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UMM KEDDADA AREA

BASELINE
and
TREND ANALYSIS
REPORT

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Best Available Document

UMM KADDADA AREA
BASELINE/TREND ANALYSIS
FEASIBILITY STUDY

I. Introduction:-

A. Criteria for Selection

The Umm Kaddada area, located in Northern Darfur, has certain characteristics that make it attractive to environmental monitoring:-

The area is very remote and has been a sort of back water and often ignored by development work. Data about the area is not only quite limited but is also scattered throughout many pamphlets and reports. There is no comprehensive study about this particular area, thus rather than this being a full blown baseline/trend analysis this paper is more of a feasibility study to see what is actually there and what potential the area has for a monitoring program.

The study area is dominantly a sandsheet formation bounded to the East and West by hills of the Nubian sandstone formation. This sandsheet is located on top of an underground water basin. There is no surface run-off in the area.

The study area is in the rain shadow of central Darfur highlands, thus experiences a relatively lower amount of rainfall than other places on the same latitude (see climatic description of the area in IIB of this report).

The study area is part of what is called a sedentary zone located between zones of camel owning nomads to the North and cattle owning nomads to the South. Therefore the area is clustered by a number of settlements the location of which is a function of water availability and nearness to the transportation routes.

The study area is dominated by the Berti tribes whose members are accustomed to a sedentary way of life and are more attached to their lands than the other tribes to the North and South. Conflicts often occur between the sedentary Berti tribes and the mobile tribes, since the settlement area of the former separates the grazing area of the latter.

Permanent settlement around water sources has induced over-stocking and signs of desertification, the result of which is the declining importance of the study area as a sedentary zone. This is evidenced by the reactivation of the gozsands which result from deflation and sand accumulation processes. This, in turn, has resulted in the reduction of cultivated areas forcing a movement toward the use of reserved lands. Satellite photos reflect clearly "N-S" (nomadic settled) strips of lands, with bright colour within the zone of the wood land savanna (Combertum Cordofanum-Dalbergia Albizzia Sericocephala woodland savanna). In addition, in this woodland savanna zone of the study area there are a number of isolated islands with bright colour surrounding the settlements. This indicates that the repeated cultivation of millet, groundnuts and sesame without shifting practice and fallow periods has caused the reactivation of the gozsands and increased the rate of desertification.

The study area was once part of the transportation zone crossed by West-East and South-North routes. It was a thriving commercial area 60 years ago when lorry transport to the West was focused in the region. From the end of the 1950's through the beginning of 1960's drastic changes occured due to the opening up of Southern Darfur and the shift of the transport zone southward, thus by-passing the study area. The significance of this development will be elaborated on in part III.

The main hypotheses which this baseline report should touch can be summarized as follows:

Umm Kaddada declined in importance as an administrative centre as part of the British administration policy in Western Sudan.

The transport zone centered around Umm Kaddada has shifted southward in response to development measures in Southern Darfur.

The sedentary zone previously including the Umm Kaddada area shifted to the South in response to deteriorating environmental conditions.

At the time water became available people started to migrate Southward. This situation tend to contrast with the hypothesis that water is the key factor for development.

The people of Umm Kaddada responded differently to the recent changes. Their traditional socio-economic foundations were challenged and put under question.

The Umm Kaddada area was pushed into the back-water of development.

B. Location of the study area (Umm Kaddada area).

The study area is the Eastern District of Northern Darfur Province with Umm Kaddada settlement as its centre. It is geographically located within the 12th and 15th degrees of latitudes and the 25th and 28th of longitudes, covering an area of some 40.000 sq km^2 (see locator Fig.1)

C. Main indicators to be used in the monitoring program.

The main indicators to be used in the monitoring program are:

1) The climatic data which will help in explaining the climatic fluctuations and forcasting the future trends.
2) The morpho-dynamic processes which produce the present morphologic features in the forms of extensive sandsheets; consolidated and reactivated sand dunes; buried and uncovered Nubian sandstone formations.
3) The presence of underground water in relation to the Nubian sandstone formations.
4) Removal of the vegetative cover in relation to the environmental deterioration and types of economic activities and the effect of that on the quality of soil.
5) The decline of the Umm Kaddada as an administrative and trading centre.
6) The Southward shift of the transport and sedentary zones.
7) The southward movements of the people of Umm Kaddada in response to the recent environmental and socio-economic changes.

II. Environmental Conditions of the Study Area:-

A. Geology of the study area.

The study area is mainly composed of a belt of fixed or

recently reactivated sand dunes which are superimposed on the Nubian sandstone formations. The latter appear at the surface in confined localities, near Um Kaddada, Burush and El Hilla settlements, in the Northern part of the study area particularly in the surroundings of the Berti Hills. The Basement Complex emerges at the surface in form of isolated pockets particularly in the Eastern and Western fringes of the study area.

In the South-Western part of the study area alluvial clays and sands are found deposited in Wadis and drainage basins, particularly in W. Abu Hamra, W. Keira, W. Golo and W. El Ku.

The drainage system of this study area is predominantly composed of periodic run-off. Permenant surface run-off is completel absent. The presence of a number of wells scattered all over the study area gives the indication that the whole study area is locat on top of underground water basin the significance of which will be discussed in relation to the socio-economic conditions in the study area (see Fig.5).

The Western part of the study area is dissected by periodical streams originating in the eastern part of Jebel Mara (see Fig.2

B. Climatic Conditions

The study area can be divided climatically into two main parts: the Southern part, South of Dam Gamd - Say el Na'am line, fall within the 300-500 mm isohyet. North of this line the area falls within the 200-300 mm isohyet. So it can be generally said that the whole study area falls within the 200-500 mm. isohyet. In the Western part of the study area the isohyets are pushed further North, thus reflecting the effect of Central Darfur highlands. The significance of this position is well illustrated by the following climat cross-section and the attached Fig.(A 4) showing the distribution of rainfall.

Human activity is shaped and influenced by climatic norms. Deviations from the norm affect the well-being of communities. In areas of subsistance economy, below average rainfall can seriously affect life of the people whose existence there may be threatened by the deviation. Drought can be ameliorated by relief from other

areas if the region hit is easily and quickly accessible, but Umm Kaddada district is rather remote. Drought recurrence can lead to extinction of plant species, lack of moisture and plants make the soil susceptible for erosion. At the fringe of the desert as is the case of Umm Kaddada wind blown sands can be deposited and soil sterilization can be the ultimate nearly irreversible result. The impact of climate on the environment is great and better understanding of climatic features can save an area from catastrophe. Because of this great impact of climate on the environment, the issue is dealt with at some length.

1. Basic Climatic Features

Average annual rainfall over the district is less than 300 mm. (figs. 1,2). Both El-Fasher (in the Western part of the district) and Umm Kaddada town (to the East) show an average of 264 mm. The maximum atmospheric evaporative demand estimated by Awadalla (1977) is 2151 mm which results in an annual deficit of more than 1800 mm. The two wetest months are July and August for each of which potential evapotranspiration exceeds rainfall. Considering a carry-over of soil moisture in a simple water balance, deficits are 99 and 32 mm for July and August respectively.

Different systems of climatic classification designate Umm Kaddada District as "ARID". Applying the well known system of Thornthwaite (1948), Awadalla (1981) designates the area as a part of the Arid Zone in the Sudan (see also Satakopan 1965, and Fayed 1965).

Maximum rainfall ever received in one day at El-Fasher in the standard period 1951 - 1980 was 88.5 mm on the first of August 1974. The coolest month is January when the normal mean temperature is 19.8°c. On the other hand the hottest month is July when the mean temperature is 30.7°c on the average. Temperatures of about 0°c were recorded more than once in 1951-80.

Bright sunshine is at 91% of the maximum possible time ($\frac{n}{N}$) in January. July and August, expectedly, are the most cloudy months when relative bright sunshine duration is about 60% ($\frac{n}{N}$ = 60%). At this time the cloud coverage is about $\frac{6}{8}$ th of the sky, while Relative Humidity is well over 60%.

Wind direction and speed are gauged routinely by the Meterological Dept. Wind speed however varies appreciably within short periods, but the average for September is 4 M.P.H. From March to July the average speed reaches 6 M.P.H. Studies on wind direction however, can delineate the raing season. When winds of a northerly component dominate dry conditions prevail and the opposite is true for winds from the South-West. In fact the North Easterlies prevail from September to April after which month the dry East-North Easterly winds weaken and the moist South Westerlies push further in-land to dominate the area indicating the possibility of some rains. By-and-large, the drying and erasive powers of the wind are determined by its nature, how humid, from which direction and how forceful. For problems of desication and desertification, among others wind data are of great relevance.

2. Annual RainfallL Amount, Variability and Reliability

The geographical location of the district results in low amounts of rainfall. The Western part is rain-shadowed by Jebel Marra. There the humid South Westerlies get depleted of their moisture on the Western slopes of the Jebel. On the Eastern slopes and further on, the Fohn effect is shown on the records of El-Facher where the average annual is 264 mm compared with 626 and 828 mm at Zalingei and Nierteti respectively on the Western slopes.

The Eastern part of the district on the other hand is reached by the South Westerlies, but after a long distance inland through which itis discharged by several storms and thus gets depleted and has a lower precipitation potential. The rain shadow, however, is not an issue in this Eastern part, but causation of relative dryness is a matter of continentality.

3. Rainfall Variability and Reliability

Statistical indicators of variability include the range, the Mean Deviation, the Standard Deviation, the Coefficient of Variation and the Interannual Variability Index. Reliability, however, is better assessed on basis of probability of receiving critical thresholds of rainfall. For this study different indicators of variability were employed. In these investigations a range of 456 - 73 mm has been revealed by records of Umm Kaddada town for the period (1945-1979). In the two successive years of 1950 and 1951 annual val-

were 456 and 137 mm showing a drop of 70%. For this period of 1951-1979 the Standard Deviation (S.D.) is 80mm which in terms of Coefficient of Variation (C.V.) is about 33%. This means that in each year to come, in the near future the amount of rainfall is expected to deviate by about ± 33% of the average, (fig. 3). At El-Fasher, the Coefficient of Variation is even greater where it reaches 36%.

