

Principal motorable roads:
 ——— all season
 - - - - seasonal

Steamer services:
 ——— all season
 - - - - seasonal

Railways:
 ———

200 miles
 300 kms.

THE REPUBLIC OF THE SUDAN

THE REPUBLIC OF THE SUDAN

A Regional Geography

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Lecturer in Geography, University College, London

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PREFACE

The Republic of the Sudan is an attempt to gather together the findings of the many scientists and other scholars who have worked in Sudan during the last half century, and to consider the light which they throw on such topics as the distribution of settlement, regional variations in agriculture and animal husbandry, and the gradual spread of a cash economy throughout Sudan. For many areas I have tried to supplement the written sources by personal observation and enquiry, but in so large a country it is inevitable that even a life-time would not be sufficient to ensure that no important topics or areas have been omitted through 'sheer ignorance'.

It is hoped that the result will be of use not only to those who are looking for background material on Sudan as a whole, but also in schools and colleges within the country, to give the young Sudanese an insight into the variety, charm and excitement of the land in which they have the good fortune to live. If one result of the publication of *The Republic of the Sudan* is to provoke Sudanese scholars to carry out their own investigations, so as to confirm or correct the statements here made, it will give me and my wife the satisfaction of knowing that our long labour has been worth while.

My thanks are due to the many persons who have helped me to write this book: to Lewis Wilcher, former Principal of the University College of Khartoum, for all the help that I received from the college authorities while I was working in Khartoum, enabling me to travel very extensively throughout Sudan; to Professors Robert Steel and John Lebon for their encouragement, and for their advice in planning the work; to the very many Sudan Government officials, both British and Sudanese, who have freely given me information and advice, particularly E. F. Agien, A. J. Arkell, Sir Gawain Bell, P. Broadbent, A. W. Chalmers, D. F. Hawley, K. D. D. Henderson, T. R. H. Owen, A. Paul, and A. B. Theobald and to the late Saad ed Din Fawzi, H. A. W. Morrice and W. P. G. Thomson; to many other inhabitants of Sudan, who have answered the questions I have put to them; and especially to those colleagues, both in the University of Khartoum and in University College, London, who have taken great pains in reading chapters and in making suggestions.

The maps were drawn in the Cartographic Office of the Department of Geography in University College, London. To R. Versey, J. Bryant, R. Geary, K. Wass and M. Watts I owe a great debt for their advice, skill and forbearance.

While this book has been in the course of preparation both the Belgian Congo and the colonies which made up French Equatorial Africa have attained independence. It has nevertheless been decided to employ their former names, not only because they are more widely known than the new ones, but also on account of the confusion that has arisen since both the former Belgian Congo and the former colony of Moyen Congo have adopted the official name of "The Republic of the Congo".

K. M. BARBOUR

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THE REPUBLIC OF THE SUDAN

A POLITICAL AND HISTORICAL
OUTLINE*The Political Status of the Republic of the
Sudan*

SUDAN became an independent state on 1st January 1956, with the full official title of The Republic of the Sudan. Politically the country is the largest independent state in Africa, with an area of almost two and a half million square kilometres; geographically it is but part of the great belt, also known as Sudan, which stretches across Africa roughly at the same latitude from Ethiopia as far as the Atlantic Ocean some 6,000 km. (c. 4,000 miles) away. The name by which both the smaller and the larger regions are known is a contraction of the Arabic expression *Bilād es Sudan*, 'The Lands of the Blacks', and refers to the fact that it was at these latitudes that the Arabs came in contact with the negro peoples of Africa when they penetrated the continent.

From 1898 to 1955 the country now styled Sudan was known as the Anglo-Egyptian Sudan, and its form of government was officially described as a Condominium. Supreme authority was vested in a Governor-General, who was responsible to both the Egyptian and British Governments for the good administration of the country. In practice, the Governor-General was invariably British, and power was vested almost entirely in British hands, though the Egyptian connection had the effect of modifying British freedom of action in various ways. The special status of Sudan was of importance for its effect on many questions, including boundary settlements, the nationality of the Sudanese, consular representation, the immigration and customs regulations between Egypt and Sudan, the allocation of Nile waters between the two countries, and eventually the development of political institutions as the Sudanese approached self-government and independence.

This peculiar situation, which distinguished Sudan from any of Britain's other African dependencies, stemmed from Egypt's connection with Sudan and Britain's involvement in Egypt during the course of the nineteenth century. A second peculiarity of Sudan is that it is made up, even more than most arbitrarily delimited territories in Africa, of several very distinct elements. While the north is held together by the Arabic language, the Muslim faith, and a sense of sharing in the Arab heritage, the inhabitants of the south consist of members of many negroid tribes, speaking many tongues and professing many beliefs; they have little unity among themselves, and virtually no affinity with the north at all.

In these circumstances a brief historical introduction may be of interest and value, to show how two regions so dissimilar as northern and southern Sudan came to be included within the same state, and how two powers so unequal in strength as Britain and Egypt came to share the responsibility for Sudan's administration.

*The Egyptian and British Connections with
Sudan*

Modern Egyptian interest in Sudan began in 1821, when Muhammad Ali, who had newly made himself master of Egypt, sent forces under his son, Ismail, to invade Sudan. His main motive appears to have been to establish an empire for the sake of the revenues that he could draw from it, whether in gold or in slaves to serve in his armies. In due course an administration was set up with its capital at Khartoum and garrisons at, amongst other places, Kassala, Gedaref and Suakin in the east, El Obeid (and later El Fasher) in the west, and Fashoda and Gondokoro in the south. This administration, generally called the Turkiya, introduced a steamer service on the Nile, started to lay a railway southwards along the

river from Wadi Halfa, established telegraphic communication between Cairo and Khartoum, and began some slight agricultural development in the deltas in the east.¹

The lack of effective control from Cairo, however, combined with the low calibre of many of the Egyptian officials, led to many abuses in the administration. The exaction of taxes from the inhabitants of the country was accompanied by considerable severity, and even after the Khedive of Egypt had in 1857 declared the abolition of slavery in his dominions, officials continued to connive at, and even to take part in, the trade in slaves drawn from the negro areas in the south. This slave raiding led the southern tribes to regard both the Egyptians and the slave traders from northern Sudan with intense hostility, while particularly in the west the sturdy Arab tribes came to despise and hate the Turks, as almost all foreigners were called indiscriminately because Egypt was still nominally a part of the Ottoman Empire.

In 1881 discontent with Egyptian rule culminated in a revolt instigated by Muhammad Ahmad, a native of Dongola and a man of great piety, who declared himself to be the Mahdi or Divine Guide to Salvation summoned by God to establish the kingdom of God on earth. By this time the British had established themselves in a dominating position in Egypt, but under Gladstone's administration they had no interest in extending British rule up the Nile. When, therefore, it became apparent that the Egyptians had not the strength to crush the Sudanese revolt, the British refused to come to their rescue and dispatched General Gordon to Khartoum, charged with the responsibility of evacuating the Egyptian garrisons. As it turned out, even the forces required for a successful and orderly evacuation were not available, and Gordon never attempted to carry out his instructions. By January in 1885 Khartoum had been besieged and captured, Gordon had been killed, and the whole of Sudan, with the exception of Wadi Halfa and Suakin, in due course fell into the hands of the rebels. These latter established an administration, usually referred to as the Mahdiya, with its capital at Omdurman. This

was the first independent Sudanese government of what is now Sudan.

It thus came about that just at the time of the 1885 Conference of Berlin, when the whole of the African continent was in the process of being partitioned into spheres of interest between the powers of Europe, Sudan became independent of foreign control. On the Mahdi's death in 1885, his successor, the Khalifa 'Abd Allāhi, made himself undisputed master of the country. He set up a fanatically Muslim régime which was equally hostile to all foreigners, whether Christians or 'heretical' Muslims, and rejected all civilized contact with the outside world, even attempting unsuccessfully to conquer Egypt and Ethiopia. Pilgrimage to Mecca was declared unnecessary, Omdurman and the tomb of the Mahdi being held to be sufficient for the faithful.

It was not to be expected that Sudan's independence would long be respected by all the powers of Europe. By 1894 the French reached the Bahr el Ghazal area from the west, and entered into negotiations with the Ethiopians concerning an expedition which was to cross the continent from west to east; at the same time the Belgians crossed the Nile-Congo watershed, previously regarded as the limit of Egypt's dominions, and reached the Nile.

Simultaneously the Italians were trying to enlarge their sphere of interest in Eritrea, and so in 1894 Britain decided that the time had come to put a stop to these encroachments and to assure the security of Egypt's southern frontier by reconquering Sudan. This was made the more important by the fact that during their period of rule in Egypt the British had initiated a number of irrigation schemes in the country, and so were anxious to ensure the uninterrupted flow of the Nile. In the interest of economy and to allay Egyptian fears, the reconquest of Sudan was carried out from Egypt, use being made of units of both the British and Egyptian armies under the leadership of Sir Herbert Kitchener.

The campaign of reconquest was well planned, and despite the fanatical and courageous opposition of the Khalifa's armies was steadily brought to a successful conclusion. In 1896 Dongola was recaptured after a march

¹ R. L. Hill, *Egypt in the Sudan, 1820-1881*, 1959.

¹ This of the Int of the Inc Britain a edition, r
² In ad Michael's reference

up the Nile and a battle at Karkah near Akasha. In 1898 a body of troops was sent round the loop of the Nile as far as Abu Hamad, while a major effort was being devoted to the construction of a railway line across the desert from Wadi Halfa to the same point. This might well have proved impossible of achievement had water not been found by boring wells half-way across. Battles were fought at Abu Hamad, beside the River Atbara, and finally at Kerreri, otherwise known as the Battle of Omdurman, on 2nd September 1898. These virtually concluded the campaign.

The expedition had come none too soon, for on proceeding farther south from Khartoum by steamer Kitchener found that a small French force had just established itself on the White Nile at Fashoda, while the Belgians had already acquired by lease temporary rights to an extensive area on the west bank of the Nile within what is now Equatoria.¹

Both these places had formerly been regarded as quite definitely parts of the Khedive's dominions. By vigorous diplomatic representations it proved possible to maintain the argument that Sudan had never ceased to be part of the Egyptian Empire, and so the two powers were persuaded, not without protest, to forgo their claims to any parts of Sudan. The French retreated at once, and the Belgians surrendered the Lado-enclave as part of a general Anglo-Belgian settlement in 1904.

An important consequence of the intervention of these two powers was that having persuaded them to retreat, Britain was precluded from paying heed to the realities of power in Sudan by establishing a régime in the country that should be dependent on Britain alone. It soon became evident, moreover, that at least at first considerable expendi-

ture would be required to pay for the administration and garrisoning of Sudan. For both political and financial reasons, therefore, no attempt was made by Britain to annexe Sudan outright.

Instead it was decided to create a new form of government, a condominium, wherein the British and Egyptian flags would be flown side by side. Officials to administer the country were to be recruited from both Britain and Egypt, but ultimate power remained in British hands, since Britain was at that time in virtual control of Egypt. Supreme military and civil command in the Sudan was vested in one officer, the Governor-General, who was to be appointed by Khedivial decree, on the recommendation of the British Government. As a result of this decision, the country was henceforth known as the Anglo-Egyptian Sudan until it attained independence, but even when the British ceased to rule in Egypt, and finally evacuated Cairo and the Suez Canal area, the Egyptians never obtained any real power in Sudan.²

The Boundaries of Sudan (Fig. 1)

Sudan as thus constituted is not a wholly arbitrary section of the desert and savannah lands of Africa north of the Equator. It achieves a significant hydrological unity from the fact that it is a large and important part of the Nile Basin, containing the headwaters of the Bahr el Ghazal drainage system in the south-west and approximately the whole of the Blue and White Nile systems below the plateaux where they have their origins.

The boundaries of the country are very varied: in some parts they have been carefully surveyed and demarcated, in others they lie in wholly unsurveyed regions; in some in-

¹ This lease had been granted under 'Agreement between Great Britain and His Majesty King Leopold II, Sovereign of the Independent State of the Congo, etc. . . ' 12th May 1894. It was subsequently annulled by 'Agreement between Great Britain and the Independent State of the Congo . . . ' 9th May 1906. See E. Hertslot, *The Map of Africa by Treaty*, 3rd edition, 1909, pp. 578 and 584.

² In addition to the works cited in R. L. Hill's *Bibliography of the Anglo-Egyptian Sudan*, 1939, among which H. MacMichael's *The Anglo-Egyptian Sudan*, 1934, is of particular value for the history of the early years of British rule in Sudan, reference may be made to the following more recent political and historical studies:

- A. B. Theobald, *The Mahdīa*, 1951.
- M. Abbas, *The Sudan Question*, 1952.
- J. S. R. Duncan, *The Sudan, a Record of Achievement*, 1952.
- M. Shibeika, *British Policy in the Sudan, 1882-1902*, 1952.
- J. Marlowe, *Anglo-Egyptian Relations, 1800-1953*, 1954.
- A. J. Arkell, *A History of the Sudan to 1821*, 1955.
- J. S. R. Duncan, *The Sudan's Path to Independence*, 1957.
- M. A. Nigumi, *A Great Trusteeship*, 1957.
- F. M. Holt, *The Mahdist State in the Sudan, 1881-1898*, 1958.
- R. L. Hill, *Egypt in the Sudan, 1820-1881*, 1959.

stances they pass through unpopulated or desert country, in others they bisect the territories occupied by individual tribes and have very little significance for the peoples who live beside them.

The one disputed boundary at the time of writing is that with Egypt. The issue is whether, as the Egyptians contend, this should follow parallel 22° N. precisely, as was originally laid down in 1899 in the Agreement for the Administration of Sudan, or whether, as the Sudanese claim, it should follow the *de facto* administrative boundary between the two countries, which was negotiated subsequently so as to include within Sudan two small areas to the north of the parallel and to include in Egypt a lesser area to the south of it.

In fact, two rather distinct problems are involved. The disputed land along the Nile is inhabited by Nubians of the central or Mahaspeaking group, and whether the boundary runs along the 22nd parallel or farther to the north it will still divide villages whose inhabitants speak the same language and are culturally identical. In the east, the administrative boundary was specifically altered so as to include all the territory of the Arabic-speaking 'Ababda tribe in Egypt, and that of the Beja Bisharin in Sudan.

The dispute underlines the fact that along the Nile there is no ethnic division or natural physical break to afford an obvious boundary between Egypt and Sudan, since throughout the river's length there has been a continuous belt of settlement for many centuries. Since the building of the Aswan Dam, it may reasonably be argued that the lands flooded by the reservoir constitute the most sensible frontier to adopt today. When the High Dam is built, the uninhabitable strip will be made much longer, but the same principle could be observed. In the west the complete absence of population makes the boundary's location immaterial; in the east a few nomads are to be found all the way through the Red Sea hills, and the line between the Arabic and the Tu Bedawie speakers is a logical one to follow.

To the east of Sudan the precise location of the Sudan-Eritrean frontier, where it crosses the Red Sea hills, could be disputed, since the Beni 'Amer tribe is split between Sudan and

Eritrea, and certain sections in fact move across the boundary in their annual migrations. In general, however, it can be regarded as a satisfactory division between the speakers of Tu Bedawie (the Beja) in Sudan and the Tigré speakers in Eritrea, while physically it may be noticed that the Eritrean plateau is considerably higher than the Red Sea hills.

Slightly farther south on the eastern side lies the land frontier of Sudan which most closely corresponds with a change in physical conditions, namely the Sudan-Ethiopian boundary at the foot of the Ethiopian Plateau. Across this line there has been an astonishing lack of movement of ideas or commodities, so that even when within a few score miles of the border one finds virtually no traces of an alien culture but feels rather that one has come to the end of the world, beyond which a high wall has been erected to prevent further circulation. While there is a motorable road between Kassala and Asmara in Eritrea which carries some traffic, the escarpment between the Lake Tana Plateau and Sudan is of great steepness and difficulty, and the gorge of the Blue Nile, here known as the Abai, is far too deeply incised to permit of its use as a route. Farther to the south, on the upper waters of the Sobat River, there is an anomalous situation where the frontier runs out on to the plain: the Anuak tribe is thus divided, and from 1902 to 1957 the Sudanese leased a trading-post at Gambela within Ethiopian territory.

This arrangement, in fact, draws attention to the validity of the boundary with Ethiopia as a whole. The difficulties of administration along the frontier are great, and the opportunities of evading punishment for offences are many. In consequence, the country on both sides of the border is very thinly populated for fear of cattle thieves and robbers, and the large Dinder Game Reserve was set up in virtually uninhabited country.

In southern Sudan there is no such obvious physical line for the boundaries with Kenya, Uganda or the Belgian Congo to follow. On the right bank of the Nile the boundary is drawn to include the whole of the Imatong, Dongatona and Didinga hill masses within Sudan, but in the extreme south-east it follows astronomical lines which bear no relation to

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physical features or tribal areas. Investigations of the origins of the Nilotic and Nilo-Hamitic tribes suggest that this has been a zone of movement and migration of considerable importance from time to time, and it can be regarded only as an accident of history that the fortunes of those tribes living north of the boundary have been linked with Sudan rather than with the tribes that live just to the south of them. In fact the Acholi tribe, a branch of the Nilotes, is divided by the boundary just east of the Nile, so that there is a small portion living in Sudan and another larger portion in Uganda. Farther east certain sections of the Turkana tribe periodically cross over from Kenya into Sudan, and so for administrative purposes the officials of the Northern Province of Kenya are permitted to enter a small part of Sudan known as the Ilemi triangle, though there has been no question of ceding any Sudanese territory.

On the west bank of the Nile the frontier again pays little heed to the convenience of the inhabitants of the area, for by treaty it was settled that it should follow the watershed of the Nile and Congo drainage systems. In this way almost every tribe of the area has been divided, since the topography is for the most part such as to favour settlement along the watersheds rather than beside the rivers. The most flagrant example of this is the division of the large Zande tribe, which in 1953 was estimated to have 230,000 members in Sudan, 520,000 members in the Belgian Congo, and 20,000 in French Equatorial Africa.¹

It cannot be denied that in the early days of the administration of southern Sudan the division of tribes in this way held certain, perhaps unforeseen, advantages, since members of a single tribe were unlikely to be at war with one another, and this meant that the number of incidents that might involve international difficulties was reduced. Today, however, the much greater range of governmental activities is having the effect of turning tribesmen into citizens. While some of the Azande are being introduced to the outside world by way of English and Arabic and may become converts to Christianity or to Islam, others are learning French, perhaps becoming Christians of a

different communion, and beginning to play their part in political institutions established by the Belgians or the French. It remains to be seen whether, as they become politically conscious, they will be content to be divided, or whether they will demand that Zandeland be reunited.

Beyond the Zande area to the north and west the country is virtually unpopulated. Unless the copper deposits of Hofrat en Nahās should prove to be much more economically important than it is at present believed, it seems likely that this frontier of Sudan will prove as unimportant and as untroubled in the future as it has been in the past.

Once the Ironstone Plateau is left, at latitude 10° N., this frontier quite changes its character, for with the decline in rainfall the country becomes more open and tsetse flies no longer hinder animal movements. The frontier between Sudan and French Equatorial Africa follows a number of watercourses, which constitute the principal zones of settlement, and is crossed regularly by various cattle-owning tribes in their annual migrations. The Ta'āisha, for instance, are generally regarded as a Sudanese tribe, but many of their members find they have to pay taxes both to the French and to the Sudanese authorities. There is also a regular movement of pilgrims and migrant labourers across this frontier. While vaccination and other frontier formalities can be carried out if the main road from Abéché is used, it is virtually impossible to check smuggling and illegal entries.

Of the ancient negro sultanates of the great Sudan belt at this latitude, Darfur was included in Sudan because of Zubeir Pasha's conquest of the sultanate in 1875 on behalf of the Egyptian Government. Dar Masalit was for many years a bone of contention between the more powerful sultanates of Darfur and Wadai, and was assigned to Sudan by the Anglo-French Convention of 1919; the same is true of the smaller Dar Gimr which now forms the northern part of Dar Masalit.

In northern Darfur the tribes pay little heed to the frontier in their migrations. There are sections of the Zaghawa on either side, and the Goran and Bedeyat frequently cross into

¹ P. T. W. Baxter and A. Butt, *The Azande*, Ethnographical Survey of Africa, 1953.

Sudan from the French territory to which they belong. The prized *jizzu* grazing of this latitude lies on both sides of the frontier, and is visited by tribes from long distances to east and west.

In the extreme north-west of Sudan the boundaries follow astronomical lines through total desert. There is no route into Sudan from this quarter, since the great sand sea of the Libyan Desert seals off all movement save for a few Bedeyat Arabs who are said to visit Selima Oasis from time to time. The one desert trade route starting in Sudan that crosses the Sahara is the Darb el Arba'in, which follows a line of oases and wells from Asyut in Upper Egypt to El Fasher in Darfur; no caravans now use this route.

Sudan as a Modern Afro-Arab State

The boundaries of Sudan are, as we have seen, of many kinds, and across many of them, including the Red Sea, waves of peoples have spread into the country over a long period. An account of the present distribution of the tribes involved is given in Chapter VI. A point that stands out is that it is from the country's northern frontiers that the most significant waves of people and ideas have come, and these in turn have had a far greater effect in the north of the country than in the south. In the former the open terrain, favourable to the movement of men and animals, has permitted the spread of Islam, and the use of Arabic has become general as a lingua franca, though it has not yet become the mother tongue of all the northern tribes.

More recently the most far-reaching importations into Sudan have been Western ideas and the products of Western manufacturing technology. The former may penetrate a country in many ways, of which the British occupation for more than fifty years was clearly the most important; the latter have almost entirely entered via the Nile or the Red Sea. While such influences have been able to pervade the whole country, it is in the north, where education is most advanced and the people are most conscious of their membership of a wider world, that their effect has been greatest.

It has thus come about that northern Sudan may be regarded as culturally a part of the

Middle East. The dominant influences and ideas prevalent in the country, such as the use of Arabic by the great mass of the population, the general practice of Islam which permeates the whole of society and provides a background for almost every event of daily life, the knowledge of a foreign language (in this case English) by every person with a claim to call himself educated: these are features that recur in almost all the countries of the Fertile Crescent. At the same time the influence of Africa is potent, not only in the southern part of Sudan where the people are black, wear few clothes, and worship many gods, but also in the north, where dark skins are far more common than can be explained merely by the purchase of a few negro slaves by former generations, where the unskilled labour force consists of very dark-skinned Nuba, Nilotes, or migrants from the west, and where broad savannahs abound, dotted with the same *Acacias* and baobabs that are features of tropical Africa from Senegal to the Limpopo.

Southern Sudan, in contrast, is truly African, with only a smattering of European or Middle East influences affecting it; these include the government schools and the mission stations, the various government officials who demonstrate modern ideas of administration, agriculture, medicine and other subjects, and the traders and lorry owners who bring manufactured articles in exchange for local produce. While Arabic is now gaining ground, Christianity and English were for many years the bases of the education of those southerners who went beyond the primary schools. The new policy of taking over all schools by the government and making instruction in Arabic compulsory has yet to bear fruit.

THE ADMINISTRATIVE FRAMEWORK

In the chapters below reference is made from time to time to the policies and achievements of the government of Sudan. It may be convenient, therefore, to include a brief note on the nature of the typical tribal organization and on the administrative framework employed to govern the country. The former varies in

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different parts of the country, being of several types in the three southern provinces, where the concept of a tribal leader of a large number of tribesmen is usually lacking. In the north, on the other hand, even the settled peoples are usually found to recognize a hereditary tribal structure of a kind originally developed amongst nomadic Arabs.

The Arab concept is that each individual is a member of a household, where he may be the head or a dependent (women can only be the latter). Each household, whether in a settled village or among a group of nomads, comes under the control of a *sheikh*, who is responsible for collecting taxes and for the maintenance of order. The *sheikh*, in turn, is subordinate to an *'omda*, who may have any number of *sheikhs* beneath him, ranging from ten to forty or more. The *'omda* is in his turn one of several owing allegiance to a tribal leader or *nazir*. The nazirates vary in size; the Kabābish number 105,000, the Hadendowa 218,000, but the Shukriya 55,000 only. If possible it is usually arranged that the limits of a *nazir's* territory shall coincide with those of an administrative district.

The political systems of the southern tribes vary considerably. They differ from those of the north in that they are generally smaller, as is appropriate in country where for one reason or another political unity is hard to establish or maintain over a wide area. Among the Shilluk there is a Reth or generally recognized supreme head, but there is considerable doubt whether he really exercises much influence among the lesser chiefs. Among the Nuer there are Leopard Skin Chiefs who are reckoned to have certain magic powers, but have no authority to settle feuds or to give judgments, and a body of elders in each local community is often called on for leadership and advice.¹ Among the Azande the summit of the pyramid of political power used to be occupied by kings, drawn from the Avungara clan, who would often be at war with one another. Today the highest rank recognized is that of chiefs, whose followers average little more than 10,000.²

The smallest administrative unit to which political officers are posted is the district,

occasionally divided into two or more sub-districts. The largest district, Northern Darfur, has an area of about 250,000 square kilometres, while the smallest rural district, Southern Gezira, is less than 8,000 square kilometres. The range of population of districts is rather less wide, varying from about 300,000 persons in Jur River District in Bahr el Ghazal, Southern Darfur District, or Gedaref District in Kassala Province, to rather less than 50,000 in Tokar (Kassala) or Pibor (Upper Nile Province).

Districts are grouped together into provinces, each with its governor, judge, police force and cadre of officials appointed by the various Ministries of the Central Government according to local needs. The number of provinces in Sudan has varied from time to time, having in general been reduced as communications have been improved. Thus the former Nuba Mountains Province has been incorporated within Kordofan, the old Berber and Dongola Provinces are included in what is now Northern Province, and the former Fung Province is now part of Blue Nile Province. The one exception to this tendency is that for a time Bahr el Ghazal Province was administered with Equatoria from Juba. This proved very inconvenient, and in 1948 the Bahr el Ghazal Province was re-established (Fig. 1).

From the early days of the reconquest the government of the Anglo-Egyptian Sudan always tried to secure the consent and co-operation of the native peoples. This involved making use wherever possible of the traditional tribal structure and employing the methods of indirect rule that had been formulated by Lord Lugard in Nigeria. Such a policy was necessary at first, but later it became evident that with its law courts, health services, veterinary department, and other technical officials the government was gradually taking over the function of leadership formerly performed by the tribal nazirs, and so making them out of date. Though much of the tribal structure still reflected the inclinations of the people, the class of young educated Sudanese which grew up, distinct from the traditional ruling families, resented the old order of things, and felt it to be unjust and undemocratic.

¹ A. Butt, *The Nilotes of the Anglo-Egyptian Sudan and Uganda*, Ethnographical Survey of Africa, 1952.

² Baxter and Butt, *op. cit.*, p. 50.

This led to the gradual creation of a system of local government, intended as a means of associating the Sudanese with the governing of their native towns or rural areas. At first the tribal leaders had *ex officio* positions on the local councils, but later the training in democracy was extended on the basis of the Local Government Ordinance of 1951, whereby local councils have in due course become wholly elected bodies. The Sudanese are showing themselves to be enthusiastic supporters of local government, and already the posts of certain District Commissioners have been suppressed, their functions being performed by the councils. It may well prove that in the creation of local bodies where the individual tribesman has the opportunity of being elected to positions of responsibility the British did more than in any of their other work in the country to transform Sudan.

SOURCES FOR THE STUDY OF THE GEOGRAPHY OF SUDAN

The nature of the published sources

From the point of view of the foreign student of Sudan, one awkward result that must arise in due course from the coming of independence to the country is that Arabic is replacing English as the official language. One day many of the reports and documents which have hitherto appeared in English will no longer be accessible to him unless he has undertaken a lengthy study of this difficult language. The change has not yet proceeded very rapidly, for many Sudanese with a scientific or technical education still prefer to use English for professional purposes.

During the period of British rule almost all the cleverest and most energetic of the Sudanese either took posts in the administration or devoted their energies to politics or law, or, if scientifically inclined, to medicine. Comparatively few were engaged in research in agricultural subjects or other applied sciences. This is why a study of Sudan written at the time when

the country attained political independence has to be based to so large an extent on the work done by foreign, particularly British, officials and scholars. While it is difficult to avoid a suspicion that in their rapid departure in 1954 and 1955 the British carried away, locked up in their heads, a good deal of information that could usefully have been written down and preserved, it is also true that the last few years of British rule saw a wide and valuable range of material about Sudan appear in print.

No separate bibliography is being included in this work, for full bibliographical details are included in the notes to the several chapters, page references being given rather sparingly unless quotations are extracted or controversial matters discussed. Useful bibliographies are to be found in Hill's work, which goes up to 1937 only, but covers historical aspects very fully; in Knight and Boyns' bibliography, *Agricultural Science in the Sudan*, published in 1950, wherein the summaries of important articles are very valuable; in Tothill's *Agriculture in the Sudan*, and in a recent article by Lebon, which critically discusses a number of recent publications of varying accessibility.¹ *Agriculture in the Sudan*, edited by J. D. Tothill, with contributions from twenty-six authors, must be accorded special attention, for it constitutes a mine of information and well illustrates the wide range of topics wherein a steady stream of research is necessary in order to develop the agricultural potentialities of a large country like Sudan. Without such a work the writing of even a tentative regional geography would have proved immensely more difficult, if not impossible.

The Agriculture, Forestry and Irrigation Departments and the Meteorological Service all published a number of valuable bulletins after the Second World War, while just as the British were leaving, two most important publications, the reports of the Jonglei Investigation Team and of the Southern Development Investigation Team, made major contributions to knowledge of southern Sudan.²

¹ R. L. Hill, *A Bibliography of the Anglo-Egyptian Sudan from the Earliest Times to 1937*, 1939; R. L. Knight and B. M. Boyns, *Agricultural Science in the Sudan*, 1950; J. D. Tothill (Ed.), *Agriculture in the Sudan*, 1948; J. H. G. Lebon, 'Recent Contributions to the Geography of the Sudan', *Geographical Review*, 46, 1956.

² *The Equatorial Nile Project*, being the Report of the Jonglei Investigation Team, Khartoum, 1954. *Natural Resources and Development Potential in the Southern Provinces of the Sudan*. A preliminary Report by the Southern Development Investigation Team, Khartoum, 1954.



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Valuable monthly and annual statistical bulletins are published by the Department of Statistics, which has all but brought to a successful conclusion the publication of the results of the First Population Census of Sudan, 1955-6. The appearance of these results within four years of the completion of the enumeration is a noteworthy achievement by any standards, particularly since they are accompanied by a number of maps based upon them.

The Sudan Government is to be congratulated for having shown a far-sighted appreciation of basic research and publication in its support for Tothill's work, as well as in its annual subsidy to *Sudan Notes and Records*, which has long been highly regarded as a journal providing information on anthropological and other subjects about the country. Indeed for the negroid areas of Sudan—the three southern provinces and the Nuba Mountains—the work of the social anthropologists, supported in most instances by public funds, has been of fundamental importance in describing and accounting for many aspects of Sudan's geography. On the other hand, it must be recorded that the government was ill-advised in failing to establish a central printing and publishing organization, whereby all annual reports, bulletins and other publications issued by the different government departments might be recorded and offered for sale. There has been no copyright law, moreover, nor provision for the deposition of one or more copies of every work published in the country; in consequence, many valuable works produced in the country are not to be found in the library of the University of Khartoum.

The Mapping of Sudan

The mapping of Sudan is very varied in quality. Single sheet-maps of the whole country have been produced by the Sudan Surveys Department at scales of 1:8,000,000 and 1:4,000,000, and these have been used as the base maps for a number of special sheets dealing with the geology, vegetation, climate, fauna, and other features of the country. There is also a three-sheet series at 1:2,000,000, which includes a very handsome relief map with layer colouring, and a number of special-

ized maps to show the distribution of tribes, the former parliamentary constituencies, the unit areas employed in the recent census, and similar distributions. Because these three series are used with a wide range of overprints, the number of place-names shown upon them is limited; in consequence, the most useful map for general reference purposes is still the 1:3,000,000 sheet produced by the Geographical Section of the British General Staff. It was first published in 1928. At larger scales there are 1:1,000,000 sheets available on the projection and grid of the International Million Series, but these do not convey very much more information than the 1:3,000,000 sheet.

The largest scale for which maps are available for the whole country is 1:250,000. The country is covered by a total of 172 sheets, most of which are printed in three or four colours, though certain desert areas are printed in black only. The framework on which these maps are based varies from chains of first and second order triangulation, following the 30th arc of meridian and the Nile and running across from Khartoum to Kassala, to very rapid reconnaissance triangulation, astro fixes, or traverses carried out by officers of the Survey Department during the last fifty years. These cover most of the country, but in parts of it there is still virtually no proper survey framework at all. The detail is quite reliable along the Nile, and in other areas where accurate cadastral survey or precise levelling has been carried out, but in much of the country the detail of the location of roads or watercourses is much less accurate, having been inserted from the reports of administrative officers and others on trek through their districts. A particular weakness, especially in the west and south of the country, lies in the place-names, especially of the smaller settlements. Since the recent war ended, the Survey Department has been far too busy with development work to devote much attention to bringing the 1:250,000 series up to date, and in consequence there are by now parts of the country where the published maps bear very little relation indeed to the names of villages in current use.

One of the main reasons why little attention was paid to keeping the quarter-million maps

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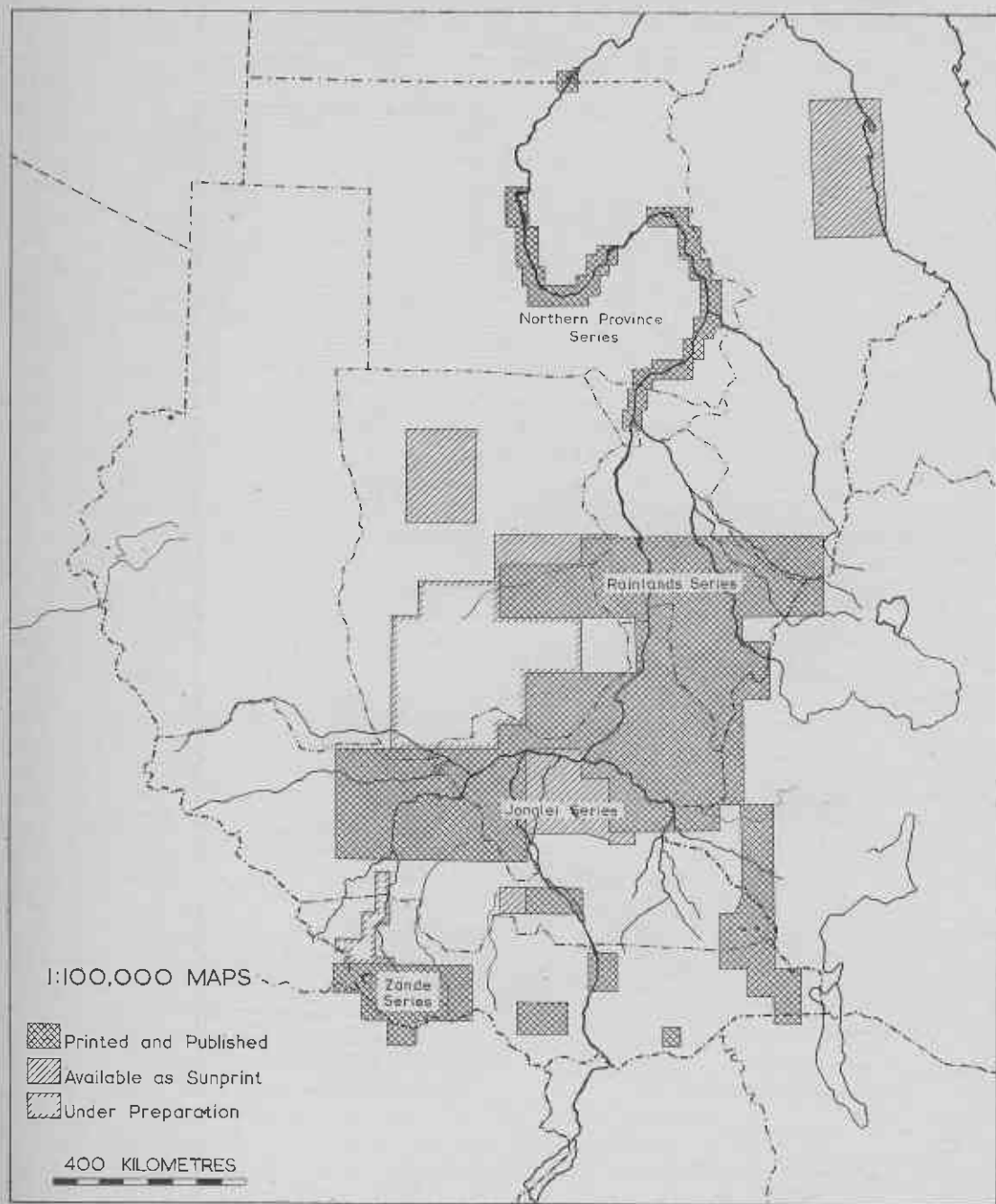


FIG. 2. The topographical mapping of Sudan—1958. All of Sudan is covered by topographical sheets on a scale of 1:250,000, while certain areas of greater interest are also covered at 1:100,000. From *Sudan Surveys Topo.* No. S869-58.

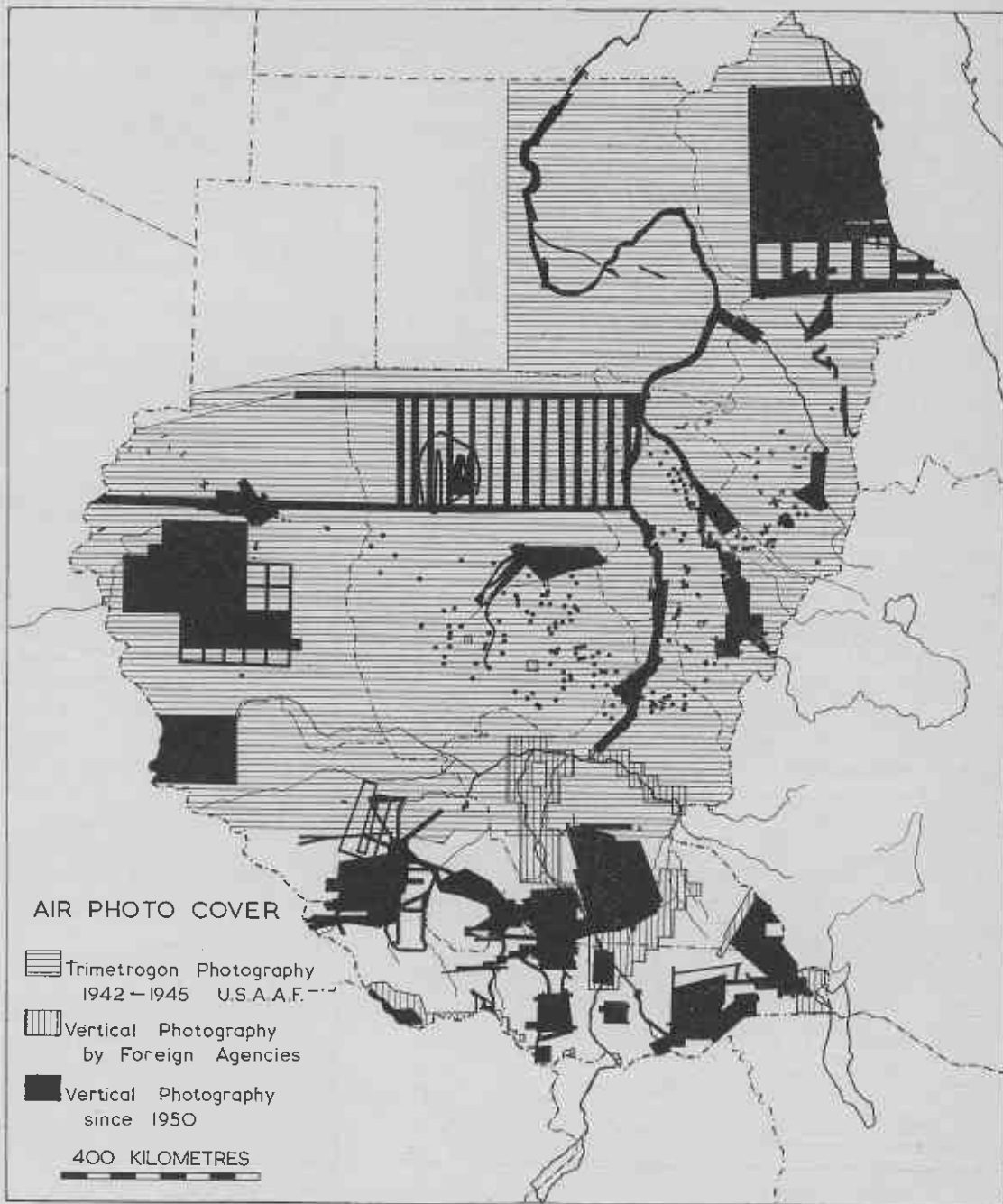


FIG. 3. The aerial photographic cover of Sudan—1958 Foreign agencies include the Royal Air Force and air survey companies. From *Sudan Surveys Topo.* No. S869-58.

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up to date was that it had been realized that for the development of the country to proceed smoothly it would be necessary to produce topographical maps at a larger scale. This task was facilitated by the fact that during the war the American Army Air Force had taken a number of strips of air photographs across the country from east to west, omitting only the north-western desert and areas south of latitude 8° N. These did not provide a complete cover even within the surveyed area, for from reasons of economy the Trimetrogon system of photography was employed, which takes vertical strips, each approximately six miles across and set twenty miles apart, the intervening territory being covered by obliques. While of limited value for detailed interpretation, these photographs proved sufficiently accurate for the mapping of broad topographical outlines.

It was therefore decided to use the Trimetrogon Air Survey and to produce a new topographical series at 1:100,000 for those parts of the country where information was most needed or where there seemed to be the best prospects of development. In effect this meant that the new series would cover the clay lands of east-central Sudan (The Rainlands Series), where developments in irrigated and unirrigated agriculture were expected; the swamps region of the Upper Nile basin, where considerable changes were expected in connection with the proposed Jonglei Canal, and parts of south-western Equatoria, which had been photographed just after the war and were of interest because of the Zande Scheme (Fig. 2).

The production of these new series has progressed quite far, but it is to be regretted that in the absence of a corresponding ground survey a great deal of material about names and tribes has been transferred from the 1:250,000 series without checking.

In 1950 the Sudan Survey Department bought an Aerial Survey Camera and had two of the Sudan Airways de Havilland *Dove* aircraft modified to take it. Since then a considerable amount of vertical air photography has

been carried out on intermediate scales, the principal areas being along the Niles, east of El Obeid, between Gambela and Lake Rudolf, and in various blocks in the southern provinces. Many of the main towns and villages have also been photographed at large scales. Much of this photography has been compiled into planimetric mapping at various scales, and Sudan has just bought three Wild plotting machines and proposes to set up a proper photogrammetric plotting unit (Fig. 3).

Along the Nile below Khartoum and in much of the Gezira, detailed cadastral surveys have been carried out in connection with the settlement and registration of land ownership. The maps produced, at scales from 1:2,500 to 1:20,000, are in no sense topographical maps, for they show few details except the boundaries of registered land. Nevertheless, they can sometimes be used in connection with geographical research if their limitations are recognized. All large towns are covered by cadastral plans at 1:1,000 scale or larger. For the more populous parts of the lands beside the Nile below Khartoum a series of maps has been produced at a scale of 1:100,000, by means of direct reduction from the cadastral series. As would be expected from their origin, these are not very successful maps. They proved of value, however, when overprinted with details of levels and soil pits, to show the results of a survey of irrigable areas in the Northern Province which was conducted in 1951-2 (Fig. 56).

In general, Sudan well illustrates how large and poor territories find it a great burden to provide themselves with a tolerable cover of topographical maps. When money was scarce before the recent war, mapping went ahead slowly; when it became more plentiful afterwards, other more obviously lucrative types of investment were given higher priority. Nevertheless, a comparison with other territories at the same latitude shows Sudan to be well advanced both in basic triangulation and in cadastral surveys.



RELIEF, DRAINAGE AND THE ELEMENTS
OF STRUCTURE

IN this and the next chapter an attempt is made to give a general account of the physical geography of Sudan. The first topics to be dealt with will be the relief, geological history and structure, and the climate; when these have been considered their interaction will be discussed, as revealed in the type of soil produced and in the natural vegetation that springs up upon it. These factors, acting singly or together, provide the basis of the division of the country into regions in the chapters below. While their individual effects will be described in more detail in due course, there are certain aspects that may perhaps be more appropriately treated as a whole in order to give a general picture and avoid repetition. One theme that might have been thought fitting to this chapter, namely, the hydrology of the Nile, has been singled out for separate treatment. Inherently complex, it may be regarded as a summation of several of the factors listed above, together with others operating outside the Sudan; in fact, it merits particular attention because of its great economic importance at a time when further proposals for Nile control are under discussion.

RELIEF AND DRAINAGE

The accompanying relief map of Sudan (Fig. 4) is inevitably much generalized, because of the small scale at which it has had to be reproduced; even without this limitation, however, the contours to be shown could never be very numerous because of the relatively restricted amount of ground survey and levelling that has been carried out throughout most of the country. Nevertheless, there are two significant features of the physical geography of Sudan which stand out, namely, the monotony of the relief of most of the million square miles enclosed within its borders and the unity of almost all of its drainage pattern. Of the

whole area of the country less than 2% lies lower than 300 m. above sea-level, about 45% lies between 300 and 500 m. and a further 50% lies below 1,200 m., which means that there are only inconsiderable areas that are so high as to enjoy a markedly different climate from other parts of the country at the same latitude. If a map be drawn of drainage and watersheds, it appears that nearly all the better-watered parts of the country are included in the Nile Basin, though admittedly many of the occasional streams of the centre or the north rarely if ever reach the Nile, but lose themselves in sandy wastes or clay-lined pools. The Nile is the only river in the country that regularly reaches the sea, for the spates that flow after storms in the Red Sea hills are usually quickly lost in the arid coastal plain (Fig. 5).

The lack of contrast in the relief that appears when the country is considered as a whole is also very noticeable to the traveller by air or the observer on the ground. South of Khartoum there is a clay plain which appears to the eye to be almost completely flat and which stretches as far as Juba, 1,200 km. away, rising only 80 m. in that distance (Plate I). Similarly, the sandy area of the west, the Qoz, consists of former sand-dunes, now fixed by vegetation, wherein there are many large stretches, particularly towards the south, of slight relief or even of almost level sand.

The only extensive areas of more marked relief are the *inselberge* of the south, especially the Imatong Mountains (Plate II), the Nuba Mountains of central Sudan, and the Red Sea hills. There are numerous isolated granitic hill masses, of which Jebel Kassala is an outstanding example.

Because of the concentration of the rainfall in most of the country into barely half the year, very few of the streams and watercourses which appear on the topographical maps of any region actually hold water all the year

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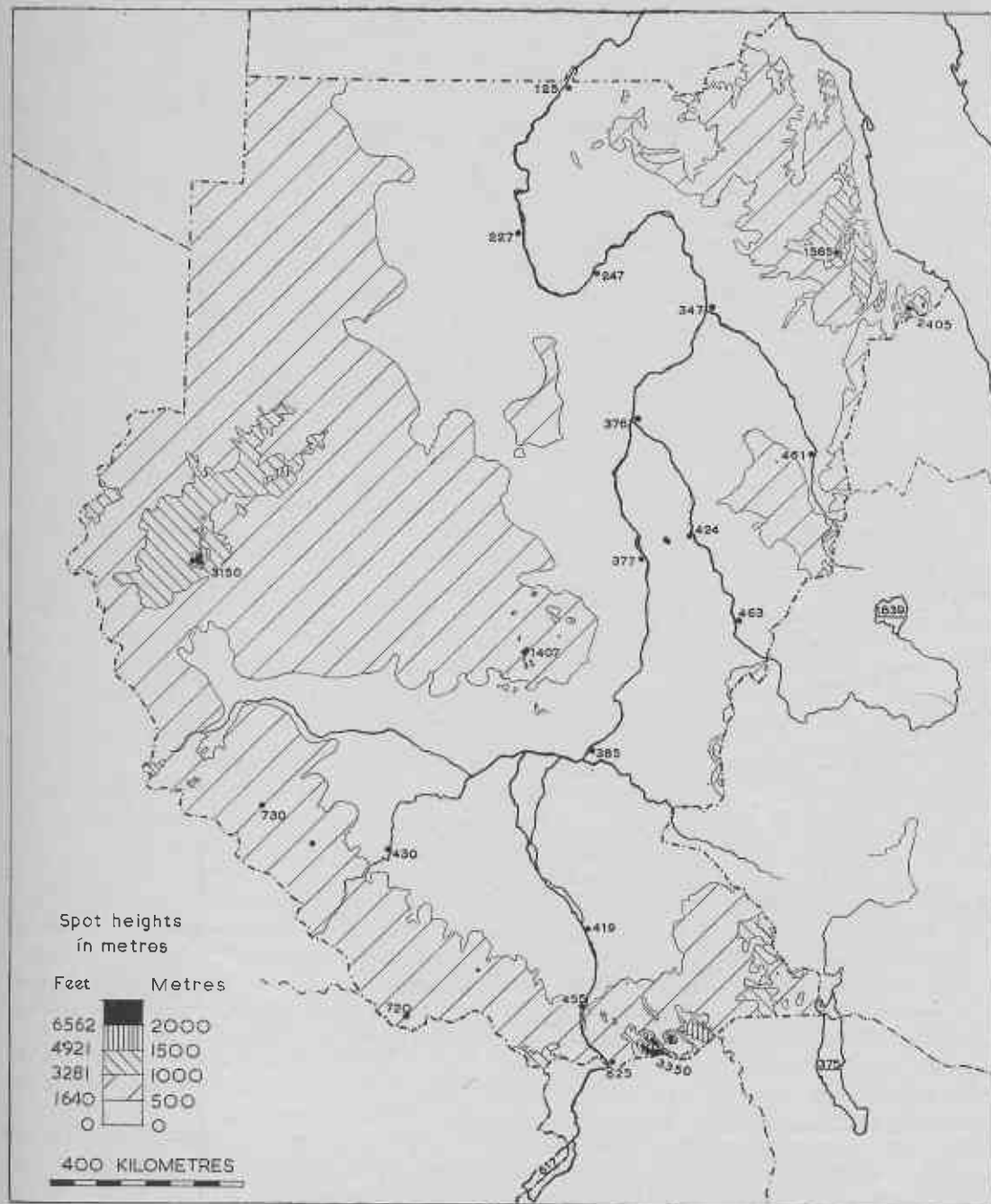


FIG. 4. Relief. From *Sudan Surveys Topo. No. S741-46*.



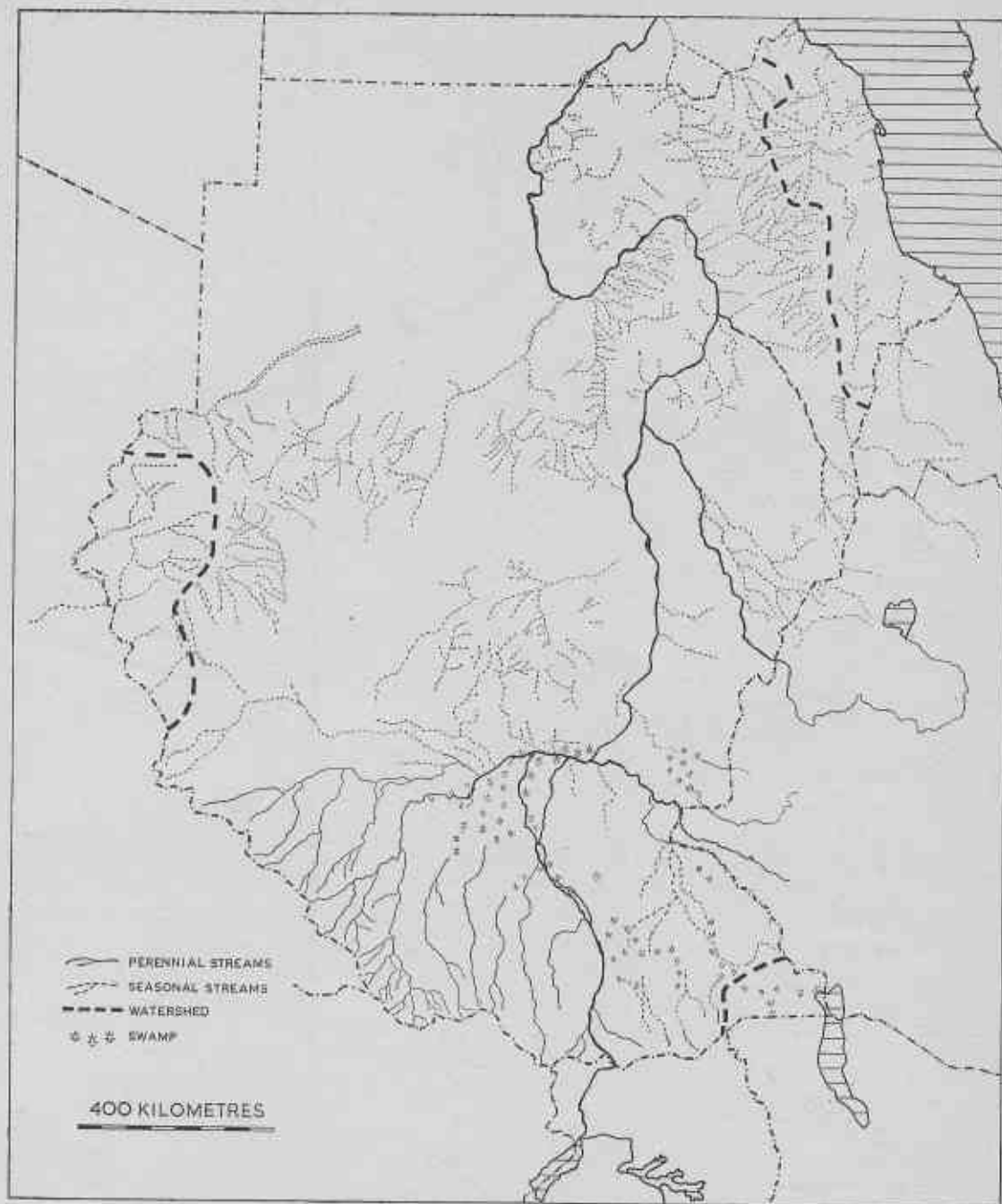


FIG. 5. Drainage and watersheds. Though western Sudan lies nominally within the Nile Basin, the contribution that it makes to the flow of the Nile is virtually nil. From *Sudan Surveys Topo.* No. S741-46.

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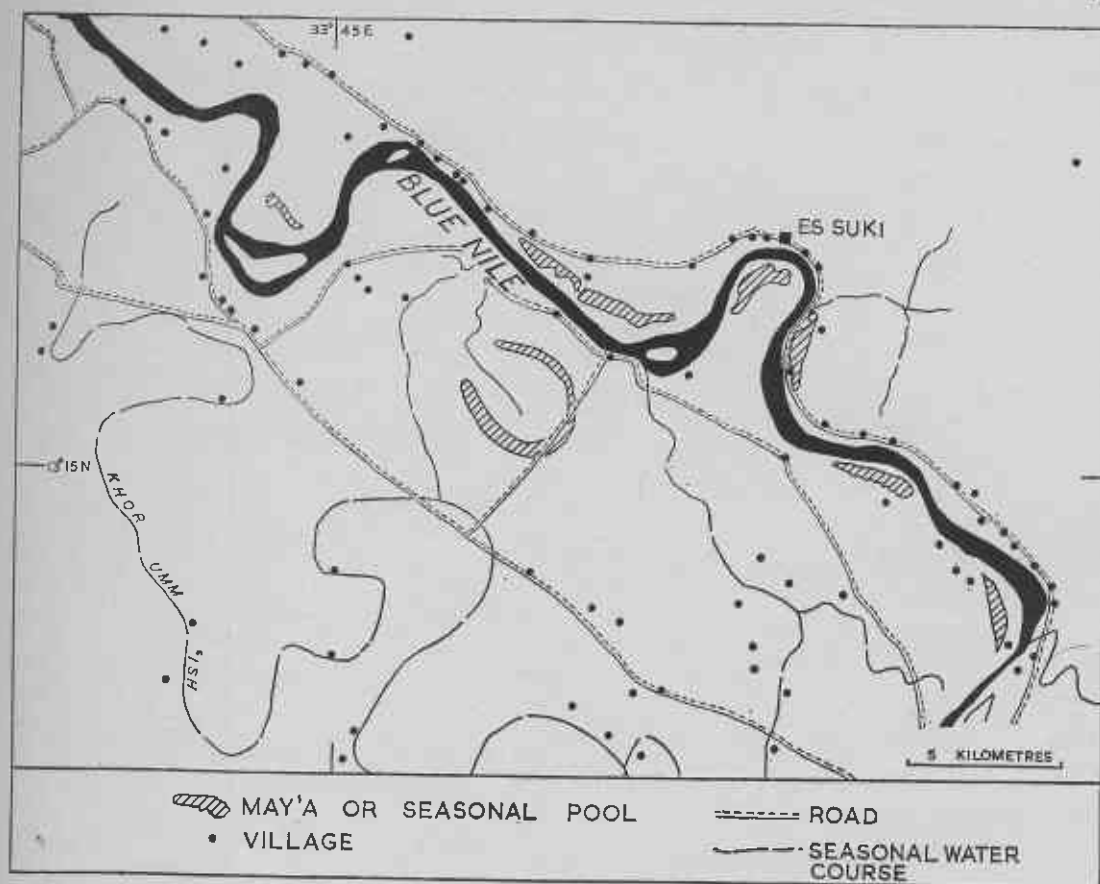


FIG. 6. Drainage pattern on the clay plain beside the Blue Nile—mean annual rainfall 500 mm. (20 in.). Apart from the Khor Umm 'Ish, which probably represents a former course of the Blue Nile, the drainage pattern is very poorly developed upon the central clay plain. From *Sudan Surveys* 1:100,000 (Rainlands Series) 55-K-5.

round. Except in the extreme south, where the rains are longer and dense vegetation checks rapid run-off, the only rivers to flow continuously are those that are fed by lakes or swamps acting as natural reservoirs: such are the Blue and White Niles, fed by lakes from beyond Sudan, or the Sobat and Bahr el Ghazal, flowing from large perennial swamps. All the other rivers, even the Atbara which makes an important contribution to the Nile in the summer, dry up into pools or else disappear wholly beneath their sandy beds in the dry weather. Their importance as sources of drinking water for man and animals continues to be great, but without elaborate works they cannot be employed for perennial irrigation. Some of the occasional streams, though they never reach

the Nile, make an invaluable contribution to the country's wealth because they spread out over large silt-covered deltas that are used for crop production.

In the absence of marked local relief in many parts of the country, the type of drainage pattern that develops is dependent on the nature of the soil or rock occurring at the surface; good examples of this are to be seen when fairly large-scale maps are studied for parts of central Sudan. Where the surface of the ground is an almost flat clay plain (Plate I and Fig. 6) there is very little run-off after rain, and virtually no percolation into the ground deeper than the 2 m. or so that natural cracks penetrate; in consequence, rain-water lies on the surface, continuously exposed to evaporation from ever-

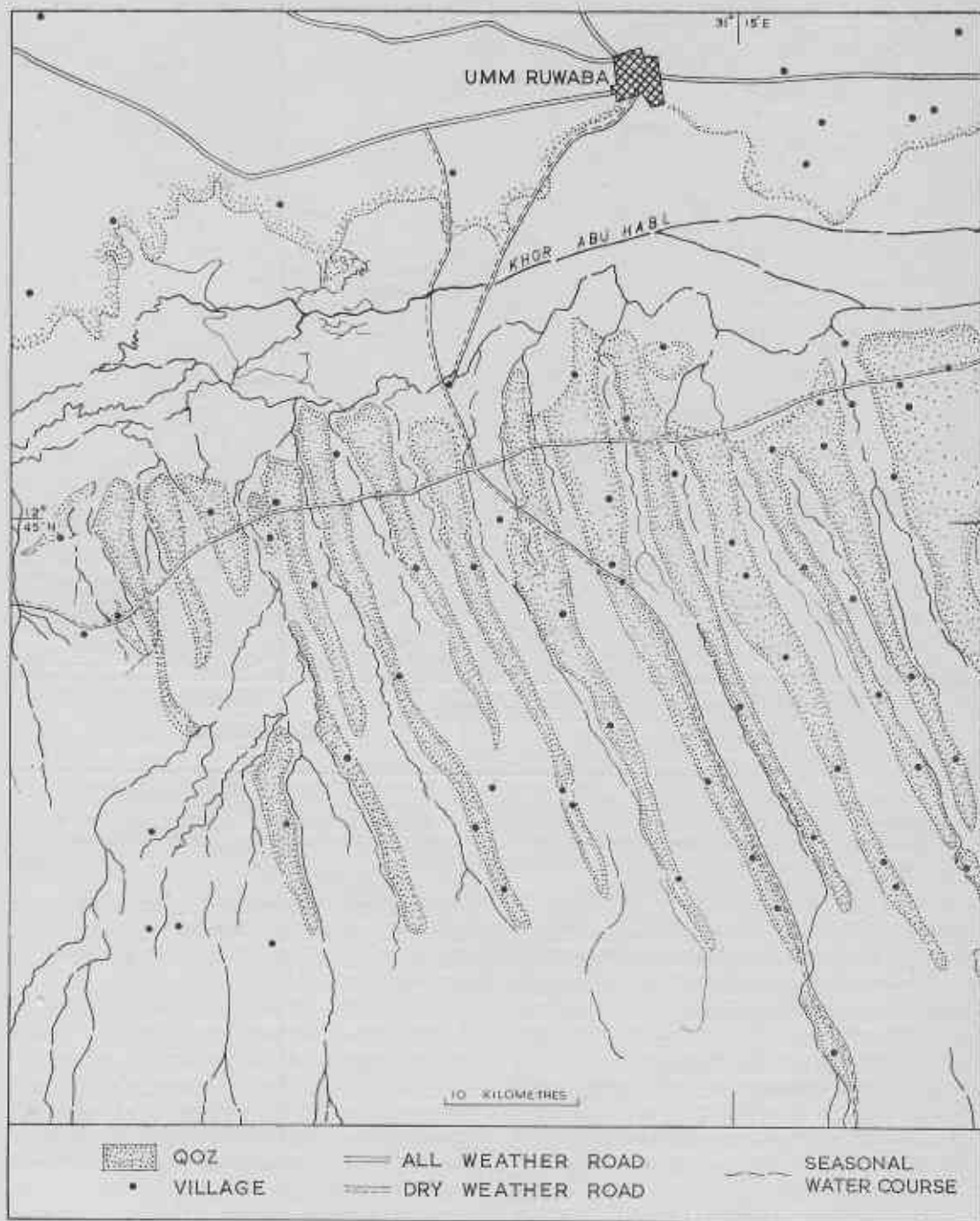


FIG. 7. The zone of contact of Qoz and clays in Kordofan—mean annual rainfall 400 mm. (16 in.). On the continuous Qoz around Umm Ruwaba and to the north there is no surface drainage; further south the dunes lie in parallel bands, with water courses developed on the clays between them. The Khor Abu Habil carries much of the drainage of the northern Nuba Mountains towards the north and east. From *Sudan Surveys* 1:100,000 (Rainlands Series) 55-M-3.

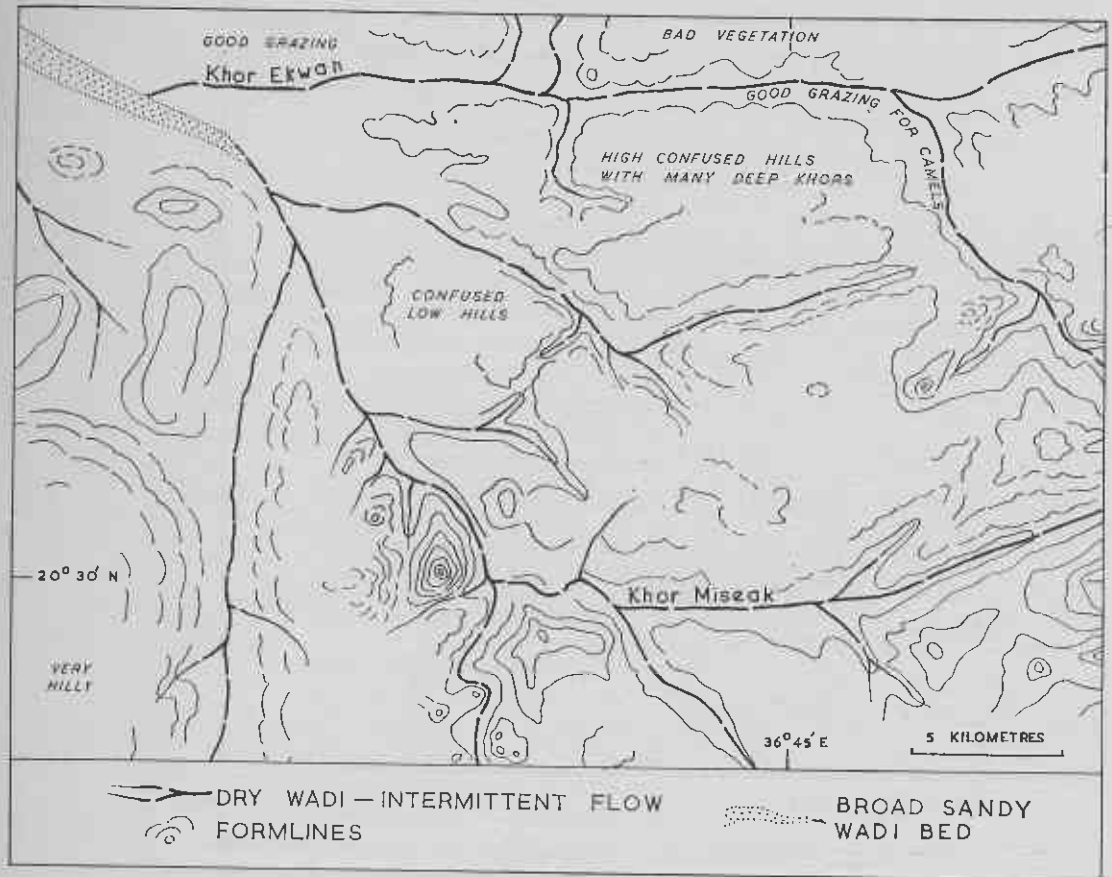


Fig. 8. Relief and drainage in the Red Sea hills. The intermittent streams dissecting the Red Sea hills provide water and grazing despite the low rainfall which averages barely 25 mm. (1 in.). The verbal information concerning relief and grazing is typical of many of the early reconnaissance-type topographical maps of Sudan. From *Sudan Surveys* 1:250,000 Series, 36-M.

decreasing pools and swampy meres, until eventually all is lost. The result is that even in parts of southern Sudan which are flooded for several months of the year water becomes unobtainable in the dry season sooner than in stony dissected areas where the immediate run-off is much greater. Where the surface consists of sand-dunes, on the other hand (Fig. 7), losses from evaporation or run-off are negligible, for water soaks into the ground as soon as it falls; virtually no stream beds are then to be seen, and it is only on the margins of the Qoz country that the hollows between dunes are linked together in a unified drainage system. The availability of water depends in these circumstances on the distance that it penetrates into the ground (i.e. whether it is

held up to form a perched water-table or not) and on the distance that man is able and willing to dig to get it. In stony but undulating and more deeply dissected areas, such as western Darfur or the Red Sea hills (Fig. 8), there is little soil to retain moisture, but an appreciable proportion of the precipitation finds its way into the sandy watercourses, and can in many instances be tapped by shallow wells throughout the year.

Beside the main streams of the Upper Nile basin many subsidiary channels are seen, which fill when the river overflows its banks, but cannot flow back when the river levels fall, and so continue to hold water almost to the end of the dry season. Farther into the clay plain, hollows and chains of depressions also hold

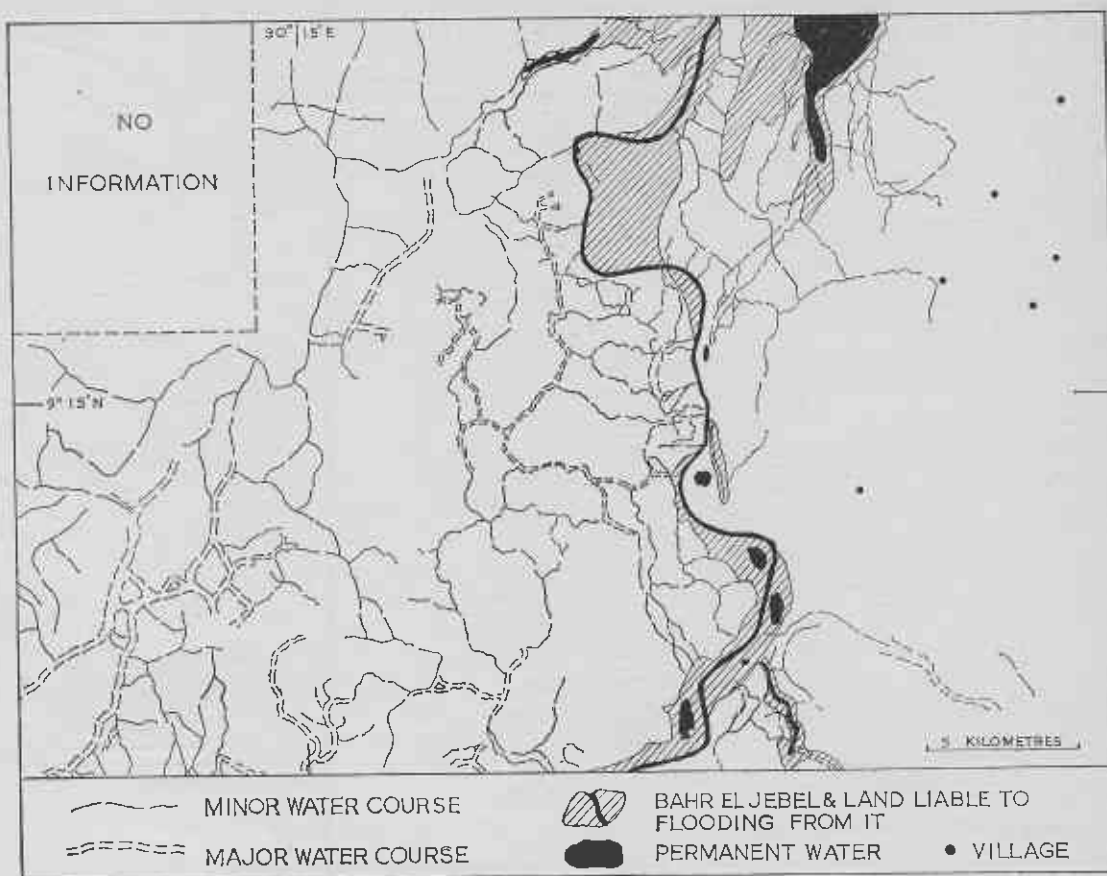


FIG. 9. The drainage pattern beside the Bahr el Jebel in the Upper Nile swamps—mean annual rainfall 1,000 mm. (40 in.). The many overflow channels are unable to discharge their waters to the Nile when the river level subsides. From *Sudan Surveys* 1:100,000 (Jonglei Series) 66-1-4.

water for considerable periods (Fig. 9).¹ On the Lateritic Ironstone of south-western Equatoria the high rainfall (1,600 mm. or 64 in.) and short dry season support numerous perennial streams. Having very gently sloping profiles they occasionally flood quite wide, treeless expanses (Fig. 10).

GEOLOGICAL STRUCTURE

Sudan lies at the zone of contact in Africa of two contrasted structural zones, the south and east where the platform of extremely ancient rocks has been uplifted above sea-level since Palaeozoic times, and the lower northern

portion of the continent which has been overlain by numerous horizontal sedimentary rocks as the result of marine incursions dating from the latter part of the Mesozoic Era. In consequence, in the southern and eastern parts of Sudan the ancient igneous and metamorphic rocks known as the Basement Complex are never far from the surface, though masked in many areas by more recent superficial deposits of continental origin. In the north and west, on the other hand, marine Cretaceous and Tertiary rocks, especially sandstones, are found at the surface in extensive outcrops, which dip very gently towards the north, their beds scarcely disturbed by warping.²

¹ Aspects of the river channels and flood plains are discussed by J. W. Wright, 'The White Nile Flood Plain and the Effect of Proposed Control Schemes', *Geog. Jour.*, **114** (1949).

² G. Andrew, chapter on 'The Geology of the Sudan' in *Agriculture in the Sudan*, 1948. This admirable chapter has proved the main source for the sections here included on Geological Structure, Solid Geology, and Superficial Deposits.

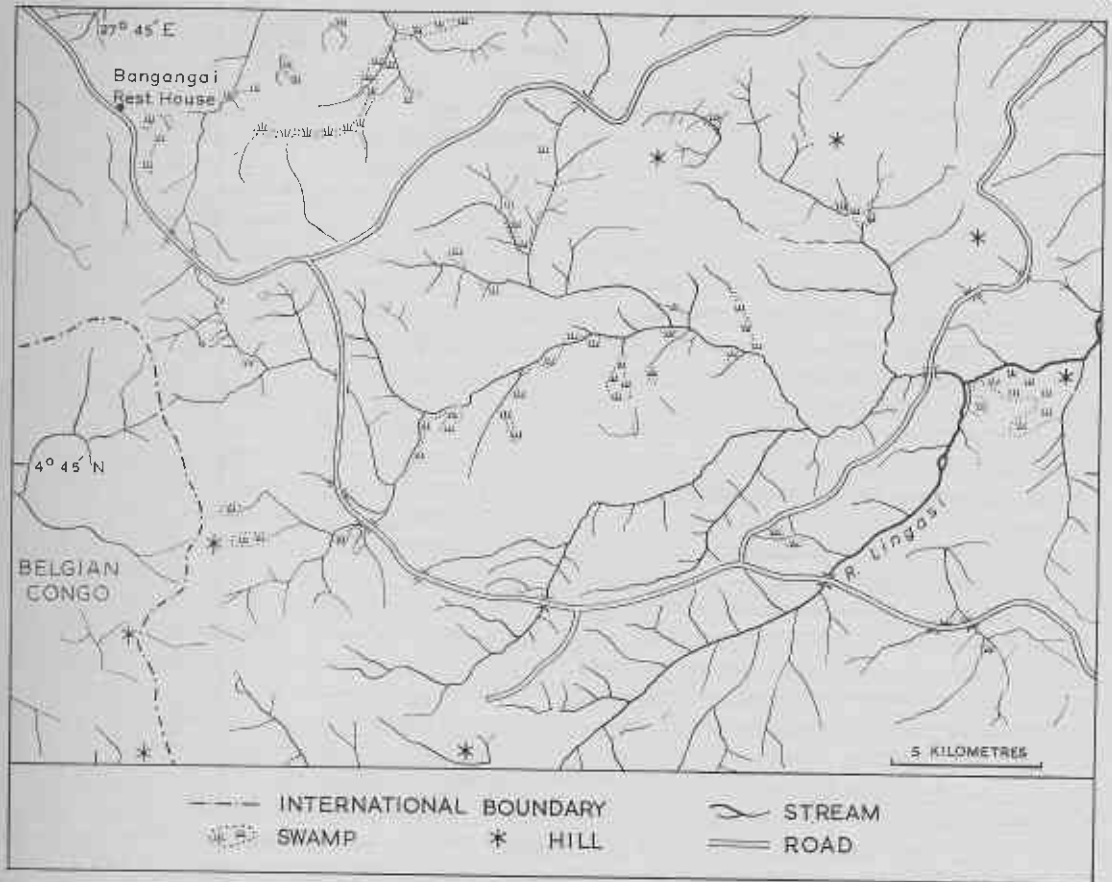


FIG. 10. The drainage pattern close to the Nile-Congo watershed—mean annual rainfall 1,600 mm. (64 in.) The streams of the area are only slightly incised into the Ironstone Plateau, and during the rainy season many swamps are formed. From *Sudan Surveys* 1:250,000 Series 77-0.

The accompanying map of the Solid Geology (Fig. 11) shows the distribution of the principal types of rock, and can be related to the map of the relief. The most extensive formation, the Basement Complex, is seen to occupy most of central and southern Sudan, with the Umm Ruwaba Series of unconsolidated sands and gravels lying in a hollow or basin upon it. It persists in the north and west beneath the rocks of the Nubian Series, and reappears at Jebel Uweinat on the Sudan-Egyptian frontier. Throughout the Palaeozoic and the early part of the Mesozoic Era the rocks of the Basement Complex were exposed to sub-aerial denudation, and while certain resistant blocks such as the Nuba Mountains or the hill masses of the extreme south stood out, most of the country was reduced to a peneplain of which small remnants

are now to be seen at the top of the rhyolites at Sabaloka and in western Darfur.

During the latter part of the Mesozoic Era changes in land- and sea-level took place, and the sea spread over the whole of what is now the Sahara and the Arabian Desert. Extensive sedimentary rocks of Jurassic or Cretaceous age were laid down, those found in Sudan being principally sandstones with a few mudstones and limestones: these are now known as the Nubian Series. During the Eocene period the sea margin retreated, and extensive tracts were swept clean of the Nubian Series. The only rocks laid down in Sudan in this period of which traces now remain are the Hudi Chert, a fresh-water deposit of Oligocene age found between Khartoum and the latitude of Berber, and certain possible Mid-Tertiary Lateritic

Ironstones found both in Equatoria and in north-western Sudan.

Since the deposition of the Nubian Series there was in Miocene-Pliocene times a gentle warping with uplift of the eastern part of Sudan, accompanied by faulting: thus the Red Sea hills and Ethiopian plateau rose and the Red Sea was formed. There has been a continued slight rise against mean sea-level on the east, shown by marine sedimentaries now above water on the present coastal plain. The height of the Ethiopian plateau was increased by extensive outpourings of lava, both as volcanoes and as sheet-flows. In the Red Sea hills the Nubian Series has now been almost entirely removed by erosion, but it is preserved under a capping of lavas in much of northern Ethiopia.

Along the present line of the Nile valley down-warping has occurred, resulting in a hollow running north and south that is tilted slightly downwards to the north. The oldest of the formations laid down in this depression, the unconsolidated Umm Ruwaba Series, lie well below the present base level of erosion, and do not, in fact, appear at the surface. Farther to the west there has been a slight up-warping along the Nile-Congo and Nile-Chad divides, and vulcanism in Darfur has produced Jebel Marra, rising to more than 3,000 m., as well as sheet-flows and other typical features farther north. West of Jebel Marra there is a number of flat-topped *inselberge* that must represent the remnants of an early peneplain (Plate XXIII).

The Quaternary Era has witnessed a continuation of the processes of erosion, resulting in the smoothing of the relief of the volcanoes of the west, the reduction of certain of the basalt areas of the east, and the deposition of extensive sand and clay deposits which mask the solid geology beneath. Beside the Nile Palaeolithic gravels have been discerned, quite distinct in nature from the modern alluvial silts and clays, and along the Red Sea coast coral terraces and raised reefs have emerged.

Solid Geology

The rocks referred to above differ greatly. The Basement Complex, as described by

Andrew,¹ consists of a wide variety of rock types, mostly strongly folded with steep dips, and mostly metamorphic or igneous rocks (gneisses and schists, with foliated granitic rocks), but it includes recognizable bedded rocks such as quartzites, limestones, greywackes, and lavas, all in an unaltered or only slightly metamorphosed condition. The Nawa beds are gently dipping non-metamorphic grits and mudstones, found only in wells and bores; they and the continental sandstones of the extreme north-west of Sudan are thought to be of late Primary age.

The Nubian Series and the very similar Yirol sandstones lie on the eroded surface of the Basement Complex. They consist of marine sandstones interbedded with occasional shales and mudstones. The total thickness of the beds is more than 150 m., still lying approximately horizontal. The only fossils found in the series are plant remains, which are difficult to identify. On this and other evidence from outside Sudan, the date of these rocks is thought to be Upper Cretaceous.

The Hudi Cherts and the Tertiary Laterites are too limited in their extent to warrant much attention, though they do help to throw light on the physiographic history of the country. The Tertiary lavas, on the other hand, are more widespread and include some important elements in the relief: they comprise the extensive outpourings of the Ethiopian plateau, which are chiefly basalts; the numerous volcanic craters, plugs and sheet-flows of Jebel Marra and J. Meidob, among which basalts, rhyolites, volcanic tuffs, and pumice occur; the basalt dykes and flows near Omdurman and Atbara, and the scattered occurrences in the Libyan desert west of Dongola.

The Umm Ruwaba Series consists of unconsolidated sands and clayey sands, some being gravelly. These rocks have not been certainly identified at the surface, but were detected by the drilling of bores to find water. Occurring in depressions, this series usually contains water, but no fossils have yet been found in it.

Along the coastal strip of the Red Sea the oldest deposits that have been found are of Plio-Pleistocene age, consisting of shelly or

¹ Andrew, *op. cit.*, p. 95.

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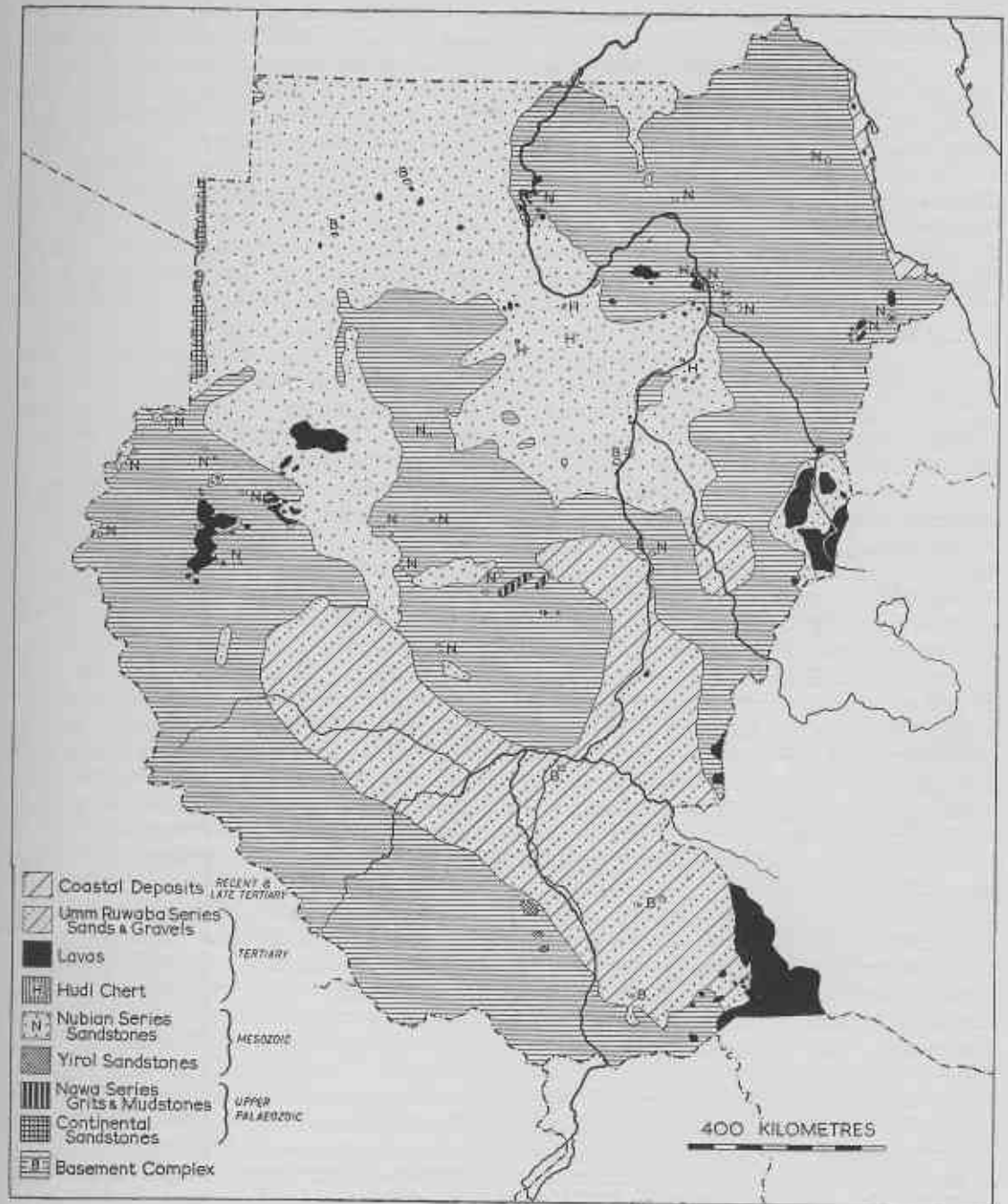


FIG. 11. Solid geology. Surface conditions in central Sudan are better indicated by Figure 24, showing the main soil categories. From *Sudan Surveys Topo.* No. S750-47.

coralline shales, with marls, clays, grits, and conglomerates and some gypsum beds. These are overlain by a Recent raised coral reef on the seaward side, while near the hills there are thick and very coarse angular river terrace deposits. At the southern end of this strip, near Tokar, there is an extensive silty outwash fan formed by the action of the Baraka river draining the Eritrean mountains and the Red Sea hills. The structure of this belt is complicated by the presence of numerous step-faults and transverse fractures which do not appear to affect the coralline deposits.

Superficial Deposits

The account given above of the structure of Sudan and the nature of the rocks shown on the Solid Geology Map (Fig. 11) provide very little indication of the actual conditions to be met with in the field throughout most of the country. This is because the wetter and therefore more populated southern two-thirds of Sudan is almost entirely covered with various superficial deposits that mask the solid geology beneath. Though represented below on the map of Main Soil Categories (Fig. 24), these are not to be confused with the layer of soil that constitutes the normal outer cover or skin of the earth wherever conditions are favourable to its development, but consist of extensive continental deposits, chiefly sands and clays, and of a lateritic ironstone crust that is thought to have been evolved in a climate different from the present.¹

The continental deposits are to be expected in a country where almost all the erosional forces at work are engaged in transporting material over fairly short distances and then depositing it; little or no sand, silt, or clay of Sudan origin is at the present time being transported out to sea. 'The lower ground of the Sudan is a plain of desert erosion in the north, and a plain of accumulation or aggradation in the south.'²

In the north alternate heating and cooling, combined with some wind erosion and chemical action, effect the breakdown of the rocks; the rock fragments are then transported to lower

levels by wind, or, particularly in the Red Sea hills, by running water. While sandstones and crystalline rocks such as granites are reduced to sand particles which can rapidly be carried away, leaving characteristically steep-sided hill masses, other rocks such as basalts and gabbros may shatter to a coarse scree-type of debris, too coarse for removal except by running water, and then the hill-sides produced are less steep. Sand particles are today being deposited as *seifs*, *barchans*, and other typical desert formations in much of north-western Sudan (Plate IV). During the Upper Pleistocene, however, the limits of the desert climate extended farther to the south than they do today, and extensive dunes were deposited throughout Kordofan and Darfur. These have now been slightly consolidated by surface oxidation and the growth of vegetation, but their undulating surface and their lack of drainage make their origin clear.

In central and southern Sudan there are extensive plains of dark cracking clay, resulting from the erosion of material from higher ground to the east and west and its deposition in a plain of aggradation (Plate I). The Blue Nile is today carrying past Sabaloka, if not right through northern Sudan into Egypt, almost all the material that it brings down from the Ethiopian highlands. At the same time it is slowly deepening the gorge at Sabaloka (Fig. 52), which was once thought to present a striking example of the effect of antecedent drainage in determining the course of a river, but still awaits a wholly convincing explanation.³ In the past, the Blue Nile has been responsible for extensive deposition within Sudan, for the Gezira plain north of Jebel Moya is believed to have been produced by the annual overflow of clay-charged water from the Blue Nile.

Farther south many streams must have contributed to the build-up of the clays, and the profile of the White Nile today suggests that it flows in a broad region aggraded to the outlet level. 'On this view the present White Nile is a young effluent which has yet had insufficient time to do more than establish its channel north

¹ Andrew, *op. cit.*, p. 120.

² *Ibid.*, p. 86.

³ H. G. Lyons, *The Physiography of the River Nile and its Basin*, Cairo, 1906; J. Ball, *Contributions to the Geography of Egypt*, Cairo, 1939.

over the clay plain, and also has too high an exit level to lower its bed.¹

The Red Loams of Equatoria, from 3 to 5 m. deep, often have a rim, parallel to the valley sides, of hardened ironstone, and frequently contain soft pisolite-like concretions of bright red ferruginous clay. They appear to have been formed by lateritic weathering from the subjacent rocks in Pleistocene times.² There is some doubt whether the present climate is such as to produce this type of deposit.

Flanking the Main Nile there are numerous gravel terraces, some of which have proved from the artefacts they contain to be of Palaeolithic age, and there are others beside the Blue Nile and Atbara rivers which have not yet yielded human relicts. These have not been fully studied and correlated, but it is to be hoped that in due course they will throw light on the problems of the development of the river valley and profile.³ Much lower than these terraces and closer to the present river beds

are found important deposits of Recent alluvium (chiefly silts and clays) beside the Blue Nile, the Atbara and the Main Nile below Khartoum; these occur as islands, as surface coverings over banks of varying steepness, and as flanking depressions or basins in former river meanders (Plate III).

In eastern Sudan there are other areas of Recent alluvial soils, the most extensive being the deltas of the Gash river north of Kassala and of the Baraka river around Tokar. These receive the run-off of the Ethiopian plateau and Red Sea hills, and are flooded each year to an extent that varies according to the intensity of the rains. As would be expected from the manner of their origin, the soils of these deltas vary from a sandy silt at their heads to almost pure clay at their lower ends. Successive depositions of alluvium cause the rivers in these deltas to flow in levees, with the result that their courses are unreliable and may change unexpectedly.

¹ Andrew, *op. cit.*, p. 106.

² *Ibid.*, p. 120.

³ A. J. Arkell, 'The Old Stone Age in the Anglo-Egyptian Sudan', *Sudan Antiquities Service Occasional Paper No. 1*, 1949.

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THE DIVERSITY OF SUDANESE CLIMATE

THE climate of Sudan is wholly tropical, for there is no part of the country where the sun does not pass directly overhead at some time of the year. Conditions vary from hot desert in the north, where there is rarely any rainfall, through a belt of summer rainfall of varying intensity and duration to an almost equatorial type of climate in the extreme south, where the dry season is very short. Because of the absence of any mountain barriers obstructing the flow of air streams between north and south, there is a gradual change of conditions with latitude, and it is not easy to indicate obvious divisions between one type of climatic region of Sudan and another.

Nevertheless, for ease of description it may prove helpful to put forward a division of the country into a number of such regions, whose climates may then be analysed systematically. For this purpose use has to be made either of a system devised for the whole world, which may not appear very appropriate in its local application, or else a local division may be made, which would not necessarily be of much value in other countries.

THE RANGE OF CLIMATE

The most widely employed classification of climates is that put forward by Köppen in 1918, and subsequently modified in 1928.¹ According to this classification (Fig. 12) the northern two-thirds of the country are described as Arid, a distinction being made between parts with less than 400 millimetres (16 in.) of rain, which are called Hot Desert (BWh), and parts with totals up to 800 mm. which are called Hot Steppe (BSh). There is a small exception to this in the Red Sea hills, where the country round Erkowit is called Temperate with Hot Summer and Two Rainfall Maxima (Caw").

South of the 800-mm. (32-in.) isohyet, Sudan

is said to experience a Tropical Rainy Climate with a winter dry season (Aw), in the southern part of which isothermal conditions are experienced, i.e. with little difference in temperature between the hottest and coolest month (Awi).

The inadequacy of this system, as applied to Sudan, comes from the fact that it underrates the value, even in the very hot conditions prevailing, of a rainfall of about 400 mm. (16 in.) per annum. Not only nomadism but also regular unirrigated cultivation can take place in the area described as hot desert, whether on clay or on sandy soils, and so the division between Steppe and Desert (BS and BW) seems to lie rather far to the south. Secondly, there is no very significant difference, from the human point of view, between Steppe and the Tropical Rainy Climate (BS and Aw), since each supports wooded savannah vegetation, and makes possible the growing of one, but not of two, crops in the year. In the extreme south, the winter is too dry to be classed as Af, i.e. constantly moist, but quite a number of perennial plants that cannot withstand a dry season are able to survive, if not to thrive very well; conditions, in fact, are significantly different from those near Malakal.

An alternative approach, which is put forward here, is to pay heed to no particular temperature or rainfall values, but instead to distinguish separate parts of the country according to the nature of the seasons that they experience. If this system be adopted, it may be said that the country consists of four climatic regions (Fig. 13), of which the central and largest one may be subdivided according to whether the rains are usually sufficient for cultivation or not.

The North, from about latitude 19° N. to the Egyptian frontier, experiences a cool, dry winter of some four months' duration, and a long and extremely hot, dry summer. In the

¹ W. Köppen, *Grundriss der Klimakunde*, Berlin, 1931.

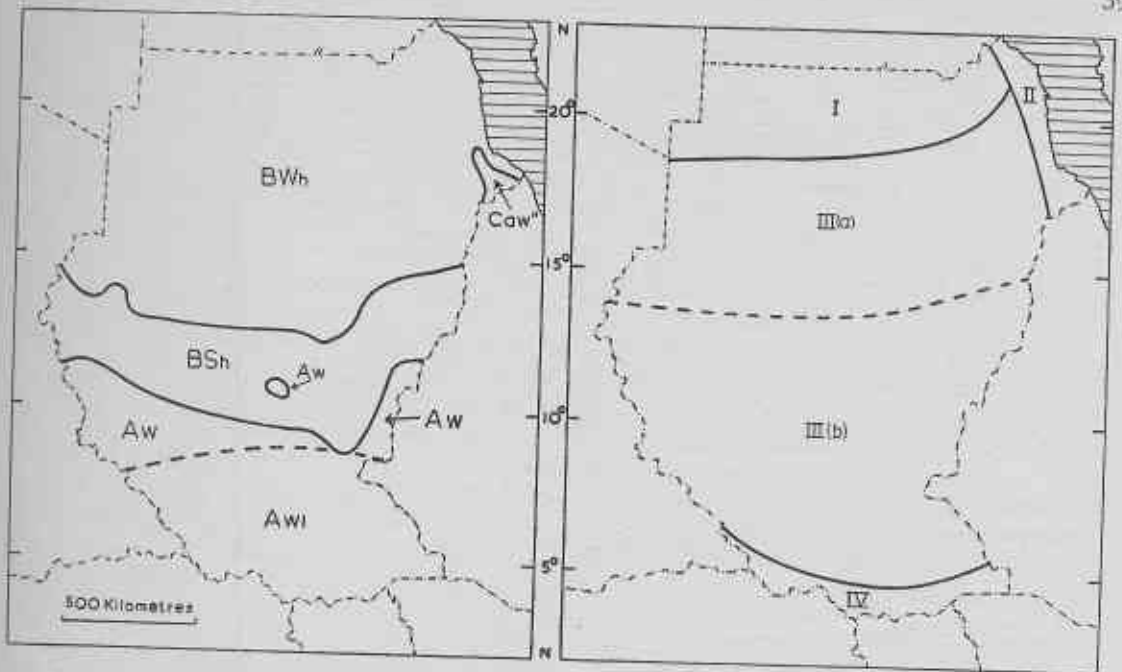


FIG. 12. Climatic regions, after Köppen. For explanation of regions, see p. 38.

FIG. 13. Climatic regions, an empirical classification based on the seasons. Region I is the North, Region II, the North-east; Region III, the Centre, is divided between area (a), which is generally too dry for unirrigated agriculture, and area (b) where crops can usually be grown satisfactorily. Region IV is the extreme South. See pp. 38 and 39.

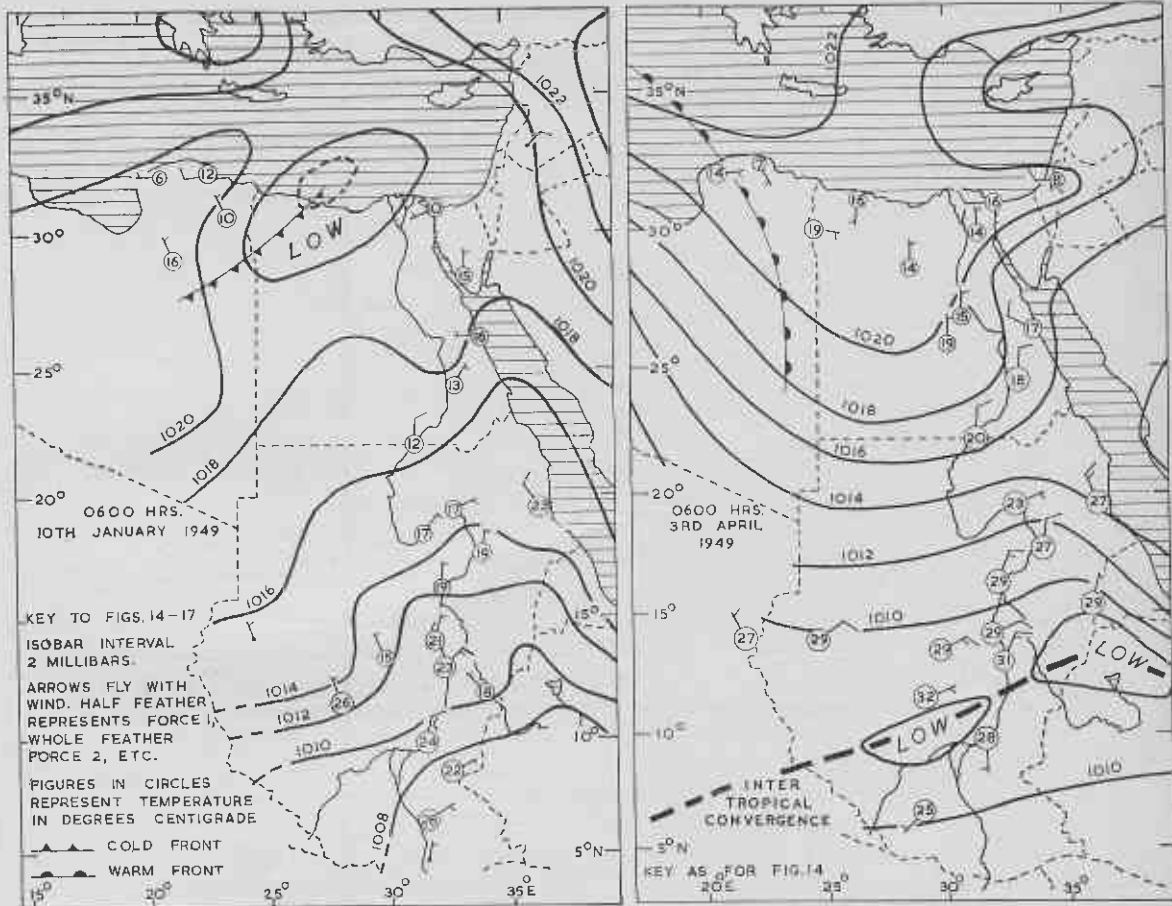
north-east, along the Red Sea hills and Coastal Plain, there is a cool winter with occasional cloud and slight rain, while for the rest of the year there is little or no rain, but temperatures and humidities near the coast are high and dust-storms are frequent. In the central region, which includes central and western Sudan and much of the southern provinces, there are four seasons, whose lengths vary according to the latitude; these are the cool, dry winter (*Arabic shītā*), the hot, dry season of early summer (*seif*), the hot, rather damper rainy season (*kharif*), and the hot, sticky season at the end of the rains, before the onset of the north wind (*darat*). In the extreme south there is an almost dry season of three months, when the north wind blows, but cooler temperatures are experienced during the long rainy season.

The climate in fact approaches the equatorial type, as exemplified in Uganda, but instead of two maxima, the rainfall régime has a prolonged peak lasting about six months.

Pressure and Winds

The explanation of Sudan's climate is to be found in the study of the distribution of high- and low-pressure belts in the northern hemisphere at different times of the year (Figs. 14-17).¹ In winter pressure is high to the north of Sudan, in the Sahara and to an even greater extent in the Euro-Asian land mass, and north winds blow across Sudan towards the Inter-Tropical Front or Convergence Zone, (Fig. 19a) which may lie as far south as the Tropic of Capricorn. These winds are relatively cool and dry, and bring no rain except when they blow

¹ All statistics concerning Sudan's climate have been obtained from the publications of the Sudan Meteorological Service. These include climatological normals for fifty-four stations, a number of Rainfall Maps, and a range of Pamphlets on Rainfall Averages, Wind Speed, Annual Rainfall Parameters, Rain-Day Averages, Khartoum Temperatures, Frequency of Specified Rainfall Amounts, Statistics and Average Pentade Rainfall. The four maps of actual pressures and winds have been taken from the Daily Weather Reports published by the Egyptian Ministry of War and Marine.



FIGS. 14-17. Daily weather reports illustrating typical weather conditions in Sudan. (14) 10th January 1949—A northerly wind is blowing over the whole of Sudan, gradually becoming warmer towards the south. A depression is centred over the eastern Mediterranean, and a cold front may shortly be expected to affect weather conditions in the north of Sudan, as is described on page 41.

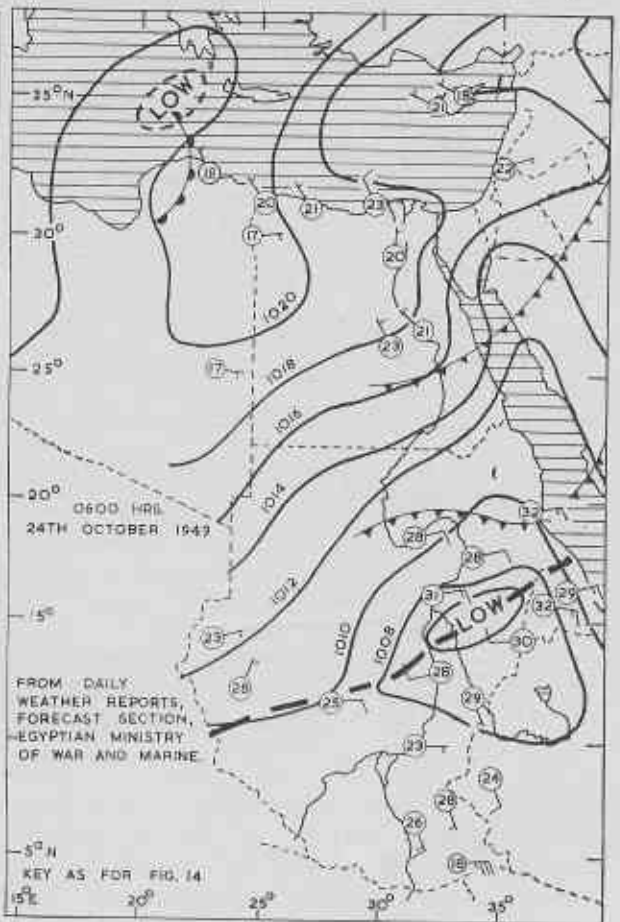
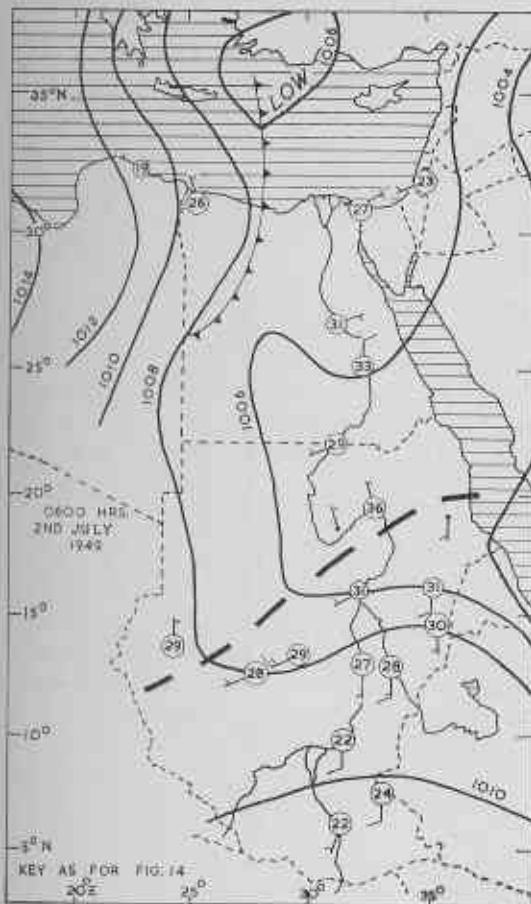
along the Red Sea. Here they pick up moisture and, being forced to rise when they reach the hills on its western side, they give a little rain. With the advance of the sun towards the summer solstice the zone of convergence of northerly and southerly air streams moves northwards across Sudan (Fig. 19*b* and *c*), and moist, unstable air is drawn in over the country from the South Atlantic Ocean. At its farthest north the Inter-Tropical Convergence normally reaches the latitude of Abu Hamad, about 20° N., though it may in fact go a great deal farther, even as far as Luxor, 25° N. Stations in central and southern Sudan,

(15) 3rd April 1949—Conditions by now much hotter than they were in January, and the northerly air stream is felt as far as latitude 10-13° North only, where it meets the southerly winds along the Inter-Tropical Front or Convergence.

therefore, have rainy seasons whose totals and lengths vary according to their latitude (Fig. 18).

THE SEASONS

The course of the seasons, though basically dependent on the movement of the sun between the tropics, is largely determined by the direction of the wind (Fig. 19*a-d*). In the extreme north and south of the country, the variation in direction is less marked than in the centre; there is a great difference in the character of the north wind at Wadi Halfa between January



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(16) 2nd July 1949—The I.T.C. has now almost reached latitude 20° N., the rainy season is beginning, and southern Sudan has become the coolest part of the country. The depression in the eastern Mediterranean has virtually no effect in Sudan.

(17) 24th October 1949—The I.T.C. has begun to retreat southwards, and east winds are experienced in eastern Sudan. Mercator's Projection. From *Daily Weather Reports*, Forecast Section, Egyptian Ministry of War and Marine.

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and July, but a much lesser difference between the seasons at Juba in the south.

Winter ('Shitā')

In the winter Sudan as a whole experiences uniform and usually cloudless weather, with a mean daily temperature varying between 15.9° C. (60.8° F.) in the north, and 28.8° C. (84° F.) in the extreme south, the mean daily range being very high, as much as 16° C. (29° F.) in the desert areas. The variation with latitude is to be explained by the greater length of day in the south, the higher angle of incidence of the sun's rays, and the fact that the northerly

air-stream is heated in its journey towards the equator. Conditions are not wholly uniform from day to day, since the wind speed and direction are affected by the passage of depressions along the Mediterranean, especially if these are of great depth or if their paths take them over the Nile Valley. When this occurs, especially in February or March, when the force of the high-pressure belt to the north is weakening, a regular pattern of events may be repeated: first when the centre of the depression lies to the north-west of Sudan there is a tendency for air to be drawn from the south and south-west in advance of its path, so that the

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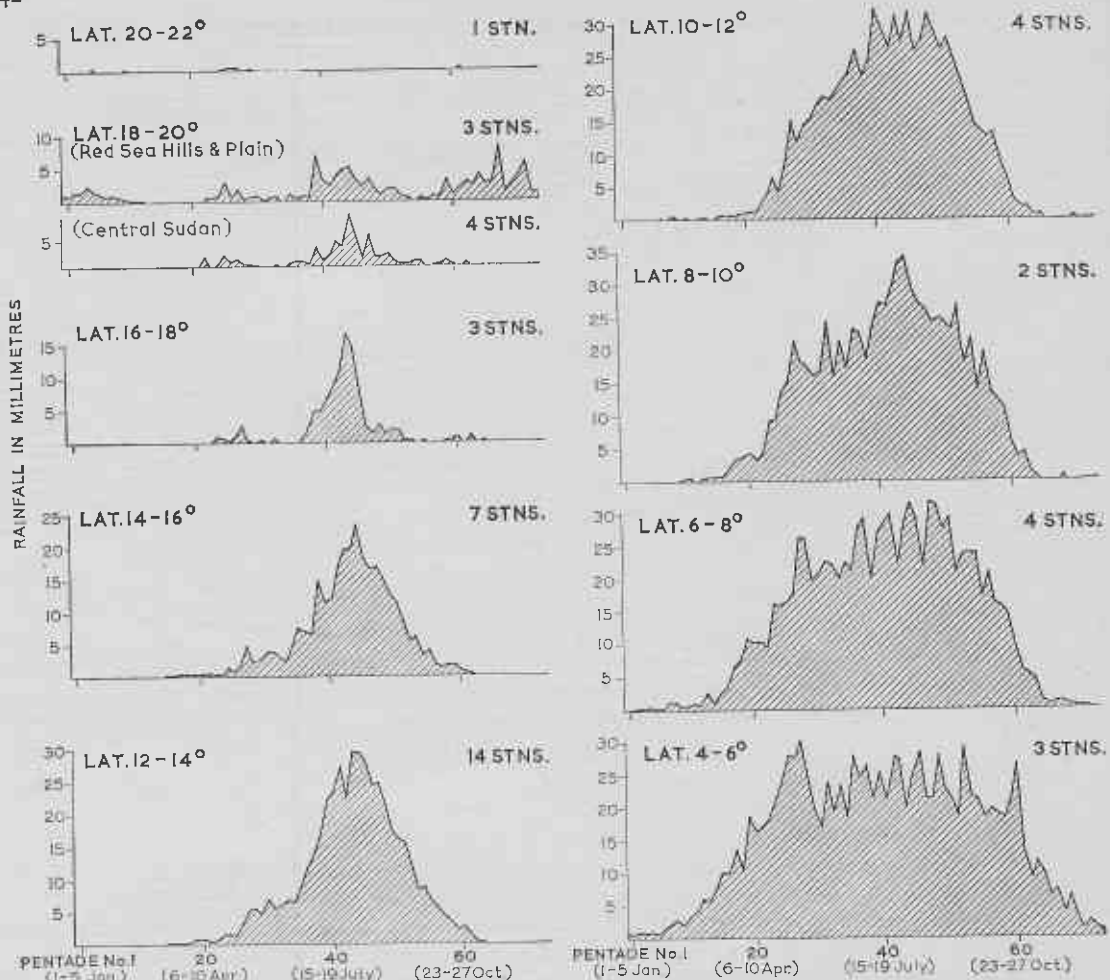


FIG. 18. Pentade (5-day) rainfall curves, 1921-1950. Both the duration and the intensity of the rainy season vary according to latitude, but the wettest pentade has approximately as much rain between latitude 12° and 14° N., as in any of the stations farther south. At the most southerly stations the pattern suggests neither a regular double maximum nor a pronounced peak or single maximum: there is rather a prolonged rainy season when the totals are nearly constant for about 6 months. From Sudan Meteorological Service, *Average Pentade Rainfall 1921-50*, Khartoum, 1957.

usual north winds are checked or may even be replaced by south winds, with a resulting increase in ground temperatures. Next, when the centre of the depression has passed eastwards to lie over Syria or the eastern Mediterranean, an associated cold front may cross northern Sudan. This establishes a continuous stream of cold air between the anticyclone over western Russia and the Nile Basin. There is a marked drop in temperature, often accom-

panied by dust-storms and rising sand, and occasionally the sky is clouded over with patches of alto-cumulus cloud that contribute to the reduction in day temperatures. This cloud occasionally gives very slight rain.¹

The Hot Season ('Seif')

By the end of March the effect of the depressions is less marked, and with solar radiation increasing in intensity and duration the tem-

¹ When a large group of scientists had gathered in Khartoum in 1952 to observe the eclipse of the sun forecast for 25th February, there was considerable anxiety in case a strong wind following a depression might bring rising sand or cloud and so obscure visibility. The danger was estimated by the Government Meteorologist to be about 1 in 20; in fact, a cold front passed across the Nile Valley about five days before the eclipse, which was in consequence observed in excellent conditions. See also J. H. G. Lebon, 'An exceptionally cool season in North-Eastern Africa', *Weather*, 13, (1958).

