILA TRAORE*, *GIGOU* and *CHOPART*, scientists of IDESSA, Bouaké, dealing more of less with soil science.

KONE LAKOUN, Director of the Ferkéssédougou station.