The Interannual Variability Index, however is concerned with the year-to-year fluctuations rather than relating fluctuations to the mean as the case of S.D. and C.V. Having this in mind, El-Fasher shows an Interannual Variability Index (I.V.I.) of 17.5% compared with less than 11% at El-Geneina further West.

Considering assessment of probability of critical amounts of rainfall. This is useful and adds a lot to the understanding of reliability of rainfall over the district. It is possible to arrive legitamately at some probability levels, but normality of data should be assured. In the present case data are skewed and some transformation (using the square root, the log values or as appropriate, it is a matter of trial and error) is necessary before further computations.

4. Seasonal Rainfall: Amount and Distribution

Not all the amount of annual rainfall is effective and available for plants (whether crop or pasture). Prior to the growing season some rainfall may scatter in small amounts which may evaporate immediately from surface, before penetrating and infiltrating the ground. Such small amounts neither add to the build-up of soil moisture nor get tapped by the plant.

Based on soil moisture balance, Awadalla 1981 defines the wet season. For him the wet season commences in the first pentad (5-day period) of three consecutive ones in each of which the available moisture in the soil can meet at least 80% of the evaporative demand of medium-term sorghum at germination and early post-germination periods. Accordingly, the event was defined at El-Fasher from 1951 to 1976 year-by-year. This revealed a mode of commencement in mid-July and an average time of commencement 10 days later. It is to be stressed here that the commencement

refered to is that of the wet season (the growing season) which happens later than that of the rainy season.

In 1972 El-Fasher received
but according to the above definition, the growing season failed to commence effectively, because of the infavourable distribution that did not result in a sufficient storage of moisture to enable germination and early growth of sorghum. Another aspect of ineffectivity relates to rainfall of small amounts within the growing season. Values of less than 5 mm/day are generally considered ineffective, because of the problems of surface evaporation which are subject to. For different parts of the Sudan such rainfall amounts to 10% of the annual or just less than that. Accordingly seasonal rainfall should be evaluated.

Using Penman's model (Penman 1948) for estimating potential evapotranspiration and using a modulated water balance approach based on 5-day unit of time, the within-season distribution of soil moisture was evaluated by Awadalla 1981. A peaky curve was revealed the primary maximum of which accounts for about 90% of the total variance. This maximum shows itself after 30 days from the onset or just after that on the average.

In conclusion of this section, Umm Kaddada District is an arid region whose rainfall is hardly reliable in amount or time. The onset of the wet season is also a highly variable event and so the duration of the wet season which is an important agroclimatological parameter. In length it varies appreciably from year to year. By-and-large, the area is delicately marginal and measures of famine relief among other issues of environmental conservation should not be overlooked.

C. Vegetation of the study area (map 3)

The Northern and Central part of the study area is dominated by the Acacia Senegal Savanna. The most Northern limit, North of Um Kaddada settlement with rainfall hardly exceeding 300 mm. is dominated by seasonal grasses (mainly Aristida types) with scattered small trees (mainly Balanties aegyptiaca and Acacia raddiana). These plant species form the basis for the nomadic way of life of the Zeiyadiya and Meidob tribes, who are presently moving southwards in response to recent environmental fluctuations.

The natural vegetation cover is excessively removed as a result of overstocking, overcultivation (necessitated by the increase of population particularly in the sedentary zone) and environmental fluctuations. Stands of Acacia-Senegal-Savanna trees are continuously decreased and the grasses (Aristida, Cenchrus biflorus, Eragrostis tremula) are removed from all settlement surroundings.

The Southern part of the study area (South of latitude 13°N) is dominated by the tree savanna of the Qoz soils of Eastern Darfur (Combertum Cordofanum - Dalbergia - Albizzia sericocephala wood land savanna).

Harrison & Jackson have presented the vegetation of the study area in the following classification (Harrison & Jackson vegetation classification, 1955):-

Desserts - no subdivision:	Ephemeral herbsand grasses spring up after a rare rain "Gizzu grazing"	
Semi-desserts	Acacia torfilis Maerua crossifolia	clay soils
	Acacia mellifera Commiphara	qozes (sand soils)
	Acacia glancophylla	
Semi-dessert plants	: Anifida plumosa (ar. bayod) Blepharis (Blenoicifolia) (ar. bogheil siha Monsonia gum	

These plants have been eliminated due to overgrazing. The ones that remain are:-

Schmidtiu pappophoraides	(mamlicha)
Cenchues biflorus	(heskanit)
Eragostis tremula	(bannu)
Annual Gristida	(gau)

The best browsed bushes of the two sub-divisions are:-

Acacia raddiana	(seiyal)
Acacia mellifera	(kitter)
Maerua crossifalia	(surha)

Optimum stocking rate for both subdivisions taken together was estimated to be about 10 animal units per sq. mile.

Savanna Wood Land:

Eragroslis tremula	bannu
Cenchrus biflorus	heskanit
Blepharis	Bogheil
Zornia diphyalls	lusseig, shillini
Annual aristida	gau

Blepharis is the chief grazing plant for camels and sheep. During the dry season cattle exist on eragrostis and arishid. Zornia diphyalla and brachiaria spp of xantheleuca are the best grazing in the "Hamaraja Qozes".

"Dukhn" (millet) Pennisetum typhoideum and "Batikh" (Water-melon) Citrudlus nulgaris are the principle qoz crops. Dukhn is the staple grain of the people of the Western Sudan.

II. Socio-Economic structure of the study area:

A. Historical background:

1. Umm Kaddada as an administrative and market centre.

The name Umm Kaddada refers originally to a well that existed long before any settlement was established around the water source[1]. This well was used by villagers scattered at short distance.

Before the advent of the colonial administration in Darfur (1916) the most important settlement in the Eastern fringe of this region was Jebel Hilla, used as a front-line post. It was used by the Sultan of Darfur as a district headquarters for all of Eastern Darfur. In 1916 the condiminium troops managed to subjugate the Kindom of Ali Dinar in Darfur. And in 1918 the Anglo-Egyptian administration chose Umm Kaddada to be the district headquarters.

The presence of a water source in Umm Kaddada with better quality than that of Jebel Hilla had stimulated the Anglo-Egyptian administration to establish a new settlement at the present Umm Kaddada. Additional wells were dug to meet the increased demand of the new settlers, who were partially compelled to move to the new established administrative centre. Subsequently Umm Kaddada developed into a big market for all the surrounding relatively smaller settlements.

2. Umm Kaddada as cross-roads (map 1)

Because of its location in the sedentary zone of central Sudan, Umm Kaddada served as a cross roads in the transport zone of central Sudan and as a main truck route across the continental savanah belt. In fact Umm Kaddada was known since the days of the Darfur Sultanate as one of the water-stops along the trade and pilgrimage route from Senegal, across West Africa, Chad, Sudan to Saudi Arabia. This route linked Umm Kaddada with the most important centres of Darfur, Kordofan and East Central Sudan (El-Fashir, Nyala, Genaina, En Nuhud, El Obeid, Umm Rowaba and Omdurman). Moreover, it was reported that Umm-Kaddada has been linked with Darb el Arbain by some feeder roads from Western Kordofan.

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(1) The name Umm Kaddada means salty soil around the settlement

The Umm Kaddada route really gained momentum when the Sudan belt became partitioned after the first World War, by the British and the French. As a result of this partitioning a strong administration was established in Umm Kaddada to provide peace and security for the transport routes.

The Camel caravan routes between El Fashir in the West and El Nuhud and El Obeid in the East passed through Umm Kaddada and Jebel Hilla to water their animals and to rest.

As motor cars and haulage trucks were introduced in 1927 in Western Sudan, Umm Kaddada became a larger and more important stopping centre offering fresh water and resting facilities.[1)]

Benzine lorries would often over-heat near Umm Kaddada thus drivers were compelled to stop and cool the engine before resuming the journey. This increased the functions of Umm Kaddada as a market and administrative centre. The settlement of Umm Kaddada grew as more service were needed for the travellers.

The exact transport route through Western Sudan was determined by the location of water points. The route usually went through Kuma, El Obeid, Umm Kaddada, Jebel Hilla, Sharif Habbashi and Damganat before passing towards Wad Banda and El Nahud.

Water was the critical factor in this transport and sedentary zone which became famous for water-melons. During the dry season travellers without access to underground water kept near settlements that cultivated and stored watermelons to be used as a source of drinking water. Thus hundreds of acres of watermelon were cultivated in this transport and sedentary zone.

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1) According to the civil secretary report 65/A/5/15 of 1927 the first private Motor Transport Project in Kordofan and Darfur was applied for by Gabriel Mirza through Aziz Kafori. The route proposed to operate was El Obeid-El Nuhud, El Fashir and vice-versa. The weight of the vehicles unladen is from 2-3 tons, and the weight of the vehicles laden is between 6-9 tons. The director of work - Sudan government refused to accept the private motor transport project because these new types of vehicles would destroy the road and it will need yearly maintenance.

3. Umm Kaddada as grain producing centres.

Umm Kaddada was one of the largest grain producing centers in Eastern Darfur, even supplying El Fashir with grain.(1) The major economic activity in the Umm Kaddada area was rainfed cultivation with millet, sorghum and watermelons as main crops. Groundnuts cultivation was popular in the Northern part of the area. In addition, Gum Arabic was widely collected throughout the area. The Berti tribe being the dominant ethnic group in the area practiced rainfed cultivation(2). They supplied neighboring tribes (Kabahish, Kawahla, Meidoub and Zagawa) with grain.

Livestock rearing started to spread to the district only after independence when trading in animals became popular. The people of the Umm Kaddada area gradually started to adopt a sort of transhumance by introducing sheep from the Kabbabish area. The earlier start of the rain season (2-4 months earlier in Southern Darfur). Particularly in Dar Saeid, stimulated periodical movement of the males to participate in the cultivation of groundnuts and sesame as cash crops. The commercialization of groundnuts production in Dar Hamar has further stimulated the periodical movement of the wage labourers from Umm Kaddada. This activity provided an additional source of income to the Berti people while not conflicting with their own cultural practices.