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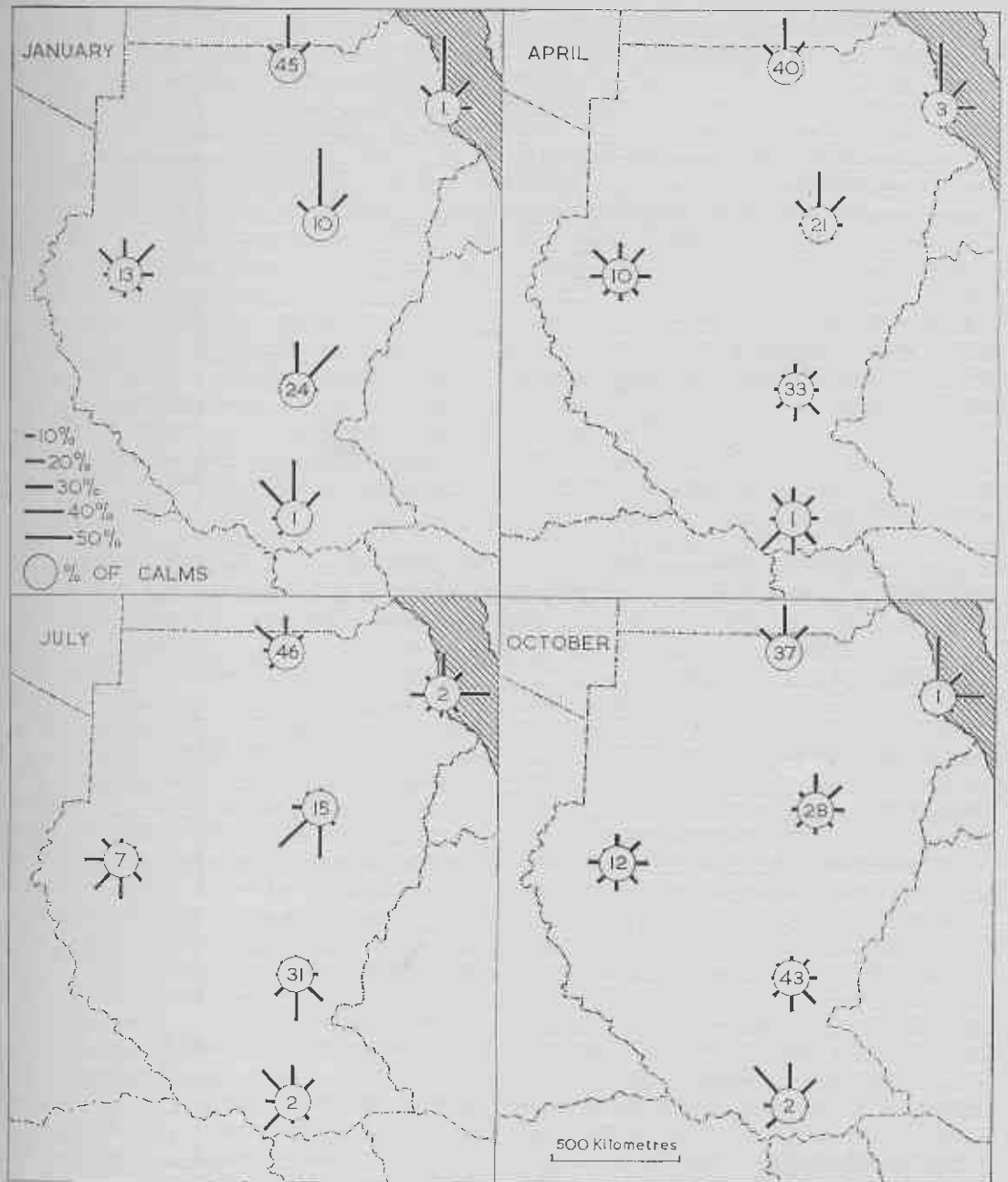


FIG. 19. The frequency of winds from different directions at six representative stations: (a) January, (b) April, (c) July, (d) October. The alternation of wind direction according to the season is most noticeable in central Sudan; the anomalous frequency of north and west winds in Juba in the extreme south in July and October is possibly related to low pressure systems over the East African plateau. The frequency of calms is conspicuously higher in the flat central plains of Sudan than beside the Red Sea or near to the high mountain masses of Jebel Marra in the west or the Imatong Mountains in the south. Figures from *Climatological norms for Egypt and the Sudan, Cyprus and Palestine*, published by the Physical Department, Ministry of Public Works, Cairo, 1938.

perature in northern and central Sudan rises towards its maximum, which is attained in May and June. The highest mean daily maximum is 39°C . (102°F .) at El Obeid in May and 42.9°C . (109.4°F .) at Atbara in June. Since the sky continues to be extremely dry and clear, night radiation is intense and, the high daily range at this season, 17°C . (31°F .) in central Sudan, means that night usually brings relief from the severe heat of the day. During these months the Inter-Tropical Convergence is gradually moving northwards, though still fluctuating widely from day to day. In the extreme south the early rains begin in March, but at this season they are often interrupted and it is too early to sow crops.

In central Sudan, the months of May and June, towards the end of this season, experience a very disagreeable kind of tropical line squall known in Arabic as an *habīb*. Cumulus clouds build up during the day, but rarely attain a sufficient height to give rain, so great are the ground temperatures, until the late afternoon or evening. When rain begins to fall, the falling raindrops have a cooling effect on the air through which they are falling; a rapid down-draught is caused in the path of the storm, picking up the loose sand and clay particles that are plentiful on the earth's bare surface and carrying them swirling into the air to a height of several thousands of feet. After a stifling, windless spell a wall of yellow dust is seen approaching, often from the east or north-east,¹ and then the storm arrives, the wind speed rises to gale force, and for an hour or more the air is filled with flying dust. Eventually the wind abates, rain usually falls, bringing a drop in temperature, and the dust is temporarily laid. Dust storms are most severe in areas like Khartoum, where the ground surface is likely to be bare of vegetation and much disturbed by animals and motor traffic, or at Kassala, where the silts of the Gash delta have been exposed after the cotton harvest. By July or August, especially in a fairly wet year, the soil is protected by a mantle of vegetation, and the dusty prelude to a convectional storm is usually absent.

¹ The cumulo-nimbus clouds, which give most of the rain in Sudan, rise high enough (about 10,000 m.) to reach the north-easterly air-stream normally blowing at that altitude. Hence storms tend to approach the observer from the north-eastern quarter of the sky.

² A. A. Miller, *Climatology*, 1946, p. 144.

The Rainy Season ('Kharīf')

The onset of the rainy season throughout central and southern Sudan is much less dramatic than the burst of the monsoon in the Indian sub-continent.² The Inter-Tropical Front shifts northwards in a succession of intermittent advances and retreats, and it is not until it has passed about 150 km. to the north of an observing station that the depth of humid air is normally sufficient to permit the build-up of convectional clouds high enough to give rain. During the rains an appreciable drop in the mean monthly temperature is recorded, about $5^{\circ}\text{--}8^{\circ}\text{C}$. ($9^{\circ}\text{--}14^{\circ}\text{F}$.) (Fig. 20); this is caused by the increase in cloudiness, the absorption of long-wave radiation by added water vapour in the atmosphere, and the conversion of latent heat that is involved in the process of evaporation. South of about latitude 13°N ., these features, combined with the cooling effect of the south-west wind, make the rainy season one of the most pleasant in the year. This is certainly to the advantage of those who have to sow and weed their crops at this season.

The asymmetrical nature of the curves of mean pentade rainfall in Fig. 18 is worth noting, for it corresponds to the fact that the advance of the Inter-Tropical Convergence from the south is much slower than its retreat. While May and June are wet months in central Sudan but dry at the latitude of Khartoum, late October and November (equally spaced after the rainfall maximum in August) are dry except in the extreme south. During the rainy season there is a marked drop in maximum temperatures, a rise in humidity, and a drop in the mean daily temperature range. Often the familiar tropical pattern of weather is to be observed, with a clear morning followed by the build-up during the day of cloud cover that perhaps leads to rain in the late afternoon or at night. Occasionally, however, the sky becomes completely overcast, and rain may fall continuously for twenty-four hours or more. Morning dew is usual during the wet weather, and can be quite heavy when a cool, cloudy day is followed by a clear night. In similar circum-

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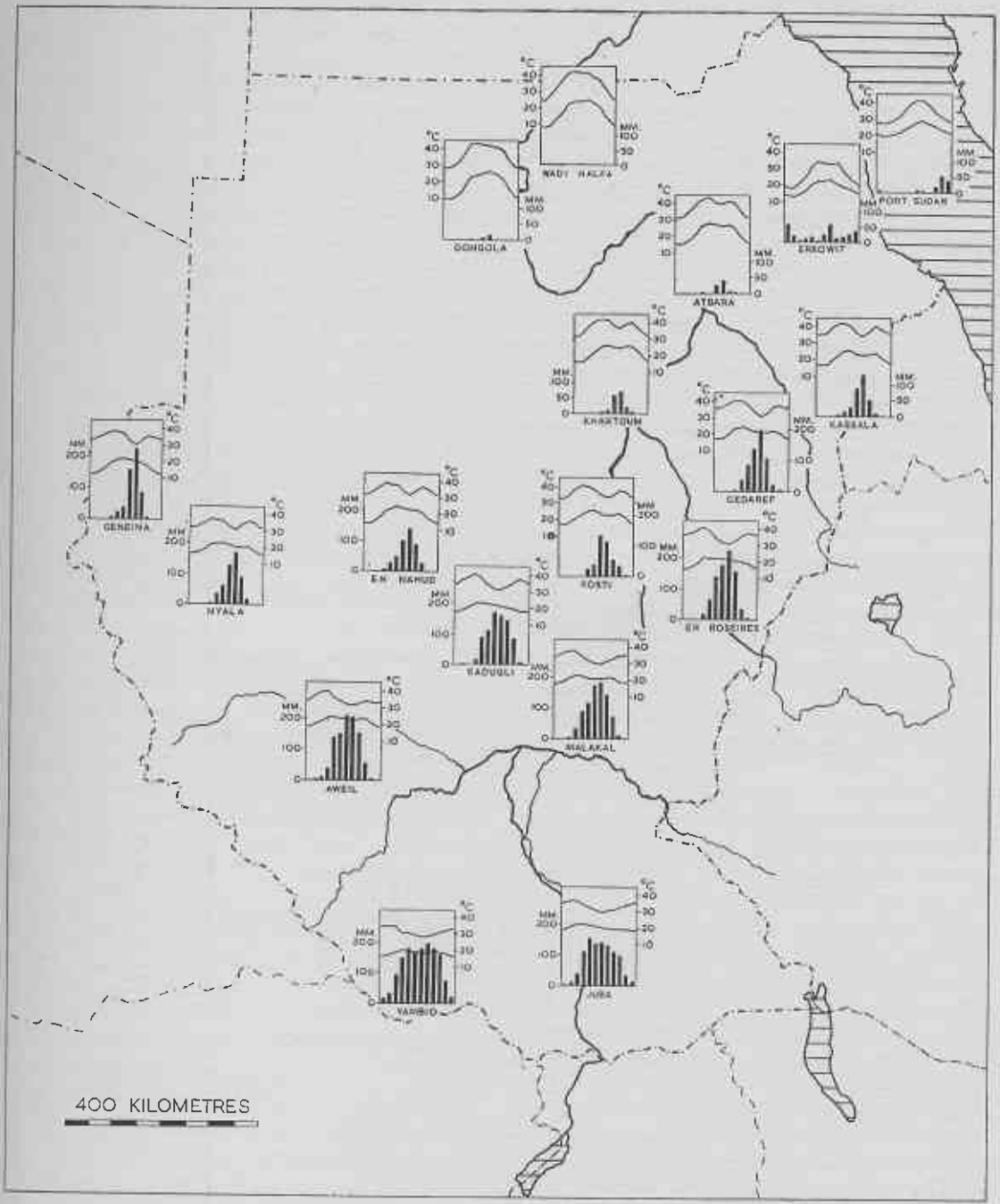


FIG. 20. Mean monthly precipitation and maximum and minimum temperature at eighteen representative stations. From Sudan Meteorological Service *Climatological Normals*, 1921-1950.



stances morning fog may occur in southern Sudan.

The mean annual rainfall (Fig. 21) has been plotted on the basis of, in most instances, thirty years' observations, from 1921 to 1950. Its principal features, apart from the obvious rise in the total from north to south, are the orographic effect, observable in Jebel Marra, the Nuba Mountains, and the Red Sea hills, and the lowness of the totals in the Upper Nile basin. It is very difficult to understand how the low rainfall total near Jonglei, at the southern end of the Zeraf Island, and the high figure at Fangak, towards the northern end of the same island, are to be reconciled. In fact, it seems very probable that the arrangements for the collection of statistics in this very primitive area were rather rudimentary and that observational errors are involved.

The normal rainfall totals, the duration of the rainy season, and the monthly distribution of precipitation are represented in Figs. 20 and 21. The mean figures on which these isohyets and diagrams, known as histograms, are based give no indication of how the rainfall is likely to be made up in terms of rainy days and dry spells, nor yet of its variability from year to year. On the former point figures which have recently been published by the Sudan Meteorological Service of the average number of rainy days at a wide range of stations have revealed the rather unexpected fact that 'the general character of individual storms and showers is much the same throughout Sudan. The wide variations in seasonal totals are almost entirely due to variations in the number of storms occurring, and not to any significant differences in the average amounts of rain yielded by individual storms'.¹ In fact, few stations in even the wettest parts of Sudan (with a mean annual rainfall of about 1,400 mm. or 56 in.) have more than fifty days in the year on which more than 10 mm. (0.4 in.) of rain are recorded, while at Malakal (mean annual rainfall 816 mm. or 32 in.) the comparable figure is 24, at El Obeid (385 mm. or 15½ in.), 13, at Khartoum (161 mm. or 6½ in.) 6, and at Atbara (74 mm. or 3 in.) only 1.

The variability from year to year may be

considered in two ways. With the publication of average pentade (five-day period) rainfall figures for forty-six stations, it is possible to plot the totals for selected stations, and to see how even when averages have been calculated over a thirty-year period the resultant curves are strikingly irregular (Fig. 18); secondly, calculations have been made to discover the probable error of rainfall, defined as 'the deviation from the average which may be expected to be exceeded on half the occasions'² and this is shown in Fig. 22. The pattern of isopleths is very similar to that of the mean annual isohyets, but it should be noted that the range of the former, from 20 to 160 mm. (0.8-6.4 in.), is very much less than that of the latter, from 25 to 2,000 mm. (1-80 in.). This means that the variability, expressed as a percentage of the mean annual rainfall, is much higher in the drier areas, being in fact more than 80% at Abu Hamad and 30% at Khartoum, but 12% only at Juba and 6% at Yambio.

Late Summer ('Darat')

The hot spell at the end of the rainy season is made rather disagreeable by the fact that moist air is drawn in over Sudan, especially in the eastern part of the country, from over the Red Sea, and its humidity is therefore rather high. Some cloud is experienced, but upper air conditions rarely favour the build-up of cumulonimbus to give rain. In Khartoum the mean daily maximum rises to 39.6° C. (103.2° F.), and the range is 14.7° C. (26.5° F.).

THE CLIMATIC REGIONS

Within this general framework the course of the seasons in each of the climatic regions described above may now be considered, using one or two typical stations to illustrate conditions in each.

The North

In the Northern or Desert Climatic region rainfall is negligible, and the course of the seasons depends on the direction and speed of the wind and on the temperature. At Wadi Halfa the winter season is distinctly pleasant, for from late November to the middle of March

¹ A. A. Wahab, 'Rain Day Averages 1921-1950', *Sudan Meteorological Service Pamphlet No. 2*, Khartoum 1957.
² A. W. Ireland, 'Annual Rainfall Parameters 1921-1950', *S. Met. S., Pamph. No. 2*, 1957.

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PLATE I. DARK CRACKING CLAY
 In the centre of the photograph the grass has been cleared by fire.

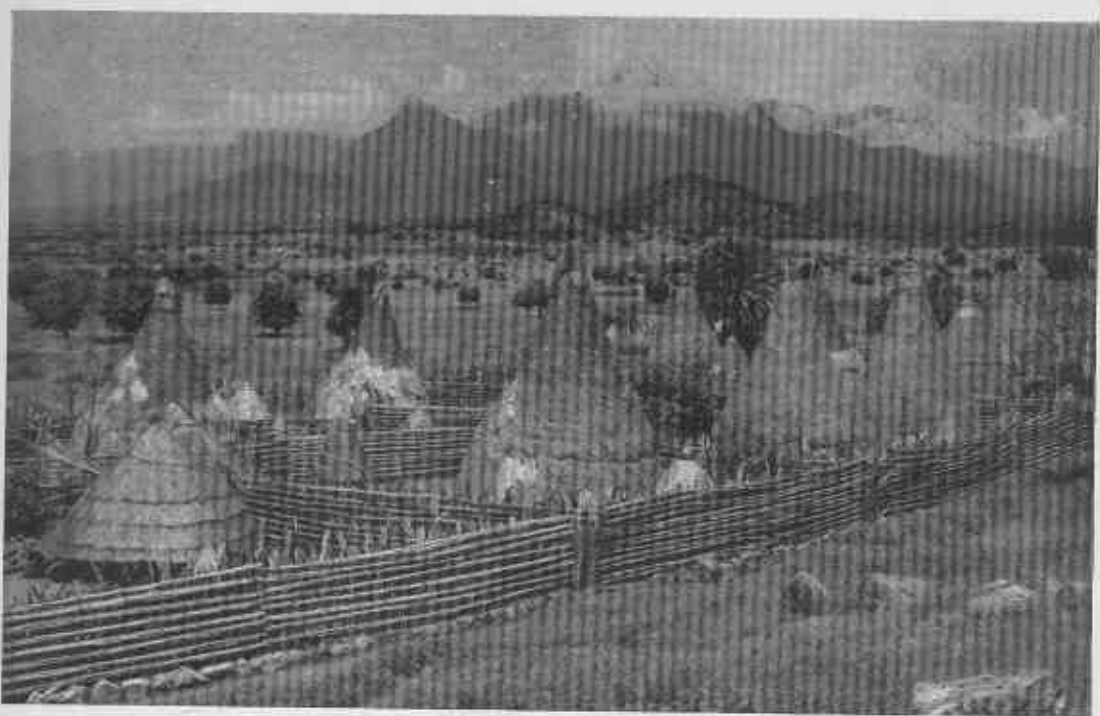


PLATE II. THE IMATONG MOUNTAINS, EQUATORIA
 The regular lay-out of the houses in the foreground shows that these are police lines, not a normal
 Latuka village



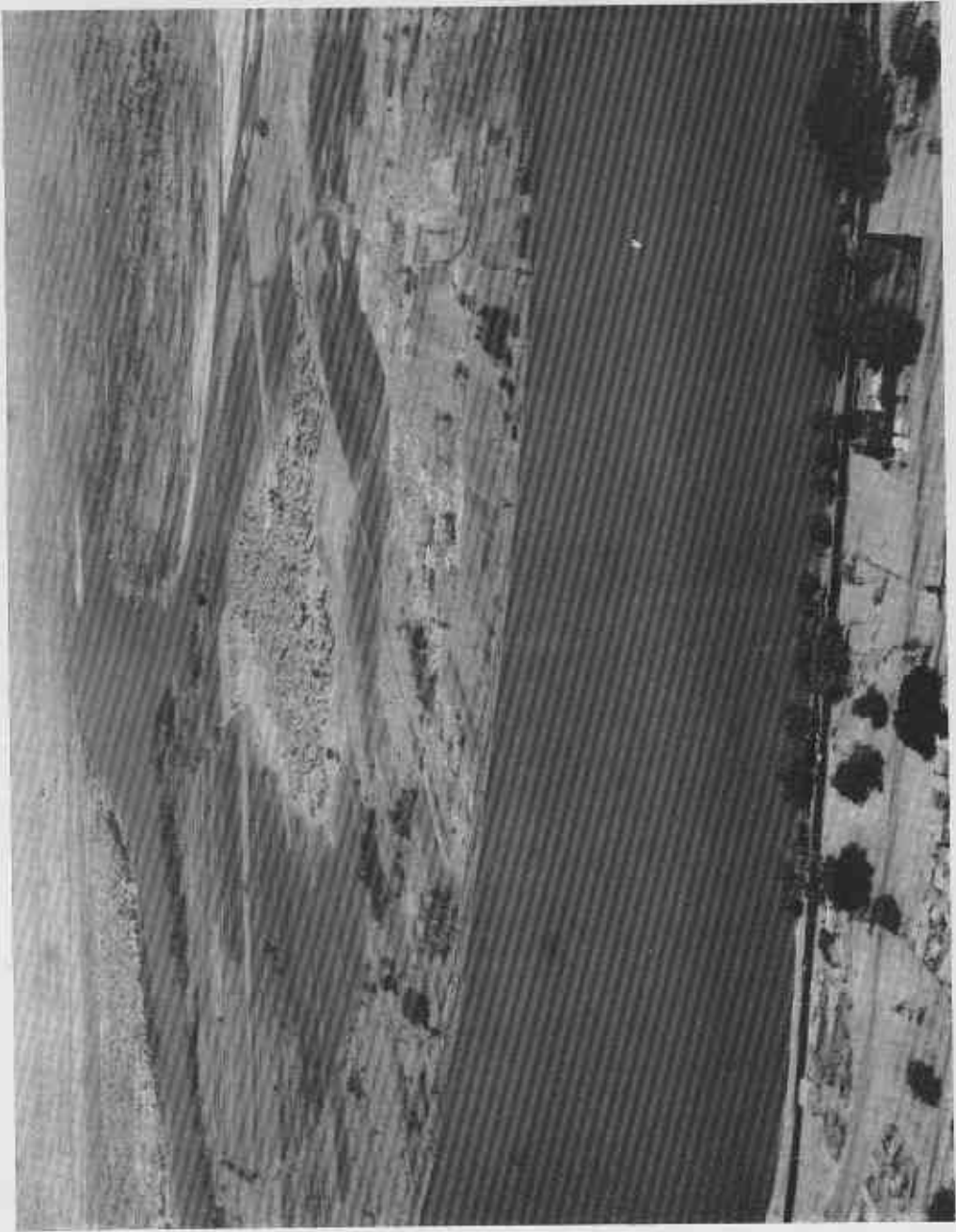


PLATE III. TUTI ISLANDS AT THE CONFLUENCE OF THE BLUE AND WHITE NILES
The alluvial soil is typical of the terraces and islands of the Blue and Main Niles.

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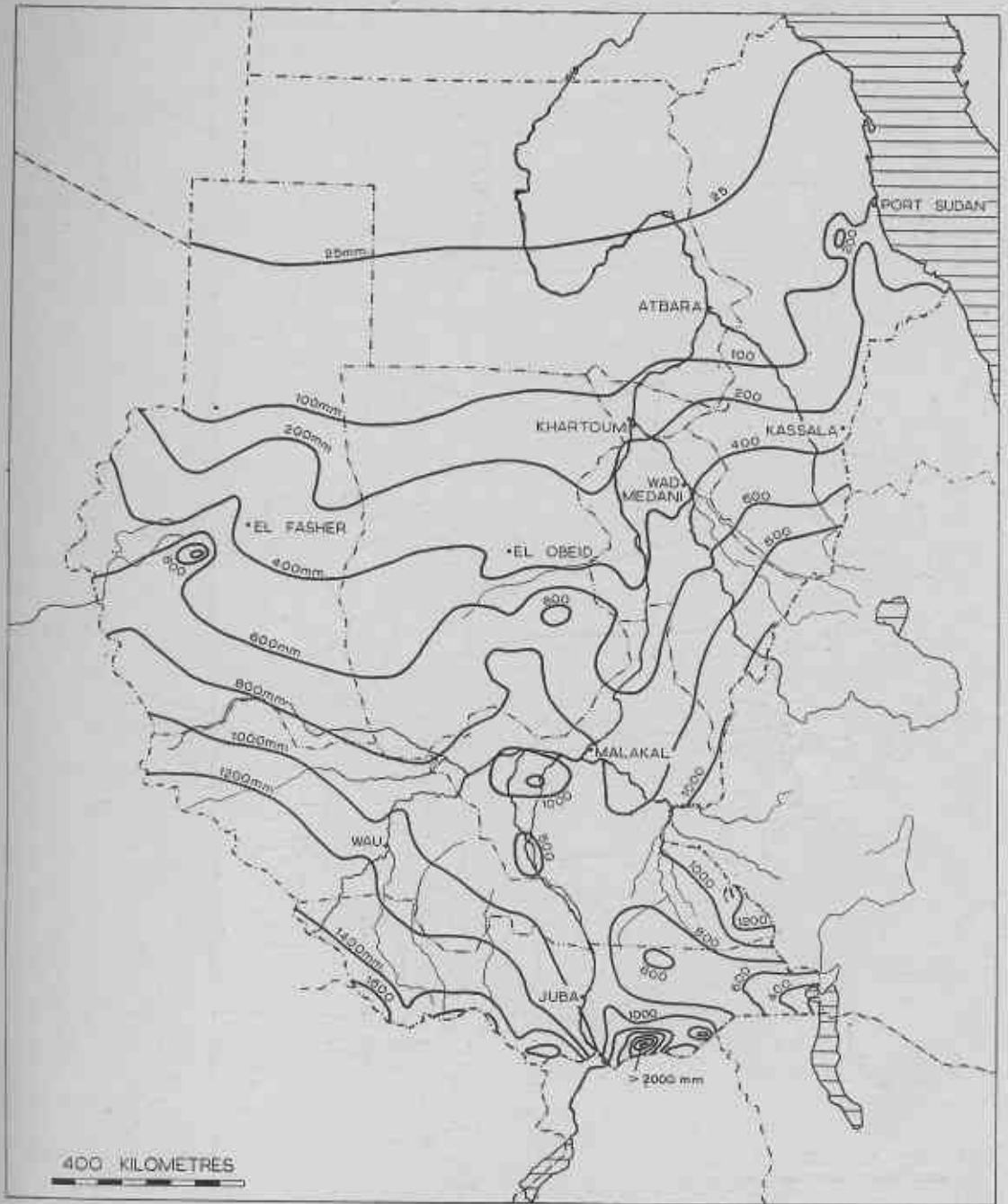


FIG. 21. Mean annual rainfall in millimetres, 1921-1950. From *Sudan Surveys Topo.* No. S912-54.

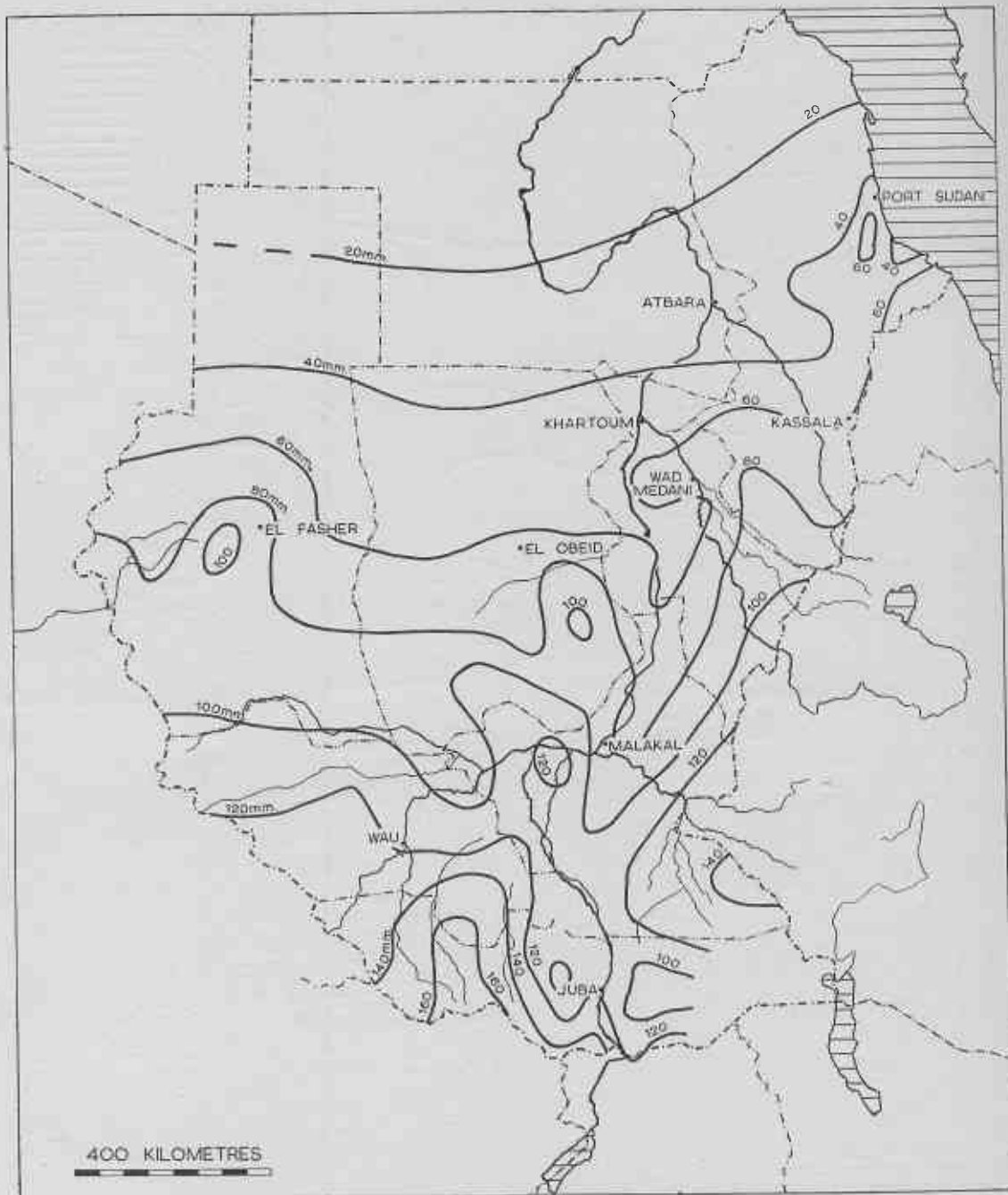


FIG. 22. Rainfall variability in millimetres, 1921-1950. See p. 46 From *Sudan Surveys Topo* No. S912-54

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the mean daily temperature is below 20° C. (68° F.), the humidity is low (about 20% at midday), there is very little cloud and no rain save a few drops occasionally from a cold front. The wind blows from the north, with a mean speed of about 15–20 k.p.h., occasionally attaining sufficient speed to cause rising dust and sand, but usually falling away at night. In particularly cold spells early morning temperatures may be little above 0° C. (32° F.).

Summer is long and very hot, and from the beginning of May until the end of September the mean daily temperature persists above 30° C. (86° F.). The humidity at midday rises from about 10% in May and June to nearly 15% in August, but in normal years no rain falls; there is little cloud, and the mean wind speed falls to about 13 k.p.h., being rather variable in direction for about a month at the farthest advance of the Inter-Tropical Convergence. Throughout the summer the daily evaporation rate stands at 20 mm. (0.8 in.) or more according to the Piché scale. This high figure explains why doubts have been expressed concerning the wisdom of constructing an over-year storage reservoir on the Nile at this latitude.

The North-east Region

It has already been remarked that the climate of the Red Sea coast and of the hills immediately beside it differs appreciably from that of the rest of Sudan, and a word of explanation is called for. The special features are particularly to be noted in the southern portion of the strip, where the alignment of the coast turns distinctly towards the south-east from nearly due south: the north wind blows against the hills to the south of Tokar, and being lifted and cooled it affects not only the hills but also a belt of coastal plain below them.

Winter begins in the north-east with the onset of the north wind, and occasional rain may be expected until the end of January. The average winter rainfall at Port Sudan amounts to less than 80 mm., and is particularly liable to vary from year to year. At this season cloudiness is at its highest, and with a small range of temperature, varying between 19° C. (66.2° F.) and 29° C. (84.2° F.), conditions are at their most agreeable. When the rains come to an end the high humidities

(60–70% at midday) persist, and conditions become increasingly unpleasant as the temperature rises to a mean daily maximum of 41° C. (105.8° F.) and the highest mean daily minimum, 29.2° C. (84.5° F.) in August, that is recorded in any station in Sudan. At this season the wind blows from the south-east, and frequent and prolonged dust-storms occur. Often much of the Tokar cotton crop is lost because it is damaged or because hardly anybody will stay in the delta in the heat to pick it.

Even when most of Sudan is enjoying a slight relief from the heat in the rainy season, therefore, the coastal strip obtains little benefit, for the humidity is so high. The mean summer rainfall at Port Sudan is about 20 mm. (0.8 in.), even less to be relied on than that of the winter. By mid-August the rain is usually over, and the hot conditions with frequent dust-storms persist until the onset of the north wind in October.

The Centre

In central Sudan the temperature and humidity of the wind are of major importance in determining the four seasons of the year. The winter resembles that of the north, but begins rather later and is not quite so cold because the sun is higher in the sky, the days are longer, and the air has had longer to warm up as it crosses the desert; thus at Khartoum the coolest month (January) has a mean temperature of 23.7° C. (74.7° F.), and at Malakal 27.2° C. (81.0° F.). In the southern part of this region grass-fires are common in the winter and the sky is often obscured by smoke.

The hot, dry season is the hottest period of the year. The north wind blows as in winter, but by April and May it no longer brings cool weather. Instead it becomes very hot and dry as it blows across the Sahara, and the mean daily temperature reaches 34.1° C. (93.4° F.) in Khartoum in June. In Malakal the peak is earlier and lower, 31.7° C. (89.1° F.) in April and 32.2° C. (90° F.) in May, because the rainy season begins in the latter month. In the northern half of the region dust-storms are frequent towards the end of the *Seif*, but farther south the denser vegetation reduces their severity. In Khartoum the April relative humidity at midday is 14% and the Piche evaporation 20 mm. (0.8 in.); at Malakal the

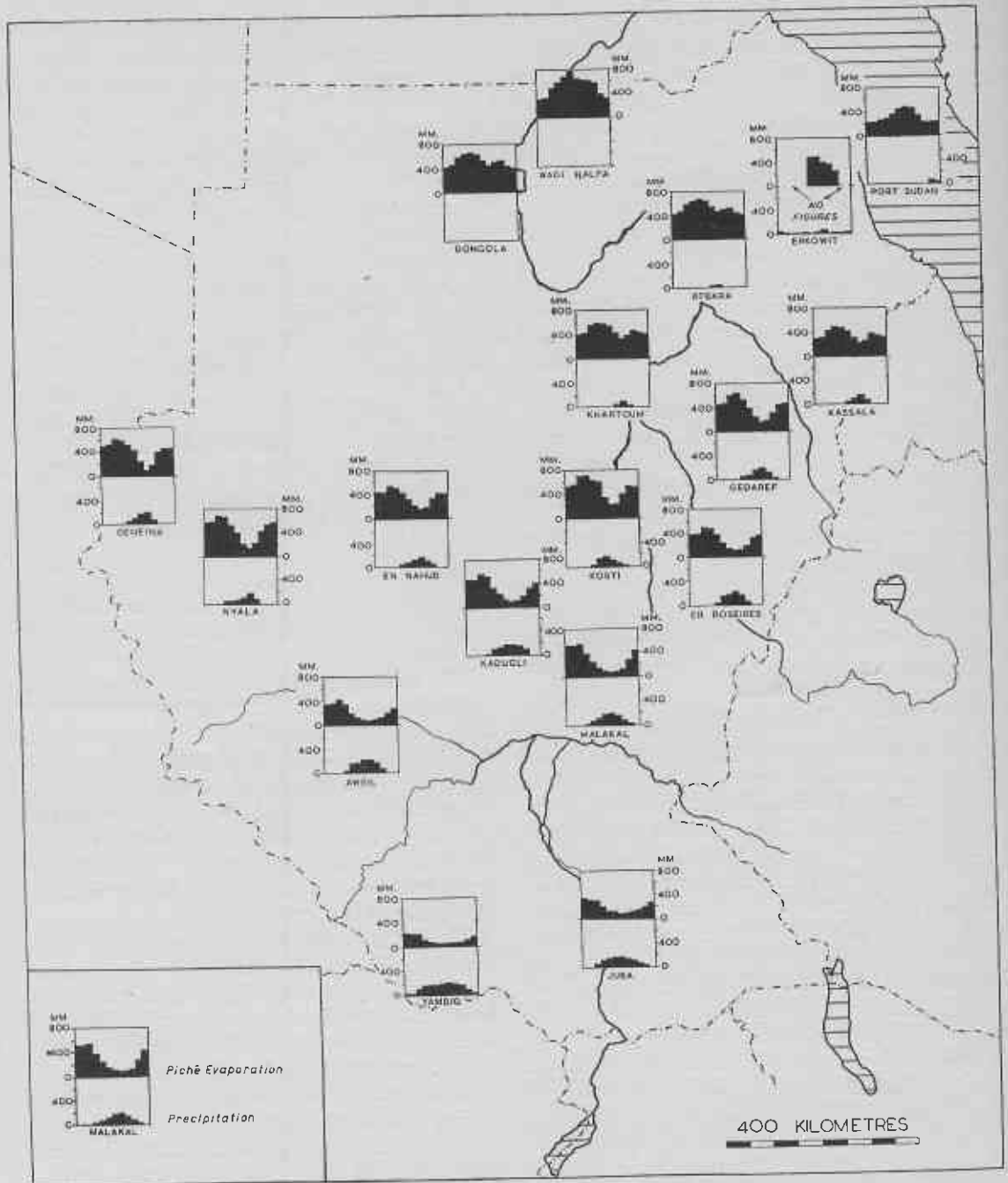


FIG. 23. Mean monthly precipitation contrasted with evaporation measured by the Piché method. No wholly satisfactory method exists of measuring evaporation in standard conditions. It is noteworthy that in many stations of central Sudan where precipitation exceeds Piché evaporation for only one or two months in the year, unirrigated crops may regularly be grown with success. From *Climatological Normals*.

corresponding figures are 25% and 12.9 mm. (0.5 in.).

The rainy season lasts from three to seven months according to latitude, and corresponding differences in the total precipitation make it possible to subdivide this region into a northern belt, normally too dry to grow crops, and a southern belt, where cultivation is regularly practised. When the south-west wind is blowing steadily conditions may become quite agreeable, for the sun is often obscured by cloud. In Khartoum in the northern sub-region, the mean daily temperature falls to 30.4° C. (86.9° F.) in August, with a mean daily range of 11.4° C. (20.5° F.) and a mean cloud cover of 5.3 tenths; farther south at Malakal in the same month the temperature is 26.2° C. (79.2° F.), the range 9.4° C. (17.0° F.) and the cloud 7.4 tenths. From July to September Khartoum receives a mean rainfall of 160 mm. (6½ in.); between May and October Malakal receives an average of 772 mm. (31 in.).

After the rains the season before the onset of the north wind is trying, for the temperatures rise once more (the mean monthly temperature at Khartoum is 32.3° C. (90.0° F.) in October, and at Malakal 27.6° C. (81.7° F.) in November), and the humidities are rather higher than they were in the *Seif*: thus at Khartoum the daily figure for evaporation is 15.1 mm. (0.6 in.) in October, and at Malakal it is 9.4 mm. (0.4 in.) in November. The north wind normally reaches the capital in early November, and is felt at Malakal by the end of the month.

The Extreme South

In the extreme south the climatic régime lies between the tropical and the equatorial. When the north wind blows, there is a definite dry season, lasting for about three months. At this time less than 30 mm. (1.2 in.) of rain are to be expected, but even so the humidity is quite high (25% at midday in February at Juba) and the noon cloud amount averages more than 5 tenths. The outstanding feature of the climate is that 'winter' is the hottest season of the year, the mean daily temperatures in February and March being 29.0° C. (84.2° F.) and 29.3° C. (84.6° F.), and the

mean daily ranges being 14.0° C. (25.2° F.).

The long wet season cannot really be said to have either one or two obvious maxima, but rather rises to a monthly mean of more than 100 mm. (4 in.) in April and continues at much the same level for six or seven months. The coolest month is August, with a mean daily temperature at Juba of 25.3° C. (77.5° F.). This gives an annual range of 4.0° C. (7.2° F.) only, not very different from 5.0° C. (9.0° F.) at Malakal, but much less than 10.4° C. (18.7° F.) at Khartoum or 16.7° C. (30.1° F.) at Wadi Halfa. The influence of the relief on the rainfall totals is most marked, for the isohyets run almost parallel to the contours at the edge of the Ironstone Plateau, and Juba at latitude 4° 51' N. has less rain than Wau at latitude 7° 42' N. The mountain masses of south-east Equatoria have essentially the same climatic pattern as the rest of the region, but storms are more frequent over the peaks at all times of the year.

Other Elements of Climate

Maps of pressure and rainfall have already been included in the course of this discussion of the seasons as they are experienced in various parts of the country. Other elements for which information is available through the vigorous publishing policy of the Sudan Meteorological Service include temperature, humidity, Piché evaporation, cloudiness and wind speed. Histograms drawn to show the precipitation and evaporation on the same map clearly reveal that at most stations and at most times of the year the potential evaporation is much greater than the actual precipitation (Fig. 23). The general effect of these figures is to confirm the picture that has been drawn of Sudan as a hot, arid country, in which although wind speeds are low by world standards, the daily rate of evaporation is extremely high. The low published figures for cloudiness bear witness to the very high sunshine totals received in central and northern Sudan in the year as a whole, and this is reflected in the style of dress worn in the country, in the design of houses and offices, and in many other aspects of Sudanese life.



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gical Normals.

DESERT AND TROPICAL SOILS

THE soils of Sudan, covering as they do an area of some $2\frac{1}{2}$ million square kilometres, are very varied in character, and it would be quite impracticable to attempt to describe them all, even if the necessary information were available, which it is not. Soil science has recently become an extremely complicated branch of knowledge, and it is only in areas of exceptional economic value that really elaborate and prolonged studies of the soil are possible. Even in these the soil scientists would be the first to admit that far more work lies ahead of them than has already been done if they are to understand fully the relationship between the soil and the plants which it can support. In Sudan soil-pits have been dug throughout much of the country, but it is only in the Gezira that anything like a complete soil investigation has been undertaken.

For the purposes of this chapter a simple genetic classification of soils has been adopted, related to the manner of origin of the soils rather than to their physical nature or potential use. This classification reveals clearly the influence of climate as a soil-forming factor, not only at the present time but also in the period since the last general advance of the Quaternary Ice Age.¹ The categories adopted are as follows:

- (a) Desert soils.
- (b) Soils formed *in situ* in semi-arid conditions.
- (c) Laterized soils of humid and sub-humid regions.
- (d) Alluvial and Lacustrine soils.
- (e) Aeolian soils, formed in drier conditions than those prevailing today (Fig. 24).

Desert Soils

The soils of the first category scarcely warrant the name, for they are extremely thin,

consisting merely of particles of the parent rock of assorted sizes. They are almost entirely lacking in humus, since organic matter from the very scanty vegetation which is the most that they can support in even the most favourable situation is quickly broken down into its constituent minerals in the high temperatures prevailing. In the absence of rainfall, however, these soils are of virtually no use to man, and they have been very little studied. In the north-west, where the parent rock consists for the most part of the Nubian Series, there are areas of aeolian deposition, such as sand-dunes, and others of aeolian ablation, such as level expanses of gravel. In the north-east, where the rocks of the Basement Complex appear at the surface and rainstorms are more common, bare rocky hills alternate with sandy stream beds and alluvial outwash fans, and salty incrustations are to be seen where short-lived pools of rain water have dried out.

Soils Formed in situ in Semi-arid Conditions

With a higher rainfall than in the desert, up to 800-1,000 mm. (32-40 in.) per annum, the soil-forming conditions are more complex. In addition to the effects of high temperatures, water plays its part, moving soluble elements within the soil and transporting material by sheet-flow over the surface. Soils formed in such conditions may be of value for cultivation, particularly those occurring in eastern Sudan, but detailed results of soil analyses are not available for them.

East of the Nile the breakdown of the local rock, whether Basement Complex in the Butana or basalt in the Gedaref area, has proceeded far. Today few hills stand out from the gently undulating plains, which are covered by deep dark brown to black cracking clays (Plate I); even in the broad depressions along the stream beds very little coarser material appears, but

¹ G. Andrew, 'Notes on Quaternary Climates in the Sudan', Appendix XXV to *Soil Conservation Committee's Report*, Khartoum, 1944.

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there are signs of the redistribution of clay in broad level flood-plains beside such major watercourses as the Wadi Abu Fargha, which drains the southern Butana. In general these soils are fairly well drained, except in the bottoms of depressions or watercourses; soil-pits show no bedding, and salt concentrations are characteristically absent. For the cultivation of unirrigated millet, these soils are among the best in Sudan.¹

In the extreme west at similar latitude and with the same rainfall lie Jebel Marra and western Darfur, beyond the limits of the Qoz. The soils of western Darfur show a transition between the desert soils in the north, where almost the only soils of any thickness appear in the watercourses, and those of northern Bahr el Ghazal, where laterization is to be observed. Much of the land between the great sand rivers is covered with a thin, reddish, sandy loam liable to sheet erosion; there are some fairly extensive clay flats beside the rivers, but the most valuable soils are afforded by terraces (Plate XXIII) largely composed of pumice and other volcanic material brought down from Jebel Marra.² On the volcanic mass itself there are various loamy or clayey soils, formed from the breakdown *in situ* of the basalts, tuffs, and pumice of which the mountain is composed. The silts in the valleys are of exceptional fertility, and since they can often be irrigated their value is great.

Towards the wetter limit of the area of semi-arid soils, the effects of water movement both within the soil and over its surface become evident. A grouping of soil types occurs according to both altitude and situation, which is known as a *catenary association*, to employ a term first used with reference to East African

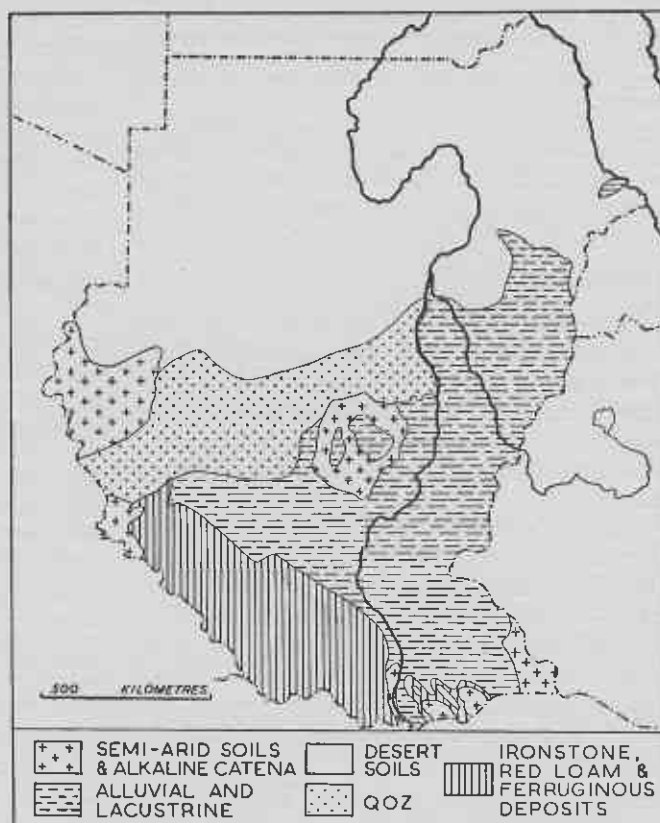


FIG. 24. Main soil categories. The narrow bands of alluvial soil beside the Main Nile below Khartoum are omitted. Adapted from *Sudan Surveys Topo. No. S750-47*, overprinted with *Superficial Deposits*.

conditions³. In Sudan the catena is best developed among the lateritic soils to be described in the succeeding section, but it has also been suggested that where the rainfall approaches 1,000 mm. and there are marked differences of altitude, as is the case in the Nuba Mountains as well as in the extreme south-east, the soils may be grouped into an Alkaline Catena. The existence of a dry season of from three to six months is an important element in the creation of this soil group.

The highest member [of the Alkaline Catena] is the partly weathered mountain rock on which a scanty drought-resisting vegetation finds a foothold.⁴ Below this is the coarse reddish weakly alkaline detritus

¹ J. D. Tothill, chapter on 'A note on the Origins of the Soils of the Sudan' in *Agriculture in the Sudan*, 1948.

² R. T. Paterson, chapter on 'Darfur Province' in *Agriculture in the Sudan*, 1948.

³ G. Milne, 'Normal Erosion as a Factor in Soil Profile Development', *Nature* 138 (1936); *idem*, 'A Soil Reconnaissance Journey through Parts of Tanganyika Territory', *Journal of Ecology*, 35 (1947).

⁴ This quoted passage was written before the publication of J. Smith's work on the distribution of tree species in Sudan.

carrying hardy thorn bushes and spiny succulents. Below this again is a fertile brown soil, moderately heavy and sometimes containing a few stones, salt-free, weakly alkaline and calcareous, low in nitrogen content.¹

The two reddish belts are together known in Arabic as *qardūd*, which means a well-drained and perhaps sheet-eroded red loam.

Lateritic Soils

In southern Sudan most of the better-drained areas are occupied by a range of reddish loam soils that may be grouped together under the general term 'lateritic'. These may be divided into broad catenary associations which vary according to rainfall totals and differences of relief.

Lateritic soils are developed as a result of alternate seasonal water-logging and drying under conditions of intense seasonal weathering.² They consist of an upper or 'A' horizon, from which iron, manganese, and to a lesser extent alumina have been removed by leaching, and a 'B' horizon at a varying depth where these chemicals have been precipitated.³ This precipitation may take place in sheet form, of varying thickness, it may form cylindrical concretions, when it is known as a vesicular deposit, or it may occur round separate nuclei to produce diffuse lateritic pebbles, known as pisolitic laterite or pea-iron. The parent rock or 'C' horizon from which these rocks are derived may be very varied, and in Sudan consists mostly of acid igneous formations of the Basement Complex. The part of Sudan known as the Ironstone Plateau is covered throughout almost the whole of its extent by a hard red concretionary ironstone of lateritic type, at a depth of 15-30 cm. (6-12 in.) below the surface. This ironstone is often 3, and may be as much as 5, metres thick. Over it lies a reddish sandy loam, containing a quantity of pea-iron and of soft red pisolite-like concretions of bright-red ferruginous clay. The ironstone is interrupted where hills stand out above the general level of the plateau, or where it is dissected by the streams which drain

the region. In the latter instance it outcrops to form a marked break of slope.

The effect of heavy rainfall in regions of laterization is that by no means all the normal precipitation can be absorbed into the ground when storms occur. Instead it flows across the surface, picking up many of the smaller soil particles, and carrying them down the slope if the land is dissected. There is thus an alteration of the soil texture, and an inherent probability that the soil in the valleys and in the lower parts of slopes will consist of finer particles than that on the plateau surface. This is the mechanism behind the idea of the catenary association of soils.

The catena as described by Milne, and observed so widely in tropical Africa (by no means solely in Tanganyika or East Africa) and apparently also in Australia, consists in its simplest case of a topographically determined set of soils, originally from the weathering of a single parent material under the influence of normal erosion. The essential feature is the tendency to mechanical fractionation and elutriation of the weathering products down the slope by the action of rainfall . . . the whole situation has a unity which it was Milne's purpose to recognize.⁴

The catena consists of three main elements, known as the eluvial, colluvial, and illuvial complexes. The eluvial complex is the highest, and is found where fine soil particles are being washed away by sheet erosion. The residue may consist of a loam with a high sand content, or if erosion has progressed further the ironstone may appear at the surface. The colluvial complex lies midway down the slopes of valley sides, where some material is being deposited as a result of erosion from higher up, while other material is being carried away. This soil is variable in character, and the results of redistribution by water movement may be evident. The illuvial complex lies at the foot of the slope, where fine material is deposited. In general, the upper part of the illuvial complex is the most fertile soil of the association, but the lower is likely to suffer from poor drainage.

Where the catena lies beside a stream, an alluvial flood-plain may be formed below the

¹ H. Greene, chapter on 'Soils of the Anglo-Egyptian Sudan' in *Agriculture in the Sudan*, 1948, p. 153.

² E. Crompton, 'Some Morphological Features Associated with Poor Soil Drainage', *Journal of Soil Science*, 3 (1952), p. 287.

³ B. S. Ellis, 'Genesis of Tropical Red Soil', *Journal of Soil Science*, 3 (1952), p. 61.

⁴ A. H. Bunting, 'The Catena: A Contribution to a Discussion', *Soils and Fertilizers*, 16 (1953), p. 331.

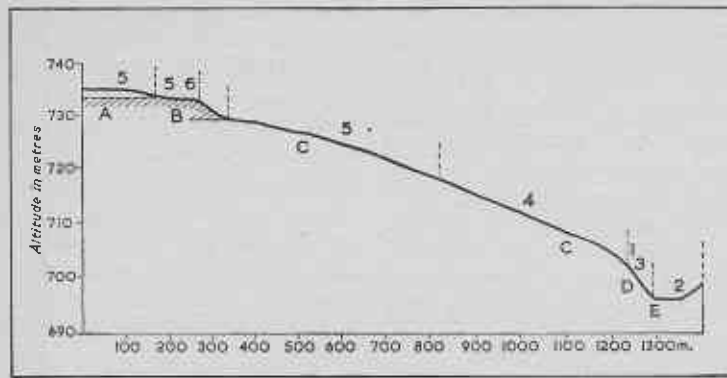


FIG. 25. Soil succession of the Ironstone Catena at Yambio, with typical vegetation types.

- A. Loam and/or pisolitic gravel—colluvial complex.
 B. Lateritic shield—eluvial complex.
 C. Loam and/or gravel—colluvial complex.
 D. Yellow loam, no gravel or stones—illuvial complex.
 E. Dark grey clay—illuvial/alluvial complex.
1. Gallery forest.
 2. Marsh.
 3. Elephant grass formation.
 4. Degraded grass-woodland.
 5. Grass-woodland of the plateau.
 6. Treeless formation on hardened laterite.

Modified from de Schlippe *Shifting Cultivation in Africa*, Fig. 4, p. 41.

illuvial complex; this is not, however, part of the catena proper.

Many versions of the soil catena exist, dependent on conditions of relief, rainfall and parent material. Within the area of lateritic soils in Sudan, Greene has distinguished three types as follows:

(a) With a rainfall of more than about 1,200 mm. (48 in.) and marked differences in altitude—the Red Loam Catena.

(b) With a similar rainfall but smaller differences in relief—the Ironstone Catena.

(c) With a rainfall of 1,000–1,200 mm. (40–48 in.) and low relief—the Toich (Toic) Catena.¹

The Red Loam Catena occurs in very limited areas near the Belgian Congo and Uganda borders, and in its natural state supports a vegetation of high forest:

Beneath a layer of leaf litter the soil is black or brown near the surface and uniformly bright red below to a depth sometimes of metres. It is notably open in texture, moist, and permits deep growth of roots. On the other hand, its content of plant foods may be small. . . . In lower situations the soil is yellow,

heavier, and more plastic, and the humus layer may be darker and deeper.²

The Ironstone Catena is found along the Nile-Congo watershed, where the rainfall totals are between 1,200 and 1,400 mm. (48 and 56 in.) per annum. This area includes the Sudanese section of the Zande tribe, in whose territory a research farm has recently been set up to study local systems of agriculture and methods of improving them. In consequence, it is possible to give a fairly detailed picture of a typical example of the Ironstone Catena, as it appears at Yambio.

Typical 'Ironstone Catena' at Yambio (Fig. 25):

(a) Loam and/or pisolitic gravel, residual, colluvial, or redistributed: partly of terrigenous origin.

(b) Laterite shields, either horizontal or sub-parallel to surface.

(c) Loam and/or gravel, presumably colluvial, overlying loam formed *in situ*.

(d) Yellow loam on slope, without gravel or stones.

¹ Greene, *op. cit.*, p. 147.

² *Ibid.*, p. 153.

(e) (Deduced from Greene) Dark grey clay with yellowish or bluish stains.¹

The Toich Catena, occupying a broad belt of country along the junction of the Ironstone Plateau and the Clay Plain, may be described in general terms as follows:

- Eluvial Complex —Sheet eroded bare or shallow limestone.
 Colluvial Complex—Red detritus.
 Illuvial Complex —Pale detritus, iron-stained subsoil.
 Illuvial Complex —Fine detritus, leached and poor drainage iron-stained near surface, alkaline below.²

This catena has also been the subject of a detailed ecological investigation, carried out just before the Second World War.³ Soil analysis near Wau has shown that in the top 5 cm. of the eluvial complex coarse and fine sand together make up more than four-fifths of the soil, the remainder being mainly clay; in the illuvial complex the situation is almost reversed, for in the top 12.5 cm. (5 in.) coarse and fine sand are less than one-quarter, about one-quarter is silt, and the remainder is clay, more than 50% in fact. At a soil-pit dug in the eluvial phase of this complex the following features were noted, which may be taken as typical of conditions over a wide area:

- 0-5 cm. —Dark reddish-brown sandy loam, (0-2 in.) with some small- and some medium-sized pea-iron (pH 6.9).
 5-20 cm. —Brownish red, with much pea-iron (2-8 in.) grading into larger agglomerations below (pH 6.6).
 20-35 cm.—Similar to above, but with larger (8-14 in.) agglomerations up to 10 cm. in diameter (pH 6.4).
 35 cm. —Very hard, compact ironstone (14 in.) with vesicular structure. Very red in the upper layers, but becoming softer and yellower with depth.

To show how wide the range of soils within the whole Ironstone Region is, an example of

a low-lying site (illuvial complex with impeded drainage) near Aweil may be compared with the above:

- 0-10 cm. —Greyish-buff soil, principally sand (0-4 in.) and clay (pH 5.5), with trace of pea-iron and considerable rusty mottling.
 10-30 cm.—Pale yellowish-buff soil, distinctly (4-12 in.) higher clay percentage (pH 5.1), with a little fine pea-iron and marked iron staining and mottling.

Whitish pebble-sized concretions, presumed to be calcium carbonate, occurred close to the surface near termite mounds.

Clearly the agricultural value of the different elements of these catenas is by no means uniform. From the point of view of the agronomist, therefore, or of the general student interested in arriving at an estimate of the potential productive capacity of the region, it is of great importance to know the relative extent of each complex, and also how far the most valuable elements may be expected to lie together or along potential lines of communication. Some hint of this is given by Morison and his colleagues in their diagram of the comparative profiles of the main natural regions of the plateau. The general point that they make is that in the highest regions, particularly along the Nile-Congo watershed, the highest (eluvial) complex is the most developed; in the main tributary region the colluvial complex is the widest spread, and in the region bordering the flood-plain the illuvial complex is the most extensive.⁴

Alluvial Soils

Alluvial and lacustrine soils are widely distributed in Sudan. It will already have been remarked that within the Desert, Semi-desert and Lateritic soil regions there are limited alluvial areas, mainly the result of quite local drainage. More important alluvial soils have been deposited by streams flowing from the uplands to the south and east of Sudan, and

¹ P. de Schlippe, *Shifting Cultivation in Africa*, 1956, p. 40.

² Greene, *op. cit.*, p. 147.

³ C. G. T. Morison, A. C. Hoyle and J. F. Hope-Simpson, 'Tropical soil-vegetation catenas and mosaics', *Journal of Ecology*, 36 (1948).

⁴ Morison *et alii*, *loc. cit.*, p. 10.

these are to be found throughout the whole length of the country from north to south. In the northern part of the country they are of limited extent, comprising merely the alluvial terraces beside the Main Nile and the deltas of the Gash and Baraka rivers in the east. In central Sudan they consist of limited areas of alluvial terraces beside the Blue and White Niles and their tributaries, together with the northern Gezira plain, which is thought to be of lacustrine origin, and all the extensive clay area that stretches from the Nuba Mountains to the Ethiopian foothills. In southern Sudan the clays are even more extensive, and occupy a vast triangle between Lake Rudolf, Renk and Aweil.

Numerous studies have been made of typical alluvial soils in northern Sudan. Greene remarks, concerning the soils near El Bauga village, forty miles north of Atbara:

A large part of this area appears to have been deposited recently, and it may be swept away no less quickly by the powerful flood-waters of the Nile and Atbara. . . . The deposits are, therefore, far from stable. They are laid down as the river swings from side to side. The receding water throws down first sand, which may show current bedding, and then as it becomes shallower silt and clay, of which the fine lamination may be lost under cultivation. In some places deposition has been rapid and regular, and the product is a good medium for plant growth; but in others a sand- or mud-bank has formed in such a way as to permit much evaporation of river water from its damp surface, with the result that calcium carbonate and sodium sulphate have been concentrated there.¹

At their best these deposits of sandy or clayey silts are easily worked and extremely fertile. A yellow-grey sandy silt examined at El Bauga showed little variation throughout its first 2 m. (6 ft.), with no stones, gravel, or coarse sand; fine sand averaged 63%, silt 12%, and clay 25%. The mean pH value was approximately 8.5 (representing a mildly alkaline reaction), and the dissolved salts of calcium carbonate and sodium sulphate averaged 0.4%. At the lower end of these silt deposits heavier soils are usual, for areas of clay which cracks on drying out may result from the deposition of finer particles in lagoons. The quality of such areas depends on the degree of

salt concentration, and when this approaches 1% crop yields are noticeably affected.

In the alluvial deltas of eastern Sudan the soils are more immediately derived from the basaltic highlands of Ethiopia and Eritrea than are those beside the Main Nile, and they vary from a rather coarse sandy silt at the delta head to a heavy clay at the tail. According to Tothill, the Gash delta is underlain by an impermeable bed of clay, and it is this which enables the silt to retain enough moisture after a single flush to produce a crop of grain or cotton. Mechanical analysis shows that there is very little material classified as coarse sand or larger, and that the proportions of silt and sand vary widely. There is no marked accumulation of salt at any point in the profile and calcareous nodules do not occur. The pH value of samples taken to a depth of five feet vary from 7.1 to 8.3.²

The alluvial soils beside the Blue Nile occur on islands (Plate III), on the steeply sloping banks and within the loops of the meanders, which are incised into the plain to a depth of about 20 m. In composition these soils are very much the same as the El Bauga silts described above; enclosed within the silts there is often a slightly depressed basin, which is flooded when the river is at its highest and is gradually filled up with fine clay particles. Along the Rahad and Dinder rivers these features are reproduced on a smaller scale.

The clays beside the White Nile are much finer. Much of the alluvium in the lower part of the valley is flooded each year when the Blue Nile rises and the Jebel Auliya Dam is filled, but a detailed examination of a fertile deep clay at Ed Dueim, just above high-water level, shows the following average figures for the top 6 ft.: coarse sand 4%, fine sand 9%, silt 9%, clay 78%; the soil is slightly alkaline, and contains less than 0.5% of soluble salts.³ This soil is thought to have been laid down in permanent water, according to the evidence of the fossils, while the presence of gypsum makes it apparent that even as far upstream as Kosti the water originally came from the Blue Nile, which must have reached the White Nile valley farther upstream than the present confluence at

¹ Greene, *op. cit.*, p. 162.

² C. H. Richards, *The Gash Delta*, Ministry of Agriculture Bulletin No. 3, Khartoum, 1950.

³ Greene, *op. cit.*, p. 162.

Khartoum.¹ Recent studies of the potential extension of irrigation in Sudan have produced much additional information concerning the White Nile alluvium farther south, and have stressed the importance of drainage as a factor affecting fertility.²

The Gezira plain north of Jebel Moya and the Sennar-Kosti railway line was once thought from its absence of bedding to be of aeolian origin,³ but it now appears from the evidence of fossils to be an alluvial plain laid down by the Blue Nile, which spread out over a vast swamp during the rains but dried out annually during the period of deposition.⁴ It differs from the plains of undoubted White Nile origin in that it contains gypsum, which is deposited only in the presence of sodium carbonate. This is abundant in the head-waters of the Blue Nile in Ethiopia. A tentative dating of the deposition of the plain is between 50,000 and 10,000 B.C.⁵

The presence of the Gezira Scheme has led to a great deal of research into the composition and proper management of the Gezira clays.⁶ Certain of the findings have geographical implications which call for comment.

At a typical site in the Gezira the mechanical composition of the upper 6 ft. of the soil is as follows: clay about 60%, having little variation with depth; silt 13-20%, varying irregularly with depth; fine sand 12-20%; coarse sand 2-10%, usually falling off slightly with depth, and stones and gravel rarely more than 2.5%. Both the stones and gravel and the coarse sand fraction are usually calcium carbonate. There is a general tendency for the clay content to increase from north to south.⁷

The most usual soil profile in the Gezira is as follows:

The surface soil to a depth of about 2 feet is dark brown and below it is a grey layer again about 2 feet thick resting on a considerable depth of yellowish-brown soil. The layers are by no means sharply

divided, deep tongues of the surface brown soil penetrate the grey layer.⁸

Such intrusions are undoubtedly the result of deep cracking which allows surface soil to fall or be washed down into the lower layers. The soil is very alkaline throughout, and gypsum is present in considerable quantities. For cotton-growing the Gezira soil has shown itself to be well suited, provided that its fertility be maintained by sparing crop rotations which incorporate long periods of fallow. Cotton should preferably be preceded by two periods of rest and followed by another; this is because wetting has a harmful effect on the soil structure, increasing its swelling when wetted and so reducing root penetration. 'Irrigation causes a temporary deterioration in physical properties; dry fallowing brings about a temporary improvement in physical properties.'⁹

Variations in cotton yield within the Gezira have been shown to be related to the salt content of the soil, and in particular to the presence of sodium carbonate, for where the total of salts rises to as much as 0.2%, yields are seriously affected. Experiments with artificial fertilizers have shown that neither potassium nor phosphorus is lacking, but that added nitrogen can raise yields significantly.

Until recently the soil between Jebel Moya and the Sobat has been much less studied. Some small granitic hills stand up from the extensive clay plain, becoming more frequent towards the Ethiopian border. The plain stretches as far as the Machar marshes north-east of Malakal. These marshes vary greatly in extent according to the severity of the rains, and may remain flooded throughout the dry season in exceptionally wet years.

South of the line of the Sobat-White Nile-Lake No-Bahr el Ghazal, the clay plain continues. In the east it consists of the lowest part of the Alkaline Catena, whose higher parts occur in the mountains to the south and east.

¹ Tothill, *loc. cit.*, p. 134.

² Sir Alexander Gibb and Partners, *Estimation of Irrigable Areas in the Sudan 1951-3, 1954*, pp. 26-7 and pp. 121-46.

³ G. W. Grabham, 'Wells of the North-Eastern Sudan', *Geological Magazine*, Decade V, Vol. VI (1909).

⁴ Tothill, *loc. cit.*, p. 138.

⁵ Tothill, 'Origin of the Gezira Clay Plain', *S.N. & E.*, 27 (1946).

⁶ T. N. Jewitt, *Gezira Soil*, Ministry of Agriculture Bulletin No. 12, Khartoum, 1955, includes a full bibliography on p. 70.

⁷ Jewitt, *op. cit.*, p. 15.

⁸ *Ibid.*, p. 12.

⁹ *Ibid.*, p. 43.

For the central part of the Upper Basin a soil-map is provided by the report of the Jonglei Investigation Team, which distinguishes the following categories:

Soils of the Flood Region:

(a) Mainly periodically flooded soils.

(b) Mainly unflooded soils.

(a) The soils liable to flooding comprise the following:

Sudd soils.¹

Toic soils.²

Cracking clay soils.

Non-cracking loam soils.

Non-cracking sandy clay.³

(Fig. 26.)

The *sudd* soils have been developed in low sites by the continuous deposition of alluvium from the waters of the adjoining river. As a result of prolonged flooding these soils have a high organic content at the surface, for a depth varying from a few inches to three or four feet; the physical composition is very varied, with sand ranging from 10 to 65% and clay from 20 to 60%. Surface layers are slightly acid, but lower layers often show an acid reaction; calcium carbonate concretions may be present. Though liable to prolonged flooding, the *sudd* soils may dry out in winter. 'The *sudd* soils are at present too wet to be utilized economically, and their development is unaffected by human activity, except for occasional fires.'⁴

The *toic* and other periodically flooded clay soils are similar and differ chiefly in the length of flooding that they undergo. The former, being flooded from the river, remain moist for several months at a stretch, while in the latter, which

are flooded by local rain-water, wet and dry conditions may alternate rapidly according to the incidence of the rainfall. The *toic* soils are formed from alluvial material, and may contain bands of sand; they have a darkened slightly acid upper layer 50 cm. (2 ft.) to 2 m. (6 ft.) deep, coloured by dispersed humus, and beneath it a more alkaline yellowish or olive-grey layer which may be stained by the oxida-

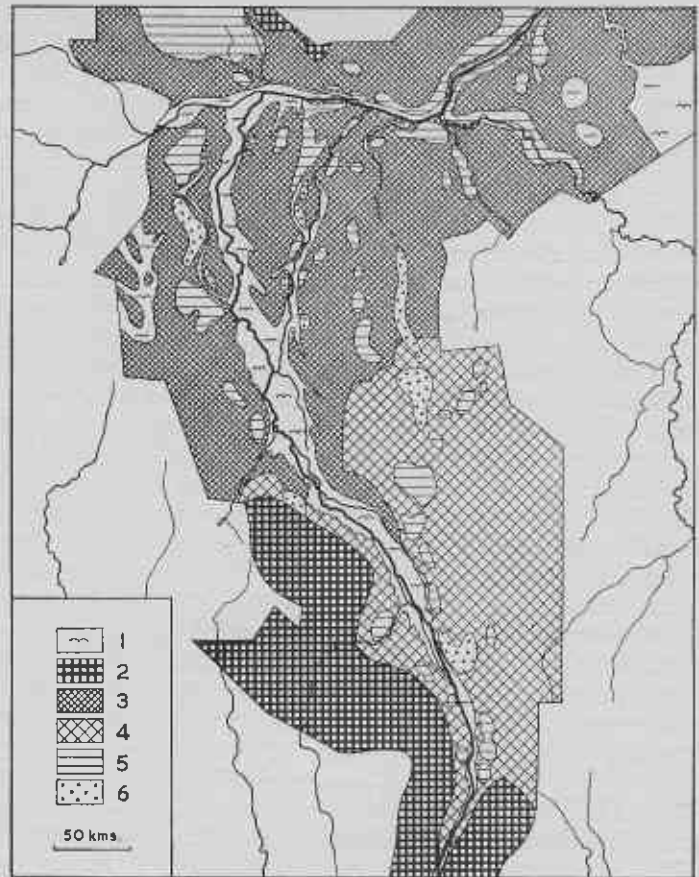


FIG. 26. Soils of the Upper Nile Basin.

1. *Sudd* and *Toic* soils.
2. Soils of the lateritic catena.
3. Predominantly cracking clay soils—periodically flooded.
4. Predominantly loam soils—periodically flooded.
5. Predominantly loam soils—rarely if ever flooded.
6. Predominantly sandy soils—rarely if ever flooded.

From *The Equatorial Nile Project*, Map 7.

¹ *Sudd* (Arabic), means literally 'an obstruction', and hence is used to refer to the portion of the Nile where floating vegetation, esp. *Cyperus papyrus* and *Pistia stratioides*, is liable to obstruct navigation.

² *Toic* (Nuer), means the flood-plain beside the Nile or its tributaries.

³ *The Equatorial Nile Project*, Khartoum (1954), Vol. I, pp. 97-127 and Map 8.

⁴ *Ibid.*, p. 119.

tion of iron compounds. Clay contents are usually high, and cracking occurs in the dry weather. The potential fertility of these soils is at present high because of their periodic flooding, which inhibits the breakdown of organic material, but it is doubtful if this could be maintained if they were drained and brought under cultivation. The other cracking-clay soils differ in that the clay content tends to be higher, up to 70%, and the humus is much less. They are also more alkaline than the *toic* soils.

There are also some loam and sandy-clay soils liable to occasional flooding, particularly in the southern part of the Flood Region. The former merge imperceptibly into the clay soils, and differ mainly in that they do not crack. The latter bear a considerable resemblance to *gardūd* soils, for they are 'characterized by complete lack of structure at all moisture contents and by a 'cemented' appearance'.¹ The physical appearance may be due to a pan formation, or to trampling by men and beasts, since these soils chiefly occur near wet-season settlements. The profile is generally yellow-grey throughout, with signs of gleying common in the wet season, and also iron staining. These are inferior, impermeable, badly aerated soils, and are the most difficult to cultivate. They are generally alkaline, with a high salt content.

(b) The non-flooded soils are very heterogeneous. They range from heavy loams, with a clay content up to 40%, to very light sands, with 1-3% clay only. The upper layers show traces of humus staining, though the humus content is much less than in soils liable to flooding. Rusty iron stains are common, suggesting a certain amount of iron translocation during the wet season, when these soils are sometimes water-logged. Calcium carbonate concretions are common in the heaviest soils. The uppermost soil layers are usually slightly acid, but at depths greater than 30 cms. (1 ft.) alkali reactions are general. The loamy soils are inherently of fair fertility, but have mostly suffered from prolonged over-cultivation. The

sands are less fertile, but their good drainage makes them widely used for cultivation.

In the extreme south of the Bahr el Jebel flood plain conditions are rather different from those farther north, because the river bears a burden of relatively coarse alluvium which is mostly deposited between Juba and Bor. Soil samples taken in connection with sugar-growing experiments show very variable conditions: 'The levee near the bed of the main river is much higher, and the flood plain behind it is more cut up by flood channels than farther north.'² At the surface the clay content varies between 50 and 60%, but 2 or 3 ft. down sandy or silty beds may be met with, and the clay proportion declines to 20-30%. The success of the sugar experiments in parts of the Flood Plain has been due to the presence of ground water not far from the surface, since the cane cannot live without water during the four or five months of drought every year.

Aeolian Soils

Within the desert there are considerable areas of active sand-dunes. These are not included within the present classification of aeolian soils, since they lie quite outside the range of cultivation, and show no mechanical or chemical effects of soil-water movements.

The principal area of true aeolian soil in Sudan is to be found west of the Nile, in central Kordofan and eastern Darfur. Known as the Qoz, this consists of a vast extent of now static, billowy sand-dunes.

In pure form it is characteristically free from mica, and is thought to be derived from the disintegration of the Nubian Sandstone . . . , and to have been deposited or redeposited by the trade winds as desert sand in the final dry periods of Pleistocene times. It is a soil of low fertility, but preserves for the use of crops practically all the rain that falls.³

The dunes are now stabilized partly by a shallow and slight surface cementation by iron oxide or clay, partly by vegetation.⁴ There is a slight tendency for the finest soil particles to be washed down into the hollows of the dunes, where they form a thin clayey crust, as

¹ *The Equatorial Nile Project*, p. 110.

² H. S. Ferguson, *Sugar Cane Trials of the Flood Plains of the Bahr el Jebel in the Anglo-Egyptian Sudan*, Ministry of Agriculture Bulletin No. 6, Khartoum, 1951, p. 3.

³ Tothill, (1948), p. 141.

⁴ G. Andrew, chapter on 'The Geology of the Sudan', *Agriculture in the Sudan*, 1948, p. 107.

is reflected in the type of vegetation that is supported. As a result of the relatively low fertility of these soils, taken with the fact that they are far too permeable for irrigation, few pedological investigations have been carried out upon them.¹

Conclusion

In the great diversity of soil conditions that has been described above it is difficult to find any single unifying factor. One striking contrast is that between alluvial soils and those formed *in situ*. For the most part the igneous and sedimentary rocks that go to make up the solid geology of the country yield soils of indifferent fertility only, as may be seen in the Ironstone Plateau, the southern hill masses, or even the Nuba Mountains. It is only where basic volcanic rocks occur, as in the Gedaref District, in

Jebel Marra, or on the Boma Plateau, that much better soils and yields are to be expected.

The alluvial soils, on the other hand, are generally of higher fertility and have a good structure. The riverain silts are easily worked, and produce excellent crops. As the country's wealth and population increase it is from them that we may expect to see an expanding production of irrigated vegetables, fruit and fodder crops. The heavy black clays are more difficult to work, tending to alternate quickly between extreme hardness and water-logging. Already, however, they have proved their worth, whether irrigated or unirrigated, for the growing of grain and cotton. It is in the possession of extensive areas, still unexploited, of these cracking clays that Sudan enjoys its best prospects of greater prosperity in the years to come.

¹ T. N. Jewitt, 'Goz Soils of the Anglo-Egyptian Sudan', *Transactions of the 4th International Congress of Soil Science*, 1, 1951.

THE RANGE OF VEGETATION FROM DESERT TO FOREST

THROUGHOUT Sudan there is a broad correlation between the amount of the rainfall and the height, diversity and thickness of the vegetation that it supports. This vegetation cannot be called the natural vegetation, since quite apart from the effects of cultivation the grass fires which annually sweep across more than half the whole country are almost invariably of human origin, and they play an important part in determining the types of tree and grass that grow. The area actually cultivated is small (Fig. 39), but the effects of fires are felt almost everywhere where dense annual or perennial grasses grow; allowing for the effects of fire, therefore, the distribution of the trees and grass in the country as a whole follows a pattern closely related to the climate and other physical conditions.

As the mean annual rainfall decreases from 2,000 mm. (80 in.) in a few mountainous parts of the extreme south to virtually nothing along the northern frontier, so the vegetation declines from a few patches of Tropical Rain Forest through Broad-leafed Savannah, *Acacia* Woodland, and *Acacia* Desert Scrub to Desert, which supports no plant life at all. Investigations have been carried out by government officials and private research workers into the species of trees in relation to soil conditions and into the composition and grazing potential of the more important grassland areas. These have made it possible to give quite a detailed account of the distribution of the vegetation of the whole country.¹

FACTORS DETERMINING THE DISTRIBUTION OF TREE SPECIES

While in a general sense there is a clear correlation to be observed between the an-

nual rainfall totals and the height and type of the vegetation in different parts of the country, a striking feature is that particular tree species are to be found in areas with very different rainfall totals. Similarly, particular species may be found growing with widely different types of soil, and in sites that vary from the tops of stony hills to the bottoms of clay-lined depressions.

For many years, therefore, it seemed that there was something arbitrary or unpredictable about the distribution of *Acacia* and other tree species, an impression heightened by the extreme variability of species within the Ironstone Plateau in the south-west. Recently, however, a very detailed examination by the late Dr. John Smith of the relationship between site, rainfall, soil texture and the tree species found upon them has made it possible to see that there is, in fact, a regular succession in occurrences, and that this is related to the amount of water required to support any particular tree.

On a given heavy clay soil, where neither run-on nor run-off affects the supply of water available, *Acacias* may be expected to occur in the following order, from the most drought-resisting to those adapted to the highest rainfall totals:

<i>Acacia</i> Species	<i>Approx. Mean Annual Rainfall</i>
<i>Acacia flava</i>	100 mm. (4 in.)
<i>orfota</i>	
<i>tortilis</i>	
<i>raddiana</i>	
<i>mellifera</i>	200 mm. (8 in.)
<i>fistula</i> (syn. <i>A. seyal</i> , var. <i>fistula</i>)	

¹ J. Smith, *The Distribution of Tree Species in the Sudan* . . ., Ministry of Agriculture Bulletin No. 4, Khartoum, 1950. C. G. T. Morison, A. C. Hoyle, and J. F. Hope-Simpson, 'Tropical Soil-Vegetation Catenas and Mosaics', *Journal of Ecology*, 36 (1948). Sudan Government, *Soil Conservation Committee's Report*, Khartoum, 1944. J. K. Jackson and M. N. Harrison, 'Ecological Classification of the Vegetation of the Sudan', in *Report of a Grazing Survey of the Sudan*, by Harrison (duplicated), 1955. This invaluable work has been drawn on extensively. It is earnestly to be hoped that it will be published in due course.

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PLATE IV. SAND DUNES AND *ACACIA TORTILIS*

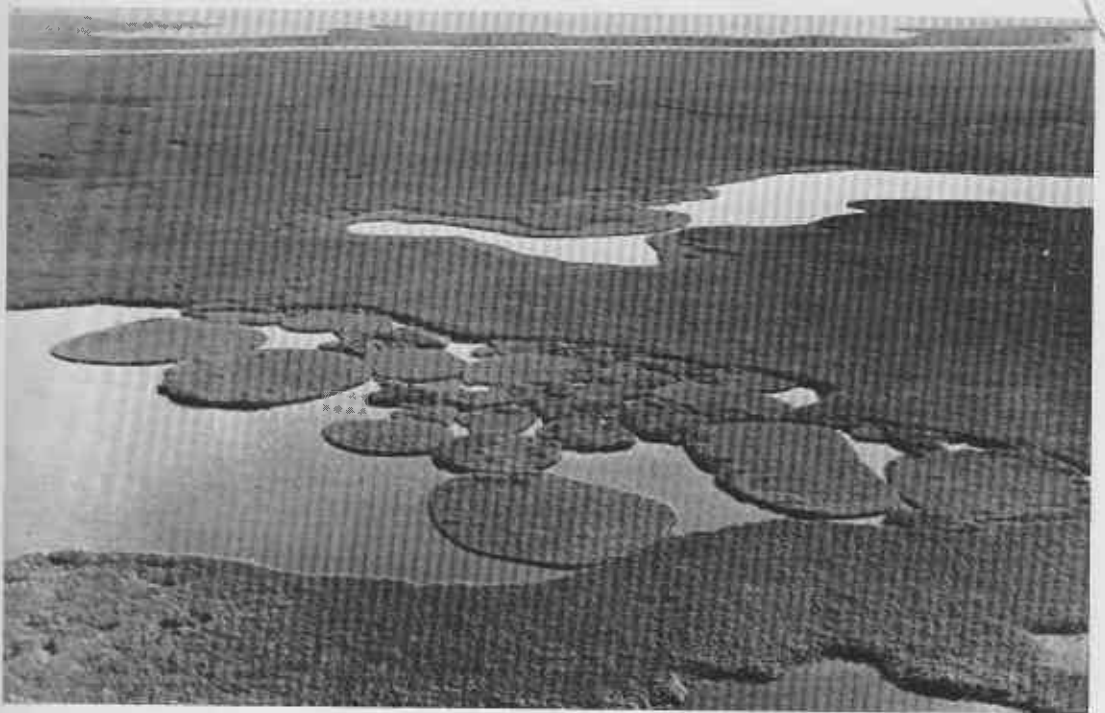


PLATE V. *SUDD* ON A CHANNEL BESIDE THE BAHR EL JEBEL.
The river appears as a narrow strip in the background.





PLATE VI. BAOBAB (*TBEEDI*) TREE



PLATE VII. FOREST FIRE IN THE ZANDE DISTRICT, EQUATORIA

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senegal (syn. *A. verrek*)
seyal
drepanolobium
campylacantha
sieberiana
 (syn. *A. verugera*)
albida
hebacladoides
seyal var. *multijuga*
abyssinica 1,200 mm.¹ (48 in.)

The sequence is best seen along a north-south axis in eastern Sudan, stretching from the River Atbara to the Sobat, a distance of 800 km. (500 miles), and a range of rainfall from 200 to 1,200 mm.

The emphasis, in the *Acacias* country, is on the fact that they do occur gregariously on wide expanses of datum² soils, and that on these soils there are narrow differences in the rainfalls appropriate to each species.³

The above list of *Acacia* species shows 'the order in which species succeed one another on any one and the same type of site in gradually changing rainfalls'.⁴ Alternatively, it is possible to imagine a number of differing sites, each enjoying the same rainfall; at these the same succession of *Acacias* could be observed, according to the proportionate amount of water available for plant growth. The factors affecting this proportion are twofold: first the soil texture, because in a soil with a high clay content more water is held by the soil particles, and hence not available to plant growth, than in a sandy one; and secondly the site, which determines whether extra water is received as run-off from the rain falling elsewhere, whether a proportion of the rain is lost by run-off and hence cannot be used, or whether there is no gain or loss of water through surface flow. The factors of texture and site work together, since if a site is at the top of a hill it is most unlikely to consist of deep cracking clay, while if it lies in a hollow it will not consist of bare boulders quite devoid of soil.

The two factors together are illustrated by Smith's analysis of transects, revealing

that the occurrence sites of any given species, beginning at that end of its range which occurs in heaviest rainfall and ending where the species disappears at the dry end of its range, succeed one another in the following order:

- | | | |
|-------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Loams | A. Hard-soil slopes, i.e. sheet slopes, not readily capable of absorbing water and usually subject to some sheet erosion. |
| Highest rainfall.
Least water available to plants | Clays | B. High-lying old flood-plains, subject now to inundation for days at a time, usually from river-water, but also occasionally from rain-water. |
| | | C. Low flood-plains inundated for weeks at a time. |
| | | D. Mounds in swamp, and high banks fringing rivers which traverse swamp. |
| | | E. The beds of land-locked pools known as <i>rahads</i> in rainland, and as <i>mayaas</i> or basins where they fill from rivers, holding water for months. |
| | | F. Clay plains known as <i>badob</i> soil. These rarely give rise to run-off, and water seldom stands on them. |
| Lowest rainfall.
Most water available to plants | Sands | G. Mature sand plains on which dunes have now been flattened out. |
| | | H. Immature sand, including new or partly fixed dunes known as <i>qoz</i> . |
| | | I. Pockets or small hollows in sand country receiving extra water but maintaining good percolation. Also valley beds of open, readily permeable, sandy soils. |
| | | K. Hills of rough, rocky, highly absorptive surface. |
| | | L. Large seasonal watercourses flushing after rain. |
| | | M. Hard plains of grit or rock. |
| | | N. Small runnels flushing for an hour or two during rain. |
| O. Banks of perennial streams or rivers. ⁵ | | |

These soil types are illustrated in Fig. 27, a contour or site transect related to a single rainfall, showing the actual species of *Acacias* and other trees observed. Smith also gives a list of the tree species to be found in Mixed Deciduous Forest on Red Ironstone soils, where the rainfall range runs from 1,050 to 1,400 mm. (40 to 56 in.). He points out that certain common species of the *Combretaceae* are so frequently secondary in occurrence that they are unsuitable for study in this context.

¹ Smith, *op. cit.*, p. 22.

² Smith defines *datum* sites as those characterized by the absence alike of flow off their surfaces and of flow on to their surfaces.

³ *Ibid.*, p. 22.

⁴ *Ibid.*, p. 30.

⁵ *Ibid.*, pp. 31 and 32.

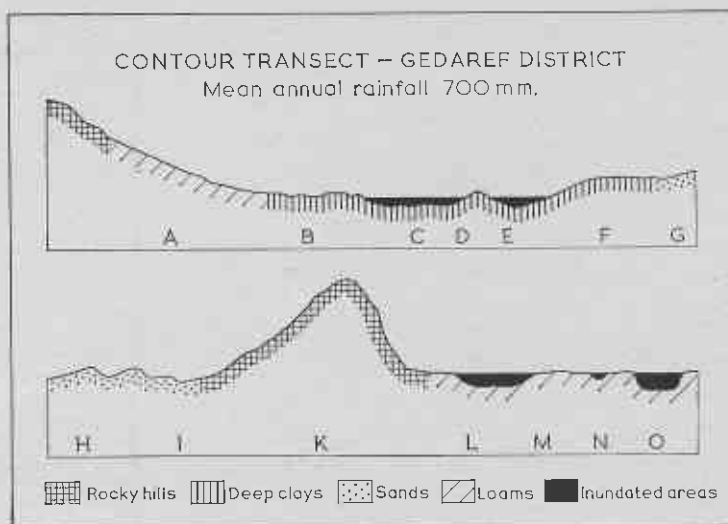


FIG. 27. Site types and typical tree species. The typical tree species occurring at a rainfall of 700 mm. on the site types illustrated above are as follows:

A. & B. *Acacia mellifera*, *A. senegal*, *Balanites aegyptiaca* and *Zizyphus Spina-Christi*

C. *A. fistula*

D. *Bauhinia reticulata*

E. *A. arabica*

F. *A. seyal*

G. *Sclerocarya birrea*

H. *Albizia zygia* and *Detarium sp.*

I. Not represented

K. *Boswellia papyrifera*

L. *A. sieberiana*

M. Not represented

N. *Pseudo-cedrela kotschyii*

O. *A. campylacantha*, *Ficus sycamorus* and *Tamarindus indica*

Smith's more detailed descriptions of the site types are given in the text on p. 63. From Smith (1950) Plate XI.

Bearing this general hypothesis in mind, we can appreciate the difficulty involved in any attempt to describe the vegetation of any particular part of Sudan in terms of local tree species, for within certain limits any species may occur with any rainfall, i.e. at almost any latitude. In practice description does not prove quite so difficult as this, since there are large areas both in the clay plains and in the stabilized dunes of the west where conditions vary little for miles, and hence a dominant tree species can often be distinguished. Such is the case with *A. senegal*, whose distribution follows two 'belt axes', one at 400 mm. on sands in Kordofan and one at 600 mm. on clays in

Kassala and Blue Nile provinces (Fig. 21). This figure confirms Smith's general statement that 'the tree species which requires 3x in. of rain on clay soils require less than 2x in. of rain on sands'.¹

THE VEGETATION TYPES OF SUDAN

Harrison and Jackson had the benefit of Smith's work when they produced their Vegetation Map of Sudan (Fig. 28). They divide the country into the following principal categories: Desert, Semi-desert, Low Rainfall Woodland Savannah, High Rainfall Woodland Savannah,

¹Smith, *op. cit.*, p. 23.

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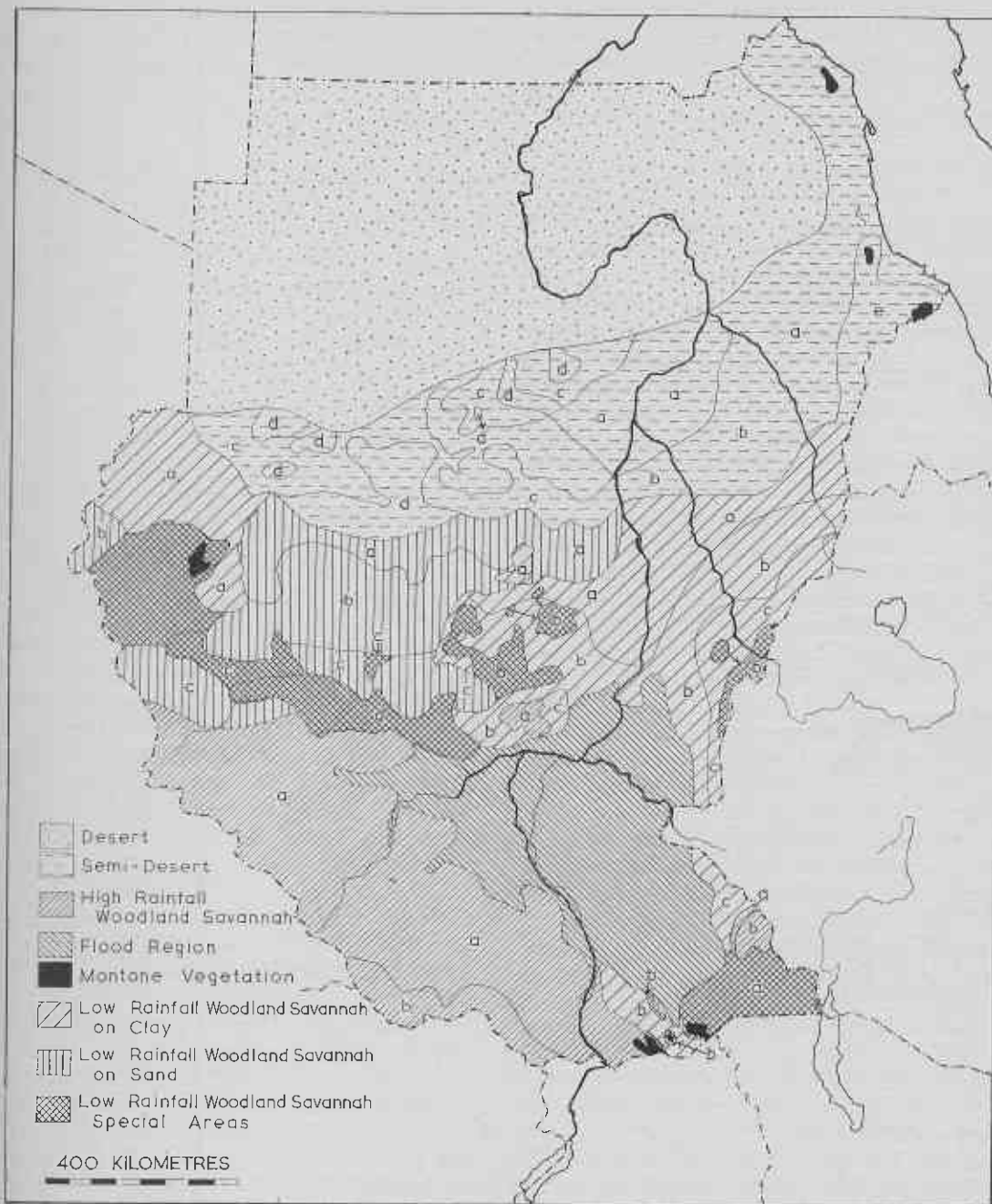


FIG. 28. Vegetation. The subdivisions of the main vegetation associations are discussed in Chapter V. A more detailed map of the vegetation of the Flood Region appears as Figure 94. From *Sudan Surveys Topo. No. S923-55*.

Woodland recently derived from Rain Forest, Montane Vegetation, and the Flood Region; they also distinguish a number of special areas of Low Rainfall Woodland Savannah to describe the conditions of the Nuba Mountains, southern Darfur and Kordofan, and the extreme south-east of the country.¹

The Desert

The southern limit of the Desert, whose area is put at 700,000 sq. km. (280,000 sq. miles) or more than one-quarter of the whole country, corresponds approximately with the 80- or 90-mm. (3½ in.) mean annual isohyet; in the east, however, it excludes the whole of the Red Sea hills, to a width of 100-150 km. from the sea, on the grounds that though the rainfall there falls to as little as 15-20 mm. (less than 1 in.) in the extreme north, the many watercourses concentrate the drainage and support a desert-scrub type of vegetation along the stream beds, while even the hill-sides with their rocky skeletal soils bear a little scattered plant life. Within the Desert, vegetation is confined to the Nile and to such great watercourses as the Wadi el Howar in Darfur or the Wadi el Melik and Wadi Muqaddam, which drain northern Kordofan and the Bayuda Desert. In these stream beds coarse tussocky grasses and *Acacias*, especially *A. tortilis*, may be found. Mention should also be made of the ephemeral herbs and grasses springing up after rare rain showers which give rise to the valuable *jizzu* vegetation (described below in Chapter XI) in northern Darfur and adjacent areas of French Equatorial Africa.

The Semi-desert

The area described as Semi-desert lies between the Desert, as defined above, and the Low Rainfall Woodland Savannah. In the sandy country of the west its southern limit corresponds roughly with the 300-mm. (12-in.) isohyet at latitude 14° N., but east of the Nile, where clay soils predominate, it runs nearer to the 400-mm. (16-in.) isohyet, in accordance with the principle, established by Smith, referred to above.

Harrison gives the following subdivisions of

the Semi-desert vegetation, with rough estimates of their areas:

	Area
a. <i>Acacia tortilis</i> — <i>Maerua crassifolia</i> Desert Scrub	180,000 sq. km. (72,000 sq. miles)
b. Semi-desert Grassland on Clay	100,000 sq. km. (40,000 sq. miles)
c. Semi-desert Grassland on Sand	84,000 sq. km. (33,000 sq. miles)
d. <i>Acacia mellifera</i> — <i>Commiphora</i> Desert Scrub	84,000 sq. km. (33,000 sq. miles)
e. <i>A. glaucophylla</i> — <i>A. etbaica</i> Scrub	30,000 sq. km. (12,000 sq. miles)
Total area of Semi-desert Vegetation	478,000 sq. km. (190,000 sq. miles)

Scrub is to be distinguished from Woodland on the basis of the size of the woody plants that go to make it up and of the normal distance between them. *A. tortilis* normally has a height of 2-3 m. when occurring on a normal or datum site (Plate IV), and *A. mellifera* and *A. etbaica* are similar.² The associated plants, *Maerua* and *Commiphora* spp., are usually rather smaller. Groups (a) and (d) above occur on thin desert soils, the former chiefly to the east of longitude 30° E. and the latter mostly to the west of 32° E. Both groups cover several types of plant association, because of the great importance of site in determining vegetation type; thus, while there are some hard-surfaced off-flow soils that are completely bare of vegetation, there are on-flow soils that bear scrub bushes and even low trees. The division between Semi-desert and Desert is therefore a rather arbitrary one.

Where the soils are deeper, run-off is less important, and the vegetation is more homogeneous over wide areas: woody plants are absent and mixed grasses and herbs provide an even and continuous cover. Nowhere is this better seen than in the Butana, between the Blue Nile and Atbara rivers: for miles the road from Khartoum to Kassala passes through a sea of grass uninterrupted by tree growth except along drainage lines or where there is a semi-permanent pool around which a few *Acacia arabica* or *Balanites aegyptiaca* have sprung up. The valuable tannin-yielding pods of the former and the fruits of the latter (the desert date) would protect them from being cut down. These grassy expanses raise the

¹ *Map of the Vegetation of the Sudan*, Sudan Surveys 1955. Jackson & Harrison, 1955, *passim*.

² In ideal conditions of soil and water supply *A. tortilis* may attain 12 m. (about 40 ft.), but its average size is much less.

problem whether treeless savannahs are a feature of the vegetation of Sudan, unaffected by human activities, or whether in fact there would be an uninterrupted succession of Desert, woody Desert Scrub, wooded Savannah (grass and trees) if it were not for man's influence in cutting down trees and starting grass fires. Harrison's findings seem to support the former theory, since he maintains that soil type determines the nature of the vegetation, and that in this climatic belt deep clays or sands produce a treeless vegetation climax. On the other hand, in both the extreme east and west of Sudan the Scrub and Woodland belts are contiguous with the Desert, which stresses the fact that no simple generalization can do justice to the complexity of the situation; Andrews, in fact, mapped the vegetation of Sudan without employing a category for grassland at all.¹

Low Rainfall Woodland Savannah

In the Low Rainfall Woodland Savannah the trees are higher, from 3 to 5 metres tall, and they often grow so close that their branches touch. They do not check the growth of grasses, however, for even when in leaf most of them give little shade. This belt may be divided into two main sections, one occurring on clayey, the other on sandy, soils. In the former a fairly simple correlation is to be observed with the rainfall, so that with less than 600 mm. (24 in.) *Acacia mellifera* Thornland occurs; next with 600-800 mm. (24-32 in.) *Acacia seyal-Balanites aegyptiaca* Savannah is found, and above that total broad-leafed species, particularly the *Combretaceae*, make their appearance in an association known as *Anogeissus-Combretum hartmannium* Woodland. The extent of these categories in the low Rainfall Woodland Savannah on Clay is approximately as follows:

	Area
a. <i>Acacia mellifera</i> Thornland	92,000 sq. km.
	(37,000 sq. miles)
also on hill soils formed <i>in situ</i> in western Darfur	50,000 sq. km.
	(20,000 sq. miles)
b. <i>Acacia seyal-Balanites</i> Savannah	115,000 sq. km.
	(46,000 sq. miles)

¹ F. W. Andrews, chapter on 'The Vegetation of the Sudan', in *Agriculture in the Sudan*, 1948.

² J. Smith, 'The Grass-Acacia Cycle in Gedaref', Appendix VII, in *Soil Conservation Committee's Report*, 1944.

c. <i>Anogeissus-Combretum hartmannium</i> Savannah Woodland	48,000 sq. km.
	(19,000 sq. miles)
Total area Low Rainfall Woodland Savannah on Clays	305,000 sq. km.
	(122,000 sq. miles)

Both associations (a) and (b) alternate with areas of open grassland. The generally accepted explanation of these is that young *Acacia* seedlings are very liable to destruction by fire, and cannot, therefore, colonize areas of dense grass; when, however, years of little or no rainfall occur, or when a chance fire in the early rains happens to destroy both the mat of dead vegetation lying on the ground and the young grass seedlings that have just germinated, *Acacias* can become established. *A. mellifera* or *A. seyal* then grows up so thickly that grass below is eliminated, and virtually fire-proof and impenetrable thickets cover the ground. As the trees grow older the thicket is broken by deaths among its members, grasses invade the area, and fires follow. The fires soon kill off the remaining *Acacias*, and grassland persists for a number of years.² The most abundant grasses of the former area are *Cymbopogon nervatus*, *Sorghum purpureo-sericeum* and *Hyparrhenia pseudocymbaria*.

In belt (b) the rainfall is beginning to reach the maximum that can be absorbed by the heavy clay soil without flooding, and so trees tend to be absent from level or low-lying sites; this belt merges, therefore, into the flood region, where there are many small areas of slightly higher ground, too small to be mapped, which carry *A. seyal-Balanites* vegetation. In the drier parts of this belt the grasses are much the same as in (a), while in wetter areas *Brachiaria obtusiflora* and *Rottboellia exaltata* occur; where flooding occurs *Setaria incompressa* and *Pennisetum ramosum* are found.

In belt (c) trees are confined to sloping ground, seldom far from hills, and there is some similarity to the wetter parts of the Hill Catenas. Apart from the trees in the type name, *A. seyal* occurs. The grasses here begin to show a shift from the annual species of drier areas to the perennials of the Flood Region and wetter savannahs, and *Hyparrhenia rufa*, *H. pseudocymbaria*, *Andropogon gayanus* and *Setaria incompressa* are dominant.

In the Low Rainfall Woodland Savannah on

Sand three main vegetation belts have likewise been distinguished, according to the totals of mean annual rainfall, as follows:

	Area
a. <i>Acacia senegal</i> Savannah	62,000 sq. km. (25,000 sq. miles)
b. <i>Combretum cordofanum</i> - <i>Albizia sericocephala</i> Woodland	82,000 sq. km. (33,000 sq. miles)
c. <i>Terminalia-Sclerocarya-Anogeisus-Prosopis</i> Woodland	62,000 sq. km. (25,000 sq. miles)
Total area Low Rainfall Woodland Savannah on Sands	206,000 sq. km. (83,000 sq. miles)

In belt (a), with a rainfall range from 280 to 450 mm. (11 to 18 in.), the characteristic tree species is *A. senegal*, the producer of gum arabic, which may occur in almost pure stands over wide areas; where cultivated land is allowed to revert to bush, *A. senegal* is normally the first tree to colonize it, so it may be that much of the apparently wild *A. senegal* is, in fact, secondary vegetation. In water-receiving sites in this belt, where a little clay has been washed down, *Adansonia digitata* (Plate VI) is often found, and also *A. nubica*. The most frequent grasses are *Aristida pallida*, occurring on the crests of dunes, *Eragrostis tremula*, more common in the troughs, and *Cenchrus biflorus*, which increases after cultivation. A fair proportion of annual herbs of many species is also to be seen.

Beyond the 450-mm. isohyet, *Acacias* and other thorny species begin to give way to broad-leaved trees, except on special run-off sites. Generally *Combretum c.* and *Guiera senegalensis* are found on the softer sandy sites, while *Dalbergia melanoxylon* occurs on harder sites, and *Albizia* on those having a hard red layer due to iron salts. The grasses differ little from those of belt (a), and certain herbs may be dominant in places, including *Blepharis* sp.

In belt (c), where the rainfall is above 600 mm. (24 in.) the best-developed type of Low Rainfall Savannah Woodland is to be found, resembling closely the High Rainfall type of the south-west. It is only distinguished by the different soil type, the slightly poorer variety of trees, and the admixture of annual grasses with the perennials. In addition to the dominant trees, *Tamarindus indica* may be found and *A. senegal* in the drier parts. The commonest grasses are *Hyparrhenia confinis*, *Andropogon gayanus* var. *bisquamulatus*, and patches of

Pennisetum pedicellatum; *Blepharis* sp. (*linariifolia*?) is the commonest herb.

The special areas of Low Rainfall Woodland Savannah are as follows:

	Area
b. Hill Catenas	68,000 sq. km. (27,000 sq. miles)
a. Baqqara Repeating Pattern	18,000 sq. km. (7,000 sq. miles)
d. Raqaba Repeating Pattern	33,000 sq. km. (13,000 sq. miles)
a. Toposa Area	36,000 sq. km. (14,000 sq. miles)
Total of Special Areas	155,000 sq. km. (61,000 sq. miles)

The *Acacia mellifera* Thornland of western Darfur is similar to that of the Claylands, except that rather more species of tree occur, including *Commiphora* sp. and *Boscia senegalensis*; alternatively, it may be likened to the Hill Catena lying to the south, the effect of the reduced rainfall being that many species disappear, while the watercourses are also smaller and less significant than those farther south.

The Hill Catena appears not only in the large areas of western Darfur, the Nuba Mountains, and elsewhere, as shown in the Vegetation Map, but also in many small sites where *inselberge* of highly resistant rock jut out from the clay plains or the sands, each surrounded by a characteristic pediment of reddish loam soils. The lower slopes of Jebel Marra and of the Imatong Mountains have also been included in this category, because their vegetation is similar despite a high rainfall. The slopes of the Hill Catena may be divided into five zones, consisting of the hill summit (often bare rock); the steep rocky hill slopes of skeletal soils; the hard-surfaced pediments surrounding the hills, liable to sheet erosion; a transition zone where the features of the pediment and surrounding plain are merged; and the seasonal watercourses formed by the run-off of the hill catchments, which have sandy beds and may be flanked by silty terraces.

The vegetation of these characteristic sites, of which one or more may be absent from particular areas, is as follows:

(a) On the rocky summit vegetation is often completely absent, except for a few species of *Ficus*, especially *F. populifolia*, whose roots

can penetrate for long distances along the joints between the boulders to find water.

(b) On the rocky slopes very many species are found, characteristic trees being *Boswellia papyrifera*, *Sterculia setigaria*, *Combretum*, *Terminalia* and *Acacia* spp., *Anogeissus schimperi*, and the conspicuous pink-flowered *Adenium honghel*; many grasses, including *Hyparrhenia*, *Beckeropsis* spp., and *Pennisetum pedicellatum* are also seen.

(c) The hard-surfaced loam soils (*qardūd*) are unfavourable to tree growth, and even the grass cover is often scanty. *Adansonia* often occurs just at the break of the slope above the *qardūd*, and in more permeable areas *Hyphaene thebaica* is common; the grasses include *Aristida*, *Hyparrhenia* and *Setaria* spp.

(d) Along the zone of transition from loam to heavy clays *Anogeissus schimperi* and *Combretum hartmannium* are characteristic, gradually merging into *Acacia-Balanites* savannah in the plains.

(e) The watercourses vary according to the size of their catchment areas. In Darfur, the terraces beside the large wadis bear fine specimens of *Acacia albida*, with *Cordia abyssinica* and *Khaya senegalensis* in wetter areas; in the Nuba Mountains the terraces are characteristically narrower, and often bear both *dōm* and *doleib* palms (*Hyphaene thebaica* and *Borassus aethiopicum*).

The Baqqara Repeating Pattern consists of frequently alternating small patches of contrasting soil types that lie along the southern edge of the Qoz flats: these are flats of non-cracking clay (*naqa'a*) and slightly higher areas of stabilized sand-dune (*atamur*), with between them a transitional zone, whose vegetation is of particular value for its 'saltiness'.

The smooth-surfaced *naqa'a*, almost impenetrable to water, has a scanty grass cover and rarely supports any trees or bushes except at its edges or where its drainage collects in shallow rain pools around which several kinds of tree may grow. The grasses of the *naqa'a* include several species of *Aristida* and many others, among which may be *Sporobolus marginatus*, which also occurs along the transition zones. Trees found at the periphery of the *naqa'a* include *Acacia mellifera*, *A. hebacladoides* and *Lannea humilis*; those by the pools com-

prise *Tamarindus indica*, *Anogeissus schimperi*, and many others including *Acacia* and *Ficus* spp.

The transition zone grasses of high salt value are *Sporobolus* sp., *Dactyloctenium aegyptium*, *Brachiaria* sp. aff. *xantholenca*, and others; within the pools *Echinochloa stagnina*, *Oryza breviligulata*, and *E. colona* grow, the former in the deepest and the latter in the shallowest water. On the *atamur* the vegetation is very variable, with mixtures of all three rainfall belts of Low Rainfall Woodland Savannah.

The Raqaba Repeating Pattern has three frequently alternating types of country; taken as a whole the area has a distinctive character, and cannot readily be fitted into any single type of vegetation. The term *raqaba* means a shallow, meandering, clay-bottomed water channel, 20-100 metres wide, of which there are many in this area. The channels are connected with the Bahr el Arab, from which they flood in the summer, and they also receive water from local drainage. They are flanked by stands of *Acacia arabica*.

Beside the channels the lowest ground consists of areas of dark cracking clay, known as *fau*, which are liable to shallow flooding and support a vegetation of tussocky grasses, chiefly *Setaria incressata*, *Hyparrhenia rufa* and *Vetivaria nigritana*; it could be classified, in fact, as Intermediate Grassland of the Flood Region. Rather higher than the *fau* there are areas of cracking clay that are not liable to flooding: these are known as *talha*, and support typical *Acacia seyal-Balanites* Savannah. Highest of all are the areas of *qardūd*, non-cracking clay flats with a high run-off; this is very similar to the *naqa'a* of the Baqqara Pattern, and bears the same vegetation.

High Rainfall Woodland Savannah

(a) Known as *Anogeissus-Khaya-Isobertinia* Woodland. In contrast with the Low Rainfall Woodland Savannah, which Harrison and Jackson have divided into numerous categories on the basis of soil type and rainfall, the High Rainfall type is shown as two vegetation-types throughout most of the Bahr el Ghazal and western Equatoria Province, covering a total of 300,000 sq. km. (120,000 sq. miles) of the Ironstone Plateau region. The limits of the drier

type correspond approximately with the 1,000 mm. (40-in.) isohyet on the dry side, i.e. the north-east, and with the 1,300-mm. (52-in.) isohyet towards the wetter south and west. This very large area does not, in fact, support a single homogenous plant association, for between its northern and southern limits there are significant differences of rainfall total and of the length of the rainy season. These are reflected in differences of height of trees and in the density of the shade which they cast on the ground; nevertheless, it generally seems that differences due to local variations in topography, i.e. the catenary association of soils described in Chapter IV, are as great as those due to variations in rainfall.

The part of the Ironstone Plateau for which the most detailed information on soils and on vegetation of the High Rainfall Woodland Savannah type is available lies in the vicinity of Wau. This has been described both by Sudan Government officials interested in agriculture, forests, and soils,¹ and by a team of ecologists from Oxford University.² The former give a general account of the High Rainfall Woodland Savannah as:

mixed broad-leaved deciduous forest in which the species present typically show adaptation to fires, and in which the dominant ground herbs are grasses. The forest is swept by annual fires [Plate VII]. It is in a state of dynamic equilibrium, the three forces at play being fire, soil, and water. Given fire control the open savannah will close canopy, and in the course of time will approach the vegetational climax. Conversely when an area is cleared for cultivation, then abandoned and allowed to revert to forest, secondary species appear which are less demanding as to soil and water requirements.³

In such forest pure stands of one species are rare, for with variations in soil texture and site are associated variations of vegetation type. According to Smith, a succession of species belts may be distinguished along any axis crossing the isohyets, but these are only valid for the wooded ridges which represent the highest element in the soil-vegetation catena. Below the ridges the subordinate types of vegetation

very often occur as a confused haphazard-looking patch-work of types. Soil-type units or plant communi-

ties of these categories may be extensive or may cover only a few square metres. . . . Only when these lowest soil and vegetation units have been recognized does it become apparent that the recurring units of a given soil-type repeatedly carry corresponding units of substantially the same plant community, so that soil-vegetation units exist as very real entities.⁴

The situation may be made more intelligible by quoting a particular example of soil and vegetation zoning from the Jur area near Wau.⁵

Zone	Soil Complex	Vegetation Type	Cultivation
Ironstone plateau	Eluvial	<i>Khaya</i> Open Savannah	Only in pockets of deep soil.
Steep rocky or gravelly slopes	Eluvial	<i>Isobertinia</i> Closed Savannah	Not cultivated.
Middle level gradual slopes and terraces	Colluvial	<i>Anogeissus</i> Open Savannah	Extensive cultivation.
Fringe of <i>Khor</i> or river valleys	Illuvial	<i>Terminalia</i> Open Savannah	Not cultivatable; water-logged in rains.
<i>Khor</i> beds and river flood-plains	Alluvial	No trees; open perennial grassland	Nil; flooded in rains.

Similar detailed information is not available for the hillier parts of the *Anogeissus-Khaya* Deciduous Woodland to the west, where there is a wider range of altitudes and of ecological conditions than in the Jur country, but the general characteristics of the vegetation have been noted by Harrison and Jackson. *Khaya senegalensis*, Sudan mahogany, is said to be the most widespread species of tree, and its great value as a handsome and durable hardwood has made it necessary to protect it by imposing restrictions on its cutting in most areas. *Isobertinia doka* often forms almost pure woodland on the lighter soils, especially in the wetter parts of the subdivision, perhaps with an under-storey of shrubs. Throughout most of the subdivision *Anogeissus schimperi* occurs, though it is scarce east of the Nile and absent at altitudes of more than 800 m. At the wetter end of its range it often forms closed woodland with a shrubby undergrowth and little grass. In areas of high clay content varieties of *Combretum* are common. *Acacia seyal* var. *multijuga* is often to be seen on areas of abandoned cultivation. Such areas may also bear extensive stands of *Butyrospermum niloticum*, whose fruit, the shea butter nut *lulu*, is collected for domestic use or for sale.

The chief grasses of the drier parts of the

¹ V. E. F. Eyre, D. M. Ramsay, and T. N. Jewitt, *Agriculture, Forests, and Soils of the Jur Ironstone Country of the Bahy el Ghazal Province, Sudan*, Ministry of Agriculture Bulletin No. 9, 1953.

² Morison *et alii*, *op. cit.*

⁴ Morison *et alii*, *op. cit.*, pp. 3 and 4.

³ Eyre *et alii*, *op. cit.*, p. 17.

⁵ Eyre *et alii*, *op. cit.*, p. 10.

area are species of *Hyparrhenia*. Near Wau there are some areas almost bare of grass, which act as fire-breaks and may be responsible for the good development of *Khaya senegalensis* in this comparatively dry country. In the wetter parts *Setaria*, *Brachiaria* and *Sporobolus* spp. occur, while on ground formerly cleared for cultivation *Imperata cylindrica* is often dominant. Numerous herbs, bulbs and tubers also occur, many of them flowering when the grass has been burnt in the dry season.

(b) Woodland recently derived from Rain Forest. Where the rainfall rises above about 1,300 mm. (52 in.), a taller, denser version of Woodland Savannah occurs, known as 'Woodland recently derived from Rain Forest'. This area is crossed by numerous streams flanked by gallery forests, wherein the tree species of Rain Forest are able to survive; this is partly due to the water-table reached by their roots, and partly to the fact that grass fires do not penetrate down into the narrow valleys, so that young seedlings are not destroyed and a continuous canopy can be preserved.