4. The decline of Umm Kaddada as an administrative centre.

In the early 1930's the British administration decided

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1) It was reported in SNR (Sudan Notes and Records) that the grain arrived at El Fashir market in January 1946 amounted to 782 "ardebs" (ardeb = 2 sacks), in January 1949 there was a shortage of grain in El Fashir and Umm Kaddada. The grain collected in El Fashir market in that month amounted to 1058 ardebs.

2) The inhabitants of Eastern Darfur in general and Umm Kaddada area in particular are predominantly Berti. A multitude of other ethnic groups are also represented. In Umm Kaddada itself the other important groups in terms of numbers and political influence are: Esirra and Gawamaa. Other groups include Sararia, Gilaidat, Bazaa, Dar Hamid, Bidairya, Bani Fadul, Bani Umran, Kaja, Meidob, Zaghava, Bargo and Karobaat. The first eight groups are Kordofanian groups.

to reduce the function of Umm Kaddada as an administrative centre. The British made a sub-division of the central district administered from El Fashir. It was thought that Umm Kaddada was only artificially a native centre and in many ways awkwardly situated as the Headquarters to the Eastern District. It was suggested by the civil secretary in May 1930 that a court for the Eastern District (Umm Kaddada) should be institutionalized under the presidency of "Shartai" Daw el Beit Abdel Daiyyim of Taweisha. Accordingly, Umm Kaddada should be reduced from a double inspectorate with full complement of 2 sub-Mamurs, clerical staff and police to a sub-division of the Central District administered from El Fashir with the assistance of one extra Asst. District Commissioner based on El Fashir and with one sub-Mamur and small staff at Umm Kaddada. It was advocated by the Civil Secretary that the administrative functions by Shartai Daw el Beit as a local "native authority" together with the proposed well bores at Taweisha, might well result at some later date in an entire regrouping of the population and the emergence of Taweisha as the true Headquarters of the native administration. At the same time the Civil Secretary emphasised the importance of Umm Kaddada as a Telegraph and Watering Station on the Western line of communication. In view of the strategic importance of Umm Kaddada, as a well centre and petrol dump on the main line of communications between El Fashir and the East it was suggested that the withdrawal of complement should be proceeded only partially. Accordingly, it was decided that a police post should be maintained in the interests of public security over the long stretch of sparsely inhabited road lying between el Fasher and El Nahud. It was argued that the Native administrative was not qualified to undertake the security task. The following government staff were then stationed at Umm Kaddada: Sub Mamur, accountant, Translator, Postmaster, Sanitary Hakim Mulahiz of police - 30 men mounted police and 7 men mounted wardens.

5. The decline of Umm Kaddada as a transport service point.

From the end of the 1950's through the beginning of the 1960's drastic changes occured in Umm Kaddada. Southern Darfur was being gradually opened up as the result of the expansion in crop production particularly groundnuts, gum arabic and tobacco. The most significant change, however, was the shifting of the transport zone Southwards passing from El Nuhud through Abu Karinka, Babanusa,

El Dacin, Nyala, to El Geneina. Thus the zone of transport by-passed the Umm Kaddada and El Fasher areas.

The new diesel lorries, introduced in the end of the 1950's could travel further then the old benzine engine lorries, without overheating, so although the new transport route was longer, it was not a problem for the new diesel lorries.

The extension of the railway line to the West and South in the beginning of the 1960's helped to strengthen this new Southern transport zone. The town of Babanusa became the junction of the Southern and Western lines and later developed into a major urban centre. El Dacin which was once a small village developed very fast into a major commercial centre. Nyala, the railway terminal became the main centre of Darfur.

As a consequence of the southwards shift of the transport zone the sedentary zone shifted southwards. This shift began in the early 1960's and is still continuing today. This southward shift has been facilitated by more favourable environmental conditions in Southern Darfur. The rainfall is more reliable in making agricultural production attractive.

The end of the 1950's and the early 1960's witnessed the opening of the Northern route for lorry transport which started from Omdurman through Sodiri, Umm Quozein to El Fasher and El Geneina. This route is still important in transporting the products of Western Sudan, particularly Gum Arabic, groundnuts and tobacco to the markets of North Central Sudan from which consumer goods are transported to the province of Western Sudan. Also this route has greatly enhanced the recruitment of labourers needed in the development schemes of North-Central Sudan.

As a result of all these changes Umm Kaddada area gradually slipped into the backwaters of Western Sudan. The town of Umm Kaddada which was once on main truck route of the sedentary Sudan belt became an isolated town and now can only be reached from El Fasher. Even the trading activities between Umm Kaddada and El Fasher declined since the early 1970's due to the diminishing role of the latter as a commercial centre. Umm Kaddada's importance as a commercial centre diminished as Nyala flourished.

6. The decline of Umm Kaddada as a grain producing area (map 4).

The drought of the late 1960's and early 1970's was first reflected in decreasing grain production. This decrease was estimated by Fouad Ibrahim (1977) to be as high as 50% of the production prior to the drought period. Accordingly the Umm Kaddada area can no longer produce enough grain to satisfy the needs of its own population. This situation intensified the traditional wage labour movements. The area became more dependent on Dar Hamar and El Obeid for employment opportunities. Gradually this lead to the socio-economic isolation of Umm Kaddada from the rest of Northern Darfur province.

B. Trend Analysis.

1. Water availability trend analysis. (maps 5 and 6)

The water availability trend analysis gives a different profile from the one discussed so far:-

The Umm Kaddada area being in the rain shadow of central Darfur highlands receives very little rainfall relative to its latitudinal position (see the climatic cross-section). Surface run-off is almost absent in the area due to the sand sheet formations which are very deep and porous and which immediately absorbs all precipitation.

Water has always been a key factor for settlement and economic activities because it is found in such restricted areas.

Prior to the 1960's the main sources of water came from hand dug wells. These wells were 10-15 feet deep with varying amount of water. Some of these dried up before the end of the dry season that is why the area became famous for drinking watermelon juice during the critical time of the year.

In the 1960's a large ground water basin in the Umm Kaddada area was tapped. The following table shows the number of wells dug between 1940 and 1980.

UMM KADDADA WELLS

Decade	N. of Wells completed	Production in gallons
1940's	4	4940
1950's	7	8540
1960's	42	28351
1970's	31	15200
Total	84	57031

The above table strengthens the hypothesis that water is the key factor in defining the Umm Kaddada area as a transport and sedentary zone. Thus the recent shift of the sedentary zone Southwards can not be interpreted in terms of water availability at the time when water became available and dependable through the exploitation of the huge underground water basin the area became very much isolated and neglected since the transport zone by-passed it and the sedentary zone followed the transport route South.[1)]

2. Environmental Changes Trend Analysis (map 3).

The new situation of the Umm Kaddada area should be dealt with from a regional prespective. The deterioration of the environmental conditions together with the steadily increase in population and livestock numbers are continuously affecting the mode of economic activities in the Northern Darfur province including the area of Umm Kaddada.[2)]

The increased overcultivation, overstocking and

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1) It is paradoxical that even though the Umm Kaddada area was no longer a viable centre, 90% of its water supply was built when the area was declining. This may makes the area attractive to environmental monitoring.

2) The population number increased from 130,000 in 1913 to 310,000 in 1945 (260%) to 728,000 in 1955 (560%) to 904,000 in 1975 (700%) and to 1050,000 in 1977 (810%). FOUAD N. IBRAHIM, 1980 P. 108.

.ercutting of trees due to the population and livestock pressure[1] ave caused a reduction in the vegetation cover. Fouad Ibrahim (1980) stimated the overstocking to be 575,936 livestock standard unit (31%), i.e. this number was calculated to be in excess to the actual apacity of the grazing areas. The estimation of MUKHTAR (1974) was ven higher than this (79%).

The ultimate result of the overstocking and overcultivation is the removal of the vegetation cover. According to OTTERMAN (1974), the removal of the vegetation cover increases the albido, thus reducing the probability of rainfall in North Darfur.[2] Therefore, t may be argued that the increased utilization by man of the cultivated and grazing areas coupled with wood cutting in response to the increased population is contributing to the problem of rought prevailing in the area since the late 1960's. The above entioned scholars argued that the removal of the vegetation cover s not an effect of the prevailing drought but it is a cause of the atter.

The result of the prevailing drought was well documented y FOUAD N. IBRAHIM (1980) in form of progressing desertification ocess, encroaching from North to South Darfur. This process is lected in the reactivation of old stable sand dunes. The effect this reactivation is reflected in the reduction of cultivated a either by removing the top soil or by covering it by blown sands. onsequently it is expected that, the cultivated area will continuously ecrease in proportion to the rate of desertification which increases, n turn, in proportion to the degree of the land utilization.

The increase in the livestock number is shown by the following table:

	1956 (All Darfur)	1976 (All Darfur)	1976 (North Darfur only)	1956 % = 100
tle	1980,000	3642,500	908,100	184
nel	170,000	368,200	226,100	217
eep	1080,000	2641,600	1409,500	245
t	890,000	2310,200	1198,000	260

(FOUAD N. IBRAHIM, 1980 P. 123)

Otterman (1974) argued that removal of the vegetation cover affects the probability of rainfall, since the albido is liable to be raised on a bare ground surface. This cause cooling down of the lower air layers, thus reducing the heat reflected to the atmosphere. In this way the probability of convectional rainfall will be reduced to a minimum (see also Charney, 1975).

The present situation in the area of study is reported to become increasingly critical. According to FOUAD IBRAHIM (1980) the desertification process has enhanced the removal of the rich organic top soil by deflation. The effect of this is not only the reduction in soil fertility but the lowering of the water table.[1] This means that water potentialities for the plants are effectively reduced and the previous amount of rainfall can no longer sustain the previous vegetation cover and the previous pattern of land use. This situation induces people in the Umm Kaddada area to search for alternative to their deteriorating traditional way of life.

J. Response trend analysis (~~map~~ 3 and 4)

Although it is not our aim to present an analytical study, at this stage, for the people's response to the new situation, it will be usefull to give a generalized idea about that.

The first response to deteriorating environmental conditions and the decreasing socio-economic role of the Umm Kaddada area was the expansion of the area cultivated to compensate for expected failure. This has resulted in the cutting down of many Acacia Senegal trees (Hashab trees), thereby reducing the prospects of gum arabic production. In fact the fall in the gum arabic prices in the last decade encouraged further the cutting down of 'hashab' trees.

The second response was the tendency towards animal rearing. Previously the Berti people were sedentary cultivators keeping only few animals. Most of the animals grazing in the area of Umm Kaddada were immigrant, belonging to the Kabbabish and Meidob pastoralists.

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1) The removal of the top soil, composed of clay, silt and organic substances, through deflation process permits the perculation of water to lower depth which can not be reached by plant roots (the roots of millet and other grasses in North Darfur hardly exceed 20 cm. Fouad 1980 P. 83).

The Umm Kaddada area became increasingly attractive to pastoralists because of its fresh water sources. Even in the years with insufficient rainfall the wells of the Umm Kaddada area did not dry up. This stimulated a new sphere of economic persuit among the Berti tribe. They began investing in water pumps to meet the increasing demand for drinking water. The first privately owned pump was installed in 1978. Today there are 12 pumps in Umm Kaddada settlement and 5 in Lughud.

The area became a major watering centre for Kabbabish, Kawahla and Meidob pastoralists. Needless to say that this has resulted in overgrazing around the wateryards.

The increased competition between the different tribes for grazing areas for large herds is causing intertribal conflicts. As a result of these conflicts some indigenous people are forced to move further South into areas having better natural conditions (rainfall, cultivated area, good quality soil and availability of drinking water).

This new trend of moving Southward of the Umm Kaddada people negates the hypothesis that the Berti tribe of the Umm Kaddada area are more attached to their lands than any other tribe in Darfur.

Traditionally, the Berti were sedentary cultivators and very few of them were engaged in pastoral transhumance. The social organization of the Berti group is patrilineal and the system of residence is patriarachal. Members of the same tribe or family used to stay on land that traditionally belonged to them. The lineage acquired, through time, is of cardinal importance in the life of the Berti which regulates land property, political membership in sub-groups and marriage transactions. Thus it was believed that the Berti group was compelled by this patrilineal lineages to stay in their land even under severe environmental circumstances such as drought and/or famine.

The recent trends of the movement Southward put the whole partilineal lineage and patriarchal residence system of the Berti group in the Umm Kaddada area under question. There must be

overwhelming factors which work together to break up this system and to induce the mobility of the Berti tribe. Identifying and analyzing these factors deserves specific investigation which add to the importance of environmental monitoring for the Umm Kaddada area.

IV. Conclusion:

The foregoing presentations revealed that the Umm Kaddada area was continuously declining in importance as far as its functional location as a transport, trading and administrative centrewas concerned. Accordingly the previous sedentary zone with its centre Umm Kaddada is shifting southward.

The actual reasons for this shift are not precisely known but some explanations can be given which, we believe, might have contributed to the declining importance of Umm Kaddada area.

The decision of the British Administration, as early as 1930, to reduce Umm Kaddada to a sub-division of a central district administered from El Fasher must have had a bearing on its socio-economic development. This was reflected not only in the reduction of Government institutions but in the reduction in services. These reductions affect negatively the trade transactions between Umm Kaddada and other places particularly El Fasher. This development was further intensified by the shifting of the transport route Southward, i.e. the previous transport route passing through Umm Kaddada area from East to West shifted to the South. Reasons for this shift could be explained by the declining importance of Umm Kaddada as administrative and trading centre on the one hand and in the deteriorating environmental conditions reflected in the decreasing grain production, on the other hand. The favourable environmental conditions in South Darfur has stimulated the extension of the railway line to Nyala to tap the potentialities of this region, particularly after the commercialization of groundnuts.

The introduction of diesel lorries facilitated the overcoming of long distances to reach the Southern and Western limits of Darfur province.

As a result of this shift of the transport route some settlements like Nyala and Daein replaced Umm Kaddada as transport centres.

The ultimate consequence of all these changes was and is the decreasing importance of the Umm Kaddada area which was neglected and gradually pushed into the back waters of development.

Now the area is confronted with a serious problem, which we believe is a direct result of the above presented changes, namely the present trend towards migrating away from the area. In fact this was

argues to be the obvious response of the population to the recent changes. Other responses like adopting new economic pursuits within the area need to be thoroughly investigated.

Paradoxically, the movement of people started at the time when water became available. The hypothesis that water availability is a key factor for development can no longer be held valid at least in the case of Umm Kaddada. The validity of this hypothesis needs to be tested and evaluated.

Having said all this about Umm Kaddada we should attempt to use this information as a feasibility study and to use the indicators outlined in this report (deterioration of environmental conditions expressed in terms of climatic fluctuations; degradation of soil; removal of vegetation cover and enhanced desertification process; reduction in grain production; changing social organizations of the Berti tribe; adoption of new economic activities; availability of underground water and lack of surface water; the recent development in Southern Darfur and the shift of transport zone Southward) for detailed studies to show how these factors are working, separately or together to produce the present situation in Umm Kaddada area.

The second step is to find out whether the present situation is reversable or irreversable by forcasting the prospect of these indicators. The ultimate aim of all these inquiries is to save and reserve the rest of the regions potentialities before it is too late.

This can only be done through an intensive research in the region which should identify and analyse the most effective factors responsible for the degradation or upgrading of the region's socio-economic structure. The available data about this neglected part of the country can hardly permit any sort of monitoring program, let alone planning for future development. The need for gathering current information about this region is becoming increasingly vital, especially in regard to recent regionalization policy and the proposed development strategies for the whole country in general and Southern Darfur in particular. We believe that the increased degradation processes of of this region will affect adversely the development programs in the whole Darfur province if it is only seen in the in increased out-migration and concentration of people in few areas which have still rewarding potentialities. In the longer prospect this concentration,

if not duly avoided or modified, will produce the same features presently prevailing in Umm Kaddada area. So the ultimate aim of a proposed study in this area is not only to reverse the process of degradation in Umm Kaddada area but to protect adjacent regions against that degradation.

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Civsec Notes: 65/10/37Competition of Road Motor Transport with Railway
65/10/40 Kordofan Lorry Owners Assoc.
65/7/21 Private Enterprises El Obeid Nahud
58/2/4 New Roads Darfur
58/5/15 Roads Wells and Hafirs, Programmes in the Sudan.

Civsec Notes Administration:
1/20/60-61 Devolusion Darfur
1/21/60-63 " "

1/22/64-64 Devolusion Darfur
1/23/66-68 " "
1/24/69-70 " "

Civsec Notes :Districts (16)
16/3/6 Umm Kaddada Merkaz 1920-1963

Civsec Notes:Trade(64)
64/6/42 Control of Markets Darfur

Civsec Notes: Tribes (66)
66/1/4 Tribal Distribution Darfur

2.D(1) Fasher A Administration
1/1/4 Several Reports Darfur Situation 54-55
2/8/1/1 Boundaries Between En Nahud and Eastern Darfur (Umm Kaddada)
2/8/2/9 Tribal Boundary Map 1926-36
19/1/1 Roads and Communications
19/1/1 Existing Roads - Maintenance of thorough and local roads 1925-60
19/1/2 Roads and Communications, Wells and Water Supplies 1967-70
2/19/2/3 Roads and Communications - Wells/ Water Supplies 1967-76.
2/19/2/4 Wells and Water Supplies, Hafirs, Dams and other projects 1949-60

Fasher 27/3/12 Personality Sheet Umm Kaddada 1956-60
29/2/7 El Fasher Market Town 1922-38
36/1/2 Umm Kaddada Merkaz Orders 1944-59
42/1/1 Population Statistics Darfur Province Civil population in Darfur 1935-55
42/1/2 Population of El Fasher 1944-55
53/1/3 Province Transport Establishment and Replacement 1946-48
2/53/3/8 Transport Regulations 1934-52
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Fig.1. Average Annual Rainfall Over Western Sudan in(mm) (1951-1980)

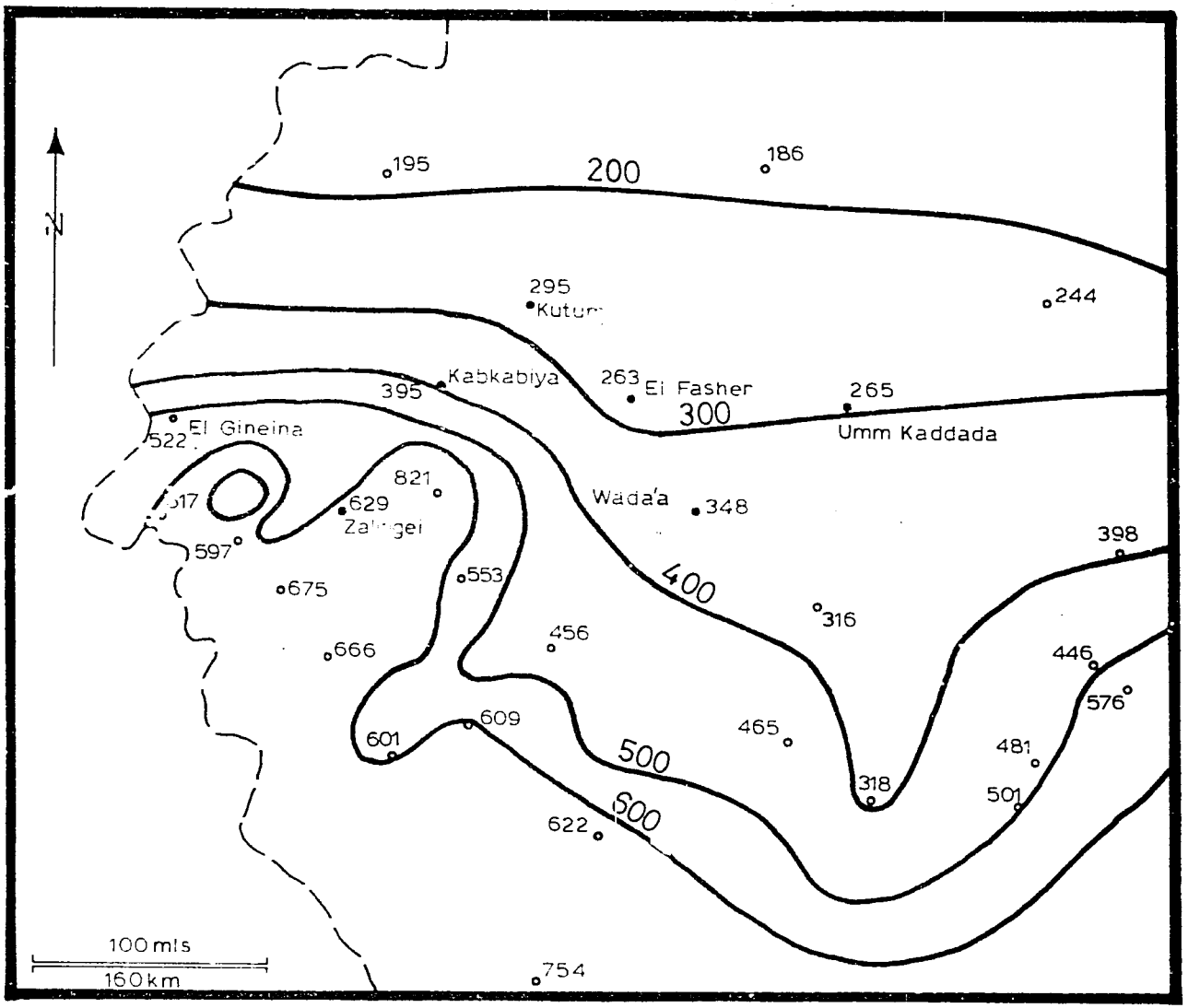


Fig.(2)