Characteristic tree species in this Woodland are *Terminalia glaucescens*, *Albizia zygia*, and, in the west, *Anogeissus schimperi*, which may grow to a tree 30 m. (100 ft.) high or more; among the smaller trees are *Combretum binderianum* and *Grewia mollis*. The grasses are of three kinds: those flowering in the early rains, which include *Panicum maximum* and *Sporobolus pyramidalis*; those flowering in the late rains, such as *Hyparrhenia cymbaria*, *H. variabilis* and *H. dissoluta*, and in valleys of streams where forest has been very recently destroyed, *Pennisetum purpureum* (elephant grass).

Rain Forest

Within this Woodland type there are a very few small patches of Rain Forest, at Lotti, Laboni, and Talanga east of the Nile, and at Azza and on the Aloma Plateau to the west. *Celtis zenkeri* and *Chrysophyllum albidum* appear to represent the climax among tall trees, and very many species of shrub and smaller tree also occur. In the gallery forests *Khaya grandifoliola* and others appear, including *Syzygium guineense*, which may remain as the sole flanking species in single lines on either side of the streams as they cross into drier country.

Montane Vegetation

The Montane Vegetation may be divided into four categories: the Imatong and Dongatona Mountains, the Didinga Mountains, the Red Sea hills, and Jebel Marra.

1. The lower slopes of the Imatongs, below about 1,500 m., have in their wetter areas a vegetation similar to that of the Woodland recently derived from Rain Forest, but with fewer species; in the drier areas, however, they resemble the rocky hill slopes of the Hill Catena, with much *Boswellia papyrifera* and *Terminalia brownii*. Above 1,500 m. the vegetation may be divided into three zones:

(a) Lower Montane Forest, 1,500–2,600 m. (5,000–8,500 ft.), where *Syzygium* sp., *Olea hochstetteri*, and *Podocarpus* provide the climax vegetation.

(b) Upper Montane Forest, 2,600–3,000 m. (8,500–10,000 ft.), where *Podocarpus* and some *Olea* spp. constitute the climax except in certain areas of fire-climax mountain meadow, where the sedge *Bulbostylis atrosanguineus* is dominant. The bamboo *Arundinaria alpina* is common in this zone.

(c) Above 3,000 m. (10,000 ft.), the Ericaceous zone, where *Erica arborea* and *Myrica salicifolia* are dominant, and many species of grass and herb also occur.¹

2. In the Didinga mountains there is a southern area similar to the Lower Montane Forest, but elsewhere the vegetation has been reduced by fire to grassland with a few relict trees except in the valleys where *Podocarpus* and *Albizia marganguensis* forest occur.

3. In the Red Sea hills the wettest area near the Eritrean border has a forest, whose area is declining, of almost pure *Juniperus procera*, with *Olea chrysophylla* and other trees around the edge.² Farther north only *Olea chrysophylla* remains, mixed with trees of less markedly montane character. In drier areas *Euphorbia abyssinica* and *Dracaena ombet* are common.

¹ J. K. Jackson, 'The Vegetation of the Imatong Mountains, Sudan', *Journal of Ecology*, **44** (1956).

² B. Kennedy-Cooke, 'The Red Sea Hills', Appendix I to *Soil Conservation Committee's Report*.

Two areas of rather denser and greener vegetation are Erkowit and Jebel Elba; these hill oases present totally different soil conditions and vegetation from their immediate neighbours, apparently because of the absence of foothills between them and the sea. The result is that, especially in winter, they are frequently invaded by sea mists, which condense on plants and rocks, and nourish herbs, grasses, lichens and epiphytes that cling to the branches of trees (Plate XVI).

4. On Jebel Marra the lowest slopes, to about 2,000 m. (6,500 ft.), are mostly cultivated; among the fields *Cordia abyssinica* and various *Ficus* spp. appear, and the dominant grasses are *Cymbopogon* and *Hyparrhenia* spp. Between 2,000 and 2,500 m. (6,500–8,000 ft.) *Olea laperrini* and *Acacia albida* are the commonest trees, with *Ficus* spp. and *Salix safsaf* occurring near streams. Most of the slopes are open grassland, however, with *Cymbopogon* and *Andropogon* spp. dominant. Much of the highest zone above 2,500 m. is covered with short grassland of dwarf *Hyparrhenia multiplex*, with scattered *Olea* trees; near the crater lakes *H. anthistivoides* (?) is dominant over considerable areas. Bracken is also common at the highest levels of the mountain.

The Flood Region

The last of these main groups, the Flood Region, occupies an area of 240,000 sq. km. (95,000 sq. miles). This corresponds closely with the region of Sudan that is described in Chapter XV of this work as the Southern Clay Plain. It consists of the various rivers with their banks and floating vegetation (Plate V) and of the area where drainage is poor and where water stands for varying periods of the year, either from the rainfall or from overflowing by the Nile. Except in a few slightly elevated areas which are normally free from flooding, the vegetation of the area consists of annual and perennial herbs and grasses, the species depending on the depth and duration of flooding that usually occurs. Because of the very intimate relationship between the water régime and the lives of the inhabitants of the area, it has seemed more convenient to defer the detailed description of the Flood Region vegetation to that chapter.

Riverain Vegetation

Finally, reference must also be made to the limited but extremely important areas of alluvial soils beside the Nile and elsewhere in northern and central Sudan, where the vegetation is much denser and more varied than in the surrounding country. This is particularly liable to be cleared to make way for cultivation, since it occupies fertile soil that can readily be irrigated, with permanent drinking water always easily available. In fact, the trees that grow naturally are so valuable for building and other purposes, and the grasses are so gladly eaten by domestic stock, that no attempt is made to eliminate the natural vegetation altogether. A description of the plants to be found falls naturally into the regional chapters below that deal with the Northern Region, the Central Clay Plain, and Eastern Sudan.

Conclusion

The natural vegetation of a large part of Sudan consists of trees and grass. As the country's population grows and the area under cultivation increases, inevitably much forest will be destroyed. It is of some importance, therefore, to know whether much economic use can be made of the trees that are cut down, and failing that, whether the supply of timber will continue to be sufficient for the traditional uses to which it has been put in the past.

As far as the first point is concerned, it is unfortunately the case that both in the Low and in the High Rainfall Woodland Savannah the great majority of the trees are too low and too crooked to make useful timber, in addition to being generally hard and difficult to work. When the needs of local hut construction have been met, all that can be done with stunted *Acacias* and *Combretaceae* is to burn them. Certain species make good charcoal, for which there is a limited internal demand, but no prospect of export because of transport costs. The most valuable timber tree of these areas is Sudan Mahogany, *Khaya senegalensis*, which is common near Wau and occurs in the Nuba Mountains and in western Darfur near to streams. This has already been cut severely, so that there are no extensive natural stands to be exploited. It undoubtedly could be

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grown in plantations in those areas, as could the *neem*, *Azadirachta indica*, which provides good building poles, in the Kordofan sands; it is almost equally certain, however, that timber produced in this way would be extremely expensive.

The second point has already arisen within the Gezira, where the supply of building poles and of fuel causes considerable difficulty, particularly because the heavy clay soil is not an easy area in which to establish plantations.¹

Elsewhere the savannah provides grass for thatching and rough poles for house building

in ample quantities, and the need to reserve areas of woodland for these purposes (as is done already in Nigeria, for instance) has not yet been felt. The forests of *Acacia arabica* along the Blue Nile and of *Hyphaene thebaica* along the Gash river are protected by legislation, but this is principally because they supply sleepers for the State railways and fuel and building poles for the towns. In southern Sudan restrictions are imposed on cutting the valuable trees in the limited areas of high forest, but the competition for land between agriculture and forestry is not significant.²

¹ T. H. Kipling, *The Supply of Wood Fuel and Roofing Poles to Khartoum, the Gezira and Government Departments*, Khartoum, Ministry of Agriculture Bulletin No. 5, 1950.

² J. K. Jackson, *The Dongotona Hills, Sudan*, Ministry of Agriculture, Bulletin No. 5, Khartoum, 1950. Jackson and F. G. G. Peake, *Forestry Research in the Sudan, 1950-1954*, Khartoum, 1955. M. K. Shawki, *Sudan Forests*, Ministry of Agriculture, Forestry Memoir No. 10, Khartoum, 1957.

THE PEOPLING OF SUDAN

ORIGINS AND RACIAL
CHARACTERISTICS

THOUGH their country bears an Arabic name, the majority of the inhabitants of Sudan are not Arabs by racial origin. Such is indeed often the case where an immigrant race has gained cultural and political domination over a less well-organized indigenous population. The term Sudan, as applied to the belt of savannah country which stretches across Africa between latitudes 10° and 15° N., is not new, for it occurs in the *Travels of Ibn Battuta*, which date from the thirteenth century A.D.¹ Indeed, at least as far as its eastern end, which is the subject of this book, is concerned, it was probably more appropriate at that time than it is today, for except in Nubia the Arab incursions into the region beginning in the fourteenth century must have had the effect of somewhat lightening the skin colour of the inhabitants.

By now the assimilation of Arab customs and traditions, and especially of Islam, throughout the northern province of the former Anglo-Egyptian Sudan is superficially complete. Yet even in this region there are still today markedly distinct elements of the population differing in physical history and speech. Their attitudes towards agriculture, animal husbandry and other economic activities, and especially towards one another, cannot be explained solely in terms of the areas in which they live. While much has occurred, especially in the last half century, to bring about a merging of these elements into a single Sudanese nationality, a consideration of how the several peoples came to occupy their present homes may still throw useful light on current regional characteristics.

The longest established inhabitants of northern Sudan fall into two groups: the Negroes and the Brown or Mediterranean Race, who

may be further subdivided into Nubians and the Red Sea tribes.² The Negroes, now represented by some of the various Nuba tribes, the inhabitants of the Ingessana hills and certain of the peoples of Darfur, are related to the negro populations of West Africa, such as the Kanuri, the Hausa, and the tribes living farther to the south. In a few instances they have traditions of having migrated from homes farther west, but this is by no means general; they certainly once occupied much of northern Kordofan and were at home in the Khartoum area before 4,000 B.C. The negroid features, especially hair and skin colour, that are widespread amongst the Nubian and Arab elements of the population today, are in most cases to be ascribed to direct intermarriage or to the traffic in slaves drawn from this stock.

Of the representatives of the Brown Race, the Red Sea Beja bear physical similarities to certain of the tribes of southern Arabia, but whether they are of originally African or Asiatic stock is not known. They have occupied their present territory for at least the last 5,000 years. At times their political influence has extended as far west as the Nile and beyond, but their wholly nomadic traditions have prevented them from colonizing either the riverain lands or the wetter country to the south and west.³ The Nubians, on the other hand, are still the dominant element of the population between Khartoum and Upper Egypt.⁴ They appear to be primarily representatives of the Brown Race, modified over the centuries by the admixture of Egyptian and negro blood; they are warmly attached to their native lands beside the Nile, and disinclined to turn either to nomadism or to the colonization of the savannah lands farther south. Recently, the Nubian and mixed Nubian-Arab inhabitants of central Sudan have shown aptitudes for politics, education and commerce that have

¹ H. A. R. Gibb, *Ibn Battuta: Travels in Asia and Africa*, 1929.

² A. Paul, *A History of the Beja Tribes of the Sudan*, 1954.

³ G. Sergi, *The Mediterranean Race*, 1901.

⁴ E. Wallis Budge, *The Egyptian Sudan*, 1907.

given them a dominant position in Sudan as a whole as it has attained independence.

The Arabs who constitute the greater part of the nomads of northern and central Sudan, and who after mixture with the Nubians have come to occupy many of the most fertile lands beside the Nile, mostly entered Sudan from the north and east, much the larger number coming up the Nile valley from Egypt. Many of the Baqqara, however, had passed along the north African coast as far as Tunisia before turning south and crossing the Sahara. Arab invasions began in the fourteenth century with the defeat of the Christian kingdom of Dongola, and continued spasmodically until the last century.¹ The spread of the nomads was checked beyond the 10th parallel by the swamps, woodlands and insects of the south, but farther north the Arabic language and Muslim faith have been powerful unifying influences even beyond the spread of the Arabs themselves. Whatever schisms exist between the educated and the illiterate, almost all the northern Sudanese are agreed on the acceptance of the Arab heritage, and of the Islamic faith and way of life that go with it. Nor is there any significant demand among those, whose mother tongue is not Arabic, whether Beja, Nubians, or Fur, that their language be adopted in place of Arabic for administrative, educational, or general use.

The southern provinces, on the other hand, are occupied by a wide range of dark brown or almost black tribes, among whom Nilotic, Hamitic, and Sudanic linguistic elements have been distinguished.² None of the tribes can with confidence be described as indigenous, but the Nilotes have perhaps the best claim to such a title, for their traditions contain no reference to migrations from outside Sudan, while their way of life is generally so minutely adapted to their present environment that it seems likely that they have occupied the same region for a very long time.³ The Hamitic speakers are generally considered to have spread outwards from the Ethiopian highlands and

the horn of Africa, their preference for a cattle-rearing pastoral life causing them to keep mainly to regions free from extensive forest or tsetse fly infection. Some of the Sudanic-speaking negroes are very long established, but others have been entering Sudan in successive waves from the west over a considerable period; apart from the large Azande tribe⁴ they have been little studied by anthropologists,⁵ but it is generally clear that while speaking loosely related languages they possess little unity among themselves.

THE TRIBES OF SUDAN

With these general facts in mind, we may turn to an examination of the individual tribes of Sudan, whose distribution is indicated in Fig. 29. This map is based primarily on the system of tribal administration and local government within the provinces and districts. It is most reliable in the nomad areas, where virtually the whole population of a given area is likely to belong to the same tribe; it cannot give so accurate an account of the areas of central Sudan where members of a variety of tribes live side by side (Fig. 30). In the southern provinces its accuracy has long been questioned by anthropologists and linguistic experts.

NORTHERN SUDAN

Northern Sudan may be regarded as a region over which Arab nomads have spread almost wherever the nature of the land suits their way of life; east and west of the Nile they dominate the plains, and have driven the original inhabitants into areas where they can defend themselves against fast-moving attackers. Only in the Red Sea hills was there a resistant population, living essentially the same life as the Arabs themselves, which was able to preserve its territory and independence.

The Nubians

The Nubians of the Dongola reach and the inhospitable rocky area between Kerma and

¹H. MacMichael, *A History of the Arabs in the Sudan*, 1922.

²*Idem*, *The Anglo-Egyptian Sudan, 1932*. J. A. de C. Hamilton (Ed.), *The Anglo-Egyptian Sudan from Within*, 1935.

³C. G. & B. Z. Seligman, *Pagan Tribes of the Nilotic Sudan*, 1932. J. P. Crazzolara, *The Luo*, Verona, 1950 and 1951.

A. Butt, *The Nilotes of the Anglo-Egyptian Sudan and Uganda*, Ethnographic Survey of Africa, 1952.

⁴In common usage, Azande is used for the people of this tribe, and Zande for the individual and as an adjective.

⁵E. E. Evans-Pritchard, *Witchcraft, Oracles and Magic among the Azande*, 1937. P. T. W. Baxter and A. Butt, *The Azande and Related Peoples*, Ethnographic Survey of Africa, 1953.

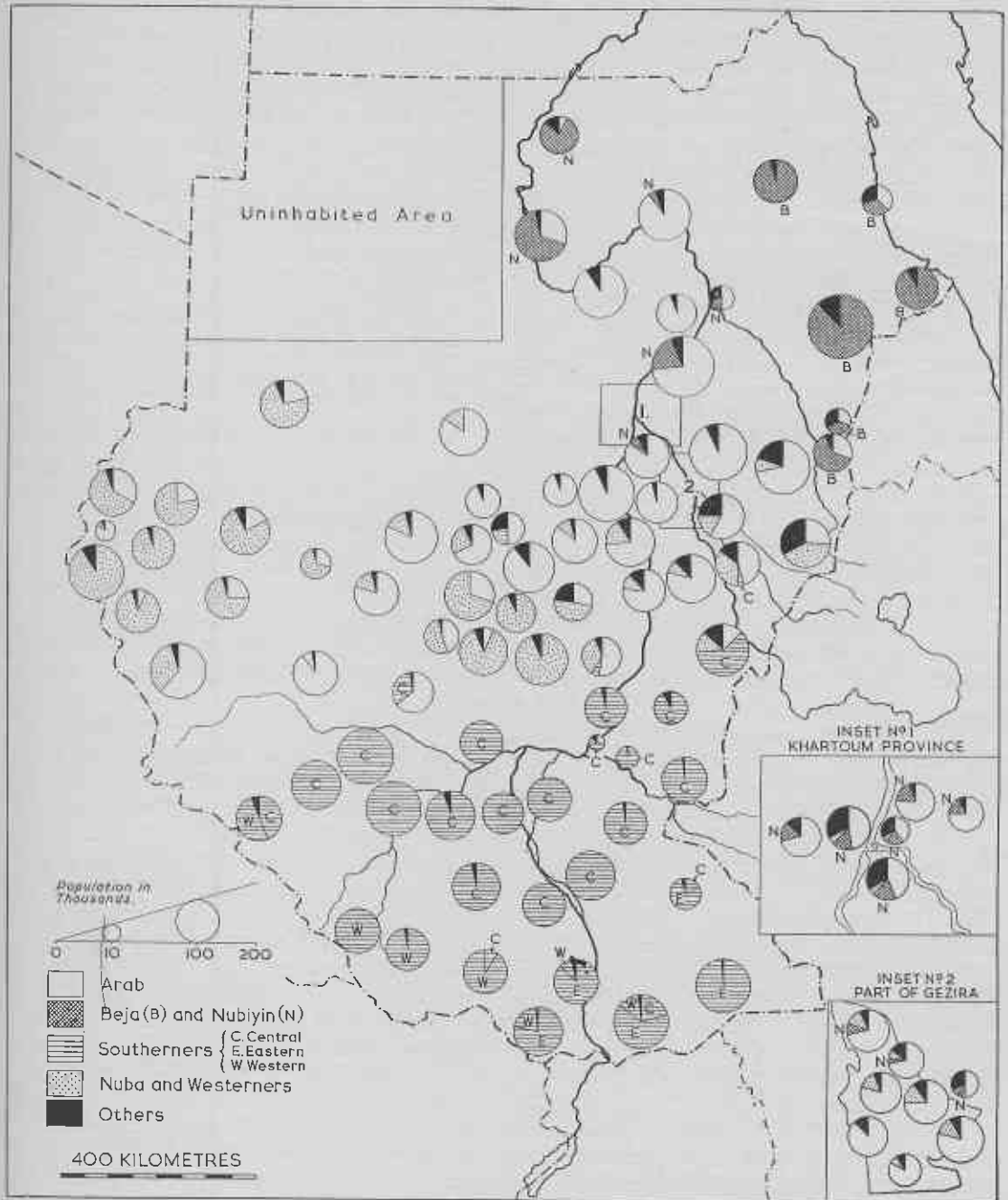


FIG. 30. The main tribal groups by census areas. This map, a simplified version (by kind permission) of the map of tribes in Sudan published by H. R. J. & G. Davies in *The Population of Sudan*, 1958, clearly indicates the dominant position occupied by the Arab tribes in the riverain areas. The mixture, or at least the juxtaposition, of many tribes in Khartoum and the Gezira contrasts strongly with the homogeneity of many of the southern areas. Nubiyin=Nubians.

Wadi Halfa have been converted to Islam, but have been able to hold on to their lands because the Nile here flows through almost complete desert, which provides no pasture for Arabs moving with their flocks and herds. In terms of population and environment Nubia is a distinct unity, and the present Egypto-Sudan border, which runs through the middle of it, is a quite arbitrary political division that leaves on either side persons who are racially, linguistically, and culturally akin.¹

Physically the Nubians are the descendants of the ancient Brown Race, slightly modified by Egyptian, negro and Arab elements that have given to the people a rich brown colour like that of milk chocolate. A marked lightening or darkening of pigmentation that may occur can usually be traced to a fairly recent admixture of Turkish or Egyptian blood on the one hand or to a slave ancestry on the other. There has been a considerable discussion of the relationship between Nubia and the negroid Nuba of the mountainous area of southern Kordofan; at present there is absolutely no similarity of appearance or culture between the two groups, but linguistic study has suggested that, apart from the likeness of names of the two areas, the inhabitants of certain of the northern Nuba Jebels speak a language remarkably similar to the Nubian tongues. The most likely interpretation is that the modern Nubians are basically men of the Brown Race, retaining with modifications the Hamitic type of language of their forebears. The Nuba, on the other hand, are Nubians now occupying the northern Nuba mountains, having fled thither before the coming of the Arabs. Their name came mistakenly to be applied to the whole region, while the brown features they originally possessed have by now been wholly effaced through marriage with the local inhabitants.²

The languages still spoken by the Nubians in their homes fall into two groups: the central group, found around Halfa, Sukkot, and Mahas, is really one tongue with slight variations that do not prevent mutual comprehension;

the other, spoken by the Dongolawis or Danagla of Dongola district in Sudan, is also understood by the Kenuz of Egyptian Nubia.

Many of the Dongolawis who leave their native lands to seek employment in the towns of Sudan or Egypt take jobs as cooks, waiters and domestic servants, and they can today be generally recommended for honesty and sobriety. It is of interest to compare this with the comment of a traveller in the area about 100 year ago, who wrote:

The Dongolawis are the greatest liars on the face of the earth . . . they will indeed rather allow themselves to be murdered than speak the truth if their interests be concerned . . . I advise every European about to travel in Kordofan to hire his servant in Cairo.³

At Debba in the extreme south of their reach the Danagla give place to the Fung, a small group who, while undoubtedly being descended in part from a Fung colony established during the period of Fung supremacy, have by now become physically assimilated to their neighbours. The Bedeirya immediately upstream of them are likewise almost wholly Nubians, though they claim an Arab origin. Many of their numbers have migrated to central Kordofan.

The Shaiqiya, whose lands extend from Korti upstream to the Fourth Cataract, are a well-built people of the same colour as the Danagla, their appearance rather more closely resembling that of the Arabs. Their official genealogies link the Shaiqiya to the predominantly Arab Ja'aliyin of the Shendi reach, and they speak only Arabic today; yet more probably they are descended from the Brown Race, and constituted a ruling class in the kingdom of Napata in the eighth century B.C. For cultural reasons MacMichael suggests that the Shaiqiya had an Egyptian origin or else an admixture of Bosnian, Albanian and Turkish blood dating from the Egyptian conquest of the sixteenth century, but Crawford declares the latter impossible.⁴ The Shaiqiya are bolder and more war-like in temperament than the Danagla, and many of them have sought careers in the police and army; the men are, however, often

¹ It so happens that the present Aswan Dam, when filled, drowns most of the agricultural land below Wadi Halfa, but leaves the broader lands above the town unflooded; nevertheless, it was the convenience of running the rail and steamer services that in 1899 determined the political boundary rather than plans for a future dam at Aswan.

² A. J. Arkell, *A History of the Sudan to 1821* (1955). MacMichael, *op. cit.*, Vol. I, p. 12 *et seq.*

³ I. Pallme, *Travels in Kordofan*, 1944, p. 117.

⁴ MacMichael, *op. cit.*, p. 213 *et seq.* O. G. S. Crawford, *The Fung Kingdom of Sennar*, 1951.

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PLATE IX. RASHAIDA TRIBESMAN

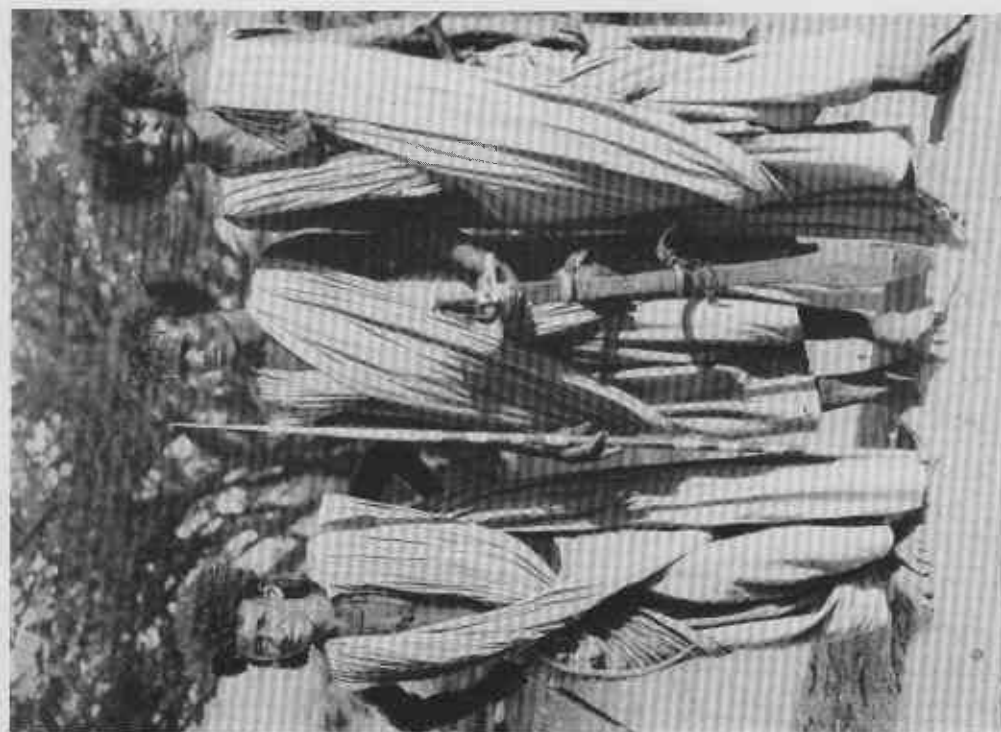


PLATE VIII. THREE BEJA TRIBESMEN





PLATE XI. FUR MOTHER AND CHILD



PLATE X. HAJAR WOMEN

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described as quarrelsome and inclined to drunkenness. Of the Shaiqiya in the Merowe reach nearly all are settled in permanent villages, but there is a diminishing number who still live on the fringe of the desert, especially on the left bank of the Nile. Marriages between the two groups occasionally occur, generally with the result that the nomadic partner comes to adopt the settled life.

Upstream of the Fourth Cataract the population consists of the Manāsir, Rubatab, and Mirafab tribes, who are a mixture of Nubian and Arab stock, claiming kinship with the Ja'aliyin farther south. They have been particularly exposed to contact with the Arab tribes who, on entering the Sudan from the north, reached the Nile near Abu Hamad after crossing the desert by the line of wells along the Wadi Gabgaba. The Rubatab are reduced by the poverty of their land to a semi-nomadic existence, grazing their animals on the thin desert scrub in the loop of the Nile and wherever they can find fodder along its banks. Burckhardt, in speaking favourably of the pride of the Mirafab of Berber and their reluctance to take slave girls as brides, says also that he found travelling through their territory very expensive.¹ Today their practice of taking toll of travellers along the Nile valley has been checked, but they still have a reputation for extreme litigiousness where land rights are concerned.

From the mouth of the Atbara river as far as the Sabaloka gorge, the settled population are of the Ja'aliyin tribe. These are probably largely Nubians, though they claim to be pure Arabs, and certainly for the past 400 years they appear to have enjoyed the uninterrupted use of this stretch of the river. Previously it seems likely that they obtained control of the region by conquest and intermarriage with the local population. There are a few semi-nomadic sections of the tribe whose flocks and herds graze the steppe away from the river and cultivate in the *wadi* beds, for here the rainfall is heavier than in the rest of the Northern Province. The Ja'aliyin have been enterprising colonists in Sudan, and in addition to the

numbers on government service there are many Ja'ali merchants throughout the country. In the Gezira there are also some scattered villages of Ja'aliyin who have become separated from the main tribal organization.

The tribes described hitherto have consisted of various mixtures of Nubian stock with successive waves of invaders from the north. The degree of admixture has depended not only on proximity to the source of invaders up the Nile valley, but also on the suitability of the various reaches for occupation by animal owners. Between Halfa and Kerma the riverain lands are narrow and difficult of access, and the desert is most uninviting, comprising either sandy wastes or the harsh broken topography of the Batn el Hagar; south of Kerma the irrigable lands are wider, but the desert still offers little fodder. Along the Merowe reach, on the other hand, the north or right bank is virtually desert, but the left bank is dissected by numerous watercourses which drain the hard rocks of the Bayuda desert. Semi-nomads can find grazing and even water away from the river, and so the older elements of the population have virtually disappeared.

The Shendi reach must have proved especially favourable for Arab occupation, both because being farther south it lies in a higher rainfall area than Nubia proper, and also because the numerous basins by the river provided until recently plentiful grazing and firewood.² Moreover, the beds of the tributary water-courses provided sites for easy if unreliable cultivation.

The Beja

Upstream of Debba the history of the peopling of the northern Sudan has been analogous to the course of events in Egypt or the Barbary States, namely, the gradual arabization of the population and the disappearance of Hamitic speech and customs under the impact of Semitic invasions. The history of the Beja of the Red Sea hills, on the other hand, stands out almost uniquely from this course of events. Though there has been intermarriage between Beja and Arab for many centuries,

¹ J. L. Burckhardt, *Travels in Nubia*, 1822, pp. 200 and 204.

² The great Kerma basin opposite Dongola is today an important source of firewood and of grazing and browse for animals, apart from the use of made it for cultivation. Until quite recently, however (1909), when a channel was cut to permit the Nile to reach it during the flood, it remained an arid wilderness of sand, silt, and clay.

the old Hamitic language 'Tu Bedawie' and the indigenous tribal organization have survived (Plate VIII).

The Amara section of the Beja have a tradition that they are sons of Kush, the son of Ham, and have occupied their land 'since the flood'.¹ While there is reason to doubt this claim in its entirety, there is no doubt that they have in fact continued to occupy the same territory for some 5,000 years, and it is not surprising if the tribal memory of earlier events has by now escaped them. In fact, archaeological evidence has been found to suggest that there was once a primitive race of hunters living in the eastern desert between the Nile and the Red Sea, and that these were succeeded by a Hamitic race of cattle owners, ancestors of the present Beja, who also inhabited the Nile valley. The arrival of the latter was probably between 4,000 and 2,500 B.C.

Cranial measurements have shown that there are marked similarities between the Beja and the pre-dynastic Egyptians. Among the former a distinction may be drawn between the southern Beja, the Beni 'Amer, who most closely resemble the early Egyptians, and the northern tribes, Amara, Bisharin, and Hadendowa, who have broader heads and are generally slightly taller.² In both instances there is a slight darkening of skin colour, to be explained by negro mixture, and in the northern group Seligman sees also evidence of Armenoid blood. In the last 500 years the northern Beja have intermarried with Arab tribes of Sudan, especially the Kawahla, without abandoning either their culture or their language: in consequence, certain Hadendowa sections now boast Arab ancestry.

The Beni 'Amer, whose territory lies across the Sudan-Eritrean border, are divided into a Tigré-speaking section in the south and some bilingual sections farther north who use both Tigré and Tu Bedawie. The former have long since been altered physically by Arab infusions from across the Red Sea, while the latter may be regarded as probably the least altered Beja stock of all, in whom almost no foreign elements are present. Also to be included among the Beja are several small groups, known

colloquially as Qabāil Ukhra (Other Tribes), inhabiting the southern part of the coastal plain and the Halenga of Kassala district. These appear to consist of persons of Arab origin who have settled in Beja country and have gradually adopted Tu Bedawie as their speech. In recent years, as government activities have expanded, there has been a marked tendency for Arabic to increase in importance at the expense of Tu Bedawie, which is not written.

The Arabs

The term 'Arab' is used in Sudan in a variety of ways, and on different occasions its meaning may be based on race, speech, an emotional idea, or even a way of life. Not all who claim to be Arabs would be universally accepted as such, and there are those, who at one moment will claim 'We are Arabs', and yet at another will dismiss a ragged stranger contemptuously as 'He's only one of the Arabs'.

The Arabs are by origin inhabitants of Arabia, who since the days of the Prophet have been spilling out into the adjoining lands and colonizing them, and have by now come to occupy a large part of central and northern Sudan. The principal migrations into Sudan have been by way of the Nile valley, but there seem also to have been lesser movements across the Red Sea which have not only affected the population of the Red Sea hills and plain but have also penetrated as far west as Kordofan.

An aspect of Arab expansion that continues to be of far-reaching importance today has been the practice of the nomads to intermarry freely with native populations. While local customs of matrilineal descent have thus enabled the Arabs to acquire material and political power with remarkable rapidity, their own tradition of patrilineal descent has quickly induced native peoples to claim that they, too, are Arabs. At the same time the conversion of native peoples to Islam has often established between them and the Arabs a potent link of spiritual brotherhood. In consequence, the modern growth of nationalism and anti-imperialism, linked, as it often is, with the revival of Islam, has tended to strengthen the position of the Arabs in the

¹ Paul, *op. cit.* G. E. R. Sanders, 'The Amara', *S.N. & R.*, 18 (1935).

² G. E. R. Sanders, 'The Bisharin', *S.N. & R.*, 16 (1933). T. R. H. Owen, 'The Hadendowa', *S.N. & R.*, 20 (1937).

countries to which they have spread. The contrast with the practices and present situation of many European settlers in various parts of Africa is striking.

The Arabs who reached Sudan through Egypt are divided by MacMichael into two main groups according to their genealogies: these are the Ja'aliyin and Danagla group who are descended from the Ismailite tribes of northern Arabia, and the Guhayna group whose ancestors included Kahlan and Himyar and who come originally from southern Arabia, the Yemen, and the Hadramaut.¹ The Ja'aliyin claim to be descended from the Quraysh tribe, of which the prophet Muhammad was a member. They first penetrated into Nubia when Egypt had been overrun by Arabs while a Christian Kingdom still persisted in Dongola, and they seem to have acquired early the somewhat sedentary habits which still mark them today. When the Christians were overthrown in the fourteenth century and Arabs came flooding into Sudan, the Ja'aliyin occupied the Merowe and Shendi reaches of the Nile, enslaving and mixing with the native population, which consisted of Nubians and negro Fung elements. There are outlying members of this group in the Gezira and in Kordofan; of these the former are cultivators, many of them now prospering as tenants in irrigation schemes, while the latter, including the Hamar (Plate X) and the Bedeiriya, are partly settled and partly nomadic, inhabiting a part of the gum belt around El Obeid and En Nahud. The Ja'aliyin are medium brown in colour and have fairly narrow noses, but slightly broadened lips and curly black hair are almost universal reminders of the negro blood in them.

The Guhayna Arabs came much more quickly from Arabia to Sudan, and were not tempted to abandon their nomadic way of life. They are represented by the Kabābīsh of the west, camel-owners who migrate long distances and are wholly nomadic, by the Shukriya of the east who keep both camels and cattle in the Butana, and by the great cattle-owning Baqqara tribes of southern Kordofan and Darfur. These latter include the Seleim, the Hawazma, the Mesiriya, the Humr, the Rizeiqat, and the Ta'āisha, from whom came

the Khalifa 'Abd Allāhi. Many of the now sedentary tribes of the Gezira, e.g. Mesellimiya, Halawin, and Rufā'a, are also Guhayna, so it must not be thought that this group is wholly nomadic. In appearance the Guhayna are more purely Arab than the Ja'aliyin. Among the Kabābīsh there are many tribesmen with straight or wavy hair, a fine nose and a palish complexion, though the possession of slaves has meant that members of the richest families may be strikingly negroid. The Baqqara are in general slightly darker, some being unmistakable Arab and others showing western and southern negro features.

The Kawahla Arabs reached Sudan across the Red Sea, and have intermarried extensively with the Beja, without, however, coming to dominate them. They are also to be found in the northern Butana, along the White Nile just south of Khartoum, and in north-west Kordofan. They are closely linked with the Dar Hāmid, who despite Guhayna origin have joined the Kawahla tribal organization. The Rashāida of eastern Sudan are quite pale skinned, and contrast strikingly with the Beja and the westerners when seen together in the markets of Kassala province. They entered Sudan a bare 110 years ago, and still keep themselves very much aloof from neighbouring tribes (Plate IX). The Rashāida of the east are of Guhayna stock: they are clearly connected with the Beni Rashīd of western Sudan, who are a small section of the Baqqara. The latter are by now much darker and more negroid as the result of local marriages. There are similarly two groups of Zebaydiya Arabs, one in the extreme east of Sudan, the other in Kordofan, who are now distinct in appearance though of common origin in Arabia.

There is an unexpected nomadic tribe of Berber stock to be found in the Bayuda desert and westwards into Kordofan and Darfur. These are the Hawawīr, whose ancestors appear to have taken part in the Fatimite conquest of Egypt from Libya and north-west Africa as long ago as the tenth century A.D. They settled for a time in Upper Egypt and became quite arabicized in speech and customs. Subsequently they earned the enmity of the Mamlukes, and after being crushed in rebellion

¹MacMichael, *op. cit.*, p. 197, *et seq.*

some of the remnants fled south to Sudan. While the Hawawir are still pale skinned, there are small cognate groups of Jellāba, Hawara, and Korobat who have settled farther south and west and are by now quite negroid.

The Fung

When the great wave of Arabs entered Sudan in the fourteenth century A.D., they were able to establish themselves along the Nile downstream of the Sixth Cataract at Sabaloka and gradually to absorb the native population. Those tribes who were not attracted by the sedentary life spread out on either side of the Nile, chiefly to the west to Kordofan. The Gezira, lying between the Blue and White Niles, would have provided favourable conditions of grazing and permanent water supplies, but it was at this period still in the control of the negro Christian kingdom, whose capital was at Soba, near Khartoum.¹

In about 1500 A.D. an alliance was formed between the Guhayna sub-tribe of 'Abdallab, whose headquarters were near Sabaloka, and Amara Dunkas, the leader of the Fung. Together they attacked and overcame the declining Christian kingdom of Alwa at Soba, and put in its place a Muslim kingdom with its capital at Sennar, which extended at the height of its power from Kassala to the Nuba Mountains, and which lasted until the coming of the Egyptians under Ismail Pasha in the early nineteenth century. The origin of the Fung, who for more than 300 years ruled their powerful kingdom in central Sudan, is still a mystery.² They were certainly Muslims, but there are no good grounds for accepting the tradition that they were descended from the Beni Ummaya who had fled from the Hejaz.³

At the present time the population of the land on either side of the Blue Nile upstream of Sennar is extremely mixed, and Fung ele-

ments are to be found alongside settled Arabs, westerners, and negro tribes such as the Fazugli, Berti, and Hameg, the latter three being towards the Ethiopian border. *Acacia* forest and hordes of flies in the summer discourage the settlement of Arabs towards the south, but nomads can use the grazing away from the river in winter.⁴

To the north and east of this Fung area lies a stretch of country between the Rahad and Dinder rivers that is so thinly populated that it has been designated a game reserve. In this part security is hard to maintain near the frontier, and the fear of poachers combines with the lack of water supplies to discourage settlement. Farther north along the two rivers, and especially beside the Sennar-Gedaref railway line, there is an extremely mixed population in which Arab tribes are virtually absent. The villagers are commonly known as 'Westerners', members of many mixed tribes of western origin—some Sudanese, some from French Equatorial Africa, some from Nigeria—who have migrated to Sudan on their way as pilgrims to Mecca. They are also attracted by the possibilities of finding work in the cotton-fields of the Gezira and elsewhere, and by the ease with which they can find lands to cultivate in the rains.⁵

The Nuba

To the west of the White Nile the Arabs came into contact with the Brown Race and with negroes. Members of the former were either assimilated into the Arab tribes and came to regard themselves as of Arab origin, e.g. the Bedeiriya, or else were driven to take refuge in certain of the hills of southern Kordofan. It was probably for this reason that the Arabs came to use the term Nuba to refer to all the inhabitants of the hill masses, regardless of their origin, especially since the Brown men, originally of Nubian type, came soon to mix

¹ Crawford, *op. cit.*, (1951).

² Several theories have been put forward, including one that they are Shilluk who migrated from the White Nile, and another that they came via the White Nile area from the Bornu kingdom in West Africa. Perhaps the most credible tale is that the Fung were little more than a ruling caste or class who came from Ethiopia and dominated the Hameg of the Upper Blue Nile country.

³ J. Bruce, *Travels to Discover the Source of the Nile*, 1790, Vol. IV, Chap. IX, pp. 455-63. J. D. P. Chataway, 'Notes on the History of the Fung', *S.N. & R.*, 13 (1930). Arkell, 'Fung Origins', *S.N. & R.*, 15 (1932). Chataway, 'Fung Origins', *S.N. & R.*, 17 (1934). Arkell, 'More about Fung Origins', *S.N. & R.*, 27 (1946). F. Nalder, 'Fung Origins', *S.N. & R.*, 14 (1931).

⁴ See Fig. 33 and below.

⁵ I. A. Hassan (sc. Hassoun), 'Western Migration and Settlement in the Gezira', *S.N. & R.*, 33 (1952). D. B. Mather, 'Migration in the Sudan', in *Geographical Essays on British Tropical Lands*, Ed. R. W. Steel and C. A. Fisher, 1956.

with the negroes and became physically indistinguishable from them.

The other inhabitants of these hill masses were sedentary cultivators. The need for perennial water supplies at all seasons compels the Nuba to live near the hills, and when the Baqqara Arabs entered the intervening plains the Nuba retreated to the interior valleys and the tops of the hills for safety. Since the coming of public security in the present century this process is being reversed. The Nuba are by no means homogeneous, for they vary in appearance and speak several quite distinct groups of languages.¹

The information on which to base a division of the very dark skinned Nuba, according to their physical characteristics, is unfortunately available only in part,² and Seligman's description of them as 'a human enclave of aboriginal negro stock probably related to the hill groups of the southern Fung and to various negro peoples stretching towards West Africa' must stand without amplification.³

There is no common tradition among the Nuba of having migrated to their present hills from one particular direction: some mention an origin in the west, and the Daju of the Lagowa area presumably did come from that direction, while others can only tell of a migration from another hill mass, or may even claim to be the autochthonous inhabitants of the homes they occupy today. The present tendency is for the wearing of clothes and a knowledge of Arabic to become increasingly widespread among the Nuba, and the schools will accelerate this process. Islam, though often very superficially accepted, is spreading, so it seems probable that the Nuba, despite their distinctive physical appearance and despite the efforts of several Protestant Christian missions which have worked in the area, will become absorbed into the mass of northern Sudanese population.

The Darfur Tribes

West of the Nuba mountains the Western District of Kordofan is principally inhabited

by Arabs; in Darfur, on the other hand, there are Baqqara Arabs in the south, and a few camel-owning Arabs in the north, but the remainder of the province is occupied by numerous negroid tribes. The principal inhabitants are known today as the Fur (Plate XI), a term which properly applies to their language. When asked the name of their tribe they more usually reply 'Keira', claiming relationship to the last Sultan's family or 'Konjara', a general name for the more aristocratic Fur families, or else use some other local name. They are sedentary cultivators occupying the volcanic range of Jebel Marra and much of the lowland around it. There is no current tradition of the migration of the Fur from any other region to their present land, and relatively little evidence of extensive admixture with Arabs or other non-negroes.⁴ Political power in Darfur was once wielded by the Daju, who have mostly migrated westwards to what is now Wadai, and later by the Tungur, a group of dark brown people who may have had an Arab or more probably a Nubian origin. The earliest historical Sultan of Darfur, Suleiman Solong (*Solong* means 'brown man', hence Arab in Fur), lived from 1596 to 1637, and founded a dynasty which in the eighteenth century overran Kordofan and extended its rule to the White Nile. At present the Fur are unquestionably negroid in appearance, but MacMichael's description of them as small and skinny, stupid, suspicious, and smelly may be taken with reserve.⁵

North of the Fur the principal tribe is the Zaghawa, a people of mixed negroid and brown race origin (Plate XII). They claim to be related to the Kanuri of Bornu and the Bedeyat, and speak a language of the Teda-Kanuri group. There is plenty of evidence that the Zaghawa have long occupied their present territory. They are a semi-nomadic people, lithe, stalwart and active, and very black-skinned. The Meidob people of north-eastern Darfur occupy a mass of volcanic hills whose low rainfall constrains them to semi-nomadic animal herding. They are probably a mixture of Zaghawa, Tibbu (mixed negro-brown race) and

¹ S. F. Nadel, *The Nuba*, 1947. P. A. & D. N. MacDiarmaid, 'The Language of the Nuba Mountains', *S.N. & R.*, 14 (1931).

² C. G. Seligman, 'The Physical Characteristics of the Nuba of Kordofan', *Jnl. Ryl. Anthropol. Inst.*, 40 (1910).

³ C. G. Seligman, *The Races of Africa*, 1930.

⁴ Arkell, 'The History of Darfur', *S.N. & R.*, 32 and 33 (1951 and 1952).

⁵ MacMichael, *op. cit.*, 1922, Vol. I, pp. 108 and 113.

Beja, and their speech and traditions tell of an infusion of Nubian at some period.¹ Farther to the south the Berti are a small negroid tribe, whose speech and appearance resemble those of the Zaghawa.

In southern Darfur there are several negroid groups, Daju, Beigo, Birkid, and Fellāta. The Daju were once the dominant tribe in Darfur, but the bulk of them have now migrated westwards to Wadai. The Beigo are a small group whose language closely resembles that of the Daju. The Birkid appear to have some kinship with the Meidob and perhaps have Nubian blood also. The Fellāta are Cattle Fulani (Bororo) from West Africa who have intermarried to some extent with the Baqqara amongst whom they live.

To the west of the Fur there are several tribes who live along the borders of French Equatorial Africa: these are the Masalit, the Gimr, and the Tama. Dar Masalit was for many years disputed territory between Wadai and Darfur, and its chief importance today lies in its position on the route from Nigeria and French Africa to Sudan and the Hejaz. The people of Dar Masalit are negroid like the Fur. The Gimr resemble the Masalit, but speak Arabic; being rather unwarlike they have long been oppressed by their neighbours. The Tama appear to be a mixture of Gimr and Daju.

The tribal complexity of the area is still further increased by the presence of certain subordinate groups including the Hadahid, low-caste blacksmiths distributed throughout the province, and certain former slaves such as the Dinka, Nuba, and others from Bahr el Ghazal who have from time to time been captured and brought in by the sultans. The group known as Fertit are akin to the Kerdi of Wadai. Their name implies that they are pagans, their ancestors having been driven to the south when the Fur accepted Islam.² At the present time the Arabic language is spreading among the people of Darfur, and Islam is becoming more fully understood and genuinely practised. With the improvement in communications and education that the government is now begin-

ning to provide for Darfur, it is to be expected that the people will be more effectively absorbed into the population of northern Sudan.

SOUTHERN SUDAN

In southern Sudan an even greater complexity of population is to be found. Linguistically, the inhabitants have been divided into three principal groups, the Nilotes, the Nilo-Hamites, and the Sudanic tribes. These groups in turn have their subdivisions, and while some languages are understood by a wide range of peoples there are others known only to small dying sections of a single tribe.

The Nilotes

The Nilotic people have been recognized by anthropologists to have 'closely related physical, linguistic, and other cultural characteristics as well as traditions and myths suggesting a common cultural origin'.³ Intermarriage, warfare, and constant borrowing have affected the Nilotes and their neighbours so as to modify their original features, and it is not always possible to determine precisely which people are Nilotes and which are not. It is generally accepted, however, that the term should be applied to the following: Dinka, Nuer, Shilluk, Anuak, Burun, Bor Balanda, Jur, Shilluk Luo, Acholi, Lango, Luo, and Alur, of whom the last two live wholly outside the Sudan, while the Acholi and Lango live across the Sudan-Uganda border (Plates XIII and XIV).

Physically the Nilotes show a marked uniformity, with negroid features that are usually considered to have been modified by Brown Race admixtures brought by one or more waves of invaders from the Ethiopian highlands. The general characteristics of the Nilotes are extreme height, with a slight long-legged build and little muscular development, frizzy negroid hair on the head and little elsewhere, dark brown to black skin and facial features varying from aquiline noses and thin lips to broad noses and thick everted lips. Most of the group are markedly dolichocephalic, but the Acholi are mesaticephalic and the Bor

¹ G. D. Lampen, 'A Short Account of Meidob', *S.R. & R.*, 11 (1928).

² The term 'Fertitawi' is commonly used in colloquial Arabic to denote any pagan non-Nilotic inhabitant of southern Sudan, though it is more strictly applied to a small group in Darfur and north-western Bahr el Ghazal only.

³ Butt, *op. cit.*, p. 1.

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have by intermarriage lost many of their original features.

A rather fascinating light is thrown on nineteenth-century ideas of evolution by Schweinfurth's comments on the Nilotes. Convinced that the long-legged Shilluk were adapted by nature to live in marshy flats, he adds: 'They give the impression that among men they hold very much the same place the flamingoes as birds hold with reference to the rest of the feathered race'.¹

There are no documents to reveal the early history of the Nilotes, but from the study of their oral traditions Crazzolara has concluded that the original home of the Luo elements, i.e. Shilluk, Anuak, Pari, Luo, Acholi, and Alur, appears to have been near Rumbek to the west of the Bahr el Jebel, whence a slow process of migration has been responsible for their present distribution.² Since Europeans first came to Sudan during Muhammad Ali's rule, there has been a retreat of the Shilluk up the White Nile from villages which once stretched as far down as Ed Dueim. The Nuer and Dinka, representing the other main group of the Nilotes, seem to have had their origin in much the same area. The Dinka first migrated to the east and north across the Bahr el Jebel and Bahr el Ghazal, and subsequently the Nuer have followed them to the east, thrusting the Dinka before them.

All the Nilotes are conspicuous for their absorbing interest in cattle, which enter widely into their customs and traditions. It is probably for this reason that they have not penetrated farther westward into the Ironstone Plateau where tsetse flies abound.³

The Nilo-Hamites

The Nilo-Hamites, too, are by tradition cattle-owners, and like the Nilotes they are to be found both within and beyond the borders of Sudan; in fact, the most southerly group extends as far south as central Tanganyika, and other Nilo-Hamites occur in Uganda, Kenya, and Ethiopia.⁴ There is no predominant physical type among these peoples, who vary in colour from dark brown to black (with a

few reddish representatives among certain tribes), and are generally fairly tall with longish heads. The original criterion which led anthropologists to formulate the term Nilo-Hamitic was the similarity between the languages spoken by the several tribes. These have been subsequently divided into three groups on the basis of cultural affinities and apparent relationships. The Nilo-Hamites of Sudan almost all belong to the northern group; traditions of their origin are very vague, but they seem at one time to have come from the mountainous area that lies along the Sudan-Uganda border east of the Nile. Whence they came before that is not known at all.⁵

The northern group includes the following tribes: Bari, Mandari, Nyangbara, Pojulu (also known as Fajelu), Kakwa, Kuku, Nyepu, Lokoya, Luluba, Latuka, Lopit, and Lango, together with some smaller remnants of a hunting people called the Ligo. The group as a whole is distinguished by cultural features, which include the great importance attached to rain-making, the existence of rain chiefs, and the use of rain stones. The bow is the chief weapon, and shields are very rarely used. Except among the Latuka, villages are rare; scattered hamlets and even individual homesteads constitute the usual type of settlement. With this goes the absence of any strong tribal organization or system of permanent chiefs, which has in turn made the political task of creating a sense of tribal, regional, or national patriotism very difficult. Within the northern group three sub-groups of Nilo-Hamites may be distinguished, according to the traditional relationships between tribes: one of these constitutes the Bari and Mandari and all the tribes which live on the west of the Nile; a second comprises the Lokoya and Luluba and a third the Latuka and the Lango.

Reliable statistics of the population of these and other tribes have now for the first time been made available by the recent census.⁶ It seems reasonable to assume that the population of certain tribes, especially the

¹ C. Schweinfurth, *The Heart of Africa*, 1873, p. Vol. 1, 119.

² Evans-Pritchard, *The Nuer*, 1940.

³ G. W. B. Huntingford, *The Northern Nilo-Hamites*, Ethnographic Survey of Africa, 1953. Pamela and P. H. Gulliver, *The Central Nilo-Hamites*, Ethnographic Survey of Africa, 1953.

⁴ L. F. Nalder, *A Tribal Survey of Mongalla Province*, 1937.

⁵ The Republic of the Sudan, *First Population Census of Sudan, 1955-6*; First to Ninth Interim Reports, Khartoum, 1958.

Bari, Mandari, and Latuka, would by now have been considerably greater if it had not been for the slave-raiding that took place in the region after the penetration of Turkish-Egyptian rule in the nineteenth century. The limit of regular navigation, and, therefore, the site where the first government headquarters were established, was at Lado, and other posts were set up at Gondokoro, Rejaf, and elsewhere. From these centres unrecorded numbers of slaves were obtained by various means, and thence dispatched down the Nile to Khartoum and the markets of Egypt.¹

A remarkable feature of the distribution of the northern Nilo-Hamitic tribes in the Sudan is the fact that they are for the most part to be found in country infested with tsetse fly, and so are unable to keep cattle. The Bari and Mandari have some herds, which they keep mainly on the east bank of the Nile outside the fly country, and the Latuka have cattle and sheep, said to be much less numerous than when Baker first visited them in 1861.² The Kuku at Kajo Kaji occupy a stretch of country that has been largely cleared of bush, and so are able to keep some herds of small cattle.

There is no particular reason to believe that the slave-raiding led to movements of individual tribes; migrations usually seem to have occurred as the result of pressure from other tribes, or when the leadership was disputed between two or more rivals.

The Central Nilo-Hamites are represented in Sudan by the Toposa, Donyiro, Jiye, and Turkana. Of these the Toposa live wholly in Sudan, in the plains to the north of the Didinga hills; the Jiye are a small section of a tribe which also has representatives in north-eastern Uganda; the Donyiro are a section of the Toposa who left the main tribe and migrated to the east, so that they came for a period under Ethiopian rule, and the Turkana are inhabitants of north-western Kenya whose migrations take them across the Sudan border during the summer. The latter two tribes are administered by the Kenya Government, which is permitted by the Sudan Government to exercise authority in an area of Sudan, known as the

Ilemi triangle, because of the extreme difficulty of reaching it from within Sudan.

All these tribes speak closely related languages of the Teso group, akin to those spoken by the Teso of the Eastern Province of Uganda. The original home of the first three named seems to have been the Karamojong area of eastern Uganda, and a fairly loose relationship is generally recognized. However, the Turkana are traditionally hostile to the remainder, having migrated from Jiyeland 180-200 years ago. The principal occupation of these Nilo-Hamites is pastoralism, with cultivation attaining greatest importance among the Toposa, who alone have well-built permanent villages which they occupy during the wet weather.

The Sudanic Tribes

The Sudanic-speaking tribes of southwestern Sudan are classified by Tucker on linguistic grounds as belonging to the eastern Sudanic group of African negroes.³ They fall into four classes, the Azande, who are a group of tribes rather than a single people, the Ndogo-Sere group, the Moru-Madi, and the Bongo-Baka. As Fig. 29 reveals, these linguistic classes are not distributed in homogeneous blocks, but are much intermingled. The greater part of every class lives outside Sudan, with the exception of the Bongo of the Tonj area, of whom there is only a very small section settled beside the Congo.

The traditions of the migrations of these tribes into southern Sudan are extremely complicated, but it seems that most of the peoples came from the west and south, in successive waves that were one by one compressed between the Nilotes and the Nilo-Hamites in the open fly-free country of the Nile floodplain and the steady pressure of newcomers from behind. The last and most powerful wave of invaders were the Azande, who began to enter Sudan in the early nineteenth century, conquering and assimilating local populations. This process was brought to a halt by the European occupation of Zande territory at the end of the nineteenth and the beginning of

¹ Schweinfurth, *op. cit.*, Vol. II, p. 5.

² S. Baker, *The Albert N'Yanza, Great Basin of the Nile, and Explorations of the Nile Sources*, 1866.

³ M. A. Brian and A. N. Tucker, *Distribution of the Nilotic and Nilo-Hamitic Languages of Africa*, 1948.

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the twentieth centuries.¹ While ethnologists and linguists may rejoice at the preservation of many dialects and customs which would have soon been forgotten had the Zande continued to extend their sway, it may also be felt that future political and economic development of the region might have been much simplified if a single local tongue were now in use throughout most of the Ironstone Plateau.

Physically the Azande are described as dull chocolate brown in colour, usually rather short in stature, with round heads and broad noses. Their physique is generally good, markedly stockier than that of the Nilotes or Nilo-Hamites.

Schweinfurth says: 'The eyes, almond-shaped and somewhat sloping, are shaded with thick sharply defined brows, and are of remarkable size and fullness; the wide space between them testifies to the unusual width of the skull, and contributes a mingled expression of animal ferocity, warlike resolution, and ingenuous candour.'² The assimilation of various Sudanic and indigenous tribes into the Azande has taken place under the vigorous political and military domination of the Avungara clan, who provide the traditional kings and chiefs (Plate XV).³

The Ndogo-Sere group, now settled near Wau, have a tradition of having come from the south, but it is hard to be more precise about their history, for as Evans-Pritchard says: 'The tribes of the Bahr el Ghazal present the appearance of a routed army. . . . Some peoples have disappeared altogether as political and cultural units, and survive only in tradition.'⁴ Only isolated scraps of information are available concerning these tribes, and there are no anthropometric data. There are four mutually intelligible dialects spoken by the members of this group, and these seem related to the Mundu tongue spoken by a small group near Maridi in Sudan and by another colony in the Belgian Congo.

The Moru-Madi group is divided linguistically into three sub-groups, of whom the nor-

thern or Moru occupy the Amadi and Maridi districts of Sudan, the Kaliko and Avukaya inhabit Yei district in Sudan and also extend into the Belgian Congo, and the southern or Madi sub-group is found in the Opari area of Sudan and in Uganda. In the group there are no clear memories of migration from elsewhere, except that those to the west seem to have been pressed by the Zande invasions, and those to the east by the Nilo-Hamites. The whole group is predominantly mesaticephalic and of short to medium stature. The languages of the three sub-groups are not mutually intelligible, so it is worth recalling that any unity between them is an artificial concept rather than something that they can feel themselves. Within the tribes there is no centralized authority, and the largest unit having a sense of belonging together and acknowledging a single chief is rarely more than a handful of villages.

The Bongo-Baka of the Tonj area are even more scattered and diverse than the language groups considered already. It is thought that they originally came from the Uele river basin in the Congo, where a small Bongo group still remains. They are conspicuous for the lack of unity or cohesion between neighbouring villages, and this was probably one reason why the Azande and other tribes were able to displace them from their earlier homes and to drive them into drier, less fertile country. According to Schweinfurth: 'The complexion of the Bongo in colour is not dissimilar to the red-brown soil on which they reside; the Dinka on the other hand, are black as their own native alluvium.'⁵ While refusing to see a causal connection between these two sets of facts, we can admire Schweinfurth's acuteness in drawing attention to the likeness.

SUDAN'S COLONIAL PROBLEM

When Sudan became independent at the beginning of 1956, power inevitably passed to the northern majority of the inhabitants, but very little had yet been done to resolve the

¹ Baxter and Butt, *op. cit.*, p. 23.

² Schweinfurth, *op. cit.*, Vol. II, p. 5.

³ The size of a kingdom or a chiefdom is variable, but 50,000 persons may be taken as a rough figure for the former, 5,000-10,000 for the latter.

⁴ Evans-Pritchard, 'The Mberidi (Shilluk group) and Mbegumba (Basiri group) of the Bahr el Ghazal', *S.N. & R.*, 14 (1931).

⁵ Schweinfurth, *op. cit.*, Vol. I, p. 261.

contrast between northern and southern Sudan that is inherent in the foregoing description of the several tribes.

It is not intended in this work to enter the field of stale political controversy, either by siding with those Sudanese who claim that the country could have been better unified if during the Condominium the Northerners had been permitted freer access to the south, or by stating that after the history of the slave trade in the nineteenth century even the present uneasy marriage represents a triumph of diplomacy. Certain facts, however, that enter into the geographer's province may throw light on the nature of the problem that now confronts the Sudanese in their dealings with the three southern provinces, and indeed with backward and remote areas in any part of the country.

The problem of incorporating the more backward peoples of northern Sudan, such as the Fur, the Ingessana tribes or the Nuba, is not a serious one, for it is evident that these are indeed the blacks who gave Sudan its name. They have long been in contact with the Arabs; many, though not all, are Muslims, Arabic is widely spoken, and their tribal organization of chiefs and village headmen resembles that of the Arab tribes. Even though they are backward in education and supply relatively few leaders, they may truly be said to be Sudanese.

In the south, on the other hand, there was during the nineteenth century a sense of fear and hostility towards the north. The welding of the south together into three provinces has been the work of outsiders, as has been the checking of Zande expansion and the ending of Nuer-Dinka wars. What the British began to do by posting their officials about the country, the northern Sudanese are continuing, and as yet few Southerners have attained posts of authority. Northerners and Southerners have sat together in parliament in Khartoum, but for a number of reasons the majority of the members of the two groups cannot easily regard the others as equals and co-citizens.

A part of the problem of creating a single nation arises from the lack of day-to-day contact between north and south. Except along the Nile there is a belt of uninhabited country

that lies between the settled areas of the north and those of Upper Nile and Bahr el Ghazal provinces. Certain of the Baqqara tribes have dealings with the most northerly of the Dinka in their annual movements, and certain of the Nilotes visit the capital to find work when they want to save enough money to get married. The recent census results have shown that there are a few Southerners settled in many of the towns and villages of central Sudan. Otherwise almost the only contacts between Northerners and Southerners arise because northern traders and officials are to be found in the towns of the south.

A helpful factor is that Arabic is already well advanced towards becoming the second language in much of the south. Yet when Northerners go to the south in official or commercial capacities, their relations with the local inhabitants tend to be in some ways less intimate than those of former foreign officials. They are bound to feel that they are themselves already true Sudanese, while the Southerners have yet to become so, and the very fact that Northerners are trying to create a single nation out of the whole country makes it difficult for them to study the local languages and customs dispassionately. The private Muslim individual is often a much better advocate of Islam than is his opposite number of Christianity, but his faith has produced nothing to compare with the trained and dedicated Christian missionary, whose power and influence are in consequence much feared.

Thirdly, even the wealthiest parts of Sudan still stand in need of a great deal of investment to exploit their potentialities. In the south, the need is greater still, and resources that could be put to good use in the Gezira, for instance, may have to be spent, less productively perhaps, on communications or research projects in the south. This may lead to discontent on both sides if mutual confidence is lacking, with Southerners complaining of neglect and Northerners of ingratitude.

The real problem, therefore, is whether a sense of Sudanese nationality can be implanted in the Azande, for instance, or in the Luo peoples. Failing that, their natural leaders may become dissatisfied with their prospects as members of parliament in Khartoum, and not

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relax until they have obtained the federal status that some of them are already demanding. They might even demand local independence in conjunction with others from the same race or tribe as themselves whom chance has made citizens of Uganda or the Belgian Congo. This is not an impossible prospect, for as we have seen there are many tribes in southern Sudan who have as many or more representatives outside Sudan as within it. At present the Azande can and do cross into the Belgian Congo, or the Acholi into Uganda, as they please, disregarding the border. If they one day ask to be incorporated within a single political unit, it might be difficult for democratic states to deny them that right.

Similarly the departure of foreign officials in 1954 and 1955 led to a great deal of accelerated promotion among Sudanese Government officials, who were almost all Northerners, and

inevitably Southerners have complained that they were left out. To ignore such protests is to run the risk of causing immediate discontent; to accede to them is to admit that there are fundamental differences between north and south.

The Egyptian expansion of the early part of the nineteenth century and European rivalries of the latter part have certainly bequeathed a knotty colonial problem to the Sudanese. Since the shock of the mutiny in the summer of 1955 the northern Sudanese have been made very conscious of the real difficulties that confront them and have made encouraging efforts to overcome them. It is very much to be hoped that they can find a solution that will maintain good relations between north and south and avoid the creation of one or more small and impoverished states in the headwaters region of the Nile.

THE SUDANESE IN COUNTRYSIDE AND TOWN

THE GROWTH OF POPULATION
AND ITS DISTRIBUTION

THERE seems little reason to doubt that the population of Sudan, like that of most territories wherein public security and a public health service have been fairly recently established, is steadily growing. Some sixty years ago, when British rule was effectively established after the Battle of Omdurman, the country had just passed through a period of famine and disease; while it is hard to accept the figure of 1½ to 2 millions that was published in the Sudan Almanac for the total population of the country in 1904, it is unlikely that the true figure was more than 3 to 4 millions.

In the early days of British rule it was generally thought that there had been a decline in population during the preceding decades. The evidence for this consisted primarily of reports by the inhabitants themselves that their numbers had fallen, combined with various travellers' tales describing the ravages caused by the slave-trade. Schweinfurth¹ speaks of the decimation of the Bongo as the result of slave-raiding, the effects being particularly severe because of the slavers' custom of carrying away as many of the young women as they could, and so destroying the tribes' power to recuperate. Baker also tells of the devastation and depopulation of wide areas caused by the passage of slaving parties.² While there is no doubt, therefore, that slave-raiding did reduce the population in certain areas, these accounts should be read with a little caution, since many tribes, like the Nuba of central Sudan, would quickly learn to avoid the routes easily taken by slaving parties and seek protection in remote hilly or thickly wooded areas.

With the establishment of British rule the prime duty of the local District Commissioners—usually army officers at first—was to secure

the confidence of the population, and to assure them that the period of oppression by government was over. To begin with, it was natural that the people should be suspicious, and village or tribal headmen, where they could be found, had an interest in keeping the recorded numbers of their followers down in order to reduce the poll-taxes that they had to collect. Even when confidence was established and the number of tax-payers admitted by the village headmen began to bear a closer relation to the truth, the problem of determining a suitable multiplying factor to obtain the total population of each district remained. Some commissioners used 5 or less, some 6 or more, and since a change in D.C. could result in a change in the factor employed, the resultant figures were liable to sudden shifts which made them most unreliable.

On the whole, however, estimates were in the course of time collected with increasing care, and the totals for each province and for the country as a whole steadily grew. Until after the termination of British rule no official census was ever taken, but it is only fair to point out that plans for the first census were well advanced before the country became independent.

The First Census

The first National Census of Sudan was taken over a period of several months in 1955-56, a sampling technique being adopted in rural areas to reduce expense and to overcome the great problem of finding sufficient enumerating and supervisory staff in a large country with a low standard of education. The reports of the Census have been published with commendable promptitude, while figures supplied during the period of compilation were used for the construction of the density and distribution maps accompanying the report, and also

¹ G. Schweinfurth, *The Heart of Africa*, 1873. Vol. II, p. 419.

² S. Baker, *The Albert N' Yanza . . . etc.*, 1866.

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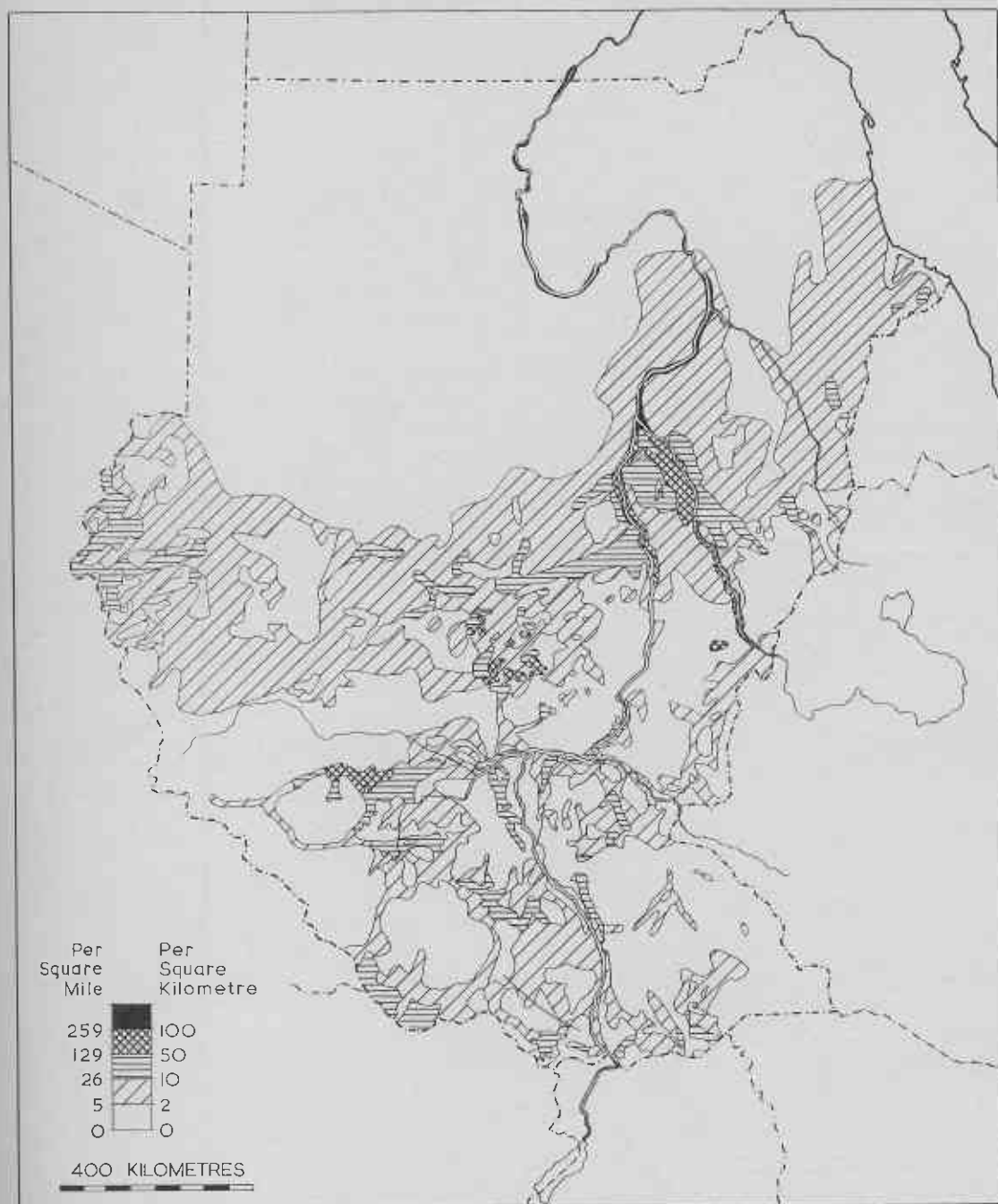


FIG. 31. Density of rural population. Compiled by the author.



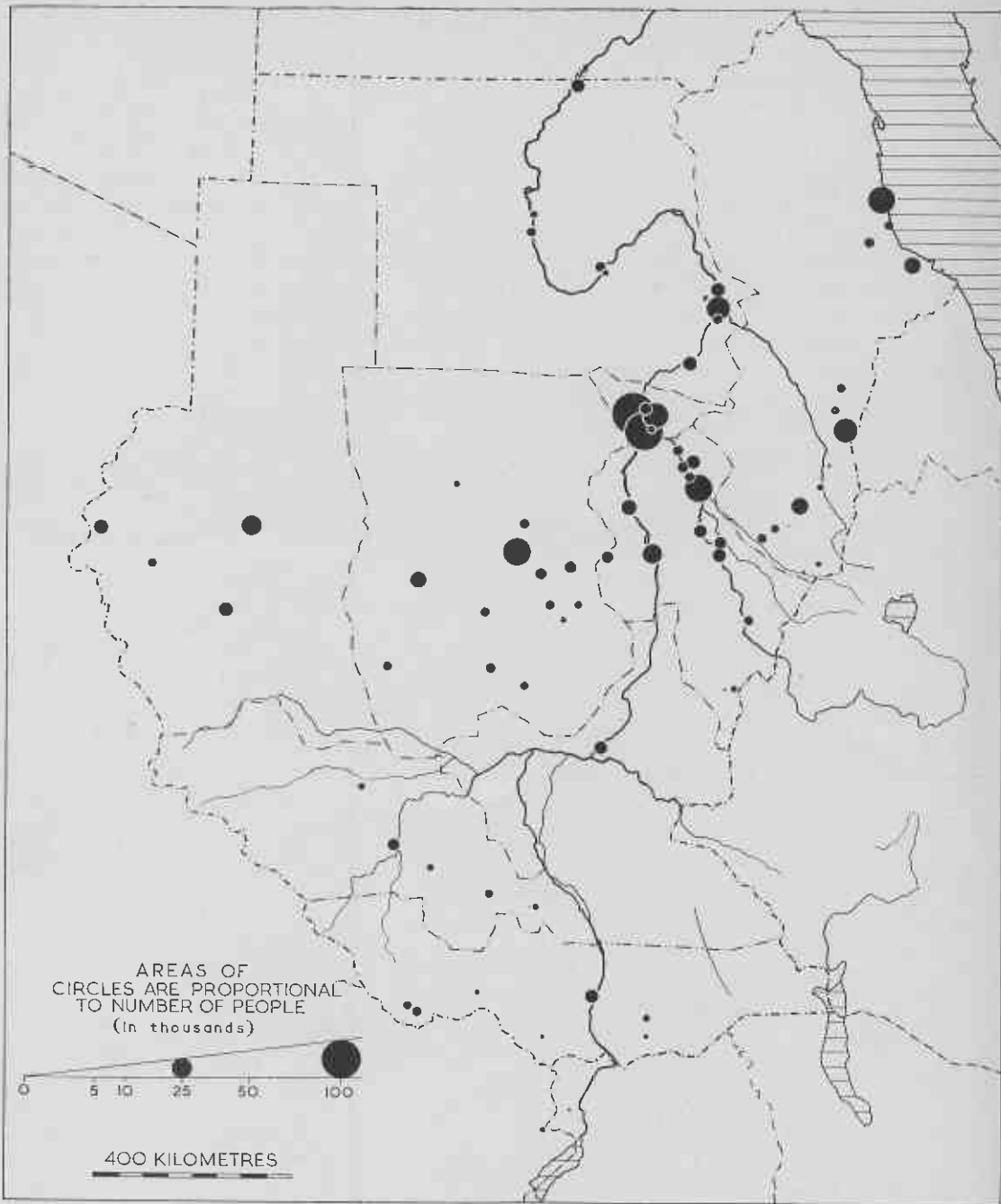


FIG. 32. Distribution of urban population. Compiled by the author.

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of the maps of rural and urban population that are shown here (Figs. 31 and 32). The Census figure for the total population of Sudan was 10,255,912.¹

The Density of the Population

In some parts of the country, particularly those occupied by the Beja tribes, the new total proved to be well above expectation; even so there is no doubt that with the exception of certain areas beside the Nile the density of population in Sudan is generally low. Even in the prosperous Gezira, where cultivation is assured by irrigation, there are less than 200 persons to the square kilometre, and elsewhere a density higher than 20 is exceptional. If Sudan be compared with other parts of Africa at similar latitudes, it appears that the country is more thickly populated than are similar areas in French Equatorial Africa, but much less so than Nigeria. The Sudan-Belgian Congo border cuts through a fairly homogeneous area, with similar conditions and densities on either side, but Uganda, higher, cooler, and wetter than Sudan, supports markedly higher population densities. No valid comparisons can be made with Ethiopia, because conditions on the high plateau are totally different from anything to be found in Sudan, except perhaps in Jebel Marra.

The Distribution of the Population

In the absence of sufficiently detailed information, it would be misleading to try to draw separate maps to indicate the distribution of the population at different times of the year, though there are many nomadic tribes which migrate considerable distances between their summer and winter grazing grounds. As far as possible the human rural density map has been drawn to represent the early part of the wet season, when most of the nomads are to be found widely dispersed within their tribal areas. To supplement Fig. 31, therefore, Fig. 33 has been drawn to show animal owners and herders as a percentage of the gainfully employed population in each census area. Figure 34, drawn to a similar plan, shows farmers and farm labourers, again expressed as percentages of the gainfully employed. The

parallel existence of such contrasted ways of life occurs extensively in central Sudan, either because tribes with distinct ways of life are intermingled with one another or because various members of the same tribe pass their lives differently. Except beside the Nile, nomadism extends farther north than cultivation, because camels and goats can find nourishment in areas far too dry to support cultivated plants. Where *Glossina morsitans* occurs in the south-west, on the other hand, men can live quite healthily but cattle and most other domestic animals cannot (Figs. 35 to 38). A special form of semi-nomadism is indicated in the Nile swamps region, to show the relatively short migrations in various directions that are imposed by the extensive summer flooding.

Among the Arabs, Beja, and other tribes with a strong tradition of animal rearing in preference to cultivation, migration rather than settlement may be regarded as the normal way of life. The people live in tents, occasionally made of hair but more often of matting woven from palm leaves (Plate XVI). The actual cause of movement may be the exhaustion of grazing, the need to seek a less transient source of water, the increase in number of noxious insects, or the onset of unfavourable climatic conditions. At some seasons the members of nomadic tribes are brought together by the rhythm of their movements, and then disputes are settled, marriages are arranged, and the sense of tribal unity is fortified; at others they disperse into small groups which move independently, often advancing in a broad band across the tribal territory.

In central Sudan the movements of nomads tend to be northwards in the summer and southwards in the winter. No easy correlation, however, is to be made with the movements of the sun, since the location of a suitable area of dry season grazing and water is the chief factor determining movements, and there is no necessary reason why this should lie in the southern part of a tribal area. In fact, both in the Red Sea hills and in the Upper Nile flood-plain short-range movements in many directions occur.

The conditions that must be fulfilled before settled cultivators can occupy a given area of

¹ The Republic of the Sudan, *First Population Census of Sudan, 1955-1956* Ninth Interim Report 1958.

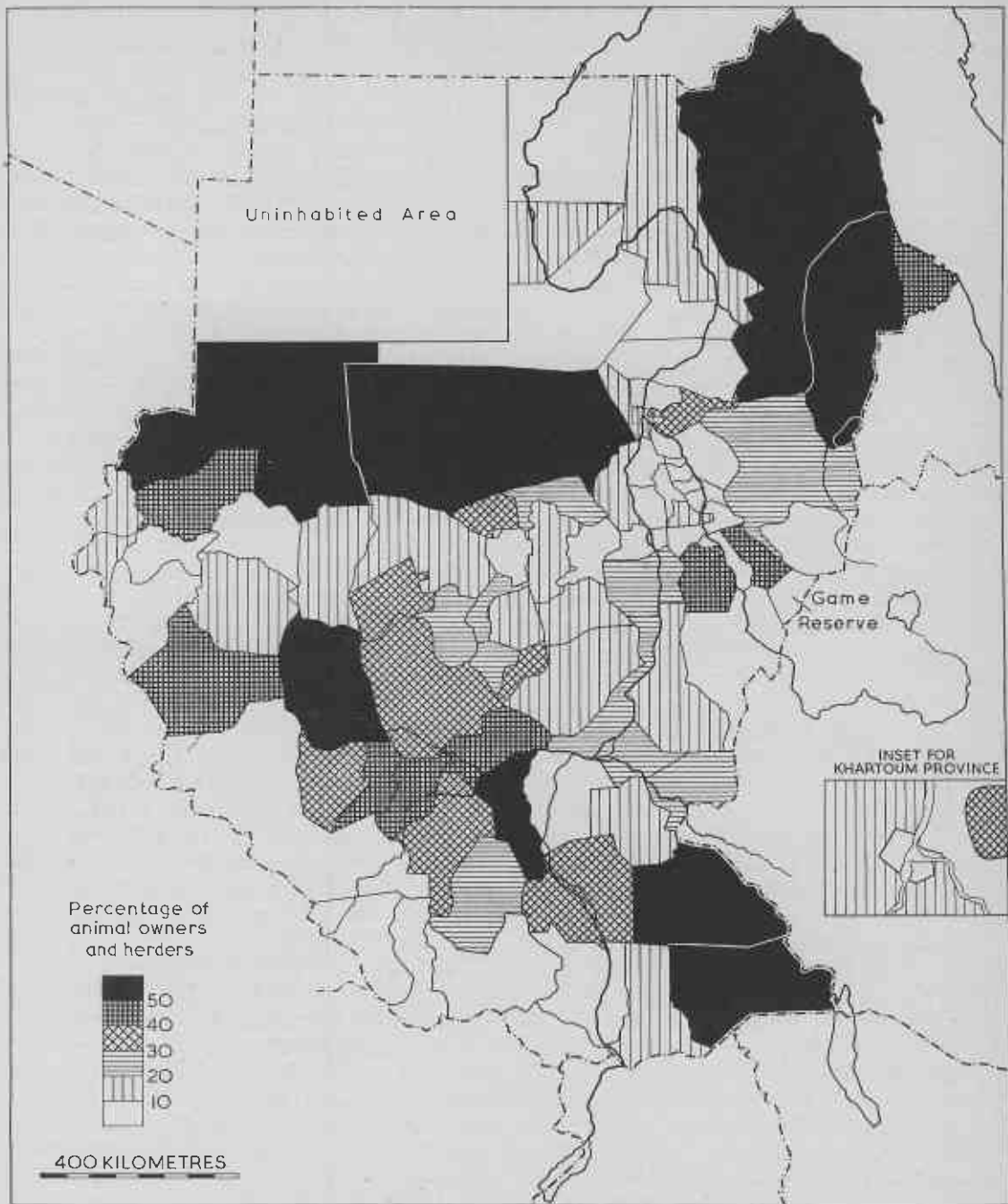


FIG. 33. Animal owners and animal herders, expressed as percentages of all persons gainfully employed. Animal rearing assumes a dominant role in Sudan in two broad belts: the southern fringe of the Sahara and the zone of contact between the southern clay plain and the Ironstone Plateau. The low figure for certain of the Nilotic tribes is to be explained by anomalies in the methods employed in the census for defining primary occupations. Compiled from *First Population Census of Sudan, 1955-56, Interim Reports, 1958*.



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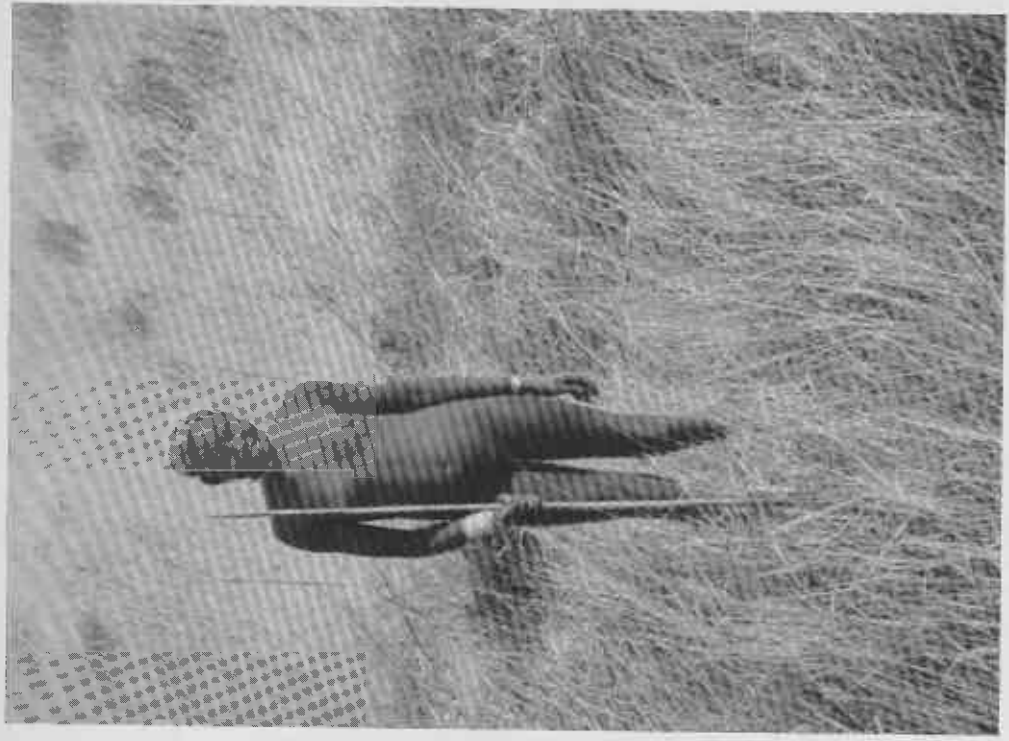


PLATE XIII. NUER GIRL



PLATE XII. ZAGHAWA GIRL





PLATE XV. ZANDE WITCH-DOCTOR

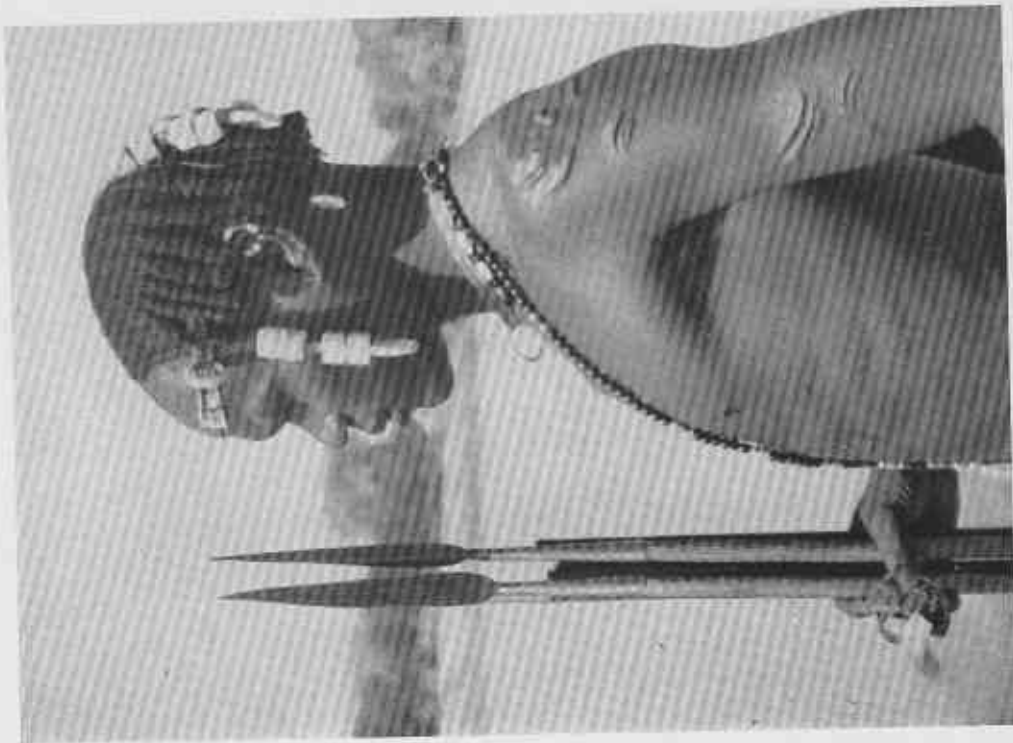


PLATE XIV. JUR WARRIOR

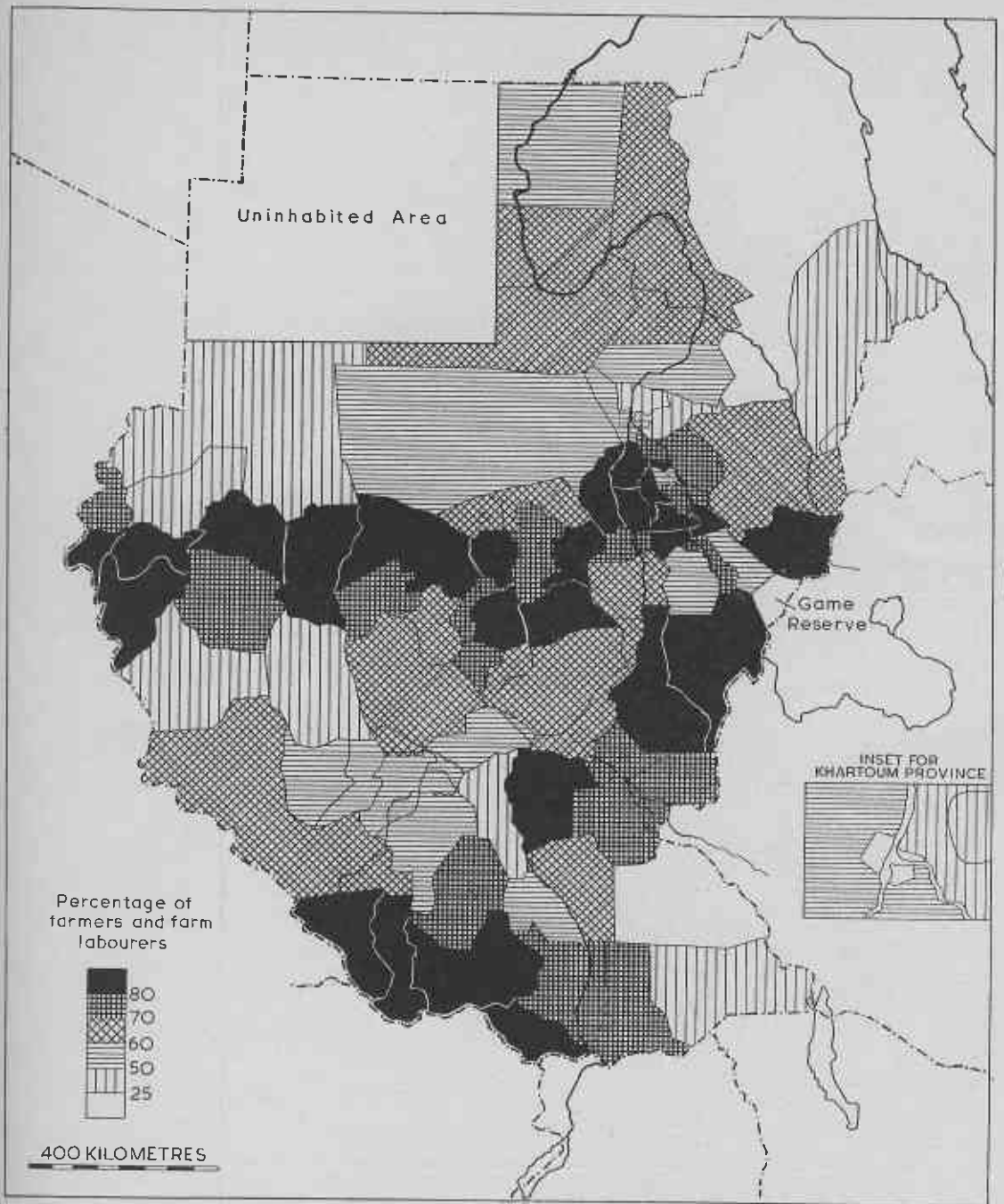
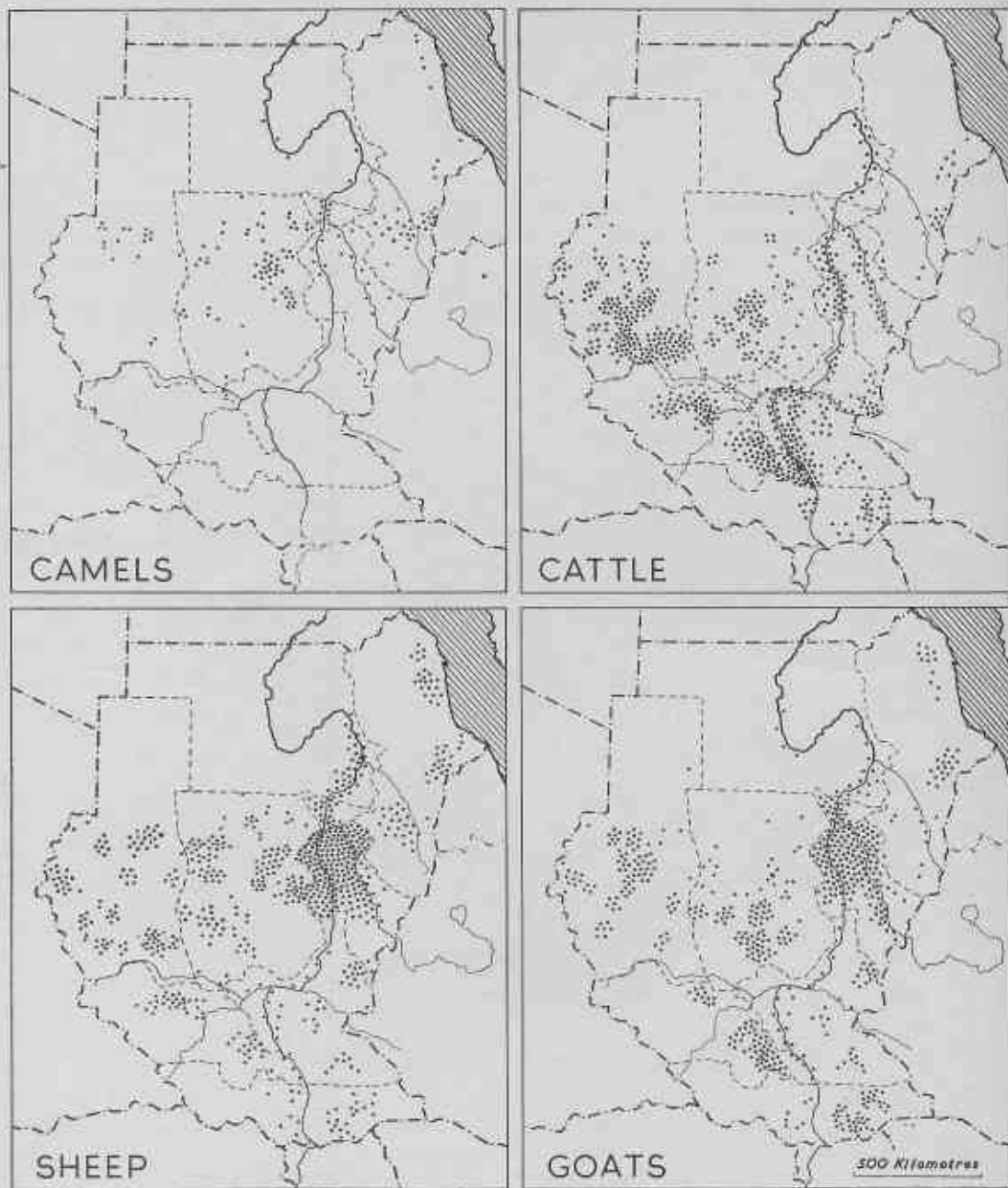


FIG. 34. Farmers and farm labourers, expressed as percentages of all persons gainfully employed. In the poorer and more backward parts of the country (except in western Bahr el Ghazal, where the numbers of semi-professional workers, craftsmen, mechanics and skilled and unskilled workers are remarkably high), this map virtually constitutes the complement of Figure 33. (Source as for Fig. 33.)

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FIGS. 35-38. The distribution of camels, cattle, sheep and goats. In each figure one dot represents approximately 10,000 animals. It is noteworthy how sheep (for meat) and goats (for milk) are concentrated near to the main markets along the Nile, as well as in the area of nomadism. Cattle, on the other hand, are found in large numbers in the subsistence areas where they can make little contribution to the national economy. These maps are drawn from those published by the Sudan Veterinary Service in August 1956 on a base map at 1:4,000,000 (*Sudan Surveys S625-40*).

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the country are by comparison rather rigid. First there must be a supply of cultivators possessing the necessary techniques to exploit the land; secondly, the land itself must be reasonably fertile, and must receive enough water, either from rain or from some form of irrigation, to grow crops in most (if not all) years; thirdly, there must be a supply of drinking water, however scanty, that will at least last through the cultivating and harvesting seasons; and fourthly there must be no special risks to health or public security to make life excessively uncertain.

Examples can readily be found of the operation of all these factors. To take the first, there has been a population of Nubian peasants beside the Nile between the Sixth Cataract and the Egyptian frontier for several millennia. These people have cultivated the river banks and the lower alluvial terraces throughout this time, and for lack of more land that they can use they have often found themselves strictly constrained and reduced to a bare level of subsistence. Yet by the use of modern techniques a start has recently been made towards bringing the Kerma basin under cultivation; similarly pumps have been established throughout the Northern Province to irrigate the higher alluvial terraces which previously were too far from the Nile or too high to be irrigated by primitive devices. In both these ways an increase of the cultivated area and the building of new villages have been made possible.

In the western Bahr el Ghazal there are adequate rains, good potential water supplies and empty lands in plenty. Since the virtual annihilation of the local tribes, however, the area has stood unoccupied and remains as a part of Sudan which may perhaps be colonized when land grows scarce elsewhere. The higher parts of the Imatong Mountains, above 2,000 m., are unpopulated, though they have shown themselves to be quite fertile in the gardens at Gilo. Such lands might prove attractive to white settlers if they were permitted to occupy them, but to the local African tribes they are much too cold and wet.

The importance of water is obvious enough in areas where rains or irrigation are wholly lacking. Yet the actual isohyet or other line

where settlement of some kind becomes insecure cannot readily be determined, since semi-speculative mechanized grain cultivation is now being practised north-west of Gedaref in land where peasant cultivators could not live in confidence of reaping a crop every year. Nomadism, moreover, obscures the limits of possible cultivation, since in sandy country nomads may be willing to chance sowing grain where the mean annual rainfall is less than 200 mm. (4 in.) and a crop succeeds one year in five only; thus field patterns may be seen on the Qoz within 100 km. of Omdurman.

Lack of permanent drinking water explains the emptiness of many areas, such as the southern Gezira or the plains between the White Nile and the Nuba Mountains. The excavation of artificial tanks or *hafāyir* (plural of *hafīr*) to hold water all the year round is encouraging new settlements in the former area, where migrants from the west are glad to find empty land and reliable water together, however harsh the environment or isolated the community. Many of the Nuba, on the other hand, prefer to continue to live by their hills, even when they go down into the plains to cultivate and reap their harvest.

The lack of public security has been one of the reasons why there are so few people settled along the upper reaches of the Blue Nile and its tributaries and the Atbara river. Even today game poachers and robbers occasionally cross into Sudan, kill some elephants or steal some grain, and then make their escape over the border into Ethiopia. Of human diseases sleeping sickness has had the greatest effect on the distribution of the population, causing the inhabitants of parts of western Equatoria to avoid the breeding sites of *Glossina palpalis* along the rivers. North-western Bahr el Ghazal, which is visited by nomads with their herds from Darfur and Kordofan in winter, is deserted as soon as *Glossina morsitans* appears at the beginning of the rains.¹

In contrast with these almost empty lands there are patches of exceptionally high population density that occur from a number of causes. In rural areas these are to be explained by the presence of fertile soils and the adop-

¹ D. J. Lewis, 'The Tsetse Fly Problem in the Anglo-Egyptian Sudan', *S. N. & R.*, 30 (1949).



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tion of sound agricultural practices, by the proximity of markets for agricultural produce, by the reluctance of members of certain tribes to abandon their homelands and settle where they can find paid employment, and by a wide range of other social and historical causes.

In the Northern Province, especially in the Merowe-Dongola reach, the people are primarily dependent on the food that can be grown on the alluvial lands by the Nile. This, because of its high fertility, could probably support 200 persons to the square kilometre. In fact, when the population rises above the figure that can find food and employment on the land, the men emigrate to Egypt, to the Three Towns,¹ or elsewhere, and leave their wives and children behind. Thus the figures for the population of the province are swollen by a number of inhabitants supported by remittances from without, whose food supply is drawn from another part of the country or even from outside Sudan. The dense population found around certain of the Nuba Mountains is explained in part by the reluctance of the inhabitants to settle in the nearby plains, but also by the fact that young men can find employment elsewhere in Sudan, earning the price of a bride by working as labourers and porters for a number of years. In this instance it is not only the standard of material prosperity of the Nuba that is sustained by remittances from without the area, but also the sense of well-being involved in keeping up the size of herds and the number of animals that change hands when marriages are arranged.

The astonishingly high density of population of the Aweil Dinka is explained by the fact that for much of the year the Dinka cattle are able to graze away from the villages on the flood-plains of the local rivers. In the rains they are driven to the limited areas near to the summer cultivations, and there their manure is used to fertilize the soil, which is cultivated very intensively and supports numerous villages. The resultant density of population—almost 100 persons to the square kilometre in the summer—seems very high for Sudan, though it is nothing like equal to the densities of more

than 500 to the square kilometre that are common in parts of south-east Asia.

Near the Three Towns the wealthy local market for fresh meat and provisions acts as a stimulus to agriculture. Apart from vegetable growing and the local fruit gardens, the production of lucerne for sale to families who keep a goat to give them milk is a profitable undertaking. Nevertheless, the actual number engaged in this business is not very large. Perhaps more striking is the absence of any significant increase in the density of population around the towns of the west, or even near to the capitals of the three southern provinces, where irrigation could be practised. Such considerations underline the map of Land Use in Sudan (Fig. 39) which has recently been produced by Professor J. H. G. Lebon, with an accompanying explanation.²

The areas of the highest density of population in the country are of course the towns (Fig. 32). The figure for the whole of the Omdurman Municipal Area, for instance, is over 3,000 persons to the square kilometre (7,500 to the square mile); this area includes a large peripheral belt that has not yet been built up, as well as considerable open squares and gardens within the town itself, so it can be seen that in the most densely inhabited quarters of the city the actual density must be many times higher. It is, however, a striking feature of the urban geography of Sudan that many of the towns have the attributes and appearance of overgrown villages: in consequence, it may prove easier to appreciate the quality and significance of the towns if attention is first paid to the nature of the villages of Sudan, to their layout, and to the materials employed in their construction.

TYPES OF SETTLEMENT

The Rural Areas

Except in small areas in the extreme north of the country, settlements are usually of a concentrated type, houses being clustered together according to a rather irregular pattern.

¹ i.e. Khartoum, Khartoum North and Omdurman.

² J. H. G. Lebon, 'Population Distribution and Land Use in Sudan', in *The Population of Sudan*, Report on 6th Annual Conference of the Philosophical Society of Sudan, Khartoum, 1958, pp. 71-4. *Idem*, 'Land Use Mapping in Sudan', *Econ. Geogr.*, 35 (1959).

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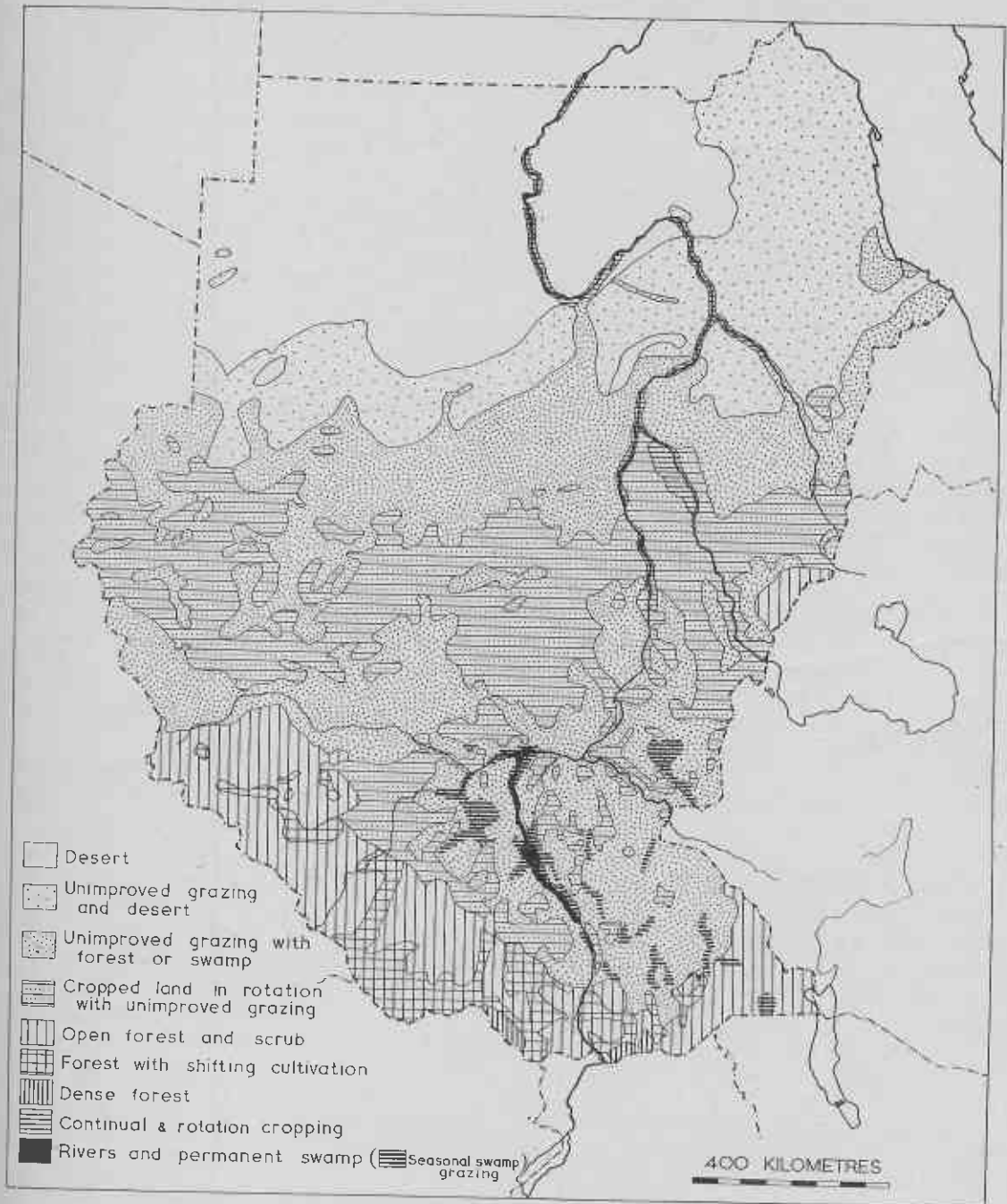


FIG. 39. Land use. This map has been adapted (by kind permission) from that published by Professor J. H. G. Lebon in *The Population of Sudan*, 1958. The original was produced by interpretation of topographical maps and air photographs.

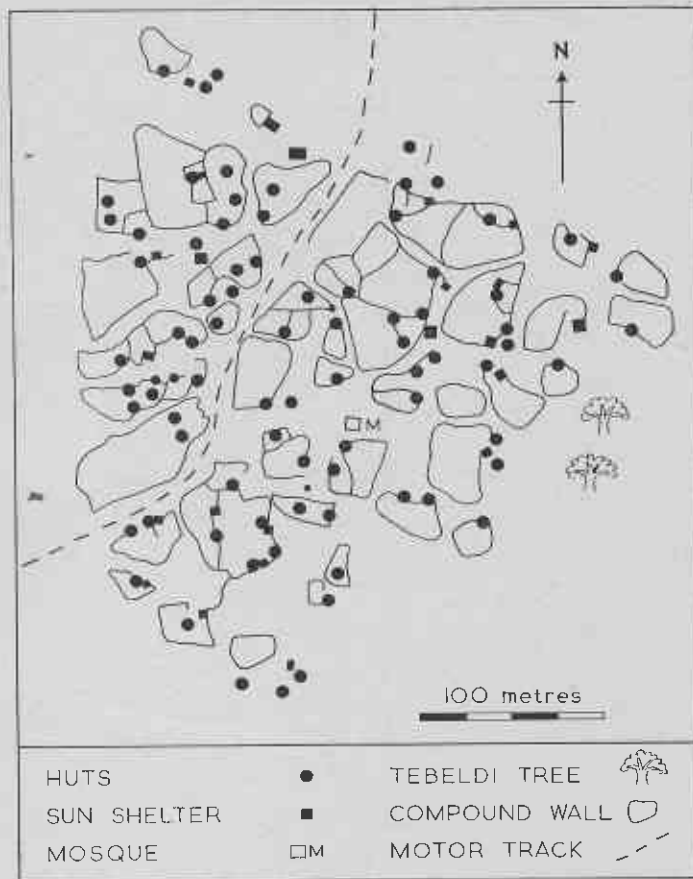


FIG. 40. Abu Mareiga village, Western Kordofan District. An unplanned village of short-lived buildings constructed from local materials in the cultivators' Qoz. From a plane-table survey by the author.

The term *nucleated* is sometimes used for this type of settlement, but is scarcely appropriate where there is no central and more permanent building, such as church, mosque, or manor-house, around which the other houses may be said to have gathered (Fig. 40). This concentration is to be explained in part by the generally sparse distribution of water supplies, but more especially by the need for security in thinly populated country where until recently nomads have ranged uncontrolled. The adoption of clustered settlements in the irrigated parts of the Gezira, where considerations of security scarcely arise, reminds us how in a tropical and virtually shadeless area, visiting between neighbours and all forms of social life are only

practicable by day if the people's homes are built fairly close together.

In the Northern Province, where settlement is possible along the Nile only, a linear type of village is common, each home and holding occupying a strip of land at right angles to the line of the river (Fig. 41). Where particularly small pockets of alluvial land are found in the cataract zones as few as two or three homes may be found on their own. In the dense woodland along the Nile-Congo watershed, on the other hand, the Sudanic tribes, and in particular the Azande, favour dispersed settlements wherein each householder builds his huts in a secluded part of his own landholding, and clearly prefers that he, and his wife or wives, should see as little as possible of their neighbours (Fig. 42). There are also some linear settlements belonging to the Toposa tribe, which are strung out along the water-courses in the arid south-east.

Types of Housing

The materials used in house construction and the layout of buildings that constitute a home vary considerably throughout the country. North of about latitude 12° , where the rainfall is relatively light and is concentrated in a few months of the year, houses are built of unfired mud-brick. The walls are protected on the outside with a mixture of dung and clay, and may have a thin coat of white-wash within; the flat roofs are traditionally of matting supported by logs cut from the *dōm* palm and plastered over like the walls to make a water-tight finish (Plate XVII). The floors are merely of pressed earth, and since no foundations are laid and the materials of the walls are so weak, houses are invariably of one storey only. Social conditions are involved here also, since no man would want his neighbour's house to overlook



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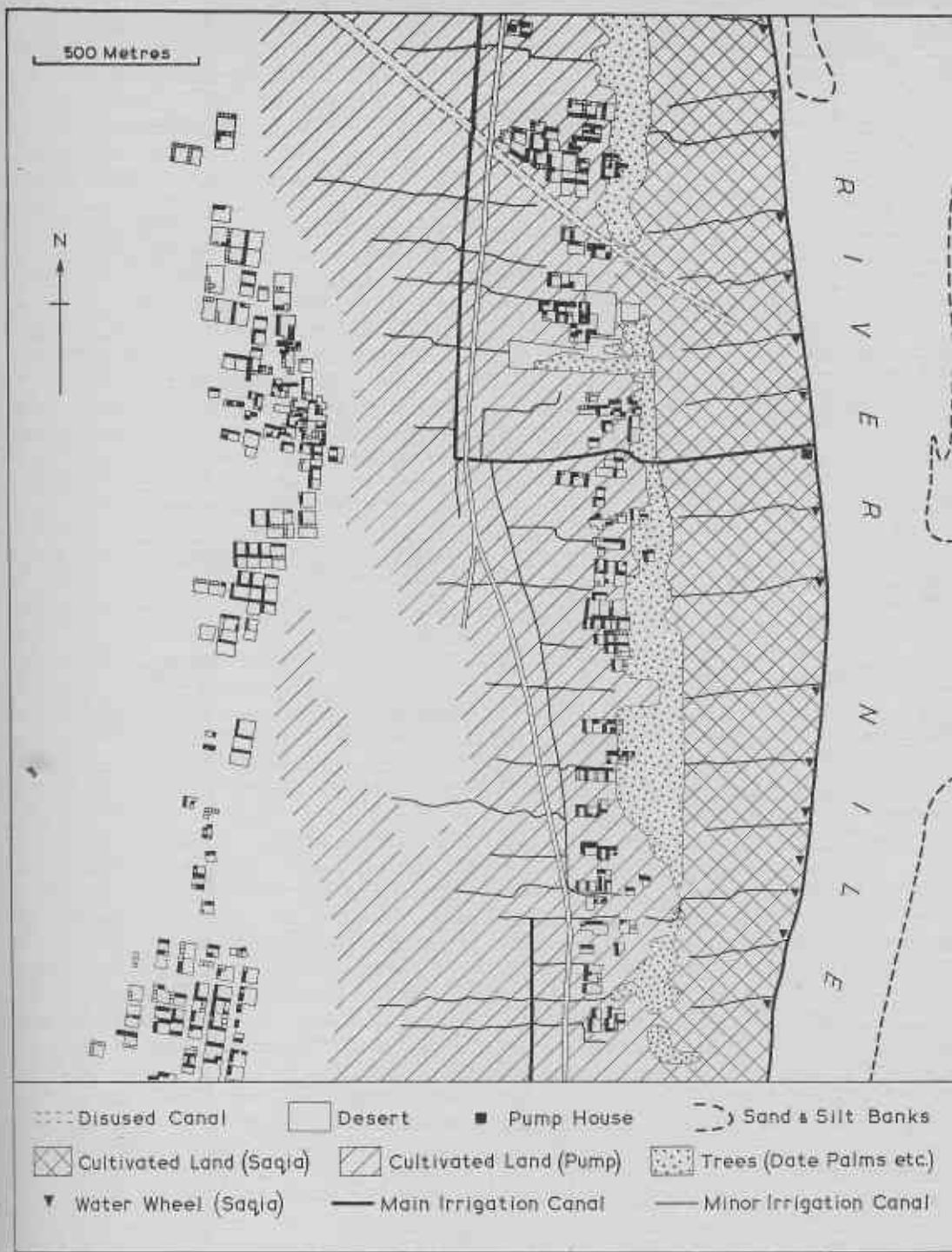


FIG. 41. A linear settlement just to the south of Dongola in the Northern Province. The new homes on the edge of the desert are generally more regular in lay-out than the older settlements among the palm groves. Within several of the houses a number of new rooms, as yet unroofed, can be seen. From *Sudan Surveys, Air Photograph No. 328061*.