UMM KEDADA RAIN GAUGE YEAR-BY-YEAR DEVIATIONS OF RAINFALL FROM THE MEAN

(1945—1979)

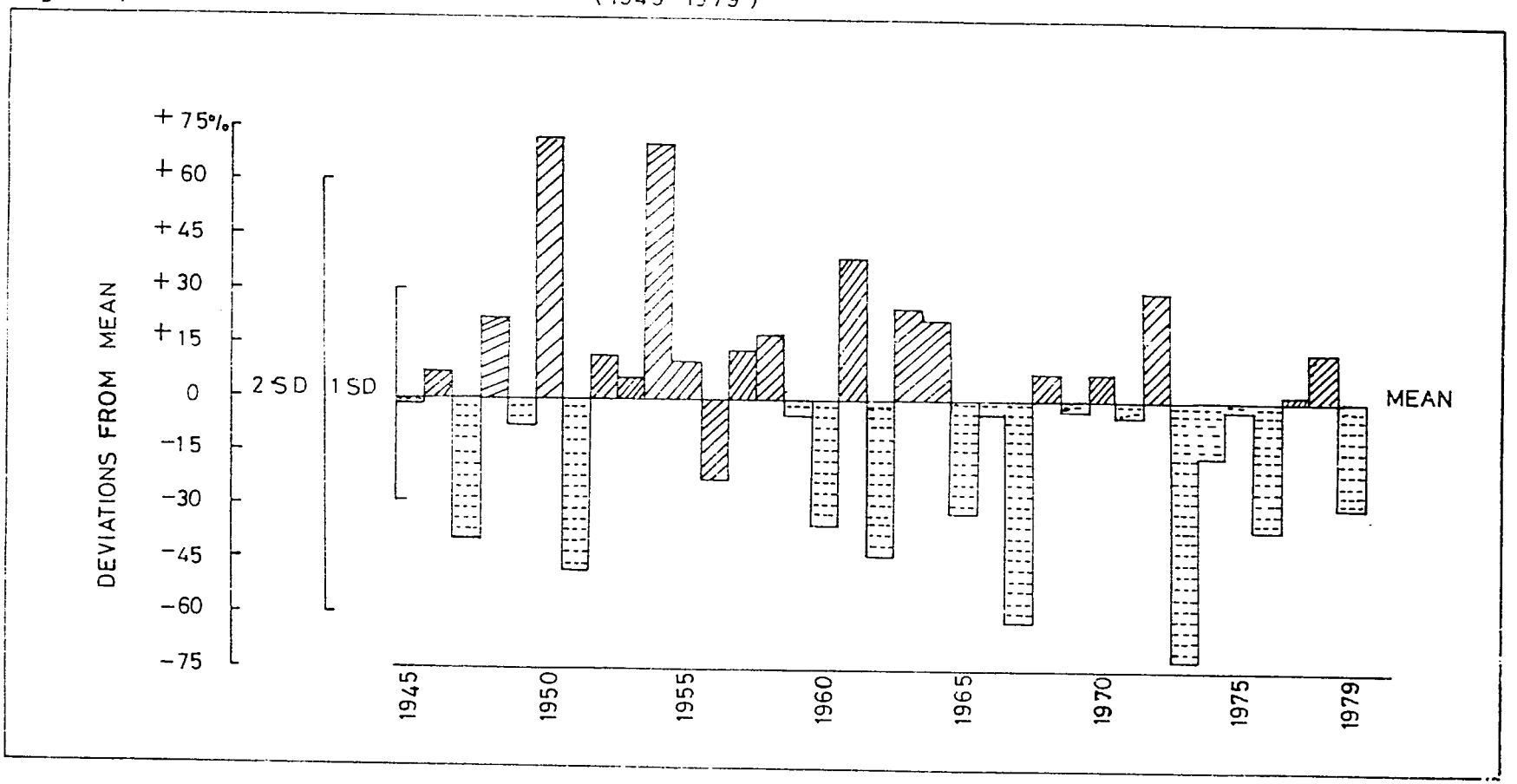


FIG.(3) MONTHLY RAINFALL OVER UMM KEDADA DISTRICT (1951–80)