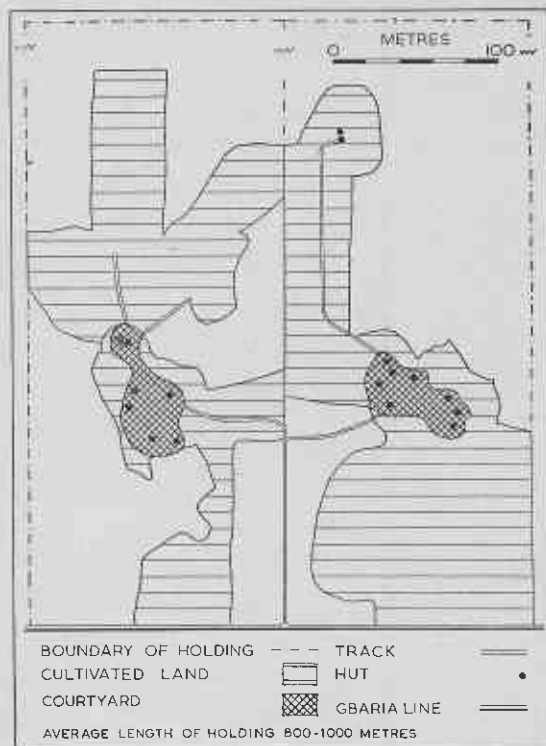


FIG. 42. Holdings and homesteads in the Zande area. The new *gbaria* lines and boundaries between holdings are straight and regularly spaced, but the cultivations carved out of the natural vegetation are more haphazard. The groups of huts are still built in traditional fashion, with neighbours screened from one another. From de Schlippe, *Shifting Cultivation in Africa*, 1956, p. 115.

part of his own compound. Windows are small and unglazed, and in the relatively low temperatures of the winter months the houses keep agreeably cool; in the summer, on the other hand, bodily comfort is only to be attained if there is a steady movement of the air, and the rooms are stiflingly hot. Houses of this kind are very liable to suffer damage if heavy rain occurs or when water stands around the foot of the walls (Fig. 43).

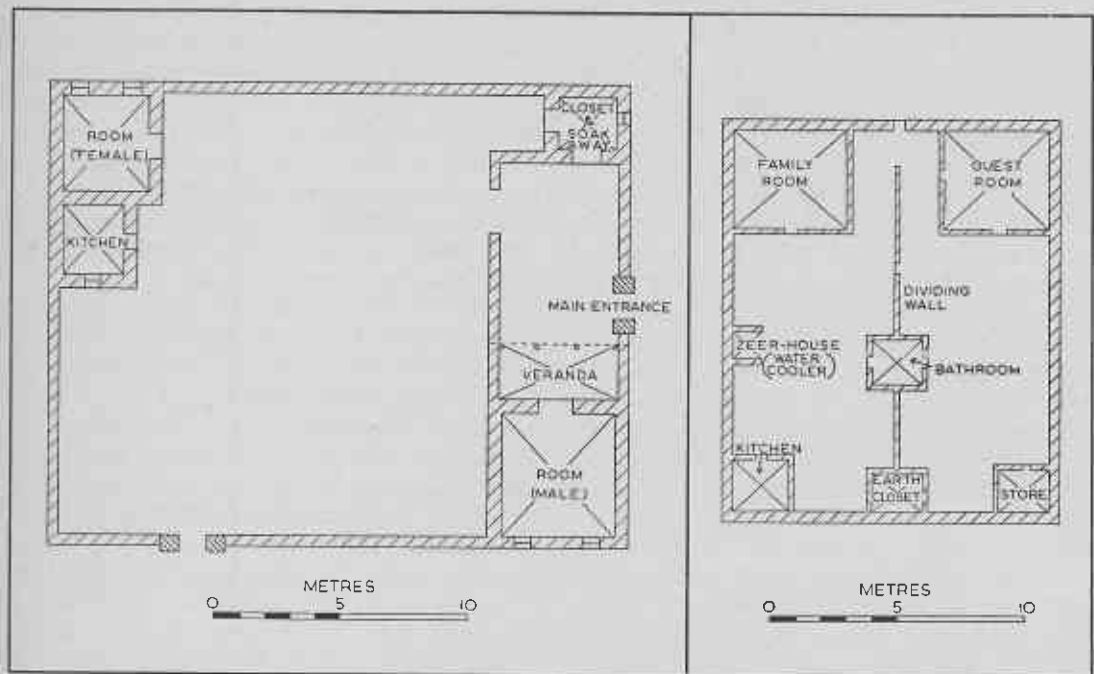
In central and southern Sudan the population can rarely find sufficient water during the idle winter months to build their houses in mud-brick; the heavy rainfall, moreover, would make this inadvisable. The normal building

materials are wood poles, grass and millet stalks which are used to make round huts with conical thatched roofs (Plates II and X). These vary slightly in design from tribe to tribe, and where natural poles and grass are hard to find, as in the northern unirrigated Gezira or on the slopes of Jebel Marra, the walls are sometimes built of mud-brick or stone (Plate XVIII).

The design of a house is strongly affected by the social customs of the Sudanese, and these in turn are to be explained in great measure by their adherence to Islam, at least throughout the northern and central provinces. Except among some of the very poorest, the settled Muslims regard the seclusion of women, and their protection from the eyes of men other than their near relatives, as of the greatest importance. Almost more necessary, therefore, than shelter from the elements is the possession of a high enough wall around a man's property to protect its inmates from observation by strangers. The building of such a wall represents no small proportion of the whole cost of building a home, whose rooms are therefore built at the sides and corners of the compound to save expense. A veranda may be built on to one of the rooms to provide additional shade, and when the sun is not too high there is usually some point where members of the family may sit out of doors in reasonable comfort. The outer wall tends to reduce the strength and cooling effect of the wind, but on the other hand, it serves to keep blowing sand and dust from entering the rooms (Fig. 44).¹ The houses of the Dongola and Wadi Halfa areas are generally higher, larger, and more elaborate than those of Shendi reach or of the towns. When men visitors are entertained in the poorer urban homes, considerable hardship is often imposed on the womenfolk, who have to keep out of sight.

In central Sudan the walls to enclose the compounds are usually built of millet stalks, and in the west, especially among the Fur, less attention is paid to their maintenance in good condition than in the riverain areas. The women are, in consequence, much less secluded, but it would be a mistake to assume that they are, therefore, very much happier, for it has

¹ P. J. Sandison, 'Problems of Low-Cost Housing in the Sudan', *S. N. & R.*, 35 (1954). Saad ed Din Fawzi, 'Social Aspects of Urban Housing in the Northern Sudan', *S. N. & R.*, 35 (1954).



FIGS. 43 and 44. A traditional house of the Dongola area and an urban house designed to be built cleanly without offending Muslim susceptibilities. In rural areas sanitation would probably be afforded by a cess pit beneath the earth closet, whereas in Khartoum and many other towns a system of removable buckets is commonly employed. From a sketch provided by Salah ed Din Eff. Maizeri of Sudan Surveys Department, and from S. ed Din Fawzi, *The Khartoum Deims: some housing problems*, duplicated by University College of Khartoum, 1953.

been observed in the Gezira that, as soon as tenants in irrigation schemes rise above the absolute poverty level, they hasten to build themselves compound walls so as to allow their women greater freedom of dress and action.¹ In addition to the huts, the compounds enclose flat-topped sun-shelters, built to serve as verandas where people can enjoy the wind while sitting in the shade, and grain stores which resemble huts raised off the ground on stilts for protection from termites.

In the southern provinces the houses and homes vary, the Nilotes and Nilo-Hamites attaching little importance to privacy or the seclusion of women; their villages consist, therefore, of little more than collections of huts and cattle byres (Plate XIX). The Nuer build these on the ground, and they look fairly similar to those of central Sudan. Certain of the western Dinka, on the other hand, build their

huts on wooden platforms raised several feet from the ground, the custom having presumably originated as a protection against flooding; yet it is observable today that there is no complete correlation between the distribution of this practice and the actual flooding of the villages that takes place from time to time.²

The Azande achieve seclusion by building their homes quite apart from one another in the dense bush (Plate XXXIX). Their grain stores are particularly conspicuous, the space beneath them being high and large enough to serve as a sun-shelter for sitting and receiving guests. Certain tribes, especially the Moru, are noted for the excellence of their thatching.

None of these types of traditional rural housing may be said to be built to last for long. The mud-brick houses of the north have the best chance of survival, especially where they are situated on a stable foundation like the

¹ G. M. Culwick, *Diet in the Irrigated Gezira*, Khartoum, 1951.

² J. M. Stubbs and C. G. T. Morison, 'The Western Dinkas, their Land and Agriculture,' *S. N. & R.*, 21 (1938).

Nubian sandstone. Where, however, they are built on the cracking clay of the Gezira, they are quickly destroyed by the alternate opening and closing of the cracks in the soil: in consequence, every long-established village may be detected by the pile of earth that accumulates wherever houses have been. There are many such sites, no longer inhabited, beside the Blue and White Niles, which offer tempting prospects to archaeologists. Apart from the risk of fire damage, the wooden huts of the savannah country are liable to attack by termites, and they soon disintegrate to leave no trace behind except an occasional ring of stones that had been set around the foot of the walls.

Urbanization

To the foreigner's eyes, accustomed to towns and cities with substantial buildings, well-laid-out street and pavements, and such modern amenities as electric lighting and good drainage, most of the towns of Sudan present a depressing appearance (Plates XX and XXXIV). It would be easy, therefore, to under-rate their importance, but in fact, though they are inhabited by little more than 8% of the population of Sudan, they constitute the centres of almost all political, economic, and administrative action in the country. An excellent guide to the general state of development of the several provinces or regions of Sudan is to be obtained from a study of their urban populations. In this chapter the size, location, and function of the towns of Sudan will be considered in relation to the provinces where they are situated. Such a treatment differs very little from a regional approach, except that the figures for the Three Towns appear by themselves in Khartoum Province, instead of being incorporated with those of the Gezira and Central Clay Plains.

The prime function of the town in Sudan seems undoubtedly to be administrative rather than commercial, for legitimate trade can flourish only when political conditions are reasonably stable, and the townsman, even more than the peasant, is the natural enemy of the marauding nomad. This is well illustrated in the southern provinces, each of which has one major town, with between eight and ten thousand inhabitants, and none other of com-

parable size. In the Upper Nile, Malakal is the only town recorded as such, and its population is a bare 1.1% of the province which it serves, far below the national average. The town is centrally situated for communications within the province, but the site that it occupies on a low ridge on the east bank of the Nile is only just large enough to contain the town and its aerodrome. In dry weather lorries can run from Malakal through Renk to Kosti and Khartoum, and with ferries they can reach all the district headquarters. During the rains contact can be maintained by the use of the Nile and Sobat for navigation.

In both Bahr el Ghazal and Equatoria, where the urban fractions of the population are 1.7% and 1.6% respectively, there are a few small towns in addition to the province capitals. Of these the smallest, Katiri, has less than 700 persons. This is not to be taken to mean that all settlements in Sudan with as few as 700 persons are classified as towns; in fact, the classification which we have to follow was arbitrarily imposed by the census organization at an early stage in planning the national census, and means that in urban as opposed to rural areas a complete, instead of a sampling, enumeration was carried out. Juba and Wau are both sited centrally within the provinces that they control, at points where river navigation attains permanent dry ground at the edge of the Ironstone Plateau. River steamers can usually reach Juba, but Wau has to be served by an outer port at Meshra' except from July to October when the Bahr el Ghazal rises.

Very few positions of commercial or administrative importance in these southern towns are occupied by persons drawn from southern tribes. Despite the disappearance of European control and influence (except in the Christian churches), something of a colonial type of social structure has had to remain, with northern Sudanese instead of British now taking the responsibility for directing and executing policy.

In the two western provinces the urban proportion of the population is slightly less than the national average, being 4% in Darfur and 6.5% in Kordofan. In neither of these provinces is there any industrial development, but trade

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is much more highly developed in western Sudan than in the south, and El Obeid performs an important function as entrepôt for most of the trade of both provinces. Both El Obeid and El Fasher lie in situations with good water supplies, near to the northern limit of permanent settlement and cultivation on the Qoz sands, at a latitude where camels constituted the best means of transport until the coming of the railway and the motor age. Their military significance is illustrated by their plans, as laid out by the British, with wide open areas between the administrative and commercial sections.

In the Northern Province the urban population is 10.5% of the whole. This figure is much swollen by the presence of Atbara, the administrative centre and main workshops of Sudan Railways, and of Wadi Halfa, a frontier town with railway and steamer workshops and an aerodrome to maintain. Elsewhere in the province the population is necessarily clustered along the Nile, but apart from the old trade routes, such as from Berber to Suakin (Plate XXXVI), there has been little local commercial or industrial activity to concentrate it in urban centres.

In Kassala Province the rural areas of the north are as arid and untamed as any other part of the country. The urban population reaches its high proportion, 15.8%, partly because it includes Port Sudan, Sudan's outlet to the sea, with one-third of the urban total, and partly because in the two cotton-growing deltas of the Gash and Baraka rivers there are considerable towns. Before Port Sudan was built, starting in 1905, the small natural harbour at Suakin was the main outlet of Sudan's trade with the Red Sea lands or other parts of the world. The new town at Port Sudan has a larger harbour, and is conveniently close to the route over the Red Sea hills that passes through Sinkat, less than 1,000 m. above sea-level. Tokar lies near the lower part of the Baraka delta, and has considerable difficulty in obtaining a steady water supply, since wells often become saline. Kassala, on the other hand, is important as the stronghold of the Khatmiya religious sect, as a garrison town on the edge of the Sudan plains, and as the site of a number of large irrigated gardens, whose cultivators

are included in the urban population. Throughout the province new small towns have sprung up wherever the railway line meets a river giving a permanent water supply.

In the Blue Nile Province the urban proportion of 6.9% is surprisingly low, in view of the prosperity that cotton cultivation has brought to the land along the two Niles. To a certain extent the explanation lies in the policy of the census authorities, who appear to have been so much impressed by the administrative function of towns in other parts of the country that they were unwilling to classify as towns even such centres as Manaqil or Maiurno, because they were not sub-district headquarters. Yet Manaqil has 3,100 inhabitants of mixed Sudanese tribes, and Maiurno has 14,000, almost all being westerners. In defence of the census officials, however, it may be said that Manaqil is small, albeit unmistakably urban in character, while Maiurno and other settlements like it that lie in the irrigated Gezira have very much the appearance of over-grown villages, having no large public buildings, often no post office or government elementary school, and sometimes no railway station, even when lying beside a railway line.

With a very few exceptions, all the towns in the Blue Nile Province lie on one or other Nile. The reason is the need for a permanent water supply, since in clay country it is very difficult to provide enough water for a large community either from wells or from surface storage. The effect of the railway is less easy to assess, since Singa and Er Roseires were already nearly their present size before the line reached them, while Ed Dueim is still not served by a line. On the other hand, Kosti has certainly grown to be the second town of the province on the strength of its role as entrepôt for all the trade of the south, because of the steamer dockyard there.

Khartoum is the smallest of the provinces, administered as a federal enclave, isolated from possible rivalries between various parts of the country. The population of the Three Towns amounts to about a quarter of a million, which is approximately equal to that of the rural areas included within the province. The oldest of the towns is Khartoum, whose good defensive position led to its adoption as capital by

the Egyptians, who conquered Sudan in the early part of the nineteenth century.

As late as 1829 the town consisted of a bare two score houses, but by 1834 the population was reported to be 15,000. Today, as the seat of Government and the University and of most of the foreign commercial communities, in addition to several large Sudanese business undertakings, Khartoum is firmly established as the centre of power in the country. During the period of British rule Omdurman was larger and traditionally more Sudanese than Khartoum. With power now in Sudanese hands Khartoum seems the more likely to grow rapidly, since among other factors its new Light Industrial Area is served by railway sidings, which are not available in Omdurman.¹ There is discussion going on at present about the possibility of moving the Khartoum Airport, which is very close to the centre of the town. If this were done it would release a large area for the expansion of the town to the south and east (Fig. 80).

The spread of Khartoum, as of the other cities of Sudan which have been growing during the past fifty years, is fortunately not likely to occur in a haphazard or disorderly manner, since town planning regulations have been in force since 1946. These make provision for the allocation of land for activities of different kinds in prescribed areas, and ensure that plots are available for houses of different classes in suitably laid-out street patterns. Various factors, such as the relatively slow growth of Sudan's towns in recent years (when they are compared with those of North Africa or the Rhodesias), and the preference of many men to leave their wives at home in their native villages, have preserved Sudan from the mushroom growth of slums or 'bidonvilles' round the cities. At the same time there is reason to believe that many single men who come to work in the cities from the poor parts of the country, in fact occupy extremely overcrowded and unsatisfactory accommodation.

The problem of the towns of Sudan is one which is common throughout Africa. In rural areas villagers undoubtedly live in very rude and simple homes, and these remain reasonably

sanitary, chiefly because space is plentiful and houses can be cheaply moved or rebuilt from time to time. In the urban areas, on the other hand, land is restricted, yet even the poor must maintain a fair standard of sanitation and cleanliness if the whole community is not to run the risk of epidemic.

Clearly the housing of the poorest classes must be subsidized, yet the municipalities are in general so short of funds that they cannot afford to provide drainage or street lighting or similar services for the more prosperous parts of the towns, to say nothing of subsidizing the poorer quarters. Nor is it easy to justify subventions for this purpose from the central government. When education, public health, and other social services are already much better provided in the urban than in the rural areas, it is hard to convince public opinion that yet more must be done by the State to improve the amenities of the towns. As it is, these constitute a standing temptation to the countryman to abandon his fields and seek employment among the bright lights of the cities. If extreme poverty in the towns is to be alleviated from public funds, the last check to an urban drift unrelated to the prospects of employment will be removed.

FUTURE POPULATION TRENDS

In the preceding discussion of the distribution of Sudan's population, it has been remarked that at the present time the outstanding areas of high density are to be found beside the Nile in northern Sudan, in the irrigated Gezira, in certain parts of the Nuba Mountains, and in the Aweil District of Bahr el Ghazal Province. This has presumably not always been the case, at least where the Gezira is concerned, but there is certainly no way of finding out precisely what movements of population have taken place, either during this century or earlier, because of the lack of census material. For the future, on the other hand, it will be of both academic and practical interest to discover whether the current distribution pattern is likely to be maintained for the next generation or so.

On this point the preliminary census results

¹ C. E. J. Walkley, 'The Story of Khartoum', *S.N. & R.*, 18 (1935), and 19 (1936). G. Hamdan, 'The Growth and functional structure of Khartoum,' *Geographical Review*, 50 (1960).

throw valuable light, as K. J. Krotki has shown¹. In the year preceding the census, the country as a whole had a crude birth-rate of 52 per thousand, which is exceptionally high by world standards. This was not evenly distributed, for it was essentially the negroid tribes of the southern provinces and of the Nuba Mountains that had the highest figures, while the northern provinces and the rest of Kordofan were less fertile, though still high by world standards.

TABLE I
Crude Birth-rates by Provinces and certain Districts

	Province	Babies born per 1,000 population	
Predominantly Negroid	Bahr el Ghazal	85	
	Upper Nile	69	
	Equatoria	54	
	Kordofan	50	
	Nuba Mountains	Northern Jebels	71
		West	
Kadugli			
Central Nuba			
	Rest of Kordofan	44	
Arab, Beja and mixed	Blue Nile	46	
	Northern Province	43	
	Kassala	43	
	Darfur	42	
	Khartoum	41	
	Sudan	52	

At the same time the national death-rate proved to be high, 19 per thousand, with a provincial distribution rather similar to that for the birth-rate.

TABLE II
Crude Death-rates by Provinces

Province	Deaths per 1,000 population
Upper Nile Province	33
Equatoria	28
Bahr el Ghazal	27
Kassala	18
Kordofan	16
Blue Nile	15
Khartoum	15
Darfur	13
Northern Province	12
Sudan	19

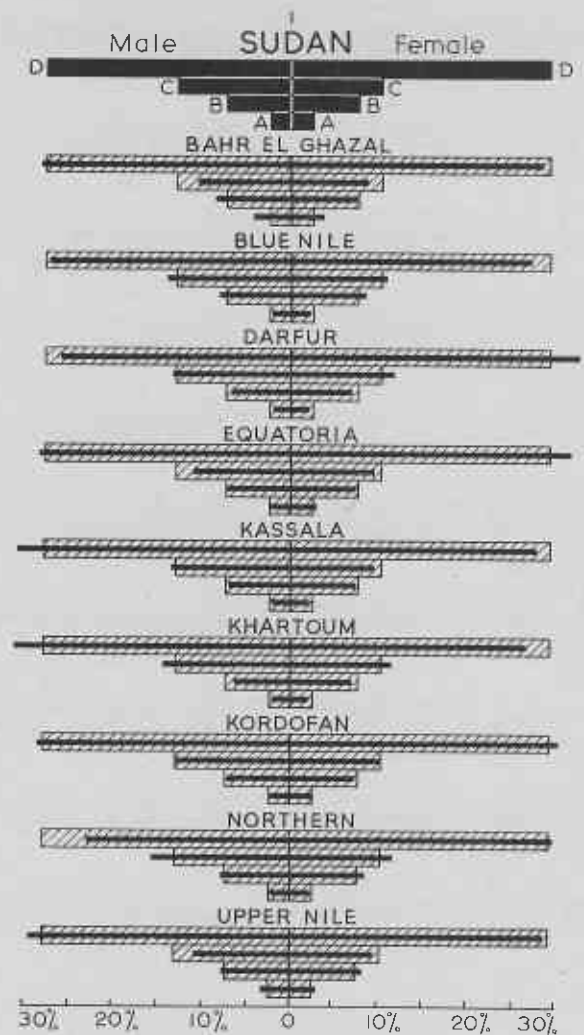


FIG. 45. Age-sex pyramids of the population of Sudan, by provinces. The solid bars for each province may be contrasted with the shaded bars representing the national percentages. A = under 1 year; B = over 1 year to under 5; C = over 5 to under puberty; D = over puberty.

These figures point to an annual rate of natural increase of 33 per thousand, which would lead to a doubling of Sudan's population within nineteen years. If, moreover, the rates persisted for thirty years, the relative populations of provinces would alter considerably, as shown in Table III on page 108.

¹ K. J. Krotki, '21 Facts about the Sudanese,' *First Population Census of Sudan 1955-1956*, Khartoum, 1958.

TABLE III
Present and prospective populations by
Provinces, in Thousands

Province	1956	%	1986	%
Bahr el Ghazal	991	9.7	5,228	18.5
Equatoria	904	8.8	1,949	6.9
Upper Nile	889	8.7	2,640	9.3
Southern Sudan	2,784		9,817	
Blue Nile	2,070	20.2	5,173	18.3
Kordofan	1,762	17.2	4,944	17.5
Darfur	1,329	12.9	3,135	11.1
Kassala	941	9.2	1,975	6.9
Northern	873	8.5	2,182	7.7
Khartoum	505	4.9	1,091	3.5
Northern Sudan	7,480		18,500	
SUDAN	10,263		28,317	

These figures are by no means certain, for they pay no attention either to changes that may occur due to emigration or immigration, or to errors that may be inherent in the birth- and death-rates employed. It may prove,

¹ H. B. McD. Farrell, 'Dearth of Children among the Azande', *S.N. & R.*, 35 (1954).

moreover, that the expected increase will be very much more rapid if medical facilities and the education of mothers in the rules of hygiene can be extended to the poorer parts of the country. In particular, this might accelerate the growth of the southern and negroid elements more rapidly than that of the Arab or Beja tribes, since nomads are in general less amenable to outside influences than are settled peoples like the Azande, among whom child mortality is notoriously high.¹ The possibility of a population explosion in the south, particularly in Bahr el Ghazal province, is clearly indicated in Figure 45, which shows age-sex pyramids for the provinces and for Sudan, according to the rather limited age groups employed in the recent census. The rate of growth of the population of Khartoum province is likely to reflect the general economic state of the country, as this affects the expansion of the capital rather than the prospective fertility of its present inhabitants or their age-structure.

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THE WATERS OF THE NILE AND THEIR CONTROL

No apology is needed for the devotion of a whole chapter to a detailed description of the hydrology of the Nile. Such physical unity as Sudan possesses it derives principally from the fact that almost all of it lies within the Nile Basin, while economically it seems beyond question that the best prospect of increasing the country's wealth lies in the further exploitation of the Nile waters (Fig. 46).

THE SIGNIFICANCE OF THE NILE TO SUDAN

Whereas in Egypt the importance of the Nile, in creating a large and populous state out of what would else be mere desert, is immediately appreciated, the influence of the Blue and White Niles in Sudan is more varied. In the northernmost part of the country the Main Nile plays the same role as in Egypt: the population is entirely clustered along its banks. The chief physiographic difference from Egypt itself is that the irrigable areas of fertile soil are very limited in extent, so that the number of people that can be supported is relatively small. In central Sudan between latitudes 10° and 17° N., where the summer rains are sufficient to support animal rearing and cultivation, the Nile does not provide the only basis of life. Nevertheless, both Blue and White Niles play significant parts in the economies of the area, in that they are drawn on immediately for men and animals to drink; they penetrate permeable beds and supply underground water which is tapped by wells and bores; and they are used for irrigation to supplement the rains or to grow crops during the dry season. In the

swamps of southern Sudan the White Nile alternately repels the inhabitants when it overflows its banks in summer and attracts them when the land dries up in winter, and only in the short, steep stretch between Juba and Nimule are the distribution and activities of the local population unrelated to the course of the river.

Hydrological Records and the Discovery of the Nile's Sources

In the circumstances it is scarcely surprising that there is a great mass of information on Nile hydrology; in fact, the subject is one that can be approached with more assurance than almost any other aspect of the geography of the country, since the Nile has been for so many centuries the object of intense practical interest that the hydrological records surpass those of any other major river, both in their length and, in recent years, their degree of detail.

The earliest Nile gauge readings that we possess date from A.D. 641, from the nilometer at Roda Island near Cairo, and from A.D. 840 there is a line of records continuing with only a few interruptions until the present day. These records are supplemented today by a total of more than 130 gauges throughout the Nile Valley. Taken with the work that has been done in correlating rising and falling levels with the actual flows at key stations, these enable a very full picture of the flood to be presented at any time, incidentally making it possible to operate the dams at Jebel Auliya, Sennar, and Aswan to the best advantage.¹

Yet while the Nile in Egypt has been known

¹ The main source of information used in this chapter has been the great publication of the Egyptian Physical Department, *The Nile Basin*, by Dr. H. E. Hurst with various collaborators. Of the eight volumes that have appeared, the following are of particular value:

Volume I. Hurst and P. Phillips, 'General Description of the Basin, Meteorology, Topography of the W. Nile Basin', 1931.

Volume V. Hurst and Phillips, 'The hydrology of the Lake Plateau and Bahr el Jebel', 1938.

Volume VII. Hurst, R. P. Black, and Y. M. Simaika, 'The Future Conservation of the Nile', 1946.

Volume VIII. Hurst, 'The Hydrology of the Sobat and White Nile and the Topography of the Blue Nile and Atbara', 1950.

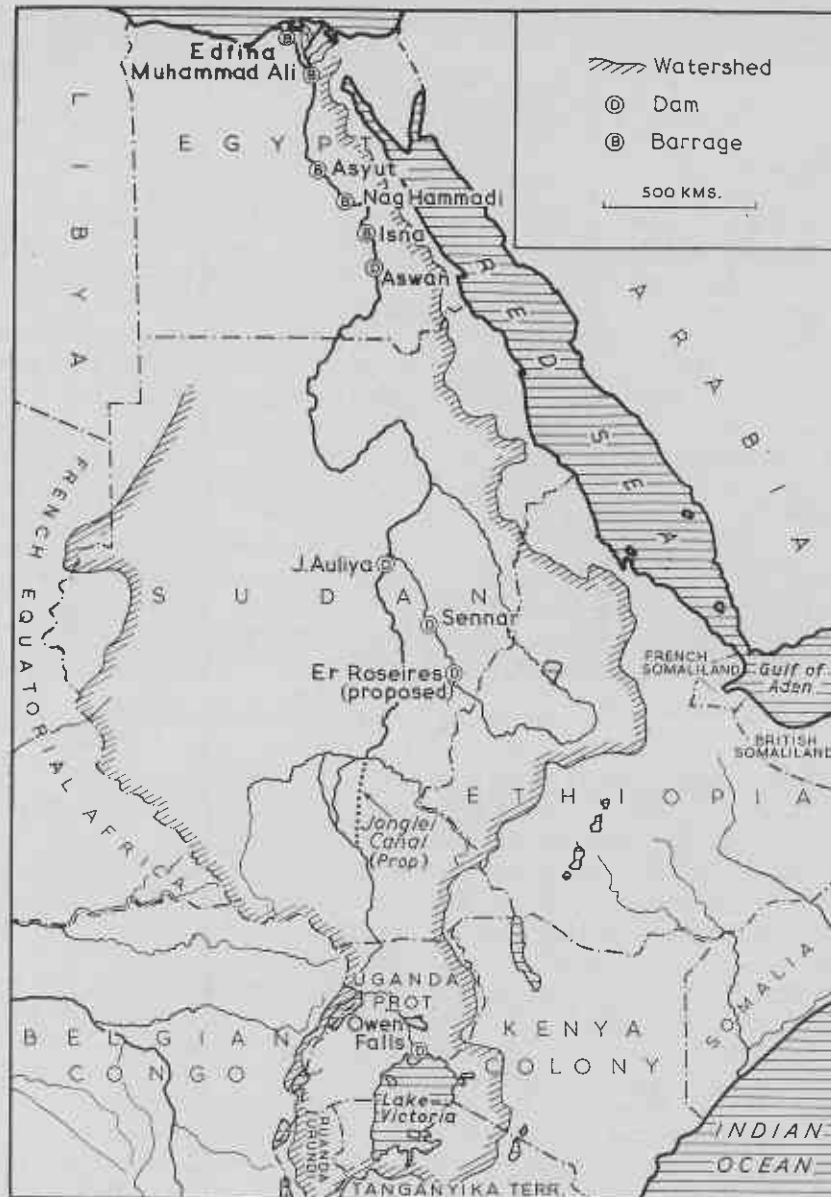


FIG. 46. The Nile Basin.

and studied almost throughout the whole period of recorded history, the origin of its annual flood and the precise location of its source or sources have been disentangled from myth and superstition only within the last hundred years. The source of the Blue Nile has been generally known since Portuguese missionaries penetrated Ethiopia in search of

Prester John in the early sixteenth century, and its course has become known with increasing accuracy in recent years as various foreign explorers have visited Lake Tana or travelled along the river valley. Lake Victoria and Lake Albert, on the other hand, were first seen and described by Speke, Grant, and Baker in the second half of the nineteenth century, though



PLATE XVI. BEJA TENTS AND *EUPHORBIA ABYSSINICA*



PLATE XVII. HOUSES IN NORTHERN PROVINCE
The unplastered wall on the right reveals the method of construction.

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PLATE XVIII. ANIMALS AND HOUSES IN THE CENTRAL GEZIRA



PLATE XIX. NILOTES' HOME THREATENED BY RISING NILE FLOOD
This is a settlement on low ground beside the river, photographed from a Nile steamer.

indeed rumours of their existence were current as early as Ptolemy's time.¹ Bruce visited the source of the Little Abai, the longest tributary of the Blue Nile, in 1770, but even today no man is known to have followed the Blue Nile through all its steep gorges as it descends from the Ethiopian plateau. The White Nile, on the other hand, is regularly used for the transport of goods and passengers, and has been navigated by many types of craft—except for certain rapids and falls—from Lake Victoria and so to the Mediterranean.

The Names of the Nile

Because in its course the Nile is made up of many distinct stretches, flowing through lands occupied by tribes of many races, tongues, and nationalities, the river is known by many different names in the various parts of its length. Its source farthest from the Mediterranean is at the head of the Luvironza river, itself a tributary of the Kagera river which drains the Mfumbiro Highlands to the south-west of Lake Victoria. Below the lake the river is known as the Victoria Nile as it flows over the Ripon Falls (now drowned) and the Owen Falls (where the Owen Falls Dam now stands), passes through Lake Kioga, descends through the narrow Murchison Falls and flows into Lake Albert. Below Lake Albert the Arabic name of Bahr el Jebel (Mountain River) is commonly used. This distinguishes it from the Bahr el Arab (the Arabs' River), the Bahr el Ghazal (the Gazelle River), and the Bahr ez Zeraf (the Giraffe River), these being the three other principal watercourses which meet at the northern end of the Upper Nile swamps. These Arabic terms are in general use in atlases and technical works today, and will be employed henceforward.

The term White Nile is most properly used for the stretch of river between Lake No and Khartoum, and refers to the pale colour of its waters, which are mixed with a proportion of decaying vegetable matter. They contrast strikingly with the waters of the Blue Nile, brown and turgid with silt in the early part of the flood and at other times clear and dark blue-grey from the clay and silt of the river bottom. The Blue Nile is known to the Ethio-

pians as the Abai, but it is not proposed to use that term in these pages, since it is not widely known. Below Khartoum the river is usually called the Main Nile when there is any possibility of confusing it with one of its tributaries. In Egypt the term 'Nile' suffices until in the delta the river divides into the Rosetta and Damietta branches.

THE RÉGIME OF THE NILE

The régime of the Main Nile, as it leaves Sudan, is distinguished by a small steady flow all the year, coming from the White Nile, and a brief summer flood of much greater volume from the Blue Nile, intensified by that of the Atbara (Fig. 47). The régimes of the Blue Nile and Atbara are fairly simple: the former has a small perennial flow maintained by the outflow of Lake Tana, while the latter dries up completely for half the year. The régime of the White Nile is more complicated, being made up of the summer flood of the Sobat, combining with the steady discharge of Lake No. That discharge in turn is the result of the flow of the Bahr el Jebel at Mongalla, the drainage of the Nile-Congo divide, and the very great losses incurred in the Nile swamps. Thus we are driven ever backward to the sources of the Nile if we are to find an explanation of its behaviour, to an analysis of the relief, precipitation, drainage, and vegetation of the several catchment areas, together with a study of the reaches themselves. Only thus may we come to understand the annual rise and fall of the Nile, the variations of its discharge, and the various proposals that have from time to time been put forward to conserve and control the waters of the Nile Basin.

Hydrology—the East African Plateau

The study of the Nile begins logically, therefore, with the farthest origin of the Victoria Nile on the East African plateau.

The most important hydrological feature of this plateau is Lake Victoria, which lies in a down-warped depression between the eastern and western Rift Valleys, thus receiving drainage on all sides except the north-west. The mean annual rainfall of the plateau varies

¹ H. H. Johnston, *The Nile Quest*, 1903. J. N. L. Baker, *A History of Geographical Discovery and Exploration*, 1931.
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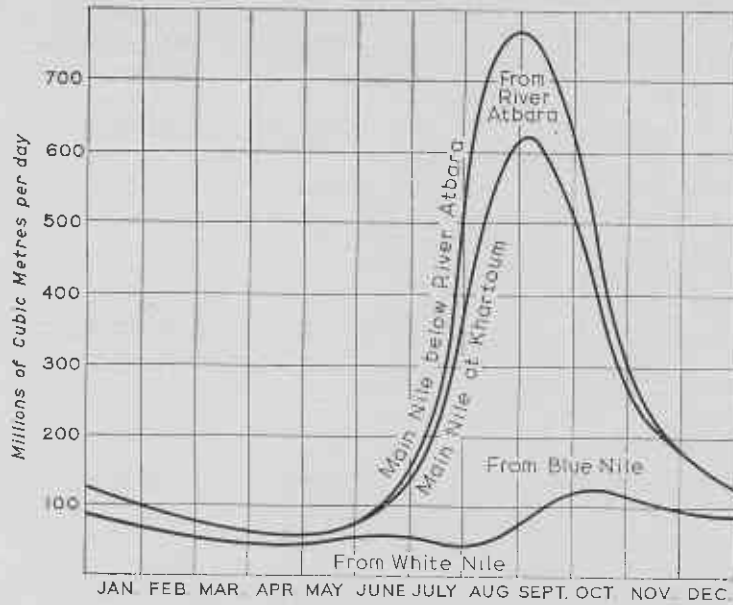


FIG. 47. Discharges of the Nile and its main tributaries, 1912 to 1936. From H. E. Hurst, *A short account of the Nile Basin*, 1944, Fig. 12.

according to altitude and aspect, and over the estimated 340,000 sq. km. of land and water surface within the Nile Basin probably totals some 400 thousand millions of cubic metres of water. Of this sum it has been suggested that as much as 85% is lost by evaporation and transpiration from the trees and grasses of the hills and the papyrus swamps of the valleys around the lake, while observations have suggested that over the lake itself the totals of precipitation and evaporation are approximately equal.

The outflow of the lake, therefore, should equal the inflow from its various tributaries, corrected for variations in the lake's level. These variations reflect the balance between precipitation, evaporation, and outflow that has prevailed in the past twelve to eighteen months, but show no periodicity that can be related to the seasons. It was once thought that a strong correlation could be observed between lake levels and the incidence of sunspots, but further observations have shown that this was probably coincidental.¹

After leaving Lake Victoria the Nile used formerly to flow over the Ripon and Owen

falls before entering Lake Kioga at Namasagali. Today both the Owen and Ripon Falls have been submerged by a dam which at present is being used to supply hydro-electric power to Uganda and Kenya, and which may later be made part of a comprehensive system of Nile control, turning Lake Victoria into a reservoir. The precise effect of Lake Kioga on the régime of the Nile has not been determined, but in general this northern part of Uganda enjoys a rainfall with a double maximum that brings distinctly more rain in the northern summer than in the other half of the year. At the same time the north wind that blows in December and January causes a high rate of evaporation. Lake Kioga has few tributaries, other than the Victoria Nile, but presents a large area of water and swamp vegetation from which losses may occur. In consequence, while the outflow from Lake Kioga, measured at the Murchison Falls, is in September approximately the same as the inflow at Namasagali, for the whole year there is a loss of about 10%.

Lake Albert receives via the Semliki river the drainage of the northern Mfumbiro Mountains and the Ruwenzori range, and there are

¹ C. E. P. Brooks, 'Variations in the Levels of Central African Lakes', *Geophysical Papers No. 20*, Meteorological Office, London, 1923. Hurst and Phillips, *The Nile Basin*, Vol. V, 1938, pp. 41-3.

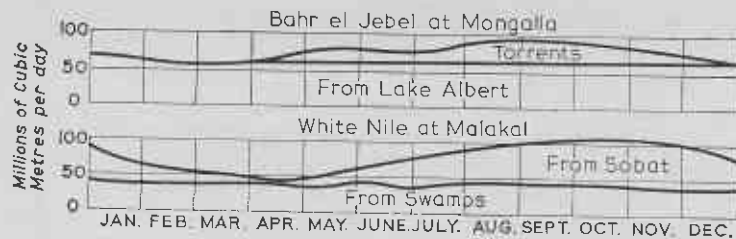


FIG. 48. Discharges of the Bahr el Jebel at Mongalla and of the White Nile at Malakal. Source as for Figure 47.

also numerous short torrents that flow down into the lake from the sides of the Rift Valley in which it lies. The altitude of the lake, however, is only 620 m. above sea-level, and the rainfall upon it, to judge from the gauge at Butiaba, is a bare 800 mm. (32 in.) per annum, compared with a presumed evaporation of 1,200 mm. (48 in.). Thus much of the drainage of its catchment area is lost, and the Nile, as measured at Pagwach after leaving the lake, shows only a slight increase over the volume that flowed in. Below Lake Albert the Nile flows placidly to Nimule, flanked by papyrus swamps and lagoons from which there is a steady loss, especially in the dry season, through transpiration and evaporation. At Nimule the river takes a sharp turn to the left and quickly drops a total of 150 m. in a distance of 160 km. In this latter stretch of many rapids the river is much narrower and the surface area exposed to evaporation is much reduced. Between Pagwach and Mongalla several torrents enter the Nile, principally from its right bank. These torrents may produce as much as 30-50 millions of cubic metres per day at the height of the rainy season, but in December and January they fall away to nothing, and in consequence the régime of the Bahr el Jebel at Mongalla reveals a marked summer maximum (Fig. 48).

The Nile Swamps—Juba to Shambe

Near Juba, upstream of Mongalla, a change in the river's character begins. No longer flanked by rising ground which confines its bed to a relatively narrow course, it enters an alluvial plain where numerous flanking swamps and channels are separated from the river by a low ridge or bank. At low water the main channel suffices to carry the river discharge,

but as it rises it overflows its banks, and extensive losses from evaporation occur, made the more serious by the fact that when the river level falls the spill water is unable to return to the river bed and so is almost all lost. The season of high water is the summer, when a rainfall of 800 mm. (32 in.) or more is experienced throughout southern Sudan, and it might be expected that some of this total would come to swell the Bahr el Jebel, or at least to reduce evaporation losses. In fact, apart from the torrents mentioned above, this does not occur, for the following reasons.

On the east bank of the Bahr el Jebel there are several torrents which flow northwards from the high mountain masses on the southern border of Sudan. On entering the clay plain these continue to flow for 100 to 150 km., their beds widening out into scarcely perceptible depressions. Eventually their flow is reduced to a sheet of water which steadily crosses the plain, until it is lost by evaporation and percolation. Similarly the rain which falls on the plain itself merely collects in depressions and watercourses, but does not drain to the Bahr el Jebel because the river level is at that time too high. The combined effect of river and rainfall is thus to create a vast area of standing water during the summer, interspersed with a few more elevated patches where the flood does not reach. This flooding, which occurs every year, results in great losses of water, but it also has the effect of serving as an escape, and thus of preventing excessive quantities of water from passing down the White Nile at a time when the Blue Nile is also in flood. Since one of the aims of any comprehensive system of Nile control must be to eliminate the risk of flooding in the more densely inhabited areas downstream, the beneficial as well as the harm-

ful effects of the overflow should not be forgotten.

Downstream of Mongalla (Fig. 49) the Bahr el Jebel is flanked by swamps whose width attains about 14 km. at Jonglei. Beyond these swamps there is a relatively high bank which is not topped except by the very highest floods. The river channel can carry a discharge of some 800 cumecs (cubic metres per second), but above this figure the river acts, as Newhouse states, as 'a natural self-regulating escape',¹ for as the level of the water rises the excess overflows into the flanking swamps and has hardly any effect upon the discharge at Bor; thus in 1917, when the Mongalla discharge reached 2,700 cumecs, Bor did not exceed 900. At first the river in this reach flows in a single channel, but north of Terakeka it splits into two distinct courses known as the east and west channels; just south of latitude 6° N. these unite. North of this point there is a channel parallel to the Bahr el Jebel in which flows the Aliab river, which receives a little water from the Ironstone Plateau but principally acts as an overflow for the Bahr el Jebel. The loss of water between Mongalla and Jonglei amounts to about 12% at the period of minimum flow, being the normal transmission loss to be expected at that latitude and time of year. At the time of the flood, on the other hand, the loss is frequently more than 50%.

North of Jonglei, whose importance in proposals for the training of the Nile lies in the fact that it is one of the few points where hard, dry ground approaches the east bank of the Bahr el Jebel, the enclosing ridges fade away. The river channel varies in size, being in places able to carry 600 cumecs, and in others only 170; in consequence, losses of water take place at all seasons, either flowing over the banks or else penetrating the walls of papyrus that contain the stream.² The swamps of this reach are especially extensive, and it was here that large masses of flood or floating papyrus and other vegetation accumulated to block navigation during the Mahdiya. Numerous channels take off water into the swamp from the east bank of the river, being known as the Atem and Upper Zeraf systems. The eastern edge of

the swamps is quite easily distinguishable from the air during the dry season, but during the wet weather, when local rainfall is combining with overflowing water from the Nile, flooding may extend for miles. Since the general slope of the ground is away from the river banks, the flow continues until finally the head of pressure is not sufficient to force the water against the dense grass of the plain; at this time, moreover, transpiration and evaporation are extremely active, and so a balance is achieved. When the river level falls, very little water drains back to it because of the height of the banks, and so both the overflow and the local rainfall are lost.

On the west bank conditions are essentially similar in that serious losses occur from the Bahr el Jebel in the flood season which are not compensated later. The area of lakes and swamps, however, is very much more extensive because between the Bahr el Jebel and the ironstone plateau lies the 'bog', as it has been called, which receives also the drainage from the Sudan side of the Nile-Congo watershed. The Ironstone Plateau of western Equatoria and Bahr el Ghazal Province (with an area of more than 300,000 square kms.) is drained by such rivers as the Yei, Tonj, and Jur, which are estimated to collect a total run-off of 8 milliards of water per annum, this being almost entirely concentrated in the summer months, with maxima occurring in September and October. Of all these rivers only one, the Jur, has a definite channel that can be traced through the swamps, and it is this lower reach, known as the Bahr el Ghazal, that has given its name to the province which it drains.

The Bahr el Ghazal

The Bahr el Ghazal channel has been gauged where it enters Lake No, and it has been found that on an average only 0.6 milliard of water is contributed to the White Nile during the whole of the year, while the remainder, approximately 92%, is lost. Even if the Bahr el Ghazal channel were fed by the Jur river alone, there would still be a loss of 86% of the water, since at Wau the annual total is very nearly 4.5 milliards. While the loss may be in part

¹ F. Newhouse, *Training of the Upper Nile*, 1939, p. 46.

² See P. P. Howell (Ed.), 'The Equatorial Nile Project and its Effects in the Sudan', *Geog. Journ.*, 119 (1953), Fig. 3, p. 38.

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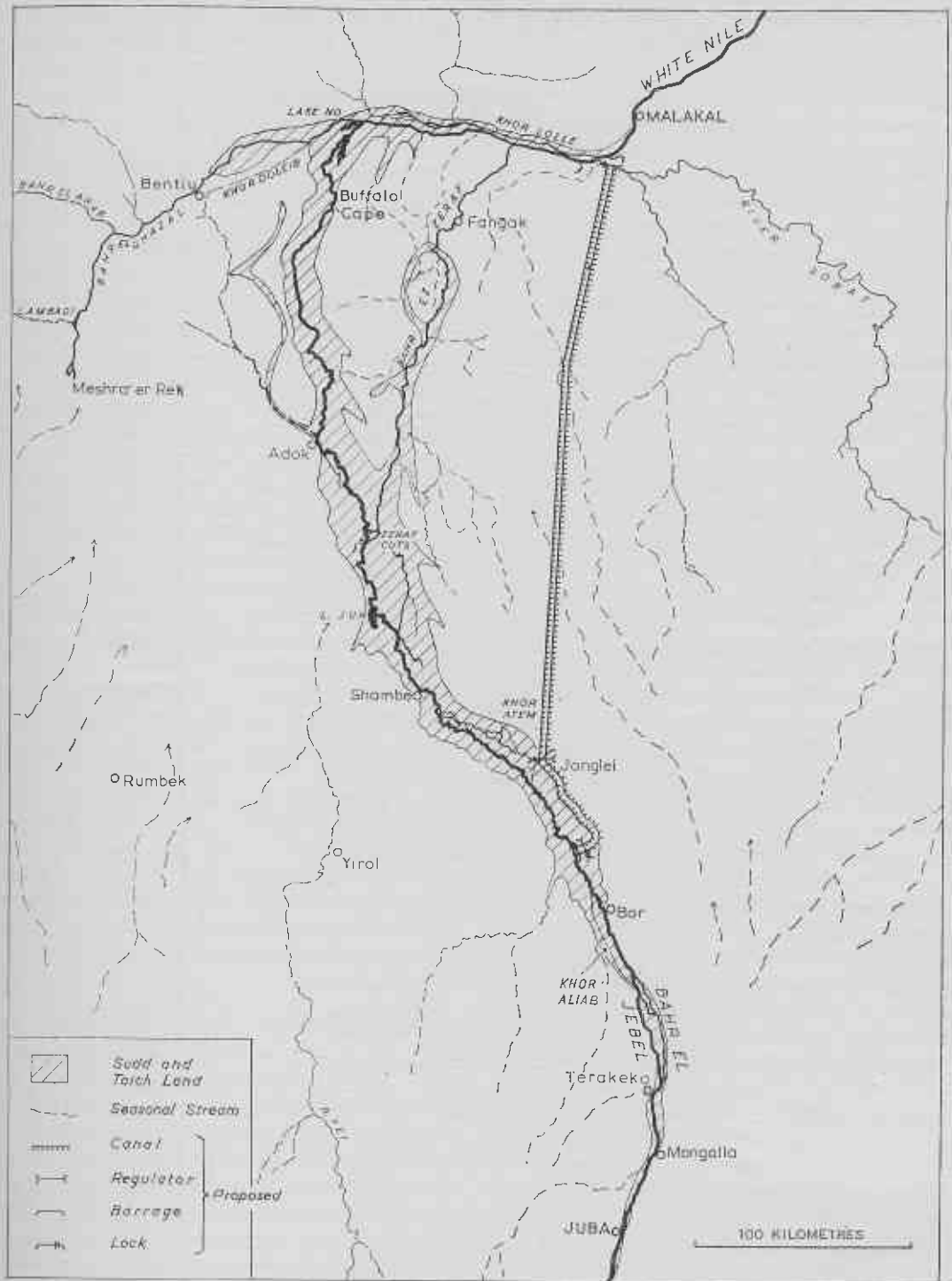


FIG. 49. The Bahr el Jebel and tributaries in southern Sudan, with proposed control works.

, Fig. 3, p. 38.



ascribed to the lack of a channel or channels large enough to carry the flood waters, in fact the differences of relief in the area are so slight that between Meshra' er Rek and Lake No the gradient of the Bahr el Ghazal averages less than one centimetre per kilometre, so that overflowing of the river banks is inevitable. Included in the Bahr el Ghazal system is the Bahr el Arab, which drains southern Kordofan and Darfur. This stream and the other water-courses to the east of it drain areas of lower rainfall than the Ironstone Plateau, and their gradients are so slight and the losses from evaporation from them are so severe that they contribute less than half a milliard to the Bahr el Ghazal, and virtually nothing to the White Nile.

The Nile Swamps—Shambe to Lake No

North of Shambe the channels leading off from the east bank of the Bahr el Jebel diverge appreciably, and leave an area of permanently dry ground between themselves and the Bahr el Jebel. These eastern streams coalesce to form a single stream known as the Bahr ez Zeraf, and the intervening land is called Zeraf Island. Discharge into the Bahr ez Zeraf was originally from a point just north of Shambe, and took place at all seasons unless the river level happened to be particularly low, in which case the Zeraf discharge fell to nil. Between latitudes $7^{\circ} 45'$ and $7^{\circ} 50'$ N. the Bahr ez Zeraf approaches within some 4 km. of the Bahr el Jebel. In 1910 and 1913 the Egyptian Government, wishing to reduce losses from the Bahr el Jebel (since the lower course of the Zeraf is much less encumbered with swamps than the Jebel), and also to experiment with types of dredger for use in the swamps, cut two channels from the Jebel to the Zeraf at this point. The effect has been to transfer to the latter water that would otherwise have flowed down the former, but unfortunately it is not known whether the total effect has been to increase the low-stage water supply for Egypt or not, since sufficient readings were not taken before the experiment to enable valid deductions to be drawn from them. The conclusion drawn by Hurst and Phillips is that the cuts had little or no effect in increasing the total discharge of the Bahr ez Zeraf, while

they can only have reduced that of the Bahr el Jebel; on the other hand, they do seem to have kept the Bahr ez Zeraf from falling to quite such low levels as formerly in late March and April, i.e. when the demand for irrigation water is greatest.

Between Shambe and Lake No the Bahr el Jebel flows in a channel which appears to be able to carry about 26 million cubic metres per day, i.e. 9 milliards per annum, without suffering exceptional losses. When the flow is greater than this there is a discharge into the very many channels on the west, where there is a line of almost continuous swamps, the only permanently dry ground being at Hillet Nuer. These channels have been found to be a continuation of the Khor Doleib which flows into the Bahr el Ghazal just above Lake No, but the weed growth appears too great for any appreciable flow to take place. On the east bank the only point to escape flooding is Bufalo Cape, and a line of levels taken across the island from here shows that the banks of the Bahr ez Zeraf are some 2 m. higher than those of the Jebel, thus accounting for the former's lack of fringing swamps.

From Lake No the White Nile flows eastward in a quite clearly marked channel limited both to the north and south by rising ground. On the right bank there are several tributaries of which only the Zeraf makes any significant contribution. On the left bank, where the swamps are somewhat broader, there are numerous channels, including the Khor Lolle, which may perhaps get some of its water from the clay lands to the north, but which certainly helps to account for losses from the White Nile in this reach.

Lake No to Sobat Mouth

By the time Lake No has been reached losses from swamps, discharge channels, and overflowing have been so great that the régime of the Bahr el Jebel is reduced to almost complete uniformity throughout the year, both April and September having discharges of approximately 40 million cubic metres per day. The Bahr ez Zeraf, with figures of 11 and 14 respectively, does little to alter the general pattern. This being the case, it might be expected that the water-level in this stretch would remain

almost constant throughout the year, and that losses would vary according to the temperature and humidity of the air. In fact, the entry of the Sobat river from the east, bringing a summer flood from the rainfall of the Ethiopian plateau, has the effect of raising levels in the Bahr el Jebel at least as far back as Buffalo Cape, and on the Bahr ez Zeraf to Fangak. Despite the higher humidity, therefore, losses in the flood season are slightly greater than at other times of the year, as is reflected by the discharges at Malakal below the junction of the White Nile and Sobat.

The River Sobat

The River Sobat itself results from the conjunction of two tributaries, the Baro and the Pibor. The former drains an area of some 41,000 sq. km. on the western side of the Ethiopian plateau, where the rainfall is thought to attain as much as 2,000 mm. (80 in.) per annum, concentrated in a rainy season of five to six months. The latter has one tributary, the Gila from the Ethiopian mountains, but principally collects the drainage of the vast clay plains (110,000 sq. km.), which stretch southwards to the Kenya border. The Baro resembles the Bahr el Jebel in that it brings down to the plains from a mountainous area a quantity of water too great to be carried away by its normal channel. The result is that extensive spilling takes place that is by no means compensated by the flow back to the river after the flood has passed. The chief losses take place northwards to the Machar marshes (which are also fed by several other streams from Ethiopia), and the total effect is to reduce the mean annual discharge of the Baro to about 9 milliards, or about 25% less than the total at Gambela. The rainfall of the Pibor's catchment area is much less than that of the Baro—probably not more than 800 mm.—and so despite its greater extent a higher run-off is not to be expected; in fact, because of the extreme flatness of the region losses are high and the Pibor contributes some 3 milliards only of water per annum. Because of the slowness of run-off the maximum discharge comes in November and December, when the Baro has begun to subside, and this enhances the Pibor's value.

Downstream of the Baro-Pibor junction the Sobat flows north-westwards to meet the White Nile. A few water-courses, none of them perennial, flow into the Sobat from either side in this reach, and it seems likely that at certain times they carry some water away from the river. That there is no great overflowing, however, is evident from the fact that losses from Sobat head to mouth amount to some 4½% per annum only, for the excess of this figure over the 3% lost by the Blue Nile in a comparable distance may readily be explained by the presence of the swamps in the loops of the Sobat's meanders. The mean annual discharge of the Sobat amounts to about 13 milliards, out of a total for the White Nile at Malakal of 27½ milliards, which is to say that the Sobat with its small catchment area yields very nearly as much water in a year as the whole of the Bahr el Jebel and Bahr el Ghazal drainage systems. On the other hand, it should be recognized that much of the Sobat water comes when the Blue Nile is still in flood, so that the more evenly distributed White Nile waters are of very much more value for irrigation (Fig. 48).

The White Nile

Between the Sobat mouth and the Mogren (the gauge on the White Nile at its junction with the Blue Nile), the White Nile flows in a broad bed with an extremely gentle slope. At the southern end the river is 300–400 m. wide, being generally flanked by swamps as far downstream as Kosti, while nearer Khartoum the width of the river, before the building of the Jebel Auliya Dam, was as much as 1 km. Including bends the length of this stretch is 840 km., but the difference in level of the water surface between the two ends is only 12½ m. when the Blue Nile is not in flood, or approximately 1½ centimetres per kilometre. When the Blue Nile flood is at its height, moreover, the difference may drop to 8 m. The only tributaries of the White Nile in this stretch are a few streams near the southern end, including the Khor Adar which drains the Machar marshes. Their total contribution is not known, but they do have the effect that between Malakal and Renk the reduction of the Nile flow throughout the year is negligible, being less than ¼%. The explanation seems to be that

when the river level is high, during the later summer, evaporation and flow into the fringing marshes is compensated by the water-courses and local rainfall, whereas when the river falls flow-back from the swamps compensates for the reduced transmission losses.

If we now consider the régime of the White Nile independent of the effects of the Jebel Auliya Dam, we shall see that levels in the lower portion are to be explained, not only by variations in the supply of water at Malakal but also by the ponding-back effect of the Blue Nile. Since the mean variation in level of the Blue Nile at Khartoum is some 5 m., it can be seen that when the flood is at its highest it will affect White Nile levels for a long way upstream. In fact, at the top of the flood the surface of the White Nile closely approaches a horizontal line for the last 200 km., and river levels are affected as far back as Jebelein, 400 km. from the Mogren. The Jebel Auliya Dam, which is filled between July and October, impounds the water ponded back by the Blue Nile, together with a portion of the flow of the White Nile, and attains at its maximum a head of about 6.5 m. Between February and May the stored water is released, being slightly less than 3 milliards.

The Blue Nile and its Tributaries

The hydrology of the Blue Nile and its tributaries (Fig. 46) is less well recorded than that of the White Nile. The highest gauge from which readings are regularly obtained is at Er Roseires, within the borders of Sudan, while for Lake Tana all that have been recorded are a few levels and discharges over a short period of years. The lack of information from Ethiopia is regrettable, for virtually all the water carried by the Blue Nile and its tributaries, the Rahad and the Dinder, comes from the summer rainfall of the Ethiopian plateau, very little being contributed by the rains of Sudan itself.

The latter two rivers may quickly be dealt with, since they drain relatively small areas beneath the main escarpment. In winter they cease to flow, and dry up to a line of pools strung out along their sandy beds, but in summer they rise rapidly, and in September the larger of the two, the Dinder, actually produces almost as much water as the White

Nile (including the Sobat), while the Rahad produces about one-third as much. Within Sudan their meandering beds are deeply incised into the clay plain, whose impermeability is such that at most levels losses from percolation are negligible. Only when their floods are at their highest is there a tendency for losses to occur from overflowing into flanking depressions or *khors*. Local rainfall usually occurs at the season when the flood is at its highest, and so there has been little development of streams draining into the two rivers; such water may stand in pools for a time until it dries up.

The summer flood of the Blue Nile is similar in the rapidity of its rise and fall, but it differs in that there is no season when the flow is reduced to nil. This is partly because the river has a much larger catchment area, with numerous tributaries from the heart of the Ethiopian plateau that are fed by springs and maintain some flow throughout the year, and is also due to Lake Tana which acts as a regulator and reservoir for the Blue Nile. Lake Tana has an area of more than 3,000 sq. km., and lies at an altitude of some 1,800 m. above sea-level. It is fed by numerous tributaries, of which the Little Abai is commonly regarded as the ultimate source of the Blue Nile. The mean contribution of the lake to the total discharge of the Blue Nile is some 7% (3.8 milliards per annum out of a total of 51.0), being least just before the rains begin and greatest in the late summer, when the lake's level may rise by 1½ m. Observations made in 1921 gave a mean discharge of 331.2 cu. m. per second in September-October, but only 5.2 in June.

In its descent from Lake Tana to Er Roseires the Blue Nile passes over many rapids and at least one notable waterfall, Tis Isat, with a drop of 50 m. It receives numerous tributaries, especially from the left bank, the outer side of the great curve that it makes as it passes through Ethiopia. Virtually nothing is known of the hydrology of these tributaries, which together contribute 85% of the Blue Nile's discharge, but it seems reasonable to assume that while normal losses occur from evaporation from water surfaces there is no loss by overflowing into swamps until the river reaches the clay plain and starts to meander.

Between Er Roseires and Khartoum the Blue Nile is deeply incised into the clay plain, its courses consisting of a succession of meanders. Within the loops of the meanders are depressions which fill at the time of high flood, and may remain full of water for many months afterwards. None of these depressions, however, takes any considerable proportion of the vast flood running, and losses from overflowing are severely limited by the fact that the flood-plain of the river is confined on either side by distinct banks rising several metres above the level of the highest flood. These banks are severely eroded by the action of the torrential rains of summer, especially where they are over-grazed by animals coming down to the river to drink, but they are not dissected by many streams because, as was noted in discussing the Rahad and Dinder rivers, there is virtually no run-off from the clay plains.

The greatest discharge of the Blue Nile is on an average about fifty times its lowest figure: this is reflected not only in the level of the river but also in the speed of the current and in the quantity of silt carried in suspension.¹ When low the river flows sluggishly and is quite clear, but in September it rushes down bearing tree trunks, dead animals, and all kinds of debris, and the silt content at Khartoum may reach more than 3,600 parts per million. At the Mogren a clear distinction is to be seen between its dark turbulent waters and the pale green flow of the White Nile.

Along this stretch of the Blue Nile above Khartoum an appreciable quantity of water is extracted for the irrigation of the clay plain, both by pumping and by gravity canal from the Sennar Dam; lesser (and virtually negligible) quantities are also removed by *saqia* (water-wheel) to irrigate silt terraces. The area of clays that might be irrigated is considerably more than that at present commanded, limitations having been imposed by the Nile Waters Agreement (see below, p. 121) more than by the lack of land, water, or capital. The Sennar Dam has remarkably little effect upon the régime of the Blue Nile, for its capacity when filled is equal to a single day's flow of the river when at high flood. Most of its contents are used to

irrigate the Gezira Scheme and are not sent down the river at all.

The Main Nile

Between Khartoum and Aswan the Main Nile has in most reaches a bed well able to transport almost any amount of water that it is likely to be required to carry. Only in two reaches does overflowing occur to any considerable extent, these being the Shendi reach between Sabaloka and Atbara, and the Merowe-Dongola reach from Karima to Kerma. In each of these reaches there is a number of clay-lined basins flanking the river, representing former sections of the river bed which are now gradually silting up when the Nile overflows into them. Hydrologically these basins are not very significant, in that much of the water that flows into them is returned to the river when its level falls. In 1946, the year of an exceptionally high Nile flood, the whole of the Shendi reach served involuntarily as a flood escape for the benefit of dwellers farther downstream, the railway, towns, villages, and fields all suffering severe damage. The great Kerma basin opposite Dongola was similarly flooded to an unprecedented extent, but the effects here were beneficial to grazing rather than harmful to buildings and cultivations.

In all this stretch of nearly 2,000 km. the only reliable tributary of the Nile is the Atbara, whose régime is very similar to those of the Rahad and Dinder rivers. The Atbara's greatest contribution is in August, when its flow attains one-third of that of the Blue Nile at Khartoum, but it soon dies away and in the whole year supplies only one-quarter as much as the latter (Fig. 46). There are also certain streams, usually dry, which enter the Main Nile, such as the Khor Abu Döm at Merowe. These carry occasional spates, but coming as they do in the rainy season when the flood is at its highest, they are of no practical value: in fact, no attempt is made to gauge their extent.

The losses experienced as the Main Nile flows through this northern reach are occasioned principally by evaporation from its surface; there is, of course, percolation into the alluvial silts, sands, and gravels by the river, and into permeable beds of the Nubian

¹ Simaika, *The Suspended Matter in the Nile*, Physical Paper No. 40, Egyptian Government, Cairo, 1940.

Series through which the river flows, but since these are tapped by few wells it seems likely that losses from this cause are negligible. Taking into account the surface area of the river and the time taken for the stream to travel from the Mogren to the northern frontier, calculations show that there is a mean transmission loss of 2.0 parts per 100,000 per kilometre, appreciably less than that on the White Nile below Malakal (7.4) or on the Blue Nile between Er Roseires and Khartoum (7.7). The total abstracted by pumps and water-wheels is a very small proportion of the whole, that taken by pumps during the Timely Season (January–July, when the need in Egypt is greatest), being compensated by releases from the Sennar Dam.

The Nile in Egypt

Once it reaches Egypt the Nile no longer concerns Sudan, except that the filling of the Aswan Dam makes navigation rather easier between Wadi Halfa and Shellal. A brief account of this lower part of the valley must, nevertheless, be given, for it is clearly of importance in determining the nature of the present and proposed control works which will be discussed below. Between Wadi Halfa and the First Cataract—now drowned by the Aswan Dam except just before the flood starts—the Nile is confined by hills of the Nubian sandstone. These stand several hundred metres above the highest level of the river, and have been dissected to produce a very rugged topography. Even before the Aswan Dam was built there was only a very narrow strip of cultivatable land on either side of the river. North of Aswan the valley of the Nile lies between high sandstone cliffs which gradually open out and become less elevated until below Cairo they disappear. The width of the river bed remains more or less constant, while that of the alluvial terraces beside it gradually increases from 5 kilometres just below the dam to 10 near Luxor and 15 throughout Middle Egypt.

Formerly this flood-plain was inundated once a year when the flood came down, and was sown with crops as the water-level fell. This system was then converted into 'basin irrigation', whereby the area to be flooded was subdivided by longitudinal and transverse

banks, so that water could be permitted to stand in each division or basin for a limited period, then be let through to another, and finally returned to the river after the flood had passed. More recently basin irrigation has been generally supplanted by perennial irrigation, which depends on the existence of a regular supply of water in the Nile, either drawn up by pumps or held up by barrages and led by canals to the fields. This makes it possible to grow two and even three crops per year on one piece of ground, and has been made necessary by the growth of the Egyptian population. In Upper Egypt there still remain some areas of basin irrigation, whose conversion to perennial use will require not only capital expenditure but also the assurance of a greater supply of water for the country as a whole.

North of Cairo lies the Nile delta, also known as Lower Egypt. The branches of the Nile flow here in slight natural levees, and perennial irrigation has been instituted throughout the southern or higher part of the delta. Farther north the level of the land is often below that of the Mediterranean, and there are many salt lagoons and ill-drained areas which have yet to be reclaimed and brought into cultivation.

To summarize the above we may say that there are in Egypt today 0.7 million *feddans* of basins (1 *feddan* = 1.038 acres), 5.45 million *feddans* of perennially irrigated lands, and 2 million *feddans* of lakes in the delta, of which perhaps one half could be reclaimed. If, moreover, it were possible to increase the economic lift for pump irrigation to a maximum of 10 metres, there would be a further 0.2 million *feddans* along the valley and beside the delta that might be brought into cultivation.

THE TRAINING OF THE NILE

Unfortunately the normal Nile flow is not sufficient at all seasons to irrigate even the present cultivated area, while if further lands were reclaimed the deficiency would be increased; on the other hand, there is a period during the flood when water comes down far in excess of any use that can be made of it. Taking the year as a whole, there is usually enough water to meet all needs, and the first problem confronting engineers, therefore, is

how to increase the winter and early summer supply, a subsidiary need being to provide protection from flooding in case the river should rise again as high as it did in 1878.

Existing Nile Control Works outside Egypt

The control works at present in operation are shown in Fig. 46; they are widely distributed, and cannot yet be said to constitute a unified system. The Owen Falls Dam in Uganda, which was completed in 1953, was constructed with the dual purpose of generating hydro-electric power and of controlling the outflow of Lake Victoria. The top of the dam has been built to a level of 1,136 m. above sea-level, and it will thus be able eventually to raise the level in Lake Victoria by as much as 3 m. At present the dam is used to generate electricity only, and has already attained 90,000 of its designed capacity of 150,000 horse-power. Plans are already on foot to build a second dam just below Owen Falls to generate further power. This will have no effect on proposals of Nile Control: the use of Lake Victoria as a long-term storage reservoir to improve water supplies in Egypt and Sudan can begin only when some means has been found of avoiding transmission losses through the swamps of the Bahr el Jebel. In the meantime the lake's level should be raised, if possible, so that when required a considerable volume of stored water may be available in case of bad years.

In Sudan there are dams on the White Nile at Jebel Auliya and on the Blue Nile at Sennar. The former was completed in 1935, and is designed and operated almost entirely for the benefit of Egypt. When the Blue Nile is in flood, levels in the White Nile are also high. The Jebel Auliya dam is closed between July and October, and holds up approximately 3 milliards of water which are released between February and May. The effect of the dam is appreciable for about 300 km. upstream, and by delaying the fall of the river has disturbed the economies of the riverain tribes to the south, as described in Chapter XII; on the other hand, the high levels maintained throughout the winter cotton-growing season certainly make low-lift *saqia* and pump irrigation easier (see Chapter XIII). Despite the great evapora-

tion losses inevitable from a long shallow dam and the transmission losses which occur between the two dams, Jebel Auliya contributes approximately 2.5 milliard of water at Aswan, coming at the period of greatest need. There is a lock in the dam to permit navigation on the Khartoum-Kosti-Juba route (Frontispiece).

The Sennar Dam on the Blue Nile was first suggested in 1904,¹ and definite proposals were put forward soon after, but through the interruption of the First World War it was not completed until 1925. It is operated entirely for the benefit of Sudan, serving both as a reservoir and as a barrage to raise the level of the water sufficiently to flow into the Main Gravity Canal of the Gezira Scheme. The dam is 17 m. high, and when filled contains 0.9 million cubic metres of water. Because the Blue Nile has a fairly steep profile, and is sharply incised into the plain, the area of cultivated land that suffers prolonged flooding is very much less than that inundated above the Jebel Auliya Dam. No lock was built in the dam, since between Sennar and Khartoum regular navigation is too difficult for river steamers.

The Nile Waters Agreement

The use of the water stored in the Sennar Dam was until the end at 1959 regulated by the Anglo-Egyptian Nile Waters Agreement, negotiated between Great Britain and Egypt in 1929. With the coming of Sudanese independence this agreement needed to be replaced by another more acceptable to Sudan, and this occurred in November 1959, when a new agreement was signed between the Egyptian and Sudanese governments. In its thirty-odd years of life, however, the agreement was the basis of almost all irrigation developments in Sudan, and so it is still appropriate to outline its provisions. The agreement was made to regulate the use of the Sennar Dam, which had just been brought into operation as the first attempt, apart from the Zeidab scheme (see Chapter X) and certain experimental pumping schemes, to practise really large-scale irrigation in Sudan. Hitherto the only irrigation in the country, apart from some 40,000 *feddans* commanded by pumps, had been carried on by the use of ox-drawn water-wheels or hand-operated levers

¹ Sir William Garstin, *Report on the Basin of the Upper Nile*, Cairo, 1904.

(*shadūf*), which watered very narrow strips of land beside the Main Nile, and to a lesser extent beside the Blue and White Niles not far from Khartoum. This had needed little water, and so the Egyptians were naturally alarmed at the prospect that much larger quantities might eventually be extracted from the Nile, before it reached Egypt, to water Sudan's extensive plains.

It was, therefore, agreed that during the Timely Season, i.e. the season of water shortage in late winter and early summer when any increase in the supply of water would be most welcome, virtually the whole natural flow of the Nile should be regarded as belonging to Egypt. During the Untimely or flood season, on the other hand, the Sudanese might make free use of the water, including filling the Sennar Dam, since at this period there was always more water than the Egyptians could use or store. In operation this worked out as follows: between 15th July and 31st December the Sennar Dam was filled, and water was drawn from it and the Blue, White, and Main Niles without restriction, except that at all times of the year the discharge into the Gezira Main Canal was limited to 168 cu. m. per second. Between 1st and 18th January lesser quantities might be taken into the Gezira Canal from the river's flow, but any water used above the stipulated maxima at that period, plus all water used subsequently in the Gezira Scheme, had to be recorded, added together, and debited to the Sennar Water Account. The account's credit consisted of the total capacity of the Sennar Dam on 1st January, reduced by evaporation losses, and periodic releases were made to compensate for water removed by pumps elsewhere in Sudan. By 1st June the winter crops had been harvested and any balance remaining in the Sennar Dam was released.

Until shortly after the end of the recent war the agreement operated very satisfactorily, and provided for all the demands made for water by the Sudanese, while satisfying the Egyptians that they had nothing to fear, and incidentally allowing them to increase their own consumption of water steadily from 40 milliards of cubic metres in 1929 to 48 milliards in 1955. More recently cotton growing and other forms of pumped irrigation have proved

so profitable in Sudan that about 1,500 private pumping schemes have been established in the country, and the margin of water to be released at the end of the irrigation season has been more than exhausted; in fact, many schemes now in operation could not have been licensed had not the Egyptians 'advanced' a total of 400 million cubic metres against the eventual construction of the Er Roseires Dam. The new agreement which allows to the Sudanese a total of 18½ milliards, will make it possible to convert existing restricted licences to perennial irrigation, and a considerable extension of irrigation is to be expected, over and above the new Manaqil scheme. An important feature of the new water situation in Sudan will be that projects for supplying drinking water to non-riverain areas such as the central Gezira or towns like Manaqil or even El Obeid may now be re-examined.

Nile Control in Egypt

During the next few years, therefore, the Sudanese will be able, providing they can find the necessary capital, to set about a striking revolution in their use of water. For the Egyptians at the same time, the urgency to find ways of increasing the supply of water will be the greater. The methods they mean to adopt will have a considerable impact on Sudan, but before considering this topic it will be appropriate to summarize briefly the existing arrangements for controlling and using the Nile in Egypt.

The control of the Main Nile in Egypt consists of three distinct operations; at Aswan there is a dam to hold up a portion of the summer's flood, so that it is not all lost to the Mediterranean but may be used when the natural flow is deficient; at several points below Aswan there are barrages which raise the level of the water sufficiently to command the permanent irrigation canals; and at the mouths of the river there were, until recently, two earth banks constructed each year to keep the sea from entering the river bed when the flow is negligible. The bank on the Rosetta branch was in 1951 replaced by the Edfina barrage, constructed of stone.

The Aswan Dam was first built in 1902 and has subsequently twice been heightened (1912 and 1934), so that it now has a capacity of 5·3

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milliards, the greatest head of water being 23 m.¹ Filling the dam usually begins in October, when the flood is starting to subside and its silt content is low, and the process is completed by the end of January. The ponding back of the river is noticeable nearly as far upstream as Wadi Halfa, 350 km. away and within the borders of Sudan. While the dam has drowned the lands of the Egyptian Nubians whose homes were along this reach, its effect on Sudan has been largely beneficial, in that it assists navigation between Shellal and Wadi Halfa, though serious inconvenience is caused at times when the dam level is allowed to fall suddenly.

The contents of the Aswan Dam are released in the early part of the summer to supplement the Nile's natural flow. For the purpose these water plus the contents of the Jebel Auliya Dam are as yet sufficient, provided that the natural flow itself is not far below the normal. A danger exists, however, that a succession of years such as 1912-14 may occur, when the summer floods were insufficient to fill the reservoirs completely and the winter flow (through an unhappy coincidence of Blue and White Niles both being below the mean) was also exceptionally low. In consequence, there was a very serious overall deficiency which led to a drastic curtailment of the cropped area and to widespread hardship and famine. Now, forty years later, the population of Egypt is very much greater, and the consequence of such a deficiency could be disastrous.

The second ever-present danger, that of flooding cultivated or inhabited areas when the summer flood much exceeds the normal, is likewise increasingly serious as the density of population in Egypt rises, and as more and more settlement takes place on the low-lying areas beside the river rather than up on the fringes of the desert. In 1946 it was the Shendi reach in Sudan that bore the worst of the exceptionally high river levels, and Egypt suffered comparatively little. On a future occasion, however, the Shendi area, now much more developed, might have banks high enough to protect it, and the blow would fall elsewhere.

For these two reasons then, i.e. both the lack of water in some years and the excess of

it in others, there is an undoubted need for a more comprehensive system of Nile control if merely present uses are to be pursued without risk. On the technical side investigations into the possibility of obtaining complete control of the Nile have been in progress for over sixty years, a leading part having been played by the Physical Department of the Egyptian Ministry of Public Works. The first means adopted to increase the timely flow of the Nile was to build a dam in 1902 at the First Cataract, Aswan. This held up a portion of the summer flood, care being taken each summer to delay filling of the dam until most of the silt carried in the early flood had passed through. As the land under perennial irrigation increased, the dam was twice raised, until in 1934 it attained its present height of 33 m. (121 m. above sea-level) and a capacity of more than 5 milliards.

The Need for Further Nile Control

Until recently it was thought that this was as far as storage at Aswan could go, partly because the dam's foundations could not bear any further heightening, and partly because higher water-levels would lead to severe flooding of inhabited lands in Sudan; a greater surface area, moreover, would lead to greater losses from evaporation. It was also feared that if the dam were to be closed earlier in the flood, much silt would be deposited and the dam's capacity would be gradually reduced. Attention was therefore turned to other means of water conservation and control, and a series of proposals was put forward involving the regulation of Lakes Albert and Victoria in East Africa, Lake Tana in Ethiopia, and the Bahr el Jebel swamps in Sudan. More recently still there has been a reversion in Egypt to the idea of Main Nile storage. Indeed at the time of writing² plans are well advanced to build a much higher dam near Aswan, sufficient to contain the whole of the highest Nile floods, to provide flood protection for Egypt, and even to store water from year to year to eliminate the danger of low years coming together.

1. *The Jonglei Scheme*

Temporarily, therefore, the idea of storage in the great lakes of East Africa has been set aside,

¹ Hurst, *A Short Account of the Nile Basin*, Cairo, 1944. ² 1960.

to be looked at again when the full benefit has been reaped from the High Dam at Aswan. Nevertheless the former proposals are still important, because having been published in some detail by the Egyptian Government in Volume VII of *The Nile Basin*, they became the basis of the work of the Sudan Government's Jonglei Investigation Team, which has thrown a great deal of light on the physical and human geography of the swamps of southern Sudan. Even if these proposals are temporarily set aside in favour of the High Dam project, they must remain a part of the ultimate regulation of the whole Nile system.¹

The basis of the proposals was a consideration of the maximum potential demand for water in Egypt and Sudan in the foreseeable future. It was assumed that none of the other countries of the Nile Basin was going to want any considerable quantity of water for irrigation, though they might be interested in other subjects such as the navigability of rivers or the development of power. The normal Timely flow of the Nile and the contribution that could be made to it from existing reservoirs being known, the amount of water that would have to be provided each year from additional sources was calculated, it being assumed at the time that there were no further sites suitable for storage on the Main Nile.

For the purpose of calculation, Hurst assumed that Egypt's demand for Timely water would ultimately rise from 17.5 to 28.0 milliards, and that of Sudan from 2.0 to 2.8. In this he clearly underestimated Sudan's irrigation potential. He then drew attention to the risk that if the Timely supply fell below its mean value for a number of years in succession, a considerable cumulative deficit might be built up which could only be met from a reservoir with an exceptionally large capacity. After an investigation of the likely variation of climatological data over a long period, he came to the conclusion that the 'Century', i.e. over-year, storage required would have to be at least 125 milliards.

Clearly if the Nile were to be successfully controlled, and if the extension of irrigation in

Egypt and Sudan were to proceed in safety, it would be necessary not merely to accumulate such surpluses in the Nile's Timely flow as might occur, but also to take steps to eliminate some of the present losses occurring every year. The decision was then required whether to begin to increase the supply of water available by conserving more of the Blue Nile flood, of which on an average more than 30 milliards per annum are now lost to the Mediterranean, or whether first to obviate in some way the great losses of White Nile water—over 12 milliards per annum. These losses occur in the swamps between Mongalla and Malakal as soon as the river rises much above its minimum level.

The difficulties involved in the former solution were not merely the risk of silting up reservoirs and the certainty of serious losses from evaporation, but also the absence of a suitable dam site on the Main Nile where a sufficient quantity of water could be held up without undue losses and without flooding large areas of cultivated land. This appeared to rule out the use of Blue Nile water for the main reservoir, since there were no major dam sites possible between Khartoum and Er Roseires, and there were obvious political objections to establishing the dam in the little-known and scarcely administered country of lowland Ethiopia. Once the decision was made, therefore, to increase the flow of the Nile by conserving White Nile water, it was clear that the long-term reservoir would have to be outside Sudan.²

This suggested either Lake Albert or Lake Victoria, of which the former has the advantage of steep, virtually uninhabited sides and suitable sites for dam building either just below its mouth or, better still, at Nimule. At first, therefore, Hurst favoured Lake Albert, but subsequently Lake Victoria has been preferred because of its greater area, for this means that any given increase in depth would produce a much larger volume of stored water. Its higher rainfall is approximately sufficient to eliminate losses by evaporation, but the chief reason is that it is situated in the middle

¹ Hurst, Black and Simaika, *The Future Conservation of the Nile*, 1946.

² The country between Khartoum and Mongalla is so strikingly flat that the Jebel Auliya Dam holding only 3 milliards of water, raises river levels appreciably for 300 km. upstream. A dam to hold 100 milliards would therefore be quite impracticable.

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of a populous part of East Africa where there is a demand to be met for hydro-electric power in large quantities. The scheme as outlined in the Jonglei Final Report, somewhat modifying that originally propounded in *The Nile Basin* may now be briefly summarized.¹ Lake Victoria is to be used as a reservoir for over-year storage, sufficient water being held to make up for the deficiencies in the annual flow in even the worst succession of years that the available statistics have shown to be likely, and the dam already built at the Owen Falls is to make this possible. At the exit from Lake Kioga a regulator is to ensure that variations in the discharge at Owen Falls shall be promptly transmitted to Lake Albert. Just below Lake Albert, or preferably at Nimule, a regulator is to control the quantity of water entering Sudan, making allowance for the effect of the torrents between Nimule and Mongalla, and if necessary using Lake Albert as a reservoir to prevent flooding in the Upper Nile Basin. Between Nimule and Mongalla it would be advantageous to have a small reservoir, in case the flow of the torrents alone should prove too great to be carried without flooding.

Downstream of Mongalla the means to be adopted to avoid losses would be as follows: between Mongalla and Jonglei the existing Nile Channel is to be improved by dredging and excavating, a duplicate channel probably being provided north of Tombe to carry the maximum flow; north of Jonglei surplus water over and above that carried by the Nile will be carried by the Jonglei canal, whose headquarters near Jonglei on the Khor Atem will determine the distribution of water between the Bahr el Jebel, the Atem, and the Jonglei canal. The canal itself may consist of not one, but two, or even three, independent channels, equipped with locks to make navigation possible.

The purpose of these works is as follows: at the present time the Bahr el Jebel at Mongalla attains its maximum in late August; that is to say, during the Untimely season, when the Blue Nile is already providing more water than Egypt and Sudan can use. This maximum is not reflected in the discharge from Lake No, whose output remains almost constant through-

out the year, since there is a great loss of water in the swamps. Merely to reduce or eliminate this loss would serve no useful purpose; what is required is that the Bahr el Jebel should be made to discharge more water, and to provide this greater quantity of water during the Timely season. In some years, moreover, the Timely discharge needed will be greater than in others. Not only must the channels employed be sufficiently large to carry the greatest discharge required, but also there must be a reservoir capable of storing enough water from year to year to tide over the worst anticipated run of years of increased demand.

In operation it is intended that Lake Victoria shall provide the over-year storage, the discharge from below Lake Albert being controlled so that in the Untimely season the flow in the Bahr el Jebel and the Jonglei Canals is the minimum required to permit navigation and to check weed growth. In the Timely season the discharge will be increased to the maximum figure required by irrigation. When the over-year storage reservoir is partially empty, any surplus will be used to fill it. When it is full excesses may be passed down during the Untimely season, additional capacity being kept in reserve in Lake Albert in case of floods.

This proposed régime has been worked out in terms of the irrigation needs of central Sudan and of Egypt. It has long been recognized, however, that the reversal of the seasons of maximum and minimum flow in the swamps area and the elimination of spilling on to the flood-plain land beside the river must have a serious effect on the Nilotic tribes, who rely on the late growth of grass as the flood subsides to keep their cattle alive during the dry season. To learn just how serious the loss of grazing and fishing facilities would be, the Sudan Government set up in 1945 the Jonglei Investigation Team, whose final report, published in 1954, constitutes a major addition to our knowledge of the whole region. This problem is also discussed in Chapter XV below.²

The operation of the Lake Victoria and Lake Albert reservoirs would be dependent on the discharge from Lake Tana, where a dam could be built to provide hydro-electric power, the

¹ *The Equatorial Nile Project*, 1954, Vol. II, p. 399-411.

² *The Equatorial Nile Project*, 1954, Vol. II, discusses proposed remedies for the effects on the local tribes.

gorges and falls of the Upper Blue Nile being well suited to this end.

All the above schemes would clearly need a considerable period before they could be brought into operation. At the same time, therefore, the proposals envisage building a dam at Semna on the Main Nile, for besides providing additional annual storage this could give Egypt extra flood protection.

In the table below are shown what the total requirements were considered to be when these proposals were formulated and the contributions expected from each individual scheme:

TABLE IV
WATER NEEDS

	<i>milliards</i>	
1. Normal supply of Timely Water at Aswan	13.5	
2. Ultimate demand for Timely Water at Aswan	31.0	
3. Ultimate normal supplement required to natural supply	17.5	
4. Contributions made by present works:		
(a) Aswan Dam.	5.0	
(b) Jebel Auliya Dam	2.5	
(c) Sennar Dam	0.6	
	8.1	8.1
5. Contributions to be made by future works:		
(a) Lake Tana Reservoir	2.1	
(b) Main Nile Reservoir	3.0	
	5.1	5.1
6. Saving expected from operation of Sudd Division channel	5.2	
7. Normal total supply when future works are completed	31.9	
8. Greatest deficiency in natural flow recorded in any one year (1914)	5.5	
9. Greatest deficiency in natural flow recorded in three consecutive years (1912-14)	11.5	
10. Volume of over-year storage to be provided	155.0 ¹	

¹ Hurst (1946), Chapters I-IX.

It should now be apparent that the two most important parts of the whole project, the building up of the long-term storage in Lake Victoria and the construction of the Sudd diversion channel, are fundamentally connected so that neither can be of any use without the other. To operate them correctly, and to obtain the greatest possible advantage from the lesser schemes, will be a complicated task calling not only for judgment and experience but also for the complete co-operation of engineers of at least four countries. When the proposals were put forward, being to a great extent the work of British engineers employed by the Egyptian Government, this co-operation could be taken for granted, since both in Sudan and in Uganda the irrigation engineers were British also.

2. The High Dam Project

Now, however, irrigation in Egypt and Sudan is controlled by engineers who are nationals of those two countries. This would not of itself be a bar to co-operation, but before the signing of the new Nile Waters Agreement, which is much more favourable to the Sudanese, there were very understandable protests in Sudan that the present division of water did not do justice to the country's demand for additional water for the cultivation of cash crops. Such demands in turn understandably alarmed Egyptian public opinion, since Sudan has vast fertile plains that may one day be brought under irrigation. There was also the possibility that by adopting more intensive rotations the Sudanese might greatly increase the water required for their existing Gezira and pump schemes.

This led to a re-examination of the long-established assumption that the main bulk of the summer flood of the Blue Nile cannot be stored, and Egyptian engineers produced proposals for a new dam at Aswan to be very much higher than the existing structure. This Sadd el Aali, or High Dam, as it is called, is to be built a short distance upstream of the existing dam, and to support a head of 82 m. of water, compared with the present 23 m. Such a dam would have a total capacity of 120 milliiards, which would enable it not only to

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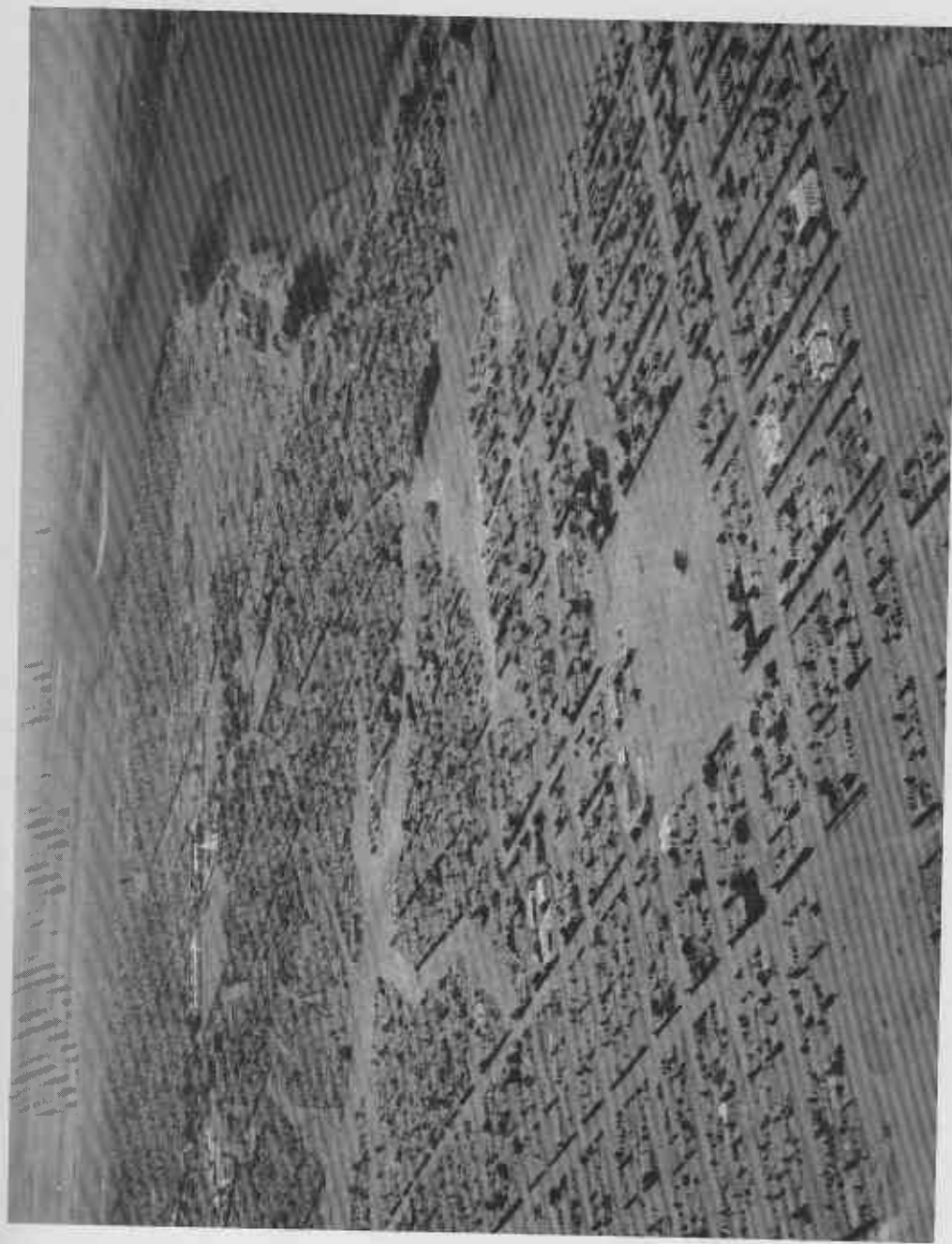


PLATE XX. OMDURMAN

The regular lay-out of the new quarter in the foreground shows the influence of current town planning legislation.



PLATE XXI. WHEAT, DATE PALMS AND ANIMALS IN NORTHERN PROVINCE



PLATE XXII. SHADUF, KHARTOUM PROVINCE

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hold up enough water for each year's needs for irrigation but also to provide over-year storage to supplement years of low flood. The technical problems involved in the construction of so huge a dam are not considered insoluble, even though there is a depth of almost 200 m. of unconsolidated valley-fill beneath the river bed where it is to be built. Additional benefits are expected from the vast quantity of hydro-electric power that it will be possible to generate, sufficient to supply light and power throughout the whole of Egypt, the surplus being available for Sudan, while ample storage could also be kept in reserve to provide flood protection, however high the Nile.

Disadvantages inherent in the scheme are first the vast evaporation losses, estimated at 2.8 m. or 10 milliards per annum, that are to be expected from a dam in the middle of the Sahara. These losses would be equal to almost twice the present capacity of the Aswan Dam. Secondly, the reservoir would extend 500 km. upstream to the Dal Cataract, and would cause the permanent flooding of the town of Wadi Halfa and the cultivated lands beside it. This is naturally unpopular among the local Sudanese Nubians, whose attachment to the slender strips of land beside the Nile that their forebears have occupied for thousands of years is very understandable. Thirdly, by flooding the potential Semna Dam and hydro-electric power site the Egyptians would be permanently reducing Sudan's power potential. No pledge made by one generation of politicians can be regarded as binding on its successors for ever, and so even if promised a free supply of

power 'as at Semna' in compensation, the Sudanese could never be said to be wholly recompensed.

The cost of the High Dam has been estimated at over £300 million together with the necessary ancillary works and improvements in irrigation, and it is clear that now that it has been decided to build the dam the other proposals for Nile control will be pushed into the distant future. Subsidiary benefits to Sudan, such as the completion of the railway link with Egypt, will probably ensue, but it is clear that to the Egyptians the most attractive features of the scheme are that its construction will provide much employment in the country and gave a great fillip to the economy, while after its completion control of the Nile will be so effectively in their hands that no manipulation of the control works upstream need cause them any anxiety. This last point is but the corollary of what has been said above about the loss to the Sudanese of the power site at Semna; though not stated expressly, it is clearly an aspect of the problem that has weighed very seriously in Egyptian thinking.

The agreement that has now been arrived at between Egypt and Sudan has been essentially a political affair. It has assured the Egyptians that Sudanese objections will not prevent the construction of the High Dam, and at the same time has given the Sudanese a much larger share of the Nile waters than their previous 4 milliards. Incidentally the division agreed at has proved strikingly close to that recommended by the writer in 1957 on the basis of the relative needs of the two countries.¹

¹ K. M. Barbour, 'A New Approach to the Nile Waters Problem,' *International Affairs*, 33 (1957).

THE REGIONS OF SUDAN

WE have already seen that Sudan is a very arbitrarily selected portion of Africa north of the Equator. A measure of functional unity has been imposed by the operation of a centralized administration for a number of years, but there is no formal unity to be observed, and conditions, both natural and human, vary widely throughout the country. These circumstances have suggested that while there are certain broad topics, particularly of physical geography or of the impact of government on Sudan, which are best studied for the country as a whole, a regional treatment will be more appropriate for the discussion of such topics as agriculture, animal husbandry, settlement, or communications, which are dependent on a multiplicity of local factors.

To a considerable extent a ready-made framework for this purpose is provided by the division of the country into provinces. Several of the provincial boundaries correspond to significant differences in the ways of life of the inhabitants of Sudan, and these in turn are related to the different physical conditions prevailing. Thus the Northern Province is the land beside the Nile from the Sixth Cataract to the Egyptian frontier; Equatoria and Bahr el Ghazal comprise between them almost all the parts of southern Sudan that are not liable to flooding, together with a part that does suffer from floods; the Upper Nile Province comprises most, though not all, of the territory occupied by Nilotes, and the Blue Nile Province comprises almost all the central clays adjoining the Blue and White Niles and the Rahad and Dinder rivers.

It has not proved convenient to follow the provincial boundaries in their entirety, however, because in several areas their boundaries reflect factors of history, or of administrative convenience, which bear little relation to normal geographical concepts. Thus in western Sudan, Darfur Province includes both the volcanic Jebel Marra and the thin-soiled country

to the west of it, and a portion of the Qoz sands which is wholly different in character. Similarly in eastern Sudan, Kassala Province includes not only a great deal of arid country suitable for nomadism but also the eastern end of the belt of peasant agriculture that stretches right across the country. The heavy clay soil of this latter area, incidentally, heightens its resemblance to the central Gezira area immediately to the west of it. Apart from the recent census, moreover, the supply of statistics referring to the country as a whole, as opposed to particular small parts of it, is very poor. There is thus very little advantage to be obtained from attempting to base a study of Sudan on the various administrative units and the figures available about them.

A second way of describing Sudan could be by distinguishing those units which, like the French *pays*, reflect the regional consciousness of the inhabitants of the country themselves.

Such an approach starts very well with units like the Merowe-Dongola reach beside the Nile between the Third and Fourth Cataracts, and is not inappropriate for the study of the Bayuda or steppe-land which lies in the loop of the Nile between Omdurman and Merowe, or for the Gwineb, which is the lowland strip of country along the Red Sea coast. Later, however, it becomes apparent that not all *pays* have clearly defined limits, or indeed mean the same thing to everybody. Thus the Butana and the Gezira are clearly defined by the Atbara river and the Blue and White Niles to the east and west, but there can be disagreement on how far they should be taken to extend to the south. The terms Kordofan and Darfur, moreover, have gradually been extended from relatively small areas, the one to the north of the Nuba Mountains and the other between El Fasher and Jebel Marra, so that they now include whole provinces whose inhabitants vary in physical appearance, racial characteristics, and ways of life.

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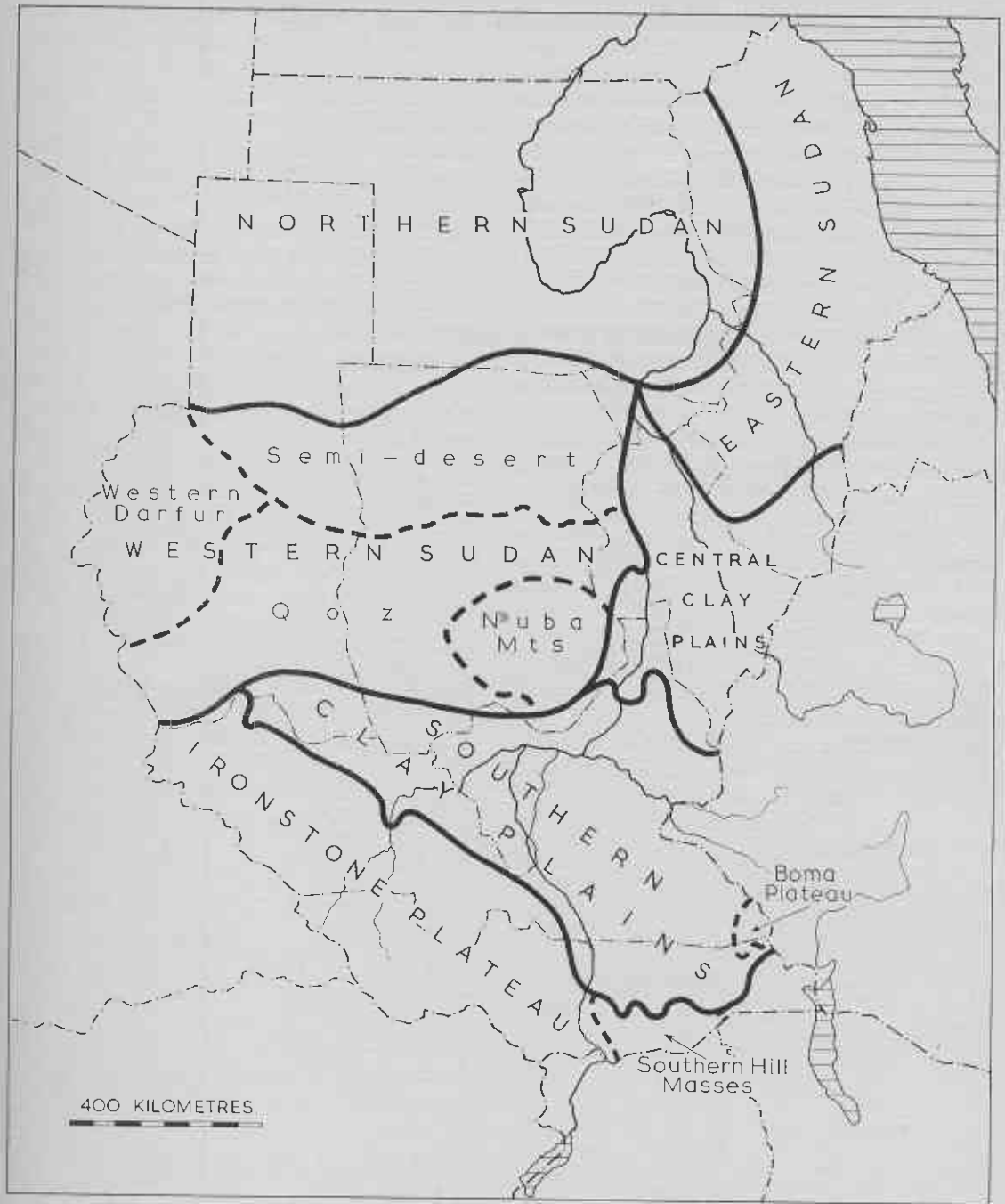


FIG. 50. The regions of Sudan.



In fact, a map of the *pays* of Sudan would be an intriguing but highly controversial contribution to the study of the country, and it would certainly leave a number of intermediate areas that could not readily be assigned to one *pays* or another, and yet had no obvious name or distinctive character of their own. The inescapable conclusion is that the regional geographer must define his own regions, using as seems appropriate to him such criteria as climate, geology, soils, vegetation, human types, or dominant ways of life. The number of regions he selects will depend also on the ease or difficulty of handling the material available to him, and on the degree of detail into which he proposes to go.

The regions that have been distinguished as the subjects of separate chapters in this book are as follows (Fig. 50):

1. Northern Sudan, which is very much the same as the Northern Province and includes all the lands beside the Nile below the Sabaloka Cataract, plus a belt of desert on either side.

2. Western Sudan, which includes the whole of the area of mixed nomadism and peasant agriculture that lies west of the White Nile in Kordofan and Darfur Provinces. The only exception is a very small area occupied by Nilotes in southern Kordofan. This region is subdivided into four sub-regions, Western Darfur, the Qoz sands, the Semi-desert and the Nuba Mountains.

3. The Central Clay Plains, which include the whole of the area of clay soil that stretches from Khartoum to the Machar marshes and from the Nuba Mountains to the Ethiopian highlands. A small area of clays in southern Butana is omitted from this region, because its rainfall is too low to support regular cultivation.

4. Eastern Sudan, which is the area of the Shukriya and other Arab tribes in the Butana, together with the territory of the Beja tribes in the Red Sea hills. This region is generally devoted to nomadism, but there are two large irrigated deltas within it.

5. The Southern Clay Plains, which include all the area of heavy clay soils liable to flooding in the Upper Nile basin.

6. The Ironstone Plateau and Southern Hill Masses, which include the extensive area of lateritic soils between the Upper Nile Basin and the Nile Congo watershed, the large hill masses east of the Nile in Equatoria, and the arid hills and plains of the south-east which stretch as far as Lake Rudolf.

In fact, even in a work of moderate length all these regions require further subdivision so that they can be described effectively. In the following chapters they are, nevertheless, submitted as a convenient framework within which to build up a general picture of the geography of Sudan today.

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NORTHERN SUDAN

THE considerable portion of Sudan which lies between the latitude of Khartoum and the Egyptian frontier may be divided into three quite distinct parts, namely, the desert, the Nile valley, and the Red Sea hills. The latter area will be discussed in Chapter XIV, while the two former may be taken together to constitute Northern Sudan (Fig. 51).

Climatically the desert and the Nile valley are alike, and this has led some authors to liken the inhabited lands to a continuous oasis stretching across the Sahara. The analogy is not a close one, however, both because the Nile is flanked by extensive alluvial soils that are lacking in the oases and because of the increasing tendency of the economic life of Northern Sudan to be integrated with that of the country as a whole, while in oases such as those of the Egyptian desert little more than a subsistence economy is possible. Moreover, Northern Sudan, unlike the typical Saharan oasis, supports a considerable animal population (Figs. 35-38).

THE DESERT

In the desert an apparently fortuitous coincidence is to be observed between the east bank of the river, where the igneous and metamorphosed rocks of the Basement Complex appear at the surface except in a few areas, and the west bank, where the Nubian Series of sandstones and limestones predominate. There are two zones of basaltic extrusions in the west, where extinct Tertiary volcanoes interrupt the relief as low hills.

The Nubian Desert

The Eastern or Nubian Desert enjoys at the present time an almost completely arid climate; towards the eastern margin, however,

there are several systems of watercourses, originating from the Red Sea hills, where occasional storms may occur at any season of the year.¹ The surface of the desert is stony or sandy, dunes and drifts of sand being frequent. There are a few considerable granitic masses, of which Jebel Korur at latitude 20° 30' N. is the highest, rising to 1,200 m. There are no oases, and underground water is scarce because of the absence of suitable permeable rocks; nevertheless, water is found at a few points in stream beds such as the Gabgaba and the Murrat Weko, and these formerly made possible a caravan route between Korosko and Abu Hamad.^{2,3}

The Libyan Desert

In the Western or Libyan Desert rain is even less frequent than to the east, and in the absence of a mountainous collecting area, water has had less effect in modelling the relief. Where the Nubian Series outcrops, the land surface is either a hard sandy or gravelly plain, or else a tangled wilderness of dissected hills consisting principally of sandstone. There are many areas of sand-dunes, especially towards the north-west where the great sand sea that divides Egypt from the central Saharan massifs is approached. The outcrops of the Basement Complex in the Bayuda Desert, between Shendi and Merowe, and in north-western Kordofan are sufficiently far to the south to receive an appreciable summer rainfall, perhaps 50-100 mm. (2-4 in.) and from them run several watercourses towards the Nile, such as the Wadi el Melik, the Wadi Muqaddam, and the Khor Abu Döm.

The extensive permeable beds of the Nubian Series permits the percolation of the occasional rains and their movement horizontally over

¹ These watercourses were probably evolved in late Tertiary or early Quaternary times, when a wetter climate prevailed over the Sahara.

² Count Gleichen, *The Anglo-Egyptian Sudan*, 1902.

³ The discovery of water in bore-holes at Stations 4 and 6 on the Wadi Halfa-Abu Hamad line proved of great assistance when the desert railway was being constructed in the campaign against the Khalifa in 1897-8.

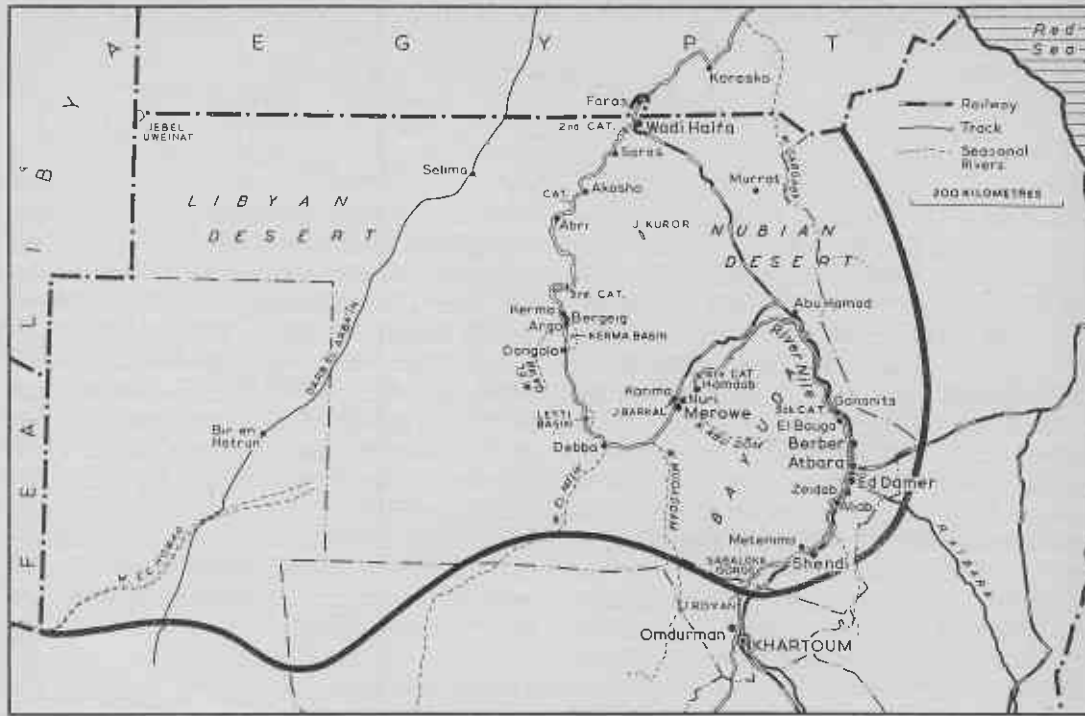


FIG. 51. Northern Sudan.

long distances, and in consequence where the ground level is low the water-table approaches the surface or may even attain it to form an oasis. There are several such oases of considerable size in the Egyptian portion of the Libyan Desert, but in Sudan there are relatively few, such as Selima and Bir en Natrun. However, these are too small to support settled populations, except for periodic military garrisons, but they have been of importance in providing a possible route for caravans away from the Nile. Until the beginning of this century the Darb el Arba'in or Forty Days' Road from Darfur in western Sudan to Asyut in Egypt was used regularly for the transport of slaves, gold, and ivory to the markets in Cairo. Those who travelled this way were compensated for their discomfort by avoiding the payment of dues to the many rulers along the Nile, and later by being able to evade the officials engaged in suppressing the slave trade. At Bir en Natrun there are deposits of natron (sodium carbonate 49.6%, sodium bicarbonate 27.4%), which was

formerly dug up and carried to El Fasher for sale.¹

In the extreme north-east of Sudan there is a considerable granitic mass, Jebel Uweinat, which rises to 2,000 m. Around the mountain there are a few wells where water can usually be found, but there is no permanent population. Towards the eastern side of the Libyan Desert there is a depression near Dongola, known as the Wadi el Qa'ab; this was probably at one time a part of the bed of the Nile, and has a silt and clay soil only a few feet below the surface. There are several wells where Arabs of the Gawarra tribe draw water, some untended clumps of date palms, and numerous bushes and low trees which provide a little grazing. The possibility of using this depression as a flood escape for the Nile was at one time under discussion, since its surface lies below the level of a high flood. A few topographic maps show the line of the canal that was proposed to fill it, but the project has never been undertaken, and now that more comprehensive plans for

¹ D. Newbold and W. B. K. Shaw, 'An exploration in the Southern Libyan Desert,' *S.N. & R.*, 11 (1928).

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THE NILE VALLEY

The Nile Valley sub-region of Northern Sudan comprises the Nile itself and the adjacent areas of alluvial land. The total width of this habitable strip is rarely more than 2 km., the river itself varying according to site and season. The sub-region is clearly divisible into reaches of greater and less productivity and wealth, which are largely determined by the nature of the rocks across which the river flows. Where these are strongly resistant to erosion, as for example the igneous rocks of the Basement Complex, the river bed is narrow, often broken by islands and cataracts, and there are few terraces of alluvial soil. Where the river crosses the Nubian Series, on the other hand, it has cut for itself a much broader trench, and fairly broad flanking terraces may be found on one side, though rarely on both. There are, moreover, many basins beside the Nile which were once part of the river bed. In the Shendi reach these are to be found almost continuously, on one or other side of the river, but in the Merowe-Dongola area they are more sporadic. The basins are floored with silt and clay, and at high Nile many of them are flooded either naturally or else through artificial channels. Recently pump schemes have been established in many of the basins, converting them in part to perennial irrigation. When the Nile flood is particularly high, large areas are liable to be flooded outside the pump schemes.

Taking them from the south, the reaches of the Nile in Northern Sudan are as follows (Fig. 52). Sabaloka is a gorge between steep rocky

walls, below which the broad Berber-Shendi reach extends as far as the Fifth Cataract at Gananita; thence almost to Karima lies a stretch of steep banks and a few fertile terraces, with the Fourth Cataract obstructing navigation at Hamdab. At Karima the valley widens and there is an almost continuous open reach with a strip of alluvial soil on one or both sides of the river in the Merowe-Dongola reach as far north as Kerma. Between Kerma and the Second Cataract, 20 km. above Wadi Halfa, the Nile follows a tortuous course between the igneous rocks, for there are numerous minor cataracts and obstructions to navigation, including the narrow Semna Gorge where the river's width is only 500 m., in addition to the Saras Gorge and the Third Cataract near Abri, and the Dal Cataract. Lastly, from just above Wadi Halfa there is a short stretch as far as Faras, where the country beside the Nile is much less hilly and the alluvial lands open out once more.

TABLE V
Reaches of the Main Nile in the Northern Province

Name	Length	Drop at Mean Gradient			
		Low Water			
	km.	miles	metres	feet	
Shendi-Berber	300	187	25	82	1:12,000
5th-4th Cataract	290	181	100	330	1:2,900
Merowe-Dongola	390	244	30	99	1:13,000
3rd-2nd Cataract	390	244	95	313	1:4,100
Wadi Halfa	30	19	n.a.	n.a.	
Total	1,400	875	250	824	1:5,600

n.a. = not available.

Vegetation found growing beside the Nile is remarkably uniform. It is most luxuriant in the open reaches, especially on the river banks and in the basins, where these have not been cleared for cultivation. It differs very little

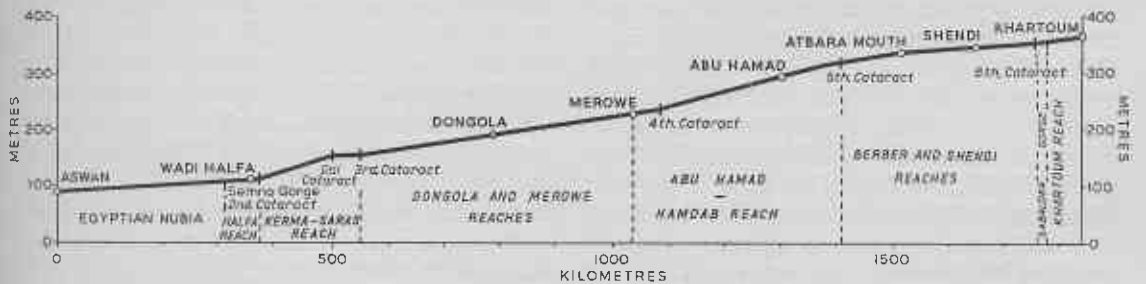


FIG. 52 Generalized section of the Nile in Northern Sudan. The vertical scale is exaggerated 1,000 X.