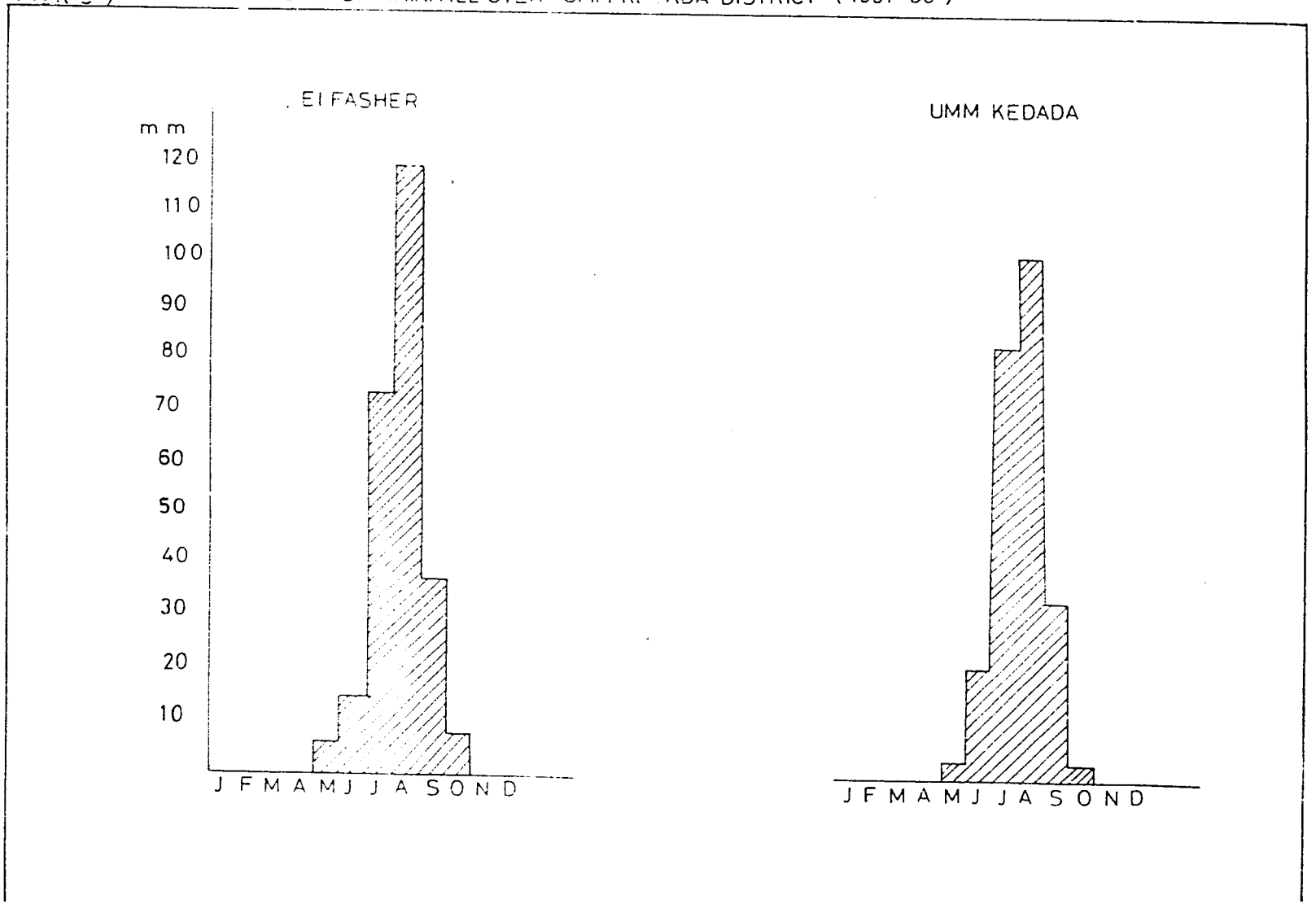


Fig. 1

NORTHERN DARFUR: INFRASTRUCTURE

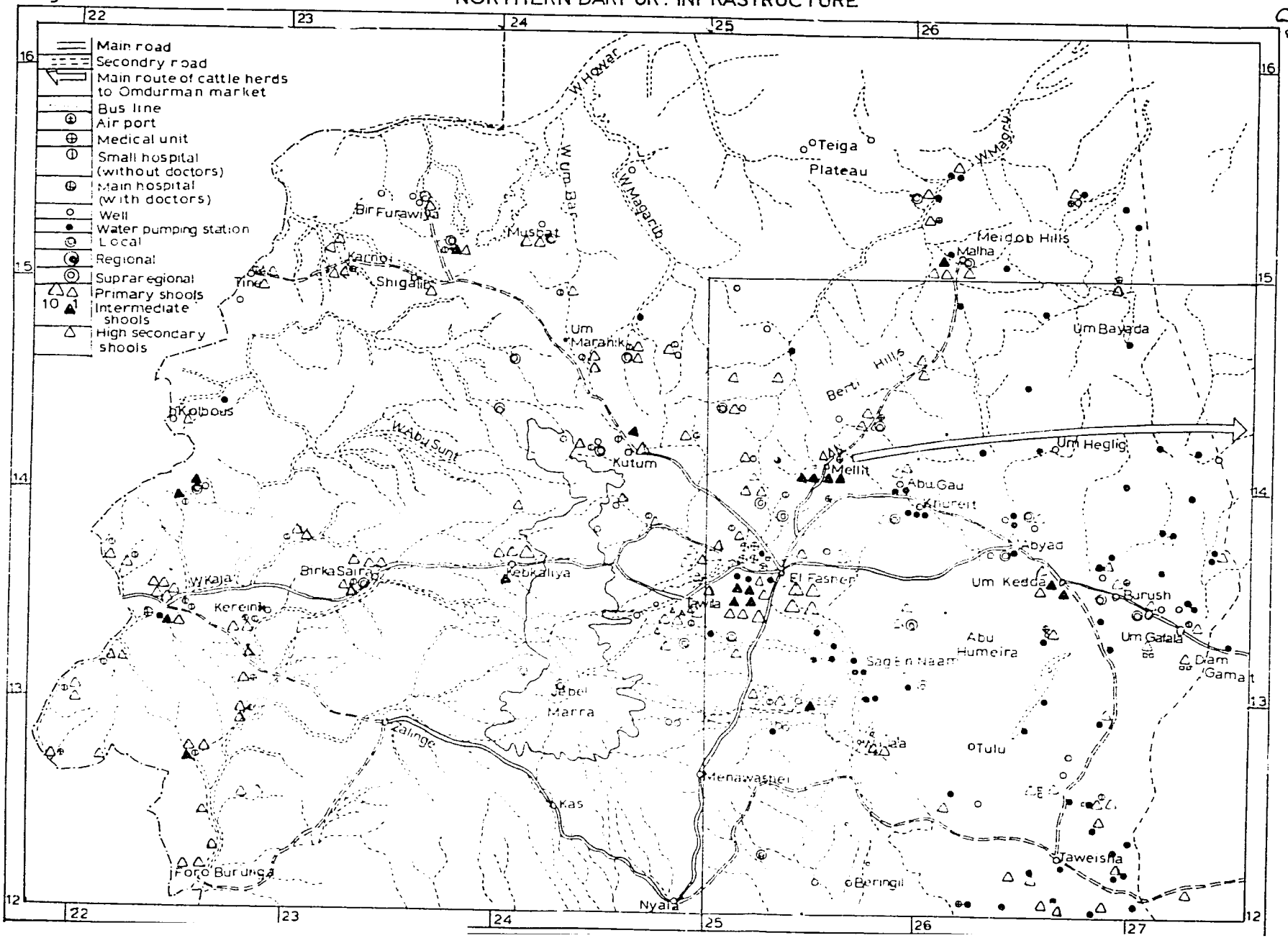
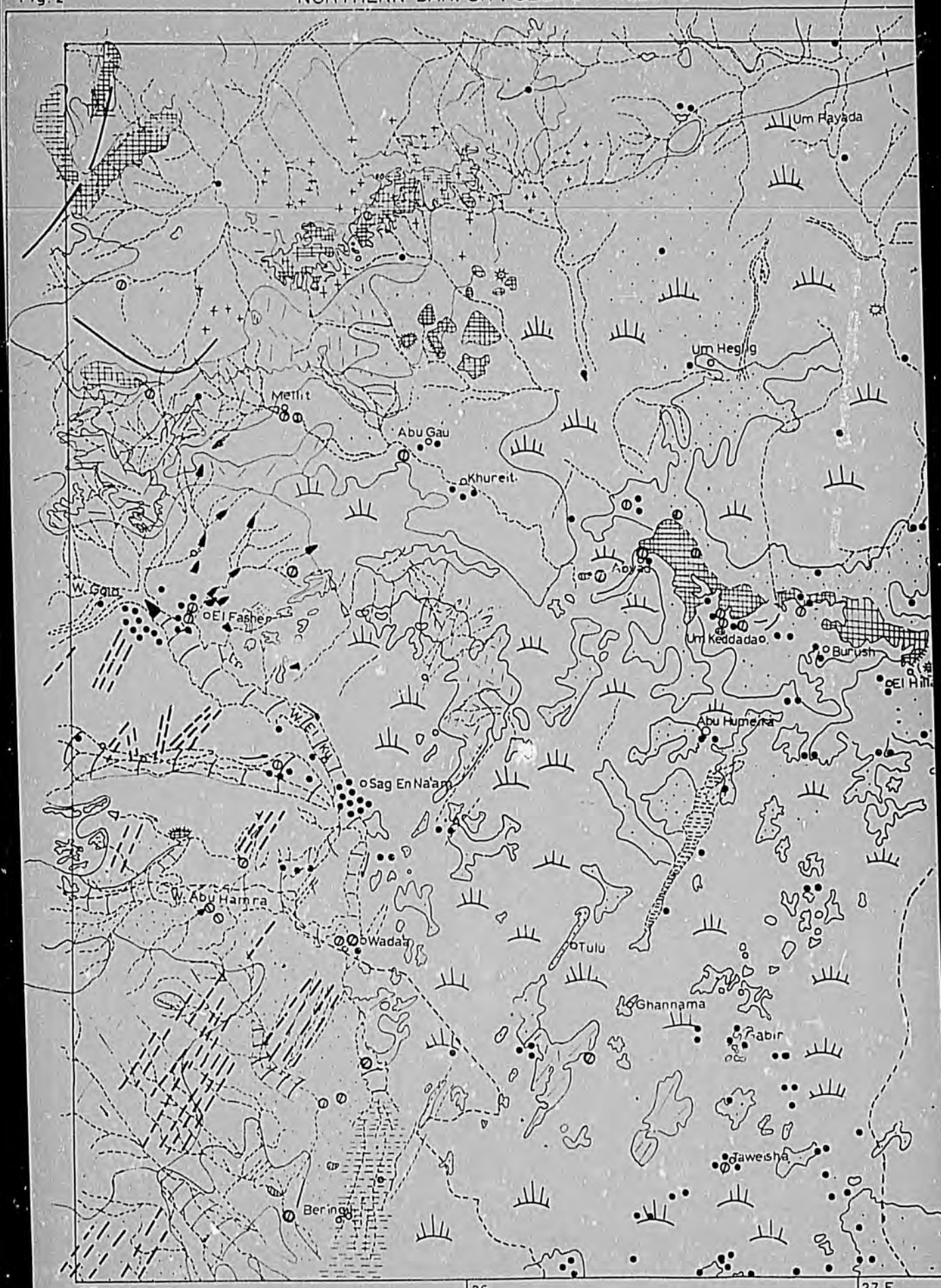


Fig. 2

NORTHERN DARFUR : GEOMORPHOLOGY



SOURCE : Fouad Ibrahim 1979

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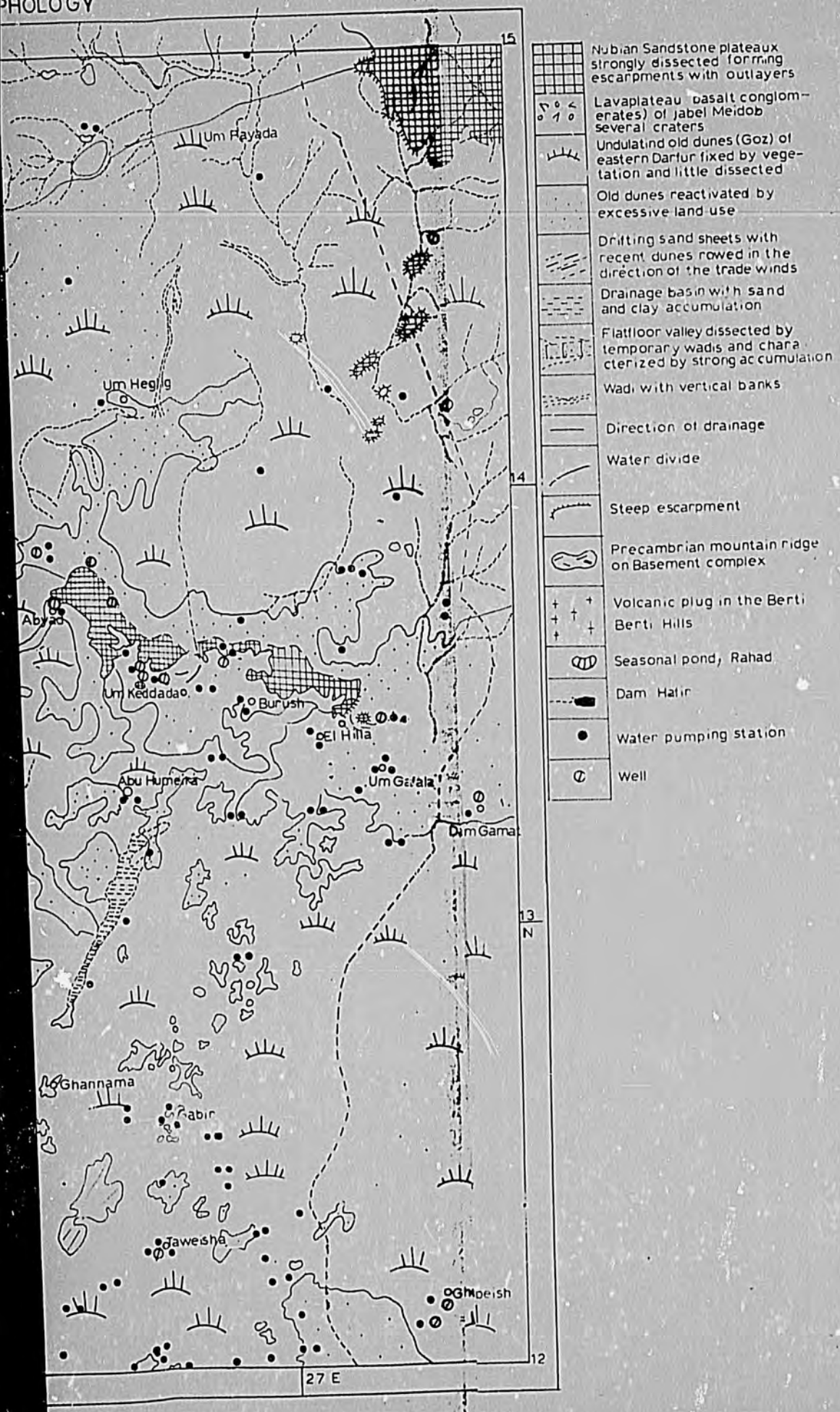
PHOLOGY