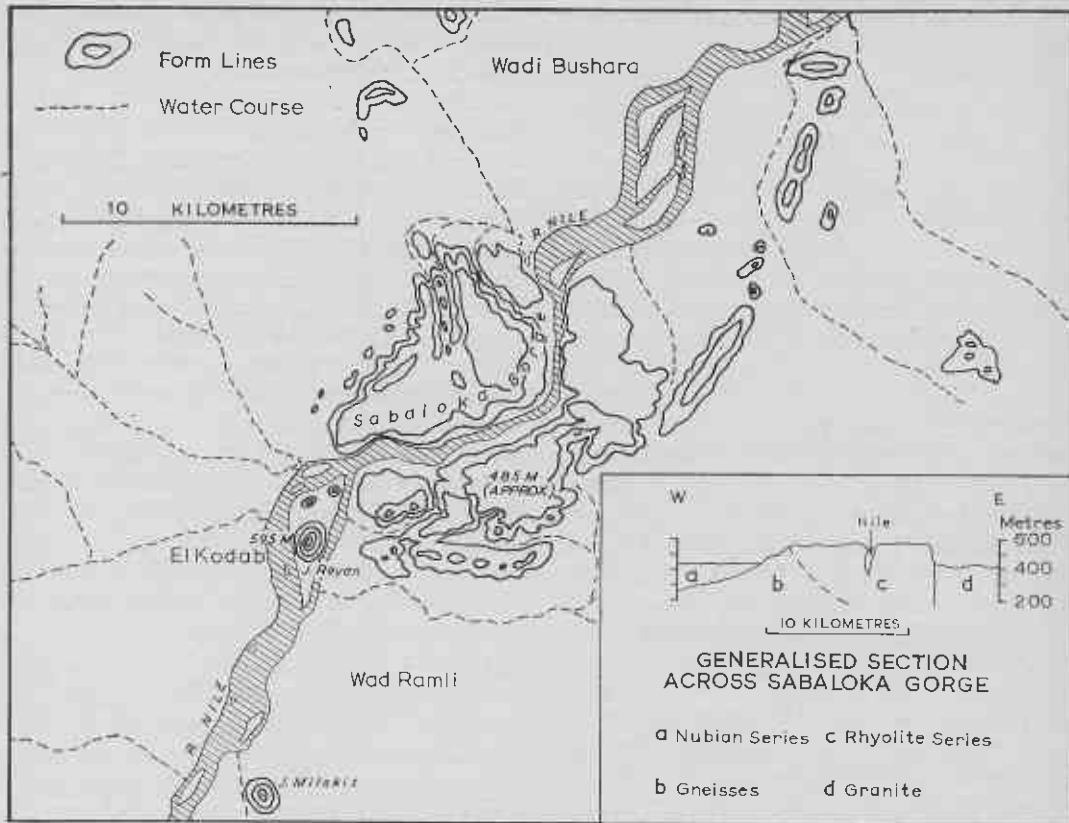


FIG. 53. Sabaloka Gorge. From *Sudan Surveys* 1:250,000, Sheet 45-N (1933) and *Agriculture in the Sudan* (1948), p. 88.

with latitude, except in that dates are less numerous and less reliable towards the south. Even so, the date palm is the most conspicuous indigenous plant everywhere. It has been grown in the Nile valley at least since the Second or Third Dynasty, and even now, despite its great value and the known possibilities of improving its culture, it is so little tended or cared for by the natives as hardly to warrant the title of a cultivated plant. At first glance the banks of the Nile appear to be almost wholly clad in date palms (*Phoenix dactylifera*, Plate XXI), singly or in clusters springing from a common stem, which present a continuous belt of green wherever there is a strip of alluvial soil between the river and the desert. On closer inspection, however, variations in the shade of green are to be detected, revealing the presence of a wide range of trees whose seeds are brought by the river from moister latitudes. These include the

branching *döm* palm (*Hyphaene thebaica*), the *sunt*, *harāz*, *talh*, and *hashāb* (*Acacia arabica* [also known as *A. nilotica*], *A. albida*, *A. seyal*, *A. senegal*), the *jammeiz* (*Ficus sycamorus*), the *terfa* (*Tamarix articulata*), and the 'aradeib (*Tamarindus indica*). Such trees spring up naturally on the cultivated lands, and are kept alive by irrigation until their roots reach the water-table. They are not uprooted or removed, though they may reduce crop yields, because of the need for their timber, especially that of the *sunt*, for house, boat, and *saqia* building, and for firewood. The *döm* palm is particularly valuable in house building as the support for the roof of a mud-brick house, for its trunk is stouter than that of the date palm, while its leaves may be woven into useful matting. The seeds of the *sunt* are collected for tanning, and those of the other *Acacias* provide useful fodder for domestic animals.

There are numerous herbs and grasses which spring up in the cultivations, to be carefully weeded by hand and fed to the animals. One perennial grass of creeping habit, *najil* (*Cynodon dactylon*), is present almost wherever field cultivation is practised, and seems to be accepted as a subsidiary crop because of the grazing it affords. In the Letti and Kerma basins, which are cultivated to a small extent only, the annual flooding supports a dense growth of trees and grasses, and these are of great value in the region for animal fodder and fuel.

The Sabaloka Gorge

The striking nature of the Sabaloka Gorge may be seen from Fig. 53: a mass of igneous rock about 10 km. from north to south and 8 km. from east to west stands up about 150 m. from the surrounding plain, and the Nile, instead of passing round one or other flank, has incised its bed through the middle, forming a steep-sided gorge which terminates in a cataract at the northern end. At the southern end of the gorge Jebel Royan is separated from the main hill mass by a distance of $2\frac{1}{2}$ km., with a branch of the Nile flowing in between. This hill consists of a mass of granite with a capping of Nubian Sandstone of particular hardness from which grindstones are quarried. The hill masses on either side of the gorge naturally provide neither cultivable lands nor sites for irrigation, and so they are quite uninhabited. There are, however, several water-courses which collect the drainage of the hills, and in these grazing for domestic animals may be found.

The cataract at the tail of the gorge makes navigation difficult for powered vessels at low water, while the rapid current that flows during the flood makes it little easier at that time. Since the railway was built running parallel to this reach of the Nile from Atbara to Khartoum, there has been no demand for regular passenger or goods services by water through the gorge. Because the land upstream of the gorge is exceptionally flat there is no prospect of using the site to construct a Nile reservoir of useful size, but it has been estimated that a

regular minimum of 50,000 horse-power of hydro-electricity could be generated if a small dam were built.¹

The Shendi-Berber Reach

The Shendi-Berber reach is the most populous portion of Northern Sudan. After passing through the Sabaloka Gorge, the Nile enters a broad trench with an almost continuous strip of alluvial land on either side. There is a tendency, most marked towards the north downstream of the confluence with the Atbara, for the Nile to shift its course from side to side over the years, but even so the area at all times available for irrigation, whether by pump or *saqia*, is extensive. As the river has swung from side to side in the past it has left a succession of depressions or basins, representing its former course, which lie at varying heights above its present bed. When the river rises in flood the basins are flooded, the area wetted depending on the height of the flood in relation to the floor of the basin. The basins where basin-type irrigation is still practised are indicated in Fig. 54. Several others have now been converted to perennial irrigation by pumps.

The climate of the Shendi reach differs slightly but significantly from that of the reaches farther north, there being a distinct rainy season in the summer, of two or three months' duration, when a rainfall varying from 25 to 100 mm. may be expected. As always on the fringes of a desert, the totals are extremely variable, but in most years the rain suffices to promote some growth of grasses and bushes away from the river. Date cultivation, on the other hand, is seriously hampered by even such low totals, which may cause the ripening fruits to rot and fall off the trees.

The natural vegetation away from the river is deceptively dense, especially in the sandy areas to the east. Animal rearing provides in good years a valuable supplementary source of livelihood for the population, but when the rains fail, as occurred in the summers of 1947 and 1948, a very high proportion of the livestock is likely to die of starvation, and persons wholly dependent on their animals may be reduced to destitution. Communications are fairly good

¹ H. A. W. Morrice, *The Development of the Main Nile for the Benefit of Egypt and the Sudan*, S. I. D. Technical Note 2/55, 1955.



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along the reach, for the natural desert surface provides tolerable motorable tracks with a minimum of expenditure, except at the crossings of sandy stream beds, while the railway keeps close to the east bank. This and the presence of sizeable markets at Port Sudan and the Three Towns have encouraged the production of relatively high-priced vegetables, fruits, and lucerne for animal fodder. Yet there is little doubt that in fact the region could produce even more crops and support a larger and more prosperous population, for the local Ja'aliyin are moderate cultivators only, and many would prefer, if they could, to live off their animals rather than off their crops.

The systems of agriculture practised in the Shendi and Berber areas differ little from those to be found elsewhere in northern Sudan, and so it has seemed convenient to defer a discussion of the topic until after the separate reaches have been described. The differences which serve to distinguish the reaches, such as the extent of land available for cultivation, the presence of valuable grazing lands for domestic animals, the ease and availability of communications, or the existence of various industries, have remarkably little effect in altering the general pattern of rural life.

Settlement in the Shendi area consists both of clustered villages and of houses or homesteads set in almost continuous lines beside the river on either bank. The former pattern is more usual where the risk of flooding makes it unsafe to build houses on the alluvial land, or else where a gravelly spur not far from the river offers a well-drained site. The pump schemes established in the Shendi basins are generally cultivated by tenants living in clustered villages near by. The line villages, on the other hand, are usually set so that each homestead occupies the width of land owned by the householder or by members of his family. A *sagia* built at the Nile's edge then supplies water to the fields before and behind the house, and also irrigates some fruit trees near the home and probably is the only supply of domestic water also (Fig. 41). There is a modification of the line pattern to be found in cer-

tain pump schemes, such as the government scheme at El Bauga. There the tenants have been allotted sites for building their houses and growing their fruits within their ten-*feddan* holdings, and yet live sufficiently close together for families to be able to visit one another easily and enjoy a sense of community life.

The disposal of surplus crops and the purchase of simple necessities take place at small markets held weekly at the larger villages, the ubiquitous donkey being used to carry both the villager and his produce to market. Motorable tracks connect the smaller markets with the larger centres such as Shendi, Metemma, Atbara, Berber, and Abu Hamad. The presence of the railway has undoubtedly been the reason why all but one of these centres is on the east bank of the Nile, yet lorry rather than rail transport is of the greater importance for local traffic. Even the distribution of goods from wholesalers in the Three Towns is mostly effected by lorry, for the speed and reliability of carriage of goods from door to door is found here, as in other countries, to outweigh the advantages of cheaper railway rates. There is a diesel-powered ferry for passengers and vehicles at Shendi, but elsewhere crossing the river is not easy, for the native craft that serve at numerous points are slow and their trips are infrequent.

Shendi

The two most important towns of the reach are Shendi and Atbara. The former has a long history, and it also includes an archaeological site of Meroitic age¹ that has yet to be excavated. The latter, by virtue of being headquarters of the national railway system, has grown in fifty years from a small village to a town with a population of 36,000 inhabitants. Shendi is the administrative centre of a district and also the principal market town of the southern part of the reach. It was once the seat of a military garrison in the early years of British rule, and it is becoming so again as Sudan's army is expanded on attaining independence. The usual trades of motor repairs, carpentry, tailoring, building, and pot baking are carried on in the

¹ The numerous small pyramids of ancient Meroe, near Kabushiya, date from the 25th Dynasty, when the Sudanese kingdom of Cush overran Egypt, and from the subsequent period when they retreated from there. Pyramids ceased to be built in the fourth century A.D., when Christianity spread to Nubia. A. J. Arkell, *A History of the Sudan to 1821*, 1955.

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town, and women also busy themselves making mats and baskets of grasses and palm leaves. Of greater significance for the future is the tradition of cotton weaving in the district, which had almost died a natural death under the influence of foreign competition when the recent boom in cotton prices came to Sudan. The sudden increase in the demand for the distinctive and prized Shendi *tōb*, with its coloured ends (this is a long outer garment worn by women, wound round their other clothes, when they appear in public) encouraged a number of Upper Egyptians to come and set up looms in the town, but even now there are only twenty-five of them, using imported yarn because there are no local spinning factories, and they are producing less than £10,000 worth of cloth in a year. There was once a proposal that a modern cotton spinning and weaving mill be set up about 20 miles to the north of the town, to enable Sudan to save foreign currency and be more independent of supplies from abroad. Cotton from the Nuba Mountains would be available as the raw material. The Shendi district was preferred for this project partly because of the available railway and water supply and partly to provide work in a region where there is marked under-employment.

Atbara, Ed Damer and Berber

Atbara was chosen as the headquarters of the Sudan railway system even before the Atbara river had been bridged (1899), and when the Port Sudan line was built Atbara was its obvious starting-point. From many points of view, Atbara matches Khartoum North as a town site, with the advantage of being closer to the ports but with the drawback that navigation upstream is checked by the Sabaloka Gorge. It is indicative of the whole country's undeveloped state that even now the only industry near Atbara, apart from the ginnery that serves the Zeidab scheme across the river, is the cement factory a few miles to the south which owes its situation to local supplies of limestone. Of the town's population of 36,000 the number of employees of the railway workshops and administration is 6,150 (1957). Ed Damer, 13 km. to the south of Atbara, is the headquarters of the provincial administration.

It is reported to have been chosen for the purpose when the Province Governor and General Manager of the Railways, both at the time resident in Atbara, were unable to agree on a point of precedence. The town is economically unimportant, though possessing some religious interest as the centre of an important religious sect, the Meghādhīb. The original *Faki Damer*, Muhammad el Maghdhīb, died in 1826. Berber, to the north of Atbara, is the headquarters of a poor district whose wealth may increase if more pumps are installed to irrigate the quite promising lands near by. The inhabitants have a reputation, however, for great quarrelsomeness in all matters relating to land, so success for such pump schemes cannot be regarded as assured.

Between the Fifth and the Fourth Cataracts

The stretch of Nile between the Fifth Cataract and Karima is one of the least populated along the whole of the river's length, for the river occupies a narrow trench incised into highly resistant rocks, and there are very few level terraces of alluvial land. In suitable sites a few pump schemes have been established, but for the most part the Manāsīr and Rubatab tribesmen must depend on small fields irrigated by traditional lifting devices; on the cultivation of islands and steep river banks when the flood subsides; and on their goats and sheep which find a limited amount of grazing and browse either by the river or in the desert beyond. The rugged nature of the country and the extreme difficulty that it presents to the traveller are well illustrated by the siting of the Abu Hamad-Karima railway line, which runs at an average distance of 15-25 km. (10-15 miles) from the river, and only comes down near it where there is a small village and a railway station. The railway thus does little or nothing to make communications easier for the riverain dwellers, but these are so few and their lands are so poor that the greater expense of building the line closer would not have been justified.

Climatically this reach differs slightly but significantly from the Shendi area, in that to the north of El Bauga the summer becomes virtually rainless. This ensures that dates can be grown much more successfully than farther

south, and compensates somewhat for the much reduced grazing available away from the river. Another difference is that below Abu Hamad the prevailing winds—north-easterlies—blow in the same direction as the river current for all but a couple of months in the year. This makes navigation rapid downstream but very difficult in the opposite direction. This fact is probably even more effective than the presence of the cataracts in preventing native boats from navigating between the Shendi and the Merowe reaches. Here and throughout the Merowe reach almost as far as Dongola, it is noteworthy that the prevailing winds pile up sand-dunes on the right or north bank of the river, so that most of the cultivable lands lie on the opposite side.

Both the Fourth and Fifth Cataracts have been studied as potential dam sites. The former has many advantages, in that it would be possible to store 10 milliards of water and to generate regularly 200,000 horse-power of electric energy, if a dam 50 m. high were built. The country that would be flooded by such a reservoir is very thinly populated, and there would be few persons needing resettlement or compensation for the loss of their lands. Downstream of the reservoir the many pumps which now use oil fuel could certainly be converted to electricity; the distance from Hamdab to Atbara, moreover, is less than 250 km., and so power generated at the dam could be made available for industries there.¹

The Merowe-Dongola Reach

Downstream of Hamdab a marked change in the topography is to be observed once the river leaves the zone of blackened igneous rocks and flows over the Nubian Series, here represented by an orange-yellow sandstone. There are a few isolated hills of the *mesa* type visible from the river, an outstanding example being Jebel Barkal on the right bank 2 km. from Karima, where numerous Egyptian remains of the eighteenth, nineteenth and twenty-fifth Dynasties stand, including several small pyramids.² The Nile usually flows in a single channel; when it is at its lowest the water surface is much

reduced, and extensive silt- or sand-covered banks are revealed. Appreciably higher, and so liable to be flooded only in years when the Nile is exceptionally high, there are silt terraces that were laid down when the river bed was higher and are now liable to lateral erosion.³ Between Karima and Debba there are several small basins which formerly were flooded when the Nile was high, but now have been protected by banks and converted to perennial irrigation.

Beyond the alluvial terraces the land rises gently on either side of the Nile to a sandy or gravel-covered plain of desert erosion. Apart from the local redistribution of material by summer storms, there is some down-cutting and deposition to be observed, particularly on the left bank, where several watercourses draining the Bayuda desert flow into the Nile.

Kerma and Letti Basins

Beyond Debba, whence the Nile flows approximately north to Dongola, the terraces become narrower, and there are no basins very close to the river. There are, however, two large basins, set at some distance from the right bank: these are the Letti and Kerma basins, whose areas when fully flooded are 70,000 and 7,000 feddans respectively. Each basin is floored with alluvial material that becomes progressively finer towards its northern end, and it seems that they must represent portions of the bed of the Nile at some fairly distant date. On the east side of the Kerma basin there is a remarkably straight line of cliffs about 40 m. high marking the edge of the desert, while on the western side a line of sand-dunes lies between the basin and a branch of the Nile. This branch, the Khor Argo, runs for 19 km. beside Argo Island, which was itself once liable to flooding but has now been converted to perennial irrigation. The island and the alluvial terrace to the west of the main Nile channel have between them an average width of about 5 km., beyond which there is a low ridge. On the other side of the ridge lies the Wadi el Qa'ab.

The type and distribution of settlement in the Merowe-Dongola reach differ so little from

¹ Morrice, 1955.

² Arkell, 1955.

³ At their highest these silts are found up to about 15 m. above the mean low-water level of the Nile, and so even those too high to be irrigated by *sagia* are within reach of pump irrigation.

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what has been described in the Shendi area that no special comment is called for, except to remark that the individual houses in Dongola and farther to the north are often conspicuously larger, and possess rather more elaborate internal designs. Nomadism is by contrast less important in the drier northern reach. Near Merowe members of the nomadic section of the Shaiqiya are to be found chiefly on the left bank of the Nile, their movements alternating between the river and the thin pastures of the Bayuda desert. They live upon the produce of their camels, sheep, and goats, and make a little money by the transport of dates and grain at the time of harvest. The mean homes that they occupy, small encampments of huts made of grass and *dōm* matting, bear witness to their poverty, and if it were not for the extreme inadequacy of the cultivable lands many would probably settle down as farmers. In the Dongola reach grazing is even less plentiful, except in the Wadi el Qa'ab and the Letti and Kerma basins, and Arabs are very scarce.

Rural Indebtedness or 'Sheil'

The marketing system of the area is generally similar to that adopted in the Shendi reach, numerous merchants in the little market towns acting both as buyers of local produce and as distributors of imported goods. The profession of merchant is highly esteemed, having been followed by the Prophet Muhammad, and is aspired to by almost every man who has a little capital at his disposal.¹ Although a shop-keeper's turnover may be small he supplements his income by the prevalent practice of *sheil* or money-lending without usury.

The underlying principle of *sheil* is that the peasant, being perennially short of ready money, pledges his crop in advance to a merchant, and receives in exchange cash, or more often his daily necessities, which thus constitutes a portion of the final purchase price. When he brings the crop in, he receives for it the balance of the price, but the total is a sum much less than the current market price for produce

freely sold. The difference is the extra profit made by the lender to reward him for having made the initial loan, and may be regarded as the interest or return on the money laid out. Sometimes debts are carried on from season to season, and the final result is that the cultivators receive a yet smaller return from their lands than their efforts have merited. Further disadvantages accrue to the community from the fact that more individuals are engaged in trade than the amount of business warrants, while investment in other forms of activity that might raise general living standards is neglected.²

Communications, Industry and Public Health

When the date harvest ripens in October the transport facilities of the reach are strained to carry all the goods offered, and native boats, camels, and lorries supplement the government service of barges and steamers that ply between Karima and Kerma.³ At other times the steamers usually operate at a loss, for with their rates adjusted according to the value of the goods they carry, they find that much of the most profitable traffic is captured by private lorries, which operate on a direct route between Omdurman and Dongola. This route was quite recently marked out (1948), and with virtually no maintenance costs has made Dongola much more easily attainable from the capital.⁴ A similar route direct from Karima to Dongola, known as the Maheila road, runs across total desert carrying passengers and goods much more quickly than the steamers can do. Motor transport is also aided by diesel ferries working at Merowe and Dongola. A regular air service was inaugurated in 1949 to connect Dongola and Merowe with Atbara and Khartoum, but the demand proved too small, and in 1951 it was replaced by a 'Northern Province Monthly Charter Flight', which, in turn, was discontinued in 1955.

The prospects of introducing any kind of industry to cure the chronic under-employment of the Dongola area do not seem good, for not

¹ The modern tendency to invest money in pump schemes has provided an alternative to the excessive dependence on trade.

² A brief summary of the inquiries of local officials into the problem of rural indebtedness has been written by M. W. Wilmington, 'Aspects of Money Lending in Northern Sudan', *Middle East Journal*, 9 (1955), pp. 139-46. The most authoritative source on this subject is an unpublished memorandum in the Northern Province Files by Sayed Dawood 'Abd el Latif, of the Sudan Political Service: this was drawn on by Wilmington.

³ When the river is low the steamers stop at Dongola.

⁴ J. H. G. Lebon, 'Desert Motor Routes in the Northern Sudan', *Geography*, 40 (1955).

only are raw materials, power, and markets lacking, but it must be recognized also that there is no tradition of craftsmanship or manufacture of any significance. The government has found it necessary to import all the wood-work and carpentry required when public buildings such as the new hospital at Dongola are erected, and private individuals, when they come on holiday to see their families, often bring with them rough deal tables, chairs, and even doors and windows that they have had made while they have been away.

The health of the Danagla and Shaiqiya, as indeed of most of the inhabitants of the Northern Province, is not generally good, for the incidence of bilharzia, malaria, tuberculosis, and trachoma is high. A particular disadvantage of the Dongola-Merowe area is that during the cool winter weather all outdoor work is made extremely trying by the presence of large numbers of small flies (*Simulium damnosum* and *S. griseicollis*). *S. damnosum* does not here carry the 'river blindness' (*Onchocerciasis*) for which it is feared in parts of southern Sudan and elsewhere in tropical Africa, but at all times of the day, and especially in the early morning and evening, both species, particularly the latter (Arabic *nimitti*) swarm round people's heads and get in their eyes, ears, and noses. This induces extreme irritability and causes men to swathe their faces in their turbans as they go about their business.¹

The Kerma-Saras Reach

The Kerma-Saras reach begins at the Third Cataract and continues through the tangled wilderness of hills and valleys known as the Batn el Hagar (Arabic 'belly of stones'), as far as the Second Cataract, 40 km. above Wadi Halfa. The extremely indirect course of the river is to be explained by the presence of the resistant rocks of the Basement Complex, through which the Nile has followed lines of weakness in eroding its bed. Numerous ruined temples and forts along this reach attest its importance at periods of Egyptian penetration of Nubia, particularly during the eleventh to twelfth and eighteenth to twentieth Dynasties, but today the area is culturally, economically, and politically a backwater, quite outside the

stream of current events. There is here no continuous line of settlements, but small groups of houses are to be found wherever patches of alluvial soil occur. The lift required for irrigation is often so great that two water-wheels have to be used in series to reach the highest cultivable land, and in consequence the people are generally very poor. Below Akasha, where there is a hot spring and a place of medico-religious pilgrimage, the hills of the Batn el Hagar rise sheer from the river, and there are very few villages.

There is no road of any kind on the west bank in this reach, and on the east bank the one motorable track, which is of execrable quality, approaches the Nile at intervals only. It follows in many places the track, still visible, of the railway which was built in 1885 to Akasha as part of the campaign to relieve General Gordon in Khartoum. In 1897 the line was extended to Kerma, but in 1905 the rails were removed after the desert line to Abu Hamad was built. Whether by native boat or by road, communications along this reach are so expensive that good dates from the area can hardly be sold in Wadi Halfa at a profit, yet the total produce is so small that no railway or metalled road could possibly be worth building. If the High Dam is built at Aswan according to present plans, this region will be flooded as far upstream as Abri when the reservoir is filled.

The Halfa Reach

The Halfa reach is limited to the south by the Second Cataract and to the north by the Sudan-Egypt frontier, beyond which most of the alluvial land is flooded when the Aswan Dam is full. In this short stretch there are cultivations irrigated either by pump or by *saqia*. The sole market of any importance is at Wadi Halfa, where the Sudan Railways system connects with the river steamers that run to Shellal, just above the Aswan Dam. The dock-yard, railway sheds, customs and immigration offices, aerodrome, and export-import agencies explain the growth of Wadi Halfa to its present size. There have on many occasions been plans put forward for extending either Sudan's or Egypt's railways to avoid the slow journey by

¹ D. J. Lewis, 'The Simuliidae of the Anglo-Egyptian Sudan', *Trans. Royal Ent. Soc. London*, **99** (1948).

steamer, but these have hitherto come to nothing. As the High Dam is built it will presumably prove necessary to complete the railway link, for the site of Wadi Halfa town will disappear when the reservoir is filled; the great variations in level, moreover, that are to be expected in an over-year storage reservoir would make it virtually impossible to provide the dockyard, loading and unloading facilities required by a steamer service.

AGRICULTURE

Agriculture throughout the whole of the Northern Province is in a state of transition, as a result of the introduction of cheap and reliable diesel-driven pumps to replace the traditional *saqia* with its bulls. Until the establishment of the government pump schemes during the First World War, virtually all agricultural lands in the region were irrigated by traditional means, but by 1955 the area commanded by pumps—approximately 150,000 feddans—was probably more than 50% of the total cropped land.¹

Systems of Irrigation

The traditional means of irrigation are of three kinds; they have given their names to several types of land, namely, *seluka* land, *saqia* or *shadūf* land, and the basins. By *seluka* land are meant the banks and islands which receive a sufficient wetting during the annual Nile flood to produce a crop without further watering. The *saqia* land means the high silt terraces above the flood which are irrigated by *saqia* (an ox-drawn water-wheel) or occasionally by *shadūf* (a hand-operated lever with counterpoised weights, Plate XXII), while the basins are areas into which the river used to flow when in flood, perhaps through a specially cut channel, so as to flood an area whose extent would vary considerably from year to year. The *saqia* or *shadūf* could be used to irrigate two or even three crops in the year, and thus formed the backbone of farming, whereas the other methods, dependent on the natural rise of the river in flood, could, of course, produce only one crop per year (Fig. 54).

Neither the figures nor the appropriate con-

ditioned maps are available to make a valid estimate of the total area of *seluka* land in the Northern Province, and indeed the task must be made more difficult by the fact that conditions vary considerably from year to year. In the course of time islands are frequently scoured away by the flood and redeposited elsewhere, and it may also happen that a thick layer of sand is laid down over a fertile bank or island, making it impossible to cultivate it. The total area watered by *saqia* may be estimated from the fact that the greatest area that one *saqia* can water is about 5 *feddans* when the Nile is at its highest, declining to perhaps 2 *feddans* when the river falls and evaporation is most severe.² In 1943 the number of water-wheels in the Northern Province was 9,456, and there are still nearly 10,000 of them. The latter figure has declined less than might have been expected in view of the rise of pump irrigation, the reason being that the growth of population has increased the pressure to make the most possible use of the land. Of the natural basins several have been converted in part to perennial irrigation. Those now remaining are shown in Table VI, with a statement of the area of each when flooded.

TABLE VI
MAIN NILE BASINS

	Area Flooded in Feddans (in a fairly good year)
<i>(a) Shendi Basins</i>	
Hugna	2,000
Wad Hamid	9,000
Basabir	5,000
Salawa	1,000
Sayal	3,000
Guweir	3,000
Taiyiba	1,000
Kelli	11,000
Kumeir	3,000
	<hr/> 38,000
<i>(b) Dongola Basins</i>	
Kerma	33,000
Letti	7,000
	<hr/> 40,000
	<hr/> Total 78,000

¹ See chapters by A. R. C. Bolton (Land Tenure), G. H. Bacon (Crops), W. N. Allan (Irrigation) and C. B. Tracey and J. W. Hewison (Northern Province) in *Agriculture in the Sudan*, 1948.

² Sudan Government, Ministry of Irrigation and H. E. P., *Irrigation by Pumps from the Nile in the Sudan*, 1955.

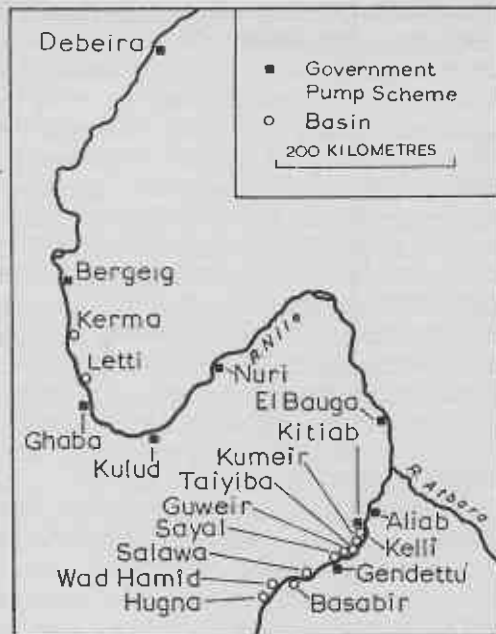


FIG. 54. Government pump schemes and areas of basin irrigation in Northern Sudan. From *Sudan Irrigation*, Khartoum, 1957.

When the Nile flood is below average the area flooded is drastically reduced, as appears in the following table:

TABLE VII
RANGE OF AREA FLOODED IN BASINS

	<i>Shendi</i>	<i>Dongola</i>	<i>Total</i>
1938 Very good Nile	41,000	62,280	109,280
1941 Poor Nile	6,050	4,680	10,730

In general the basins are popular because of the ease of cultivation and the fact that the yields usually suffice to cover the low irrigation charges, if there are any, quite easily. Some officials of the region declare that basin irrigation leads to indebtedness and irresponsibility in the peasant, who sees only too clearly that prosperity or poverty depends on the will of the Almighty rather than on his own endeavours, but judgments of this sort are too common in the mouths of the more fortunate to carry much weight, and it is certainly true

to say that some of the basin farmers are extremely diligent and skilful cultivators.

In the *saqia* lands three cultivation seasons are recognized—*shitwi* or winter, *seifi* or summer, and *damira* or flood. The *shitwi* season extends from November to March, and is the time when the cooler conditions encourage the growing of wheat as the principal crop, barley being also cultivated in the sandier and less fertile areas. Among the leguminosae *bersim* (*Medicago sativa* or lucerne) may be found in the fields in the winter, for it is a perennial crop, and *lubia* (*Dolichos lablab*) may still be being irrigated to produce a crop of seed, having been sown in the hotter flood season which it prefers. In the Shendi-Berber reach particularly, *fasulia* (*Phaseolus vulgaris* or the haricot bean) is grown both for export as dried beans and as a green vegetable, while farther north lupin and *ful masri* (*Vicia faba* or the tick bean) are grown where the winter is longer and cooler.

Summer crops are not very important, for the river is so low and the temperatures are so high that irrigation is difficult and unrewarding. Because of the shortage of animal fodder some *dhura* millet (*Sorghum vulgare*) may be grown, to be cut green, but apart from this the *saqia's* chief duty is to keep the perennial crops like lucerne and the fruit trees alive (Plate XXII). Dates, mangoes, and citrus must all be watered copiously if they are not old enough for their roots to have reached the water-table, and if pumps break down through overwork the trees die. The summer season extends from May to August, and so a second reason why field crops are not much grown is the danger that the river may rise before they are harvested and then may burst its banks and destroy them.

The flood season extends from August to November. It is the time of year when cultivation is easiest, because the river is full and the high humidity of the air reduces the need for water, but it is also the time when insects and other pests are most likely to attack the crops. Millet, *lubia* and maize are the principal *saqia* crops, and small areas of ground-nuts, sesame, and *bamia* (okra, *Hibiscus esculentus*) are also grown. On *seluka* land, much the most important crop is *lubia*, which provides both animal fodder from the leaves and beans, and

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human food when the beans are finally harvested. Millet and maize are also grown, the latter being most popular while still green and soft.

In the basins the soil is usually heavier than in the *seluka* land, and ploughing may be needed after the flood subsides to break up the surface to make a seed-bed and also to kill weeds. No rotation is practised, and in consequence pests which attack the crops and reduce yields are common. The most usual crops are *lubia*, millet, chick peas (*Cicer arietinum*), haricot beans, and wheat. In the Kerma basin the high yields obtained in the first few years of cultivation soon fell off as the soil became contaminated with salts. Subsequently, heavy flooding to encourage the washing out of the salts and the deposition of silt has brought some improvement, and now the wild lucerne-like plant *kiteih* (*Trigonella laciniata*) provides useful grazing outside the forest reserves.

Land Tenure

All the *saqia* land, like some of the *seluka* land and of the basins, consists of privately owned land that has been surveyed and registered since the earliest years of British rule in Sudan.¹ Because the inhabitants of the area are Muslims, when owners die the division of land between heirs follows the *Shari'a* law of inheritance. This has meant that though the holdings were mostly of quite reasonable size at the time of first registration soon after the reconquest, subdivision has taken place progressively as each owner has died and the smallest individual right to land today is extremely small. In fact, very minute areas are not demarcated or registered separately, for they would be much too small to be worked economically. Instead, when the size of individual shares falls below a prescribed minimum,² they are recorded as undivided shares, and then it is customary for one member of the family to act as the representative of several owners, working the land and distributing the yield to the owners or their representatives.³

¹ Over certain areas of *seluka* and basin land peasants had merely rights of cultivation rather than freehold tenure.

² This minimum cannot be expressed in terms of area, for it in fact depends on the width of the irrigable strip of land beside the river.

³ In practice the rights of absentee heirs frequently lapse.

⁴ The Republic of the Sudan, Ministry of Irrigation and H. E. P., *Sudan Irrigation*, 1957.

⁵ This method of sharing the profits of cotton cultivation bears a close family likeness to that adopted in the Gezira Scheme. The workings of such a distribution of shares are discussed in more detail in Chapter XII below.

The distribution of the crop on irrigated land is still further complicated by the customary division of shares between the *saqia* builder, the owner of the bulls, the land-owners and the persons who actually do the work of cultivating; all these have their traditional shares, several of which may accrue to the same person. In fact, frequent and long-drawn-out disputes about inheritance, the demarcation of land, and the distribution of profits from it have given the Northerners a well-merited reputation for quarrelsomeness, and it sometimes even happens that land is allowed to go out of cultivation for lack of agreement on the proper distribution of its produce.

The Modernization of Agriculture

The conversion of *saqia* lands and basins to pump irrigation is part of a process of modernization of agriculture in the Northern Province that is as yet incomplete. The first step was taken in 1904 with the establishment of the Zeidab concession, when 11,000 *feddans* on the west bank near Atbara were leased to a private company which intended to settle on the land numbers of freed slaves from the United States of America. When this scheme foundered, the concession was taken over by a company known as the Sudan Plantations Syndicate, which undertook the growing of cotton as a commercial venture.⁴ Despite some ups and downs caused by variations in the price of cotton the scheme has on the whole prospered, and is now in the hands of a wealthy Sudanese family. Tenants are responsible for the growing and harvesting of cotton in tenancies of 5-10 *feddans* each, and receive a 50% share of the profits in addition to some 2 *feddans* of irrigated land on which they may grow whatever they please, retaining the whole crop.⁵

The government's first venture into agriculture in the province, apart from setting up small gardens for the supply of fruit and vegetables to officials, was during the First World War, when irrigation schemes were inaugurated in a number of hitherto little-used basins

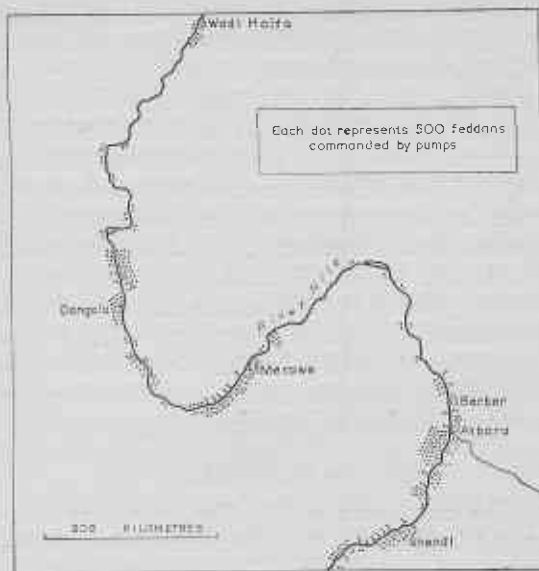


FIG. 55. Pump irrigation in Northern Sudan. From a map drawn by the author to accompany *Irrigation by pumps from the Nile in the Sudan*, Khartoum, 1955.

to avert the risk of famine in years of low flood. Despite various difficulties caused by inefficient cultivation, the schemes have continued to operate until the present time, their number having been increased during the Second World War by the addition of two new large schemes, Aliab and Bergeig (Fig. 54). In the government schemes there is no sharing of crops, the government taking its return by charging a water-rate which varies according to the crops grown. For many years now these government schemes have been run at a loss, the sums collected from tenants being inadequate to cover all the costs of fuel, maintenance, depreciation, and supervision that the government has incurred. Successive efforts have been made for many years to eliminate this loss, but if the water-rates were raised to the levels needed to cover costs, many of the tenants would have to abandon their holdings. It is, however, easier to diagnose such faults as over-staffing of government offices, poor agricultural practices on the part of tenants, or bad marketing facilities than to overcome them. Some officials have felt that the wisest course would be to dispose of the schemes to private individuals or to local co-

operative societies, though the withdrawal of the element of subsidy involved in their running would certainly be unpopular.

Despite the discouraging example of the government's schemes, there has been a considerable development of privately financed pump schemes, whose present distribution is indicated in Fig. 55. By taking advantage of the higher lift and output of a mechanical pump, these schemes have been able to bring under cultivation land too high or too far from the river to be irrigated by water-wheel. Sometimes existing *saqia* land is incorporated in pump schemes; sometimes channels are dug to enable *saqia* land to be irrigated from the pumps in return for a suitable water-rate; and sometimes nearby water-wheels are undisturbed and continue to operate as before. The most efficient schemes have undoubtedly been those where private individuals have acquired enough land to be able to set up schemes completely within their own control. These schemes are not popular with the local populations, who are usually associated as employees only, but some of the longer established private schemes are quite profitable.

The more usual types of non-government scheme are usually either private and commercial or else co-operative, though in practice they differ little. In each instance a pump is bought and installed, and canals are dug to command an area which may include both private and government, i.e. unregistered, land. The former remains in the hands of its existing owners, whilst the latter is shared out in tenancies, usually of 5 or 10 *feddans* each, and these are watered according to an agreed rotation, the crops being shared equally between tenants and the pump owner. When the pump is the property of a private individual and the scheme is being run as a commercial enterprise, he keeps any profit that remains after paying his expenses. This sum may be presumed to be sufficient in most years to reward him for his pains and his investment, since there is still a long waiting list of applications for pump licences. When the pump has been bought by a subscription between the villagers themselves, the scheme is called a co-operative one, and the profits, if any, from the scheme's 50% of the crops are used for the improvement of the

scheme, for works of social betterment in the locality, and for the payment of a dividend of not more than 12% to the shareholders. In the Shendi-Berber area the majority of the schemes are of the commercial type, whereas in the Merowe-Dongola area, and to a smaller extent near Wadi Halfa, the co-operative type is more common. The commercial pump-owners are usually businessmen or retired government officials, while the subscribers to co-operative schemes, who are required by ordinance to be local persons, often include members of the villages who have found work outside and are anxious to do something for the people left at home. Indeed, in view of the difficulties of communications north of Dongola and the high cost of fuel and spares, it is probably only philanthropic rather than commercial motives that have been able to bring about the establishment of pump schemes there at all.

The crops grown on the pump schemes differ little from those to be found on the *saqia* land. Yields are, however, usually better because watering can be more thorough and more frequent. On the other hand, the growing shortage of animal manure in relation to the area cultivated is having harmful effects on fertility which artificial manures can only in part restore. There is a common practice of digging sand from the desert and using it to enrich cropped land. Such manure, especially when it comes from the site of former habitations, provides a source of nitrogen of value to the crops. This practice is understandably deplored by the Antiquities Service.

It may be thought surprising that cotton, the most important crop both in Egypt to the north and in the Gezira to the south, is not grown in the Northern Province except at Zeidab, particularly since a major agricultural problem of the region is the low financial return to be obtained from the existing field crops. The reason is in part that the strict discipline required in proper levelling, ridging, weeding, and cleaning, if a success is to be made of cotton growing, is not readily accepted by the independent-minded Northerners. A more important problem, however, is that they cannot be prevented from growing such crops as *bamia*, which harbour the pests of cotton, throughout

the year, and in consequence pests abound and yields suffer. Renewed attempts are shortly to be made to grow cotton at Aliab.

Among existing crops quite high returns are to be obtained from lucerne, which is commonly grown among young fruit trees and also as a field crop at Gendetu. It needs a nearby urban market, being bought to feed the goats which many townsmen keep to provide a daily milk supply. The highest profits of all can be obtained from onion cultivation, which requires a great deal of skilled work in the preparing of seed-beds, transplanting of young plants, manuring, and harvesting.

High returns can also be expected from the growing of fruit trees, those best suited to the region being citrus fruits and dates. Of the former Sudan can produce a very good sweet orange, green in colour, while the grapefruit are of quite outstanding quality. The government's pomological section, with its headquarters at Nuri, has been vigorously engaged in propagating and distributing good species, and large numbers are now coming to bear fruit, after a set-back in 1946 when many young trees were drowned by the exceptional Nile flood. There are estimated to be 2,000,000 date palms in the Northern Province, which should be sufficient to supply the whole of the country's needs and to support a vigorous export trade. Unfortunately, of the existing palms more than half are self-sown seedlings of poor varieties which are not watered and give small crops only. Even the better palms are usually allowed to branch until six or more stems are growing from the same roots, and the yields are in consequence much lower than they should be. Experiments in government gardens have shown that if dates of good varieties are planted at the proper spacing, and if young shoots are removed as they appear, regular watering will bring an annual return of more than £60 to the *feddan*, the life of the trees being as much as 100 years. The main obstacle to the adoption of a rational policy of date production is that the ownership of date palms does not necessarily go with the ownership of the land from which they grow. When an individual tree may be shared between a dozen or more owners, it is an almost impossible task to reach an agreement to cut it down

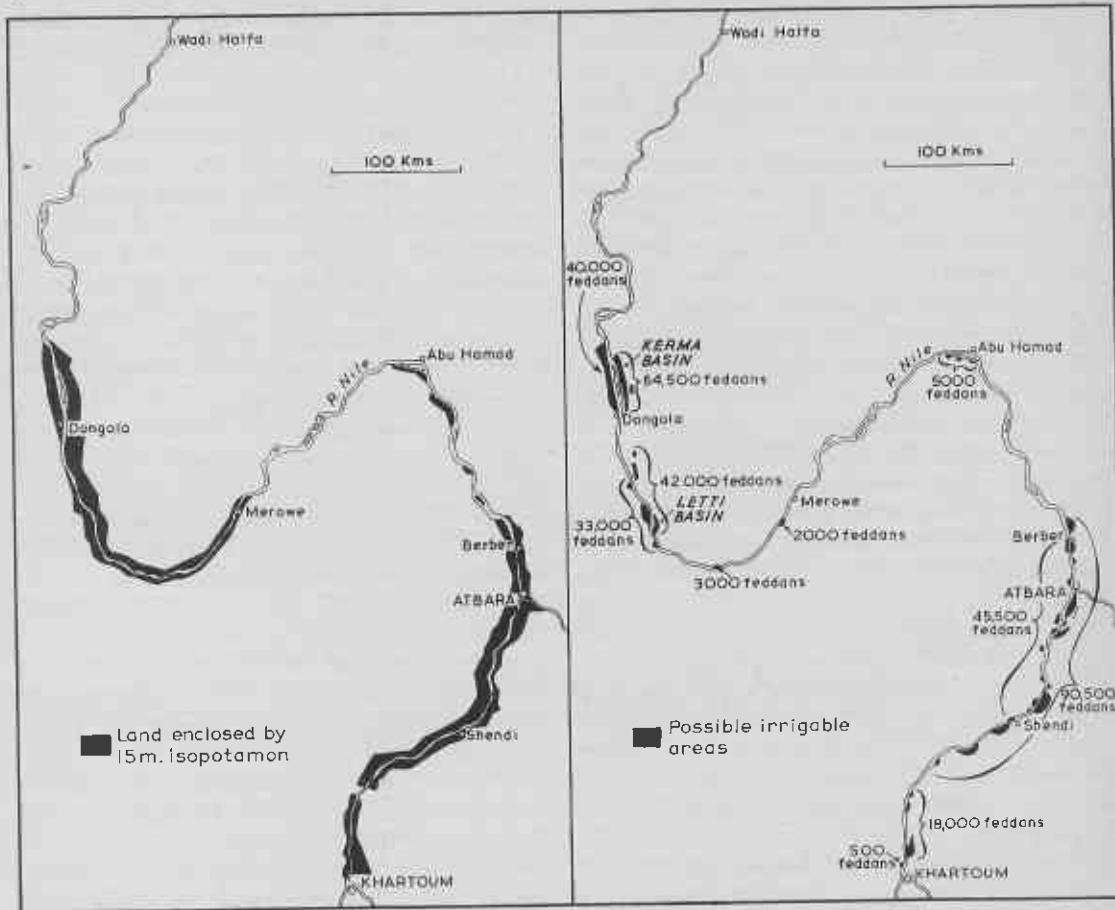


FIG. 56 *a* and *b*. Land enclosed by 15-m. isopotamon in Northern Sudan and areas recommended for extension of irrigation. These maps indicate the overall area to which water might be raised and the portion of that area where soils are satisfactory. In fact a lift of 15 m. is rather more than is generally regarded as economic today. From overprint to *Sudan Surveys* 1:100,000 series of Northern Province and a Report from the Soil Research Section of the Ministry of Agriculture, 1955.

and replace it with another that will not bear fruit for a number of years.

The government pump scheme at El Bauga, it will be recalled, lies near the southern limit of date growing. The scheme presents a most attractive appearance, for each 10-feddān holding contains in addition to the fields in the rotation a 28-feddān plot of dates and 1 feddān devoted to citrus fruits and a vegetable garden. Except in the fine gardens near Metemma there has been much less planting of dates or other fruit trees in the commercial and co-operative schemes, for there has not been sufficient agricultural extension work to make

known the results of the government's pomological experiments, while the owners and tenants are often too impatient to care for a crop that takes seven to eight years to bear fruit.

The economic limit to which water can be raised by pump has not been precisely determined; at present it is rarely more than 10 m. in the Northern Province. For the purpose of determining the ultimate irrigable area in the region a survey was recently conducted to locate the 15-m. 'isopotamon' on either side of the Main Nile, an isopotamon being defined as the intersection of the land surface with a plane

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at a given height above the mean low level of the river at its nearest point. The figure of 15 m. was chosen on geomorphological as much as on economic grounds, in that the highest alluvial terraces throughout the Northern Province are generally situated below the 15-m. isopotamon. While a lift of 20 m. is being attempted at Guneid on the Blue Nile, it is very doubtful whether anything more than 10 m. could prove successful where cotton is not grown. The survey included the digging of soil pits to investigate both the clay percentage and the sodium value of the soil; from it Fig. 56 has been drawn, which represents the whole area below the 15-m. isopotamon.

Yet even if the necessary capital can be found, as should be easier now that a new Nile Waters Agreement has been signed, to permit the irrigation of all these areas, there will only be a temporary lessening of the pressure of the population on the land in the Northern Province. The present tendency for the men to go away to find work, whilst leaving their wives and families in their native villages, reflects in part the fact that this is probably cheaper than trying to set up a home in any of the towns where work is to be found. It is also to be explained by the general conservatism and lack of education among the women, who are afraid to abandon their circle of friends and relatives and follow their husbands wherever they go. Certainly it appears that the influence of Islam and social custom almost entirely eliminates the problem, so common in other parts of Africa, of the wife who turns to other men's arms for consolation when her husband is away. The penalty

for a wife's infidelity would be complete social ostracism or even death.

Conclusion

Some reference is made above to attempts that have been made to introduce a wider range of industries in the province. Yet in a region where the people are spread out in so long a line, and where communications are in consequence both costly and difficult, it cannot be expected that emigration will ever be wholly unnecessary to relieve the pressure of increasing numbers. At the present time most of the educated Sudanese throughout the country can trace their ancestry to the Northern Province, whose interests are in consequence unlikely to go by default when government investment is planned for the country as a whole. However, as educational facilities spread throughout the rest of the country, this predominance is likely to decline, the process being speeded up by the growing tendency for educated Sudanese of whatever origin to settle on retirement in one of the Three Towns, usually Omdurman.

In this way local ties are being weakened and are being replaced by a growing sense of loyalty to the city and to Sudan. Yet at the same time the organs of dissemination of Sudanese culture—the press, the radio, the schools, the trade unions—remain principally in the hands of persons with a Northern Sudanese background. The paradox remains of a Land of the Blacks where Nubian and Arab elements occupy central positions in the State, and are likely to determine the course of national policy for many years.



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WESTERN SUDAN

WESTERN SUDAN is a term commonly used to refer to the whole of the provinces of Kordofan and Darfur, which together comprise more than 850,000 sq. km. (340,000 sq. miles). Despite the considerable physical differences which exist between various parts of this large area, there is some justification for regarding the whole extent as a single regional unit (Fig. 57). Climatic and vegetational zones, running from east to west, cut across distinctions of soils and relief, which run from north to south. The unity of the region, and its difference from comparable areas east of the Nile, become apparent when it is observed that negroid elements of great antiquity are widespread both in Kordofan and Darfur. Many of the Arabs and other nomads who are to be found in the two provinces have come from the north and west moreover (Fig. 58). Except among the Nuba, Islam is widespread and the Arabic language is accepted as the lingua franca everywhere. For the past century the administration has been directed from two main centres, El Obeid and El Fasher, and of these the former has much the greater commercial importance, being the entrepôt for all the trade of the west.

Within Western Sudan numerous subdivisions may be distinguished according to differences of structure, soil, climate, and vegetation. For convenience of description these will here be grouped together into four principal sub-regions, their boundaries being determined by physical phenomena but reinforced by differences in the origins, languages, and customs of their inhabitants. These sub-regions are Western Darfur, which extends rather beyond the administrative region of that name, the Qoz, the Nuba Mountains, and the Semi-desert.

An ubiquitous feature of the west is the absence of perennial streams, which means that during the dry season, lasting more than half the year, men and animals are confined to such limited areas as lie within the reach of permanent pools or wells. The region as a whole

is thinly populated, the 1955-6 census giving a population of just over 3,000,000 inhabitants and an overall density of twenty-three to the square kilometre (less than sixty to the square mile). This is unevenly distributed, however, for many areas with densities of more than fifty to the square kilometre exist, particularly in the Nuba Mountains, while in the Semi-desert lying to the north the mean density is less than two persons to the square kilometre. There is no doubt that a much larger human and animal population could be supported by the agricultural and grazing resources of the region, particularly if the water supplies could be extended, and rational grazing control could be instituted and enforced. In the accounts of the sub-regions that appear below, special attention will be given to the differences in structure and relief that make different methods of securing a water supply appropriate.

WESTERN DARFUR

Western Darfur, lying to the west and north of the Qoz sands, is one of the few habitable parts of Sudan where the solid geology is not masked by extensive superficial deposits. The region is made up of two distinct elements: the plain wherein outcrop various rocks of the Basement Complex; and the volcanic range of Jebel Marra, which consists predominantly of basalt together with some phonolite and trachyte. The general elevation of the plain is about 900 m. (3,000 ft.) above sea-level, the underlying platform of the continent having here undergone a slight upwarping along the divide between the Chad and Nile basins. The volcanic range rises to 3,000 m. (10,000 ft.) and dominates the drainage of the surrounding country, but its extent is not great, being only 50 km. (30 miles) from east to west, and 110 m. (70 miles) from north to south. There are also some smaller basalt areas to the north-west of Jebel Marra.

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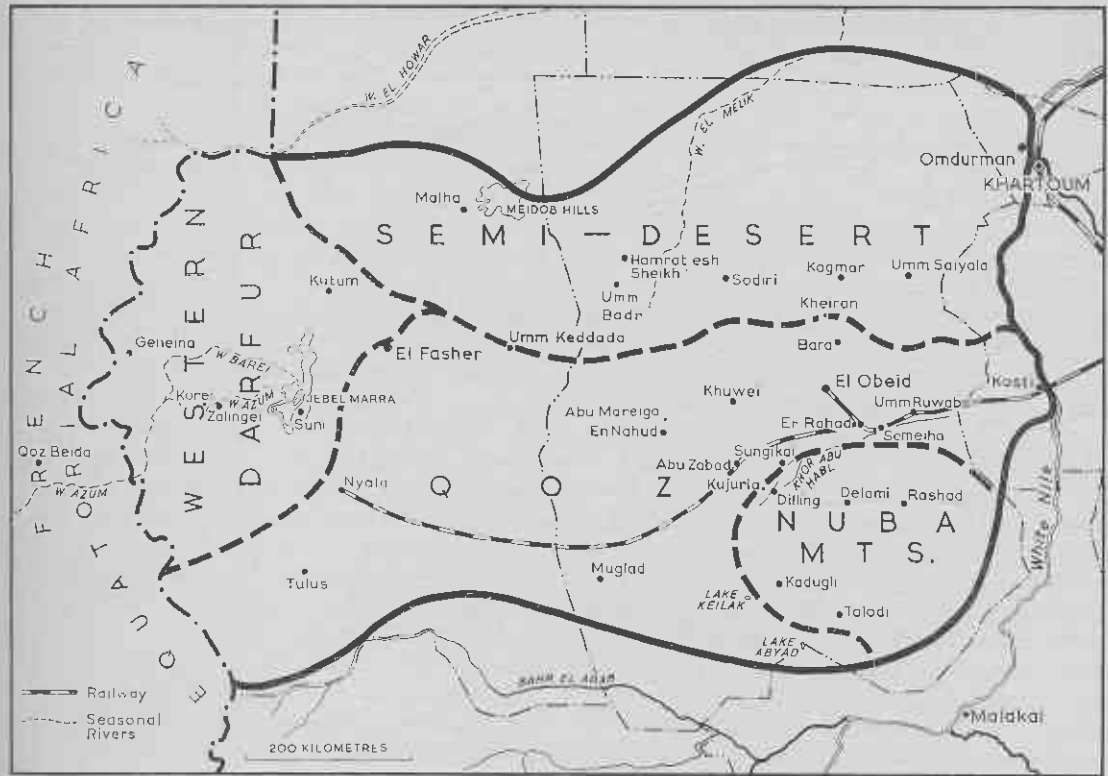


FIG. 57. Western Sudan.

The plain of Western Darfur consists of gently undulating country, dissected by local streams and by larger watercourses which drain Jebel Marra. The incision of the main wadi beds into the plain suggests that there is here a former peneplain whose drainage has been rejuvenated by uplift, while the presence of a number of flat-topped *inselberge* rising from 100-200 m. above the plain suggests the remnants of a still earlier peneplain. Just to the east of Jebel Marra and in the extreme west of the province near the border, there are some small outcrops of Nubian Sandstone which appear as low hills, and suggest that formerly much of the province must have been overlain by sedimentary rocks.

The rainfall of this lowland area varies considerably, from a bare 300 mm. (12 in.) at the fringe of the Semi-desert to more than 700 mm. (28 in.) in the extreme south where the Qoz

sands overlie the southern portion of the province. On the strength of both the rainfall and the natural vegetation it is appropriate to recognize two zones in the plain, a northerly and a more southerly. The former bears a vegetation described as *Acacia mellifera* thornland, and because the soils are thin and stony, with a few sandy patches, grazing is not good and the population is sparse and impoverished. The latter bears a denser woodland savannah, the Hill Catena variant of Low Rainfall Woodland Savannah, according to Harrison's classification, has better water supplies, and is altogether more suitable for human occupation.¹

THE NORTHERN ZONE

The more northerly zone reaches its northern limit where the Nubian Series overlies the Basement Complex rocks, there being also a marked

¹ M. N. Harrison, 'Report of a Grazing Survey of the Sudan', duplicated typescript circulated by the Ministry of Animal Production, Khartoum, 1955.

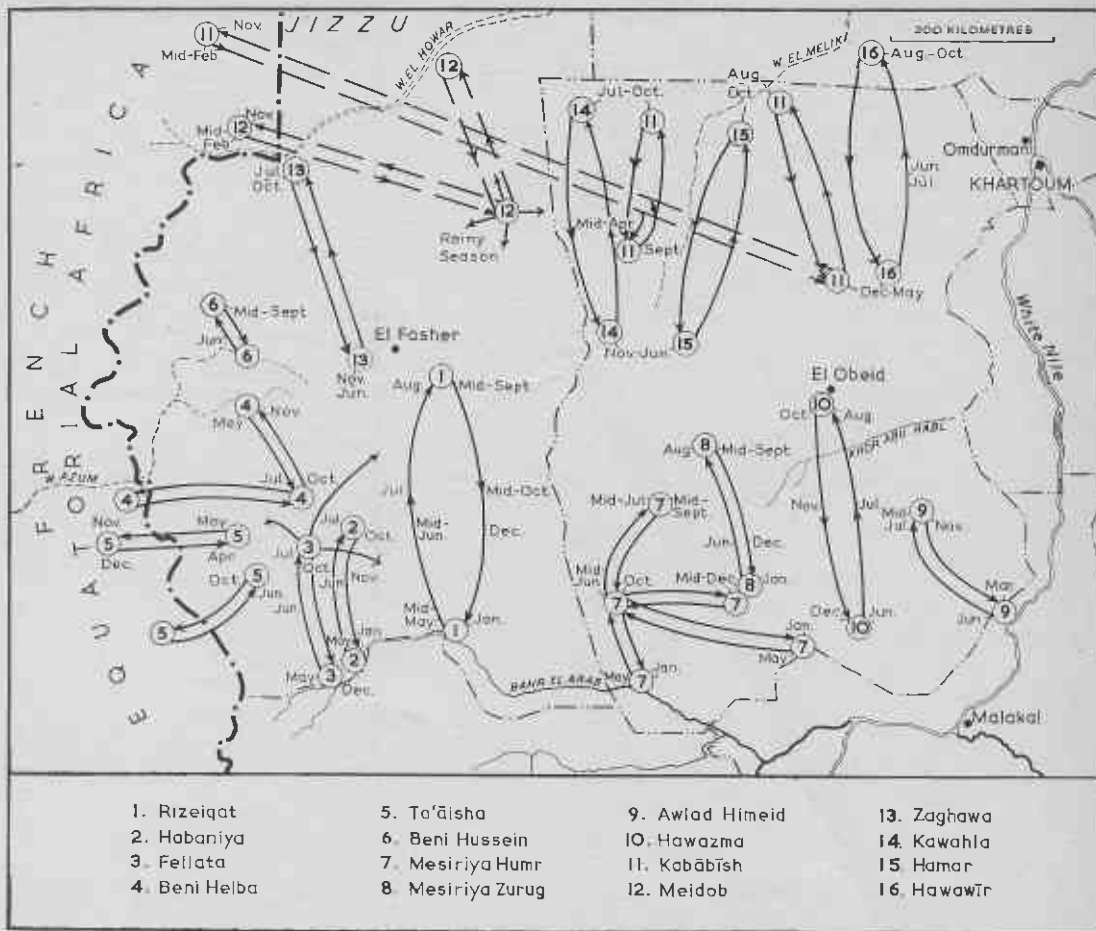


FIG. 58. Seasonal movements of nomads in Western Sudan. This generalized map of seasonal migrations in the west may be studied in conjunction with Figs. 35-38 (the distribution of animals in Sudan) and Fig. 33 (animal owners and animal herders). The winter migration to the Jizzu grazing, indicated by a broken line, depends on good late rains and does not take place every year. From information kindly supplied by P. Durran, the Ministry of Animal Resources, and other sources.

decline in rainfall towards the north and east. Since this zone lies close to the Nile-Chad watershed the streams carry little water, and in the dry season the wells dug in the sands and silts of the *wadi* beds soon dry up. Some official attention has recently been given to the problem of improving the water supplies, and it has been found that since deep bores are clearly out of the question the best policy is to build dams at suitable points on the streams to hold up summer flushes that at present run to waste.¹

The inhabitants of the zone are principally

Zaghawa, with small numbers of Fur and a few Beni Hussein and other Arabs, including some small sections of the Rizeiqat tribe. The stony country is not as suitable for the nomads' herds of camels as are the Qoz sands, and flocks of sheep and goats and a few cattle make up the domestic animals of the area. While the Rizeiqat live in tents and are nomadic, the other tribes are settled in villages and rely on cultivation as their chief means of subsistence.

The range of the nomads extends from the great *wadis* such as the Azum and the Barei in

¹ A. D. da Vajda, 'Some Aspects of Surface Water Development in Arid Regions', *F.A.O. Development Paper No. 21*, 1952.

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the south, whither they go to find water in the dry season, to the sandy soils overlying the Nubian Series at latitude 16° or 17° N. The latter area, known as the *jizzu*, has an importance that extends beyond the limits of the Semi-desert region, and even beyond those of Sudan, for when late rain falls a valuable association of grassy and herbaceous plants springs up in the cool weather and remains green and succulent until January or February, so that camels and sheep can be grazed upon it and need no other water supply. The chief species of value are *Indigofera bracteolata*, *I. arenaria*, and *Neurada procumbens*. Not only Zaghawa, Northern Rizeiqat, and Meidob from Darfur, but also Goran and Bedeyat from French Equatorial Africa, and most of all the Kabābīsh from Kordofan, send a number of their animals to the area in the care of their young men when reports of grazing are good, and both men and beasts eventually return to the tribal wintering areas in the best of health and spirits.¹

The cultivators of the zone live near the watercourses, and grow their crops in two types of area. Where patches of sand occur, as outliers of the Qoz, they grow bulrush millet (Arabic *dukhn*, *Pennisetum typhoideum*), since this grain can withstand even drier conditions than the common millet (*Sorghum vulgare*, Arabic *dhura*), which provides the staple food of the majority of the Sudanese. They also cultivate the sandy stream beds, sowing grain and vegetables when a flush has thoroughly wetted the soil. Near Kutum, the administrative centre of northern Darfur, which has a reliable water supply from wells, cultivation along the *wadi* is of great importance. There are fruit gardens producing citrus fruits and some of the few date palms of the province. These latter are of more interest as a rarity than as a commercial crop since the summer rains usually make the trees shed their flowers, after which they have to flower again, with the result that by the time the crop ripens the weather is too cold and the dates are of poor quality.² In the winter tobacco is grown, and irrigated plots of onions are culti-

vated by the women. The Wadi Kaja is the most reliable source of water in the area, but other *wadis* are less well supplied, and by the end of the dry weather many of the wells are almost dry, so that most of the Zaghawa villagers have to migrate to the south or west to live along the more reliable watercourses. Lacking the habit of frequent movement of the nomads, these villagers undoubtedly find their forced migrations a considerable hardship, and they settle outside the permanent villages of the Fur in temporary huts and shelters. The villagers who stay behind reap the harvest and protect their homes and lands from strangers.

THE SOUTHERN ZONE

In the southern zone of Western Darfur there is a gradual amelioration of conditions. The soil of the plains remains thin, stony, and infertile, but the streams which drain larger and wetter areas hold more water in their beds; they can therefore supply drinking water not only for the local inhabitants but also for the immigrants from the north, and for others from the south and east, who bring considerable numbers of animals with them. This is one of the most prosperous areas of the Fur, whose villages are situated beside the streams both to the east and the west of Jebel Marra (Plate XXIII). The broad, sandy stream beds offer permanent water supplies, which make for the stability of settlements and the continuity of development, and are flanked by valuable areas of alluvial soil, fertile and easily worked. These comprise terraces laid down by the main streams, derived not so much from the basalts of Jebel Marra as from the dissection of the volcanic tuffs within the mountain. There are also sandy or silty alluvial fans deposited by the local streams, which are favoured for cultivation. The nomads are attracted both by the water supplies and by the good fodder for their animals afforded by the *najil* grass (*Cynodon dactylon*) and by the pods of the *harāz* trees which fall in large quantities in the late winter.

As seems general in Africa at this latitude,

¹ Harrison, *op. cit.*

² Farther west in Nigeria dates are successfully grown at Fika, latitude 11° N., which has a much higher rainfall (750 mm., c. 30 in.) than Kutum; this is because it has proved possible to adapt dates to a changed environment, so that they bear their fruit in the winter, which is dry. Kutum lies in an intermediate belt between true desert and the moister conditions of Fika, and the date palms, which will have sprung up from haphazardly discarded seeds, cannot thrive there.



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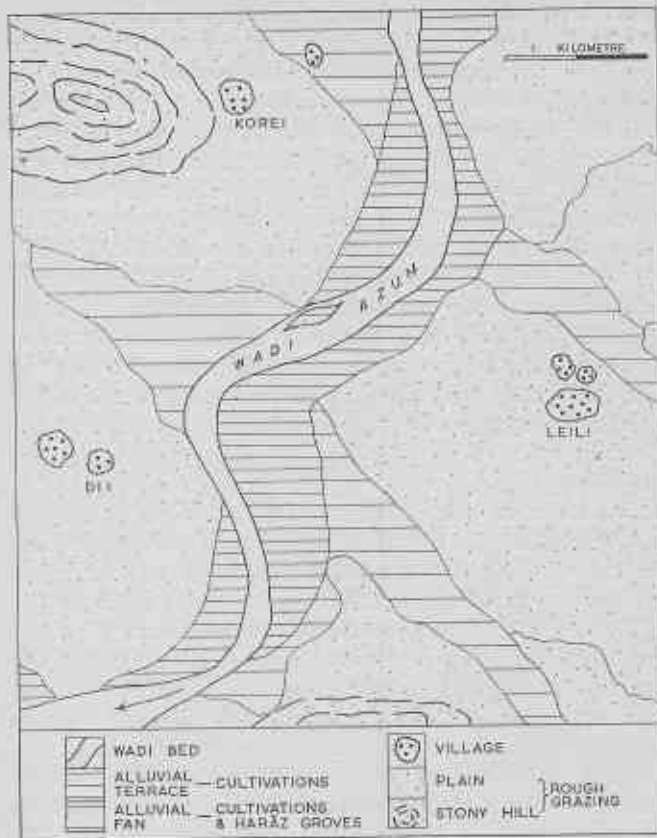


FIG. 59. Land classification and use in Western Darfur. From U.S.A.A.F. Trimetrogon Air Survey (1943) and local survey by the author.

where both nomads and settled villagers are found occupying a common territory, the Fur live exclusively in compact villages, varying from a bare 50 huts, which would indicate a population of 150-200 persons, to as many as 200 huts or more. There is evidence from the distribution of broken sherds and disused grindstones on many of the hills near the Azum that at some earlier date villages were sited in defensive positions, comparable with those occupied until very recently by the Nuba. Today, however, villages are built at a distance of about half a mile from the *wadi* bed, usually on a stony site where drainage will be rapid after rain.¹

The principal areas of cultivation of the Fur are to be found along the river terraces and on the sandy soils laid down by the minor *wadis*,

where groves of the *harāz* tree occur (Fig. 59). The land is cultivated every year, with only short periods of fallowing, but crop failures are rare since the soils are well supplied with plant foods and because the rains, especially on the western side of Jebel Marra, are fairly reliable. The staple crop is millet, and other subsistence crops grown during the summer include bulrush millet, used to improve the flavour of *dhura* porridge, and also ground-nuts, maize, sesame, and *bamia*. Sowing of the summer crops takes place in June or even July, rather than with the first rains in May, because of the probability of a dry spell in May or June which would be fatal to young crops. Maize and *bamia* are harvested green, but the main crops stand in the fields until November or December. Whilst clearing the land is the work of the men, women are expected to contribute to the work of weeding, and are subsequently responsible for harvesting, threshing, and bringing the grain into store. Many of them, moreover, cultivate crops of millet on their own, in the intervals between carrying out their duties of cook-

ing the family's food and caring for the children.

During the winter the women often burn and clear small patches of ground near the stream beds, and use them to grow green vegetables, especially onions (Plate XXIV). At the same time a few of the more enlightened men tend the fruit gardens that are to be found near the larger villages. Lemons and guavas are the most popular fruits, and mangoes, other citrus fruits, and bananas are now being introduced. Conditions are favourable, for the trees' roots soon reach the water-table, making irrigation unnecessary. The occasional frosts on winter nights, however, mean that trees may be hard to establish, and bananas can only be grown under the shelter of tall *harāz* trees. At Geneina (Arabic 'Garden') mangoes

¹ K. M. Barbour, 'The Wadi Azum', *Geog. Journ.*, 120 (1954).

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grow extremely well, and some are now transported in May and June as far away as El Obeid.

A long-established indigenous cotton is sown in the summer and treated as a perennial crop, being allowed to stay in the ground for three years or more, the lint being gathered as it ripens. The crop is of poor quality, diseased and giving a low yield, but centres of commercial production are far away, and there has as yet been no control by the administration. The cotton is used to produce a coarse native cloth, spinning and weaving being carried on in most families. In this as in their other trades the Fur show how peasants' traditions differ from those of the Arabs who live round about them, for while the nomads keep their personal possessions to a minimum, to reduce the labour of constant removals from place to place, the Fur have a greater need for self-sufficiency than the mobile Arabs and accumulate possessions with less embarrassment. Apart from weaving, the Fur also have members who can tan and dye hides and skins to make slippers; tailors and cap-makers who make garments ready to wear; smiths who make and repair spears, hoes, and knives; and women pot makers who form and fire water and cooking pots in a range of sizes. The dyes used by the tanners are today imported, and the source of iron for the smiths is now usually a broken lorry spring rather than a local ferruginous sand, but otherwise the craftsmen are almost wholly self-reliant.¹

Local Crafts and Markets

This self-sufficiency is a relic of earlier days, when Darfur's only link with Europe or the Mediterranean world was by the precarious *Darb el Arba'in*, a forty days' journey across the desert to Asyut and Cairo.² The crafts have persisted until today because communications with the rest of Sudan are still difficult and expensive, so that on the one hand there are few products of Darfur that can bear the cost of transport to central Sudan or to markets abroad, while on the other hand goods brought more than 800 km. (500 miles) from the rail-

head are rarely able to compete with local manufactures.

Commerce in Western Darfur consists mainly of an exchange of local products, and takes place at markets which are held regularly, usually at the larger villages. The markets attain their greatest importance during the winter months, for then the Fur have little or no work to do in the fields, and can readily spare the whole day to walk 15 km. (10 miles) or more to market, do a little buying and selling, and walk home in the evening. Objects offered for sale at the markets include baskets of grain and *bamia* and raw cotton brought in by the cultivators, limes and onions from the irrigated gardens, native thread and cloth, locally made hoes, knives and axe-heads, and occasionally some chickens, eggs, sheep, or goats. There is a section of each market devoted to the sale of native beer, brewed by women from millet, for few of the uneducated Fur pay heed to the Islamic ban on alcohol.

Camel-owning Arabs may also attend, buying grain and offering to carry loads to Geneina, Nyala, or El Fasher, while the Baqqara bring milk and butter and an occasional bull for slaughter. There are, moreover, several pedlars of various tribes who travel from market to market selling a mixed assortment of foreign wares. Sugar and tea are the only additions to the native diet apart from certain spices and Port Sudan salt, which is now generally preferred to the coarse native salt evaporated from the streams of Jebel Marra. The merchants also sell cloth for women's robes, the blue *töb* being worn increasingly in preference to local cloth. Other wares include beads, matches, razor blades and needles, mirrors, charms, sandal-wood and incense, the largest items being aluminium trays, tea-pots and tea-glasses. Coffee is rarely drunk, and can be obtained in the larger markets only.

The principal markets of the region, where trade is carried on every day, and where there are lock-up shops in which merchants can leave their goods in safety, are to be found in the administrative centres of the districts: Zalingei, Geneina, Kutum, and Nyala.³ In addition to

¹ Nyala, which lies on the borders of western Darfur and the Qoz, is chiefly important as an administrative and commercial centre for the Baqqara Arabs.

² *Idem*, 'The Wadi Azum from Zalingei to Murnei', *S.N. & R.*, 41 (1950).

³ W. G. Browne, *Travels in Africa . . .*, 1792-1798, 1799, 1806.

Jellāba, i.e. merchants from the riverain areas of central and northern Sudan, who are also to be found in the southern provinces and as far west as Nigeria, these towns support a few Levantine merchants, who generally make a rather better living than the Sudanese because they can supplement their dealings in local commodities with a trade in imported groceries and liquors. The consumers at these towns are the members of government departments and various locally recruited officials, together with the small number of urbanized members of local tribes. Away from the centres of government activity there is scarcely any commerce of importance, and hence few extraneous groups to be found.

At Zalingei and Geneina and beside several of the streams between El Fasher and Jebel Marra, e.g. the Wadi Golo, some of the more enterprising merchants have been encouraged by the presence of good soils and plentiful underground water to undertake commercial crop production on a small scale. Potatoes did well while there was an appreciable number of Europeans at El Fasher to buy them, and tobacco, intended for the manufacture of coarse snuff which is generally chewed rather than taken by the nose, has proved the one commodity which can bear the cost of transport to Omdurman. To grow these crops, suitable plots are leased from the tribal authorities, the labourers employed being usually westerners resident in the towns. The mangoes grown at Geneina are already dispatched for considerable distances into Sudan, and there is no doubt the crop could support a small canning or syrup-making industry if the capital were forthcoming.

Of other industrial prospects Western Darfur has at present none, both from the lack of raw materials and because of the difficulty of communication with the rest of Sudan. Now that the railway has reached Nyala it seems likely that the existing small transit trade which carries goods from Port Sudan to Wadai in French Equatorial Africa may well increase, particularly since the local authorities are making serious efforts to develop the production of cash-crops there.

JEBEL MARRA

The volcanic Jebel Marra is a small but quite distinct sub-region: it is a complete barrier to movement, whether for Arabs or for motor transport, and the streams to which it gives rise are responsible for almost all the pattern of settled life, as opposed to mere nomadism, that has been described above. The Jebel is here discussed in conjunction with Western Darfur because physically and linguistically its inhabitants are hardly to be distinguished from the lowland Fur, while their economy is even more nearly self-sufficient.

Jebel Marra has long been a refuge for the Fur in time of trouble, and contains evidence of settlement much more intensive than the present pattern. Apart from ruins such as those at Turra and at Jebel Killing there are traces of the system of terracing having formerly been extended nearly 3,000 m. (10,000 ft.) above sea-level. The range is generally agreed to be of Tertiary age, and consists of three principal elements: to the south lies the highest peak, on the rim of a much eroded crater, in whose centre are two lakes; to the north of this there is an extensive mass, almost as high, of alternate sub-horizontal basalt flows and accumulations of volcanic breccia; while beyond this mass to the north there is a number of isolated massifs and a confused topography of isolated plugs and subsidiary cones, which present a strange and irregular outline. Steep-sided gorges and areas of pumice, eroded to form a 'bad-land' topography, make movement difficult within the Jebel.¹

No climatic stations have been established on Jebel Marra, so the actual rainfall totals and temperatures experienced are not known. Essentially the climate is of the same type as that in the surrounding country, with a somewhat higher rainfall and generally cooler conditions. No rain falls in the winter, since the north-east trade winds are much too dry and the latitude is too far south for Mediterranean depressions to bring more than an occasional cloudy day. Observation suggests that the north and east sides of the mountain are appreciably drier than the south and west. This is explained in part by the fact that the prevailing winds in the

¹ R. T. Paterson, chapter on 'Darfur Province', in *Agriculture in the Sudan*, 1948.

summer come from the south-west, and in part, apparently, by the tendency noted above in Chapter III, for the convectional storms which form around the highest peaks to be carried westwards with their load of moisture by the winds which blow at upper levels. The vegetation of the Jebel is grassy savannah; trees are generally scarce and stunted, except beside the streams where tall *jammeiz* (*Ficus sycamorus*) and *harāz* abound. The wild olive grows on the higher part of the mountain up to 2,700 m. (9,000 ft.), and bracken occurs towards the tops. In general, affinities of species are as much with the Red Sea hills and the Mediterranean as with the mountain areas of Central Africa.

On the steep and relatively youthful slopes of the Jebel flat land is rare, and can with difficulty be spared from cultivation for the purpose of building villages upon it. The level areas of the central block of the Jebel are preferred for this purpose, there being a tendency to look for protection from the cold north winds of the winter behind a convenient hill or slope. Elsewhere settlements occur on spurs, while all but the steepest valley slopes are cloaked with terraces. These are constructed chiefly in order to protect the thin soil from erosion, but they also serve where there are perennial streams to make irrigation possible. This is by no means confined to fields beside the streams, for long channels following the contours carry water for considerable distances to wheat and barley fields and to fruit gardens.

In summer the upland or Jebel Fur grow millet and maize, and various vegetables and relishes, very much as in the plains, but in winter they also grow some irrigated bearded wheat and barley. Cotton and tobacco are rare, and among the few cash-crops are red peppers and small red tomatoes, which are dried and exported to markets throughout central Sudan. Small fruit gardens are common, producing fine Italian lemons and guavas of exceptional quality in addition to the usual limes.

Domestic animals are relatively scarce in the Jebel; there are no camels and cattle are of a small breed. Donkeys are the normal means of transport, and are used to carry the products of the Fur to the markets of the plains. The leopards which abound in the mountain are a menace to all the smaller animals, and stone

leopard traps are to be seen near most villages. Baboons are also common and do much harm to the crops. For government purposes trains of mules are employed to carry baggage, goods, and officials along the narrow stony tracks that provide the only means of communication.

In general, it may be said that the Fur are less prosperous in the Jebel than in the plains. The difficulties of their rugged environment are reflected in the general meanness of their villages, whose stone-walled huts seem to merge into the dark basaltic rocks and soil of the countryside, in the backwardness of domestic crafts, and in the poorer standard of clothing worn. In its policy of developing fruit gardens throughout the country the government has made an effort to exploit the Jebel's soil, climate, and water. The most important garden is at Suni, which lies about 1,200 m. (4,000 ft.) above sea-level. Sub-tropical fruits such as apricots and mulberries do well, but those needing a cool resting season, such as apples, cannot adapt themselves to such low latitudes. The chief value of such gardens lies in raising seedlings, and in providing vegetables as an amenity for government officials. The transport costs are too high for any of the gardens to be run as economic concerns.

El Fasher

For purposes of administration and trade Western Darfur is not regarded as a distinct province or region, but is governed together with portions of the Semi-desert and the Qoz from El Fasher, the historic capital of the Kingdom of Darfur. This town lies in the zone where the sand-dunes gradually peter out, not in a single abrupt line but in an irregular alternation of clay valley-bottoms liable to flooding and dunes of red sand. El Fasher itself is built on two sandy ridges on such a site, the intervening valley being occupied by a football pitch, a seasonal lake, and a number of cultivated plots. The surface water supply of the town is provided by the Wadi Hallouf, which flows into the lake. Water for animals is also pumped from the reservoir on the Wadi Golo 15 km. to the south. For drinking water there is now a total of fourteen deep bores, sunk to an average depth of 55 m. to tap the Nubian Sandstone, and these supply several water-yards.

In El Fasher town, as in every commercial and administrative centre in Sudan, the population is considerably more mixed than in the surrounding country. Apart from Fur, therefore, there are settled Arabs, *Jellāba*, a few Levantines, a number of westerners and a very small number of merchants from the Fezzan, together with the officials of the provincial administration, now entirely Sudanese, the senior officials being mostly from the riverain areas in the east. There is also a military garrison, recalling the days when Sultan 'Abd er Rahman and his successors here built the sturdy palace which is now occupied by the provincial governor. The town has been until recently the entrepôt for almost all the province's exports and imports, with the exception of camels, sheep, and cattle sold on the hoof; it lies, however, at the end of a fearful 650 km. (400 miles) of road across the sand-dunes to El Obeid, and there is a growing tendency for commercial lorries to follow the southern route to Nyala, which lies in a potentially wealthier zone, and has now become the terminus of the railway extension to the west.

Communications and Trade

The imports of Darfur cannot be satisfactorily distinguished from those of the country as a whole, since no statistics are available for commodities carried by road. They differ chiefly in that machinery, private cars, high-quality goods of any kind, and perhaps most noticeably bicycles (because of the sandy roads in the towns and the poverty outside them) are all very rare in the province. Apart from a few shops serving the needs of officials, the goods offered for sale in El Fasher are essentially the same as those already described in the country markets. Sugar and tea and bales of cloth form the bulk of lorry loads. Petrol is brought in four-gallon cans, which are later used for carrying water, and are also employed in the *semm* trade described below in Nyala.

The principal exports are tobacco, which is wrapped in mats woven of palm leaves, *semm* (clarified butter), and soft cheese, which are carried in petrol tins and hides. Since a large proportion of the province's exports consists of cattle, which go on the hoof to El Obeid, lorries find it harder to get loads when running east-

wards than on the outward journey, and so their rates are lower. The cost of transport is too high to encourage the tapping of gum except in the eastern part of the province.

Communications in Darfur are especially liable to interruption during the rains. While the surface of the sandy roads over the Qoz is improved by rain, the clay patches near El Fasher become impassable when wet, so that even after considerable expenditure by the government on road building it is still not possible to reach Geneina or Nyala during a spell of wet weather. To the west of Jebel Marra 'Irish bridges' of brushwood and stone are laid across the *wadi* beds, and once broken by the stream they cannot be repaired until late October. The road to Geneina is of importance, apart from its local value, as a section of the trade and pilgrim route which crosses the continent from west to east. The frontier lies not far from the economic watershed between Port Sudan and Port Harcourt, but a certain amount of the import trade of Wadai in French Equatorial Africa comes by this way, particularly goods such as cloth from the Far East. Numbers of cattle are quietly driven into Sudan across this border every year, and consumer goods such as cloth and sugar are taken back in return, prices in Darfur being generally cheaper than in Wadai. Some of this trade, however, is contraband, and naturally keeps away from the main road. The most regular traffic along the road consists of *fellāta*, Muslim pilgrims bound for Mecca from French Equatorial Africa, Nigeria, and beyond. These people come to be known later in their journeyings as the 'westerners' who are to be found in many parts of central Sudan, and constitute a valuable labour force in the cotton-growing areas.

Ways of introducing new cash crops to Darfur

These have been the object of some study since the Second World War, for the conjunction of good soils, potential irrigation water, and lower temperatures has suggested that it might be possible to dispense with imports of various commodities and so to strengthen the country's economy. The crops investigated in 1945-7 were tea, coffee, tung, and some other oils, but it generally appeared that physical conditions were not very favourable and that

suitable extensive soils were lacking. It was thought that enough sugar-cane might be produced to support a small factory, though it was not at all certain that the prospect could be made attractive enough to interest a private investor, and it was recognized that from the point of view of improving the local diet it would be beneficial to grow more pulses. Where certain of the streams on the eastern side of the mountain spread out over deltaic fans, tobacco might be grown of higher quality than that now cultivated for the snuff trade, but tribal grazing and cultivation rights are involved, to say nothing of the initial experiments that would be required. In fact, the difficulties of starting a successful and profitable venture are considerable and so far no faction has been taken. During the recent war there was extensive felling of the best timber of the region, especially of mahogany and *inderāb* (*Cordia abyssinica*); these are now being replaced in government plantations which should meet local needs but which because of transport costs cannot be expected to supply the other parts of Sudan.

During the years of high cotton prices (1951 and 1952), there was a strong local demand for help to be given to growing cotton in the areas of clay soil towards the fringe of the Qoz in the Nyala district. Some cotton was in fact grown and exported, but the problem of providing sufficient ginning capacity imposed a limit upon expansion. Subsequently, prices have fallen, and no longer warrant the transport of cotton up to 800 km. (500 miles) by road to the rail-head at El Obeid. The southern Darfur railway will probably make this cotton-growing economic, especially if transport rates are adjusted to help outlying regions.¹ The search for mineral wealth in the region has hitherto proved unsuccessful. The local salt produced by the hill Fur cannot compete outside the Jebel with Port Sudan salt, and supplies of limestone are barely sufficient for local needs.

THE QOZ

The area of sand-dunes may be seen from Fig. 24, the map of main soil categories. Its northern limit coincides approximately with

the transition from the Semi-desert to the Low Rainfall Woodland Savannah. This line lies slightly to the north of the limit of permanent settlement and sedentary agriculture. It thus happens that the wholly nomadic tribes range between the Semi-desert belt, where they spend the rainy season and have most of their tribal headquarters at points providing permanent water supplies, and the northern fringe of the Qoz, whither they migrate at the end of the dry season to enjoy the first of the rains. (Fig. 58.)

The eastern and western limits of the Qoz may be defined as the edges of the sand-dunes, which in many places peter out into isolated dunes, increasingly interspersed with clay-covered flats and depressions, rather than come to a distinct end. On the southern side, as on the northern, nomadic tribes range in their annual migrations across both the Qoz and the lands beyond, which in this case consist of broad clay plains. Since their tribal headquarters lie within the Qoz, they will be described in this section.

Within the Qoz there is astonishingly little variety of scenery or natural conditions; almost everywhere the ground is gently undulating, covered with a mantle of grasses and herbs and low scattered trees whose size and density increase gradually from north to south in accordance with the rainfall. The few hills that appear at the surface consist either of resistant granitic masses from the Basement Complex or of inliers of Nubian Sandstone. The former are to be found principally to the east of El Obeid, constituting an extension of the Nuba Mountains, while the latter occur farther west and provide, *inter alia*, the landmark that has given its name to En Nahud. ('The Breasts' in Arabic). In both areas the hill masses are too small to warrant special attention. There is, on the other hand, a rather low area to the north of El Obeid, the *Kheiran*, where the water-table comes so near to the level of the ground as to have a direct effect on the lives of the local inhabitants.

The ways of life of the inhabitants of the Qoz bear a certain similarity to the pattern observed in Western Darfur, in that there are

¹ In 1956 some American cotton was grown on the *wadi* terraces of the Wadi Arwalla 70 km. (45 miles) south of Zalingei, and gave extremely high yields.

nomads to the north, settled cultivators in the centre, and nomads to the south. An important difference, however, is that in Western Darfur the chief areas of cultivation are found on the favourable soils beside the stream beds. In the Qoz, on the other hand, soil conditions are more uniform, and the distribution of the cultivated areas is to be explained by a variety of physical, historical, and economic factors. These include the presence of reliable water supplies, the siting of the Kosti-El Obeid railway and the El Obeid-El Fasher road, and the location of the principal belt of *hashāb* (*Acacia senegal*), which yields gum arabic. The significance of these factors is liable to alter with the passage of time, for the modern development of deep bores can provide new water supplies, while the siting of the new railway along the Rahad-Abu Zabad-Nyala trace will greatly diminish the importance of the El Obeid-El Fasher road. The more southerly portions of the Qoz, with their heavier and more reliable rainfall, should ultimately prove more suitable for permanent settlement than the En Nahud area, especially for the production of cash-crops such as sesame and ground-nuts.

THE NORTHERN OR CULTIVATORS' QOZ

At the present time the location of the main belt of settled cultivators corresponds to the greater density of population along the Umm Ruwaba-El Obeid-En Nahud axis (Fig. 31, Chapter VII). The principal tribes involved are the Gawama'a and the Dar Hāmid in the eastern area along the railway line, the Bedeiriyā around El Obeid itself, and the Hamar, whose headquarters are at En Nahud. Though all these tribes have Arabic names and genealogies which they trace back to the original inhabitants of the Arabian peninsula, the only genuine Arabs among them are the Hamar, the remainder being Nubians, only slightly modified. These latter have long been settled cultivators, but the Hamar owe their way of life to the fact that during the troubled years of the Mahdiya they lost their herds and flocks to other more powerful tribes. The same fate overtook several of the Baqqara tribes farther south. It is interesting to speculate whether the success of the Baqqara, rather

than of the Hamar, in building up their herds again is to be ascribed to greater physical courage and determination, to the greater difficulty of clearing cultivations in the more thickly wooded southern Qoz, or to the presence farther north of the principal belt of *hashāb*, conveniently situated along the trade route from Kosti through El Obeid to El Fasher, which has supplemented the incomes of the settled tribes.¹

The actual location of the cultivators throughout the region is mainly determined by the presence of permanent water supplies. Although it is not necessary that each village should be sited beside a well, it is imperative that when other sources fail villagers should be able to go with their donkeys to a nearby well area to bring back full waterskins. If such a supply is not available within half a day's journey, say 25 km. or 15 miles, the whole village may have to migrate after the harvest and settle where water can be more easily procured. Thus the concentration around En Nahud may be explained by the large and reliable well area in the town. There is as yet no problem of land hunger, for the area is still very thinly populated. Similarly, around Khuwei farther to the east and at Abu Zabad, water and good markets for grain, gum, and melon seeds attract the population.

A further factor determining the choice of village sites is the use that is made of the baobab tree (Arabic *tebeldi*, *Adansonia digitata*) to supplement water supplies (Plate VI). As was noted by Ibn Battuta in his visit to Timbuctu in the fourteenth century A.D., the soft pith of this tree can be hollowed out, leaving a 'tank' which is used to store water during the dry weather.² Khuwei lies at the centre of a large *tebeldi* grove, a fact which gave it some importance as a settlement before the recent drilling of a number of deep bores that now give a plentiful supply of water. *Tebeldi* bark may also be used to make excellent rope, but if too much is removed a tree's value as a water container is impaired.

El Obeid

El Obeid itself, the administrative centre of the province and railway terminus, owes its

¹ J. Smith (1950), Plate IX.

² H. A. R. Gibb, *Ibn Battuta: Travels in Asia and Africa*, 1929.

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importance to the plentiful supply of water which its position in a slight depression encourages to collect within reach of shallow wells. The town overlies a basin-like mass of rotted acid gneiss, with the result that when water has descended too low to be drawn out from hand-dug wells it is not lost but can be extracted by pumps. The town's water supply has, nevertheless, given rise to considerable anxiety as the population has grown over the last decade, for the two large reservoirs which supplement the underground water do not always fill if the rains are poor. New reservoirs have recently been built at Banno, 11 km. (7 miles) to the south of the town and near Jebel Wad el Bagha, 40 km. (25 miles) away, and water is pumped from them and from Khor Taqqat, 8 km. (5 miles) to the east, to supplement the town supplies.

During the dry season villagers come from a considerable area to El Obeid for water, and the urban perimeter has been denuded of vegetation by the grazing of animals and the cutting down of trees and bushes for firewood. To check this tendency, which leads to strong dust-laden winds blowing through the town's broad streets, enclosed forest reserves have been established for an average distance of 3 km. all round, and the growth of grass and bushes within these reserves has been remarkably rapid.¹

To the east of El Obeid the country along the railway line is densely populated in comparison with the land to the south and north of it. Here, near the southern edge of the Qoz, the water supplies are distinctly better than elsewhere, for there are several points where the dunes overlie patches of clay whereon perched water-tables may exist not far from the surface. The northern portion of the Nuba Mountains, moreover, is drained by a stream, the Khor Abu Habil, which is probably responsible for much of the water that percolates down into the Umm Ruwaba Series, and also feeds a number of surface pools along its length. The various railway stations provide convenient markets for gum and grain, and there is reason to believe that overpopulation in the area is causing a deterioration of the soil and

vegetation. Around each village extensive stands of the 'Dead Sea apple' (Arabic *Ushar*, *Calotropis procera*), which no animal will eat, give an indication of the overgrazing, over-cultivation, and excessive cutting of firewood which distinguish the area.

Crop Production and Animal Husbandry

Around El Obeid and to the west the uniformity of the soil limits the possibilities of cultivation. Except in the Kheiran the ground water is never close enough to the surface to permit the growth of irrigated crops, and the country people's needs of cereals, vegetables, and vegetable oils must be met from production during the limited growing season in the summer. The principal grain sown is bulrush millet, which is grown on lands which, after being cleared, remain under cultivation for a period of four or five years, until yields fall too low. A quick-maturing *dhura* millet is also grown as a staple crop. In each man's fields there is also likely to be a plot of water-melons, grown not only for the sake of the seeds, which are sold, but also for the moisture contained in the pith and rind, which is of great value to men and animals.

Near the villages smaller plots are grown of *bamia* and sesame (*Sesamum indicum*), enclosed with thorn fences to keep out animals. While still green *bamia* is picked, sliced, and dried for use throughout the winter. Sesame seeds are added to food for their oil. Within the enclosure or compound that surrounds every group of huts further crops of a garden type are grown. Maize is sown to be eaten green before the main harvest (the rains would probably not suffice to bring it to maturity), there are a few red peppers, and gourds are planted to climb over the thatched roofs, since, until the recent adoption of cheap imported hardware, they were almost the only type of receptacle available, and they are still widely used. Ground-nuts provide a cash crop and a useful addition to diet, but they have not been much cultivated in the past.

The total area cultivated by a man and his family is estimated to be between 3 and 10 *jeddans*. In a good year this provides enough

¹ Sudan Government, Appendix XIV, 'El Obeid Town Perimeter Protection', in *Soil Conservation Committee's Report*, Khartoum, 1944.

grain for all to eat and a surplus for sale in the market towns, but if general opinion is to be accepted, such years, at least in the northern part of the cultivated Qoz, occur only about once in five. At other times the crop is barely adequate, and far too often it happens that crops fail altogether and the cultivators are forced to sell from their scanty flocks to keep themselves alive.

The sheep and goats owned by the cultivators yield regular supplies of milk and hair, and when they die provide the raw material for water-skins, buckets, and other appliances. If he can afford it a man also likes to have a donkey to ride on and to use in carrying produce to market. Few cultivators possess camels because of their high cost and because they do not stand up well to wet weather. Goats are often criticized for their omnivorous habits, and it is true that around the towns and large villages, where they are kept to supply milk, they eventually destroy all vegetation except the Dead Sea apple. Elsewhere, however, they probably do no more harm than any other animals kept in the bush, and there is little reason to believe that the desert is encroaching on the grazing areas as a result of their depredations.

Among the settled Arabs smiths and pot-makers are not common, partly because of the absence of raw materials and partly because these are crafts more often found in tribes long accustomed to village life than among Arabs. The curing of hides to make water-skins is understood, use being made of the pods of the common *Acacia arabica* as a source of tannin, but for fair quality leather slippers or saddles the villagers have to go to the urban markets. From the undyed hair of their domestic animals some of the women spin thread and use it to weave coarse rungs to put on the floor or walls of their huts. They also weave girth-straps and saddle-bags to use on their donkeys.

Gum and Melon Seeds

Reference has already been made to the collection of gum from the *Acacia senegal* which grows wild in the Qoz. Its principal, but by no means its only, occurrence is in a belt which

roughly coincides with the Kosti-El Obeid-En Nahud axis, and here it may be found in almost pure stands. Near the villages private ownership of 'gum gardens', as they are called, is recognized, in the sense that once a man has cleared and cultivated land any gum trees that may subsequently grow up on it are his to tap. In unclaimed areas, especially towards the north where villagers are fewer, any man is usually free to tap gum in the territory of his 'omodia'.¹ The collecting of gum is almost entirely confined to the winter and early summer, and thus does not clash with farming. In November, or later if the grain harvest has been heavy, young men go into the bush with small axes, with which they tear off strips of bark from the gum trees. Returning at intervals of a fortnight or three weeks, they collect the globules of gum that have been exuded by the plants to protect their wounds from excessive moisture loss through evaporation. With the coming of the first rains the trees cease to bear, and any gum that has been rained on is sold at a lower price. When enough gum has been collected to fill a sack, or at least to justify a trip to the local market town, the gum is taken to the gum auction and sold.

On the same journey the cultivator will often be carrying a sack of melon seeds, which are also sold by auction. Though the melons would be well worth cultivating for the sake of the water that they contain, a man who is diligent in collecting his seeds can hope to sell them for almost as much as his gum. Attempts to use the seeds to produce oil commercially have been unsuccessful, but as long as the Egyptian public is keen to buy them to chew, the cultivator will have reason to be satisfied. Early in 1957 the Egyptians decided for reasons of financial stringency to ban or restrict the import of melon seeds and Sudan dates. This could have been a severe blow to the people of Kordofan and the Northern Province, but the restrictions were soon relaxed.

Recently, some investigations have been made by the Ministry of Agriculture into ways of improving cultivation in the Qoz and relieving the serious poverty of the peasants. Experiments conducted near Sungikai to the

¹ K. D. D. Henderson, 'Note on the History of the Hamar Tribe', *Sudan Government Administrative Memo No. 2* (1935), and Appendices.

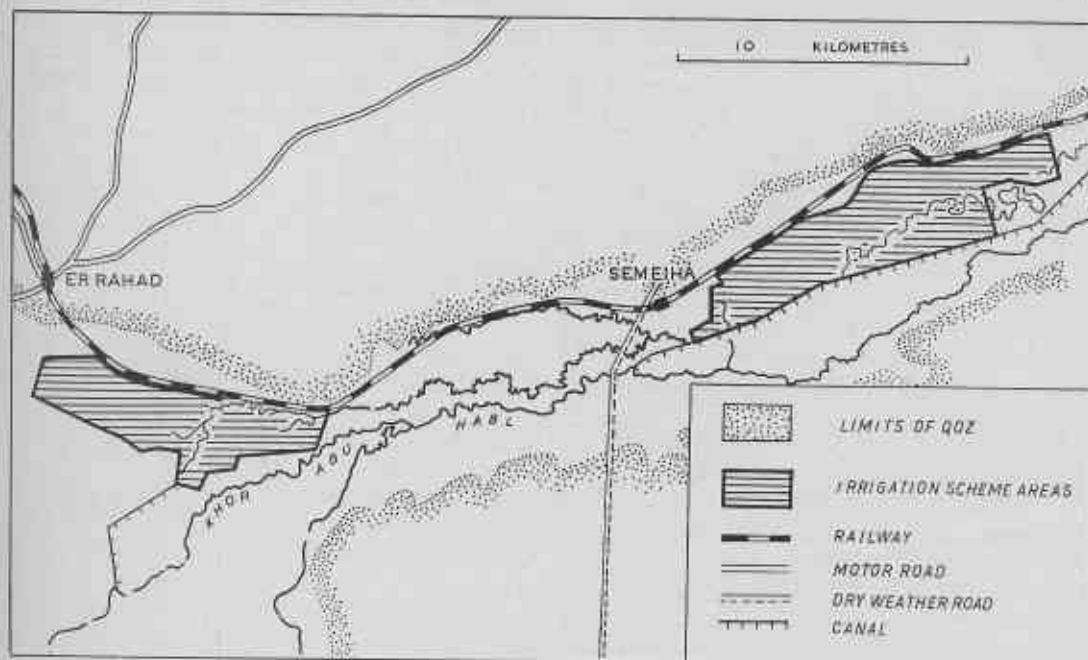


FIG. 60. The Khor Abu Hahl scheme. From information kindly supplied by the Ministry of Agriculture.

south of El Obeid showed that ground-nuts could yield a paying crop. No satisfactory way, however, has yet been found of enabling a peasant to till a much larger area, and no marked increase of income can be derived from hand-tilling and hand-weeding. Probably the uncertainty of the rains and the relative infertility of the soil are such that peasant rather than plantation agriculture must remain the basis of the economy of the Qoz, since a high cash return is required if it is to satisfy the investors in any scheme of agricultural expansion and give a reasonable living to local participants.

The Khor Abu Hahl

The one successful agricultural scheme that has been initiated by the government for the benefit of the inhabitants of the Qoz lies just beyond the limits of the sands. This is known as the Khor Abu Hahl scheme, and is dependent on a watercourse which drains the northern portion of the Nuba Mountains and brings down every year two or three notable flushes of water (Fig. 60). The possibility of using some of the flood water for irrigation was first proposed in 1919, but it was not until the end of

the Second World War that a preliminary investigation was carried out. This was considered favourable, and in 1945 a first area of 4,000 *feddans* was canalized, to be followed by 10,000 more the following year. At first the cultivation of *dhura* was attempted, and the local inhabitants from the villages on the Qoz immediately to the north were associated as share tenants after the style of the cotton-growing Gezira scheme. It soon proved that a fundamental error had been made in attempting to irrigate the clay soil according to the Gezira system of frequent light waterings; the flow of the *khor* is much too irregular to permit this to be done. Likewise, flush irrigation over extensive areas, such as is practised in the deltas of the Gash and Baraka rivers of Eastern Sudan, was not suitable because with its higher clay content the soil is less permeable than the silts of those deltas. In the end the scheme has been reduced to 5,000 *feddans* only, water being led into basins of not more than 30 *feddans* with banks all round. After these have received a single thorough flooding cotton is sown to produce seed for the cotton-growing areas of the Nuba Mountains. Being drier than the areas of unirrigated cul-

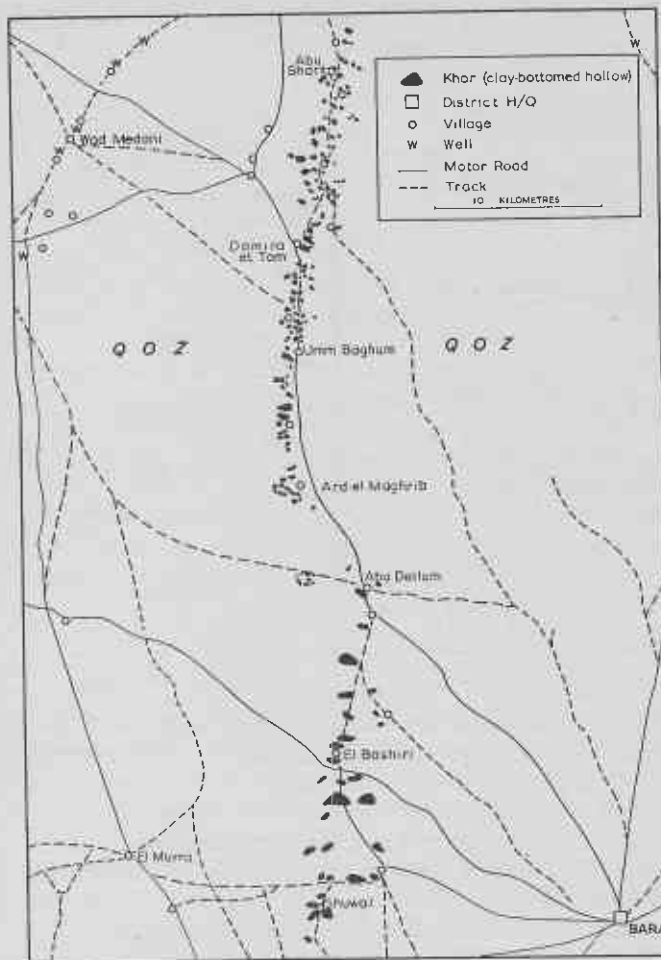


FIG. 61. The Kheiran. From *Sudan Surveys* 1:250,000, Sheet 55-1 (1946).

tivation, the Abu Hahl scheme has the advantage of being relatively free from cotton pests. During the experimental years of the scheme the local population was much discouraged by the heavy growth of weeds and by the serious attacks of *dhura* midge (*Contarinia sorghicola*), which almost destroyed the whole crop.¹ A few tenants are still working in the scheme, taking a 50% share of the proceeds of individual plots of 5 *feddans* each.

The Kheiran

Another special area is the Kheiran (Arabic plural of *Khor*, 'the watercourses') to the

north-west of Bara, where there are numbers of sand-dunes running from north to south, with between them clay-lined depressions separated by lesser transverse dunes. The Kheiran receive the drainage of a considerable area to the north, and since the depth of sand is not great and the underlying rocks are of the Basement Complex and consequently impermeable, the water-table comes within a short distance of the surface. In many of the basins the wells reach water at 1-3 m., and wherever irrigation is practised the water is not deeper than 3 m. A comparison of the figures given by MacMichael, writing in 1911, with those obtained by more recent inquiries, suggests that the water-table of the Kheiran is dropping, and this may in part account for the decline which is taking place in the number of the cultivated Kheiran. There is no large-scale survey of the Kheiran, and the accompanying Fig. 61 is based on the 1:250,000 series together with various first-hand accounts. In their natural state the north-south dunes are covered with the normal Qoz vegetation of the latitude, but the short east-west dunes, which are said to be still in motion, are pure sand. The vegetation of the dune

bottoms consists principally of various *Acacias*, especially *Acacia albida*, and of a dense growth of herbs and grasses.²

At the present time a total of 148 depressions is cultivated, while many others which were formerly in use have been allowed to revert to natural vegetation and are used for grazing. Rights of cultivation are in the hands of the Dar Hāmid tribe, especially the Ferahna section who have not many animals. Small areas of wheat and *dhura* are grown in winter as subsistence crops, and are of especial value if the grain sown on the surrounding dunes has failed. The most profitable crop, however, is onions

¹ J. W. Cowland, 'The Sorghum Midge in the Anglo-Egyptian Sudan', *Ann. App. Biology*, 23 (1936).

² H. A. MacMichael, 'The Kheiran', *S. N. & R.*, 3 (1920).

which are taken in large quantities to El Obeid when fully grown and dry. There are also increasing numbers of citrus fruits and guavas, which sell easily in Bara and El Obeid. Before the Mahdiya the Kheiran were in the hands of Dongolawi *Jellāba*, who employed slaves to raise the water by *saqia* or *shadūf*, and to till the ground. Today the Arabs have to do the work themselves, which is perhaps the chief reason for the decline in cultivation. Water is still raised today by traditional means,¹ and pumps have not been installed for irrigation, though there are a few raising drinking water in Bara Town. Very recently the government has been able to take a lease of one of the basins to make experiments in their proper use, but previously the suspicions of the Ferahna had prevented them from doing this. To the east of the cultivated Kheiran there is another line of depressions wherein the water is too far from the surface to permit cultivation. These hollows provide an important winter watering ground for the nomadic section of the Dar Hāmid tribe, while at their southern end they also maintain the administrative centre of Bara.

Governmental efforts to raise the standard of living

Within the central or cultivators' Qoz the chief material contribution of the administration to raising the people's standard of living has been the improvement of rural water supplies by drilling deep bores. These have not only helped the nomads in their annual movements and when bringing animals to market, but have also in many instances enabled small villages of cultivators to spring up round about them (Fig. 62).² The amount of work done in improving roads, on the other hand, has been negligible, for in the absence of plentiful supplies of good building stone the construction of permanent all-season roads would be prohibitively expensive. A few traces, such as one between El Obeid and En Nahud, have been opened for the exclusive use of government

vehicles, but for the most part lorries tend to find their own way over the dunes, the 'road' becoming ever wider as successive drivers search in vain for an easier track.

Valuable assistance has been given to the peasant cultivators in the Qoz by the organization of produce auctions in the market towns. To some extent this has protected the peasant from the *sheil* system described in Chapter X. A more important result has been to ensure that the poor man, always in urgent need of cash, can get offers from more than one merchant, and so obtain a fair price for his produce. If the buyers seem to be acting together to keep the price low, the sellers can act in concert to refuse the bids offered. For commodities the demand for which is relatively inelastic, little purpose would be served by establishing Marketing Boards such as those in West Africa, since the prices of gum or melon seeds fluctuate less than those of cocoa or palm-oil.

Some attention has been given to the possibility of speeding up the regeneration of *Acacia senegal* on lands that are temporarily fallow, of propagating better varieties of seed, and of establishing, if it should prove desirable, a government monopoly in the purchasing and disposal of all gum produced, but in none of these directions has any important change in existing practice been made. Other forestry work has included the successful propagation of the Indian *neem* (*Azadirachta indica*). The conspicuous stand of *neem* near Umm Ruwaba shows clearly that this tree once established can maintain itself in Qoz conditions. Areas of prohibited grazing have been demarcated round several of the towns to check the destruction of the natural vegetation.³

THE SOUTHERN QOZ—THE BAQQARA

The most southerly section of the Qoz, the boundary being determined once more according to the way of life of its inhabitants, is that wherein the nomadic Baqqara tribes are to be found (Plate XXVI). These Arabs are not confined to the sandy country, but also occupy the

¹ In 1957 there were 9 *saqias* and 139 *shadūfs* still in operation.

² The possibility that increasing the number of water-points is merely to multiply, in the long run, the number of points where overgrazing may take place has not been ignored. In 1956-7 a Working Party drawn from several departments of government began an inquiry into the proper relation between animal population, water supply, and grazing potential.

³ Sudan Government, *Soil Conservation Committee's Report*, 1944, Appendix XIV, 'Minutes of the Sub-Committee on the Town Perimeter Problem of El Obeid.'

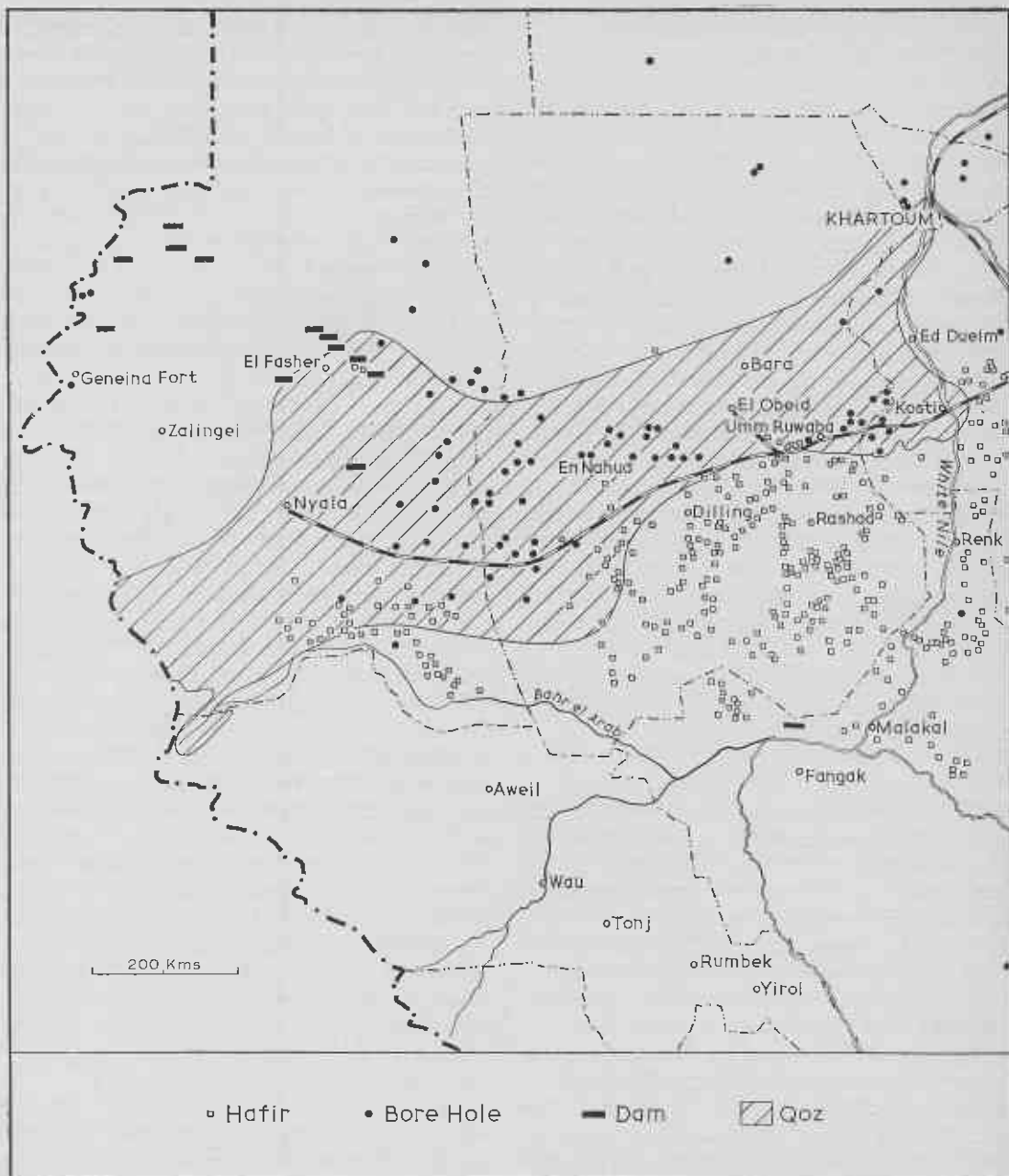


FIG. 62. Deep bores, hafirs and dams in Western Sudan. Boreholes and pumps, together known as water-yards, are widespread in the Qoz wherever there is a suitable underground aquifer; they may be set up to supply water to a town, to the railways, or to villagers and nomads. Where impermeable clays lie at the surface to the south and east of the Qoz, hafirs are generally preferred to meet the needs of the rural population. In Darfur neither deep wells nor hafirs are suited to local conditions, and several dams have been constructed to preserve surface run-off. From a map kindly supplied by the Department of Land Use and Rural Water Development.

plains which lie between the Nuba Mountains where clay soils and red sandy loams occur. Moreover, even as the Arabs of the north move beyond the limits of the Qoz during the summer, in winter many of the Baqqara retreat southwards across the clays to watering-places along the Bahr el Arab (Fig. 58).

Rainfall in the southern Qoz is heavier than in the centre or north, rising to as much as 700 or 800 mm. (28–32 in.). The wet season is longer, and the higher total means also that the danger of crop failure through drought is reduced. At present, however, this factor is not of great importance, since cultivation is restricted and the people are primarily dependent on their animals for their subsistence. In the wettest areas a distinctly denser natural vegetation is found, including various broad-leaved species such as the *Combretaceae* and *Terminalia* spp., which are also dominant in the Ironstone Plateau to the south-west. The growth of grass is generally taller, except where particularly dense thickets of *kitir* (*Acacia mellifera*) or *talh* (*A. seyal*) occur.

It has been suggested that the annual migrations of the Baqqara may be best understood if the concept be borne in mind of the home *dars*, areas like Muglad, if it were possible, the Arabs would like to pass much of the year particularly the rainy season.¹ These areas, to which Harrison has given the name of the Baqqara Repeating Pattern, consist of an association of sandy ridges alternating with basins floored with a fine non-cracking clay. They tend to occur towards the southern limit of the sandy area, where the depth of sand is not great and deposits of clay are frequent not far from the surface.

The especial value of the basins and ridges lies in the nature of the grazing that they provide, which compares favourable with that found either on the clays or on the Qoz. As is discussed in Chapter V, the natural grasses of the clay plain, with the exception of one or two species that are not very common, are somewhat sour and provide poor grazing during the dry season. Whatever the conditions of water supply, therefore, the Baqqara would not wish to spend the whole of the year on the clays. The grazing of the Qoz, on the other

hand, is sweeter, and provides fodder all the year. Owing to the poverty of the soil, however, these grasses are almost entirely lacking in salts, they produce little or no regrowth after burning, and cattle cannot be kept fit on them alone. In the home *dars*, where the soil alternates in character from sand to clay, there is a gradual merging of vegetation types, and the grasses which grow in the intermediate zone provide the beasts with the salt they need, as well as being good to eat when dry.

Migrations, therefore, consist of movement away from the home *dar* whenever lack of water or grazing compels it, followed by a return as soon as possible. At the start of the rainy season, a convenient period to begin an account of the seasonal movements of the Baqqara, the tribes arrive at their home *dars* from their wintering areas, which are situated either along the Bahr el Arab or in the Ironstone Plateau beyond it. With the growth of young grasses the animals improve in condition, and water is available to them in pools in the hollows. The cattle are kept on the good grazing of the home *dar* for as long as possible, but eventually the number of flies and insects that breed in the rainy season increases, and it becomes necessary to lead the herds away northwards to graze in the open Qoz. In these areas, some of which are known as *babanusa* from the nature of the bushy vegetation, drinking water can be obtained from scattered pools, but there is a lack of salt in the grazing which causes a decline in condition of the cattle.

During this period crops of grain are sown in the home *dar* on the ridges between the clay hollows, the cultivators being either the Arabs or westerners settled in the area who are willing to work for food and low wages. The growing of these crops might be neglected were it left to the Arabs themselves to decide whether to cultivate or to rely on being able to buy their needs of *dhura*, but by tribal ordinance each family is required to grow enough grain to meet its own needs, and thus the risk of famine is reduced. When the rains come to an end the herds are brought back from the *babanusa*. They drink from the water still standing in the pools and graze the good grasses within easy reach.

¹ Harrison, *op. cit.*, Appendix No. 6. See also I. Cunison, 'The Humr and their land', S.N. & R., 35 (1954).



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Soon the pools dry up, the grazing around the home *dar* is finished, and a hurried journey is made to the winter grazing. For most of the tribes this is found in a belt of country to the north of the Bahr el Arab, where many isolated pools are found in the heavy clay, but there are some variations in the west. The Beni Helba tribe winter along the *wadis*, especially the Azum, of Western Darfur, and their cattle get excellent grazing from *harāz* pods, and *najil* grass. In summer they cultivate extensively, and in winter they exchange milk and *semm* for grain and other commodities produced by the Fur. Certain of the Rizeiqat do not stop at the Bahr el Arab, which here flows incised into a relatively narrow bed, but carry on into the northern part of the Bahr el Ghazal province, until they come to the area infested by tsetse fly (*Glossina morsitans*). Many of the Ta'āisha cross the Sudan borders and spend this period in the Qoz Beida district of Wadai, thereby incurring the misfortune of having to pay full taxes every year to two separate governments.

The period spent by the Bahr is hard, for the grasses provide poor fodder, and as the months go by it becomes increasingly hard to find grazing within easy reach of water. Finally the animals can be watered once in two days only, and even that entails spending a large part of the day in walking to and from the pools, so that the cattle become thin and in a bad year numbers of them may die. During this season some contact, now peaceful, is made with the Dinka, of whom a small number are actually administered along with the Arabs in Southern Kordofan District. There are not many opportunities of trade, since each group consists chiefly of cattle-owners, but some exchange takes place of Arab grain for Dinka dried fish. So different are the physical requirements of the two environments that the Baqqara cattle are quite distinct from those of the Dinka, and there is no incentive to trade them. The large long-horned Nilotic cattle can tolerate flies but would not do well in the wooded country of the Arabs. The Arab beasts, on the other hand, find the flies and muddy soil almost intolerable, and are prized above all for speed of movement through the bush and for keep-

ing up with the herd rather than wandering off on their own, where they may be lost or pulled down by a lion.¹

With the coming of the rains the Arabs at once leave the wintering area, which soon becomes flooded, and move slowly back towards their home *dars*, while the cattle enjoy the fresh growth of grasses. Since the distribution of rain is very irregular at this stage, careful scouting is required to ensure that grazing is always available.

There are a few members of each Baqqara tribe who do not follow this way of life: some who possess few cattle prefer to pass the whole of the year near their home *dar*, concentrating on growing crops and selling milk to the permanent population of merchants and officials; others—this applies especially to the Baqqara of the Nuba Mountains and of south-western Kordofan—have been attracted by the high prices to be obtained from growing cotton, and are spending most of the year on the clay plains. When the rains come, instead of migrating to the Qoz they sow cotton and either weed and pick it themselves or hire labour from westerners and other landless persons to do the heavy work. In such a case the Arabs cannot keep a large herd with them, but send the bulk of their animals away to be tended by a relative. If they keep a few beasts to give them milk, they have to imitate the Dinka by building byres in which their animals can spend the night, protected by the smoke of dung fires from the assaults of insects. Other Baqqara, wishing to build up herds, take employment with merchants who come to the *dars* to buy cattle. They then pass their time driving the beasts on foot to El Obeid or Kosti.

Such variants are few, however, and generally the whole of each family moves with the whole of the herd in search of grazing and water. There are, however, two groups of Fellāta, otherwise Cow Fulani or Bororo, fairly recent immigrants to Sudan, whose annual movements are different. One group, which has its headquarters near Tulus to the west of Nyala, does not have a range of grazing in its exclusive ownership, but has come to an arrangement with the Habaniya and other tribes in whose

¹ The physical characteristics of the several breeds of cattle in Sudan are discussed by S. C. J. Bennett, E. R. John, and J. W. Hewison in the chapter entitled 'Animal Husbandry', in *Agriculture in the Sudan*, 1948.

territory it lives. These Fellāta are keen cultivators, and the larger portion of the tribe remains permanently in the Tulus area, keeping a proportion of the cattle with them. During the rains the young men of the tribe go off with the younger and more vigorous bulls and cows to find grazing, and move very rapidly from place to place, so that they are able to graze patches too far from water supplies to be of much value to slow-moving tribes with all their families and effects. It has been suggested that the Arab way of life is probably more satisfactory for the tribes as a whole, in that all the cattle fare equally well, while sufficient cultivation is carried out by various non-Arabs settled in the Dars. If in the future, however, the nomadic tribes are not to fall permanently behind the remainder of the Sudanese in their progress towards a more modern form of society, the Fellāta way of life seems to offer the obvious basis of improvement. Already this group of Fellāta has come to speak Arabic and to be scarcely distinguishable from the Baqqara tribes.

The other group of Fulani is still wholly nomadic, and consists of an uncertain number of tribesmen, originating apparently from Nigeria, who have travelled across French Equatorial Africa, entered Sudan from the west in the past ten or fifteen years, and made their way eastwards as far as Er Roseires on the Blue Nile. They own herds of tall red or white long-haired cattle, which can move very fast, and with these they pass rapidly from district to district, evading all control or taxation. The cattle devour the grazing of other tribes and damage their cultivations, while the Bororo engage in bloody and fatal disputes from time to time. Very few of the Fulani can speak Arabic, and they have shown themselves quite indifferent to government of any kind. Recently numbers of these Bororo were arrested, their animals were purchased from them compulsorily, and the tribesmen themselves were deported beyond Sudan's borders. There is reason to believe that many of those so deported have rejoined their fellows, and the problem of their ultimate fate remains unsolved.

In recent years there has been a marked growth in the trade in Baqqara cattle. This and

their willingness to turn to cotton growing suggest that they have progressed beyond the stage where nomads are solely interested in increasing the size of their herds and maintaining their way of life. In fact, numbers of young Baqqara have in recent years set themselves up as merchants, and among all the tribesmen the sale of cattle is regarded as normal, not only to pay taxes but also to pay for an increasing supply of consumer goods, particularly cloth, sugar, and tea.

There are no reliable statistics for the animal population of this or any other nomadic area in Sudan. Herds are listed for taxation purposes, but since almost every member of a tribe, from the Nāzir downwards, is an animal owner, there is no doubt that the figures given are much too low. The tax lists for Kordofan give the following figures for 1957, which are printed with the proviso that listing is a triennial event only (see Figs. 35-38).

Cattle Camels Sheep Goats Horses Donkeys
590,416 155,547 386,967 266,077 1,330 71,875

The animals sold by the Baqqara are either consumed locally in Sudan, exported to Egypt, or (from 1952 to 1956) processed at the meat-canning factory at Kosti. There are no figures available for domestic consumption, but the latest figures show the following exports of animals in 1956: cattle: 59,480 head, value £51,026,067; Camels: 38,107 head, value £51,232,682; and sheep: 148,569 head, value £5493,041. The factory, which began operating in 1952, was temporarily closed in 1956 when the price asked for cattle was held by the managing company to be too high for profitable operation. The export trade in meat is of considerable value to Sudan, and various efforts have been made by the government to assist it, both by improving the health of the cattle and by making it easier for them to reach their destinations. To the former end the work of the veterinary department has been largely devoted to the elimination of rinderpest and bovine pleuro-pneumonia. By producing suitable vaccines in the laboratories in Khartoum and by persuading the Arabs to take advantage of mass inoculation, they have been able to defeat the epizootic diseases which formerly used to decimate the herds, and so

greatly improve the stock from which exports may be drawn, incidentally raising the Arabs' standard of living. At the same time the work of the geological survey and the soil conservation branch has been largely devoted to improving rural water supplies, particularly by establishing cattle routes, with wells or *hafirs* at intervals of 30-50 km. (20-30 miles), along which the bulls can be driven to the railhead from the tribal areas where they are bought. There is great need for an easier journey for cattle on their way to slaughter or dispatch by rail, because at present only bulls five or six years old are considered strong enough to make the journey, and so the beef from them is older and tougher than it need be. If the journey could be made easier and the periods of seasonal hunger which check growth could be averted, younger animals of the same weight could be produced with a much smaller fodder consumption, and they would at the same time be more palatable.¹

Apart from the sale of cattle the Baqqara produce from their herds important surpluses of milk, which is exported in the form of *semn* (clarified butter-fat). This is separated and processed by the women, who take all the profits from the trade, and it is bought by the merchants settled at the tribal centres. Apart from what is produced in southern Darfur considerable quantities come from the Muglad area and from the centre of the Hawazma tribe between El Obeid and the Nuba Mountains. There is also a parallel trade in cheese made from the surplus butter-milk, soft and white and of fair quality, but too often tainted by a slight flavour of petrol from the tin in which it has travelled. The Baqqara men also collect some gum, but their nomadic life, and the fact that most of them spend their winters off the sands, make the quantities much smaller than those of regions farther to the north.

The economic potentialities of the Qoz

In considering the potential future of the Qoz region and the part it might play when the economy of the whole country is further developed, one is constantly struck by the

dominant position occupied by El Obeid in the trade and life of the whole area. Lying at the railhead, it takes the whole of the trade of Darfur and of the western part of the Qoz region, and a considerable portion of the import trade of the Nuba Mountains, for though the cotton produced there (average production 1951-2 to 1955-6 9,860 tons of lint) is carried by diesel lorries to the stations of Semeiha and Umm Ruwaba, the money received in return seems to be spent almost entirely on goods imported through the provincial capital. The El Obeid gum market is the largest in the world, and all gum bought at the auctions at En Nahud, Abu Zabad, or elsewhere in the west must be loaded on the railway at El Obeid, which in 1955-6 carried 27,500 tons of gum from Kordofan. Cattle exports from El Obeid have averaged more than 50,000 head per annum, and have required a service of three special trains per week to carry them. Consignments from the town of all kinds of grain, including sesame, have been large, with a recent increase in ground-nuts produced in the area where the new railway extension is being built.

At El Obeid the necessity of transshipping from train to lorry all goods imported from outside, has called into existence a well-organized system of commission agents, working with the owners of heavy lorries. Any parcel or load of goods may be safely consigned to El Obeid for onward transport to such destinations as El Fasher or Nyala, providing an agent in El Obeid is informed of its coming. The lorries used in the traffic are mostly 3-ton American Fords, grievously overloaded and overworked as they churn through the sandy tracks of the Qoz. Recently some British and Italian firms have been producing rival vehicles which have had a good chance of establishing themselves during the dollar shortage, but the Fords still seem to be preferred. The lorry owners put the working lives of their vehicles at not more than four years.

Though the recent growth of the population of El Obeid is clearly due to the functions out-

¹ The ultimate solution to the problem of getting beef to market will presumably lie in the use of refrigerated rail trucks, or even of air transport, as is already the practice in French Equatorial Africa. This will only prove a paying proposition when there is a larger and wealthier market in eastern Sudan and in Egypt, and even then the general African preference for freshly killed, rather than tender meat, may tend to keep the point of slaughter close to the consuming areas.

lined above and to the presence of a total of 400 government officials, together with their families, the town was already of importance as a centre of administration before the railway was built. The capture of El Obeid was the first major success of the Mahdi in the revolt which led to the total ejection of the Egyptians in 1885, for the town was even then the capital of the west, because of the good water supply in the central well area.¹ Even with modern improvements that have been made to this supply, the tendency for government activities to increase, and for towns to grow, means that the problem of finding enough water will recur whenever a few years of bad rains come together. Increased prosperity, moreover, is always reflected in a rise in water consumption, and one is led to wonder whether any long-term solution can be found except by pumping water from the Nile, a policy formerly ruled out by the Nile Waters Agreement (*vide* Chapter VIII).

In the meantime it is probably a good thing that the measures undertaken for improving communications in Western Sudan are likely to have the effect of reducing the dominating position of El Obeid. An unsuccessful attempt was made under the two post-war development programmes to build a road direct from Omdurman to El Fasher, in a perhaps ill-conceived and certainly ill-executed attempt to reduce the transport costs involved in crossing the Qoz. If this could have been brought to a successful conclusion, some of El Obeid's traffic would have been by-passed, but a route so far north could scarcely have generated enough local traffic to justify the expense of building or maintaining it. Improved communications are of the greatest value, however, when they pass through regions themselves capable of development and of participation in trade, and so greater results may be expected from the extension of the railway to the west, which reached its new terminus at Nyala in 1959. There is good reason to believe that this courageous investment will be rewarded by the development of a large export trade in ground-nuts, cotton, and sesame from the wetter southern portion of the Qoz (Fig. 57).

¹ A. B. Theobald, *The Mahdīa*, 1951.

THE SEMI-DESERT

The Semi-desert and the northern portion of the Qoz are inhabited by several nomadic tribes, principally the Kabābīsh, Kawahla, Hawawir, and Dar Hāmid in Kordofan, while farther west in Darfur there are the Meidob, Zeyyadiya, and some smaller tribes. The former group all claim descent from Arab tribes, and like to trace their descent from the Prophet or his relatives, but in fact their origins are more varied, as has been discussed in Chapter VI. For the most part the Arabs resemble their forebears, but especially among the wealthier families an admixture of slave and non-Arab blood is to be detected.

The Physical Basis of Nomadism

Apart from the Meidob, all these tribes are wholly nomadic, being predominantly camel-owners, some of their number being very wealthy (Plate XXV). Their annual movements follow a regular pattern according to the seasons, and clearly indicate the advantages of Western Sudan for the nomadic life. With all their uncertainty, the summer rains of Kordofan and Darfur are more to be relied on than the spasmodic showers of the Nejd in Arabia, and when grazing is poor the nomads in Sudan have the advantage that they can retire southwards, and by coming to agreements with other tribes can find some grazing and water even in the worst years.

While principally engaged in camel-rearing the nomads also keep valuable flocks of sheep and goats. The grazing available to them is provided by both annual and perennial grasses. These have often been eliminated by grazing near water-holes, when other species of less value take their place. These grasses are reasonably palatable at all times of the year (sweet veld), but in the rains there are also ephemeral herbs, particularly *leguminosae*, which the animals enjoy. When the grazing is reduced towards the end of the rains, browsing bushes become important. Harrison estimates the optimum stocking in favourable areas at 10 animal units per square mile (a camel being taken as 1½ units, a cow or bull as 1, and a sheep or goat as ½).²

Because the rainy season in their territory

² Harrison, *op. cit.*, Part II.

lasts a bare three months, the nomads cannot be continuously on the move, but they require bases or reliable watering-grounds to which they can retire during the latter part of the dry season. From these bases, of which the Kabābīsh, for instance, have six, each with its dependent grazing area, the first movement at the onset of the rains is towards the south, when scouts have reported the falling of rain and the growth of new grass. Subsequently during the cooler wet weather the tribes split up into groups of two or more families, with 50-100 camels; the animals are then taken gradually to the north, scouts still being required to advise on each move. At this period waterings may be restricted to once in ten days or even less often. The animals grow fat and she-camels drop their calves. At the same time a few members of the tribes, who have stayed behind at the wintering-grounds, sow millet on the sands in the hope that the rains may be heavy enough to bring a crop to maturity. When the rains are over, watering is needed more frequently, but the tribes still keep away from their wintering grounds as long as possible to preserve the grazing there.

The watering-points available vary in their origin, and in the amount of water they can provide.^{1,2} The shortest-lived sources are those which occur in small clay-bottomed depressions after rain. These are rarely recorded in maps, but are of great value to beasts and men because they reduce the demand from the perennial sources. When the catchment area of such sources is greater and the ground is more permeable, a useful shallow-well area may be formed. Elsewhere, and especially in the rocky areas of the Bayuda Desert or along the great Wadi el Howar of the west which carries water and grazing far into the desert, there are pronounced drainage lines along dry *wadi* beds, and in these, shallow wells are dug at favourable sites. Unfortunately each year's flood destroys the old wells, and they have to be re-dug. When the sandstone overlies the Basement Complex above the junction, there is usually water to be found, and it may also penetrate below into a mass of rotted granitic rocks. In

such sites hand-dug wells are rare, but deep bores dug by the government have been successful. Within granitic hill-masses there are occasional natural reservoirs of small capacity, whose overflow may be reached by shallow wells dug into rock debris in the valleys. In low-lying depressions the water-table may come to the surface to form an oasis, or be accessible at no great depth to permit the watering of animals and even some irrigation.

At Meidob there is a low basaltic plateau with a number of wells around its base, and a large volcanic crater at Malha, 1500 metres across and 100 metres deep, which has two springs on its interior slopes and a salt lake at the bottom (Plate XXVIII).³

During the winter many of the young men go off with some of the camels to graze the *jizzu*. The remainder of the Arabs live close to their permanent watering-grounds, and have leisure to devote to crafts and trades. Children spin goat- and camel-hair into coarse thread, women weave hair rugs, men make water-skins, buckets, and harness from the skins of dead beasts, carve saddle-frames of wood and make ropes from the bark of *Acacia* trees or from oryx hide. Some of the men go to market towns like En Nahud, El Obeid, or Omdurman to sell animals and to buy grain, cloth, sugar, and tea. If pressed for money to pay their taxes, they may take employment carrying gum or grain.

These journeys are made necessary because there are few markets established within the Arabs' territory, even at the principal wintering-grounds. This is not because the tribesmen are poor, for there are rich Arabs with as many as 500 camels in their herds, but because they are accustomed to make all their purchases for the coming year when they go to market to sell their animals. In this way they can buy at lower prices than those obtained in their own territory and make themselves independent of other sources of supply. An interesting effect of this practice was noted during the war years, when rationing of sugar and cloth was imposed. Since many of the Arabs of Kordofan and Darfur had been accustomed to buy these commodi-

¹ K. S. Sandford, 'Sources of Water in the North-West Sudan', *Geog. Journ.*, **85** (1935.)

² G. W. Grabham, 'Water Supplies in the Anglo-Egyptian Sudan', *Bulletin of the Geological Survey*, No. 2 (1934).

³ G. D. Lampen, 'A Short Account of Meidob', *S.N. & R.*, **11** (1928).

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ties outside their own provinces and districts, the quota system that was applied to the principal markets favoured Omdurman and El Obeid rather than the remoter areas. Yet when the Arabs tried to buy from their usual suppliers they were told there was nothing for them and that they must go home to their districts and get their share there.

While the sheep and goats are sold in the markets of Sudan, there is still a regular trade in camels going 'on the hoof' to the markets of Upper Egypt. There is no governmental interference with this traffic, nor even definite knowledge of its extent, though from time to time attempts have been made to draw conclusions from the figures of camels slaughtered in the abattoirs of Egypt.

The Impact of Government on Nomadism

For many years, in fact, it has appeared that there is remarkably little the government can do to improve the lives of nomads, whether cattle- or camel-owners, apart from the provision of public security and the protection of animals against epizootic diseases. Education is little appreciated, while medical treatment is accepted with reluctance, and then only after native remedies have failed. The value of locust-control work is recognized, for this has been pursued with considerable success in the Semi-desert areas of Sudan, both in investigating the life-cycle of the Desert Locust (*Schistocerca gregaria* Forsk.), and in evolving methods of combating it,^{1,2} but the principal boon that the nomads have constantly asked of the government, with the whole-hearted support of their administrative officers, has been water; this is the key to nomadism, always inadequate and always being sought afresh by constant and wearying treks.

Until recently government policy has been to do all that can be done to improve water supplies, in the belief that extensive areas of grazing have been wasted every year for want of the necessary water to exploit them. Recent pasture research, however, has suggested that where communal land tenure and private animal ownership obtain there is always a

danger of animal numbers rising too high. In fact, it is the very inadequacy of the water supplies that has kept the nomads from damaging their grazing areas by overstocking. Around Malha or Umm Badr in the Semi-desert, or beside the rivers in Eastern Sudan, the water supply is virtually unlimited, and in consequence there has been a serious deterioration of the vegetation and soil erosion. Elsewhere water runs out as soon as grazing, and the vegetation can usually recover before it is completely destroyed, even though particularly valuable species may be eliminated.

What nomads really need is not so much a greater total volume of water as a much wider dispersal of small water sources to reduce the long journeys that the animals have to make towards the end of the dry season from water to grazing. If watering-points were sufficiently numerous they could drink more frequently, suffer less checks to their growth, and generally keep in better condition, avoiding the plight which Harrison describes when 'they come to resemble skin and bone carrying large bellyfuls of water out to the grazing'. Technically *tanks* or bores, according to the type of country, are often suitable sources of water, but in view of the very low cash off-take (as little as 3 pts. per *seddan* or 7½d. per acre) that most nomadic country in Sudan can provide, smaller and cheaper types of water supply, such as earth dams or shallow wells, may be more advisable. If these could be controlled and used to enforce a system of rotation grazing with resting periods, most of the advantages afforded by fences in ranching country could be achieved at very much less cost.³

Improvements on such lines would materially improve the lot of the nomads of the west, especially if they showed themselves willing to sell a larger proportion of their animals rather than increase the size of their herds. Yet limits are clearly set by the low rainfall totals, the distance from markets, and the impossibility (at least in the Semi-desert areas) of turning to cultivation or milk production as alternative sources of livelihood. If the individual tribesman wishes for a significantly higher standard

¹ H. H. King, 'On the Use of Poison in the Control of Locusts in the Anglo-Egyptian Sudan', *Cairo Scientific Journal*, 7 (1913).

² J. S. Kennedy, 'The Behaviour of the Desert Locust in an Outbreak Centre', *Trans. Roy. Ent. Soc. Lond.*, 89 (1913).

³ Harrison, *op. cit.*, Part II.

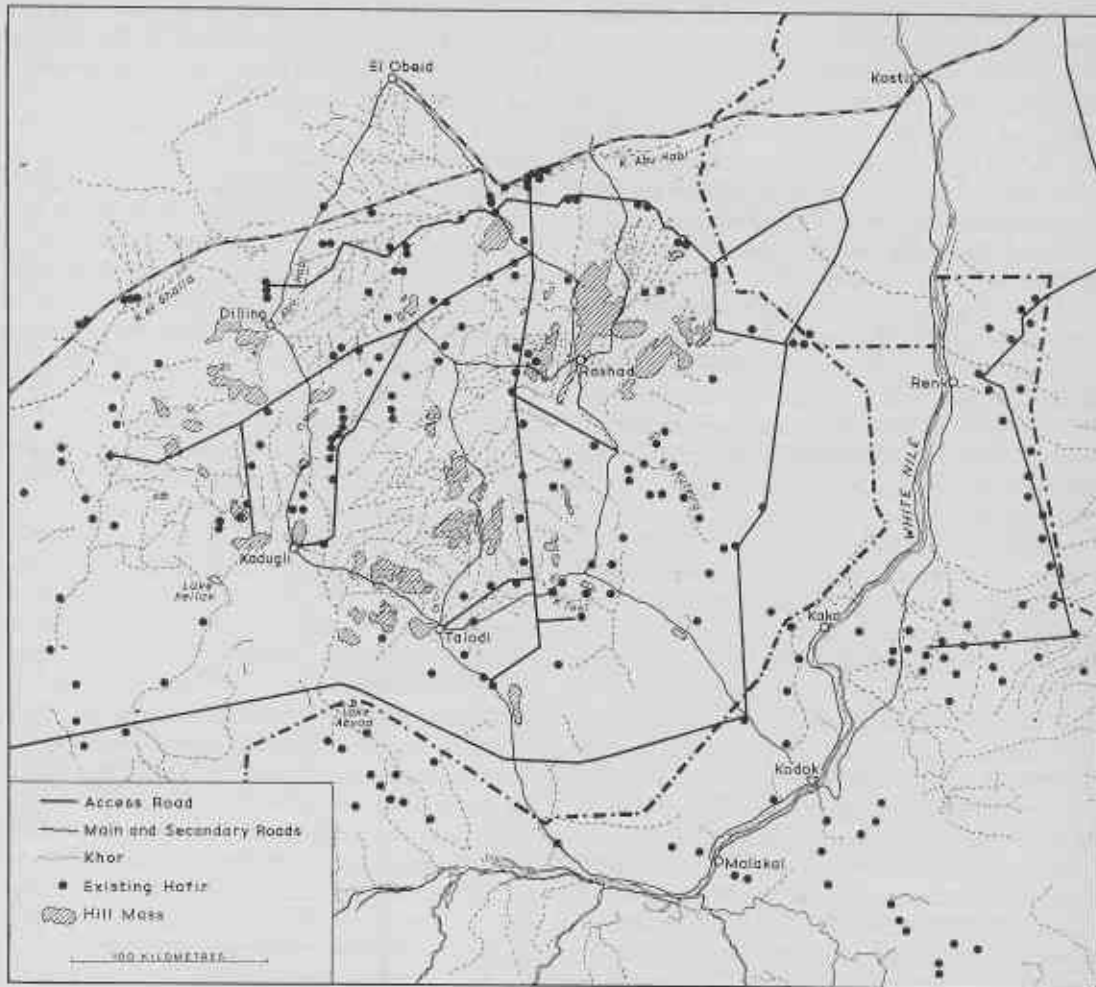


FIG. 63. Hill masses, hafirs, access and other roads in the Nuba Mountains. The access roads are the graded earth roads which are cleared mechanically to enable the excavating teams to reach the hafir sites. From *Soil Conservation in the Sudan*, Khartoum, (1955).

of living, he will have to abandon his native surroundings and move to the river or the irrigated parts of the Gezira, where much greater and more diverse prospects of development await fulfilment.

THE NUBA MOUNTAINS

The fourth major element of the region here called Western Sudan is the Nuba Mountains of south-eastern Kordofan. On the basis of the dominant soil type, it might be thought that the 'Jebels' (*Jubal en Nuba*, as they are called in Arabic) would be better discussed along

with the clay areas to the east, but both because of the Baqqara tribes who move through them and on account of their commercial and administrative links with El Obeid, it has been thought more appropriate to treat them as part of Western Sudan.

Physical Conditions

The Nuba Mountains (Fig. 63) consist of a number of isolated hill-masses made up of a variety of rocks of the Basement Complex, particularly soda-granites which weather to form dome-shaped sugar-loaf hills with bare rocky tops and steep sides. At the foot of each

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hill there is usually a pile of detrital boulders, succeeded by a pediment of coarse reddish loam (Plate XXVII). Many of the hills are quite isolated, covering a few square miles only, but there are also several considerable hill-masses, such as the Heiban group in the centre or the Nyima Jebels in the north-west, which are sufficiently extensive to include considerable internal valleys elevated above the surrounding plain.

The various types of terrain occurring in the Nuba Mountains vary both in appearance and potential value. Greene gives them the name of the Alkaline Catena.¹ The actual hill-tops are almost invariably bare of soil or vegetation, but the steep upper slopes are often masked by trees and shrubs whose roots penetrate deeply into the joints and fissures of the rock. At best a little soil accumulates in pockets and protected positions, and supports a mixed vegetation of herbs and grasses, which may be grazed by the small Nuba goats. Somewhat lower the vegetation is a little thicker, but the soil can still only be regarded as skeletal, as the finer constituents have all been removed by erosion.

The soils which can be regarded as of value to man are those which are formed by illuviation. Of these the uppermost soil of this origin, known as *qardūd*, is to be found flooring the major internal valleys and as an apron surrounding the hill-masses. It is a reddish, sandy loam including a certain amount of coarser material, and usually has a slope sufficient to give good drainage, the apron surrounding the hills perhaps being as much as 5 miles wide. Beyond the *qardūd* the lowest element of the catena is a fine dark cracking clay not unlike that found in the clay plains of Eastern Sudan.

The vegetation of the Nuba Mountains consists, in the clay areas, of extensive stands of *Acacias*, especially *talh* and *kitir*, interspersed with stretches of grass. On the *qardūd* soils the types of tree to be found are extremely mixed, including various *Acacias*, broad-leaved species typical of the Ironstone Plateau, and two palm trees, the *dōm* and the *doleib*, while in

some areas of this kind large numbers of *tebeldis* are found together. Beside the stream beds in the hilly areas there are specimens of fine trees such as the 'aradeib (*Tamarindus indica*), the sausage tree (Arabic *Umm Shuttur*, *Kigelia aethiopica*), and the Sudan mahogany, while on the hill slopes, growing with their roots penetrating deeply into the joints of the rock, several kinds of *Ficus* are common, and also various *Euphorbias* and the distinctive poison tree (*Adenium honghel*), whose pink blossoms are a sight of great beauty when they flower in winter.

The climate of the Nuba Mountains closely resembles that of the surrounding plains, but because of this area's greater elevation, with the plain rising to 600 m. (2,000 ft.) and the tops of the hill-masses to about 1,500 m. (5,000 ft.) above sea-level, the rainfall is distinctly heavier and starts rather earlier in the year. The mean annual rainfall variability of the area lies between 10 and 15%, which is rather less than that of the Qoz region, and may in part explain the success of the cotton growing which has been carried on in the area during the past twenty-five years. Since it is only the upper portions of the higher hill masses that lie at more than 1,300 m. above sea-level, there is no area of appreciably lower temperatures that could be used as a summer resort, as is the Jos Plateau of Nigeria, for example. There are certainly no fertile soils situated high enough for the cultivation of a more temperate range of crops.

Settlement and Water Supplies

The clay plains between the hills are rarely suitable for perennial settlement because of the lack of permanent water supplies, but they provide extensive grazing which is used by several Arab tribes. The Arabs are the inveterate enemies of the Nuba, and undoubtedly have been responsible for the retreat of the latter to fortified villages among their rocky hills. In the north-eastern portion of the Jebels, where the Arab kingdom of Tegale was established during the sixteenth century,^{2,3}

¹ H. Greene, chapter on 'Soils of the Anglo-Egyptian Sudan', in *Agriculture in the Sudan*, 1948.

² R. J. Ellis, 'The Kingdom of Tegali', *S.N. & R.*, 18 (1935).

³ J. W. Kenrick, 'The Kingdom of Tegali, 1921-1946', *S.N. & R.*, 29 (1948).



FIG. 64. Land classification and use around Kujuria in the Nuba Mountains. The representation of houses and house-farms within the villages is purely schematic. From *Trimetrogon Air Survey* and local survey by the author.

the people have been more influenced by Arab ideas than elsewhere. They are frequently described as arabicized, denoting a conversion to Islam and the adoption of clothes which many of the other Nuba do not wear. There are some settled groups of Arabs in various parts of the region, in particular in the neighbourhood of Kadugli, and these people, while proudly claiming Arab blood, are intermarrying with the Nuba and becoming physically indistinguishable from them.

Settlement in the Nuba Mountains is closely related to the distribution of permanent water supplies. The most reliable sources are to be found in the beds of the streams which drain the hills, and consist of either a point just upstream of a rocky bar, where water comes

to the surface, flowing gently, or of shallow wells which are dug in the sandy silt and find water at a depth of a few feet. Farther down the *wadi* courses wells may have to be dug rather deeper, but they can be relied on at all times, though of course they have to be re-dug after the *wadi* has flowed during the rains. Elsewhere there are permanent wells dug in the valley-fill and underlying rotted rock of the interior valleys and in sandy areas not far from the *wadis* on the edge of the clay plains. The two lakes in the south, Abyad and Keilak, while holding water at all seasons, cannot be regarded as supplies for the Nuba, since they occur well away from the hills in unprotected sites on the plains. Less permanent supplies are also to be found in shallow pools, in sandy areas where a limited supply is held up over an impermeable bed, and in rocky cisterns in the hills where a deep pool of limited capacity may occur within large granitic masses. Man's contribution to the improvement of supplies has consisted in the drilling of a number of deep bores, the construction of various dams, and the excavation of surface reservoirs, first by hand and

more recently by the use of earth-moving machinery.

Agriculture

The Nuba, who number 700,000, are mainly cultivators, and before the coming of the British administration they devoted their labours to producing crops for subsistence. Their villages were sited on the sides and tops of hills or in inaccessible interior valleys, the need for protection from surprise Arab attacks being as great as the need to be within easy reach of water. At this period their cultivations were distributed around the villages, and use was made of every little patch of ground, however infertile. On many of the hill-sides traces are still to be seen of extensive terracing, which

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PLATE XXIII. VILLAGES AND *HARIZ* GROVES BESIDE THE WADI AZUM



PLATE XXIV. FUR WOMEN WATERING ONION BEDS

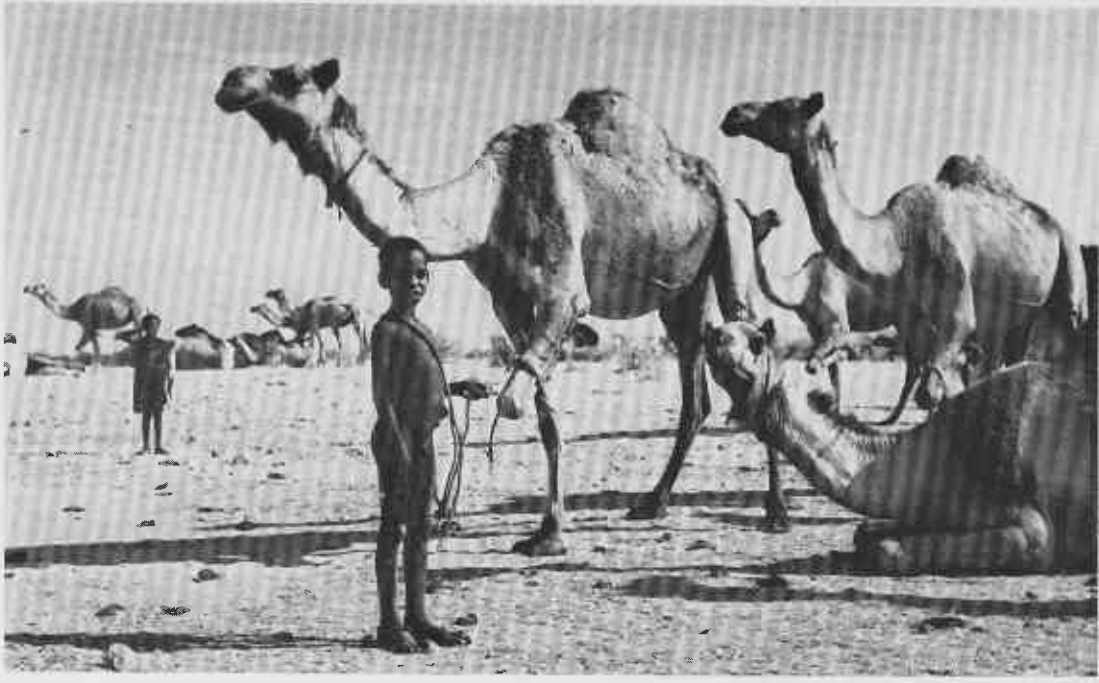


PLATE XXV. MEIDOB BOY WITH CAMELS



PLATE XXVI. BAQQARA FAMILY ON THE MOVE IN THE QOZ

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was sometimes carried out in most unfavourable circumstances to produce tiny fields of not more than a few square metres.¹

Today the villages are no longer built in hill fastnesses, partly because after the revolts of the early days of British rule it was decided to require the Nuba to settle in more accessible sites, and partly because the former villages were inconveniently placed for exploiting the best fields and sources of water. The present villages are sited on the *qardūd* soils around the hill-masses or on the edges of the interior valleys, in positions where a well or other water supply is within easy reach.

The cultivations of the Nuba today are of four main kinds: immediately around the huts in which the people live there are the home farms; not very far away within the hill-masses there are the hill-side farms; farther off, perhaps as much as 5 miles into the clay plain, there are the 'far farms', and in addition where the water supply is good and near to the surface small irrigated plots are common.² The home farms are of limited extent, and are used by the women for growing vegetables and maize. They are cultivated every year, though many are situated on thin stony soil. These fields, which are often ridged up into a close network of little squares to prevent losses of water from rapid run-off, probably benefit from fairly regular manuring, in an haphazard way, from the pigs, goats, and fowls kept in the homesteads. The same ridging is to be seen on the hill-side farms, together with a practice of collecting old stalks and the branches of trees and laying them across the slope of the fields, thus presumably reducing the rate of run-off and encouraging water to penetrate the soil. The crops grown on the hill-side farms are chiefly early-maturing *dhura*, *bamia*, and sesame (Figs. 64 and 65).

The far farms are usually to be found on the clay plains, though they may also occur on the better parts of the *qardūd*. They are cultivated on a system of four or five years' cropping, followed by as many as possible of fallow, and are used to grow the main crop of grain and all the cotton. The principal cotton areas are those not far from the ginning factories, where

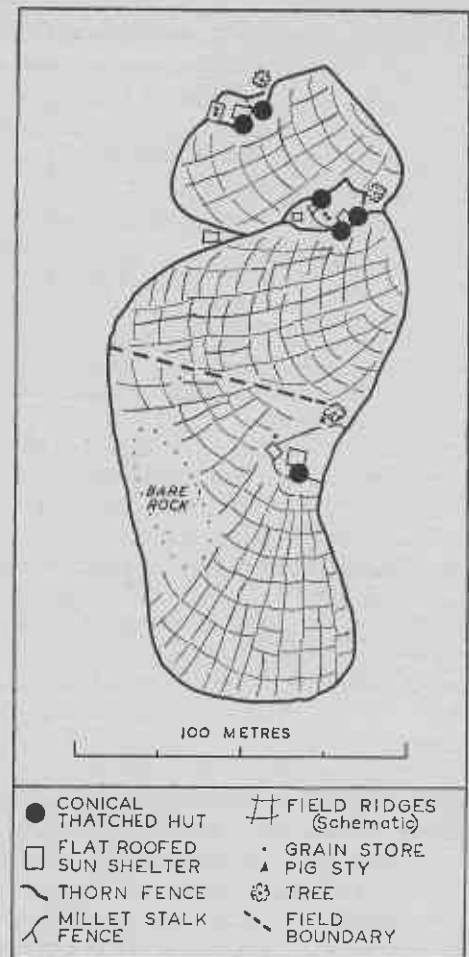


FIG. 65. House farms and homesteads at Kujurja, Nuba Mountains. From a plane table survey by the author.

government propaganda to encourage cotton cultivation has been most effective. Cotton is generally sown as a first crop on freshly cleared ground, the seed supplied to the peasants being an American Upland variety that has been adapted to local conditions. The yields, on the better fields, average 1 to 1½ kantars of 315 *rotls* each per feddan. The crop has steadily grown in importance since it was first introduced, as the accompanying figures show (Table VIII) except for a drop during and just after the Second World War. The irrigated plots

¹ R. C. Colvin, *Agricultural Survey of Nuba Mountains*, written in 1939, published in Khartoum in 1948.

² S. F. Nadel, *The Nuba*, 1947.

TABLE VIII
Area, production and yield of cotton in the Nuba Mountains

Years	'000 Feddans	'000 Kantars	Kantars per feddan
1925-26/1929-30 (average)		19.2	
1930-31/1934-35 ..		63.8	
1935-36/1939-40 ..		107.5	
1940-41/1944-45 ..		40.6	
1945-46/1949-50 ..	34.3	31.1	0.91
1950-51/1954-55 ..	162.3	199.2	1.23
1955-56	147.6	203.5	1.39
1956-57	112.0	107.9	0.96
1957-58	158.1	239.2	1.51
1958-59	192.0	182.2	0.94
1959-60	137	61.9	

occur in *wadi* beds or terraces where the water is not far from the surface. They are used for growing vegetables such as onions, tomatoes, and chillies, but the most frequent crop is tobacco. Little of the irrigated produce reaches the markets.

Animal Husbandry

The Nuba keep a number of domestic animals. Colvin, writing in 1939, stated that the average Nuba household had one or two cattle, and this figure was confirmed by inquiries conducted by the author in 1953. There are also numerous sheep and goats, a few pigs in each household (since the majority of the Nuba are not Muslims), and a small number of donkeys used for transport to market. The heavy clay soils and long rainy season are quite unsuited to camels.

The cattle graze in or near the Jebels during the dry weather, under the care of the young men, and if not far from a ginning factory they may be driven there to feed on cotton seed. During the rains, when biting flies are prevalent, they are kept on the hills, spending much of their time in smoke-filled huts where the flies do not penetrate. The tsetse flies formerly reported from the Koalib Jebels area,¹ were never widespread, and are now reported to have disappeared. During the dry weather cattle are often tethered on the hill-side farms, in a conscientious effort to maintain soil fertility. When

this is linked with feeding *dhura* stalks and cotton-seed to the animals, a system of mixed farming may be said to be in operation. Yet no use is made of animal power for ploughing the soil. Apart from their value as milk-producers the cattle are highly regarded as elements in the normal bride-price (more properly the exchange of valuables that takes place when a girl leaves her parents' home and joins her husband's family), when seven beasts are demanded along with lesser animals, quantities of grain, hoes, spears, and baskets.² This number, so much higher than the average total herd of a Nuba father, can clearly be provided only if numerous relatives combine together and make of the match a union between the two families. It seems likely that in fact considerably fewer are exacted by the bride's family. Certainly the need to accumulate the price of a bride is one of the chief forces driving young Nuba into the towns of Sudan, where they are to be found in various lowly capacities.³

Crafts and Commerce

The Nuba practise crafts not very different from those of the Fur. A few smiths make iron implements, women bake excellent clay pots, and gourds are used as general receptacles. Not being Muslims the Nuba have only recently come to care much for clothes, and even today the women usually go almost naked and the

¹ W. Ruttledge, 'The Tsetse Fly (*Glossina Morsitans*) in the Koalib Hills, Nuba Mountains Province, Sudan', *Bull. Ent. Res.*, 19 (1928).

² Nadel, *op. cit.*

³ The bucket system of sanitation, which even now is coming to be replaced in the capital by water-borne sewage, and still persists in the provinces, is dependent chiefly on Nuba labourers for its functioning.

men wear only a scanty loin-cloth. In consequence, they do not weave their own cloth, but sell all their cotton to the ginneries.¹ Some of the women collect the young leaves of the *dôm* palms: they either use them to weave baskets, or else sell them to the Arabs at the weekly markets, to be used in making the light woven mats which constitute the walls of the Arabs' huts.

The weekly markets bring Nuba and Baqqara together, and give the merchants a chance to sell their imported wares. With the growth of the cotton trade, the Nuba are beginning to come to market in lorries with a sack of their produce, rather than to ride there on donkeys. They buy sugar and tea and ornaments for the women, and there is an increasing demand for coloured robes for the women to wear on special occasions. The larger markets depend less on the Nuba or Baqqara than on the officials, police, and soldiery for their customers. Indeed, the only places where there is any number of permanent lock-up shops are to be found at the administrative centres. This reflects the essentially rural nature of the region, in that the towns have come into existence to fulfil purposes imposed from without, and incidentally to become points of dissemination of the Arabic language, Islam, and the use of articles of Western manufacture. Delami, lying on the intersection of an east-west road from Dilling to Rashad and a north-south road from Talodi to El Obeid, is not an administrative centre, and hence the shops there are few and their wares are very limited, for there are no regular customers except a few Arabs and villagers.

The Arabs

The other main inhabitants of the Nuba Mountains, the Baqqara, number about 250,000. They are in a transitional state from their original nomadism, still practised in western Kordofan, to a dependence on both animals and cultivation on the clays of the Nuba Mountains area.

The Mesiriya and the Hawazina tribes (Fig. 29) once occupied the Muglad area. Today the former have their headquarters at Rigl el Fula while the latter have theirs at Roshad. These

and the several tribes who enter the region from the east, especially the Awlad Himeid, used to come to the Nuba Mountains in winter merely to graze in the plains and to drink at the springs and wells and at the lakes in the south. In fact, today the Baqqara are devoting much of their time to growing crops, especially cotton, which makes it essential for some at least of the family to stay on the clays through out the rains to guard and weed the crops, while the animals are sent off to the Qoz to avoid the flies. In some cases the Baqqara have begun to keep their cattle on the *qardūd* and to protect them with dung fires by night, to avoid the need for long treks.

The Arabs, being less fearful of external influences and better acquainted with the ways of commerce and the world at large, have been quicker than the Nuba to learn the advantage of growing cotton rather than subsistence crops. The contrast is now diminishing, but it was at first most marked. Apart from the traditional methods of clearing fields with hoe and axe and burning the grass, the Baqqara are adept in the use of fire in the *hariq* system, which is of much importance in the cultivation of this and other areas of well-watered clays. The *hariq* system is employed in areas where there are almost pure stands of thick grasses, especially *Sorghum purpureo-sericeum* (*anīs*) and *Hyparrhenia pseudocymbaria* (*ansora*), which dry out during the winter and eventually are blown over and lodge, being overgrown in the coming year by a further dense growth of grass. If such an area can be preserved from fire for a period of three or more years, a dense mat of grass forms over the soil, which burns with a hot flame. When the land is required for cultivation, the Arabs wait until the first rains have fallen, causing the seeds in the ground to germinate, and then by setting fire to the dry grass as soon as a break occurs in the rains they are able to destroy the young seedlings and to clear the ground completely, leaving it almost weed-free for sowing cotton or millet.

This method well suits the inclinations of the Arabs, for they are not keen cultivators. When possible, they hire labourers to weed and har-

¹ The wearing of clothes, strings of beads, or string girdles varies from tribe to tribe. The women like bright dresses, and might appreciate the chance of seeing examples of West African fashions.

vest their fields, finding them from the landless westerners, of whom there are several settlements, from others, such as Dinka or Shilluk who are looking for a chance to earn some money; or even from Nuba of the densely populated south-western regions around Lira and Toro Jebels, where some overpopulation and land-hunger are to be found. Some of the Arabs have abandoned the nomadic life and have settled around the administrative centres, and now make their living bringing a daily supply of milk to the market. During the rainy season when the roads over the clays are impassable, some of the Arabs take employment, using their bulls to carry mails and dispatches for the government across the plains, which become impassable for lorries.

The Impact of the Twentieth Century

Very few of the merchants in any of the market centres are Nuba, for their period of emergence from economic isolation has been short. The riverain merchants who have entered the area have chiefly been interested in buying local grain and imported and manufactured articles. Such initiative, therefore, as has been employed in attempting to develop the resources of the Nuba Mountains has come almost entirely from public rather than private sources. The final establishment of law and order occurred later than in the rest of Kordofan, for in their fastnesses the Nuba, armed with rifles, were almost as inaccessible to British arms as they had been to the Arabs. The last military patrol took place in 1929, and was followed by a policy of requiring recalcitrant tribes to come down from their crags and settle where they could be reached more easily. The first tasks undertaken were the opening up of motorable roads and the establishment of medical services to win the people's confidence. Education was until recently left to Christian missionaries, it being felt that the influence of Muslims on the Nuba had hitherto been largely harmful, and that Christian schools would make them more able to retain their native virtues and traditions. In fact, many social factors have favoured the growth of Islam rather than Christianity among the

Nuba, and now that the government's Institute of Education is flourishing at Dilling, with several schools throughout the Jebels area, the assimilation of the Nuba into Northern Sudan is likely to go ahead rapidly.

Probably the most far-reaching single action of the administration has been the introduction of cotton growing, which began in 1925.¹ In 1957-8 a quarter of a million *kantars*² were produced, the profits being distributed to the Arabs and Nuba in a large number of very small payments. Cultivation of cotton is entirely voluntary, the area available to Arabs and Nuba being determined by tribal usage, by their own diligence, and by the limitations of suitable clay soils within reach of their homes. Once the decision to grow cotton has been made, however, the seed employed is strictly controlled, being supplied free of charge in appropriate quantities from the ginneries. Cotton breeding is carried out at a government research station at Kadugli, and the bulking of seed takes place in the irrigated Khor Abu Habl area. There are demonstration plots where the best methods of cultivation of cotton are shown, and inspectors visit the fields to observe and check the incidence of pests or diseases. All the cotton is bought either at outlying markets or at the ginneries themselves, the price for each grade being fixed by the Nuba Mountains Cotton Industry, a government-controlled board.

The improvement of water supplies in the Nuba Mountains has been an objective of governmental policy for many years. Before the war a number of wells were drilled, without very much success, and these had little effect on the development of the area's resources. Since the war the Nuba Mountains have profited from the activities of the Soil Conservation Department, which has been engaged, here and elsewhere in areas of heavy clay soil, in excavating surface reservoirs or tanks, known as *hafirs*, with depths of 5-9 m. and capacities of 5,000-29,000 cu. m. Such pits are sited in areas of unused but potentially fertile soil, and water is led to them by channels from nearby watercourses. If they have been well sited the *hafir* fills in the rains and may last

¹ G. F. March, chapter on 'Kordofan Province', in *Agriculture in the Sudan*, 1948.

² One *Kantar* of unginned cotton = 315 *rotls*: 1 *rotl* = 0.99 lb.

until the next rains or even longer^{1,2} (Plate XXX).

The wells and *hafirs* dug in the Nuba Mountains are indicated in Fig. 62. The graded roads through the bush which unite them had to be cleared to enable the machines to reach their sites. They now remain to facilitate communications in the area, provided that they are cleared of grass and scraped each year. It was originally thought that *hafir* digging might contribute to a permanent redistribution of the population, persuading the Nuba to abandon their hills and live near the *hafirs* to take advantage of the more fertile soils of the plains. In fact, this has not occurred, for the Nuba have religious attachments to various sites in their hills, and in many instances they would be ill-advised to build villages on the low-lying clay areas near the *hafirs* rather than on the healthier *qardūd* where they now live. The variety of soils which they now cultivate, moreover, could not be found in the middle of the clays.

The graded roads across the plains are designed to drain quite quickly, and so can provide all-season, though not all-weather, communication between the centres of administration. A gravel road has been built between El Obeid and Dilling, to keep that route open at all times. All these roads suffer from the defect that with intensive use their surfaces become corrugated, with the result that only large and powerful vehicles travelling fast can avoid severe vibration, and the lorries and trucks in use wear out at an excessive rate.

Conclusion

In conclusion, the paradox emerges that though the Nuba Mountains still remain one

of the most backward parts of Western Sudan, they are potentially better suited to a balanced development than any other part of the country away from the Nile. To the west the southern Qoz undoubtedly has an important future as a ground-nut producing area, but water supplies are certain to be difficult, the production of fruit and winter vegetables within the area is virtually impossible, and both permanent buildings and tolerable roads are very hard to construct. To the east the clay plain between the Blue and White Niles has long-term potentialities as an irrigation area, but when settlement spreads towards the wetter areas in the south difficulties of drainage and the prevalence of insects will make themselves apparent. In the Nuba Mountains, a sturdy peasant population is already distributed throughout the area, as are numerous permanent water sources, suitable sites for building, and supplies of stone for construction. Existing irrigated gardens could be extended, considerable quantities of useful timber could be grown (such as the Sudan mahogany, of which there are well-established plantations at Dilling), and the economic basis for all this could be provided by the cultivation of cotton and millet, perhaps in mechanized farms, in the broad plains which lie between the hills. Much still remains to be done before these potentialities can be converted into reality, but the Nuba are already engaged in the production of one cash crop, and if the means can be found to increase commercial production and trade throughout the Jebels, the emergence of the Nuba from their present backwardness could come with surprising rapidity.

¹ J. H. K. Jefferson, *Soil Conservation in the Sudan*, 1954.

² J. H. G. Lebon, 'Rural Water Supplies and the Development of the Economy in the Central Sudan', *Geografiska Annaler*, 38 (1956).

THE CENTRAL CLAY PLAINS—UNIRRIGATED AREAS

THE CENTRAL CLAY PLAINS

To the east of the Nuba Mountains clay plains stretch as far as the Ethiopian border, extending from the junction of the Blue and White Niles to the mountains of south-eastern Equatoria. Between north and south, however, there are such great differences of physical geography, added to the contrasts between the inhabitants and their cultures, that it would be a mistake to treat the whole clay area as a single region on the basis of the broad soil type alone. It has seemed best, therefore, to treat the northern and southern portions of the clay plains as two distinct regions, taking as the divide the boundary between Blue Nile, Kordofan and Darfur Provinces on the one hand, and Upper Nile and Bahr el Ghazal on the other.

These central clay plains are of such great economic importance to Sudan that it is difficult to avoid the conclusion that if this region had been no more productive than the Red Sea hills to the east or the Qoz to the west, Sudan as a modern state could not have come into being. In this core region are situated not only the capital, strategically occupying the junction of the two Niles, but also the Gezira Scheme, which has been responsible for many years for more than half the country's receipts of foreign currency and for a like proportion of all government revenues, and now many other lesser schemes of irrigation in government or private hands. In the southern portion of the region, moreover, there are further great areas which it is hoped soon to bring under irrigation, with great prospects of unirrigated mechanized cultivation. In this chapter a physical description will be given of the northern plain as a whole, and then the ways of life in the unirrigated areas will be discussed. The succeeding chapter will deal with the irrigated areas, showing how great are the changes which follow the establishment of a planned, reliable,

and incidentally much more profitable type of cultivation.

Physical Conditions

To the observer on the ground probably the most striking feature of the clay plains is their utter monotony: a bare 80 km. (50 miles) to the south of Khartoum one can stand in an apparently absolutely flat plain of grey cracked clay, where the thin natural vegetation has all been cleared and where there is neither a hill nor a village nor a tree nor a blade of grass in sight in any direction. A like distance west of Singa or Er Roseires one can drive for hour after hour through apparently uniform savannah country, dry grass and thorny leafless *Acacias* seemingly without end, and only a low hill in the distance interrupts the perfect circle of the horizon.

Yet between these two types of scenery an orderly gradation of conditions must occur. Physically the most significant differences in the geography of the region are dependent on the mean annual precipitation, and several belts of vegetation and potential land use may be distinguished running from east to west. So great is the importance of a perennial water supply, however, that the human occupation of the region may be divided into the White Nile settlements, the Blue Nile settlements, and the lesser populations along the Rahad and Dinder rivers, while only a very few inhabitants are to be found permanently occupying the areas in between (Fig. 66).

On the basis of the rainfall it is convenient to recognize three belts. These are a northernmost one, with a rainfall of less than 400 mm. (16 in.), wherein summer cultivation is practised with difficulty unless earth banks or ridges (Arabic *teras*, plural *terūs*) are constructed to hold storm-waters and give them time to sink into the ground. There is a central belt where crops of grain are regularly grown without the use of either irrigation water or ridging. Finally, there is a most southerly zone, with a

rainfall rising from 600 mm. (24 in.) to nearly 1,000 mm. (40 in.), which is almost unpopulated for a variety of reasons and is occupied by dense stands of *Acacias* and other types of drought-resisting tree.

An analysis in terms of water supply will reveal the existence of an alternation of waterless belts, virtually uninhabitable for most of the year unless shallow wells can be dug round a hill-mass, and ribbons beside the rivers, 10–15 miles wide, where the clays can be reached and cultivated from settlements beside the streams. This is particularly the case in the southern part of the region, where the clays are underlain by the rocks of the Basement Complex. Farther north the ribbon on the west bank of the White Nile almost disappears downstream of Kosti, since the Qoz sands reach right up to the flood-plain of the river, while in the Gezira and on the right bank of the Blue Nile hand-dug wells can reach water at depths of 20–30 m. (70–100 ft.), making the distribution of villages, and even towns like Manaqil with 3,100 inhabitants, independent of the rivers.

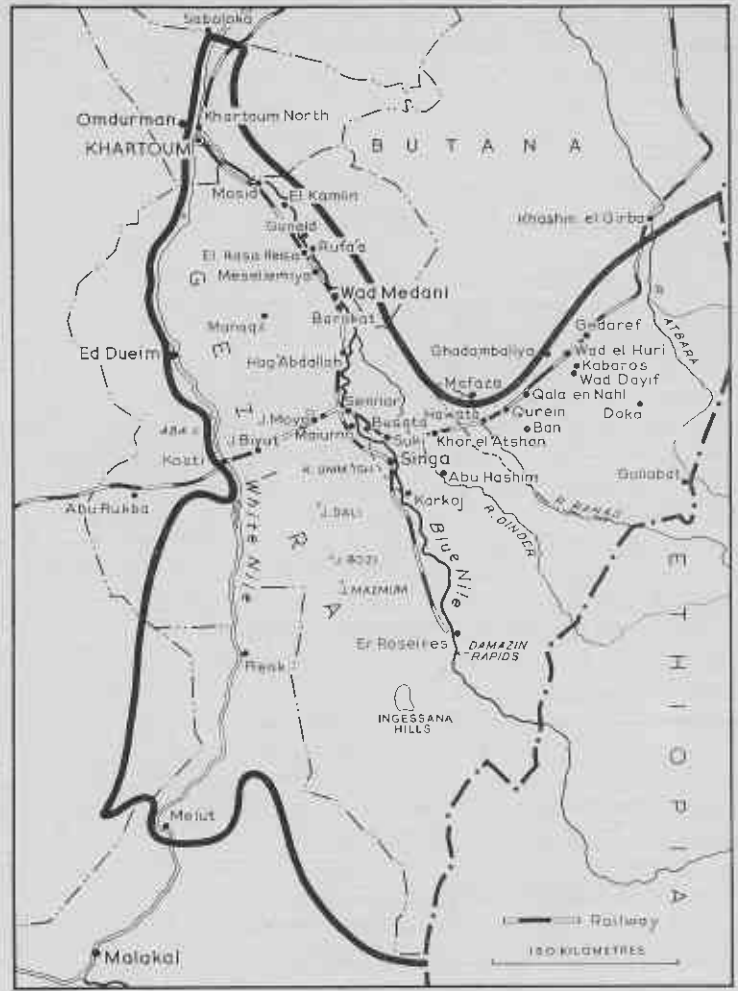
Between the Rahad and Dinder rivers there is a narrow and very flat *gezira*¹ which is crossed by several meandering flood overflow channels, along some of which permanent villages are sited. Farther to the east the country rises gently to the watershed between the Rahad and Atbara rivers, where a tongue of basalt extends northwards from the Ethiopian massif into Sudan. The relief of the low ridge thus produced is gently undulating, with a few hills standing out along the watershed

FIG. 66. The Central Clay Plains.

itself. Except along the narrow outcrop of the Nubian Series the soil is a dark brown clay not very different from that of the Gezira, but the generally better drainage of the land makes it distinct from that to the west, and it will be convenient to call it the Gedaref Ridge, after the administrative centre that lies at its northern end (Fig. 74).

Within the central clay plain as a whole a settled population is usually to be found wherever a permanent water supply occurs. The few exceptions to this rule are chiefly in the south and west of the region towards the

¹ The Arabic word *gezira*, literally an island, is also used to refer to a peninsula, and hence to a piece of land lying between two rivers above their confluence.



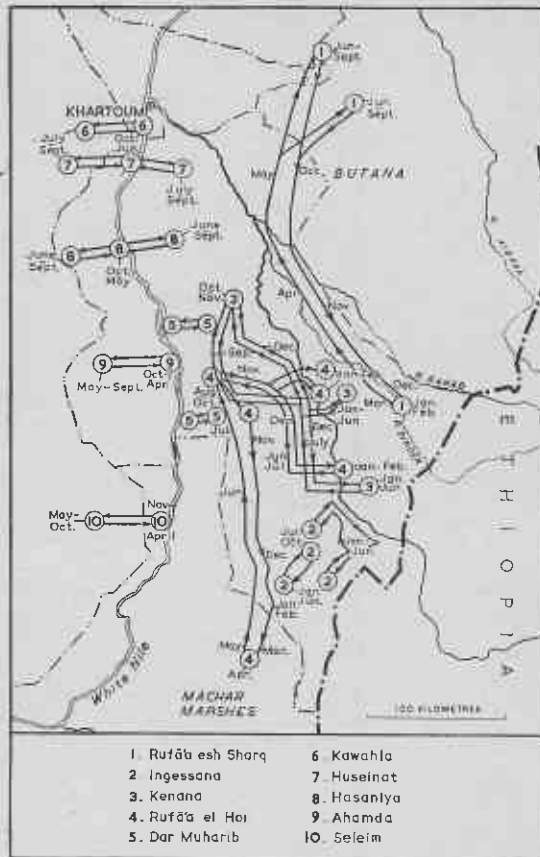


FIG. 67. Seasonal movements of nomads in the Blue Nile Province. With dry-season water supplies dependent on the rivers as well as on the Machar Marshes of the Upper Nile Province, shorter east-west movements are found in addition to long north-south migrations, such as those observed in Western Sudan. The fine grasses of the Butana afford good wet-season grazing and freedom from flies. From information kindly supplied by Dr. Bayoumi of the Sudan Veterinary Service and others.

Ethiopian border, where until recently security has been bad, and along the White Nile south of Kosti, where variations in the river level make the choice of village sites difficult. The existing settlements can exploit only a small proportion of the region, and elsewhere the extensive grazing afforded by the natural vegetation has attracted various nomadic tribes, both cattle-owning Baqqara by the White Nile and other Arabs with mixed flocks and herds of camels, cattle, sheep, and goats in the Gezira and farther to the east. The nomads

cannot exploit all the available grazing, for they are restricted in their movements by the necessity, especially during the dry weather, of keeping fairly close to water supplies. Hence there are possibilities of extending both the cultivated area and the number of animals supported, if the water supplies can be improved. Later in this chapter an account will be given of some of the means that have been adopted to this end.

THE NOMADS

The rainfall of the region is more intense and more reliable than that found in areas of nomadism fringing the Sahara, and this makes it possible for animal owners to follow fairly regular routes across the clays in their annual migrations. Despite the difficulties of water supply, moreover, a higher density of population can be supported by animal rearing, about 20 persons to the square kilometre (50 to the square mile) in the territory of the Rufā'a el Hoi as compared with 10 (25 to the square mile) only among the Hawawir of the Bayuda Desert. Two distinct patterns of migration are to be noted in the clay region, for differences of topography and water supply make the seasonal movements of the nomads beside the White Nile rather different from those of the Arabs farther to the east (Fig. 67).

The White Nile occupies a broad, shallow depression, and when the Blue Nile is in flood in late summer the ponding back of the White Nile is perceptible as far upstream as Renk. This raising of the level is nowadays prolonged by the operation of the Jebel Auliya Dam. When the flood subsides a strip of land averaging about 1 km. wide is laid bare, which produces a flush of green grass, especially *Echinochloa pyramidalis*, at a time when the rain-grown grasses away from the river are quite dried up. Such conditions are very favourable for cattle rearing, and the local Baqqara tribes, whose territory lies on either side of the White Nile southward from about latitude $13\frac{1}{2}^{\circ}$ N., make relatively short annual migrations between the river, where they spend the dry weather, and the country to the east or west of it, whither they migrate during the rains. Those on the west bank have the advantage

that they can move on to the patches of Qoz which alternate with clay areas to the south of the railway line. These provide easier going and altogether healthier conditions, while there are wells yielding water in moderate quantities throughout the year which account for the presence of the Dar Baqqara administration headquarters at Abu Rukba. The Dar Hasaniya Arabs, whose tribal areas lie farther north on either side of the river, are gradually settling down as increasing opportunities are afforded them of becoming participating tenants in private pump schemes in the region. At the same time added wealth is making it possible for them to buy more animals, especially sheep and goats, which in summer are led into the Gezira clays and eastern Qoz. Those tribesmen not fortunate enough to be tenants in cotton-growing schemes or to own large flocks live a wretchedly poor life. In years when the rains are bad, cases of severe hardship and even starvation are not unknown.

The central Gezira and the banks of the Blue Nile provide no such favourable winter grazing ground, and annual migrations are in consequence much longer. The Rufā'a el Hoi tribe, who with the Kenana are the principal occupants of the southern Gezira, travel a distance of more than 200 miles between their summer and winter grazing areas. These extensive migrations are made necessary by two prime needs: the trek southwards is undertaken to find palatable grazing, which in winter becomes available as the Machar marshes dry out, while the return to the north is required to avoid the mosquitoes and other insects, including *Stomoxys* sp. and various of the *Tabanidae*, which abound throughout the wetter parts of the southern Gezira during the rainy season. When the Arabs decide to move they divide into small groups and travel briskly, covering up to 10 km. in a day and grazing on the way. When moving southwards they are required to wait on the northern side of the Blue Nile—Upper Nile boundary until the middle of February. This is because there have been complaints at times from the Dinka that the Arabs damage their crops before they are harvested. The principal grasses of the marshes

are *Echinochloa pyramidalis* and *Hypparrhenia rufa*. The northward movement of the Arabs at the onset of the rains is uncontrolled, and their chief concern is to get away to fly-free country as fast as they can. Other sections of the Rufā'a el Hoi and also the Kenana move down to the Blue Nile during the winter. The Kenana cross the river, but the Rufā'a el Hoi do not. The camel-owners find some work carrying grain and other produce, and the Kenana, who are particularly noted for the good milking qualities of their cattle, sell milk to the inhabitants of the permanent villages. During the summer the Arabs like to grow some millet, if they find grassy patches suitable for *harīq* cultivation, and the allocation of such lands often brings them into dispute with the settled villagers.¹

The Rufā'a esh Sharq on the eastern side of the Blue Nile find winter grazing in the pools and watercourses of the Dinder-Rahad Gezira, but in the summer they disperse throughout the central Butana, where they find plentiful green grazing and come into contact with the Shukriya. Elsewhere it is rather rare for the seasonal movements of nomads to take them outside the district or province where they usually live. This is because such boundaries have usually been selected to correspond with the nomads' traditional migrations, and thus to reduce the likelihood of disputes and intertribal fighting. In this way the province and district boundaries on the western side of the Rufā'a el Hoi territory constitute also a division between the Baqqara and Rufā'a types of nomadism in the north and between the Rufā'a and Dinka ways of life farther south.

The nomads of the Gezira have no need of an organization such as that which has grown up in the west in order to dispose of their animals. Their market, the wealthiest in the country, is at their doorstep, both in the villages of the irrigated Gezira and in the towns, particularly the capital, Omdurman and Wad Medani. Generally mutton in Sudan is better than beef, being fatter and tenderer, and it is much preferred by the Sudanese when they can afford it. There is no local market for camel

¹ Information concerning the movements of the nomads has been obtained from a memorandum written by Dr. M. S. Bayouni of the Ministry of Animal Production.

flesh, and the camels of the Rufā'a are mostly bought by Rashāida tribesmen, who drive them to the markets of Egypt.

THE SETTLED AREAS

The settled cultivators of the clay plains differ markedly from the nomads, in that many of them are recent immigrants, coming from a wide range of tribes. In consequence, they are much less intimately associated with the traditional administrative structure of *sheikh*, *'omda*, and *nāzir*, who exercise authority over them, and are very ready to migrate to other districts and even provinces if they hear that some of their kinsmen are settled there. Individual villages usually consist of persons having a common origin, but adjoining communities may be quite distinct, with former cattle- and camel-owners settled alongside one another. There are many areas where almost all the villages are occupied by westerners, each having an appropriate village *sheikh*, but all being subordinate to an Arab *'omda*, who may be of quite different physical type. It is not suggested that this mixture is undesirable, there being clear signs of the development of a general sense of Sudanese nationality to replace a narrow adherence to tribal loyalties.

Very few settled villages are to be found in the western part of the clay plains. There are virtually none in the waterless area beyond the White Nile, while in the country near enough to the river to draw water from it there are some new settlements dependent on the recently established pump schemes, but few relying on unirrigated cultivation. The scarcity of population in the open plain is understandable enough. The paucity of settlement by the river, on the other hand, is to be explained by the poor protection that the region used to afford against the incursions of nomadic robbers, added to the difficulty of establishing permanent villages beside a broad stream with gently sloping banks, since the waterline may retreat a mile or more when the level of the river is low. In the nineteenth century this was Dinka and Shilluk country as far north as Kosti. During the Mahdiya general insecurity made the Nilotes retreat southwards, but there was no corresponding settlement of

their land by the Arabs, who preferred a nomadic life.

The Northern Gezira

In the Gezira between the Blue and White Niles the greatest density of population, apart of course from that in the areas now irrigated, occurs in the north at about the latitude of Wad Medani. The rainfall at this latitude is a bare 350 mm. (14 in.) per annum, and so crop production can be ensured only by the construction of earth banks or *terūs* to conserve water. It is somewhat surprising that the population should be densest in this semi-arid belt, while farther south where crops grow more reliably there are many fewer inhabitants. The explanation seems to lie, as so often in Sudan, in water supply, since wells can be dug here successfully, as noted above, and there were also numerous surface water-tanks excavated laboriously by hand in the days before mechanical drills and earth-moving machinery were known. At the latitude of the Sennar-Kosti railway the only wells are the relatively shallow ones dependent on local run-off, these being situated around the hill-masses of Jebel Moya and Jebel Biyut. The granites that lie beneath a thick mantle of clay yield no water.

In the *terūs* belt of cultivation, wherever the soil is a suitable clay, there is an almost continuous pattern of ridging on the ground, and very little of the natural vegetation remains. Where the surface of the ground is at all sandy or gravelly *terūs* cultivation cannot be practised and grassy patches occur, while in ill-drained hollows tussocky grasses and *la'ot* bushes grow (*Acacia orfota*). There are, however, very few trees since those that have not been felled to clear the land for cultivation are almost certainly taken for firewood or building poles.

The ridges are constructed on the better soils of a high clay content, ill-drained hollows and chains of depressions being avoided (Plate XXIX). The ridges (Fig. 68) are really low banks not more than 1 or 2 feet high, which are thrown up either at a right angle to the slope of the ground or quite often so as to form a V pointing down the slope. In certain areas a man will make a major and permanent ridge to surround his plot, and within it will

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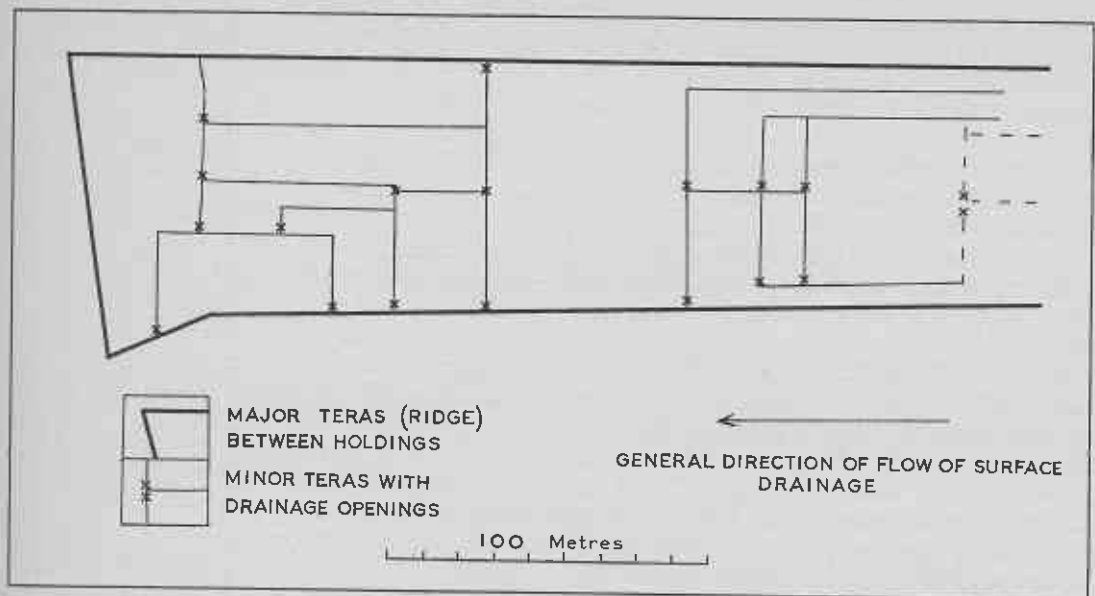


FIG. 68. *Terūs* near Manaqil on a heavy clay soil: a single holding at Kogeila, Blue Nile Province, with a mean annual rainfall of ca. 30 cms. (12 in.). The low internal ridges permit a considerable measure of water control during the rainy season. From a plane table survey by the author.

site minor ones which divide up the holding and avoid excessive flooding at one end accompanied by complete aridity at the other. The minor ridges also make it possible to use successive storms to flood different pieces of ground, and to let off water which has stood for long enough (about 14 days) on any one site. In most sites *terūs* do not appear to collect water from a large area in order to concentrate it on a small and favoured patch, but rather to avoid losses by run-off and to ensure that some at least of a man's ground is wet enough to yield a crop. Almost the only crop grown is a quick-maturing millet called *Peterita* which takes a bare 80 days from germination to maturity. Associated with it may be some *bamia* including a wild variety which seeds itself.

Even with the aid of ridging, cultivation in the area is by no means secure or remunerative, and its continued existence is to be explained in part by the proximity of the irrigated areas and the towns associated with them. On the one hand these ensure the existence of a reliable market for grain in the years when the farmers are able to produce a surplus, and on the other they afford a steady source of income

to those who are willing to go and work as cotton pickers during the months when they would otherwise be idle. The nomads moving through the area, moreover, buy grain and occasionally sell a sheep or two to a farmer. Even so, the peasants are poor, as is attested by their generally shabby clothes and by the bareness of their homes.

It has been stated already that the various villages are occupied by inhabitants from a wide range of tribes. While mutual relations are generally good and disputes are few, a result of some consequence is that lurking suspicions prevent the development of co-operative organizations to protect the peasant from more powerful bodies. In the disposal of his crops the cultivator only too often falls a victim to the system of *sheil*, as has already been discussed in the chapter dealing with the Northern Province. Co-operative buying and selling schemes are being introduced by the government to combat this evil, but they have not yet proved very successful, since efficient and honest managers are not easily found.

When working in the cotton fields likewise, the farmer earns a daily rate that often bears little relation to the high price of the product

that he is picking. In this instance co-operation might prove even harder to organize, since the local villagers come into competition with groups of migrant labourers from all over Sudan and even outside it, and except at periods of maximum demand, when rates of pay do rise considerably, the tenants could probably dispense with the labour of any one group without great inconvenience. Another factor of some importance is that the extension of the irrigated area of central Sudan, now in progress, has been foreseen for a number of years. Thinking of themselves as future members of the tenant and employer class, the farmers of the region are not keen to build up an organization to raise labour rates against themselves.

In the absence of local supplies of grass and timber as building materials, house construction presents some difficulties because of the occasional severity of the summer rains. Sun-baked mud bricks are used for walls, and a skilled builder must be paid for the work, which means that a compound wall to give his family privacy is a luxury the average villager cannot afford, much as he would like it. Poles and grass for roofing have to be bought at the markets, and so poor thatching and roofs sadly in need of repair are common sights (Plate XVIII). Village sites seem fairly permanent, for as old houses crack and crumble new ones are built up upon them. This has the advantage of raising the villages gradually above the plain, so that water does not stand between the houses after rain.

The traditional markets of the *terūs* area were spaced at distances convenient to be reached by foot or donkey. Some of these, especially Manaqil, are places of some age and religious significance, and *qubbāt* (domes raised over the tomb of a holy man after his death) are a characteristic feature of an otherwise exceptionally severe landscape. The development of lorry transport has much reduced the importance of these markets, for no longer is a convenient stage required half-way along the road from one Nile to the other, while even for the local inhabitants it is often better to take a cheap ride on a lorry into Wad Medani or

El Hasa Heisa than to buy at the more limited market nearest to their homes. The mixed nature of the population has encouraged the development of local government, which has its centre at Manaqil. Here as elsewhere in Sudan the development of local government as an effective means of associating the people with the work of government departments and as a training ground for democratic procedure has been among the most striking developments of recent years.

The task of allocating tenancies in the newly irrigated areas of the Manaqil extension to the Gezira has been much simplified by the fact that this is almost the only area of Sudan, apart from the irrigated lands of the Northern Province and along the two Niles, where ownership of the land had already been settled by judicial process. Lands that were found at the time of the settlement (1927) to be in regular cultivation were assigned to individual owners, while unused land was registered to the central government. The relevant cadastral plans, while in no sense topographical maps, yet provide a framework on which to base present studies of land occupation and use, while the registry, in so far as it has been kept up to date, will at least show what families have possessed enough land at the time of expropriation or leasing to warrant granting them tenancies in the new schemes.¹ Elsewhere in the areas of unimproved peasant agriculture in Sudan, land tenure is customary and tribal, and even in areas of apparently quite unused land there is usually some interested body to come forward with a claim to a share in the benefits of any proposed scheme.

The Rainlands

Towards the south the rainfall increases, and when it attains 400–500 mm. (16–20 in.) cultivation becomes more assured. This has caused the central Gezira and the country to the east of it to be known sometimes as the 'Rainlands'. Immediately to the south of the irrigated Gezira at this latitude there is a rather dense area of villages dependent on unirrigated cultivation, their inhabitants drawing their water supply from the main Gezira canal and from

¹ An important preliminary stage in the construction of the Manaqil Irrigation extension has been the bringing up to date of the land register, which had been allowed to become very much out of date. An index is available to the Registration Sections in Gezira, CAD 179, published by *Sudan Surveys* in 1949.

the Blue Nile. In this area various signs of over-cultivation have been noted, such as the appearance of witchweed (Arabic *buda*, *Striga* spp.) in the fields, the decline in yields of millet to be obtained, and the use of ridging in an area whose rainfall, about 450 mm. (18 in.), should make it unnecessary.¹ Elsewhere the only settled villages in the southern Gezira are those situated around Jebel Moya and others of the hill-masses. At Jebel Moya there are several villages which originally drew their water supply from wells but now depend on the *hafirs* that have been built by the Soil Conservation Branch of the government.^{2,3} In these wetter areas a slightly wider range of crops can be grown than in the *terūs* area. Where there are settlements of westerners, *Pennisetum* is often grown in preference to *Sorghum*, and sesame is fairly common, though this is near the dry limit of its range, and in a dry year it will fail. In the villages, which consist of the usual round thatched huts set in enclosures of millet stalks, there are plots of maize, *bamia* and chillies planted within the compounds, while gourds and melons climb over the roofs. Away from the villages, there are occasional opportunities for *harīq* cultivation, which is coveted both by the villagers and by the Arabs. The allocation of particular areas is the responsibility of a committee composed of the representatives of both sides, but it often leads to dissatisfaction and disputes.

The Southern Gezira

Southwards from about latitude 12° N. the savannah woodland becomes fairly dense and continuous, and open grassy areas, known as *saqiyat* are infrequent. Some communities have in the last few years been springing up near the *hafirs* which have been built near Jebels Bozi and Mazmum and elsewhere, but apart from these and the nomads the country away from the river is uninhabited until the Ingersana Hills are reached at latitude 11½° N. These granitic hills bear a considerable resemblance to the Nuba Mountains, in that they presumably enjoy a slightly higher rainfall than the country around them, though there

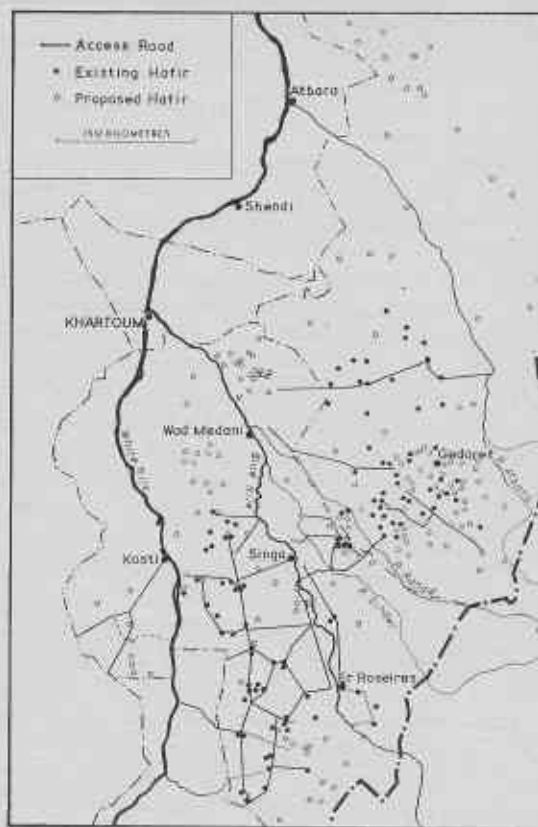


FIG. 69. *Hafirs* and access roads in Blue Nile Province and the Butana. Source as for Figure 63.

are no statistics to prove it. There is the same association of rocky outcrops, accumulations of valley fill and *qardūd* soils, and away from the plain a similar clay plain provides opportunities of cultivation. This hilly country towards the Ethiopian border is occupied by a large number of small tribes of more or less negroid peoples, in whom there has been a mixture of Hamitic stock from across the Ethiopian border, but virtually no infiltration of Arab blood. While the tribes have taken to occupying the hill-tops in the same way as the Nuba, they seem to have been less successful in evading the depredations of slave-raiders and poaching parties. The Ingersana tribe appear to be the most enterprising group of this area, and in addition to bringing grain, sesame, and vege-

¹ J. H. K. Jefferson, 'The Sudan's Grain Supply', *S.N. & R.*, 30 (1949).

² *Idem*, *Soil Conservation in the Sudan*, Khartoum, 1954.

³ J. H. G. Lebon, 'Rural Water Supplies and the Development of the Economy of the Central Sudan', *Geografiska Annaler*, 38 (1956).

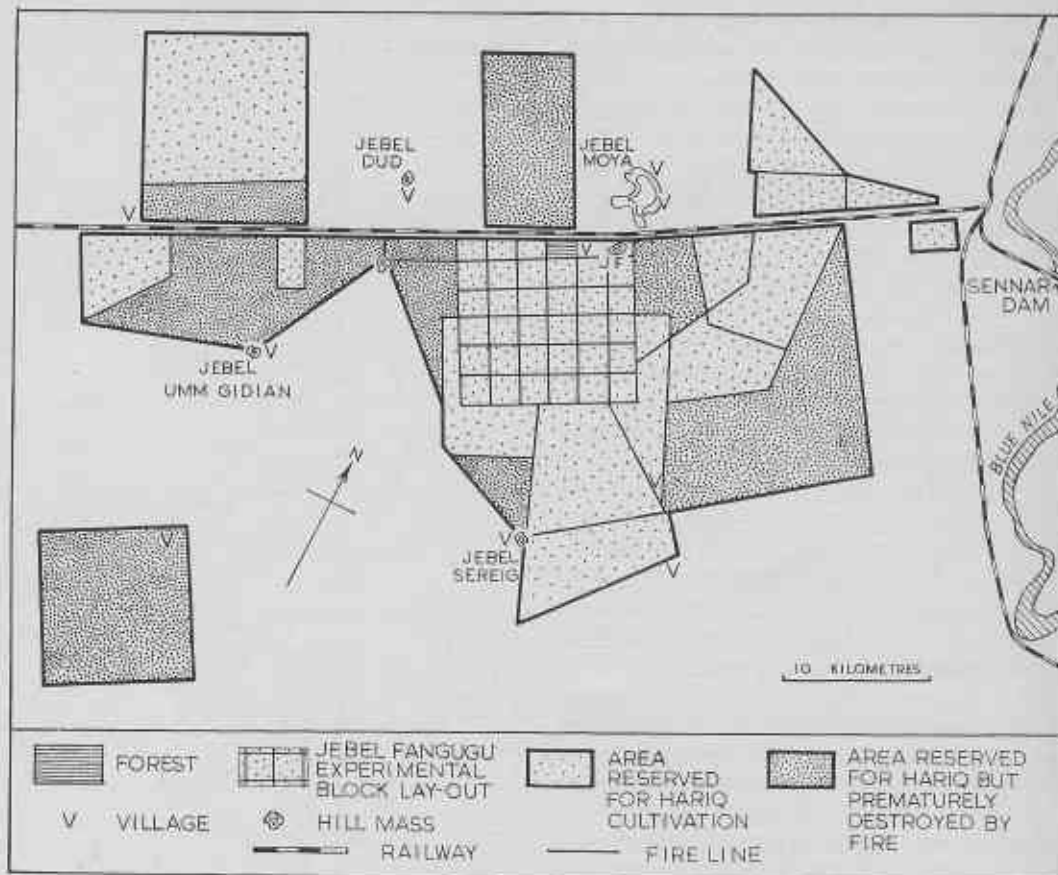


FIG. 70. Jebel Fangugu experimental block lay-out and *harig* fire-lines, 1956-57. The Ministry of Agriculture is trying to determine how to improve peasant farming by a system of blocks of land cultivated in rotation, as at Jebel Fangugu. Attempts are also being made, with varying success, to protect areas of natural grassland with fire lines, so as to permit extensive *harig*-type cultivation. From a map supplied by the courtesy of the Inspector of Agriculture at Sennar.

tables to market, they are acquiring herds of cattle which they send down into the plains and towards the river during the dry weather.

This southern Gezira has been in the post-war period one of the principal scenes of activity of the *hafir*-excavating teams of the Ministry of Agriculture (Plate XXX). To increase animal and grain production, and generally to make the resources of the area more readily available to its inhabitants, roads have been cleared and mechanically excavated *hafirs* have been dug over a wide area (Fig. 69). The *hafirs* in the north have been intended to help *harig* cultivation, especially between Jebel Dali and a line west from Jebel Moya, where the best expanses of grass are usually to be found.

Farther south the main aim has been to assist the Kenana and Rufā'a el Hoi tribes, who have hitherto had a hard time during their annual migrations and when occupying their summer areas. Near Jebel Fangugu there is already a scheme of planned settlements where improved methods of peasant agriculture are being tried out and demonstrated (Fig. 70), and a cattle-breeding and grazing research unit has just been established near Singa to upgrade the Kenana cattle and to determine their territory's optimum stocking level. Serving this Gezira region and drawing its water supply by a small canal from the Blue Nile is the Rainlands Research Station known as Jebel Tozi: here experiments are being carried out to learn what crops can

profitably be cultivated without irrigation in the better-watered parts of the Gezira, and how machinery can best be employed to increase the area under crops. Crops that have shown the best promise are millet, American Upland cotton, sesame and ground-nuts, the latter growing exceptionally well on a soil that would not normally be considered suitable for it, provided that the surface can be prevented from baking and producing a hard, impenetrable pan.

The Blue Nile Ribbon

The ribbon of land that follows the Blue Nile southwards from the southern end of the Gezira Scheme is much more densely inhabited than that along the White Nile. Here is the former centre of the Fung kingdom, whose territory once extended as far as the Red Sea hills in the east and the kingdom of Tegale, which it subdued, in the west. The origins of the kingdom, whose power was finally destroyed by the invasion of Muhammad Ali's son Ibrahim in 1820, have been much disputed, but what is certain is that the power of the kingdom was largely determined by the secure base provided by the lands along the Nile.¹

The Blue Nile flows in a succession of meanders with its bed incised about 20 m. (65 ft.) below the general level of the plain. During the summer flood its waters are charged with a high proportion of silt, up to 3.6 parts per thousand at the maximum as far downstream as Wadi Halfa,² and in consequence silty alluvium has been deposited both along the river banks and as islands on inner curves of the meanders. Over the years the relative distribution of the river bed and the silt terraces within the curves undergoes a steady alternation. A typical example of this type of topography (Fig. 71) shows the following features: on the outer loops of the meanders there is a belt of eroded clays (Arabic *kerrib*), wherein nodules of calcium carbonate are common at the surface, having been left *in situ* by the sheet erosion that has carried the fine soil particles away. Next is found the steep bank of the river, where undercutting is taking place due to the scouring action of the river in flood. Because

the river is at its highest by the time the streams crossing the *kerrib* are in spate, there is relatively little erosion of the banks by the latter. In the middle of the stream, or towards the inner side of the loops, small islands are common, often being altered in shape or even completely removed by a severe flood. Within the loop of the meander there is usually a depression or basin, liable to be flooded when the river is at its highest, but often having no drainage afterwards. On all the better-drained parts of these basins the natural vegetation is forest, mixed at the edges but mainly consisting of *Acacia nilotica sunt* towards the centre where the period of inundation is several months, while at the very centre of the depression a semi-permanent pool is found where no trees can grow.

Settlement along the Blue Nile occurs chiefly in villages on the eroded land next to the high river bank, for such sites are well drained during the rains and are not close to the malarial swamps within the *sunt* forests. Unlike the practice in the Northern Province of Sudan, where houses are strung out along the river, here in central Sudan the people are invariably concentrated into distinct villages. These provide greater security from wild animals, nomads, or robbers who may emerge from the bush, and reflect the fact that cultivations in the 'rainlands' usually occur all round a village, whereas in the Northern Province they are strung out in lines. The houses in the villages consist invariably of round huts with thatched roofs and walls of millet stalks, privacy within the compounds being secured by a wall of grain stalks or plaited grass. There are few wells, for the villagers normally draw their water direct from the river.

Apart from their summer cultivations on the clays the inhabitants cultivate the silts on the sloping banks of the Nile as the flood goes down, and have also cleared some of the level terraces which they irrigate by pump or water-wheel. The terraces have all been surveyed and either legally settled to individual owners or reserved to the government as Forest Reserves. Where cultivation is practised

¹ O. G. S. Crawford, *The Fung Kingdom of Senner*, 1951, includes a complete bibliography on this topic.

² Y. M. Simaika, *The Suspended Matter in the Nile*, 1940.



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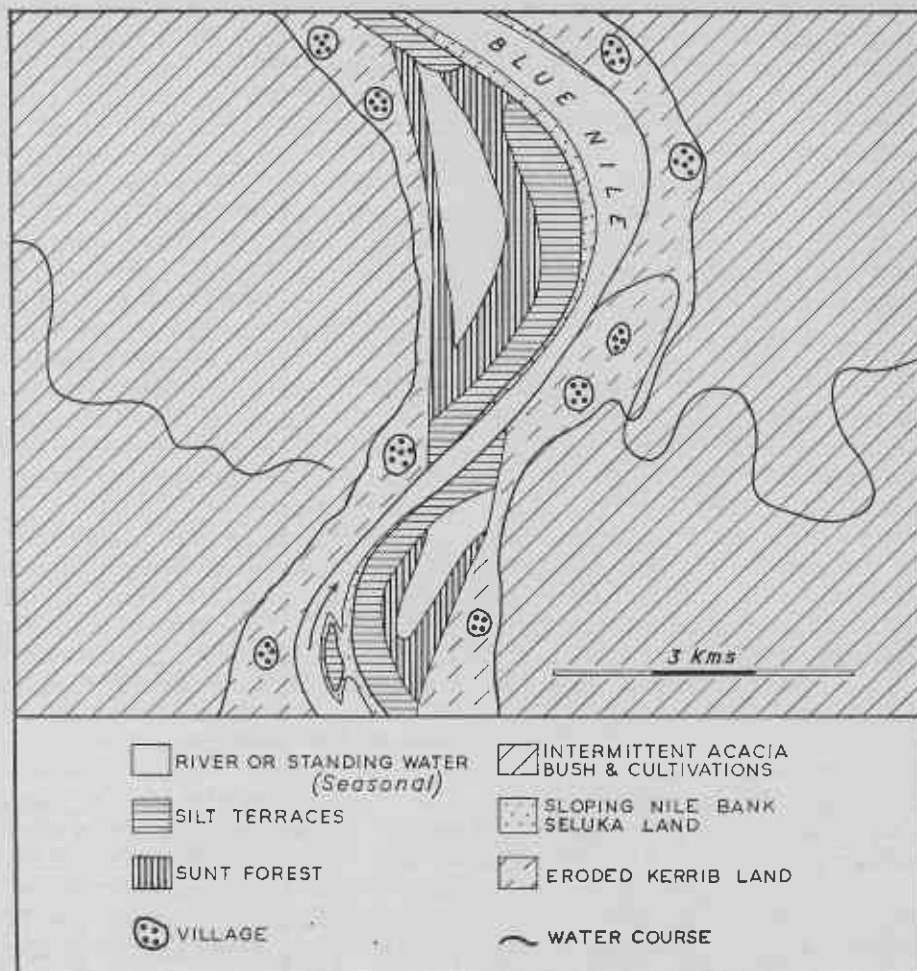


FIG. 71. Land classification and use beside the Blue Nile near Singa. From *Sudan Surveys Air Photographs*.

the land is in the hands of some of the longer-established families of the region, and the Mek of Singa, descendant of the former kings of Sennar, has a considerable holding, which he either lets or uses himself, chiefly for growing cash crops.

The importance of the Forest Reserves is that they supply timber for railway-sleepers of a kind that the white ant (termite) does not eat, and also provide fuel for cooking in the towns of central Sudan. Upstream of Sennar

there are 37 of these forests, having a total area of 21,650 *feddans*, while between Sennar and Khartoum there are 33 such forests, with a total area of 11,860 *feddans*.^{1,2}

The use made of the land, both along the terraces and on the clay plain, depends on whether it is in the hands of the peasants, working with no capital and the simplest of implements, or of richer men who have been able to set up irrigation schemes. The former use the silts to grow maize and a variety of

¹ G. A. Booth, *Working Plan for the Forest Resources of the Southern Blue Nile Circle*, Miscellaneous Publication No. 2, Agricultural Publications Committee, Khartoum, 1950.

² *Idem*, *Working Plan for the Acacia nilotica Forest Reserves, Gezira Circle*, Memoirs of Forestry Division, No. 6, Agricultural Publications Committee, Khartoum, 1954.



PLATE XXVII. HOUSES AND HILL FARMS IN THE NUBA MOUNTAINS



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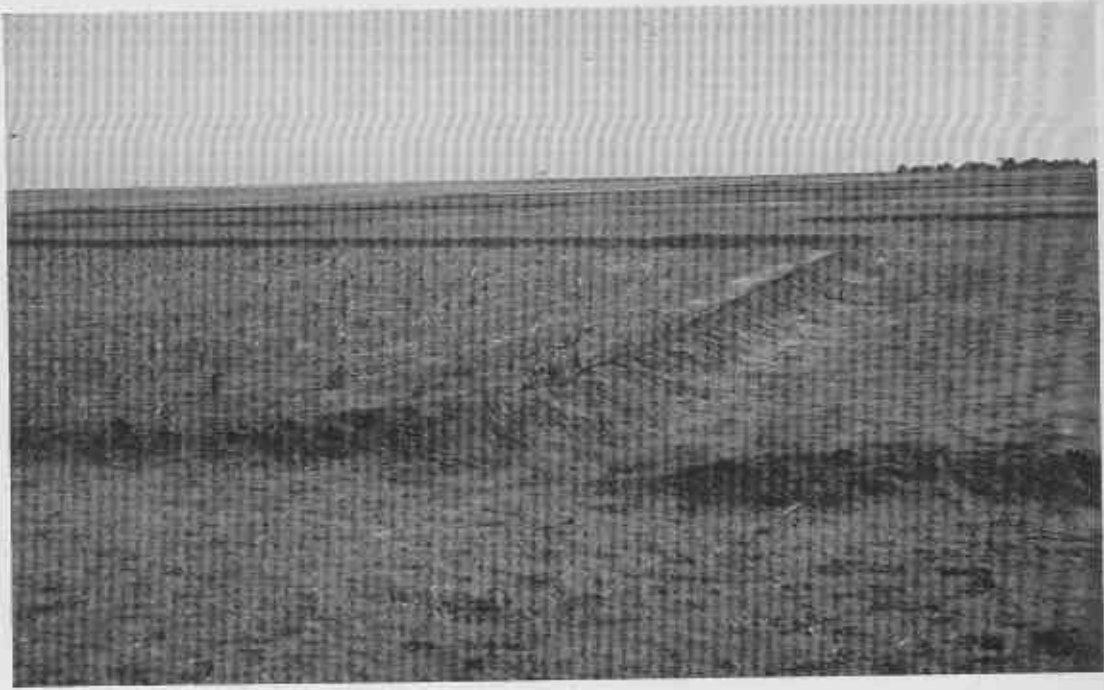


PLATE XXIX. *TERÛS* IN THE CENTRAL GEZIRA



PLATE XXX. *HAFIR*-EXCAVATING TEAM AT WORK

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vegetables, relying mainly on the summer rainfall, and also plant French beans, *lubia*, and melons on the steep banks as the water goes down after the flood. In a few places they have also built water-wheels to irrigate fruit trees. On the lands away from the river they practise a simple system of bush fallowing, growing millet and sesame until yields decline, and then they leave the land until its fertility has been naturally restored. Clearing the bush to grow grain is hard work when thick grasses and young trees have grown up. This encourages old men and women, who no longer have the strength to open new fields, to cultivate worn-out land near the villages when it should be resting, and this may cause a serious and long-lasting decline in fertility. Some of the more vigorous villagers go inland to find *hariq* lands, which they have to share with the Arabs.¹

Not every family has the fortune to have a patch of silt terrace on which to grow vegetables, and in some areas lack of knowledge prevents the peasants from making full use of the existing silts. In the alienation of many of these silt areas to forest a narrow strip has usually been left beside the river for cultivation. Some further diminution of the forest reserves could probably be permitted without serious reduction to the supply of *sunt* logs. Near Singa there are some villages situated several miles from the river, drawing their water from shallow wells near the watercourses that are a feature of this part of the clay plain (probably the Khor Umm 'Ish just west of Singa marks a former course of the Blue Nile). These have no share in the riverain silts. Most of the riverain villagers have small numbers of cattle, sheep, and goats. In the rains they sell a little clarified butter-fat, and at other times those near to the markets, such as Sennar or Singa, make some money from the sale of fresh milk.

In contrast with these peasants, some of the more educated and prosperous villagers have been able to establish schemes of irrigation, both on the terraces and on the clays. It is intended to discuss the development of irrigation in the clay plains in its several aspects in Chapter XIII below, but it is worth noting that the effects of irrigation in the Blue Nile

area are rather different from elsewhere in the Gezira. There are no villages whose members are almost universally participators in irrigation schemes, but there is rather a growing tendency for individuals to become associated with minor pump schemes, either as owners, managers, or tenants. Near Singa, for example, there is a number of fairly small schemes, having a pump diameter of not more than 4 in., which have perennial licences and are permitted to draw water from the Blue Nile throughout the year. These are the fruit gardens on the silts, many of them having been in existence for thirty years or more. Originally employing steam-driven pumps burning local timber, they have increasingly turned over to diesels, and now irrigate plots of not more than a dozen *feddans* at the most, whereon they grow mangoes, bananas, guavas, and citrus fruits which are taken by lorry and sold in the urban markets and throughout the Gezira. The owners employ hired labour, usually permanent rather than casual, and so these schemes do not have a great impact on the villages around them. Recently, they have been experimenting with tobacco, which grows well, and with cotton, with which they have had less success.

The villages along the Blue Nile are of various origins; some are inhabited by Fung, but others have been established by settled members of Arab tribes such as the Kenana or the western Baqqara, and still others are occupied exclusively by westerners (Fig. 72). The villages of persons from within Sudan are losing their individuality and are gradually merging to create a common Sudanese nationality, but the westerners keep themselves apart. They are generally unable to find wives from Sudanese families, and either send for kinsfolk from their native lands or else look for a western girl within Sudan. The most important of such settlements is at Maiurno, where there is an overgrown village of more than 10,000 westerners living beside the Nile south of Sennar. Their traditional chief, who enjoys the powers of a petty *nāzir*, is known as the Sultan, and has powers as a magistrate of a native court serving a number of villages stretching across to the Dinder river. Towards Er Roseires the population declines, for above that point

¹ Jefferson, S.N. & R., 30 (1949), p. 81.



FIG. 72. Villages and tribes in the Fung. The situation is very similar on the east bank of the Blue Nile, and a comparable diversity of tribes is to be encountered as far upstream as Er Roseires. The pensioners are former soldiers of mixed tribes who have settled in the area on retirement. From an enquiry conducted by the author.

proximity to the Ethiopian frontier brings a sense of insecurity, while the country is at once more densely wooded, stonier, and less fertile. Near the frontier, trypanosomiasis is common, being transmitted mechanically by tabanid flies to cattle, while beyond the border there are tsetse flies which keep the disease alive.

The Rahad-Dinder Gezira

To the east of the Blue Nile there is a belt of country a bare 30-50 km. (20-30 miles) wide before the Dinder river and the Khor el Agaliyin are reached. It might be expected, therefore, that all this strip of land would prove to be in reach from one or other line of permanent water, and that a considerable population would be found in the area. In fact, much of this country and of the Rahad-Dinder Gezira is extremely ill-drained and includes many water-courses and depressions which are in-

festated by insects even after the rains are over. In consequence, while there is a considerable population at Es Suki and near the Busata pump scheme to the north of it, the banks of the Rahad and Dinder rivers themselves are not followed by settlements in the way that the Blue Nile is, and the whole region is very thinly populated. At its southern limit, in fact, it has proved possible to designate a considerable area as a Game Reserve in which no settlement is allowed at all.

Almost the only villages to be found along the Rahad are at Hawata, the railway crossing, or to the north of it, Mafaza being a market of some importance for cattle and grain. These villages are mostly inhabited by westerners, practising almost exactly the same type of agriculture as those along the Blue Nile. The silt lands are scarcer, however, and their lack is by no means compensated by the use of the sandy river bed between pools for growing onions, melons, and tobacco. Along the Khor el 'Atshan, which takes some overflow from the Rahad to the Dinder and

may represent an earlier course of the former, there is a group of villages occupied by a considerable range of westerners, some Fur, some Kanuri from Bornu and some from French Equatorial Africa.

In Fig. 73 (a-d) are shown some of the results obtained by the writer in an investigation at Khor el 'Atshan in the winter of 1950-51. After the excavation of four *hafirs* along the *khor* in 1946, a count had been made of the then populations of the local villages, and blocks of land had been assigned to each, surrounded by fire-lines (Fig. 73 (a)). Within each block three strips were divided by fire-lines, it being intended that each strip should be used in rotation for a period to be decided, probably five years, and then rested for ten. In fact within four years the populations of certain villages had declined, while others, particularly Shamiya, had increased, and the proportion of women and children in the villages varied

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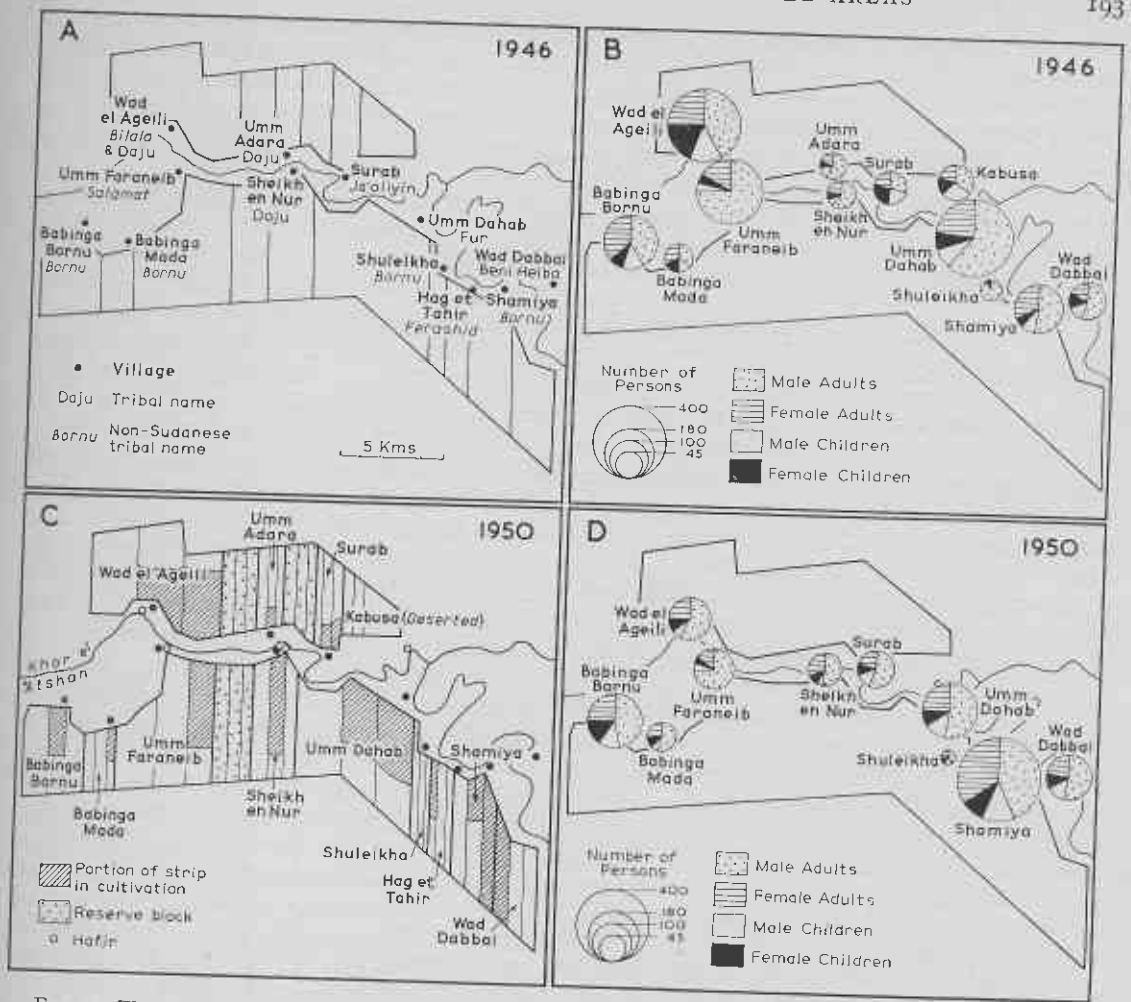


FIG. 73. The Khor el 'Atshan agricultural scheme, 1946-50. The crude classification of 'adults' and 'children' was made by the local *sheikhs*, and roughly corresponds to 'over' and 'under' puberty. From enquiries carried out by the Ministry of Agriculture and by the author.

enormously (Figs. 73 (b) and (d)). Agriculturally, too, the scheme had been disappointing, for surpluses of grain despatched from the area by rail had been negligible, nor had the use of the strips followed the intended plan (Fig. 73 c). It is not easy to explain the growth of one settlement, or the decline of others, purely on an environmental basis. It is probably more significant to record that the *sheikh* of Shamiya is an outstandingly determined personality and a devout and strict Muslim. Among the westerners, far from homes in Nigeria or Chad, his leadership is clearly much appreciated.

It has already been remarked that Arabs come south between the Dinder and the Blue Nile during the winter, and graze the areas of open grassland around Abu Hashim. When grazing is scarce the Arabs like to set fire to the dry grasses, thus stimulating the growth of fresh green shoots for their animals to eat, and so in order to protect the *hariq* cultivation the Arabs are forbidden to cross the firelines that are burnt annually along the east bank of the Dinder. Within this empty Gezira there is in fact very little human activity except for some irregular gum collecting by the villagers. A few areas are allotted each year for charcoal burn-

ing, but no use is at present being made of the *Acacia nilotica* belts along the watercourses, though they encourage so many birds to roost during the summer that cultivation near them has been almost abandoned. In the residual pools along the Rahad and Dinder quantities of fish are caught during the dry weather, dried in the sun and taken by itinerant westerners to be sold wherever western settlements occur.

The Gedaref Ridge

East of the Rahad there is a significant change in the trend of the mean annual isohyets. Under the influence of the Ethiopian massif to the south and east they turn to run in a north-easterly direction, more or less parallel, it is thought, with the Hawata-Gedaref railway line, which corresponds with the 600-mm. (24 in.) isohyet. At the same time there is a steepening of the isohyetal gradient, so that in the 160 km. (100 miles) between Gedaref and Gallabat the total precipitation rises from 600 to 900 mm. (36 in.), whereas in the southern Gezira the overall increase from Singa to Malakal or Akobo, a distance of over 550 km. (350 miles), is only 75 mm. (3 in.). A second reason for this rather higher rainfall may be that from Gedaref to the frontier there is a perceptible ridge along the Blue Nile-Atbara watershed.

In consequence, the country to the south of the railway line is thickly wooded, and open, grassy spaces that can readily be employed for agriculture are rare. The absence of permanent water supplies, moreover, makes the area virtually uninhabitable except during the rains, and then the prevalence of biting flies and mosquitoes makes conditions unhealthy both for animals and men. The Shukriya Arabs of the Butana rarely travel farther south than the railway, along which line the greatest number of settled cultivators is to be found.

Until recently the only reliable water sources to be found west of the Rahad were shallow wells around hill-masses like Qala en Nahl and the Ban-Buweida group, together with wells dug in the beds of streams draining the Gedaref-Gallabat ridge. There were also some hand-excavated *hafirs* of limited capacity near

Qurein and in a few other places where a regular run-off from a hill-mass could be used. These have been supplemented in recent years by deep wells drilled at Khor el 'Atshan station to reach the Umm Ruwaba Series, and at Gedaref, Wad el Huri, and Umm Shigera to extract water that has penetrated through the joints of the basalts to reach the Nubian Series. Lately, there has also been a vigorous policy of digging *hafirs* by machinery, which has eased the water situation at a number of villages and has made some undeveloped lands available for cultivation. In the long run, advantage might be taken of the nearness of the River Atbara to the southern end of the Gedaref Ridge, for a dam a bare 30 m. high, if built near Meshra' Akrib or Hagar Bakr (latitude 13° 15' N.) on the Atbara, would make it possible to carry water across the ridge and into the fertile and unpopulated area that stretches as far as the River Rahad. This could supply drinking water, or even water for irrigation, and is worthy of closer investigation now that the new 1959 Nile Waters Agreement has been concluded. The same applies to the proposal referred to below for supplying Gedaref Town with drinking water from the Atbara (Fig. 74).