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Um Rayada
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Abyad
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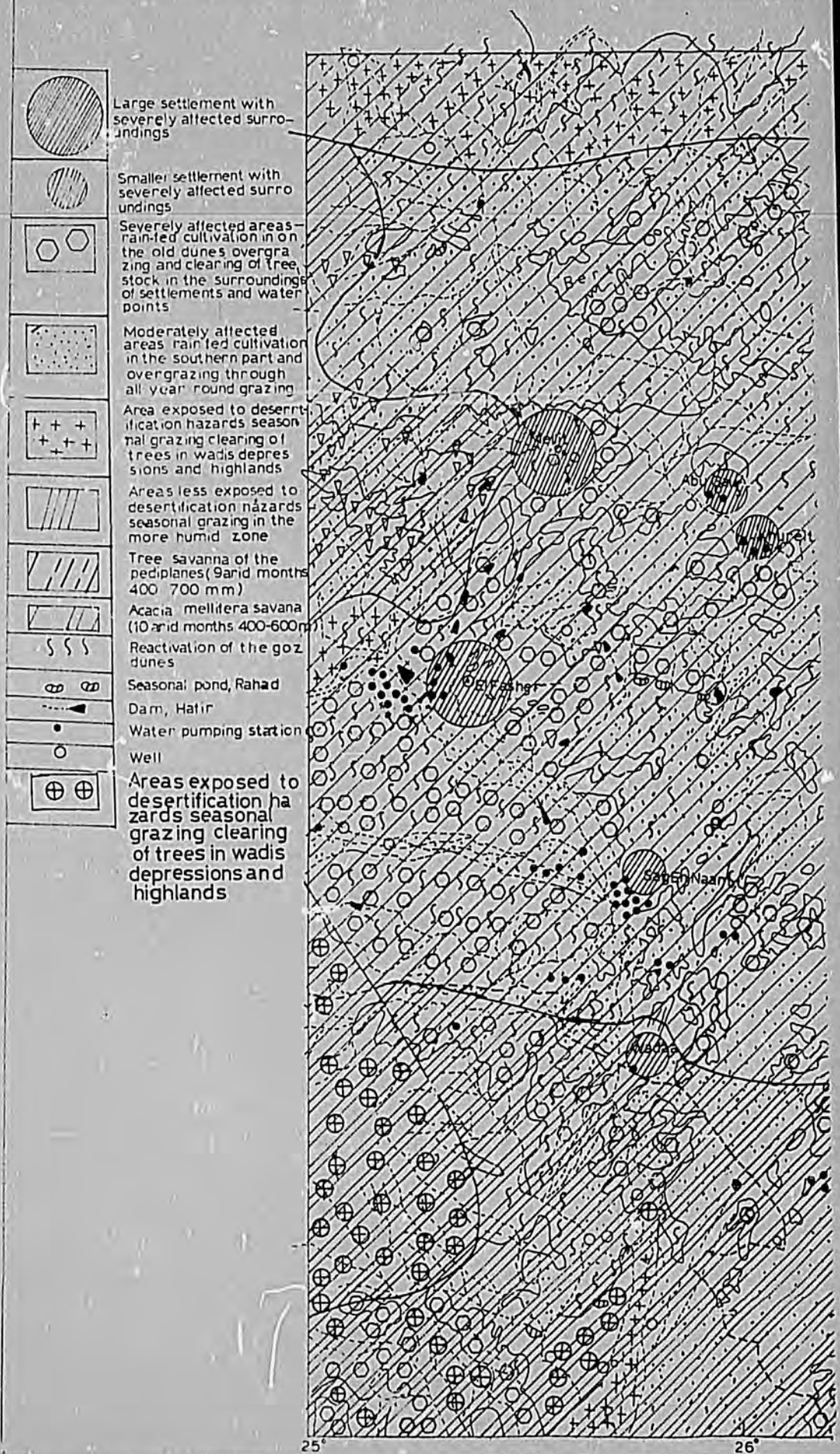
Burush
El Hilla
Abu Humeira
Um Gafala
Dam Gamat
Ghannama
Gabir
Taweisha
Ghbeish
Nubian Sandstone plateaux strongly dissected forming escarpments with outlayers
Lavaplateau basalt conglomerates) of jabel Meidob several craters
Undulatind old dunes (Goz) of eastern Darfur fixed by vegetation and little dissected
Old dunes reactivated by excessive land use
Drifting sand sheets with recent dunes rowed in the direction of the trade winds
Drainage basin with sand and clay accumulation
Flatfloor valley dissected by temporary wadis and characterized by strong accumulation
Wadi with vertical banks
Direction of drainage
Water divide
Steep escarpment
Precambrian mountain ridge on Basement complex
Volcanic plug in the Berti Berti Hills
Seasonal pond, Rahad
Dam Hafir
Water pumping station
Well