This eastern portion of the clay plain is thought to have been seriously depopulated during the Mahdiya, confiscations of grain and forcible movements of population having had the effect of reducing the number of the inhabitants of the hills near Qala en Nahl and leaving the rest of the country almost bare. Subsequently the region has been peopled almost entirely by western Sudanese such as Fur and by western immigrants, so that today the Nāzir of the country to the south of Gedaref is a Fur. The usual features of a western population are to be found: there are no blocks of villages of common origin, and even individual settlements, such as Kabaros or Wad Dayif to the south of Gedaref, are made up of subsections from different tribes. The peasants are poor and uninterested in education, health measures, or social and economic advance: they have few animals, though indeed the combination of climate and soil make it hard for any except goats and cattle to thrive, and the latter have to be sent away during the rains because of the flies (Figs. 35-38). There is a

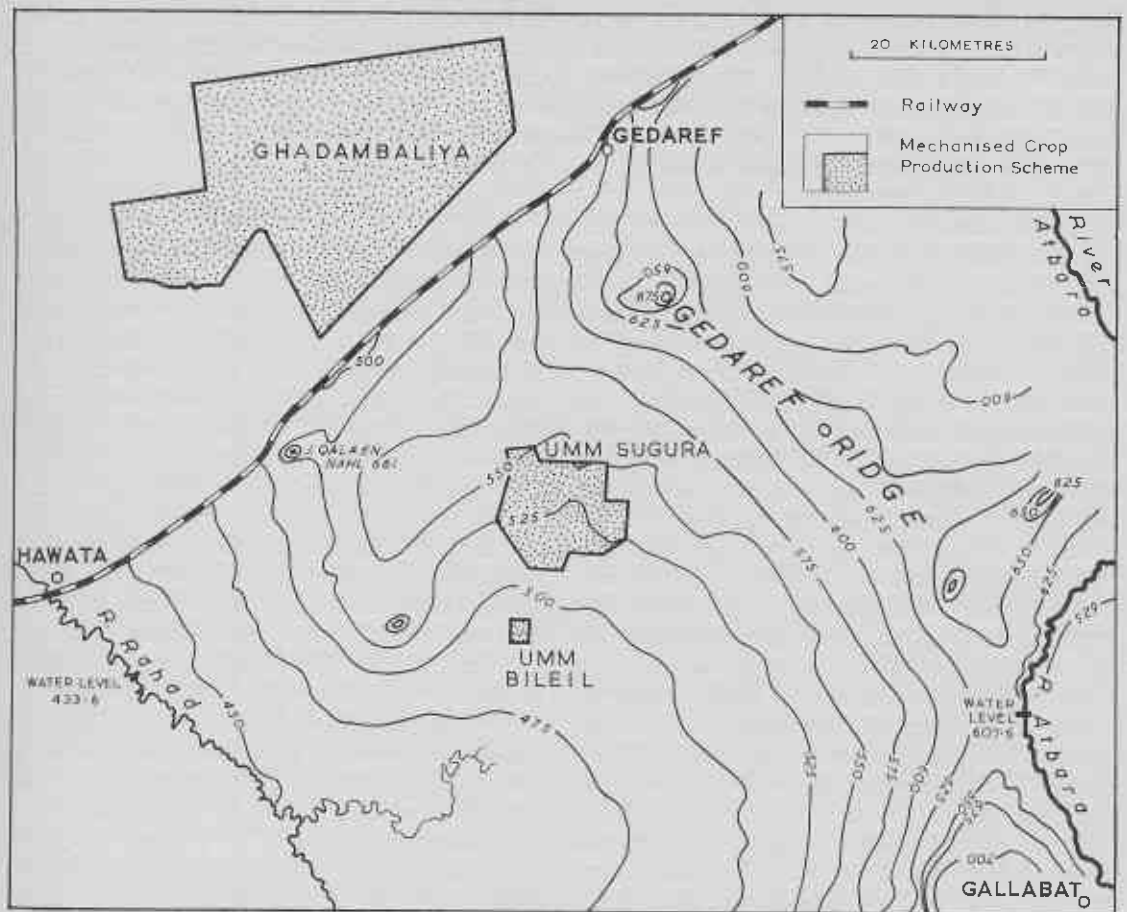


FIG. 74. Mechanized crop production schemes between the Atbara and Rahad rivers.

recurrent tendency for villages to spring up, and then die away as their occupants decide to go and try their luck elsewhere.

Nevertheless, the richness of the soil and the reasonable reliability of the rain are such that this is today the chief granary of Sudan. In 1956, 66,000 tons of grain, chiefly millet, surplus to the people's requirements were consigned by rail from the stations serving the Gedaref and Kassala areas, and there is also a considerable export from the region of sesame as seed or oil, this being grown chiefly in the wetter southern parts of the area. Until recently there was also some smuggling of sesame over the border to Ethiopia, for its export was prohibited to prevent internal shortages. There is the usual small production of *bamia* and maize round the villages to provide green vegetables,

but in general the inadequacy of the diet is most marked during the winter, there being little or no milk and virtually no source of greenstuffs except for onions that are brought by traders from Hawata or Qurein.

The administrative centre and chief market of the area is Gedaref. This lies near to the northern end of the basalt ridge and owes its existence to the presence of some reliable wells fed by a reasonably large catchment area, together with some defensible hills on which a fort and a garrison have been established as a protection against possible incursions by bandits, poachers, and others from Ethiopia. Today the town's population has grown to 17,500, and its poor water supply, incapable of considerable expansion, is giving rise to some anxiety. Work is being carried out to improve

the retention and use of water in the town's own catchment area of low hills, but after that opinion is divided between the merits of tapping the Nubian Series to the west by a number of wells linked by pipe to the town's supply, or of bringing a pipe-line from the Atbara River to the east.

Grain is brought to Gedaref by commercial lorries which go round the villages collecting peasants, each with his sack of millet, and bring them to the grain market. At the market an auction is in almost continuous progress during working hours from November to May, and grain is bought by local merchants or by the agents of traders in the cities and is consigned away by rail. While much money has been spent on building graded roads in the clay lands to open up new areas of grain production, the routes to the villages actually taken by the lorries are often the result of bold 'bush-bashing' by a private lorry, subsequently consolidated by other vehicles following the same route.

During the winter some sporadic transport work in the district brings Arabs of the Shukriya tribe and Beja from the hills to the north-east. They collect gum on their own account, and also carry loads of grain and building materials to the larger villages and to Gedaref. Occasionally they offer for sale baskets and matting woven from *dōm* leaves. Sometimes pedlars with a string of donkeys are to be met, having come across the Ethiopian border with some coffee, and intending to buy manufactured goods in Gedaref to take back with them.

One notable feature of the inhabitants of the region is that although they are almost entirely members of peasant tribes from the west, when they settle in central Sudan they seem to lose all the crafts and traditional skills which are still common in their homelands. They make no attempt to grow enough cotton to satisfy their own needs of cloth,¹ they neither tan skins and hides nor make themselves slippers and other leather articles, and both metal-working and pot-baking are left entirely to a few craftsmen, who are chiefly settled in the towns. This may be regarded as a typical

example of how specialization and factory-made articles available in the urban markets drive out the products of domestic industry, but in a region where the inhabitants are perforce idle for half the year it seems unfortunate.

The Mechanized Crop-production Scheme

In recent years the country to the south and west of Gedaref has been the scene of a considerable attempt to introduce mechanized farming to the clay plains, known as the Mechanized Crop-production Scheme. While the results achieved so far have not been as successful as was at first hoped, there seems reason to believe that in due course a satisfactory system will be evolved for converting large areas of grass and thin woodland to productive fields of millet and other crops. The work of the Mechanized Crop-production Scheme began in 1944 in an open area of grassland on the north side of the railway, known as Ghadambaliya, where it was intended at first to produce sesame to make a contribution to the world shortage of fats that was very marked at the end of the war. The machinery available at the time, however, was not at all suitable, and it also became plain quite soon that the mean rainfall of the area, less than 600 mm. (24 in.), was not enough for sesame, particularly in view of its unreliability. Subsequently, attempts were made to put the work on a more practical basis, by recruiting persons with experience of large-scale mechanized farming, by buying machinery better suited to the conditions, by concentrating on varieties of *dhura* that demand a lower rainfall, and by setting up other mechanized farms at points farther south where the rainfall could be expected to be higher and more reliable (Fig. 74).²

Even then, however (and these criticisms are taken from the report of a government working party set up in 1953 to review progress and to record the lessons to be learnt from the scheme to date), it seems that the proper succession of research followed by pilot testing followed by planned development was not followed; nor

¹ In fairness it should be pointed out that in much of the Central Clays region cotton-growing has been forbidden under the Cotton Regulations (1926), Part III, which have been interpreted to forbid uncontrolled cotton cultivation in unirrigated areas near to the Gezira, for fear of harbouring pests and reducing yields there.

² T. W. Clouston, *Mechanization in Agriculture in the Rainlands of the Anglo-Egyptian Sudan*, Khartoum, 1948.

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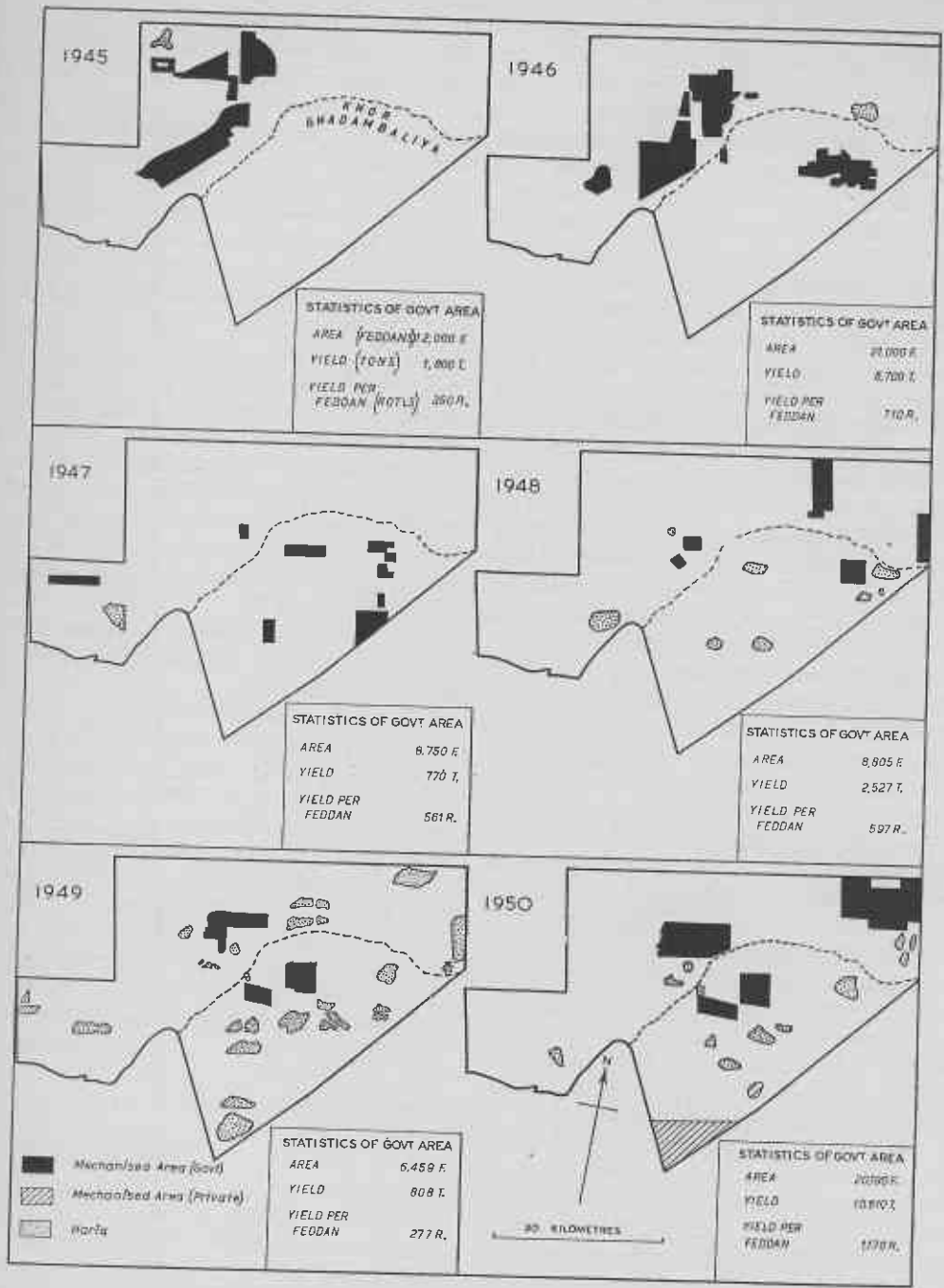


FIG. 75. The first six years' cultivation at Ghadambaliya. The success of the M.C.P. schemes is to be measured not only in the areas or yields of *dhura*, but also in the increasing tendency, foreshadowed in the 1950 map, for merchants and other capitalists to buy tractors and operate them on their own account. From *Mechanization in Agriculture in the Rainlands of the Anglo-Egyptian Sudan*, 1952.

can signs of any national rotation be seen in the map of the first six years of work at Ghadambaliya (Fig. 75). Nevertheless, there has been gain in two directions: on the one hand, the money spent by the government and the occasional good crops produced have had an important stimulating effect throughout Gedaref district, so that already there are several private farmers who own their own tractors and are hiring labour and producing grain on their own account both near Khor Kaffai and in the southern part of the Ghadambaliya area. On the other hand, it has become clear that the type of organization that has succeeded in the irrigated Gezira, producing a high-value crop under rigorously controlled conditions, cannot be extended elsewhere where the value per *feddan* of even an outstanding crop of millet is likely to be one-third only of that of irrigated cotton. It may also be noted in this context that the rapid development of trade unionism in Sudan has had the effect of making all labour performed by government servants extremely expensive, whether they be expatriates, classified Sudanese staff, or casually hired labourers. The effective supervision of unskilled labourers is always difficult, and as long as employees stand to earn more by chalking up hours of overtime than by bringing their duties to a rapid and successful conclusion, they are quite unsuited to the alternating spells of inactivity and intensive effort required of the farm worker.

It may well be that in the drier areas of the clays mechanized agriculture can never be sufficiently profitable to warrant the establishment of new settlements and the development of ancillary services such as water supplies and good communications. The present system of going out from existing settlements to grow the crops and harvest them may therefore have to remain. Farther south, where other more valuable crops such as cotton, sesame, and ground-nuts can be grown, a policy of encouraging new villages to spring up may be justified. If this is so, then the Gedaref area, where the railway runs near the dry limit of cultivation, is the obvious site for the former type of de-

velopment, while the new Sennar-Er Roseires line, cutting across the isohyets and running close to much hitherto undeveloped land, should be the base for developing more ambitious types of farming. The Rainlands Research Station at Jebel Tozi and the mechanized farm adjoining it provide an ideal site for investigating the latter prospects.¹ There are now two mechanized farms operating in the southern Gezira, near Jebels Bozi and Mazmum, putting into practice the findings of the research station.

Communications

The map of the distribution of population in the Central Clay Plains makes it clear that whereas water supply, whether for drinking or irrigation, is the first requisite of settlement in central Sudan, good transport facilities also play an important part in determining where rainland cultivators live, especially if they are keen to grow surplus crops for sale. Of this the line of population following the railway from Gedaref to Sennar and Kosti affords ample evidence (Fig. 31).

Where inter-regional communications are concerned, modern developments have tended to confirm the nodal position of Khartoum and the Blue and White Niles in the country's transport system. From the time of the Egyptian invasion and conquest of Sudan in the early nineteenth century, the country's capital has always been at Khartoum, whence forces can be dispatched in three directions with assured water supplies. When steamers were first introduced, the importance of the rivers was enhanced, since it became possible to move forces rapidly and certainly along them, with the great fire power afforded by guns mounted aboard. When Gordon was besieged in Khartoum his last contact with Egypt was by steamer, and it was by steamer that the relieving force arrived, too late to rescue him.

Since before the First World War the construction of the railway up the Blue Nile to Sennar and across to Kosti (reached in 1911) has greatly diminished the importance of the Blue Nile for navigation. The Blue Nile bridge

¹ R. G. Laing, *Mechanization in Agriculture in the Rainlands of the Anglo-Egyptian Sudan, 1948-51*, Sudan Government, 1952. Sudan Government Ministry of Agriculture *Working Party's Report on the Mechanical Crop-production Scheme*, Khartoum, 1954.

at Khartoum was originally designed to open to permit the passage of steamers, but for many years now this has not been possible, since electricity and water mains are laid along the lifting portion of the bridge. This has been allowed to happen because navigation on the Blue Nile is made difficult by sand-banks when the river is low, and by the force of the current when it is high, while the railway from Khartoum to Sennar follows the same line much more directly. It was for this reason also that no lock was provided when the Sennar Dam was built. Upstream of Sennar a number of steamers used to be employed to transport timber from the *Acacia nilotica* forests and to provide communication with Er Roseires when rain made the roads impassable. With the completion of the railway to Er Roseires (1955) (Plate XXXI), navigation on the Blue Nile is now almost entirely confined to native boats, which carry grain, building materials, and other local products.

On the White Nile natural conditions are easier and navigation is still of considerable importance. Apart from the service provided by Sudan Airways, the normal route from Khartoum to the southern provinces is by rail to Kosti and thence by steamer to Malakal, Juba, or Meshra' er Req. Between Khartoum and Kosti, the Jebel Auliya Dam is provided with a lock and a regular local steamer service is operated. Many native boats ply on the White Nile, carrying not only grain and building materials but also supplies of oil fuel for the many pump schemes in this reach. Kosti, named after a Greek merchant who used to run a store there, was an entrepôt for the purchase of the products of the west until the railway was built to El Obeid, and is now the dockyard and headquarters of the southern steamer fleet.

The only use made of the Atbara for navigation is in the transport of timber products downstream during the summer flood, for in the dry season the river dries up to a chain of pools. The Rahad and Dinder rivers are not used for navigation.

Conclusion

The Central Clay Plains may be regarded as in many ways the most important part of Sudan. Quite apart from their many irrigation schemes, which will be discussed in the next chapter, and their even greater area of potential irrigation, they are already a granary for much of Sudan, with a prospect of increased production as mechanization is extended. In recent years the region has witnessed a marked tendency towards the settlement of nomads, and the way in which members of different tribes have come to live peaceably side by side augurs well for the development of the Sudanese nation.

Yet on the other hand it must be admitted that the region will always be a hard and a harsh one for all but the richest to inhabit. Except along the Blue Nile the dark soil and the absence of any noticeable relief present a grim appearance that compares unfavourably with, for example, the hills and fields and palm trees of the Northern Province. The climate is severe, to be out of doors in the sun is uncomfortable at any time of year, and even with irrigation, trees, fruit, and vegetables can be grown only with difficulty in the heavy clay soil. The lack of local supplies of building stone or of good earth for brick-making makes it very difficult to attain a good standard of housing, while the construction of metalled roads to replace the uncomfortable corrugated tracks between towns would be far too expensive for any developments to be expected in the near future.

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THE CENTRAL CLAY PLAINS — IRRIGATED AREAS

WHETHER derived from the Blue or the White Nile the deep cracking clays of central Sudan have shown themselves to be well adapted to irrigation. They have become the basis not only of the extensive Gezira Scheme, fed by gravity flow from the Sennar Dam, but also of an ever-increasing number of medium- and small-sized irrigation schemes dependent on diesel-driven pumps. While occupying at present a mere 2½% of the clay lands north of the Machar marshes, the irrigated lands are responsible for so large a proportion of the wealth of the whole country that it seems appropriate to devote a complete chapter to

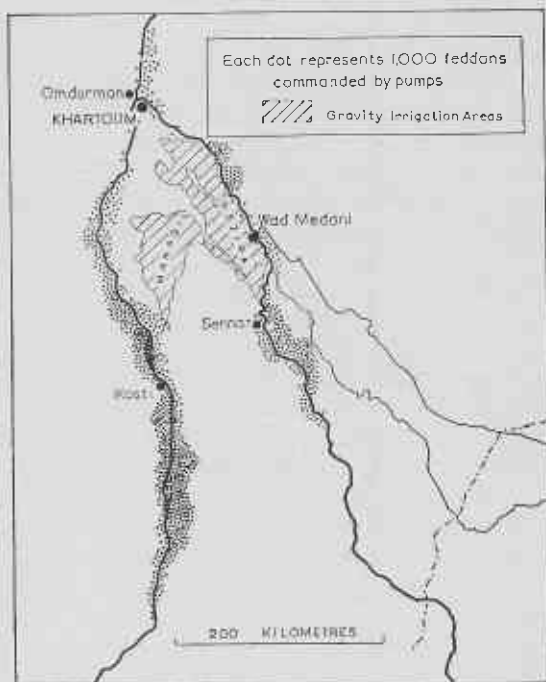


FIG. 76. Pump and gravity irrigation in central Sudan. According to the scale there should properly be 30 dots indicated on Aba Island; these have mostly been displaced to east or west. Sources: *Sudan Irrigation*, 1957, and as for Fig. 55.

Sir William Garstin, *Report on the Basin of the Upper Nile*, Cairo, 1904.

their study. There are, moreover, many proposals under consideration at the present time to extend the area under irrigation, and the Manaqil extension was first brought into production in 1958. The reason for the extreme popularity of this type of investment is that the long-staple cotton invariably grown gives a much higher return than any other field crop suited to Sudan. Where individuals have set up schemes they have recently been able to make remarkable profits, while the community as a whole not only takes a large share of the profits of the Gezira and other schemes which the government has established, but also benefits from the resources of foreign exchange which cotton sales bring to the country.

The irrigation schemes lying between Khartoum and the latitude of Er Roseires (Fig. 76) may conveniently be classified as follows: first in size and importance comes the Gezira Scheme, with its extension in the north-west known as the 'Abd el Māgīd scheme; secondly, there is the Manaqil scheme, lying to the south and west of the Gezira scheme, which has been in the process of being brought into operation since 1958; thirdly, there is the group of schemes around Khartoum, where the proximity to a large urban market makes the cropping practices different from elsewhere; fourthly, there are the White Nile schemes, including the large irrigated area on Aba Island; and finally come the more recently established schemes along the Blue Nile upstream of Sennar.

THE GEZIRA SCHEME

The Gezira Scheme was first proposed as early as 1904, when it had already become obvious that without the introduction of some export crop and an increase in government revenues it was going to be very difficult to establish any kind of effective administration in the newly reconquered Sudan.¹ Sennar was

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chosen as the best site for a dam, and work began in 1913, only to be held up for five years by the First World War. In the meantime, fortunately, the government had realized that to establish an irrigation scheme to cover more than 300,000 *feddans*, as was at that time planned, would hardly be possible without some prior investigation of the best irrigation practices and a period for training the necessary managers and inspectors who would control the work. In view of their own shortage of money and of agricultural staff, they invited the Sudan Plantations Syndicate, a private company which had already had some experience in growing cotton in the Zeidab basin, to put up some capital and to take part in the scheme as managers on a share-cropping basis.

This was arranged, and small pumping schemes were started at Tayiba in 1911 and at Barakat in 1914. Bringing some of its tenants from Zeidab the syndicate showed that cotton could be grown profitably under Gezira conditions, and began investigating the best rotations to adopt. After the war construction of the dam was resumed, and so as to have enough staff ready trained the Syndicate opened two larger proving units at Hag 'Abdallah and Wad en Nau in 1921 and 1923 respectively. By 1925, when water in the Main Canal began to flow, 50,000 *feddans* had already been under irrigation, and the increase to 240,000 was successfully effected, rising to 300,000 in the following year. The major pumps were no longer required for irrigation, but have been retained for supplying drinking water throughout the canal system from May to July, when the Sennar Dam does not hold enough water to command it.¹

The dam had been constructed to be able to supply a much larger area, if all went well. This was by no means a foregone conclusion, and in fact during its first decade the Gezira Scheme ran into very serious trouble, for there was a catastrophic decline in cotton yields, which coincided with the world slump and the collapse of cotton prices. The reason for the decline in yields was found to be in part climatic, depending on the incidence of rain both in the growing season and before it, and in part due to pests and diseases, against

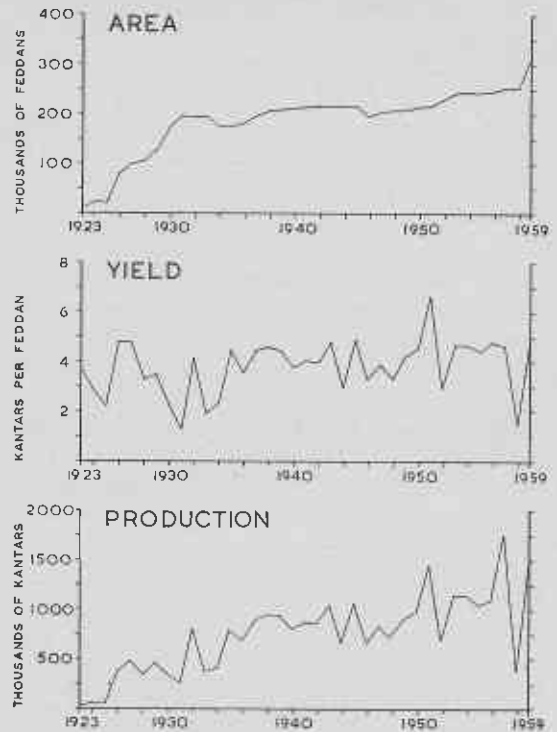


Fig. 77. Cotton in the Gezira. Totals earlier than 1926 refer to the pilot pumping schemes in operation at Hag 'Abdallah and Wad en Nau before the main canal was supplied with water from the Sennar Dam. Dates refer to the year of harvesting, not sowing; thus 1923 refers to the cotton season 1922-23, etc. From *Agriculture in the Sudan* and Sudan Department of Statistics.

which various measures were taken, as discussed below.

TABLE IX
GEZIRA SCHEME
Cotton production from 1915

	'000 Feddans	'000 Kantars	
1915-16/1919-20	3,850	14,200	3.7
1920-21/1924-25	13,600	45,000	3.2
1925-26/1929-30	118,200	442,000	3.75
1930-31/1934-35	187,000	523,000	2.8
1935-36/1939-40	202,800	850,000	4.2
1940-41/1944-45	216,400	910,000	4.2
1945-46/1949-50	214,400	834,000	3.9
1950-51/1954-55	236,900	1,150,000	4.7
1955-56	248,900	1,190,000	4.8
1956-57	255,400	1,710,000	6.7
1957-58	255,400	383,000	1.5
1958-59	320,700	1,480,000	4.6
1959-60 (Est)	384,614	1,600,000	4.16

¹ W. N. Allan, chapter on 'Irrigation in the Sudan', and E. Mackinnon, chapter on 'Blue Nile Province', in *Agriculture in the Sudan*, 1948. See also on this whole chapter A. Gaitskell, 'Gezira: a story of development in the Sudan', 1959, which has appeared while this work has been in the press.



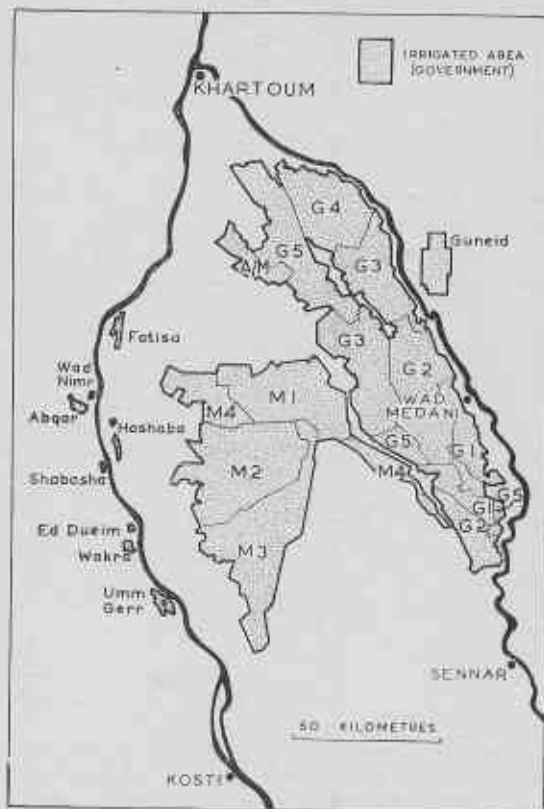


FIG. 78. Government irrigation schemes in central Sudan. The various stages of the Gezira scheme were attained as follows:

- G1. Area under pilot pumping schemes, 1925
 - G2. Limit of initial 300,000 *feddans*, 1926
 - G3. First extension, to north and west, 1929
 - G4. Second extension, to north, 1931
 - G5. Present limits, 1960
 - A/M. 'Abd el Magid scheme, 1941
 - M1. Manaqil first stage, irrigated 1958
 - M2. Manaqil second stage
 - M3. Manaqil third stage
 - M4. Manaqil fourth stage
- } to be brought into use at one or two-year intervals.

Irrigation in the White Nile schemes began as follows: Ed Dueim, 1927; Fatisa, 1938; Hashaba, 1939; Umm Gerr, 1940; Wad Nimr, 1943; Shabasha, 1950; Abger, 1956. Irrigation at Guneid on the Blue Nile began in 1955. Sources: Gaitskell's *Gezira*, 1950; *Sudan Irrigation*, 1957; *Agriculture in the Sudan*, 1948.

Subsequently the irrigated area dependent on the dam has steadily increased until it is now 987,000 *feddans*, the growth of which is illustrated graphically in Figs. 77 and 78, and Table IX. The concession originally granted to the Syndicate was to last until 1950, and since

by that time the Gezira Scheme had proved itself to be an outstanding success, it was not surprising that the Sudan Government used the opportunity to take over its administration, establishing in the place of the Syndicate a semi-independent organization known as the Gezira Board. There was little immediate effect either on policy or even on staffing in the new body, but with the rapid Sudanization of the Civil Service after 1954, most British officials have resigned and been replaced by Sudanese staff, until by 1957 it was only in the technical fields of new development lay-out, cotton examining, cotton marketing and engineering that British staff were still to be found. Cotton classifying continues to be in the hands of Greeks recruited from Alexandria.¹

Because of the tilt of the Gezira plain down towards the north and west, it was decided to lay out the Main Irrigation Canal along the east side of the Gezira, following a slight ridge that runs from Hag 'Abdallah to Masid. In this way it could command not only the adjacent ground but also the more distant areas to the west, if it should ever be desired to extend the irrigated area. Later investigation has shown that the better quality land, with a relatively low concentration of sodium salts, is to be found in a fairly unified block in the east, whereas towards the west there are numerous patches of worse soil which are not worth irrigating.

Within the irrigated area the siting of the minor distribution canals is made easy by the remarkable flatness of the ground, the mean slopes being between 1:5,000 and 1:10,000. It has thus been possible to adopt a standard layout which brings water to units, known as numbers, of 90 *feddans*, each being in turn divided into plots of 10 *feddans*. Each such plot comprises the cotton holding of a single tenant, and thus it is easy to supervise irrigation and cultivation practices by ensuring that all plots in any one number are always kept at the same point in the rotation. Watering is carried out by day only, and the minor canals are so designed as to be able to fill up overnight and store water for distribution next day (Plate XXXII).

When the scheme was begun the fear was

¹ Sudan Gezira Board, *Staff List*, 1957.

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expressed that repeated irrigation of the soil would bring about an accumulation of harmful salts, especially sodium, that might eventually render the land useless; fortunately, however, the waters of the Blue Nile are not heavily charged with salts, and such deterioration of the soil has not taken place. In fact, when experiments were made to install a system of underground drainage to prevent any such accumulation, it was found that the soil was so impermeable when wetted that very little water flowed in the drains. This impermeability has its good side in that losses from the various canals have proved much less than was at first expected, and in consequence the area irrigated has been increased. When heavy rains fall, on the other hand, the ground dries out very slowly, and for this purpose surface drains leading to the river have been installed in the eastern part of the scheme, while on the west water sometimes has to be pumped out into natural depressions to save the cotton.

Because of the need for regular supervision of the growing crops, it has proved necessary for the homes of the tenancy holders to be situated fairly near their fields, and in fact it has been made a condition of tenancy that those allotted a *hawasha*, as a holding is called, should reside within the scheme. The tenants, whether riverain Arabs, northerners or westerners, have little taste for a solitary existence, and so they settle in villages which are to be found at regular intervals of every two or three kilometres. The villages are sited at convenient distances from the major distributory canals, which always hold water even when no irrigation is in progress, and from them they draw their domestic water¹ (Fig. 79). Long hours of sunshine keep the water relatively free of bacteria, but in recent years it has been realized that the people's common practice of bathing in the canals, together with their Muslim customs of ablutions, have resulted in infecting the water with bilharzia snails. The snails living in the canals play their part in the cycle, and flukes are absorbed into the people's bodies when drinking, washing, or working in the flooded fields. They then develop the symptoms of schistosomiasis. Virtually com-

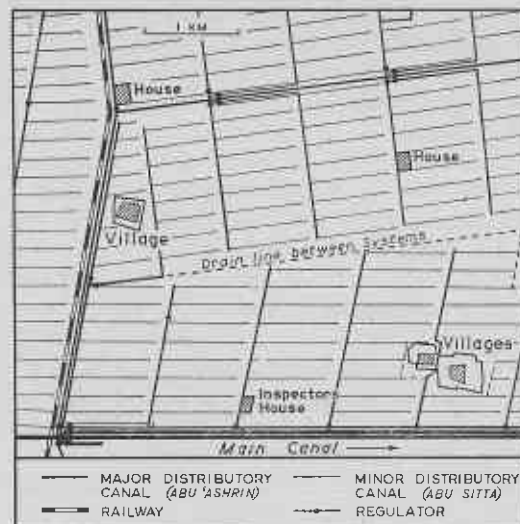


FIG. 79. Typical lay-out of villages, canals and fields in the Gezira. From *Agriculture in the Sudan*, Fig. 245.

plete control of the disease has recently been achieved by treating the water in infected canals with copper sulphate.

The crop whose cultivation first prompted, and has subsequently justified, the establishment of the Gezira Scheme is long-staple cotton of the strains first produced in Egypt, and despite periodic investigations of other crops, none has shown itself so profitable or so well adapted to the climate and soil of the region. An eight-course rotation is employed as follows: Cotton, Resting, *Dhura*, Resting or *Lubia*, Resting, Cotton, Resting, Resting. Compared with Egyptian practice, this represents an extremely lavish use of the land, cotton being grown one year in four only, as opposed to the more common one in two there, and the land in Sudan being required to bear only two or three crops in eight years instead of twelve or more in the same period in Egypt. The explanation lies in the fact that the development of irrigation in Sudan has been limited not by land shortage but by the need to obtain the largest possible return from the available supply of water. While it is possible, as a study of the private pump schemes will show, to grow cotton one year in three, with

¹ Certain of the villages have long had hand-dug wells to supply drinking water, and since 1950 the government has been boring wells throughout the irrigated area to make pure water available.

one year of fallow and one of *dhura* or *lubia* to complete the rotation, such systems merely reduce the initial expenditure on land clearing, levelling, and canalization, but they do nothing to increase the amount of cotton that the available water will produce. In fact, since yields are likely to be less under such rotations, the existing system is to be preferred.

Yet despite these arguments it is obvious that the eight-course rotation can only be employed when the pressure of population on the land is very slight, and when a system of management is in force which is free to prescribe the rotation most profitable to itself, even when other rotations might bring a higher cash return to tenants. Egyptian concern for the control and allocation of Nile waters, however questionable on other grounds, must be considered in light of the fact that there are in the Gezira approximately 1 million *feddans* of land already laid out for irrigation. While at present only one-quarter of these bear cotton in any one year (the areas of *dhura* and *lubia* consume relatively little water between them and in any case are irrigated for a short time only at the end of the rains in the 'free' period), more intensive rotations could undoubtedly be introduced, and could very rapidly increase the amount of water to which the Sudanese might regard themselves as legitimately entitled.

Only two types of cotton are grown commercially in the Gezira, Sakel and XI730A which has been derived locally from it. These produce a good white lint whose staple length is classified at $>1\frac{1}{2}$ in. and they thus compete in the markets of the world with the longer staple of the Egyptian cottons, such as Karnak and Giza 6. While the Egyptians have aimed at regularly improving their cotton and increasing its length, and have produced over the years a succession of new varieties, Sudan breeders have concentrated on producing a reliable and consistent commodity, trying to improve its yield and to breed into it resistance to disease, especially wilt and leaf-curl, without losing fineness or staple length.

The cultivation of cotton follows a very strict routine which has been evolved by experi-

ment to give the highest yield, and at the same time to reduce the risk of loss from plant diseases. Cotton is sown in mid to late August, thinned shortly after germination to three plants per hole, and subsequently cleaned and weeded by hand as necessary, probably three times. Picking starts in January and ends by mid-April, after which all cotton stalks must be uprooted to prevent the carry-over of black-arm disease. At the start of the growing season the watering of the cotton is rather sporadic, depending on the rains, which especially in the south may be quite severe. Subsequently, the crop is watered every 12 to 18 or 20 days, and usually receives in all about 15 waterings. Ploughing and ridging before sowing are done by steam-plough, but all subsequent operations are performed by hand or animal power, the tenants being permitted advances against their eventual share of the proceeds of the crop so that they can hire sufficient labour (Plate XXXIII).

Tenancies are of approximately 40 *feddans* each, and this means that each tenant has four fields, inevitably rather separate from one another, and in any one year one of the four is growing cotton, two are resting, and one is growing either *lubia* or *dhura*, or perhaps resting too.¹ The initial allocation followed the settlement (in a legal sense) and registration of almost the whole of the area between the two Niles north of Sennar. The land needed for the scheme was taken over compulsorily by the government, which either pays a standard rent of 10 *piastres* (2/-) per *feddan*, or else, in the case of land needed for canals or other similar works, has bought it outright. Persons with more than 40 *feddans* of registered land were granted tenancies as of right, and if they had 120 *feddans*, say, they were also given tenancies in the names of two relatives, to be known as nominees. Those with more than 20 *feddans* were held to have preferential rights to tenancies, but in fact at first the supply of holdings exceeded the number of persons willing to take them on, and it proved necessary to grant tenancies to numerous non-Sudanese westerners to get the ground worked at all.²

¹ *Dhura* and *lubia*, which are grown once in the rotation on any one plot, are shared between the tenants of two adjacent holdings.

² Isaan Ahmed Hassoun, 'Western Migration and Settlement in the Gezira', *S.N. & R.*, 33 (1952).

The registered holders are assured that when they die their holdings will remain in their families, and the remainder of the Sudanese can confidently presume that the allocating committees will give their heirs preference after them. The westerners, on the other hand, are regarded jealously by Sudanese who have no holdings, and while the Board is not willing to displace satisfactory tenants, if they die or surrender their rights the lands are allocated to natives. In the last few years it has been realized that 10 *feddans* of cotton are too much for one man to weed and harvest, even with the aid of his family. Both from egalitarian motives, therefore, since there is a growing need for extra tenancies as the sons of farmers grow up, and because as the irrigated area increases it is becoming more and more difficult to find enough labourers at the busy times of year, it has been decided to reduce the size of tenancies. As tenants die their holdings will be divided into two tenancies of 20 *feddans* each, to be distributed to members of his family or other close relatives, while all new tenancies in the Manaquil or south-west extension of the Gezira are planned to give the tenant 5 *feddans* of cotton only. Since it has been decided to use a three-course rotation in the Manaquil area, the number of tenancies to be distributed will be more than twice as high per square kilometre as in the original Gezira allocation.

The division of the proceeds of cultivation is one of the most distinctive features of the Gezira Scheme, and it has been much studied and discussed for its bearing on other schemes of agricultural development in Africa, and indeed in the tropics generally. Its essential feature is a partnership between, originally, the government, the managing company, and the tenant, and this has now been replaced, since the nationalization of the Sudan Plantations Syndicate, by a partnership between the government, the Gezira Board, and the tenant. For its services in providing the land and the water for the scheme, the government takes 40% of the net proceeds of the sale of the cotton crop; for performing the tasks of management the Board takes 20%, any surplus over its expenses being divided between

its own and the tenants' reserve fund, the social welfare fund, and the state. The remaining 40% goes to the tenant, out of which he has to defray all his labour costs, the costs of ploughing, and a share of such costs as the transport of the cotton to the ginnery, sacks, and the cost of spraying with insecticides.

The tenants' reserve fund is restricted by law to a maximum of £S3,000,000, and so there is no question of its possible growth to attain the vast size of the Cocoa Marketing Board's stabilization fund in Ghana, for instance. In fact, ever since prices declined from their highest peak the tenants have been clamouring for sums to be paid to them out of the fund, maintaining in their optimism that cotton prices have undoubtedly fallen as far as they ever will go. Only the future can show if they are right in this.

The system whereby the government receives an automatic 40% of the profits of cotton growing, and is thus a major shareholder in the scheme, provides an interesting contrast with the far larger irrigation schemes of the Punjab, where the government was content to accept about 7% on its investment,¹ by way of the sale of water, and with the Marketing Board system of West Africa, where the governments in controlling the prices paid to primary producers for various commodities have built up large balances in recent years. In the former example, the government in effect made a free gift of the enhanced value of the land to the Punjabi peasants, and could secure some benefit to the general revenue only by export duties and similar unpopular measures. In West Africa, balances held by the Marketing Boards have indeed been used for a variety of purposes for the common good, but only by appropriating the funds to uses for which they were never intended.²

In addition to his 40% the tenant gets the whole of the millet crop, which is so fitted into the rotation that he gets 5 *feddans* each year, rather than 10 *feddans* every other year; the *lubia*, if it is grown; and the *dhuwa* (sorghum) straw, which he feeds to his animals or sells as fodder.

In the early days of the scheme the serious decline in yields referred to above coincided

¹ K. S. Ahmad, *The Agricultural Geography of the Punjab*, London Ph.D., 1939.

² P. T. Bauer, *West African Trade*, 1954.

with a period of exceptionally depressed world cotton prices, with the result that many of the tenants found that they were actually losing money by having tenancies, and surrendered them. Since about 1935, however, things have gone much better, and after the recent war there was a boom in cotton, culminating in an *annus mirabilis* (1951-2) when cotton prices rose as high as they had ever been and at the same time the Gezira produced its record yield. The tenant's income rose in exceptional cases to as much as £E1,000, and still he had his millet sufficient for his family's needs and his crop of *lubia*. Things have not maintained this remarkable level since, but it is easy to see why there have been no tenancies surrendered for a number of years; in fact, the prosperity achieved in the Gezira has stimulated irrigated cultivation elsewhere.

For some time now the Tenants' Association has been demanding that their share should be raised from 40 to 50% of the proceeds of cotton sales, and they are also demanding that the excise tax on cotton exported should be rescinded, because, they say, they are being required to make an over-large contribution to the national exchequer. The number of votes cast in the Gezira is so large that it cannot be said for certain that the tenants will never succeed in this request, but there are those who feel that, in fact, the share of the proceeds at present taken by the tenants is greater than their deserts. It is argued that in the partnership of capital, labour, and skill all that they have provided of the former is their land, for which they receive an assured rent at its highest previous value. Their labour, at least when prices are good, consists of borrowing money from the Board, so that with it they can hire labourers to do the actual work of weeding and picking, and their only skill lies in having the sense to obey the instructions of the Block and Field inspectors who come round telling them when to sow clean, or pick the cotton. Whether the tenants' share be considered too large or too small, the system adopted has been of great importance in establishing a precedent for the association of local inhabitants with schemes set up in their midst.

Though the tenants are much richer than the inhabitants of the villages just to the west

of the scheme, the homes in which they live are remarkably similar, consisting of thatched or flat-topped houses built of mud-brick. The villages in the irrigated area may have more enclosures wherein the women can enjoy some privacy, since this is one of the first luxuries they ask for when they can afford it, but neither group enjoys metalled roads, street lighting, sanitation, a clean, piped water supply, or indeed any of the semi-urban amenities to which settled and successful villagers might aspire. In recent years there have been a few wealthier homes, schools, court-houses, and mosques built in the villages in burnt-brick or stone, but land being cheap, these are always of one storey only and lack architectural distinction both within and without.

The villages are distributed fairly evenly throughout the irrigated area, and except for their need to be near a water supply, no obvious geographic factor affecting their location can be detected. From the beginning villages have tended to be inhabited by persons from the same tribe or region, and the western tenants are to be found in specifically more western villages by themselves. In appearance these cannot be distinguished from the others. During the cotton-picking season, when the weather is quite dry, temporary settlements of pickers are to be seen throughout the Gezira, consisting of erections of straw which provide a meagre shelter from the sun and from the gaze of passers-by. Some are inhabited by whole families from neighbouring villages, others by virtual dormitories of single westerners or others who have come, perhaps, to earn their bride-price.

The towns which have grown up, usually from the nucleus of a small village as a result of the wealth produced by the Gezira Scheme, are all situated near the Blue Nile. The eroded and sloping *herrib*, so useless for agriculture, affords a relatively well-drained situation for building towns. These can be at once healthier and in terms of lay-out more interesting than settlements that might spring up on the open Gezira plain. They have also the advantage of lying close to the Khartoum-Sennar railway line, which was sited along this side of the Gezira because plans for the Sennar Dam and Gezira Scheme were already far advanced when the railway was built (1911).

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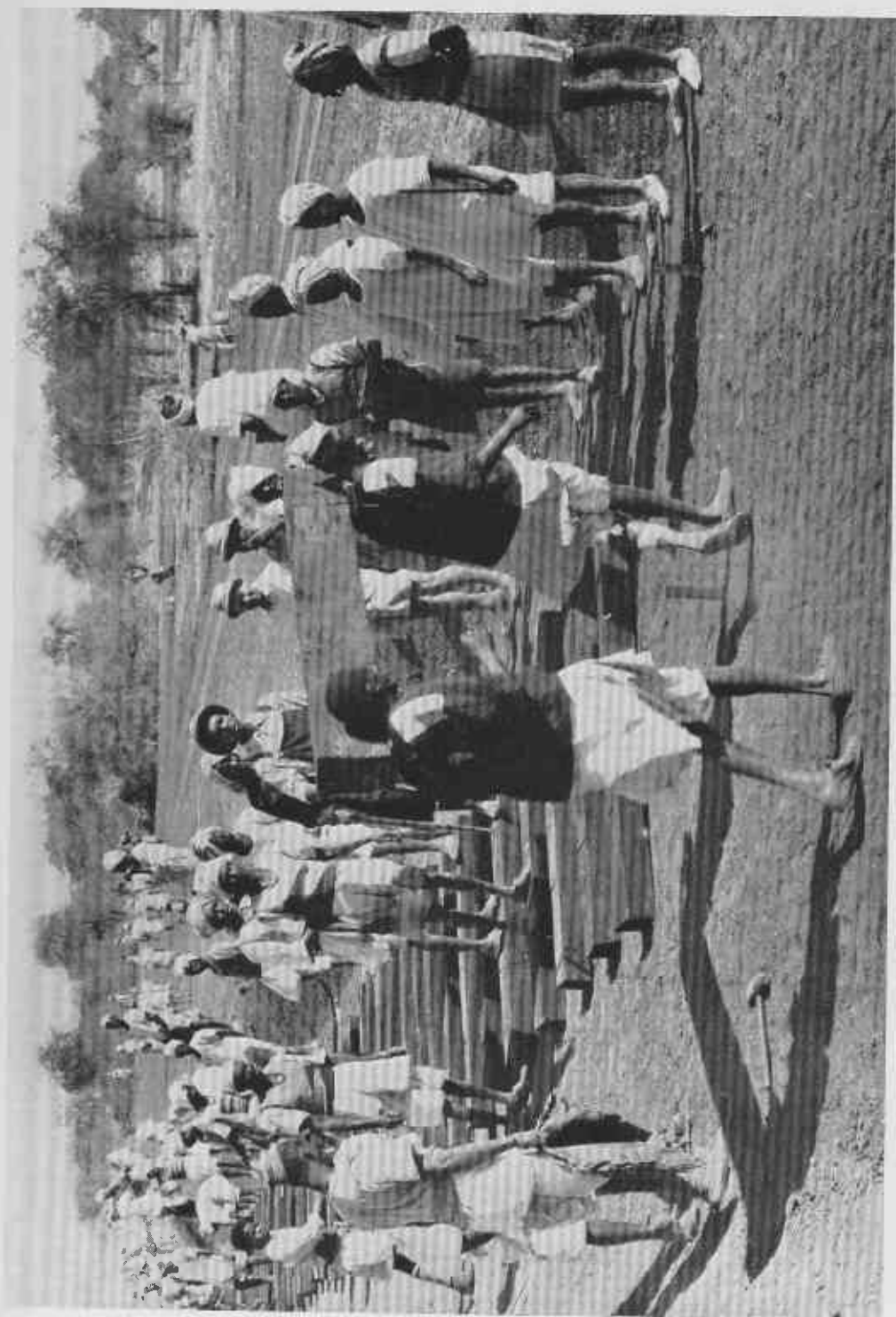


PLATE XXXI. LAYING THE SENNAR-ER ROSEIRES RAILWAY



PLATE XXXII. CANAL AND COTTON FIELDS IN THE GEZIRA SCHEME

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The largest of the Gezira towns, Wad Medani, with a population of nearly 50,000, is the headquarters of the Blue Nile Province and the Irrigation Service. It is also very close to Barakat, the administrative centre of the Gezira Scheme. With plentiful irrigation water led down from the Gezira Main Canal, the town is fairly well provided with trees and public gardens. The fine view across the Nile from the town towards Hantoub Secondary School and the nearby confluence of the River Rahad reveals another advantage in siting the towns by the river: the intensive market-gardening that takes place on the Blue Nile silts.

The other towns of the eastern Gezira are mostly the centres of administrative districts (El Kamlin, 4,300; El Hasa Heisa, 6,600; El Mesellemya, 3,100). They are rather smaller than might be expected in a prosperous farming area, the main reason being the unified system of administration and the rigid cropping policy that are imposed by the Gezira Board. This means that individual farmers have neither large agricultural surpluses to dispose of at local markets, nor occasion to borrow money from local banks or to buy seed, machinery, and fertilizers from local merchants.

KHARTOUM PROVINCE

Irrigation in Khartoum Province is in easy reach of the large market for fresh produce that is afforded by the Three Towns: it has, in consequence, developed along rather different lines from that in the Northern Province or the Gezira. The best clay areas lie along the Blue Nile and along the eastern side of the Main Nile, these being occupied by large private farms such as the Belgravia Dairy, which provides Khartoum's excellent milk supply, and the fruit and vegetable gardens belonging to enterprising capitalists such as Dr. Malouf or Sayed Surur. Very little cotton is grown in the province, for equally high returns can be obtained more easily from lucerne which is bought to feed private animals, especially the goats which, even in the capital, provide the poor man's milk supply.¹

Tuti Island, situated at the confluence of the Blue and White Niles, occupies a most favour-

able position to concentrate on market-gardening (Plate III). Apart from extensive *seluka* cultivations on land revealed as the river falls, the inhabitants have a large co-operative pump scheme in the middle of the island, and a number of water-wheels, now being replaced by small pumps, around the edges. The people of the island and of much of the province's irrigated land came originally from the Mahas area of the Northern Province. They have abandoned their ancient Nubian tongue, but have contrived to retain a reputation for argumentativeness, and even now there is good land uncultivated because of disputes over its ownership.

On either bank of the Blue Nile there are several small fields, irrigated by *saqia*, *shadūf*, or small pumps, which are used to grow vegetables for the urban markets. On the White Nile upstream of the confluence, and to a lesser extent below it, extensive gently sloping areas are revealed as the Nile flood recedes. Here *seluka* cultivation is widely practised, *lubia*, being the favourite crop, and the inhabitants often set up water-wheels so that they can irrigate their crops and get higher yields. These water-wheels have to be dismantled each year as the flood rises, the labour involved in setting them up and taking them down being considerable, and warranted only by the good prices to be obtained for produce. Though agriculture in the area is generally profitable, labour is scarce, for it is hard to persuade young men to work in the fields rather than take a job as messenger, garage hand, coffee-shop attendant, apprentice carpenter, etc. The short hours and low productivity demanded by the government from its lower-grade staff undoubtedly contribute to this attitude.

It is not only in the choice of crops to grow, therefore, that the influence of the capital is felt on agriculture in Khartoum Province, for the supply of money for investment, the presence of experienced farm-owners, and the nature of the labour force are all affected by the proximity of the Three Towns.

The Capital City

Khartoum, Omdurman, and Khartoum North stand on the three sites afforded by the

¹ Milk can also be bought in the Three Towns from Arabs who have settled in villages nearby.

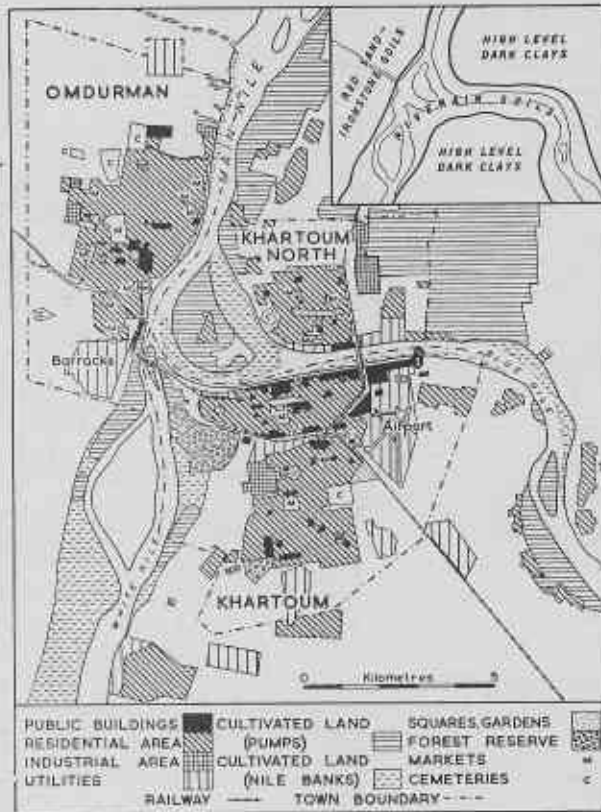


FIG. 80. Principal land-use categories in the Three Towns, with soils (inset). Details of land use supplied by courtesy of the Town Planning Department of the Sudan Government. Soils from G. Worrall.

confluence of the Blue and White Niles. From a national point of view the Three Towns are in such close and regular contact as to constitute a single capital, but they have not developed as a single city because the Blue and White Niles are fairly broad rivers (at high flood 650 and 850 m. wide respectively), and it used to take a long time to cross them by ferry before they were bridged in 1909 and 1928. They have always been separately administered whether as districts or more recently as municipalities within Khartoum Province.¹

Khartoum is the seat of the central government, and also contains the country's first university, formerly the Gordon Memorial College, which was originally founded as a centre of primary education in memory of

General Gordon. The principal banks and commercial companies operating in Sudan have their head offices in Khartoum, and the city also contains, now that political independence has been attained, all the foreign embassies and legations and most of the members of the foreign communities in the country. Khartoum itself is built on sand and clay, and many fine irrigated gardens have been laid out, especially near the Blue Nile. There has recently been a great expansion of housing on the southern side of the town where the tendency of the clays alternately to swell and crack, and the flatness of the ground making for poor drainage, have presented considerable difficulties in house construction, especially in the poorer areas (Fig. 80).

Even if they are employed in Khartoum, the Sudanese generally prefer to live in Omdurman, which is an almost wholly Sudanese city (Plate XXXIV). Traffic over the White Nile bridge becomes very dense when work begins each morning, and again at 2 p.m. when government offices close for the day. Omdurman is built on a rather less level site than Khartoum, standing beside the White Nile where the Nubian Series sandstone outcrops at the surface. Except for the tomb of the Mahdi, the new municipal buildings and a few private houses, the town is in Western eyes almost entirely lacking in architectural distinction. Even the quaint but insanitary Murada area, where the town's timber supply is still landed, has recently been pulled down and rebuilt according to the dull, rectangular pattern that climate, public security, and convention seem to require² (Plate XX).

Apart from local trade, the merchants of the town are engaged in import and export business. They are particularly interested in those lines, such as livestock, spices, cloth, and other cheap manufactured goods, where a specialized and intimate knowledge of the habits and tastes of the man in the street is required. The town is the centre of such native crafts as sur-

¹ See G. Hamdan, 'The growth and functional structure of Khartoum', *Geog. Rev.*, 50 (1960).

² J. W. Kenrick, 'The Need for Slum Clearance in Omdurman', *S.N. & R.*, 34 (1953).

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vive in the urban areas, including the manufacture of earthenware coffee-pots, cheap glassware, domestic utensils hammered out of petrol cans, native skull-caps, bedsteads, and cheap furniture, but has been at a disadvantage compared with Khartoum or Khartoum North in the establishment of modern industries because it lacks a railway line. There is an important animal market where camels and sheep from the tribes of the west are sold, and in the winter it is a common sight to see, or by night to hear, flocks of sheep being driven through Khartoum from the market in Omdurman to be put on the railway at Khartoum North for export to Egypt.

Khartoum North has a more utilitarian air than either of these two towns, with its dockyard for the assembly and repair of river steamers, its large open-air government grain stores, the Central Prison, and a growing light industrial area near the railway line. This is rather larger than the similar area in Khartoum, and is occupied by a brewery and various light engineering works. With the potential expansion of Khartoum severely limited by the Civil Aerodrome, Khartoum North has seen a high-class residential area develop along the North Bank of the Blue Nile.

PUMP SCHEMES

White Nile Irrigation Areas

The development of irrigation along the White Nile has been one of the most striking features of Sudanese agriculture since the war. Before the Jebel Auliya Dam was completed in 1936, the White Nile was an unfavourable

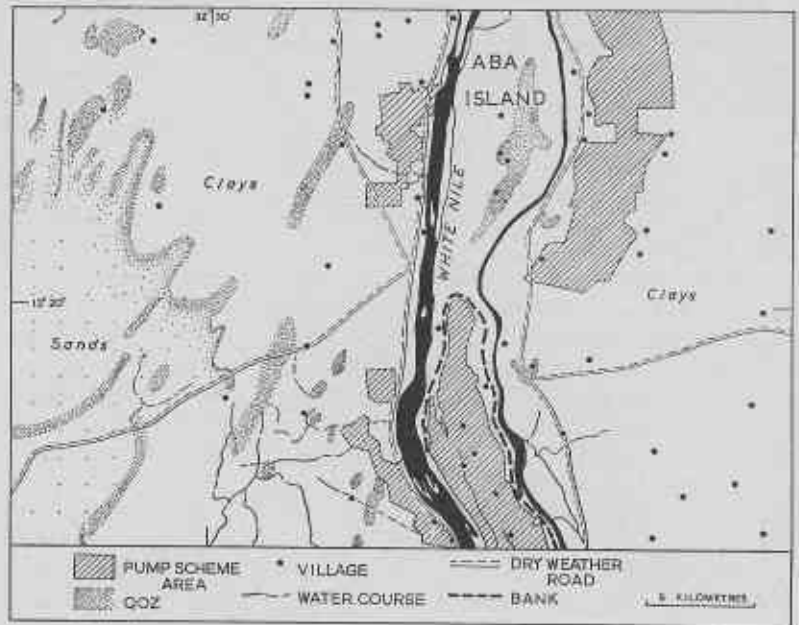


FIG. 81. Pump schemes on Aba Island and beside the White Nile. The edge of the Qoz to the west forms an absolute bar to the extension of irrigation in that direction. From *Sudan Surveys* 1: 100,000, Sheet 55-J-6 (1952).

area for pump irrigation, because the ponding back of the White Nile flood, extending far upstream, made conditions very changeable during the cotton-growing season. For a short period the river level was high and irrigation might be easy, but when the river fell it was almost impossible to obtain a good supply of water for a pump intake, since the water's edge might recede a kilometre or more from the pump site. The area uncovered provided useful grazing for animals after the end of the rainy season, and could grow a *seluka* crop, but it was unsuitable for perennial irrigation. The only important pre-war schemes in the area were those set up by the government and those belonging to Sayed 'Abd er Rahman el Mahdi, at Aba Island, and elsewhere, and these had to be protected from flooding by high banks¹ (Fig. 81).

The building of the Jebel Auliya Dam made a significant change in the régime of the White Nile. The normal operation of the dam is that it is filled during the flood, raising the White Nile to a level of 377 m. above M.S.L. at Alexandria, and this level is held until Febru-

¹ J. R. Thomson, *Pump Scheme Management on the White Nile*, Ministry of Agriculture Bulletin No. 7 (1951).

ary, when the water is fairly rapidly released and sent down to Aswan as that dam empties. Thus during most of the cotton-growing season of central Sudan the water-level is kept high and nearly constant. When the dam was built it was recognized that much of the grazing and *seluka* cultivation previously enjoyed by the local Arabs would be lost. They were compensated by the payment of a lump sum by the Egyptians (who alone benefited from the water, stored in the reservoir), and this sum was used to set up a number of Government Pump Schemes. These schemes were opened just before the Second World War, and the high-water level made it easy to irrigate the clays and to grow cotton (Fig. 78). Having been a success, these schemes have been widely imitated. During the war, when there was a general pressure to grow more food, numerous private schemes were established, and since then there has been much investment of private capital in cotton-growing schemes in the area (Fig. 76).

Because the lift from the river to the adjoining land is low, the main factor limiting development has been the quality of the soil. On the west bank there are numerous poorly drained depressions which have had to be avoided, and once the Qoz sand-dunes are reached irrigation becomes impossible. On the east bank suitable pump sites are not easy to find, but schemes have been widely established.

The normal rotation adopted both in the government and private schemes has been one year of cotton, one year *dhura* or *lubia*, and one year fallow, but there have been great differences in the standard of cultivation attained, for generally the local inhabitants do not take readily to agriculture. Especially in the years 1950-1 almost everybody made large profits, and even with lower prices today the ownership of a largish—say 700-*feddan*—pump scheme will support a man very comfortably. Tenancies are usually smaller than in the Gezira, not more than 5 or 6 *feddans* of cotton per tenant. This helps to keep the financial gulf between tenant and non-tenant less than it is in the Gezira.

The right to secure a licence and set up a scheme was originally reserved to local people, but these generally proved too poor and too little educated for the task, and now many

educated families from the capital have an interest in schemes along the White Nile. Because of the Nile Waters Agreement, schemes could not until recently be set up unless a licence had been obtained and the water account debited accordingly. At one period any person who could get a licence could easily borrow the capital needed for a pump scheme, and with reasonably good fortune such loans were usually repaid within three years.

Recently it has been realized that the water requirements of successful cotton cultivation are appreciably less than was once thought; in particular, if watering is stopped one or even two months before the normal date—mid-March—the decline in yields is probably not more than 10%, while subsequent cleaning of the land is made easier. In the last few years, therefore, several licences were issued for Flood or Restricted irrigation only. Such schemes can be reasonably profitable even if no watering be done after 1st January, while the licences were hoping that once a new Nile Waters Agreement was negotiated they would be able to pump as much water as they like. As the riverine north of Kosti has become crowded with schemes, there has been a move in the last three or four years to extend the irrigated area farther south, and already a few schemes of about 700 *feddans* each have been set up in the Upper Nile Province. As wetter areas are reached, the demand for irrigation water, at least during the rainy season, declines, and the installation of suitable drainage arrangements is likely to be equally as important as the irrigation canals themselves.

There are still considerable areas by the White Nile where pumps have not been installed for one reason or another, and on these there is an increasing use of the low-lift *saqia*, which with its simplified and more efficient design is able to maintain a much larger output than the conventional kind, the output with 2 bulls attaining 80 cu. m. per hour, which should suffice to keep 30 *feddans* under crops simultaneously.¹

Blue Nile Irrigation Areas

Along the Blue Nile the development of pumped irrigation has been slower than

¹ Ministry of Irrigation and Hydro-Electric Power, *Irrigation by Pumps from the Nile in the Sudan*, 1955.

FUTURE PROSPECTS

The present limits of irrigation in the Gezira as a whole have been determined by the amount of capital invested and by the quantity of water consequently made available. The steep sides of the trench in which the Blue Nile flows make the establishment of pump schemes such as Guneid expensive; at the same time the slight tilt of the Gezira plain down towards the north and west means that if a barrage can be constructed on the Blue Nile to command a gravity canal, the natural fall of the land will facilitate the distribution of water over long distances, while the impermeable clay soil makes percolation losses from the canals negligible.

Since it was first built, the Gezira Scheme has been extended several times, and water from the Main Canal is also used in the 'Abd el Māgid area that is under separate management. Since cotton-growing is so profitable in Sudan, not merely raising the standard of living of those engaged in it but also providing a major part of the State's revenues, there is a general desire to make use of the still undeveloped parts of the clay plain, which must exceed in area the existing cultivations.

For some years it has been recognized that irrigation could certainly be extended to the south and west of the existing Gezira Scheme, for the suitability of the area was revealed by precise levelling and by the digging of large numbers of soil-pits at the time when the existing scheme was established. In 1958 work was well advanced in the construction of the necessary canals for the Manaqil extension (Fig. 78), which was to pass to the north of the Manaqil Ridge (rising about 30 m. above the general level of the plain) and to spread out over the areas of better soil. The first block of 200,000 *feddans* had its first watering in 1958.

For the vast areas farther south much less information was available, and so in 1951 the Sudan Government, being unable to recruit easily men of the right calibre to carry out investigations, commissioned Sir Alexander Gibb and Partners, the consulting engineers, to

beside the White Nile. Physical reasons have been mainly responsible, in that the river is so deeply incised into the plain that during the latter part of the cotton-growing season a lift of 15 or even 20 m. is required to command suitable areas of flat land. This is clearly much more expensive, both in initial installation and in running costs, than the lift of 7 m. (and often very much less) that is common by the White Nile. North of Sennar, moreover, private cotton growing in the Blue Nile Province has always been strictly regulated by ordinance to keep the Gezira free from pests.¹

In the last few years, however, there has been a great expansion of pump schemes, water being drawn from above the Sennar Dam where the lift is quite small as long as the reservoir is full enough to command the Gezira canalization. The first important scheme was at Busata, on the east bank, set up in 1948, and since its success many others have been established. The system of agriculture is essentially the same as in the White Nile schemes. Because the area was already fairly densely inhabited, the tenancies have been kept very small, a 5-*feddan* plot of cotton being usually shared between two tenants.

Downstream of Sennar there are two schemes which draw their water from the Gezira Main Canal and a few pumping from the Blue Nile. The area involved was small until 1955, when the Guneid scheme was completed near Rufā'a. This scheme, which commands a total area of 30,000 *feddans*, was built at a cost of over £1,000,000. It has four 46 inch intake pipes, and uses 5,000 horse-power to raise water to a maximum height of 20 m. from the mean low Nile level. This is probably the largest pumping station in Africa, and running costs will necessarily be high. The scheme was established for social and political as well as economic reasons, for it is intended to alleviate the poverty of the Rufā'a Shukriya of the area. Having previously enjoyed about the same conditions as the Arabs on the other side of the Blue Nile, the Shukriya have now fallen conspicuously behind them, and in years of poor rains suffer extreme hardship and even famine.²

¹ *The Cotton Regulations, 1926*, Part III, para. 16.

² G. M. Culwick, *Diet in the Gezira irrigated area, Sudan*, Khartoum, 1951.

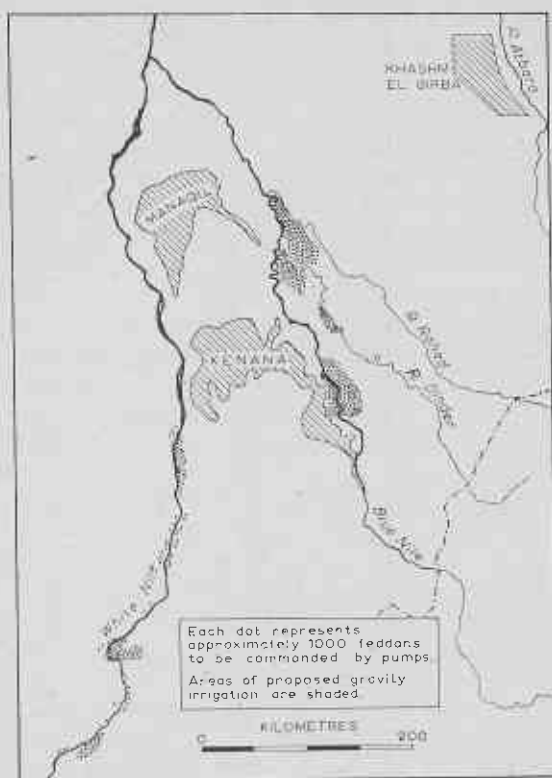


FIG. 82. Potential irrigation areas in central Sudan. Of the areas recommended by Sir Alexander Gibb and Partners in 1954 as suitable for the extension of irrigation, the Manaqil scheme is already under way, and many new pumping schemes on the Blue and White Niles are now in operation. From *Estimation of irrigable areas in the Sudan, 1952-53, 1954*.

ascertain the extent of the several areas which may be suitable for irrigation:

- (a) in the catchments of the Rahad and Dinder rivers between the Abyssinian border and the Nile;
- (b) by the Blue Nile between Sennar and Abyssinia;
- (c) by the White Nile between Kosti and the confluence of the Sobat river.

The engineers submitted two reports early in 1954.¹ They recommended the construction of a dam at the Damazin rapids on the Blue Nile just above Er Roseires. The dam would at first raise the level of the water by 34.5 m., and store 1 milliard cubic metres of the summer flood, which could either be passed through the Roseires Dam canalization or else sent down the river to increase the supply of

water available at Sennar. From the dam a canal could be constructed along the west bank, to irrigate an area of 1,220,000 *feddans* to the south of the Sennar-Kosti railway line. At present this proposal is known as the Kenana scheme, from the Kenana Arabs in whose tribal area the scheme would lie (Fig. 82).

A considerable extension of pumped irrigation was also recommended, along both the Blue and White Niles. The Blue Nile areas fall into three groups: on the east bank near the mouths of the Rahad and Dinder rivers two large areas, totalling 189,000 *feddans*, could be irrigated by pumping from the Sennar Dam; near Es Suki there is a block of land beside the Busata private scheme where about 35,000 *feddans* could be irrigated in the same way; finally near Karkoj and Taiyiba there are several likely areas on either bank, including two of 54,000 and 65,000 *feddans*. These would require maximum lifts of 18½ and 25 m. respectively by the end of the irrigating season, and thus approach what has been taken to be the limit of economic lift. The west bank areas in this group might be irrigated by pumping from the canal instead of the Blue Nile. Farther south only one area of any size has been recommended, for the lift to command the clay plain becomes excessive. The extension of the railway system to Er Roseires, completed in 1955, was intended to stimulate development in this reach, and in due course to facilitate building a dam at Er Roseires (Plate XXXI).

On the White Nile the construction of a barrage to command a gravity canal is not practicable, both because of the lack of suitable sites where water could be held up without spreading out and suffering excessive evaporation losses, and because the gradients of the river and the adjoining plain are so slight that the necessary flow in a canal could hardly be maintained for any distance. Pump irrigation is clearly indicated, limiting factors being on the west bank the presence of the Qoz sands which extend near to the river as far south as latitude 12° 10' N. approximately, and on the east bank a low rocky ridge which between Kosti and Jebelein approaches to within 7 km.

¹ Sir Alexander Gibb and Partners, *Estimation of Irrigable Areas in the Sudan, 1952-53, 1954. The Roseires Dam, 1954.*

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Near to Kosti the success of existing private pump schemes shows that no considerable problems, whether of engineering or agronomy, are likely to attend expansion. A number of schemes has been recommended upstream of Geiger, the largest being 31,600 *feddans*, where the clay percentage averages 50 and the Na value 16, the total area proposed being about 45,000 *feddans*. Farther south a number of small areas fairly close to the river has been recommended. A low sandy ridge between 7 and 20 km. from the river restricts development on the east bank; while on the west, traces of a probable former river bed make extension difficult more than a few kilometres from the Nile. South of the bend at Meteimer there is a tendency to flooding on the east bank, and the water-logged soils are not considered suitable for irrigation. In the bend of the river at Melut a large area was pronounced suitable, representative soil-pits showing favourable clay content (59–84%), salt percentage (0.04–0.20) and sodium values (4–15). The area is intersected by several watercourses which could assist drainage but, though otherwise promising, this extension area was finally pronounced unsuitable on account of the danger of flooding. The more southerly schemes are too far upstream to benefit from the ponding by the Jebel Auliya Dam. The maximum lift anticipated is about 8 m.

Between Melut and Malakal sandy ridges run parallel to the river, occupied by Shilluk on the west bank and Dinka on the east. The irrigable areas lie between the ridges and the swampy land of seasonal flooding (*toich*) that borders the river, but many drainage channels and areas liable to water-logging reduce the area available for cultivation. The areas proposed for development will require a maximum lift of 6½–8 m. In view of the rather different ecological conditions here and in the Melut bend from those farther north, it may prove that different rotations, or even different crops such as rice, are better suited to the region. The establishment of an agricultural research station will, therefore, probably be required.



FIG. 83. The Atbara gorge at Khashm el Girba. The Arabic term means literally "the mouth of the water skin"; this is the site where a dam may come to be built to command about 500,000 *feddans* on the west bank of the river (Fig. 82). From *Irrigation by gravity from the River Atbara*, 1955, Fig. 4, Sheet 1.

The total area of the proposed pump schemes along both Blue and White Niles amounts to 551,000 *feddans*. Including the Kenana scheme, therefore, a total of 1,771,000 *feddans*, or more than one and a half times the existing Gezira Scheme, can be added to Sudan's irrigated area, if the necessary capital can be found. The demand for water would be between 2½ and 3½ milliard cubic metres during the flood or Untimely season, and a little more than 1½ milliards during the Timely season.¹

The capacity of the proposed Er Roseires dam will depend on the height to which it is built. The initial scheme provides for a maximum reservoir level of 471.5 m., holding about 1 milliard. This should suffice at first, while later heightening to 480 m. could increase the storage to more than 2½ milliards. The lower part of the dam will merely hold water in the compara-

¹ K. M. Barbour 'Irrigation in the Sudan: its growth, distribution and potential expansion,' *Trans. Inst. Brit. Geog.*, 26 (1959), Fig. 9.

tively narrow trench of the river bed, where storage capacity will not be very great, but heightening the dam will make use of the much wider valley, so that for each metre that the water is raised the total capacity will rise rapidly. The higher total should suffice for all the proposed schemes, including the Manaqil extension of the Gezira Scheme, which is estimated ultimately to require 0.51 milliard of stored water in the Timely season.¹

The River Atbara has hitherto been quite neglected for irrigation, though its profile and régime do not materially differ from those of the Blue Nile. Apart from questions of finance, the reason has been that the Atbara is even more deeply incised into the clays than is the Blue Nile (about 100 m., compared with 20-25), so that on either side of the river there is a broad band of severely eroded land (*kerrib*) (Fig. 83) which makes it difficult to construct irrigation canals. Recently, the government has re-investigated the problems involved, and it has been shown that there is a very reasonable dam site near to Khashm el Girba. Farther downstream there are extensive areas of suitable clays, and an Atbara scheme of 500,000 *feddans* is under active consideration (Fig. 82). Apart from providing tenancies for the local Shukriya and Lahawin Arabs, it is thought that this scheme might afford alternative homes and livelihood for the inhabitants of the Wadi Halfa reach when the High Dam is built by the Egyptians.²

Conclusion

The development of Sudan has been almost entirely due to the introduction of irrigation in the central clay plain and to the cultivation of high-quality cotton that this has made possible. At the worst, in the slump years of the early 1930s, cotton growing was carried on at a slight loss, but for the last twenty years it has been continuously profitable, and some considerable private fortunes have been built up based entirely on cotton. More important, the revenues of the state have largely been sustained by the profits of the Gezira Scheme.

Excessive dependence on a single export crop is recognized to expose a country to grave

economic dangers, since a sudden fall in the world demand for its produce might dry up the state's supply of foreign currency almost entirely. In Sudan, moreover, it would also empty the Treasury in a very short time. For a number of years, therefore, attempts have been made to discover alternative cash-crops which could be grown in place of, or in addition to, cotton. Within the clays the main experimental centre has been the Gezira Research Farm near Wad Medani.

Hitherto, the main fact established by this research has been that while there are several other crops, such as wheat, maize, millet, or various beans, that can be grown successfully in the Gezira plain, there is none which can approach cotton in profitability. Where the rainfall exceeds about 800 mm. (32 in.) American-type cotton can be grown without irrigation, but the higher yields and greater reliability of Egyptian-type long-staple cotton usually make the expense of establishing irrigation worth while.

In these circumstances it is not to be expected that either the government or the private scheme owners will turn from cotton in the near future. Such a policy is made less likely by the manner of associating the tenants as profit-sharers which is a feature of irrigated agriculture in central Sudan. While it is possible to imagine a private land-owner deciding to devote a portion of his land to a less profitable crop as a protection against a possible decline in cotton prices, it would be impossible to persuade a group of tenants to accept an appreciable reduction of the small incomes, perhaps £S20 per *feddán*, that they now get from their 5- or 10-*feddán* cotton holdings.

Cotton production may, therefore, be expected to predominate as long as prices do not fall far below their present levels. If ever they do fall, however, it is reassuring for the Sudanese to know that the possibilities of grain production in central Sudan will continue to be enormous. While it is reasonable to expect that the population of Sudan will grow rapidly in the future, it must be very many years before the shortage of agricultural land can give rise to anxiety for the nation's food supply.

¹ H. A. W. Morrice, *The Use of Stored Water in the Sudan, with particular Reference to the Manaqil Extension and the Roseires Dam*, S.I.D. Technical Note, 4/1955.

² H. Bell, *Irrigation by Gravity from the River Atbara*, undated (c. 1955).

EASTERN SUDAN

EASTERN SUDAN is defined for the purposes of this work as the country lying to the east of the Blue Nile and to the north of the line of permanent villages and regular cultivation that runs approximately from Sennar through Gedaref to the valley of the Setit river (Fig. 81). To the north it follows the division between Desert and Semi-desert, as shown on the vegetation map, and so includes the whole of the Red Sea hills as far as the Egyptian frontier. The principal occupation of the inhabitants of the region is animal rearing (Fig. 84), but two important areas of irrigation are also included, while in many parts, where the mean annual rainfall is even less than 300 mm. (12 in.), a little speculative unirrigated agriculture occurs, some of it being remarkably successful.

The region forms the northern and central portions of Kassala Province, and includes several units, each possessing a distinctive personality and bearing a generally recognized name. These are the Butana, lying between the Nile and Atbara rivers, the Atbai, which is the Beja country lying to the west of the Red Sea hills and their continuation into Eritrea, the Red Sea hills themselves, and the Red Sea coastal plains. Just as none of these units is sufficiently populous to warrant its establishment as a separate province, so it has seemed best to describe them all in the same chapter.

THE BUTANA

The Butana is a gently undulating plain with a rather lower rainfall and better drainage than the Gezira. It lies too high for irrigation from the Nile and is too dry for regular rain-fed cultivation, but good grass growth and freedom from flies in the summer make it well suited to animal rearing. In the south and east it is covered with a dark, heavy clay soil, apparently formed *in situ* with a few granitic hills standing out as landmarks. In the north-west there is an extensive outcrop of the

Nubian Series, giving reddish sandy and gravelly soils and dissected by several long drainage systems such as the Wadi el Hawad. In the centre there are hill-masses formed of various rocks of the Basement Complex, on which very mixed desert soils occur. In the extreme north, at the latitude of Atbara, the mean annual rainfall is barely 100 mm. (4 in.), but southwards it rises to as much as 400 mm. (16 in.), where the limit of cultivation is reached. There is a marked variety in the density of vegetation corresponding to variations in site, soil, and rainfall, with semi-desert scrub in the north-west, treeless grassy savannah in much of the centre, and some *Acacia* savannah in the south.

The west and south-west Butana are occupied by semi-nomadic tribes, Shukriya and other Arabs, who migrate short distances every year, and depend for their sustenance on animals and cultivation, although they sometimes work as cotton-pickers in the Gezira. In the centre there are other Shukriya, who are wholly nomadic, migrating long distances and depending almost entirely on their animals to support them. In the east, the Lahawin who live along the Atbara river are mainly animal-owners, but they also grow some grain and other crops.

The Western Butana

The villages of the western Butana are to be found along the Rahad and Dinder rivers and farther north opposite the irrigated Gezira. In the former area the inhabitants are chiefly of the Arab Kawahla tribe and of various mixed elements belonging to the Dar Bakr administration from Gedaref. Agriculture is the chief means of subsistence, unirrigated crops of *dhura* being usually successful, and the river banks are also cultivated as the rivers subside. The villagers also have important herds of cattle, sheep, and goats, which they send northwards into the drier parts of the Butana during the rains to escape the flies. The local grazing is

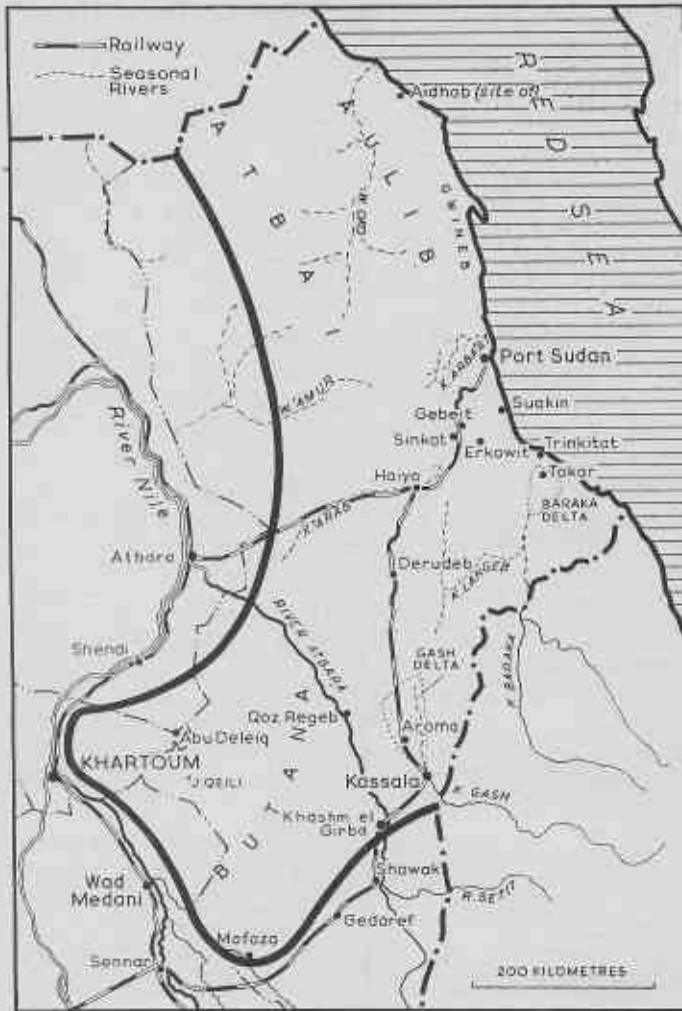


FIG. 84. Eastern Sudan

mostly rather tough and dry towards the end of the dry season, but valuable fodder for animals is provided by the many semi-permanent pools near the rivers and by the banks of the watercourses themselves.

Opposite Wad Medani and some of the other towns of the Gezira, there are some villages of completely settled Shukriya, whose chief source of livelihood is selling milk to the urban markets, and there are many semi-nomads settled in villages up to 20 miles from the river. They draw water from wells which tap the Nubian Series, which underlies the clay. The depth of

water increases away from the river and 40 m. is not uncommon. The way of life of the inhabitants of these villages resembles that of the Manaql area within the Gezira, for both groups keep animals but mainly depend on growing grain in fields divided up by *terūs*. Nomadism is declining, and it is rare for more than one or two members of a family to go into the Butana with the animals during the rains. In the dry weather, when other fodder has been consumed, the animals are often taken into the fields of the Gezira to eat millet stalks and other waste. Many of the men find work as cotton-pickers between December and March, and some have even been driven by poverty to offer themselves as general agricultural labourers. For such work they are not well suited by temperament, and the sturdy westerners are preferred by employers. As research into the habitual diets of families in central Sudan has shown, the life of the villagers away from the irrigated areas is a hard one, and rarely provides a diet adequate for maintaining health and strength. When the rains are poor, animals are likely to die and crops may fail completely, and then there is an actual risk of death

by starvation, since pride will often prevent the aged and infirm from revealing their need.¹

From the latitude of Khartoum northwards for about 150 km. (100 miles) there is a strip of country stretching eastwards for some 30–50 km. (29–30 miles) which is occupied by poor semi-nomads. With the decline in rainfall, the practice of agriculture becomes increasingly hazardous, and the *terūs* tend to be confined to the beds of broad depressions and watercourses. In place of the more or less permanent round thatched huts of villages farther south, the

¹ G. M. Culwick, *Diet in the Gezira irrigated area, Sudan*, Khartoum, 1951.

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Arabs live in tents made of hair or of grass and palm matting. These are not, however, sited by the wells from which they draw their water, since this would lead to a rapid exhaustion of the grazing around them, but at a distance of 5-10 miles. In the rains, the people and their animals move towards the Butana, and then they sow their crops of millet. During the succeeding dry season they migrate towards the river, ending up by building their rude grass huts a mile or so from the limit of cultivation. Their animals graze the rain-grown grasses and herbs and browse off the *Acacias*. In the Shendi reach these semi-nomads often have to pass through the irrigated fields to reach the river, but they have very little economic contact with the riverain folk, and prefer whenever they can to draw their water from wells.

The Central Butana

The central Butana is essentially animal-rearing country, for which it has many advantages. During the summer, biting flies abound in the clay plains to the south, and malaria is prevalent in the villages along the rivers. At this season, the treeless Butana offers freedom from flies, new grass and herbs, and enough pools of water for human needs. In the dry weather from October to May, there are still, at least at the current rate of animal stocking, more expanses of palatable sweet grasses than can be conveniently exploited from the existing water supplies. Much the best dry-season grazing is afforded by *Blepharis* sp. (Arabic *siha*, *B. edulis?*), which is both palatable and highly nutritious; but its steady elimination from overgrazed areas near watering-points is a source of anxiety both to the nomads and to the government, and must influence the policy of improving water supplies in rural areas, a subject which is discussed below.¹ The Butana is not free from the curse of very variable rainfall, with its consequent dangers of drought, famine, and animal deaths, but the Arabs here have an advantage over those of Western Sudan in that there are perennial rivers nearby, where water can always be found, while urban markets for their meat and other animal products are within easy reach.

Several types of water supply exist in the

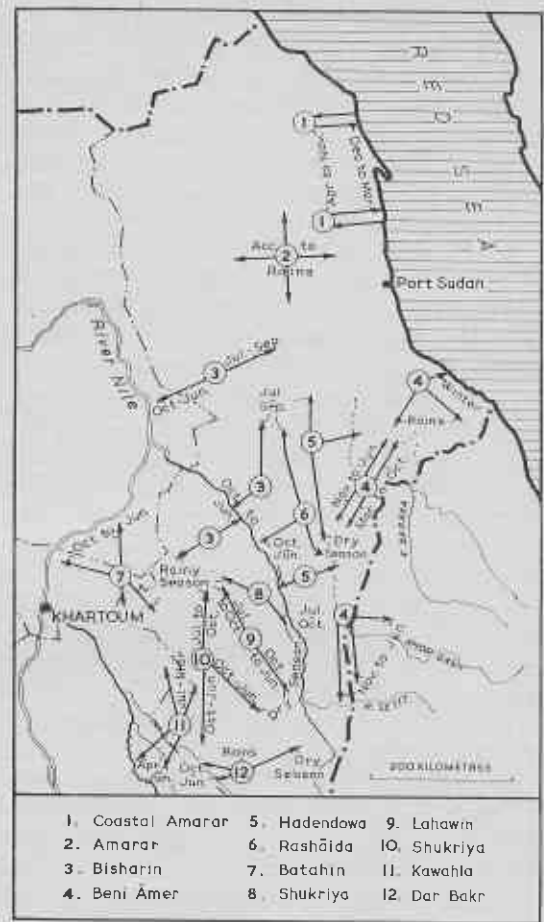


FIG. 85. Seasonal movements of nomads in Eastern Sudan. The north-south alignment of the Atbara river and the Red Sea hills and plain make seasonal migrations follow an east-west pattern as often as a north-south one. From information kindly supplied by the late D. Stewart and others.

Butana (Plate XXXV). In the south some low hills project from the plain, and shallow wells can usually be dug around them, sufficient to water a small number of animals. Farther north there are areas where the relief tends to concentrate the underground water, and some important well-fields exist. Along several watercourses small hand-excavated *hafirs* are to be found, filling in the rains and providing for the herds for a few months. At Jebel Reira there are also some pools in the joints of the granite which supply a little water. Such

¹ M. N. Harrison, *Report on a Grazing Survey of the Sudan*, Part III and Appendix No. 5.

traditional watering-points have not in the past been sufficient to allow for the exploitation of all the potential grazing in the Butana, whose stock-carrying capacity has in consequence been limited. In recent years a policy of *hafir*-digging has been pursued, using the same machinery and teams that were first used in the clay plains (Fig. 69).

The inhabitants of the central Butana are Shukriya and Lahawin Arabs; they are completely nomadic, the resident inhabitants of such centres as Subagh and Abu Deleiq consisting of a mixture of merchants, petty officials, and other outsiders with virtually no members of the local tribes. The nomads' flocks consist of camels, cattle, sheep, and goats; of these the camels and sheep are sold when money is needed to pay taxes, the camels going on the hoof to Egypt and the sheep to local markets on the fringe of the Butana. The cattle are rarely sold, and are eaten only when very old, but they provide milk, butter, and cheese, considerable quantities of liquid butter-fat being sold when yields are high in the rains. One of the motives for increasing the number of watering-points has been to encourage the keeping of sheep, which are the favourite meat of the Sudanese townsmen, rather than of camels, which do not have to drink so often and can graze wider areas from limited watering-points but are eaten only by Egyptians.

The annual migrations of the nomads are a simple alternation between north and south. In winter the beasts are taken to graze and water along the Rahad near Mafaza or the Atbara near Showak; in summer they come about as far north as latitude 16°. In the meantime they wander according to the grazing. During the rain, patches of millet are sown in the stream beds, and these usually suffice to make purchases of grain unnecessary. The lack of vegetables in the nomads' diet is largely compensated by their consumption of fresh milk.

The Batahin of the north-west move in the reverse direction according to the seasons, for during the rains they come south-eastwards into the Butana around Abu Deleiq and the head of the Wadi el Hawad, while in the dry weather they go down to the Nile around

Shendi. Probably because they lose less water from run-off, the sands support a generally denser vegetation of grasses and low trees than do the soils formed from the Basement Complex in the north-eastern portion of the Butana, but the latter appears, in fact, to provide better fodder for animals.

The Eastern Butana

This north-eastern area is occupied by the Beja tribe of Bisharin who are also to be found on the east side of the Atbara and farther north in the country between Berber and the Red Sea hills. This section of the tribe came to the Atbara river during the eighteenth century, having been invited to help some other Beja to whom they were related against the Batahin and other Arabs of the Butana. Having found the water and grazing better than in the hills, they have remained. They are camel and sheep-owners, and migrate short distances away from the river during the rains.

Farther upstream on the Atbara river are the Eastern or Atbara Shukriya and the Lahawin, who likewise move only short distances west and north-west from the river during the summer. The rainfall usually suffices here for the cultivation of millet, and the river banks can be sown with maize, melons, and vegetables, so the country may be said to be very favourable for the Arab life. For those who have animals there was formerly the possibility of earning some money collecting the nuts and young leaves of the *dōm* palm, which grows in great numbers along the river banks. The *dōm* nuts produce vegetable ivory, which was used at a factory in Atbara for making buttons until the coming of plastic buttons, which have eliminated the trade. However, the leaves are still woven together to make matting, baskets, and other domestic necessities. During the short period when the Atbara is in flood, the trunks, leaves, and matting from the *dōm* palms, which are widely used in house building, are shipped down the river to Atbara, and thence by native boats to the Three Towns and other urban markets. So great is the demand for building timber that in recent years it has proved profitable to transport the trunks across the Butana in heavy trailer-drawing diesel lorries.

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THE ATBAI

To the east of the Atbara river the southern portion of the Atbai stretches as far as the frontier, beyond which rise the Eritrean Highlands. The potentialities of this plain would be very similar to those of the Butana, with a similar rainfall and heavy clay soil, if it were not for the presence of several streams which flow down from the hills and lose themselves in the plain. Most of these streams have small and ill-watered catchment areas, since down-cutting and river capture have brought the Nile-Red Sea watershed well to the west of the highest part of the Red Sea hills, and thus they produce insignificant and irregular floods during the summer. In the south, however, the Gash river drains a total of 21,000 sq. km. of Eritrea and Ethiopia, where the mean annual rainfall is probably well over 500 mm. (20 in.), and thus every year it brings down a substantial flood, which has built up an extensive delta.

The Gash Delta

Geophysical investigation has shown that north of Kassala there is a deep depression running from south to north. This depression has been filled up with sand and silt brought down by the Gash river, so that a delta has now been created whose surface lies slightly above that of the surrounding plain. The delta spreads out to the north of Kassala for a distance of more than 100 km., and it seems possible that the river used formerly to reach the River Atbara, and thus was a tributary of the Nile. Today this does not happen, even after the highest floods.¹

In its natural state the Gash delta provides an area of exceptionally good grazing, the flooded silt soils yielding a heavy growth of grass, which continues to be green and palatable long after the rains have ceased and the surrounding country has dried up; many trees and bushes, moreover, provide browsing for camels. The region has, therefore, long been highly valued by the Hadendowa section of the Beja, in whose territory the delta lies. They can come south after the rains, confident of finding

food and water, and so have been almost free from the risk of losses of stock in dry years. At the present time the growing of cotton in the delta reduces the amount of grazing available, and also means that the Hadendowa are required to keep their animals away from the cotton areas until after the picking season is over in May or early June. In return, however, they receive considerable sums from the profits of cotton growing, so they still benefit appreciably.

The soil of the delta is 'a rich silt of great depth, known locally as *lebad*, which is prodigiously fertile'.² The property that has made possible the cultivation of annual crops, including cotton, in the delta is that a very large quantity of water is absorbed after flooding, saturating the ground to a depth of as much as 6 m. Moreover, this water is not quickly lost either by percolation downwards, because of the less permeable clay strata found below the surface, or by evaporation from the surface, since the silty soil does not crack on drying as do heavy clays, but remains available for plant growth. Even six months after the annual flooding it is often possible to find the soil quite moist a mere foot below the surface. Soils are not homogeneous throughout the delta, for there is, in general, an increase in the clay percentage towards the north and west. The clay areas require longer flooding and are generally less productive, and since they occur at the tail of the delta they have mostly been omitted from the scheme of canalization.

The annual Gash flood, on which the exploitation of the delta depends, is of great variability, the total discharge, measured at Kassala weir, having been known to vary from 137 to 1,290 million cubic metres, and its duration from 68 to 111 days.³ The average discharge over a period of twenty-three years at Kassala has been 483 million cubic metres, the length of the flood being a little less than three months, from late June to mid-September. The silt content of the river is high, and investigation has shown that the Gash usually has three or four times as much silt in suspension as the Nile when it enters Egypt in summer,

¹ O. G. S. Crawford, *The Fung Kingdom of Sennar*, 1951, p. 94.

² C. H. Richards, *The Gash Delta*, Ministry of Agriculture, Bulletin No. 3, Khartoum 1950, p. 5.

³ C. H. Swan, *The Recorded Behaviour of the River Gash in the Sudan*, published by the Ministry of Irrigation and Hydro-electric Power, Khartoum, 1956.

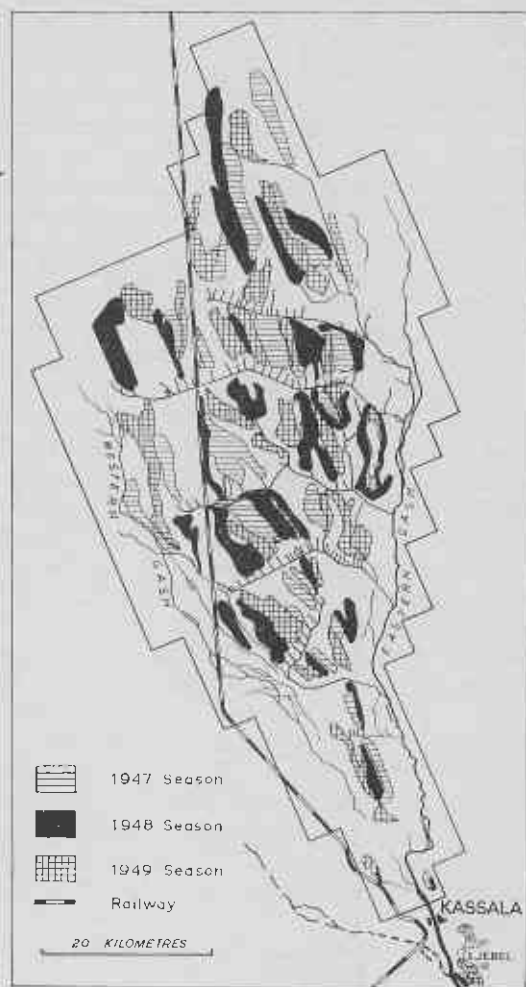


FIG. 86. Cotton-growing in the Gash delta in three successive years. The eastern Gash flows in a marked levee, from which it is possible to lead distributory canals on the left bank, and so to command the greater part of the delta. From *The Gash Delta*, 1950.

the explanation being that the delta is much nearer the river's source.

The commercial exploitation was first begun in the period of Egyptian rule in Sudan before the Mahdiya. Ahmed Mumtaz Pasha, who was Governor of Suakin and later of much of eastern Sudan between 1865 and 1872, was an ambitious man who put forward many ideas for the development of agriculture in Sudan. Of these the most fruitful was his proposal for growing cotton in the Gash and Tokar deltas, for in

due course seed was issued to the Halenga tribesmen who live near Kassala, and some cotton was grown, its cultivation being continued until the Mahdi's forces overran the area. During the early years of the condominium no immediate steps were taken to resume cotton growing, probably because there was no adequate means of transport to the coast. After the First World War, however, a railway line was built from Haiya to Kassala in 1923, and the first large canal was excavated in the following year. By early 1926 six main canals, complete with headworks and regulators, had been constructed and cotton production was resumed.

The system adopted to control the flood and to bring it to a pre-selected portion of the delta can best be illustrated by a consideration of Fig. 86, wherein the areas irrigated in three consecutive seasons are shown. The flood is brought down the eastern side of the delta along a natural course known as the Eastern Gash. Leading from the left bank there are five main canals with masonry headworks, and on the right or north side of these main canals there are in turn masonry headworks leading to channels (known as *misqāt*) which actually bring the water to the land. When a fairly steady flow has been established in the Eastern Gash, water is permitted to enter the main canals, the regulators being designed to take only the relatively silt-free top water, while the rest flows down to the tail of the delta. Then according to the supply of water one or more channels are opened and the water spreads over the land between low banks which divert it northwards and keep it off the fallow land. The period of watering varies from twenty-three days for the lightest, to thirty days for the heaviest, soils, and during that time it is very important that the flow of water should not be checked, permitting the surface of the ground to dry out, for in that case a heavy growth of weeds would instantly spring up and seriously reduce cotton yields.

The normal rotation adopted is one year of cultivation followed by two years of fallow, since a more intensive rotation would encourage a dense grass growth and make weeding very difficult. The cultivated areas are divided between 80% cotton and 20% millet, the

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latter usually being grown on the fringing areas of each plot that have been less well watered. When the flood has subsided and it can be seen which areas have been sufficiently wetted, the land is allotted to agricultural agents or headmen, each of whom has a number of tenants, varying between six and more than a hundred, under his care. The agent allots the tenancies, which average 5 *feddans* each, among his followers, the tenant being allowed 1 *feddān* of millet to every 4 of cotton. The actual distribution of tenancies is determined by lot, so that no person is permanently allotted a particularly good or bad area. The land is divided by beacons into large and small squares of 4000 and 160 *feddans* each. Between these, chainmen each year mark out plots of 10 *feddans* for ease of allocation to tenants.

All the millet grown is retained by the tenants, while the profits of cotton growing are distributed between the Government, the Gash Board which manages the scheme, and the tenants in the proportion of tenants 50%, Government and Board 20-30% each, according to the actual turn-out of lint in each year. In 1949-50 the average sum paid to tenants was approximately £E9 per *feddān* of cotton.¹ Cotton-seed is distributed by the Board, and is sown as soon as the land has been allotted; weeding then begins, and must be carried on almost continuously until the end of October. Picking starts in January, and is not completed until the beginning of June, after which the seed cotton is dispatched by rail to Port Sudan for ginning. The cotton grown is either Sakel or X1730A, the seed being supplied from the Gezira seed-farm at Barakat.

The Gash delta is chosen for the building up of stocks of seed (bulking) because of its relative freedom from Blackarm disease. The delta produces a very high grade of cotton, appreciably higher than that of the Gezira, but yields average only about one half as much because the amount of water available, while adequate for plant growth, by no means attains the optimum. The effective cotton area and yield in recent years are shown in Table X.

The tenants of the scheme are chiefly members of the Hadendowa tribe, who traditionally used the Gash delta to graze their animals and to grow crops of millet. At the present time the tribe receives 70% of the lands flooded, their allocation being the responsibility of a committee representing the management of the scheme, the local administrative authorities, and the Nāzīr of the Hadendowa tribe. The allotment of land is made to the agricultural agents on the basis of their record and of the number of their followers, and it is they who select the individual tenants. This system, while apparently inequitable in that it gives excessive power to the agent, works very well and rarely leads to complaints, for it seems to accord with the tribesmen's ideas of what is fitting. It does not seem impossible, however, that in some cases the names carefully recorded in the agricultural inspector's lists of tenants may refer to imaginary persons. Important members of tribes often get much larger areas allotted to them than do the ordinary people.

About 30% of the flooded land is allocated to various westerners and recently to a few individuals coming from northern Sudan who

TABLE X
Area, production and yield of cotton in the Gash Delta

Years	'000 Feddans	'000 Kantars	Kantars per Feddan
1920-21/1924-25 (average)	9.1	13.2	1.75
1925-26/1929-30 ..	29.4	59.3	2.12
1930-31/1934-35 ..	26.5	49.1	1.82
1935-36/1939-40 ..	31.2	61.5	1.98
1940-41/1944-45 ..	29.4	72.4	2.44
1945-46/1949-50 ..	35.4	74.1	1.55
1955-56	36.2	80.5	2.22
1956-57	68.6	78.5	1.14
1957-58	40.3	79.5	1.97
1958-59	37.9	83.9	2.21
1959-60 (est.)	36.9	55.4	

¹ Richards, *op. cit.*, p. 31

live in Kassala. It is rather ironical to record that the Kassala Cotton Company, which was granted the original concession in 1924 to manage the scheme, was in 1927 replaced by the Gash Board, because it had paid too much attention to commercial rather than political considerations, in particular giving tenancies to the industrious westerners in preference to the Hadendowa tribesmen. Subsequently, the Gash Board found itself compelled in 1931 to allot tenancies to westerners because the Hadendowa lost interest in their cotton when the prices no longer justified the hiring of labour to do the actual work. At the present time there are a few areas of particularly bad weed growth entirely in western hands, where the Board makes a special contribution to the cost of clearing the ground.

Because the Hadendowa are still essentially nomadic herdsmen rather than settled cultivators participating in a scheme of irrigated agriculture, the density of population in the delta is remarkably low, regular villages, like those situated by the canals in the Gezira, for example, being wholly absent. In fact, this is rather fortunate, for though there is an abundance of water during the flood, and though the bed of the Gash itself can always be relied on to provide water in shallow wells, elsewhere in the delta permanent supplies are very scarce, and the Gash Board has been put to considerable expense to provide permanent water for its own staff. For native use there is a number of well areas, where a high earth bank has been constructed surrounding a space of an acre or more into which flood water can be diverted during the summer. The water thus sinks into the ground, and can be tapped by wells which have to be dug anew each year. Such well areas depend on the existence of suitable underground strata to hold up the water.

In recent years some *hafirs* have been built to improve the water supply for specific points, for instance Aroma, where the presence of the headquarters of the Gash Board and of a sub-district headquarters have led to the growth of a small town (3,500 in 1955). These *hafirs* have been quite successful in holding water throughout the dry season. For the officials of the Board, who until recently included many British living with their families, a piped water

supply was established in 1923, wells at Mekali being used to feed into a system of pipes running along the Main Canals. Subsequently, this system has been modified and improved, and Gemmam is now the well area used, supplying 10,000 gallons an hour. Recently, the demand for piped water has risen steeply, and a much larger piped water supply has now been installed.

The Hadendowa in the Gash live in tents built of matting made from *dōm* palm leaves. When dry such matting has an insubstantial air, and looks ill-suited to a region where rain can be severe, but it appears that when wetted it swells and fills the gaps between leaves, so that in fact one can keep quite dry within. The sides of the tents can be raised or lowered according to the wind or dust that is blowing, and all the tents in a group are usually set up in the same way to catch the prevailing wind. Apart from their allotted areas of flooded land the Hadendowa often have the chance of cultivating areas that have been flooded by mistake, known as *balagh*, where a canal bank has broken, and they also crop the flooded land at the tail of the delta where some water is usually allowed to go to waste. Along the side of the delta, in areas not included in the scheme, rain-grown crops are common, *terūs* being built to ensure a crop in all but the worst years.

Kassala and the Sawāqī

Kassala Town, which lies at the head of the delta, has surprisingly little to do with the Gash scheme. Its primary function is that of a garrison town, situated near the traditionally lawless lands of Eritrea over the border. The reliable supply of drinking water from the Gash and the defensive possibilities offered by the river and the great steep Jebel Kassala make it an obvious site for this purpose. Kassala has also been chosen as the administrative centre of the province which bears its name. The province is in no sense a unity, and is in fact made up of three very different units (the Red Sea hills, the Gash delta, and Gedaref district), none of which is sufficiently populous to warrant being made a province on its own. Kassala enjoys a position where the necessary fresh fruit and vegetables for a comparatively sophisticated and prosperous population can readily be produced, and is centrally situated

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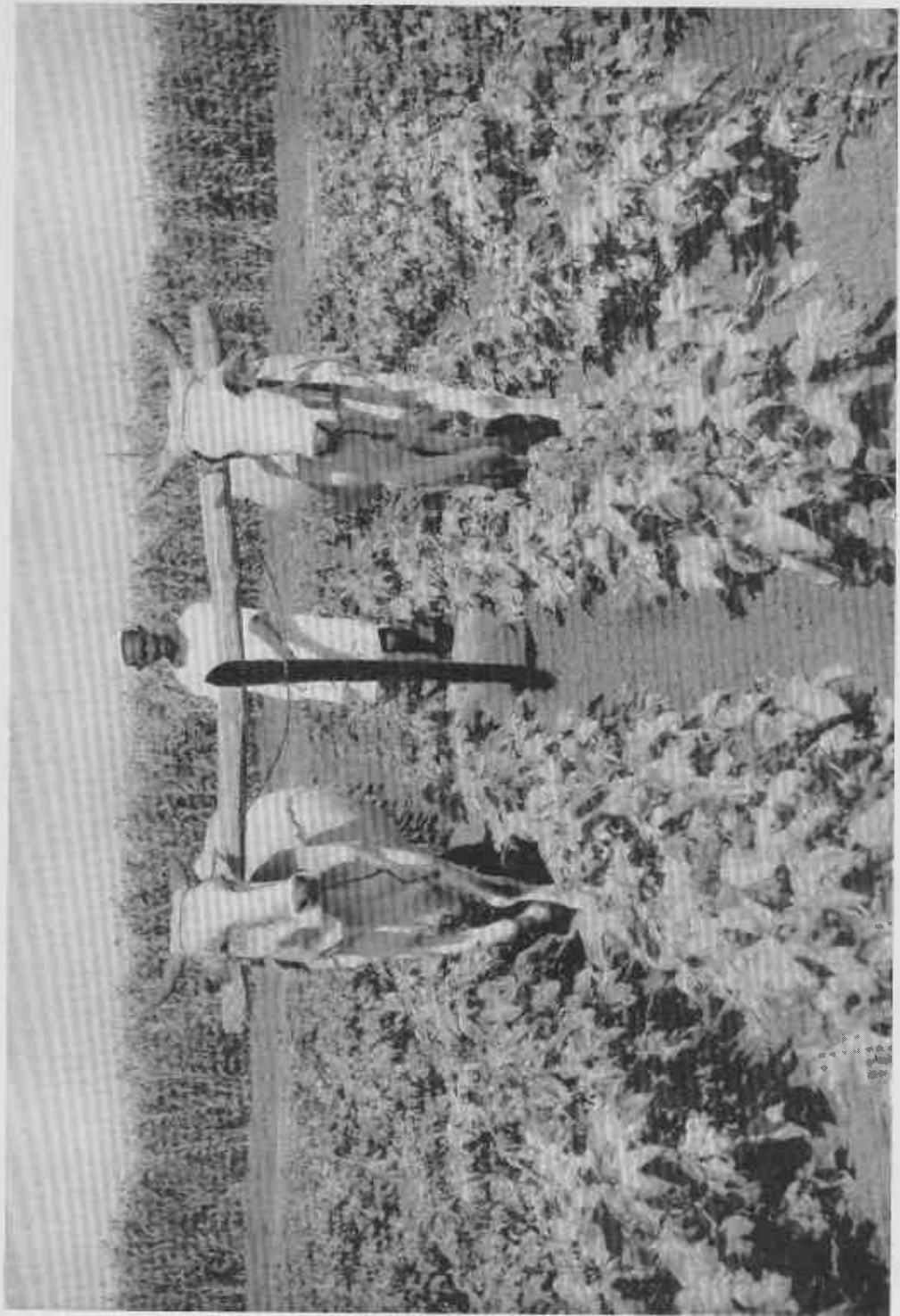


PLATE XXXIII, RIDGING COTTON IN THE GEZIRA

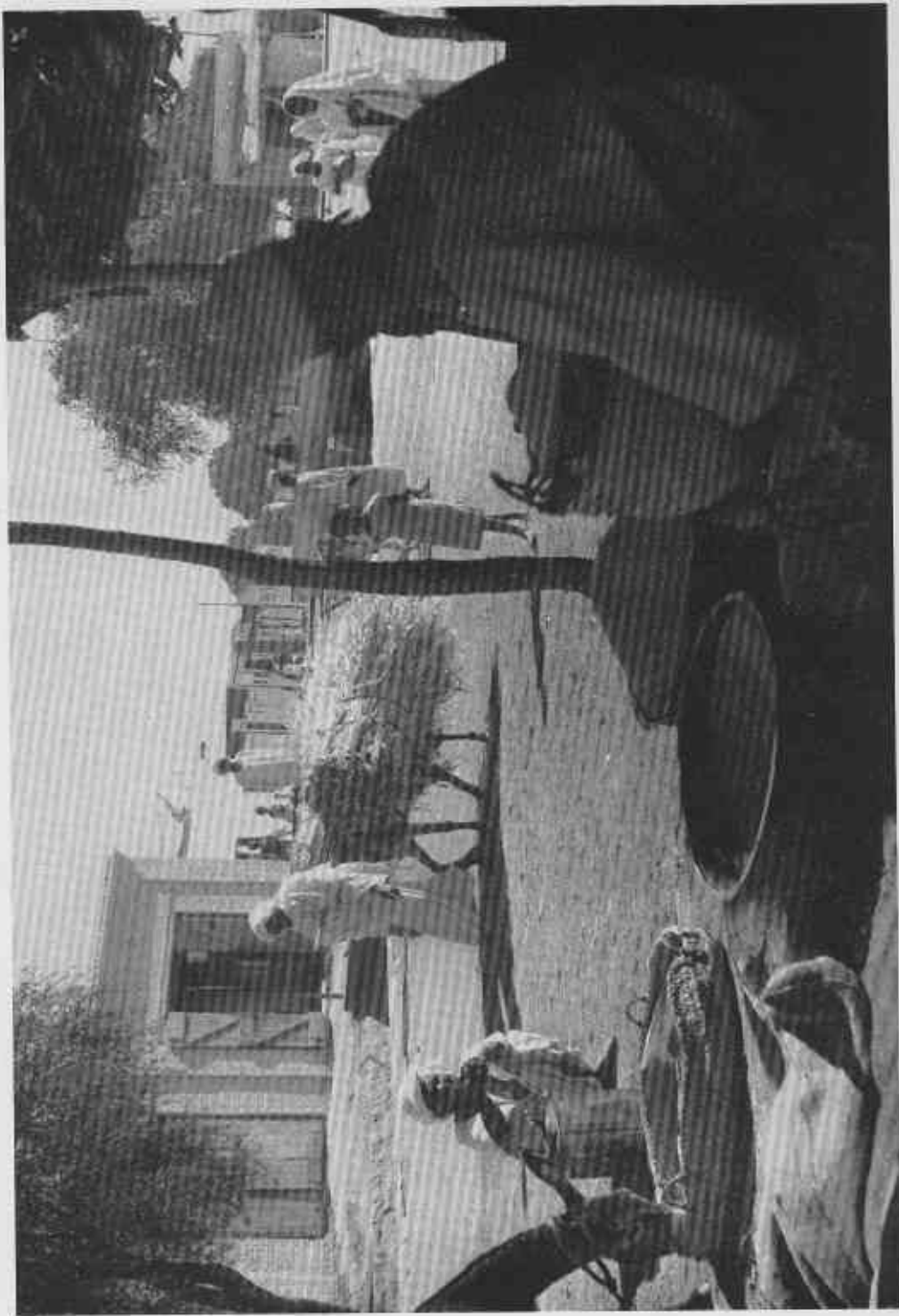


PLATE XXXIV. STREET SCENE IN OMDURMAN

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between the northern and southern sections of the province. The town is, of course, uncomfortably hot in the summer, suffering from particularly disagreeable dust-storms that blow in from the fine soils of the delta, and it was once the practice to withdraw the province administration to Sinkat in the Red Sea hills for several months each year. Now, however, with the modern expansion of government activities, this has become impracticable and is no longer done.

Neither the administration of the Gash scheme nor the marketing of its produce brings any wealth to Kassala, but it seems likely that the money received by the Hadendowa for their cotton, in so far as it is not spent in paying taxes and in buying more animals, probably swells the trade of importers, wholesalers, and retailers of tea, sugar, cloth, and similar commodities in the town. The urban population provides a steady market for the sheep of the Hadendowa and Shukriya, and for milk produced by the Beni 'Amer and other Beja, some of whom spend the whole year within a short distance of the town. The people of Aroma, in return, provide a market for the produce of the gardens beside the Gash opposite Kassala town. Another growing function of the town is the importing and maintenance of the pumps and agricultural machinery used in these gardens.