Fig. 3 NORTHEN DARFUR : DESERTIFICATION

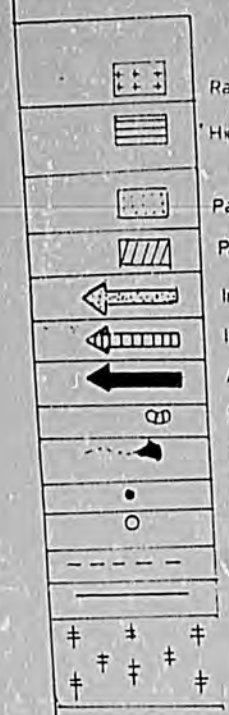


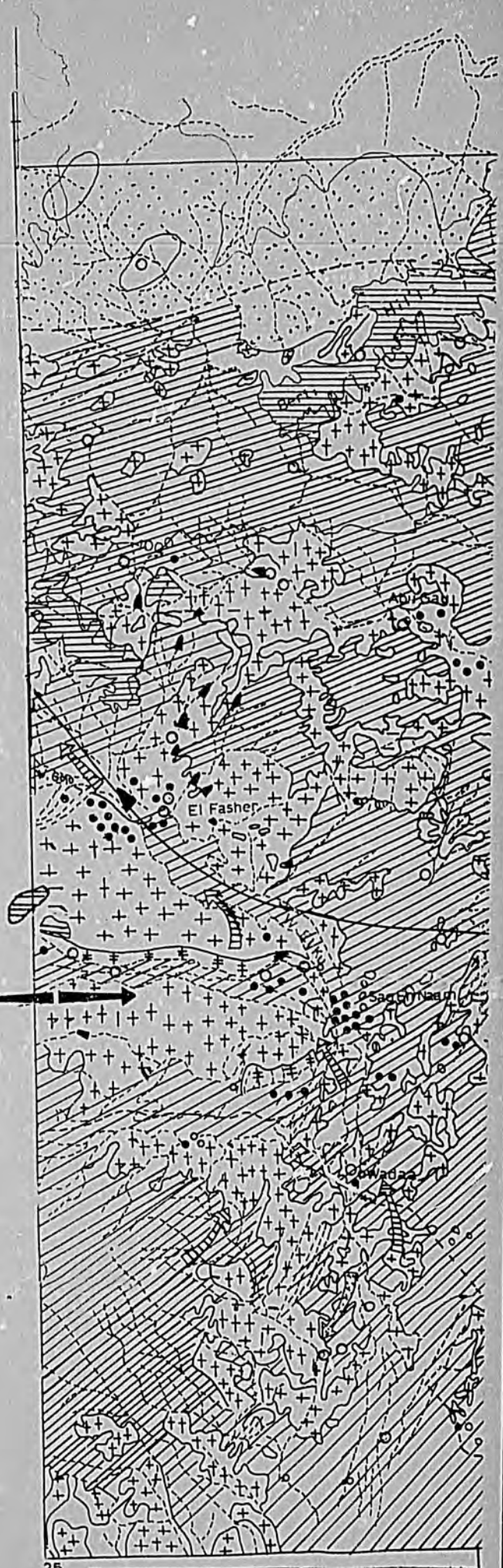
SOURCE : Fouad Ibrahim 1979

R : DESERTIFICATION

Fig. 4

NORTHERN DARFUR: LAND US





SOURCE: Fouad Ibrahim1979

FUR: LAND USE

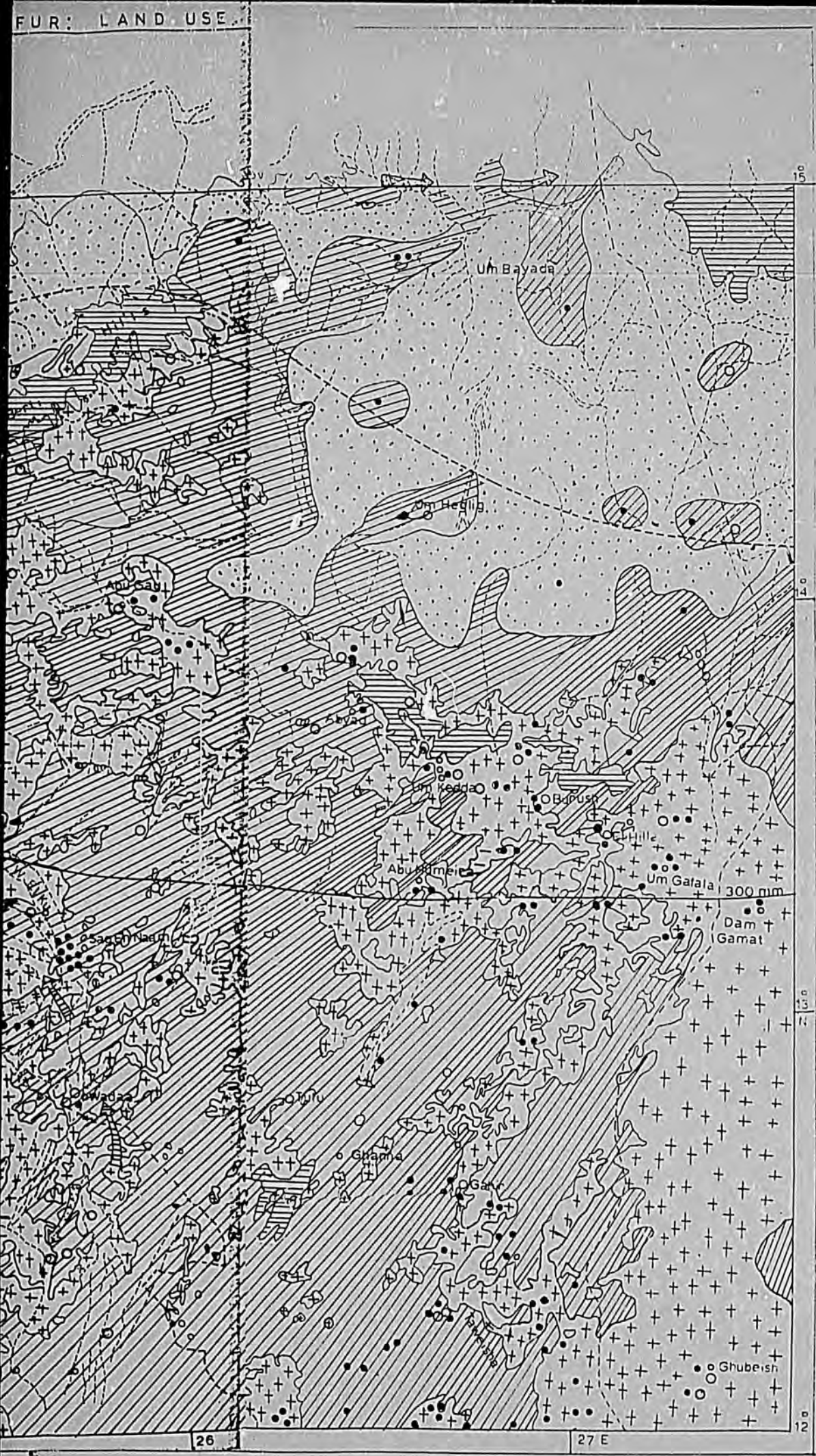


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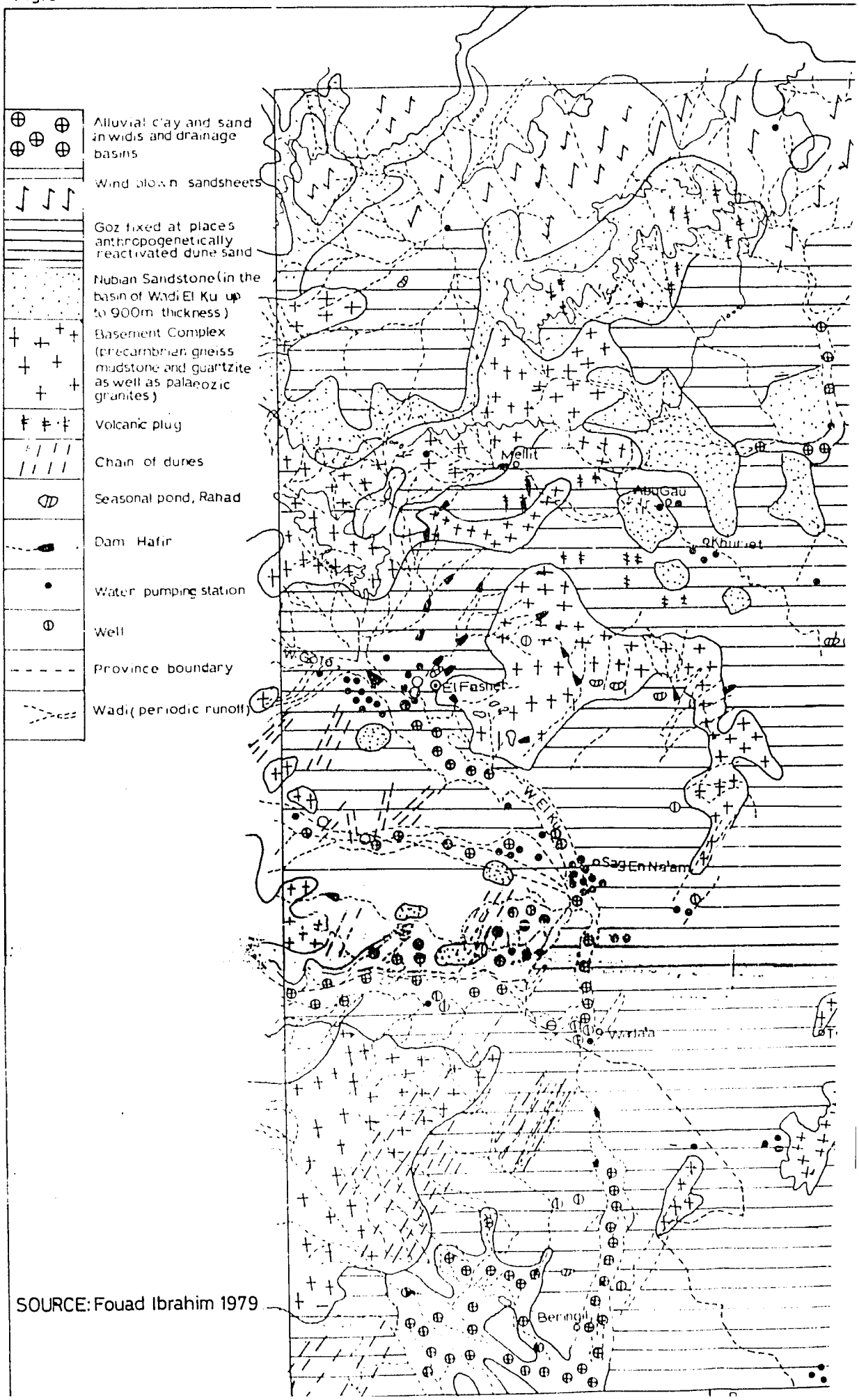
Fig. 5

NORTHERN DARFUR: HYDROGEOIOGIC



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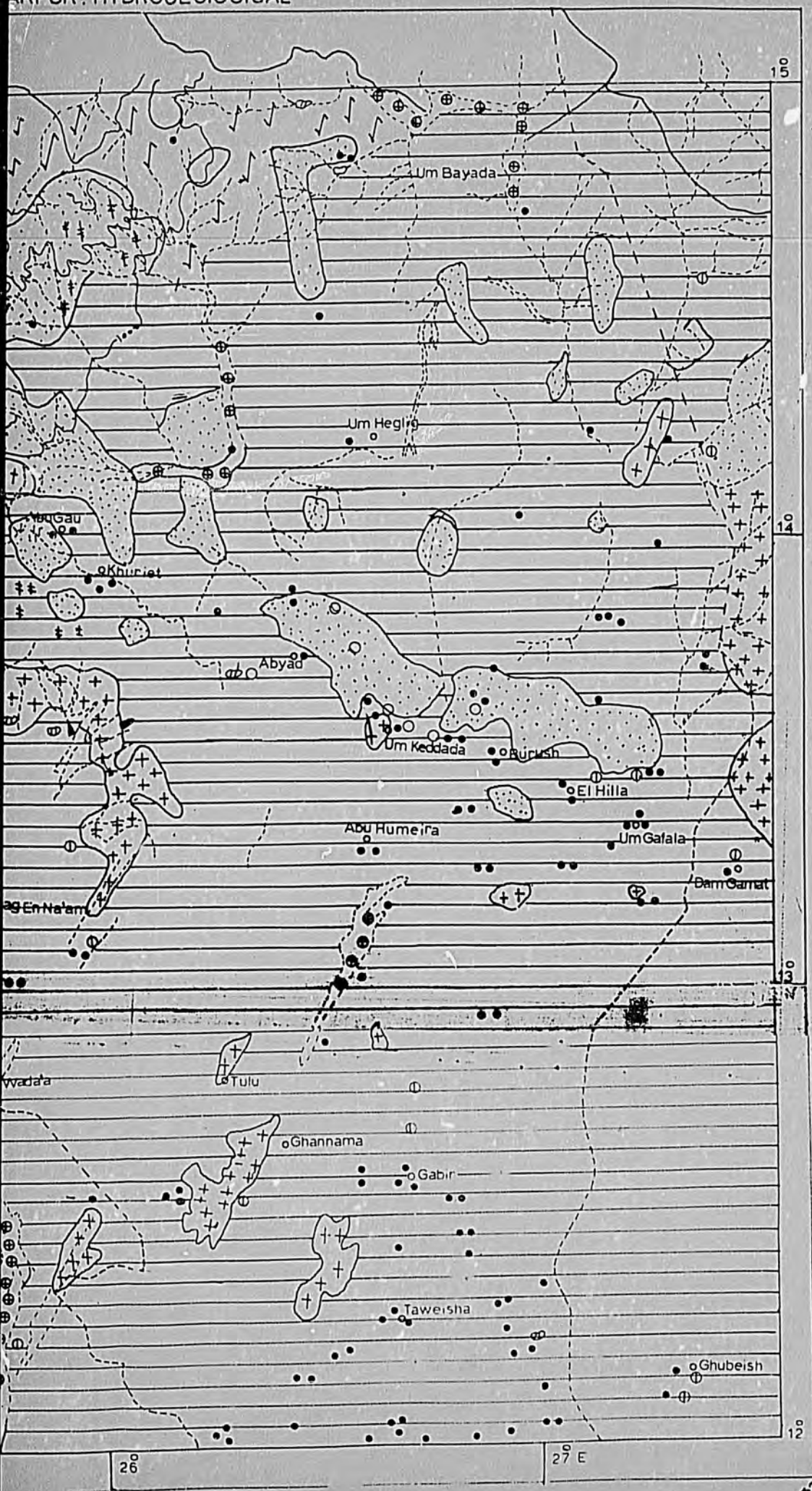
ARFUR: HYDROGEOIOGICAL