The population of Kassala is very mixed. The local Beja-speaking tribe is the Halenga, whose Arab ancestry is revealed in their appearance, and they are to be found in the town and in a small area to the east and south of it. There are many merchants from the riverain areas of northern Sudan, Ja'aliyin, Shaiqiya, and Danagla, and these tribes have obtained almost complete control of the irrigated areas beside the Gash, since the techniques required are essentially the same as those practised in their native villages. There are Yemenis and

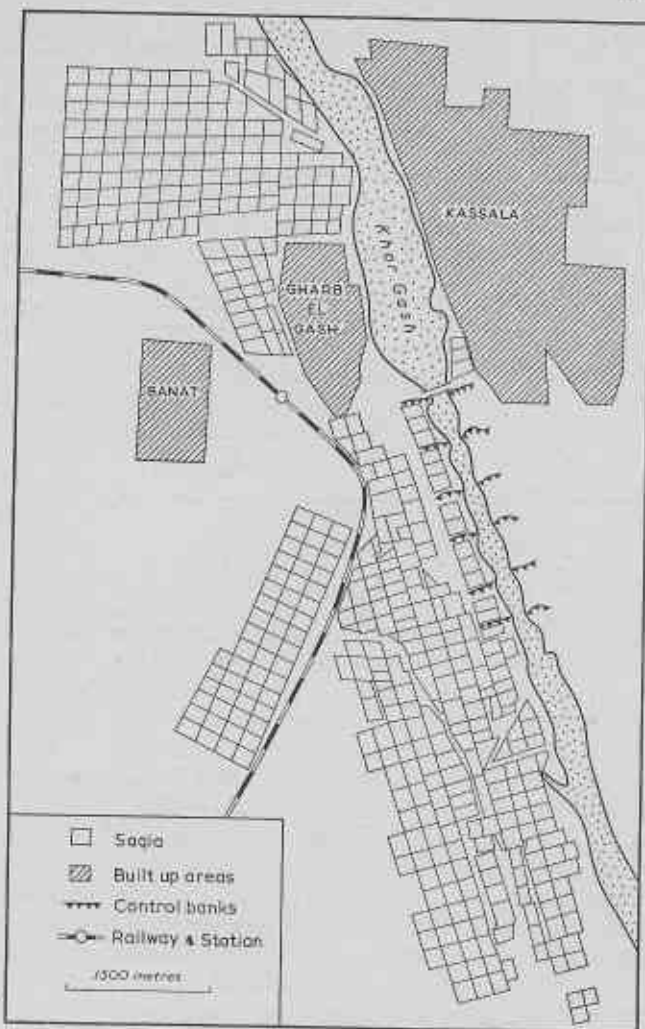


FIG. 87. The *Sawāḡi* (Irrigated gardens) at Kassala. Both Kassala and Gharb el Gash are built in low-lying areas which would otherwise be well-suited to the development of *sawāḡi*, and hence it has proved necessary to construct numerous embankments to prevent the Gash from changing its course disastrously. From plans provided by the Inspector of Agriculture in Kassala, and with the kind assistance of the Town Planning Department.

others from across the Red Sea engaged in petty trade, especially selling food; there are Ethiopians as traders and as prostitutes (these latter are found in all the main towns of northern Sudan); there are Italians who have come down from Eritrea and make a living as merchants and fairly skilled craftsmen, and there are educated Sudanese, mostly of families now resident in Omdurman but coming

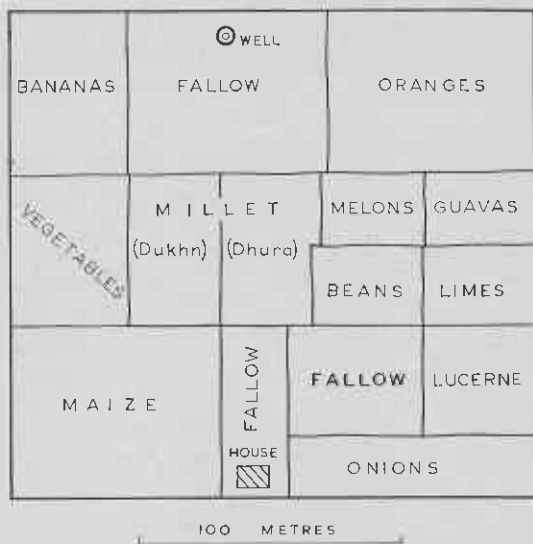


FIG. 88. A *Sagya* at Kassala. Generalised from a survey by the author.

originally from the Northern Province, who are serving as government officials. Until recently there was a number of British officials and army officers, and the houses and gardens that they had built for them represent here, as elsewhere in administrative centres, a welcome break from the monotony of Sudanese house design.

Opposite the Gash from Kassala is the large village of Gharb el Gash, occupied by westerners who work as labourers in the town and in the Gash delta, and also have their own cultivations farther to the west. Both north and south of this village lie the irrigated gardens (Fig. 87). These are known as the *Sawāqi* (plural of *saqia*, a water-wheel, hence an irrigated garden, since all the gardens were originally watered in that way). The gardens lie on the silt terraces of the Gash, and draw their water from wells with an average depth of 5 to 10 m. In 1953 there were over 400 *sawāqi* occupied, with an average size of 8 *feddans* each. With its rich silty soil, its high hedges, its perennial fruit trees, numerous water wheels and other signs of irrigation, this *sawāqi* area recalls the landscape of Middle Egypt, particularly when a glimpse is caught of Jebel Kassala in the background, reminiscent of the high cliffs bordering the Nile Valley.

Sagya cultivation began to be of importance shortly after the First World War. At first the

government encouraged its development by enabling cultivators to obtain freehold tenure of the land they occupied. Subsequently, this policy has been changed to the granting of thirty-five year leases at very low rents, which are thus revocable in case of poor husbandry, but are otherwise virtually assured of renewal when their term comes to an end. All that a man needs to become a tenant is the approval of the allocating board, and enough money (about £570) to buy a couple of bulls and get a well dug and a water-wheel constructed. The basis of *saqia* cultivation at the present time is the growing of grain and vegetables for the tenant's subsistence, and of fruit and vegetables as cash-crops. Tenancy regulations require that the tenant shall grow at least 1 *feddān* of fruit, but in fact this is usually much exceeded: bananas are the first fruits planted, because they bring a cash return after nine to twelve months only, and at the same time the tenant, usually aided by a sub-tenant who is trying to set aside enough cash to become a *saqia* holder himself, plants his permanent orchard of mangoes, guavas, and citrus fruits.

In a typical holding (Fig. 88) the area of fruit remains constant, except that as the years go by, the tenant, if successful, may gradually increase the number of his trees. Elsewhere, the millet alternates from year to year with fallow, while vegetables and onions occupy a space of their own. Millet is grown in the summer, and irrigated only as a supplement to the rains, the onions providing a reliable source of cash when they are marketed by the sackful.

The produce of the irrigated gardens meets the local demand in Kassala for fresh fruit and vegetables, for every day tenants are to be seen riding into the town on their donkeys, with large *dōm*-leaf baskets piled with produce suspended from poles laid across the animals' backs. Twice a week there is also an important market held in Gharb el Gash, when the trains which connect Kassala with Haiya and Port Sudan to the north, and with Gedaref, Sennar, and Khartoum by the southern line, are due to call in the evening. The towns away from the river, especially Port Sudan with a population of nearly 50,000 and regular visits by ships, provide obvious markets for Kassala produce, but

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quite a large proportion is consigned to Wad Medani for the Gezira, and even to El Obeid. Occasionally, lorries are loaded with fruit, especially bananas, and driven direct across the Butana to Khartoum or Wad Medani, for the saving in time and hence in condition of the produce pays for the greater cost of transport. The damage to fresh produce on its way to market by train is naturally great, for soft fruits such as tomatoes are packed in pliable baskets which give little or no protection when piled up on top of one another, especially in the high temperatures usually prevailing in Sudan.

A perennial complaint of the *sawāqi* farmers is that the middlemen engaged in the green-grocery trade make excessive profits, and combine together to keep prices to the producer as low as possible. This is a standing complaint of market-gardeners everywhere, but it may be particularly true in Sudan, where many merchants seem more interested in making the maximum profit out of the existing trade than in extending it. Yet the obvious remedy for the producers' weakness—the development of co-operative organizations—has hitherto been quite unsuccessful, the tenants having proved too independent and too suspicious of one another, as well as too ignorant of business principles, to make a success of the attempt that was made shortly after the Second World War to unite them. Debt is rare in the *sawāqi*, which is an encouraging sign; yet if agricultural credit could be made available at cheaper rates than those usually demanded by merchants, there is no doubt but that increased capital investment in the Kassala *sawāqi* could bring great rewards.

South of Kassala the Gash river flows for 25 km. (15 miles) from the Eritrean border, flanked by silt terraces like those on which the Kassala *sawāqi* are set up. These terraces are covered with trees, especially *dôm* palms, and have been declared to be forest reserves because of the great value of their products. One day a clash may occur between the demands of agriculture and forestry, but at present there are still prospects of extending the *sawāqi* on to vacant ground near Kassala; moreover, if the *sawāqi* farmers were to cease growing their family grain supply on their farms, they could enormously increase the

supply of fresh fruit and vegetables from the existing irrigated area.

The Eritrean Borderlands

Between the eastern side of the delta and the Eritrean frontier is an area of stony soils, intersected by several watercourses which flow westwards from the highlands to the Gash. Here is found the western section of the Beni 'Amer tribe, who, though their name proclaims their descent from a common ancestor, are in fact a mixture of varied elements. The northern members of the tribe speak Tu Bedawie, and are turning today to Arabic, while the more numerous southern section is resident in Eritrea and speaks Tigré. The western Beni 'Amer spend their winters as far south as the Setit river, where they find plentiful grazing, but when the rains come and the *surret* fly (*Tabanus* sp.) begins to attack both animals and men, they move north to the plain by the Gash.

The Beni 'Amer are great cattle-owners, keeping a rather small breed which proves well able to travel over their stony terrain. The cattle suffer from trypanosomiasis, which is transmitted mechanically by the *surret* fly, but few animals die from the disease. A particular custom of the tribe is to slaughter male calves at birth, which gives a good supply of veal, but means that they contribute less than they might do to the trade in beef, while hides are scarce. Their cows are of varied quality, and might be improved by selective breeding if the tribesmen were less backward. The only cultivation practised by these nomads is in the beds of the streams after they have flowed in the summer, the general custom being to broadcast the seed where the ground is wet and then to come back after three months to see if a crop has grown. In the meantime there are inevitable depredations by wild game as well as by untended domestic animals, and these combined with rats and locusts ensure that a good crop is rarely enjoyed.

To the north of the Gash delta, in the country lying across the Kassala-Haiya railway line, are found the more northern Hadendowa, Rashāida, and Beni 'Amer. With streams like the Derudeb providing water and grazing for much of the year, the nomads do not find it necessary to engage in regular migrations from

north to south and back again, but move in small groups rather irregularly according to the rains and the reports of grazing. The Rashāida are relatively recent immigrants from Arabia, having reached Sudan during the last two hundred years. They have no definite tribal territory, but move over large distances between Kassala and the Egyptian frontier. They are noted for the quality of their riding camels, and it is they who principally manage the export of camels to Egypt from eastern Sudan, taking a route by the wells along the western edge of the Red Sea hills and coming to the Nile near Aswan.

For the Hadendowa the vegetation of the Gash affords a defence against drought and famine, but it is not necessary to visit the delta every year. Even if the head of the family is allotted a tenancy in the cotton areas, it will suffice for him to leave the whole of its management in the hands of the agricultural agent, who receives a share of the profit for his pains in supervising its cultivation and harvesting. The other watercourses of the Hadendowa territory are much smaller than the Gash; nevertheless, they afford useful cultivable lands and valuable fodder for animals to graze and browse. Along these watercourses the *dōm* palm grows profusely, but the trade in *dōm* nuts has now virtually come to an end.

All along the line from Kassala to Haiya, and especially where the large Khor 'Arab flows down from the hills, the railway has to be protected by numerous stone-faced earthworks from the effects of violent floods; even so, a period of unusually wet weather often has the effect of putting the railway line out of action. The railway administration takes the view that the cheapest and most sensible way of finding the weak points in a line is by waiting for them to be revealed by floods, whereupon they can be strengthened piecemeal; in the meantime it is not unusual for a train journey scheduled to take one day to take, in fact, four or five in the rainy season.

The problem posed by the watercourses would undoubtedly be very much greater were it not that in the course of normal erosion the headwaters of the streams draining the

Red Sea hills have cut back to the west. The watershed between the Nile and the Red Sea lies some 40-50 km. to the west of the line of the highest crests of the hills, a fact which helps to explain the large flow of the Khor Baraka at Tokar and the low pass, barely 1,000 m., by which the railway reaches Port Sudan from the Nile Valley.

THE RED SEA HILLS

The Red Sea hills may conveniently be divided into a southern and a northern section, meeting approximately at the latitude of Sinkat.

The Southern Red Sea Hills

To the south lies the territory of the Hadendowa and the Eastern Beni 'Amer, which is distinctly more humid than the northern section, occupied by the Bisharin and Amarar. In the south the summer rains are not heavy, Erkowit having a mean rainfall of 121 mm. ($4\frac{3}{4}$ in.) in the six months from April to September, but the region also enjoys a slight winter rainfall when the north wind is blowing along the Red Sea. Cloud and mist are common on the higher mountain peaks, encouraging plant growth, and at points particularly open to the mist, such as Erkowit, the vegetation is comparable with that of much wetter areas farther south in the Eritrean Highlands.^{1,2} In addition to a movement down towards the Red Sea coastal plain in the winter, the Beni 'Amer also migrate in summer across the border into Eritrea, and so enjoy both the winter greenery of the high valleys exposed to the winds from off the Red Sea, and the summer growth of vegetation when the rain-bearing winds reach the Eritrean plateau (Plate XVI). Nonetheless, they are not wholly free from the curse of the nomadic life in the whole of eastern Sudan, namely the unreliability of the rainfall from year to year, the mean annual rainfall variability at the southern end of the Red Sea hills lying between 30% and 50%. If both summer and winter rains fail, or at least are much below the average, many animals are likely to be lost through undernourishment, and it is such dangers which account for the nomad's conviction that it is better to keep a large herd

¹ F. W. Andrews, chapter on 'The Vegetation of the Sudan', in *Agriculture in the Sudan*, 1948.

² B. Kennedy Cooke, 'The Red Sea Hills,' Appendix I to *Soil Conservation Committee's Report*, Khartoum, 1944.

of beasts, even if some of them are of very poor quality, than to cull the weaklings and run the risk that disease, wild animals, or famine will kill off a high proportion of the remainder and leave their owner destitute. Whether he stays with the tribe and works as a herdsman, trying to build up a herd anew for himself, or whether he goes away and offers himself for employment as a casual labourer, there are few individuals so wretched as the member of a nomadic tribe who has no animals of his own.

Sinkat and Erkowit

The administrative centre of the Red Sea hills, Sinkat, occupies an important strategic position on the easiest route from the Nile near Berber to the sea. During the Mahdiya it was the capture of Sinkat by the forces of Osman Digna in 1884 that enabled the Khalifa to establish his grip on eastern Sudan, and during the period of British rule in Sudan a garrison was maintained at Gebeit nearby.¹ There is a good water supply at Sinkat, supporting a town of 5,200 inhabitants; little water is available for fruit gardens, but in the summer millet is sown in the broad, sandy stream bed of the Khor Adit. Erkowit, nearby, was developed during the Second World War as a summer resort, with the construction of a commodious hotel in addition to houses for the Governor-General, the provincial Governor, and for other officials. The altitude, barely 1,000 m., is not, however, sufficient to make any really marked reduction in temperatures, and the scenery and amenities of golf and tennis ceased to attract many visitors once travel abroad became easier after the war had come to an end. Since 1945, therefore, the hotel has gradually fallen into disuse, for foreign officials have been able to take their holidays elsewhere, their fares being paid by the government, while the members of the foreign trading communities would rather visit their own countries every two or three years than make annual visits to Erkowit. The future of the station must depend on whether the Sudanese themselves appreciate a hill-station to which they can take their families relatively cheaply.

The Northern Red Sea Hills

Immediately north of the railway line lies

¹ H. C. Jackson, *Osman Digna*, 1926.

the territory of another Beja tribe, the Amara. These nomads recognize three principal elements in their part of the country, namely, the western plains or *Atbai*, the hills or *Aulib*, and the coastal plain or *Gwineb*. The rainfall throughout the area is low and uncertain, and there are no good plains where sheep or camels can be fattened. The western Amara move irregularly between *Aulib* and *Atbai*, depending on the incidence of the rain, while the eastern group go down to the *Gwineb* in the winter to feed their camels on the bitter herbs and grasses there, returning to the hills with the onset of the hot weather. The opportunities for cultivation are less than in the Hadendawa territory farther south, and torrents often wash away whatever grain has been able to germinate in the stream beds. Milk and grain are the habitual diet of the northern Beja, with some onions and spices bought at the markets. A few of the coastal sections of the Amara eat fish instead of meat, but there do not seem to be many who combine the knowledge of sailing and fishing with that of tending sheep and camels.

North of about latitude 21° N. the Amara give place to the *Atbai* section of the Bisharin. The density of the population in their almost waterless hills is low, though it is worth recording that at the time of the first population census of Sudan, the total number of Beja, who are extremely retiring by disposition, proved to have been more severely underestimated than any other major section of the Sudanese people. Until recently there was a working gold-mine at Gebeit, while elsewhere there are traces of earlier workings for gold and precious stones dating from the Egyptian dynasties of the Middle Kingdom (c. 2000-1600 B.C.). On the coast there are still to be seen traces of the ancient port of Aidhab, which lay on the route from Thebes to Punt and must have seen a trade in gold, incense, and tortoise-shell.²

THE RED SEA COASTAL PLAIN

The coastal plain between the Red Sea hills and the sea is of varying width. Its largest extent is in the south, where around Tokar and the delta of the Baraka it stretches as much as

² A. Paul, 'Aidhab: a Medieval Red Sea Port, *S.N. & R.*, 36 (1955).

55 km. (35 miles) inland. Farther north, between Port Sudan and the promontory of Ras Abu Shagara, there is a long strip averaging 25 km. (15 miles) wide, but between Ras Abu Shagara and the Egyptian frontier, where the line of the coast turns somewhat to the west, the hills are much nearer to the sea. The coastal strip consists of a wide range of relatively unconsolidated rocks, including limestones, clays, marls, grits, and gypsum, and is overlain in most places by coral reef of Recent age on the seaward side, and by thick coarse river terrace deposits near the foothills.¹

North of Port Sudan the coastal plain is extremely dry, with probably 50 mm. (2 in.) of rain or less per annum. Port Sudan and Tokar in the south have averages of barely 100 and 75 mm. (4 and 3 in.) respectively, and the mean variability at the former is more than 50%. While, therefore, some vegetation does spring up after rain to support a few camels and goats belonging to the Beja, no reliance can be placed on this source of fodder. During the winter, cool north winds give agreeable weather, with frequent cloudy days and occasional rain, but in the summer conditions are exceptionally unpleasant, for mean daily temperatures as high as those experienced in Khartoum are associated with relative humidities of 40–50% at midday. From July to September, when rain-bearing winds are elsewhere bringing some relief from the heat, there is little or no rain, but the prevailing instability of the air reveals itself in the form of frequent dust-storms, which often last for three days or more. In the cotton-fields of the Tokar delta, a hot east wind, known as the *Hababai*, which blows in October before the onset of the north wind, may kill off the young cotton plants when the surface is already too dry to replant.²

There are many different ways of life to be observed along the coastal plain. In the south, around Tokar, the delta of the Baraka river provides an opportunity for cotton growing very similar to that in the Gash delta. Near to Port Sudan there are deposits of gypsum and limestone that are quarried for building materials, and by the sea a successful salt factory is producing salt by the evaporation

of sea-water. Along the coast there are native boats engaged in fishing and various trades, while the biggest and richest centre of population is Port Sudan, a town of 47,500 inhabitants, through which passes almost the whole of Sudan's import and export trade, valued at £S45 millions and £S66 millions respectively in 1956.

The Tokar Delta

The Tokar delta (as the delta of the Baraka is usually called) (Fig. 89) differs from that of the Gash in that its slope is much steeper, with a drop of $1\frac{1}{2}$ m. per kilometre at the southern end, and its waters are often much more heavily charged with silt, figures of 100 parts silt per 1,000 being common. For these reasons both scouring and deposition are frequent, and from time to time the flood changes its course from one side of the delta to the other.³ If the Gezira irrigation be likened to the dutiful Sudan donkey, happy to do what he is told, and the Gash to the camel, controllable but never truly domesticated, the flood of the Baraka resembles most closely the wild gazelle, which man may by his cunning drive into his snares but can never hope to subdue.

Cotton growing at Tokar began with Ahmed Mumtaz Pasha in about 1867, came to an end during the Mahdiya, and was resumed when the British had re-established their rule in the coastal provinces in 1896. At first various cottons then popular in Egypt were grown, including Afifi and Asili, and trials were made with some American Upland varieties. In 1920 Sakel was introduced, and remained the principal variety until 1935, when it was replaced by strains of Sakel, such as X1530 and X1730, which had been selected for their immunity to leaf-curl. To protect Tokar town, to increase the area flooded sufficiently for cotton growing, and to prevent the waste of water at the tail of the delta which irrigates useless saline land or flows directly out to sea, the government has from time to time built earthworks and banks which divert water into a particular bed or keep it away from depressions. The construction of definite channels and regulators, however, has never been attempted for the physical reasons mentioned above, and because the

¹ C. Crossland, *Desert and Water Gardens of the Red Sea*, 1913, in *Agriculture in the Sudan*, 1948.

² E. Mackinnon, chapter on 'Kassala Province', ³ F. W. C. Roberts, *Report on Tokar*. . . Ministry of Finance, Cairo, 1923.

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Cairo, 1923.

strong dust-storms of the early summer would be likely to fill them up and so make maintenance very expensive. Even the radiating banks proposed in 1921 by Mr. F. W. Cramer Roberts of the Egyptian Irrigation Department, intended to make some sort of rotation between fallowing and cultivation possible, were never constructed on the grounds that the expense would be great and the result uncertain, and so at the present time the water goes more or less where it pleases. The actual area flooded depends on the volume of water that comes down in any one year, and on the largely haphazard distribution of the flushes in time and space; Fig. 89 indicates the area flooded in typical years.¹ There can be no careful calculation of the number of days flooding that a piece of ground receives; but Tokar has an advantage over the Gash delta in that the more humid weather and occasional rain of winter can be very beneficial to the growing cotton.

The cotton-growing season may be said to begin with the allocation of land by a local committee before the flood. The tenants consist of a mixture of Arabs from the several tribes which used to live in the plain and cultivate the delta before the government assumed control of its use, together with various Beni Amer, westerners, riverain Sudanese, and foreigners. The latter groups are required to pay a rent of 10 piastres per *feddan*, while the first-named have their holdings free of charge. When the flood season is over, in about October, there is a distribution of wetted but unallotted land, to satisfy those whose original allocations have not been watered, and then approved seed is issued to the tenants, together with an advance of varying amount, to help with the expenses of sowing, weeding, and harvesting. At one time there were no such advances, and the tenants were compelled to borrow at exorbitant rates from local merchants; but now the government has increased the percentage of the crop that it takes as tax from 20 to 25, and uses the difference to help keep the tenants out of debt.

The work of weeding and picking the cotton provides a useful source of income for pilgrims waiting to cross over to Jeddah or on their way

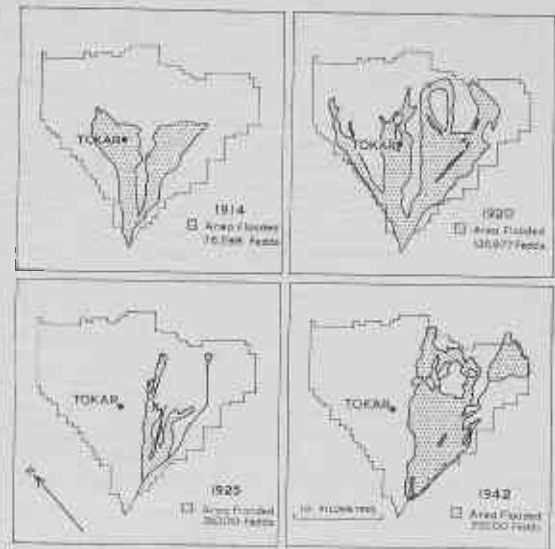


FIG. 89. The flooded area of the Baraka delta at Tokar in four years. There has been a tendency in recent years for the flooded area to shift towards the west. The variability of the flood is suggested by the fact that in 1955-56 the flooded area, where cotton could be grown, was nil. From *Agriculture in the Sudan*, 1948.

back, and others in the labour force include local tribesmen, Eritreans and Ethiopians, Somalis, Yemenis, and various inhabitants of the Red Sea littoral. When the area sown to cotton much exceeds the average figure the supply of labour will often prove inadequate, and this, together with the fact that many of the workers are seasonal visitors aiming to earn money for a particular purpose rather than persons wholly dependent on their earnings, means that an appreciable proportion of the cotton sown may go to waste, especially at the end of the season. This waste is estimated to average as much as one-third of the potential crop, but is hard to avoid since in the very severe climatic conditions of May and June the current labour costs will often exceed the value of a final picking.

This problem of labour supply prompts some reflections on the relationship between tenants and labourers in all the cotton-growing schemes in the country. In whatever part of the world cotton is grown, the provision of an adequate labour force at the picking season presents difficulties, since employment can only last for

¹ W. N. Allan, chapter on 'Irrigation in the Sudan', in *Agriculture in the Sudan*, 1948.

TABLE XI
Area, production and yield of cotton at Tokar

Years	'000 Feddans	'000 Kantars	Kantars per Feddan
1920-21/1924-25 (average)	35.0	48.0	1.27
1925-26/1929-30 "	34.8	39.4	1.13
1930-31/1934-35 "	42.3	56.8	1.34
1935-36/1939-40 "	29.2	66.1	2.19
1940-41/1944-45 "	30.4	83.0	2.56
1945-46/1949-50 "	38.4	74.0	1.81
1950-51/1954-55 "	41.4	56.9	1.17
1955-56	Nil	Nil	—
1956-57	100	93.4	0.93
1957-58	20.3	10.1	0.5
1958-59	44.5	44.6	1.00
1959-60 (Est.)	90.4	86.0	—

about three months at the most, and may well come at a time when other crops need harvesting. In Sudan much of the problem is solved by the presence of the westerners, few of whom have family responsibilities. They are content, or at least do not refuse, to live in very rough quarters, and experience little hardship in leaving the Gezira when the cotton-picking season comes to an end and in moving to the Gash delta or to Tokar to find further work. The Ministry of Labour helps to guide the movement of workers, and can usually supply enough men; it can use no compulsion, however, and when conditions are exceptionally disagreeable labourers may not prove to be available at economic prices.

Such conditions merely cause a local and relatively unimportant shortage of labour. A more serious way in which the supply of labour might be reduced would be if any legal limitations were imposed on the freedom of westerners to enter, settle and work in Sudan. As a predominantly Muslim state Sudan would do nothing to check the right of West Africans to make the pilgrimage to Mecca, but there is no doubt that the westerners are unpopular for various reasons, being generally poor, ignorant, superstitious, and at times quarrelsome and inclined to drunkenness. It might happen in the future, therefore, that for one reason or another the westerners would find Sudan a less agreeable place to spend a few years in, or even to settle more or less permanently.

In the Gezira the tenants might in such circumstances find that they had to pick the cotton themselves, on pain of being deprived

of their holdings for bad husbandry, and in due course the average size of a tenancy would probably decline to that which the tenant could be sure of managing without outside help. In the Gash and Tokar deltas, however, there was never any idea that the local Hadendowa tribesmen were to become peasant farmers. They were associated with the cotton-growing scheme for political reasons and as compensation for the loss of their grazing, but if they had to weed and pick the cotton unaided they would probably rather have nothing to do with it. In that case both government revenues and the country's receipts of foreign exchange would suffer.

All the cotton from the Tokar delta is sold at official auctions at Tokar, and thus the authorities can readily extract the government's share. Areas and yield for some recent years are shown in Table XI. The cotton is then conveyed by lorry to the ginnery, formerly at Suakin but now at Port Sudan. There was once a light railway to take it from Tokar to the small harbour at Trinkitat, but this proved uneconomic and was removed in 1952. Tokar itself is a mean little town of single-storey buildings and wide streets, constantly encroached by moving sand- and silt-dunes whose removal constitutes a recurrent expense. The town's water supply comes from wells, which with use become increasingly brackish until they have to be replaced. Elsewhere in the delta and along the coast generally, water can almost always be found by sinking wells to sea-level, but such wells are always slightly saline and are often undrinkable. The Baraka flood appears to have

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little effect upon wells in the delta, for the water clearly never sinks in very far. The most reliable and sweetest water is that found in the Baraka bed, but wells here would probably soon run dry if vigorously exploited.

The Red Sea Coast

The coast of Sudan consists of a level plain terminating in low coralline cliffs from 2 to 5 m. high. It is flanked by a fringing coral reef which is up to 300 m. wide. To the east of the reef runs a channel 3 or 4 km. wide, with depths of 100 metres or more. Beyond that again lies an off-shore reef, interrupted in places and stretching as much as 15 km. (10 miles) from the shore, which runs beyond the northern frontier of Sudan as far north as the promontory of Ras Benas, at latitude 24° N.

Along the coast there are a few brackish mangrove swamps, and a number of beaches, such as Mersa Darur (latitude $19^{\circ} 51' N.$) or Mersa Sheikh Ibrahim (latitude $18^{\circ} 53' N.$), where small native boats can be drawn up out of the water. There is also a number of creeks, such as those occupied by Suakin, Port Sudan, or the desolate Khor Shinab (latitude $21^{\circ} 21' N.$), that stretch inland for several kilometres and can give shelter for ships to lie at anchor.

These conditions have favoured the activities of the small number of coastal Beja, together with more numerous Yemenis and other inhabitants of the Arabian peninsula, who own small native boats and ply along the coast. They earn their living by a variety of means: some catch fish, which they sell fresh in Port Sudan or dry and salt to sell to Arabs and Beja; others collect trochus shells and bêche-de-mer which are exported, their chief base for this trade being Flamingo Bay, a few miles to the north of Port Sudan. During the pilgrim season, i.e. in the Muslim month of Zi el Haja, when pilgrims are anxious to find a cheap way to cross the Red Sea and make their way to Mecca without paying the Saudi Arabian government's pilgrim dues, many of the boatmen used to turn to carrying passengers. The trade was very profitable, for the pilgrims were crammed together, and little or no provision was made for their welfare. Unfortunately the traffic was quite uncontrolled and

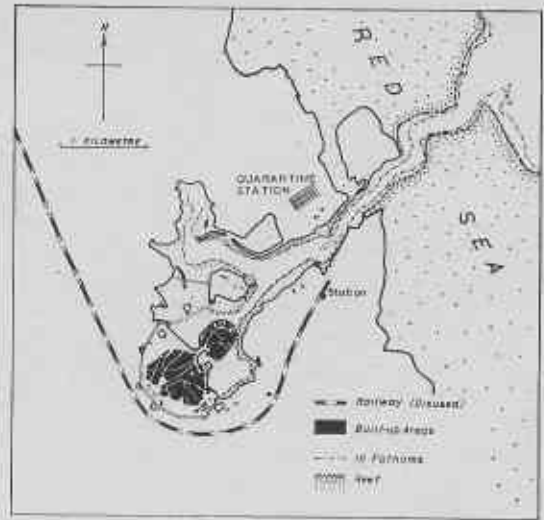


FIG. 90. Suakin. This map indicates the defensive value of the site of Suakin, with access to the sea and only 2 kilometres of walls to be manned. Both the Railway and the Quarantine Station are sited near the deeper water at the entrance of the harbour. From *Sudan Surveys* "Towns 928"—1917-18.

lent itself to numerous abuses. All official pilgrims are now transported by air or by steamer, and closer supervision is making it no longer possible for the dhow owners to maltreat and trick their passengers as they used to in the past.¹

Suakin

Of the many harbours along the Red Sea coast that are used by these small craft, much the oldest and most important in Sudan is Suakin, whose existence as a port and trading centre is recorded as early as the 10th century A.D. The island on which the town is built, connected to the mainland by a narrow artificial causeway, is reminiscent on a smaller scale of the island of Mombasa, and both have benefited from the good defensive sites that they offer (Plate XXXVI; Fig. 90). Unfortunately the approach to Suakin from the sea through the reefs is too hazardous for ocean-going vessels, and the harbour itself is rather small. Consequently, it was decided soon after the reconquest of Sudan to develop Port Sudan, 40 miles to the north, as the principal outlet for the country's produce, and Suakin has stagnated.² Today the fine two- and three-

¹ In 1957, more than 27,000 pilgrims passed through Port Sudan, almost 6,000 of them travelling by air across the Red Sea.
² J. F. E. Bloss, "The Story of Suakin with Plates, S.N. & R., 119 (1936).



FIG. 91. Port Sudan. This map, at the same scale as Figure 90, clearly shows the greater width and depth of the harbour at Port Sudan, where defence from land or sea has never been of major importance. From *Sudan Surveys 'Towns 2680'*—1953.

storey houses of the latter, built in the style common along the Red Sea coast in Jeddah, Massawa, and Mocha, are deserted and falling into decay, and the town only comes to life in the month when pilgrims are passing on their way to Mecca. The number of pilgrims depends on a variety of factors, such as the general level of prosperity in Sudan and the Muslim countries farther west, the dues currently imposed by the Saudi Arabian government, and the cost of transport.

Port Sudan

The growth of Port Sudan (Fig. 91) has been rapid. At the beginning of the century the creeks around which the town has grown up were known only to local fishermen, who would shelter there and find water, (a major problem along this coast), in a number of shallow wells in Khor Mog, to the west of the present town. Today the population numbers nearly 50,000, and the main quays, 695 m.

long, can normally accommodate five ships working general cargo.¹ The town's main function is to provide an outlet for Sudan's produce and a gateway through which the manufactured articles needed in increasing quantities can be imported.

Most of the inhabitants of Port Sudan make their living from work connected with the harbour and the sea: these include merchants, many of whom are Indians, engaged in importing and exporting, and others who act as the agents of Khartoum firms; there are numerous government officials employed in the port and railway organizations; and there is a dock labour force of Beja, who are now gradually abandoning a semi-migratory existence and taking up permanent residence in the town. Two petroleum companies have installations for discharging tankers, storing their products, and dispatching them in bulk or tins throughout the country. The salt-evaporating works has a production of 50,000 tons per annum, more than enough to meet the needs of Sudan, so that there is now a small export.

The provisioning of so large a community on a semi-desert shore naturally presents something of a problem. Fruit and vegetables come mainly from Kassala, *dhura* from the central clays, and beef by train from the Baqqara country, while mutton is supplied by the local Beja. Drinking water was at first obtained from local wells, but these soon proved inadequate, and the growth of Port Sudan to its present size has been possible only because a much larger and reliable source has been found in the Red Sea hills not far away.² This is brought from the Khor Arbaat, which drains a mountainous area of nearly 5,000 sq. km. and flows through a succession of gorges down to the coastal plain. The valleys between the hills are flooded to a considerable depth with an unsorted accumulation of sands and gravels, which constitute an admirable reservoir where water can be stored and avoid evaporation, and so by the construction of an underground dam in one of the gorges it has proved possible to hold up a large volume of water. This water is then siphoned out of the reservoir and flows in two 10 in. pipes by gravity to Port Sudan.

¹ Sudan Railways Port Authority, *Port Sudan Harbour*, Atbara, 1954.

² H. E. Hebbert, 'The Port Sudan Water Supply', *S.N. & R.*, 18 (1935).

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No purification is needed, and high-level water reservoirs fed by booster pumps enable the continuous flow to be stored and used during the day when demand is greatest. In 1930 the flow was 1,500 tons a day, when Port Sudan's population was less than 20,000, while by 1957, the summer flow had been raised to nearly 7,000 tons per diem. Water is available to supply ships, Port Sudan being the only port in the Red Sea apart from Suez where it can regularly be obtained, and there is enough for essential services in the town.

Port Sudan differs noticeably from other Sudanese towns in that the public buildings, shops, and other private houses are better built, and often rise to two and even three storeys. This is because the local coralline limestone of which the coastal plain is made up can easily be quarried and cut to provide a durable building stone, while local supplies of gypsum make excellent mortar. There is, however, a number of one-storeyed buildings dating from the earliest days of settlement in Port Sudan, and these are mainly built of wood, raised on stilts to prevent dry-rot and termite attack, their slatted roofs and wooden frames and floors of imported timber giving a foreign air to the older streets where they stand. Unconventional building materials are also to be found in certain of the poorer quarters of the town, where old wooden sleepers and beaten sheets of tin-plate from four-gallon petrol-cans are used to make the homes of the poorer labourers. The hot and humid climate which persists throughout a long and tiring summer makes it desirable for living-rooms to be open to the sea breezes, and in the homes of non-Muslims verandas and roofs are much used for this purpose. The heavy dew that forms by night makes it undesirable to sleep under the stars, and so small covered structures are commonly seen on the roofs of houses.

The future growth of Port Sudan is clearly dependent on the level of foreign trade of Sudan as a whole. The search for oil along the shores of the Red Sea has hitherto been successful in the Suez-Sinai area only, though some prospecting near Tokar persists. When the poverty of the Red Sea hills and the coastal plan are considered, perhaps the most astonishing thing is that they have been able to provide

a suitable site, water supply, and labour force for a town of Port Sudan's size at all.

Conclusion

When eastern Sudan is looked at as a whole, it appears that a major contrast may be drawn between the south-west and the north-east. The former, comprising the Butana, the Gash delta, and the land between the Atbara and the Red Sea hills, is better watered by rain and rivers, has better communications, and has in the Gezira and in various towns good markets for grain, fruit, and vegetables and animal products. It is not difficult to imagine a gradual shift from nomadism to settlement, from illiteracy to education, and in fact a general participation in the growing prosperity of the whole country.

In the north-east, on the other hand, the rural areas are much closer to a primitive, self-sufficient economy. The nomadism of the Beja prevents any but a very small proportion of the children from going to school, and so the spread of literacy is likely to be slow. There is no reason to believe that a larger off-take of camels could in the future bring much added wealth, nor that irrigation or other devices could be used to permit extensive cultivation. The aridity and harsh climate of the coastal plain make Port Sudan an unattractive site for further industrial growth, while poor communications and its outlandish situation suggest that Tokar will never rival Kassala.

If this analysis should appear unduly pessimistic, it is worth looking at a map of Africa as a whole. It can then be seen that between the latitudes of 15° and 22° N. the remainder of the continent is almost total desert, and were it not for the Red Sea hills and Ethiopian plateau, with their effect on the rainfall, eastern Sudan would be equally desolate. In Sudan, as elsewhere in Africa, the problem of the future is not whether the poorer areas can one day catch up with the prosperity of the richer, but whether the distribution of the population and the ways of life of the inhabitants will continue to be controlled by traditional rather than economic considerations. As long as they are, the picturesque poverty of the inhabitants of the Red Sea hills will persist.

THE SOUTHERN CLAY PLAINS

THREE main types of country go to make up the provinces of Upper Nile, Bahr el Ghazal, and Equatoria, known collectively as southern Sudan: these are the broad alluvial plain of the Upper Nile basin, which receives the drainage of higher lands to the east, south, and west, the Ironstone Plateau which lies along the Nile-Congo watershed and is dissected by streams flowing to the north and east, and the mountain masses which lie towards the southern border and rise several thousands of feet above the surrounding countryside.

PHYSICAL CONDITIONS

This chapter describes the first of these three types, the clay plain which lies mainly to the north and east of the others in the form of a large flat triangle with its apices at Lake Rudolf in south-eastern Equatoria, Renk on the White Nile, and Aweil in northern Bahr el Ghazal (Fig. 92). An analysis of the physical features of this plain will show that while there are significant variations of soil texture from place to place, and while the climate at Malakal is appreciably different from that at Mongalla, differences of relief throughout the whole region are exceptionally small, the country being extremely flat and the gradient of the Nile a bare one part in thirteen thousand. Nevertheless, it is with these minor differences of relief that we shall first be concerned, for the considerable rainfall that occurs in the region in summer, combined with the Nile's habit of overflowing its banks at the same season, causes various degrees of flooding. It is this which determines the type of natural vegetation, the utility of the land for grazing or cultivation, and indeed the whole nature of the region as a field for human occupation. According to these differences in water régime the region may be divided into several elements (Fig. 93).

1. The Nile and other permanent water surfaces such as Lake No or Lake Ambadi.

2. Permanent swamps along the Nile of *Papyrus* and kindred vegetation, which remain flooded all the year.

3. The flood-plain (Nuer *toich*) which is inundated from the rivers for a period of four to six months every year.

4. 'Intermediate land', areas where flooding from the rivers is not likely, but which become flooded for several months every year because of the impeded drainage of the rain which falls upon them. The intermediate land is crossed by numerous watercourses which remain flooded for much longer periods and more closely resemble the flood-plains.

5. Distinctly higher areas, either within or beyond the flood-plain, described in the report of the Jonglei Investigation Team as 'high land'. These normally escape flooding from the river and have sufficiently permeable soils to drain quite quickly after rain.

6. The Boma Plateau in the south-east near the Ethiopian border, which is included in this region merely because it is surrounded by the clays on every side.

The terms 'high land', 'intermediate land', and 'flood-plain' do not correspond precisely with actual differences of altitude between the several categories. This is because the distance from the rivers attained by overflowing waters is dependent not merely on altitude but also on the effect of vegetation, since the growth of dense grass during the rains impedes the slow movement of water, and may have the result that some areas which hardly ever flood and are known as 'high land' are in fact lower than others known as 'intermediate land'. Moreover, since the clay plain has been built up by the deposition of alluvial material, the rivers tend to flow in slight levees, so that even the flood-plains may be higher than 'high land' at the same latitude.

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FIG. 93. The Jonglei area—Land classification.
From *The Equatorial Nile Project*, 1954, Map E 1.

extremely difficult at all times of the year, since the land around it is either water-logged in the summer or waterless in the winter.

2. Climate

A general account of the climate of southern Sudan has been given in Chapter III, and neither the Jonglei Investigation Team nor the Southern Development Investigation Team, working as they did for comparatively short periods, had time to amplify existing knowledge to any great extent. It has been shown that an equatorial double maximum of rainfall, with its implication of a short dry spell coming in June and July, may in certain years be experienced as far north as Malakal. The consequent risk of droughts prevents full use being made of the whole length of the rainy season, since crops sown early quite often die from lack of moisture. This Sudan continental type of climate, moreover, has particular disadvantages in an area of ill-drained soil, since periods of

intense heat and insolation, alternating in the rainy season with spells of severe rainfall, produce in the soil a rapid transition between a hard, dry condition, difficult to work and giving little moisture to plant roots, and a saturated state when plants suffer from water-logging and the use of agricultural machinery is impossible. The cool spell when the north wind blows in the winter is much less marked than farther north, and at the latitude of Juba is scarcely felt at all. Nevertheless, the low humidities and increased evaporation rate make this a period of some hardship to the Nilotes, who habitually wear no clothes, for both men and animals are in danger of being carried off by pneumonia.

3. Vegetation

The distribution of vegetation in the clay plain (Fig. 94) has been closely studied, and the Jonglei survey has made it possible to distinguish vegetation types in greater detail than do maps produced for the whole country. Apart from the Boma plateau and the *Cyperus papyrus* swamps beside the Nile, annual and perennial grasses dominate the whole region, whilst tree growth is prevented by the effects of excessive water and poor drainage in the summer, combined with fierce grass fires in the winter, throughout much of the region. On the high land not far from the Nile, however, *dōm* and *doleib* palms and mixed *Acacia* species with *Balanites aegyptiaca* occur in the sandier sites, while where the soil is heavier *Acacia* species, especially *sieberiana*, and *Balanites* are usual. In many instances, however, these have been cut down to make way for cultivation, or to provide fuel for the Nile steamers in the days when they burnt wood.

The grass species vary according to soil and water conditions. The findings of the Jonglei team on this topic will be related in some detail because of the marked differences between the various species in their habits of growth and nutritive value. On the high land which quickly drains after rain, most of the grasses are annuals, with *Setaria pallidifusca* and *Pennisetum ramosum* dominant on the clay soils and *Dactyloctenium aegyptium*, *Cynodon dactylon* and *Eragrostis* spp. the most common on the sands. These provide excellent grazing during

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the early rains, and the fact that they later become woody and unpalatable is of little consequence since they are quickly grazed down by cattle hemmed in on the high land when the rest of the country is flooded.

Of the intermediate land investigated by the Jonglei team, the more northerly part, generally that lying on the north side of the Sobat-White Nile axis, consists principally of the perennial *Setaria incompressata* and other grasses, with a few areas of *Acacia-Balanites* woodland. These grasses have the disadvantage of being flooded for much of the time when they might give useful fodder, and so after a couple of months in the early rains they cease to be of much value except as bulk fodder eaten in conjunction with the green growth of the flood-plain region, but even for this purpose they often lie too far from the sources of dry-season water to be exploited. Farther south *Hyparrhenia rufa*, also a perennial, is dominant. This suffers from most of the same disadvantages as *Setaria*, but has the important property that if the dry growth of *Hyparrhenia* is burnt off in the early part of the dry season, while the ground still retains some moisture, the plant produces a valuable flush of new green growth that can be used by cattle as long as water remains available.

Along the flood-plains of the principal rivers and in the beds of the streams that meander across the plains, riverain grasslands occur that may be classified according to the length and depth of the flooding that they undergo. In the shallower areas the dominant grasses are *Echinochloa pyramidalis*, *Oryza barthii*, and *O. punctata*. These are inaccessible during their period of growth, flowering and seeding because of the Nile flood, and only *Echinochloa* affords a valuable regrowth when burnt in the dry season. An occasional member of the association is *Phragmites communis*, which also occurs in the deep-flooded areas and has the disadvantage of being unpalatable at all periods of its growth. In the deep-flooded areas *Echinochloa stagnina* and *Vossia cuspidata* are the dominant grasses, which are occasionally found together. The former is palatable to cattle even when fully mature after setting seed, and is eaten unburnt when the water recedes from it; the latter is rather less palatable

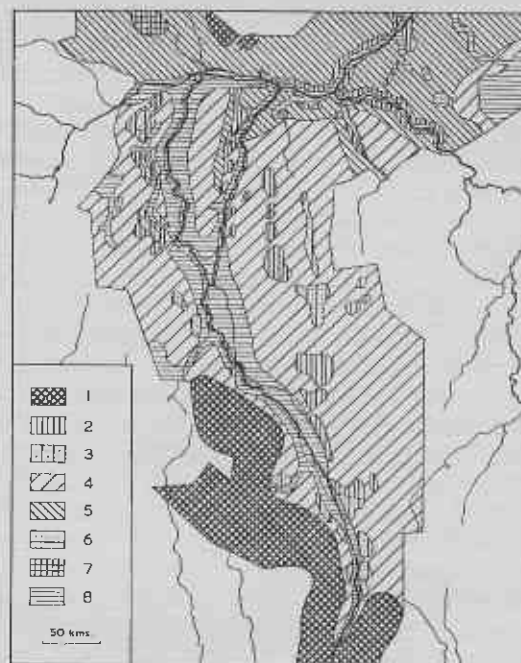


FIG. 94. The Jonglei area—Vegetation. This and Fig. 93 have been compiled largely with the aid of air photographs.

1. Mixed deciduous broad-leaved woodland with tall perennial grass.
 2. *Acacia-Balanites* woodland, with *Setaria incompressata* grassland.
 3. Open palm or mixed *Acacia* woodland savannah.
 4. Open *Hyparrhenia rufa* grassland, with limited woodland.
 5. Open *Setaria incompressata* grassland, with some woodland.
 6. Permanent *Papyrus* swamps.
 7. *Acacia-Balanites* forest with areas of open tall grass.
 8. Riverain and inland *khör*-bed grassland.
- From *The Equatorial Nile Project*, Map 7.

when dry, particularly in the swamps region, though in the Kosti region what is apparently the same plant is finer and more readily eaten. Throughout the whole area ambatch (*Hermimiera elaphroxylon*) occurs occasionally in clumps. It is used for making light canoes.

SETTLEMENT AND WAYS OF LIFE

The distribution of the population in the southern clays region is by no means uniform, and may be divided into a number of principal

concentrations occupying favourable sites. The location of such sites is closely dependent on hydrological conditions; instead, however, of a simple tendency for permanent settlements to be found where drinking water is available for animals and men during the dry season, there is an even more marked movement away from areas of flooding in the summer, with a concentration on the few pieces of land that remain dry during the rains. Thus, there is a close correlation between the map indicating 'high land' and that showing the distribution of population during the wet season (Fig. 31).

Starting from the north and east, these concentrations may be listed as follows: first, the Shilluk and Dinka ridges which are found on either side of the White Nile below Lake No (Plate XXXVII); second, the eastern Nuer areas beside the Sobat near Nasir; third, the 'island' of high land near Waat; fourth, the ridge running north from Bor almost as far as Fangak; fifth, the ridge within Zeraf Island which lies close to the Zeraf channel; sixth, the high land of western Nuer District which lies between Bentiu and Adok; seventh, the ridge on the north side of the Bahr el Ghazal between Ghabat el Arab (Wang Kai) and Riangnom; and eighth and last, the intermittent belt of high land stretching from the Aweil District of Bahr el Ghazal south-eastwards as far as Yirol through the swamps at the foot of the Ironstone Plateau. On the southern fringe of the clay plain there are comparable ridges of high land flanking the streams which flow down from the Imatong, Dongatona, and Didinga hill-masses, while in the south-east the Boma plateau is of course high land according to the criteria employed, though in fact other conditions are quite different.

MEANS OF LIVELIHOOD

Throughout the region the sources of livelihood of the population are cattle-rearing, agriculture, and fishing. These vary in their relative importance according to the areas of grazing and cultivable land available, but since among the Luo peoples (chiefly the Nuer, Dinka, Shilluk, and Anuak) the types of crop grown, the types of cattle kept, and the prevailing attitudes towards them are fairly con-

sistent, it will be convenient to study the way of life of all these peoples as a unity.

I. Cattle Rearing

The cattle kept in the Nile swamps and southern clays are quite distinct from those owned by the Baqqara Arabs. They have long, rather slender legs, small to medium-sized humps and rather long horns, which may among the Bor and Aliab Dinka herds attain the extraordinary length of 150 centimetres (5 ft.), and the animals are quite large, mature beasts attaining weights of over 400 kilogrammes (1,072 lb.). At present little commercial use is made of the Nilotic cattle, and their meat and milk-producing potentialities are inefficiently exploited by their owners, who delay the slaughter of beasts beyond their optimum age and weight. It may be worth recording, however, that the animals give a better quality of beef than do the Baqqara cattle, provided they are slaughtered in good condition, but that even with extra care and special feeding the cows produce very little milk.

Compared with other types of cattle in Sudan, the herds of the Nilotes show marked ability to tolerate biting flies, ticks, and other insects; nevertheless, they certainly show signs of irritation when attacked while grazing by the *Stomoxys*, which is prevalent throughout the year, by mosquitoes, or by the tabanid *swiret* fly, whose bites are exceptionally painful and draw blood copiously. During the rainy season the Nilotes burn dung fires in their cattle byres to keep insects away, and pick off the ticks which get on to the beasts' bodies from the tall grass. The low milk yields are in part related to these trying conditions, and in part to the fact that the Nilotes do not take steps to cull poor cows.¹

In fact, the animal husbandry practised by the Nilotes is simple and unscientific. The better-looking bulls from good milking cows are kept for stud, and others are castrated, but breeding is permitted from all cows. Some natural control of herd numbers arises from the fact that the weaker calves often fail to survive the hardships of inadequate grazing in the late summer, followed by cold winds and pneu-

¹ D. J. Lewis, 'The *Tabanidae* of the Anglo-Egyptian Sudan', *Bulletin of Entomological Research*, 44 (1953).

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PLATE XXXV. WATERING CATTLE IN THE BUTANA



PLATE XXXVI. OLD HOUSES AT SUAKIN



PLATE XXXVII. HOUSES AND DŌM PALMS ON THE SHILLUK RIDGE



PLATE XXXVIII. DINKA FISHING PARTY

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monia in December and January. For the rest the inhabitants have been happy to maintain their herds at the greatest size possible. This they do not only because a large herd is loved for its own sake, for its value in bridal transactions, and for the products it yields, but also because until recently herds in the region have been liable to decimation by such diseases as rinderpest, trypanosomiasis, and bovine pleuropneumonia. Today the veterinary services have greatly reduced the losses due to these causes, and there is a strong case for ascertaining the safe carrying capacity of the tribal grazing-grounds and for limiting herds if that should prove necessary. Where land is communal property, however, and cattle are owned privately, no individual will willingly reduce his own herd, nor is it easy to see how an equitable and acceptable system of limitation could be devised.

The Nilotes attach a quite exceptional importance to their cattle, as may be illustrated by quoting from the remarks of a social anthropologist who worked among the Nuer, and there seems good reason to believe that what he says of the Nuer is to some extent true of the Shilluk and Dinka also. 'At heart', writes Evans Pritchard, 'they are herdsmen, and the only labour in which they delight is care of cattle. . . . Cattle are their dearest possessions, and they gladly risk their lives to defend their herds or to pillage those of their neighbours. Most of their social activities concern cattle, and *cherchez la vache* is the best advice that can be given to those who desire to understand Nuer behaviour.'¹ This intense interest in their herds is of more than academic anthropological interest because of the Jonglei proposals which have been under discussion for a number of years for modifying the régime of the Nile as it flows through the Nile swamps. Any developments severely interfering with the Nilotic way of life and with the people's dependence on their cattle would clearly have very serious effects upon the morale, and indeed even upon the continued existence of the Nilotes as a distinct element of the population of Sudan. The problems involved are among those that

have been studied by the Jonglei Investigation Team, whose recommendations are discussed below, and whose report has provided the greater part of the material for the writing of this chapter.²

The problem of ensuring that their cattle have at all times sufficient grazing and water is for the Nilotes a surprisingly difficult one, when it is recalled that the region they inhabit consists of natural grassland intersected by numerous watercourses. The difficulty lies in the fact that most of the grasses which grow on the clays are palatable during the wet season only, at which time large areas are liable to flooding, while during the winter half of the year virtually no natural growth takes place in the greater part of the region. Moreover, apart from the Nile and Sobat, there is only a handful of perennial streams in the region, while the impermeable nature of the clay makes the digging of wells of little use.

The solution lies in the custom of migrating annually between the banks of the rivers and the areas of high ground. On the latter lie the permanent villages, surrounded by the land that is required for cultivation during the rains and for wet-season grazing. These are occupied from May to October or later, and when the rest of the countryside is flooded (Plate XIX), they constitute regions of refuge for both animals and men. The grazing available upon them is, however, limited, and when the flooding has been exceptionally high the animals suffer severely from undernourishment. As the floods recede the animals move on to the intermediate land, where they find that certain of the grasses provide some not particularly palatable grazing, while where *Hyparrhenia rufa* occurs it can be burnt off to produce a valuable green re-growth. This kind of grazing is of value only as long as water can be provided from pools and *khors*, and then when these gradually dry up, both men and stock must move to the permanent rivers.

Along the rivers the flood-plains provide further grazing, which at the present levels of animal population is quite sufficient to last until the early rains, when with the new

¹ E. E. Evans-Pritchard, *The Nuer*, 1940, p. 16.

² Sudan Government, *The Equatorial Nile Project*, Report of Jonglei Investigation Team, Khartoum, 1954, and *Natural Resources and Development Potential in the Southern Provinces of the Sudan*, Report of the Southern Development Investigation Team, Khartoum, 1954.

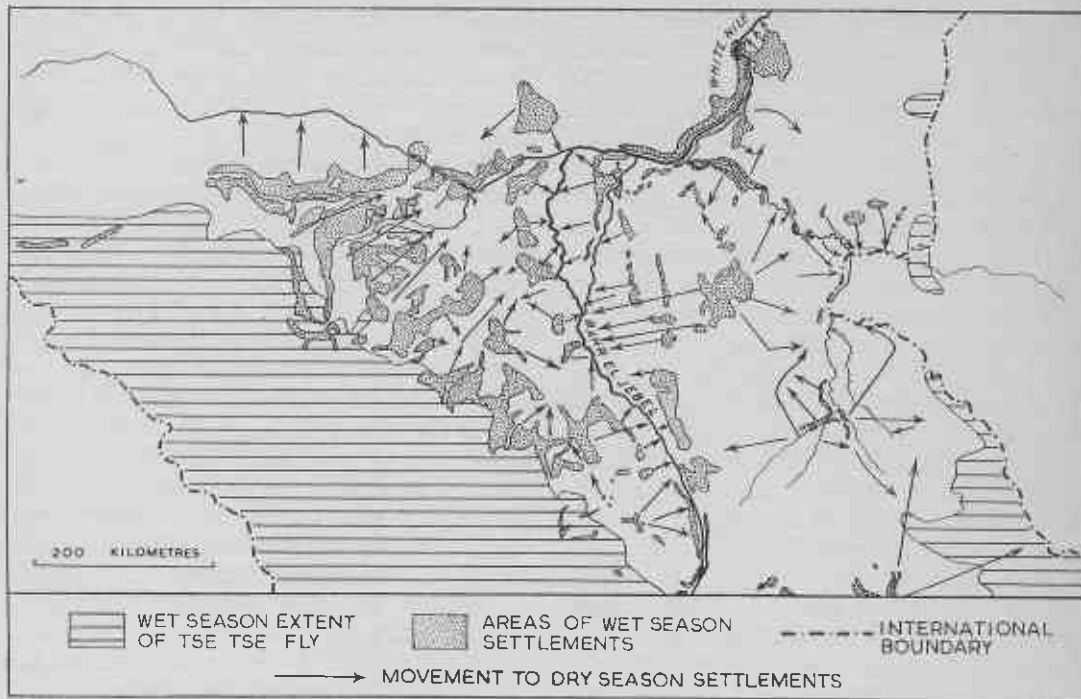


FIG. 95. Seasonal movements of animals and men in Upper Nile and Bahr el Ghazal Provinces. From *Natural Resources and Development Potential in the Southern Provinces of the Sudan, 1954, Fig. B.*

growth of grass conditions for animals are at their most favourable. The areas of wet and dry-season grazing are quite separate for the various sections of the main tribes, though between Dinka and Nuer in particular there is a tradition of raiding and continuous warfare. During the last hundred years there has been an appreciable displacement of the former, who are reputed to be the more cunning, by the latter, who are the more warlike, away from the Nile and its swamps towards the east, north, and south-west. The normal seasonal migrations (Fig. 95) are short, about 150 km. (100 miles) or less in the centre of the region, and much less among the Shilluk and northern Dinka along the White Nile. Movement is towards and away from water, rather than north and south with the sun, as generally occurs farther north in Sudan.

The value of their cattle to the Nilotes differs little from tribe to tribe, except that the Anuak care little for them and eat them readily. Milk is the principal product, the yield per cow in lactation being rarely more than three to four pints per day, and the cows being

milked twice per day. Since the calves are not forcibly weaned a lactation may last for two years. Milk is occasionally drunk fresh, but is more usually soured with bull's urine to make a curd which keeps well. Animals are not killed regularly for beef, but there are enough festivals in the year that require the slaughter of a bull to make meat a fairly significant item of diet. Bloodletting from bulls is not unknown among the Dinka and Nuer, but it is practised in years of famine only. From the animals slaughtered every year it is estimated that 80-90% of the hides are cured and sold, either for export or for use within Sudan. In 1956 the total weight of hides consigned from stations south of Kosti was 827 tons.

2. Agriculture

Agriculture is much less important in the southern clay plains than animal husbandry. The Nilotes have little interest in the hard physical labour involved in clearing and cultivating the soil, but this can hardly be held against them since the natural conditions of their land are ill-suited to crop production,

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with pests, diseases, droughts, and floods all taking their toll of growing crops in the field. In many areas, moreover, the scarcity of suitable agricultural land makes it impossible to hope to grow an appreciable surplus for sale, and it frequently happens that fields which should be fallowed are in fact cropped for want of better land.

The principal areas of cultivation are the ridges of high land which are free from flooding, but certain of the tribes also plant crops on the higher part of the intermediate land, thus providing a measure of insurance against exceptionally dry conditions. Downstream from Malakal and in the south-west there is also some cultivation of the flood-plain areas. As the flood recedes these are cultivated like *seluka* lands of northern Sudan, though their soils are markedly heavier. Land is prepared for normal cultivation by cutting and burning grasses and bushes or trees during the dry season. With the onset of the rains weeds spring up and are hoed by hand, this being the only physical disturbance of the soil, since ploughing with animals is quite unknown. The Shilluk have a practice of cutting wild grasses, laying them on the sandy-clay cultivations near their homesteads and burning them, thus reproducing the effects of *hariq* cultivation. Areas of true *hariq* also occur on either side of the White Nile below Malakal, where flooding is much less than farther south.

Millet is the staple crop of the area, there being numerous varieties with different growing periods and water requirements. These varieties are often planted together at a high seed rate, it being hoped that the variety best suited to the conditions of the year will make good growth even if others die. Early sowing, especially in the south of the region, begins in April or May, with the harvest in September; a second sowing is then often made of a slow-maturing variety which ripens in December or January. In the central part of the region the supply of grain barely suffices for subsistence even in good years, and when conditions have been bad imports from central Sudan are necessary, paid for by the sale of cattle. The high humidities prevailing throughout the year prevent the storage of grain surpluses for more than one season. Grain surpluses are

normally produced in the western Dinka areas of the Bahr el Ghazal province and probably could be around Yirol if the farming there were more efficient, the proportion of well-drained land being greater along the border between the clay plain and the Ironstone Plateau regions than it is elsewhere.

Despite the extreme attachment to their cattle shown by the Nilotes, investigation has shown that the greater part of their diet comes from their agriculture and the grain crops they grow. Grain stocks fall at the end of the dry season and during the rains there is a hungry period until the new crops are harvested (Fig. 96).

Other food crops include maize, eaten early before the main *dhura* crop ripens at a season of distinct food shortage, ground-nuts and sesame, which do best on the sandiest soils; various beans, pumpkins, and marrows, and some tobacco, are grown near the houses in the summer, and the last of these is also occasionally treated as a winter crop on the flood-plain land, in which case it needs some hand watering. American cotton was grown before the recent war as a cash-crop, but the natives had little interest in it and treated it carelessly. However, the administration felt that this was the best way to enable the area to make some small contribution to the costs of government, and the local District Commissioners and Inspectors of Agriculture expended a great deal of effort persuading the people to grow it. At the time the relative profitability of *dhura* and cotton made this a policy of doubtful wisdom, and the people never really took to the latter. Since the war these efforts have been dropped, and the region is beginning to be reached by the spread of irrigated commercial cotton-growing along the White Nile from Kosti.

Various pests attack crops in the region. The desert locust is unknown, but the more voracious migratory locust, (*Locusta migratoria migratorioides*) is occasionally reported. Damage to crops is caused by various birds, but fortunately the gravest bird pest of central Sudan, the Sudan dioc (*Quelea quelea aethiopica*) does not penetrate much south of Renk. Concentrated cultivation and settlement is rarely touched by game animals, but where

isolated patches are left unguarded occasional damage is done by bushbuck and waterbuck. Elephants, (especially the great Bor herd) and buffaloes do more serious destruction, but their range is restricted, and where they menace important interests guards of the Game Wārdens' organization are employed to drive them back into uninhabited areas. The most widespread animal pest, especially in the south-west, is the baboon, which will filch millet heads and other agricultural produce. Particularly severe losses are caused to the *dhura* crop by the parasitic witchweed, *Striga* spp., whose growth is encouraged by the necessity of cultivating the same ground year after year, and can reduce yields to almost nothing.¹

Certain local differences of agricultural practice have already been mentioned. These depend in part on differences of climate, in that the rainy season in the extreme north is shorter than in the south, and the cool weather of winter is more marked, but they are chiefly related to differences in soil and water conditions. In the Melut-Dinka area beside the White Nile there is extensive land not liable to flooding, stretching across into the southern Fung. *Hariq* grasses grow naturally, and the availability of dry-season water supply is the principal control of agricultural expansion. Several successful *hafirs* have been excavated by the Soil Conservation Department, which have made possible a great expansion of the cropped area. In the densely inhabited Aweil District of the Bahr el Ghazal the flood-plain of the River Lol is very limited in extent. There is a number of permanent streams in the area, and consequently the supply of drinking water at harvest-time presents few difficulties, and the Dinka are able to cultivate extensive areas. In the dry season cattle are moved north to the Bahr el Arab or else south into the fringes of the Ironstone Plateau.² Around Yirol and farther south where the Bari-Mandari tribes occupy the fringe of the clay zone, agriculture can be much more diverse, for appropriate crops are grown in different parts of the soil catena, and there are wild products, such as honey and *lulu* (the shea butter nut, produce of

Butyrospermum niloticum), which can be collected from the forest.

The Boma plateau, which lies towards the eastern edge of the clay plain, is an area of exceptional fertility. The plateau has an area of about 250 sq. km. (100 sq. miles), lying at an altitude of some 1,000 m. The mean annual rainfall is thought to be about 1,300 mm. (52 in.), with only three months of drought in the year. From the basalt rock a red-brown loam soil has been produced by normal weathering, supporting on the steeper slopes and beside the streams a dense tree growth that elsewhere has been cleared for cultivation. The Kachepu and Murle tribesmen, who are thought to have physical affinities with the Azande, are good farmers, and grow a wide range of annual and perennial crops. The former include *dhura*, maize, ground-nuts, beans, sweet potatoes, and *colocasia* (taro), and also many vegetables, including onions, tomatoes, spinach, carrots, lettuce, and *bamia*, whilst among fruits oranges, mangoes, cashews, bananas, and grape-fruit all do well. Coffee and sugar-cane flourish, and in general the size and quality of crops are markedly better than those of the wetter parts of the ironstone plateau, where the soils are derived from the Basement Complex. Neither cattle nor sheep and goats are kept, but domestic fowls are large and of good quality.³

3. Fishing

Conditions throughout the region are very favourable to fishing. The high temperatures that persist throughout the year encourage the rapid growth of fish, while the numerous shallow khors, lagoons, and lakes make it easy to catch the fish with primitive methods. As a result, fishing is not a specialized craft but is widely practised by men, women, and children (Plate XXXVIII).

The most common means of fishing are by spear or harpoon; these are thrust at random into shallow waters or *papyrus* swamps at regular intervals, and in favourable conditions, as when a section of a *khor* has been cut off from the Nile and is drying up, many hits are

¹ K. Wilson Jones, 'The Witchweeds of Africa', *World Crops*, 5 (1953).

² J. M. Stubbs and C. G. T. Morison, 'The Western Dinkas, their land and agriculture,' *S.N. & R.*, 21 (1938).

³ Report of the Southern Development Investigation Team, 1954.

made. Traps are also widely used, these being set at the mouths of watercourses or where they narrow, to catch fish trying to make their way to the Nile. A kind of basket trap is also used in the hand for haphazard scooping. Nets are a fairly recent innovation; gill nets are set up at the mouths of the small streams, and casting nets, which should probably be discouraged because they catch too many young fry before they have had time to develop, are being introduced by the Shilluk. In deep waters fishing is usually by hook and line, but this is less important than the seasonal fishing when the Nile falls and the *khors* dry out. Many kinds of fish are caught, and most are eaten, the best being the Nile perch (*Lates niloticus*), which may weigh 300 lb. or more, and there are other useful kinds such as *Citharinus latus*, *Tilapia* spp., certain of the *Bagridae* and the *Clariidae* and *Protopterus aethiopicus*, the mud or king-fish, which in times of famine can be taken from *khor* beds where it spends the dry season.

The only regular markets for fresh fish are at Malakal, the provincial headquarters, Juba in the clay plain and at Wau on the fringes of the Ironstone Plateau. These are supplied by local tribesmen and by some northern fishermen, who for the last few years have been operating along the White Nile between Kosti and Lake No. There is also some production of sun-dried salted fish, which is sold in Sudan or else exported to the Belgian Congo, where there has been a rapid growth of demand. Not many of the Nilotes take part in this commercial fishing, yet of the various forms of economic development open to the inhabitants of the region, fishing undoubtedly offers the best prospects, for by the proper control of water-levels, the regular drainage of hitherto isolated lakes, and the improvement of transport and marketing arrangements, it is clear that immensely greater quantities of fish could be produced for sale. The most difficult problem would undoubtedly be to persuade the inhabitants that any form of regular employment was to be preferred to their existing way of life.

Seasonal Movements and Types of Settlement

The practice of seasonal migration between the high land and the flood-plains has already

been referred to in connection with the rearing of cattle. The permanent villages of the Nilotes are built on the high ground, and consist of collections of homesteads, each comprising a number of huts and a large cattle byre. Both huts and byres are round in plan, with wooden poles used to support the walls, the walls being made of daub and wattle, and the roofs thatched with grass. The huts provide shelter from both sun and rain, but except among the Shilluk, have no compound walls around them. Privacy is little esteemed by the Nilotes, who pass their lives out of doors as much as they can. By night the cattle are brought into the byres, the door is tightly shut, and dung fires are lit to produce copious smoke to keep off insects. Young boys sleep in the byres with the cattle on raised platforms, and replenish the fires as they burn down.

The settlements by the rivers on the flood-plain are known as cattle-camps. Young men in charge of the cattle move to the flood-plains as soon as the water recedes, and build simple grass screens to give them some shelter from the north wind at night. They are later joined by the rest of their families when the harvest has been reaped and water is no longer available near the permanent villages. The distance between village and cattle-camp varies according to the topography. Between parts of the Bor ridge and the Nile a migration of 50 miles is necessary, whereas the Shilluk ridge north of Malakal lies so close to the river that much of the population is able to spend the whole year in the permanent villages and daily contact is possible between the two groups (Fig. 95).

The extent of the high land in any one year is dependent on both the volume of the Bahr el Jebel flood and the severity of the local rainfall. When one or both are appreciably above the mean, there is a serious danger of flooding extending to the cultivations and villages. When in 1918 the flood was exceptionally high there were serious losses of cattle throughout the region, since even when animals are not actually drowned they may be reduced to starvation from lack of grazing, and widespread hardship was experienced. In proposals for controlling the Nile waters, therefore, it is clear that the prevention of

flooding in the Upper Nile basin must be an important consideration as long as the present way of life persists. Nor should it be readily assumed that it will be a simple task to convert the inhabitants of the region to any other type of existence; the Nuer in particular are reputed to be so attached to their existing life and territory, with all its hardships of climate, insects, diseases, poverty, and insecurity that they are unwilling to believe that life anywhere else in the world might be preferable.

Hitherto, there has been little to shift them from this opinion. The only town in the region is Malakal, with a population of 9,700, which is the provincial headquarters and occupies a restricted site free from flooding on the east bank of the Main Nile. The town's situation is well chosen for directing those government services which make use of the rivers for assured communications, and there is a dry-season road which links Malakal with Renk and so with the Gezira and central Sudan. There are a few well-built public offices and officials' houses in the town, and some Levantine merchants offer a tolerable range of imported goods. Urban life, however, makes little appeal to the Nilotes, especially since those local inhabitants who have taken employment in Malakal have to abandon the pleasant easy-going life, with their cattle ever near at hand, to which their culture is closely adjusted.

The diseases to which the Nilotes are liable are many: malaria of the malignant tertian type is hyper-endemic, causing a high infant mortality but doing little harm to adults provided they survive the attacks of childhood; yaws is endemic, guinea-worm infections are fairly common in the south and hook worm is fairly frequent among the Shilluk. Tropical ulcers are very common, for the generally low standard of nutrition makes minor scratches and abrasions of the legs, which are almost unavoidable, develop into persistent and debilitating sores. Eye infections, particularly granular blepharitis, are very prevalent, probably being aggravated by the intense irritation caused by the smoke of dung fires to which the people submit themselves at night in the rains to escape the attacks of insects.

¹M. F. Gage, 'Sudd Cutting: Experiences of the Expedition from Uganda, 1899-1900', *S.N. & R.*, 31 (1950).

Communications and Trade

The inhabitants of the Upper Nile basin have been little affected by world trade or modern advances in technology, each family and tribe being nearly self-sufficient, meeting its own needs for food and shelter without outside assistance. Their economic isolation is to a large extent the result of the difficulties of communication in the region, for the only route usable all the year is the Bahr el Jebel and White Nile, and even this was liable, until the beginning of the present century, to become blocked by masses of floating vegetation (*sudd*), which totally obstructed navigation¹ (Plate V). The build-up of such obstructions is now prevented by regular supervision, but navigation along the meandering course of the river is still very slow, the journey from Kosti to Juba, 1,100 km. (700 miles) as the crow flies but 1,500 (more than 900 miles) by river, being scheduled to take twelve days.

Lorry transport in the region is of increasing importance, and graded clay roads now connect the principal administrative centres, following as far as possible the ridges of high land where the permanent villages stand. Lorries can, however, be used only during the dry season, when the population is down on the flood-plains. However, in the absence of substantial surpluses of local produce there is little motive for lorry owners to make many journeys, except between Malakal and Kosti, where the Paloich Dinka have appreciable quantities of surplus *hariq*-grown *dhura* to sell, and the inhabitants never move far from the road. During the rains movement has to be on foot, and administrative officials' reports tell of many treks carried out involving prolonged marches through water rising to waist level or even higher. The Nilotes do not follow the Baqqara practice of using their cattle as beasts of burden.

Despite such difficulties, their instinct for trade has brought numbers of northern Sudanese merchants to settle in the region, at the administrative centres, Nile steamer landing-stages, and elsewhere. They buy local produce of grain, hides, and cattle to ship away to the north, and sell in exchange cloth, salt, metal implements, and spear-heads, and in

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years of shortage, grain. In fact, it often happens that the local people sell some of their grain at harvest-time, use too much of what they have retained in making beer, and find before the next harvest comes due that they must buy their grain back at much enhanced prices to keep themselves alive. They are then reduced to selling cattle, but the prices they receive are not such as to encourage the development of the trade. The keepers of the small bush stores are in most instances members of southern tribes, acting as the agents of wealthier merchants in the district and provincial headquarters. While there is little natural sympathy or community of interest between the Arab merchants and the local Nilotes, this trade has been one of the means of spreading the Arabic language in the south, and the practice among some of the northern merchants of taking a local wife must also have helped to forge bonds of mutual interest.¹

The two aeroplane landing-grounds that serve the region, at Malakal and Juba, are now of primarily local significance only, although when the range of commercial aircraft was much less than it is today they were occasionally used by planes on international flights, especially since flying-boats could land on the Nile nearby. The scheduled air services of Sudan Airways are well patronized, since they have greatly reduced the time taken to get to and from the region. Nevertheless, both air and steamer services are to be regarded as subsidized aspects of governmental activity, since the steamers run at a loss, and the air services, even when apparently profitable, are mainly engaged in carrying official passengers and so in transferring public funds from one purse to another. If it were not for the presence of the rather more profitable area of Sudan lying to the south, moreover, it is doubtful whether the needs of the clay country could justify a regular transport service at all.²

When the waters rise in the Sobat-Baro and Bahr el Ghazal river systems, steamer services used to be run to Gambela and Wau. The former, though lying at the foot of the Ethio-

pian plateau 120 km. (75 miles) beyond the Sudan border, was from 1902 to 1957 occupied by the Sudan Government as a customs and police-post. The Gambela steamer service runs when the water-level is high enough and when a cargo, usually *Coffea arabica*, awaits transport. When Wau cannot be reached, the steamer service runs as far as Meshra'er Rek, which is linked by road and telegraph to the province capital. The two ports deal with approximately equal quantities of goods, southbound traffic totalling about 6,500 tons and northbound 1,700 tons. This trade is essentially destined for Wau and the Ironstone Plateau, since traffic to stations along the route makes up less than 10% of the whole.

The Impact of Government on the Nilotes

Until recently the independent spirit of the Nilotes has shown itself not merely in their reluctance to take part in trade, their disinclination to wear clothes, and their preference for their traditional way of life, but also in a marked indifference to the government's representatives, who until they could establish their personalities would find that they had extremely little influence in their districts. The people would continue to acknowledge in their hearts no authority save that of their own leaders, whether the hereditary Reth of the Shilluk, the Spear-chiefs of the Dinka Clans, or the group of elders in the Nuer community.

Today, with the coming of independence, one set of strangers has been replaced by another in positions of authority, and elections and the national census have made the Nilotes conscious of their numbers and of the political power put into their hands. The few educated Nilotes are beginning to show a desire for progress, education, and economic development. They are strongly supported by the Sudan Government, which is reluctant to allow a large part of the country to be a permanent drain on the resources of the rest, and is resolved to remove any influences that would make the Nilotes think themselves foreign to the northern Sudanese.

¹ For a further comment on this theme see K. J. Krotki, 'Demographic Survey of Sudan', in *The Population of Sudan*, Report of the 6th Annual Conference of the Philosophical Society of Sudan, Khartoum, 1958.

² In 1953 the General Manager of Sudan Railways estimated the total annual loss on the southern steamer services at £350,000, including interest, depreciation, etc. For the air services the regular administrative practice of sending as 'fill-up' passengers officials and others not otherwise entitled to fly makes interpretation of the accounts difficult, since such passengers are paid for in full.

Yet stronger far than any policy leading towards integration that the government could pursue are the prospects inherent in the proposed Jonglei Cut. If in the interest of the populations living farther downstream it is resolved to carry out a project involving the elimination of the present extensive water losses in the Upper Nile basin (see Chapter VIII), the current way of life and economy of the Nilotes will be completely undermined.¹ Such considerations have led to various studies and investigations in the region in the past decade, and to the publication of two important reports. The former, published in 1954 by the Sudan Government, was entitled 'A Preliminary Report by the Southern Development Investigation Team of the Natural Resources and Development Potential in the Southern Provinces of the Sudan' and dealt, as its title shows, with all the three southern provinces. The latter is known as the 'Report of the Jonglei Investigation Team on The Equatorial Nile Project and its effects in the Anglo-Egyptian Sudan', and it came out the same year.

The Southern Development Investigation Team

The circumstances leading to the setting up of the 'Southern Development Investigation Team' and the general conclusions that it arrived at are discussed below in Chapter XVI. This has seemed appropriate because the greater part of its recommendations is related to the wetter parts of the Ironstone Plateau rather than to the Southern Clays.

In the region now under discussion most of the theoretical potentialities of development are recognized to be very difficult to realize. Agriculturally, the best prospect is sugar-cane growing, which experiment has shown to be possible near Mongalla.² In terms of soil and water conditions, rice could clearly be grown over wide areas, but there are major problems of human attitudes to be overcome before progress can be made in this line. Similarly, of the limitations on improved animal production none is more significant than the reluctance of the Nilotes to part with their beasts or to be content to maintain small herds of the optimum

size in relation to the available grazing resources. The development of fish-ponds and commercial fisheries is now recognized to hold out very great prospects in tropical areas, providing that markets can be found. In the Upper Nile basin conditions are ideal for fish production, and in the Ironstone Plateau there is a definite shortage of animal protein, so it may be that further investigation and investment would be warranted. Various possible uses of *papyrus* were considered, and further investigation into the conversion of *papyrus* into power alcohol was recommended.

The Jonglei Investigation Team

The work of the Jonglei team was more prolonged and more intensive than that of the Southern Development Investigation Team, since it was concerned not with generalities but with inquiring into the precise effects to be expected from the construction of the Jonglei Canal. The economy of the Nilotes is, as we have seen, minutely related to the existing régime of the Bahr el Jebel and the other rivers of the region. A particular feature is that though the natural grasses of the region are mostly valueless as fodder when dry, the inhabitants are able to keep large herds of cattle because they can find fresh grazing for them in the dry season in areas liable to prolonged flooding. The essence of the Jonglei Canal proposals is that they are intended to eliminate this flooding and consequent loss of Nile water. If no remedial steps were taken, therefore, the effect of the Jonglei Canal would be to destroy the livelihood of many of the Nilotes and completely alter their way of life, which is intimately related to the keeping of cattle.

The remedies for the loss of natural grazing that the Jonglei report discusses consist more of tentative proposals for likely lines of research than of the findings of successful investigations. They may conveniently be divided into two main classes; namely, attempts to make better use of existing vegetative growth, and efforts to stimulate new or improved growth by various means.

¹ H. E. Hurst, R. P. Black and Y. M. Simaika, *The Future Conservation of the Nile*, being Vol. VII of *The Nile Basin*, Cairo, 1946.

² H. S. Ferguson, *Sugar Cane Trials of the Flood-plains of the Bahr el Jebel in the Anglo-Egyptian Sudan*, Ministry of Agriculture, Bulletin No. 6 (1951).

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¹ H. E. Hurst, R. P. Black and Y. M. Simaika, *The Future Conservation of the Nile*, being Vol. VII of *The Nile Basin*, Cairo, 1946.

² H. S. Ferguson, *Sugar Cane Trials of the Flood-plains of the Bahr el Jebel in the Anglo-Egyptian Sudan*, Ministry of Agriculture, Bulletin No. 6 (1957).

For the former purpose the remedy normally adopted in Sudan is the provision of additional rural water supplies in areas where valuable grazing has hitherto not been fully used because animals could not get to it in the dry season. Such a policy is scarcely applicable in the area covered by the Jonglei Scheme, because only in the extreme north-east are there natural grasses which remain palatable during the dry season. Elsewhere, the grasses are almost valueless in the dry weather, and so it matters little whether they can be reached or not. There do seem to be prospects, on the other hand, that some of the grass which at present passes quickly through its green and palatable stage could be cut before it becomes woody, and be preserved, either as silage or as hay. However, the technical problems of designing suitable silos and systems of hay-drying remain to be solved and may prove excessively expensive. Indeed, research in this field is always up against the fact that the Nilotes are not at present involved in a money economy, and any money spent on improving or remedying their living conditions would have to be written off as compensation for disturbance, rather than being considered as an investment that might one day produce worth-while dividends.

Alternatively, attempts might be made to improve the natural grazing. One method would be to eliminate useless species and replace them with others which are more nutritive, or remain palatable for a greater part of the year; another might be by further interfering with the normal water régime, either draining land which normally becomes flooded by the rains, so as to permit longer grazing, or bringing extra water to parts of the land to encourage additional growth. Among suggestions in the former category are the elimination of dense bush from areas of *Acacia mellifera* and *A. seyal* in the plains of the north-east, and the sowing of selected seeds by hand or aeroplane, especially after burning off the existing grasses. Both these ideas require further investigation.

The proposal for draining land seems unlikely to bear fruit, because the clay lands rarely have a suitable slope, or lie near enough to a watercourse, to make it possible to get the water away. Irrigation, on the other hand, seems the best prospect of all. The use of

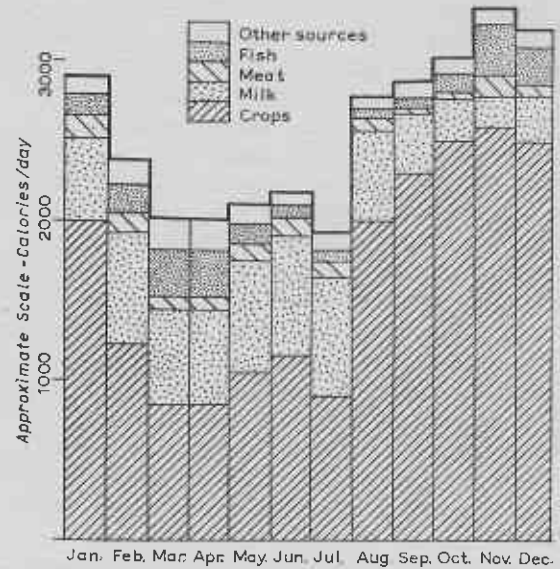


FIG. 96. Nutrition levels in the Flood Region. From an enquiry carried out by the Jonglei Investigation Team, included in *The Equatorial Nile Project*, Map E 12.

pumps to raise water would be the obvious course, but what was said above about grass preservation and the need to avoid unproductive expenditure applies equally in this context; in fact, the final solution will probably be found in adopting a system of controlled flooding, whereby small banks would be raised across the plains, and particularly across the narrow watercourses, to hold up the slow movement of water. In this way a system of irrigation essentially similar to the *terūs* of central Sudan would be employed. While much of the grazing would not be affected, there would be a number of sites in and beside the drainage channels which would remain flooded much longer than they do at present. They would not merely give green grazing later in the dry season, but might be changed from their existing types of grass, like *Panicum porphyrrizos*, *Hybarrhenia rufa*, or *Andropogon gayanus*, which are of limited value only, to others normally met with in areas of longer flooding, such as *Echinochloa* and *Oryza* spp., which can produce good regrowth after burning.

Such remedies are designed to enable the Nilotes to continue to enjoy their existing way of life with as little disturbance as possible. Yet

if dams, canals and similar works are to be built in the Southern Clays Region, it is certain that some at least of the Nilotes will be induced to abandon their present way of life and settle down to paid employment. Thus, as a money economy penetrates the region there will be a need for surpluses of grain and other food-stuffs available for sale, and gradually agriculture will assume a greater importance. With the Nile kept artificially low, natural drainage will be improved, and the area of high land will increase, permitting more crops to be grown. Yet even better long-term prospects clearly lie in the cultivation of rice, a plant which prefers a heavy soil, plentiful water, and a high humidity. The Ministry of Agriculture is engaged in experiments at Malakal and Aweil, which clearly show that rice grows well in the prevailing conditions, and already the Nilotes are learning ways to prepare and eat it.

Conclusion

If the ultimate prospects of development of a territory could usefully be assessed in terms of

the physical conditions alone, it might appear that the clays of southern Sudan were likely one day to become a rice granary comparable with the great deltas of South-east Asia. As things are, however, the way of life of the Nilotes stands as an obstacle not merely to the extension of agriculture in the region but even to the adoption of a commercial attitude to the rearing and sale of cattle. Fortunately for the local inhabitants, there are such extensive areas elsewhere in Sudan where the cultivated area could be enlarged that there is no immediate question of land hunger driving the inhabitants of other parts of the country into the southern clays.

The potential disruption of their way of life by the construction of the Jonglei Canal has been so minutely studied that it seems certain that ways can be found of protecting the Nilotes from its full impact. Nevertheless, if the canal is constructed one day, it is difficult to believe that the existing way of life of the 'Gentle Savage' will persist unchanged for many generations more.¹

¹ R. Wyndham, *The Gentle Savage*, 1936.

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THE IRONSTONE PLATEAU AND SOUTHERN HILL MASSES

LYING to the south and west of the southern clay plains is the region of the Ironstone Plateau: this lies almost entirely on the west bank of the Nile, in the province of Bahr el Ghazal and Equatoria. On the east bank there is a much smaller area of ironstone soils, and the high Imatong, Dongatona, and Didinga mountains (Fig. 97).

The Distinctive Character of Sudan's Southern Borderlands

This region is quite distinct from the rest of Sudan, because the length and difficulty of communications are a serious hindrance to intercourse with other parts of the country. The distinction goes deeper, however, for all the criteria of climate, soils, vegetation, population, agriculture, or animal husbandry, whereby regions have been distinguished in other parts of the country, mark off the south-west and extreme south from the rest of Sudan, and make them resemble similar areas in Uganda and the Congo Basin. This is particularly true of Equatoria, and while it may prove one day in the future that the province can yield products complementary to those of the more arid north, this is not yet the case.

PHYSICAL CONDITIONS

1. *Climate*

Partly from its greater altitude, and partly, it would appear, because it lies nearer to the source of the rain-bearing south-westerly winds, the Ironstone Plateau enjoys a distinctly wetter climate than the southern clays. The mean annual rainfall ranges from 1,000 m. (40 in.) in northern Bahr el Ghazal to nearly 1,500 mm. (60 in.) along the Nile-Congo watershed, while totals in the high mountains are presumably higher still. The rainy season is longer than elsewhere, particularly in the

south, for Loka and Sources Yubo have only three months in the year with less than 50 mm. (2 in.) of rain, while the reliability of the precipitation is also greatest in the extreme south. As would be expected, this high and comparatively evenly distributed rainfall is associated with a low mean range of temperature from day to night, and with little variation according to the season. Mean annual temperatures are lower than those at most other stations in the country, but because the humidities are usually high the climate is generally disagreeably hot. Chilly conditions and even mist may occur during wet spells in the rains, but the cool north wind does not make its effect felt so far to the south. In fact, the short, dry winter season constitutes the hottest part of the year.

In the wettest part of the region the rainfall régime is not normally fatal to perennials, such as citrus fruits that cannot withstand a dry season without irrigation, but the precipitation totals are not high enough for the optimum growth of trees adapted to the conditions of Equatorial Rain Forest, such as rubber or cocoa. Oil-palms, which thrive in derived savannah in West Africa, find conditions rather arid. Added difficulties of economic exploitation arise from the fact that the onset of the rains in the early part of the year is often delayed by a month or more, so that trees occasionally die and crop rotations are disrupted if irrigation water cannot be provided.

2. *Relief and Drainage*

The region here described as the Ironstone Plateau and Southern Mountains is divided into two parts by the Nile, an exotic river deriving a small proportion only of its water from the drainage of land within Sudan. The river's course from Nimule to Juba corresponds quite closely with the natural division between the south-east, where the high mountain masses rise steeply from limited red-loam pedi-

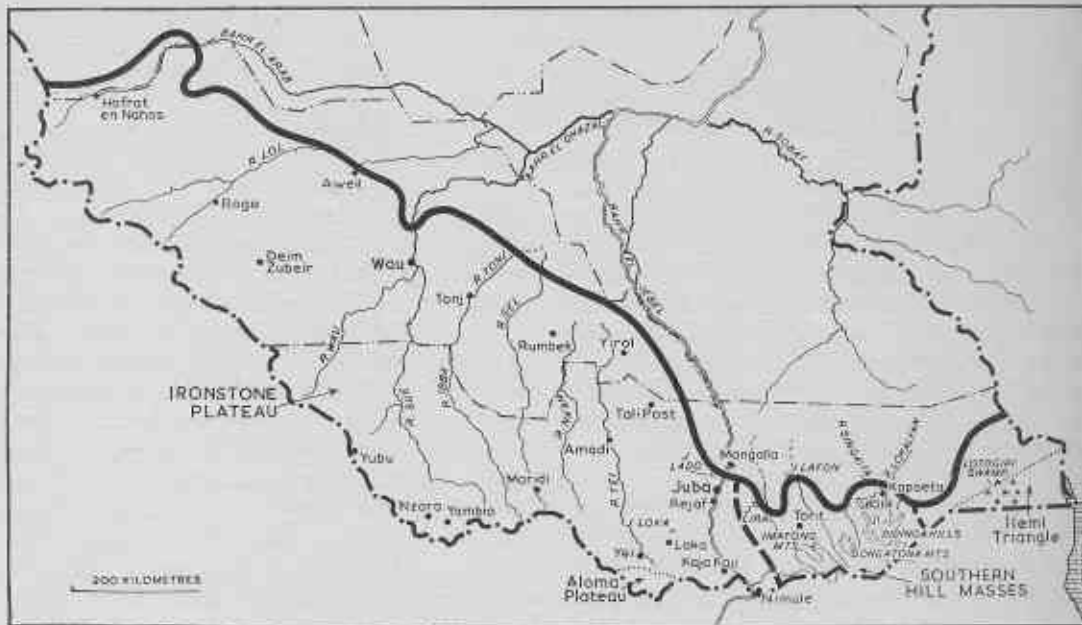


FIG. 97. The Ironstone Plateau and Southern Hill Masses.

ments surrounded by clay plains, and the west where laterized red loams are very widely spread and the relief is much less marked. The drainage of the eastern mountains is either by torrents which flow to the Nile, such as the Ateppi, or else by streams like the Kinyeti which flow to the north and lose themselves in the grassy clay plains (Fig. 99).

West of the Nile almost all drainage is into the Upper Nile basin, but only a very few streams in the extreme south actually make any contribution to the Nile flow, for of the water that flows into the Bahr el Ghazal swamps all but a negligible quantity is lost by transpiration and evaporation. The Ironstone Plateau may conveniently be divided into three main sub-regions: starting from the east these comprise the southern hills area, the Nile-Congo watershed and central plateau, and the hill country of the north-west. The southern hills area includes a number of relatively small *inselbergs*, among which are Jebels Loka and Lado, and the fault scarp overlooking the Nile at Nimule which is part of the African Rift Valley system. In the central area there are a few granitic outcrops at the surface, and even some low rounded hills which rise a bare 100 m.

¹ H. Greene, chapter on 'Soils of the Anglo-Egyptian Sudan', in *Agriculture in the Sudan*, 1948, p. 147.

above the neighbouring countryside, but for the most part the area consists of a gently undulating plateau, dissected by a number of consequent streams which flow down to the north and east. In the north-west there is a number of hills comparable with those of the southern hill area, but this virtually uninhabited part of Sudan is so far isolated from the rest of the country that little information is available about it.

3. Soils

The soils of the region have been discussed in Chapter IV. To the west of the Nile differences in the depth and texture of the soil may be explained in terms of the three lateritic catenas described by Greene,¹ while to the east the more arid conditions and the great differences in relief have produced soils of the Alkaline Catena.

Within these catenary associations the actual soil found depends on the site. In the *Toic* catena differences of altitude are less than elsewhere, generally not more than 10 m. from the eluvial to the illuvial complex, and inadequate drainage is a feature of the lower levels. The level plateau surface (the cluvial complex) consists of a red loamy soil of moderate fer-

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tility, having a very low humus content. It is liable after prolonged cultivation to suffer from sheet erosion and to be swept almost bare of soil. The next soil in succession is the colluvial complex, which is found on the slopes of the valleys, and consists of a deep well-drained loam. It is the most fertile element in this catena, and supports the most valuable tree growth. Below this belt comes a poorly drained strip, less fertile and rather bleached by water-logging, and finally the flood-plain is reached, an illuvial-alluvial complex of dark clay soil, somewhat iron-stained near the surface and often rather alkaline or calcareous beneath it.^{1,2}

In areas of higher rainfall the relatively hilly country near the Uganda and Congo borders east and west of the Nile has soils of the Red Loam Catena, while farther west the generally flatter Nile-Congo divide is assigned to the Ironstone Catena. The former soils are deeply weathered, leached, and acid in reaction; their natural vegetation is high forest, and their upper levels are darkened with humus. In lower situations the soil is yellow, heavier, and more plastic, and the humus level may be darker and deeper. These soils are favourable for cultivation, but their extent in Sudan is slight. The Ironstone Catena soils are not strikingly different, being red and non-plastic on the hills, and pale, mottled with iron stain and slightly plastic in the valleys. The swamps occurring beside some of the streams have a slaty clay soil with yellow and bluish stains.

In the high mountains of the south-east there are quite limited areas of high forest rising from deep brown soils developed in the relatively cool conditions prevailing. These might be of some value for agriculture were it not considered even more important to protect the forests to maintain the flow in the local streams. In general, it may be said that the soils of the Ironstone Region are of rather low fertility, comparing very unfavourably with those derived from the basalts of Ethiopia or of parts of the East African plateau. Regular cul-

tivation requires the adoption of extensive periods of bush fallowing, and if these are omitted there is the ever-present danger that the soil may be converted into a sterile ironstone scarcely capable of supporting any vegetation at all. Examples of this are to be found around certain of the early trading and slaving stations, such as Deim Zubeir.

In the drier parts of the mountainous area of the south-east we find the Alkaline Catena, in many ways similar to the soils of the Nuba Mountains although the dry season is generally shorter. In such conditions the higher parts of the mountains consist of bare rock, while their flanks are covered with thin, reddish, skeletal soils, quite unsuitable for cultivation. Around the hill masses the colluvial-illuvial complex is represented by a brown loam pediment of fair fertility, and this passes downwards 'into the more strongly alkaline, grey, plastic, siliceous and calcareous clay, free from stones, very sticky in the wet season, deeply cracked when dry, and of low salt-content'.³ Such soil is of good fertility, but in eastern Equatoria difficulties of water supply and communications at present inhibit its use.

4. Vegetation

The vegetation of the Ironstone Plateau Region is classified as High Rainfall Savannah Woodland, for an association of trees and grass is to be found almost everywhere in the region. There are exceptional areas of swamp grassland bare of trees to be found in strips along the flood-plains of the streams draining the region. Grass without trees also occurs where the soils along the junction of the Ironstone Plateau and the Bahr el Ghazal swamps have been cleared for cultivation.⁴

From the evidence of the distribution of certain tall forest tree species (e.g. *Khaya grandifoliola*), it seems likely that high forest formerly occupied a larger part of the region than it does today. Its present distribution is confined to three types of site, namely, the bowl or depression forests, the gallery forests, and

¹C. G. T. Morison, A. C. Hoyle, and J. F. Hope Simpson, 'Tropical Soil-Vegetation Catenas and Mosaics', in *Journal of Ecology*, 36 (1948).

²V. E. F. Eyre, D. M. Ramsay, and T. N. Jewitt, *Agriculture, Forests and Soils of the Jur Ironstone Country of the Bahr el Ghazal Province, Sudan*, Ministry of Agriculture, Bulletin No. 9, Khartoum, 1953.

³Greene, *op. cit.*, p. 153.

⁴J. K. Jackson and M. N. Harrison, 'Ecological Classification of the Vegetation of the Sudan', in *Report of a Grazing Survey of the Sudan*, by Harrison (duplicated 1955).

the cloud or high mountain forests. The depression forests 'are the nearest approach in the Sudan to the true climate rain-forest such as exists on the Amazon or the Congo'.¹ There are four such forests, of which Lotti forest (7,000 *feddans*) is the largest. Without strict protection these forests would undoubtedly soon be invaded by grasses and so by fire, and thus be reduced in size and eventually converted to broad-leaved woodland. The mountain high forest is found at about 1,800 m. (6,000 ft.) and upwards in the Imatong, Dongatona, and Didinga mountain masses. It includes a number of species of commercial value, and is felled selectively for *Podocarpus* and *Olea* spp. and a number of other valuable trees. In the Didinga mountains there is some competition for land between high forest and cultivation, but elsewhere the forest will extend its area if protection from fire can be provided. The gallery forests are found in western Equatoria, extending as fingers along the streams which drain the Nile-Congo watershed. They are particularly liable to attack from fire, and survive best when the banks are rather steeply incised, for then it is harder for flames to attack the young saplings. The African mahogany, *Khaya grandifoliola*, is an outstanding member of this association.

The broad-leaved woodland, as the High Rainfall Savannah Woodland was known in earlier vegetation maps of the country, varies considerably in height and density from north to south. In the north the woodland is fairly open, and the trees average little more than 7-10 m. high, with numbers of *Acacia* species to be found among them. In the Zande area, on the other hand, the trees are 12-16 m. high, their canopies often touch, and there is an appreciable undergrowth. In the wetter areas high forest might come to establish itself, were it not for the regularity with which fires sweep through the area in the dry season, burning up the dry grass and brushwood, killing young trees and scorching old ones, and so degrading the natural vegetation by its conversion to fire-resisting species. For a time the experiment was made of completely protecting Loka

forest from fire, in the hope that grasses might be eliminated and the risk of fire removed. In February 1946, however, the forest caught fire by accident after two years of protection, and the resulting damage was so great that it is now the practice to encourage early, relatively cool, burning soon after the end of the rains, to avoid the risk of a later hotter fire and doing even worse damage² (Plate VII).

A feature of all the soil sub-regions described in this chapter is that extensive homogeneous stands of trees, in which a single vegetation association persists unchanged for many miles, are extremely rare. In fact, the detailed pattern of vegetation occurring in any area is as complicated as that of the soils. As Smith has shown with the *Acacias*,³ very minor differences of soil texture and drainage affect the species which naturally establish themselves, and Morison records that: 'The vegetation which develops on these three main types of site (i.e. eluvial, colluvial, and illuvial) being closely correlated with the soils, likewise follows the form of a catena, and the detail of the vegetation within any one of the sites is, like the soil pattern, complicated by micro-relief'.⁴

SETTLEMENT AND WAYS OF LIFE

Distribution of Population

The great diversity of the population in the south-west of Sudan is largely to be explained in historical terms, in that while the Dinka and other Luo peoples seem to have occupied the same area for as long as their folk-history extends, many of the smaller tribes, and particularly the Azande, have traditions of having migrated into the region from the west. Geographical factors seem to have played their part in accentuating tribal and political fragmentation, for communications are difficult in the wooded country, where horses or cattle cannot be kept, and large political units cannot be readily held together. In fact, both the Dinka and the Azande, the two largest tribes of the area, with their territory stretching

¹ F. W. Andrews, chapter on 'The Vegetation of the Sudan', in *Agriculture in the Sudan*, p. 50.

² M. P. Vidal Hall, *The Sylviculture and Regeneration of Forest Types of the Equatoria and Bahr el Ghazal Provinces*, Forestry Memoir No. 4, Ministry of Agriculture, Khartoum, 1952.

³ J. Smith, *Distribution of Tree Species in the Sudan in Relation to Rainfall and Soil Texture*, Ministry of Agriculture, Bulletin No. 4, Khartoum, 1950.

⁴ Morison, etc., *loc. cit.*, p. 5.

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beyond the limits of the Ironstone Plateau in Sudan, consist of congeries of tribes speaking a common language rather than of single political entities, while some of the other tribes are very small indeed. All this poses political as well as economic problems, as will be discussed below.

The division of the population into three main groups appears very clearly from the map of its distribution (Fig. 31). To the north there are the Dinka, Jur, and other related tribes, occupying the lowest part of the plateau where clearing of the natural vegetation now keeps tsetse fly away. To the south there are the Azande, Moru, and Bari, who inhabit the wettest areas towards the Sudan frontier. To the south-east there are the Acholi, Latuka, Toposa, and Turkana, who live on the slopes of the high mountains, the pediments around them, and parts of the plains below them. Lastly, the extreme west (western Bahr el Ghazal), is almost empty of population.

The Dinka are cattle-owners, and their semi-nomadic migrations between the swamps and watercourses in winter and their cultivations at the edge of the plateau in summer are very much like those of the Nilotes of the Southern Clay Plains. However, their life generally differs because the area available for cultivation is very much larger, and because the collection of wild forest products—honey, beeswax, shea butter nuts—is open to them. The distribution of other tribes in this area has been much affected by administrative policy, since the need for sleeping sickness control has meant that the people have been encouraged to live beside the roads and in other accessible areas, while the extreme west and north are quite empty.¹ The growing attractions and prospects of commerce have probably also influenced this distribution. Settlement beside the rivers is discouraged by the prevalence of *onchocerciasis* (Jur River blindness) transmitted by *Simulium damnosum*.²

In the Yei and Maridi districts also this tendency for the population to settle along the roads is most marked. It has meant in some instances that the population has had to

abandon the most favourable soil areas and to inhabit others of much lower fertility. Now, therefore, that the danger of human *trypanosomiasis* appears to have receded, the regulations requiring the people to live by the roads have been relaxed.

Around Kajo Kaji a very high proportion of the natural woodland, harbouring tsetse fly (*Glossina morsitans*) has been destroyed, and within this enclave the Kuku are able to keep cattle with relatively little infection from *nagana*. Even so, herds of wild buffalo and other game in the surrounding woodland continue to be sources of infection, and drugs such as antrycide (dimidium bromide) are needed to keep the domestic animals healthy.

Farther west, in Zandeland, the influence of the government on the distribution of the population has been even more significant. The Zande were first persuaded to shift their homes in the anti-sleeping sickness campaigns which were carried out between 1910 and 1918, and were brought to live beside the roads where they could be reached by medical aid. This also served to bring them away from the vicinity of the streams, where *Glossina palpalis* was more abundant. Subsequently, as part of the 'Zande Scheme', to be described below, they have been persuaded to settle in an almost uniform density throughout their territory, each man's lands being laid out according to a grid pattern. This is intended to make it possible to introduce and maintain stable crop rotations, while at the same time making access easy to each plot by road or bicycle track, and facilitating the inspection and transport of crops.

In the south-east settlement follows several patterns. The Acholi to the south and east and the Latuka to the north of the Imatong massif cultivate the undulating red soils and occupy sites conveniently near to permanent water supplies, whilst the Latuka, who suffered severely from slave-raiding in the last century,³ have also some settlements perched on hill-tops for ease of defence. Around the isolated hill masses farther to the north, such as Jebels Liria or Lafon, settlements are generally on the

¹ Major G. K. Maurice, 'The History of Sleeping Sickness in the Sudan', *S.N. & R.*, 13 (1930).

² D. J. Lewis, 'The Simuliidae of the Anglo-Egyptian Sudan', in *Transactions of the Royal Entomological Society, London*, 99 (1948).

³ Sir Samuel Baker, *The Albert N'Yanza, Great Basin of the Nile, and Explorations of the Nile Sources*, 1866.

gently sloping pediments where water can be obtained from shallow wells. Throughout the three main mountain areas the distribution of the population is related to the presence of areas of gently sloping land, the villages backing against the steep mountain flanks which are a feature of the topography. There are a few high basins and plateaux inhabited within the mountains, the upper margin of settlement being about 1,800 m., at the lower limit of mountain forest. In the east the Toposa, occupying the lowest portion of the Alkaline Catena, live in exceptionally long villages strung out beside the watercourses. During the dry season many of them move to cattle camps (for they are essentially a pastoral people), which are widely scattered close to water sources.

REGIONAL TYPES OF AGRICULTURE

Throughout the Ironstone Plateau the presence of tsetse flies (Figs. 95 and 100) makes animal husbandry virtually impossible, and in consequence it is only in the south-east and along the north-eastern fringe of the plateau that pastoralism or mixed farming are at all practicable. For the most part the tribes, whatever their origin or traditions, must rely on cultivation, and to a much lesser extent on hunting or fishing, to feed themselves. Even for agriculture conditions are not exceptionally favourable, since clearing the soil of its natural vegetation is arduous work, yields are not very high, and land soon loses fertility and has to be allowed to revert to bush after it has been cropped. Moreover, agricultural implements are simple, and it is not possible to use animal labour to reduce the drudgery of clearing, weeding, or harvesting the crops.

1. *The Plateau Margin*

Along the north-east margin of the Ironstone Plateau conditions for agriculture do not differ very much from those of the low rainfall savannah farther to the north, and are strikingly uniform over a long distance occupied by a great variety of tribes. Generally, only one crop is grown in the year, and sowing takes place early in the rainy season. The main cereal crops are millets; cassava, sweet potatoes, and yams are grown in lesser quantities, while sesame is

¹ Eyre, Ramsay, and Jewitt, *op. cit.*

widely cultivated on the red loamy soils, and ground-nuts are grown on sandy areas. The Jur around Wau grow millets and oil-seeds, their villages and cultivations being situated along the middle phases of the *Toic* catena, where there is a deep rich red soil. Such conditions are quite widely distributed within the area because of the numerous streams which dissect the edge of the plateau. The system of shifting cultivation adopted is perhaps rather wasteful of land, individual plots being cultivated for about five years and rested for fifteen to twenty, but there is at present no land hunger. Many goats are kept, and the Jur possess a number of cattle, which they give to the Dinka to tend during the rains when tsetse flies abound. They use no animal manure, however, saying it either encourages weeds or else produces stalk and leaf at the expense of grain. Some manuring is achieved by burning off old grain stalks and refuse just before sowing. The Jur grow a number of vegetables, and also a little tobacco and hemp.¹

The wild products of this belt include fish from the swamps and watercourses, which are caught as the water subsides, and shea butter nuts and honey from the otherwise unused parts of the plateau. *Khaya senegalensis*, the Sudan mahogany, which grows to be a fine tree 50 ft. tall, has been cut for a number of years from the upper levels (cluvial complex) of the plateau, and is becoming scarce.

2. *The Zande Area*

Along the south-west border of Sudan the higher rainfall totals and longer wet season make for a more elaborate system of agriculture, with a larger number of crops grown, and two successive crops often taken from a piece of ground in the same year. Our knowledge of the type of agriculture adopted by the Azande, in particular, is richer than that for anywhere else in southern Sudan, mainly because of the interest engendered by the Zande scheme. By far the fullest contribution to the knowledge of Zande agriculture has been made by de Schlippe,² whose *Shifting Cultivation in Africa* is in fact an account of Zande agricultural practices, written as a result of a number of years' work in the area at the Experimental Agricul-

² P. de Schlippe, *Shifting Cultivation in Africa*, 1955.

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PLATE XXXIX. ZANDE HOUSES AND GRAIN STORES



PLATE XL. YOUNG COTTON PLANTS IN THE ZANDE AREA



PLATE XLI. 'DREAMING TRUE'
Punch's comment (December 10th, 1898) on Sir Herbert Kitchener's proposal to build a college in Khartoum as a memorial to General Gordon.



PLATE XLII. THE UNIVERSITY COLLEGE OF KHARTOUM—1953
 The original buildings of the Gordon Memorial College are in the background, beside the Blue Nile.
 The College became an independent university in July 1956.

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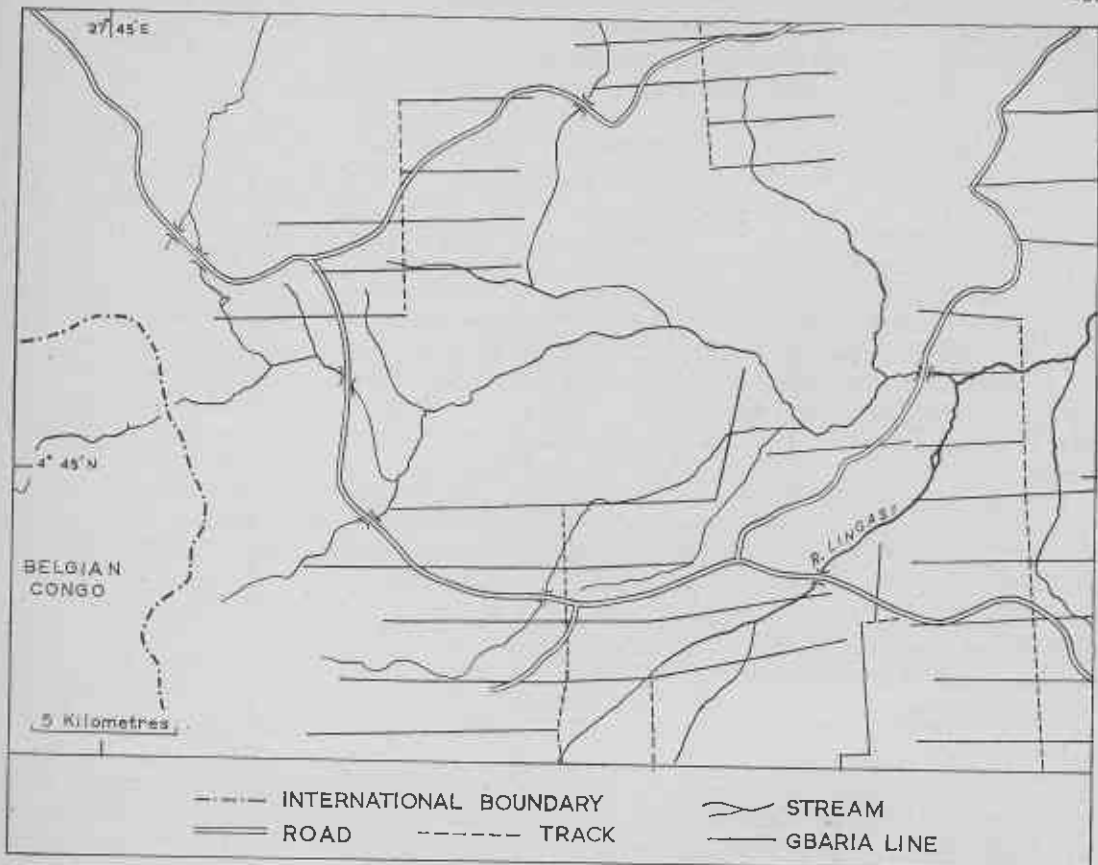


FIG. 98. *Gbaria* lines in the Zande area. The individual holdings (see Fig. 42). lie along the *gbaria* lines, stretching back about 1,000 m. to meet in the bush. From *Sudan Surveys* 1:250,000, Sheet 77-0, 1954.

tural Station at Yambio, supplemented by a day-to-day investigation of farming activities, using questionnaires and native informers. The essence of de Schlippe's findings is that prolonged residence in their region has made of the Azande excellent practical ecologists, and that in their choice of where to cultivate, of what crops to grow, and when to sow their seeds they are following a system minutely adapted to their environments. The agriculturist, therefore, who comes from another culture and another society would be well advised to master the local system, and to understand how minutely it has been adapted to local conditions, before he sets about recommending changes or the introduction of new crops. 'When one enters a Zande homestead for the first time, the impression is that of complete

chaos. The courtyard is shapeless. . . . The huts in it are scattered. Crops, food, and household belongings may lie about the courtyard . . . in what seems to be a most disorderly fashion. Worst of all no fields can be seen. The thickets of plants surrounding the homestead seem as patchy and purposeless as any wild vegetation. It is impossible to distinguish a crop from a weed. It seems almost incredible that a human intelligence should be responsible for this tangle¹ (Plate XXXIX).

In fact, de Schlippe holds that Zande agriculture should be looked at in the light of two concepts, the field type and the pseudo-rotation. The field type consists of the following associations of crops which from time to time are grown together: the main eleusine association, wherein maize and eleusine are sown side

¹ P. de Schlippe, *ibid.*, p. 101.

by side; the ground-nut association, wherein ground-nuts, maize, and cassava occupy the same field, perhaps followed in the same year by eleusine, maize, or other crops; the eleusine through grass association, with perhaps sesame following; and finally the beans through grass type. Variations in the weather, the actual success of the crops as they grow, the appearance of the land and the question of how much time or energy the peasant can spare all affect the order in which these types are sown on any one field. For these reasons it is not possible to speak of any fixed rotation of crops, but rather of a pseudo-rotation, which is none the less securely rooted in the soil because it varies from year to year.

Other crops which the Zande grow in lesser quantities near to their homesteads are very varied: they include pumpkins, maize, sweet potatoes, cassava, oil-seed gourds, okra, chillies, upland rice, tobacco, and hemp, and a number of fruits including mangoes, pineapples, bananas, paw-paws and tomatoes. In view of the large number of crops cultivated, it is not surprising to learn that the Azande enjoy a diet balanced in most respects. They are even able to obtain enough protein, though they keep no stock, obtaining it partly from vegetable sources, partly from hunting wild animals, and partly from collecting termites.¹ There is a season in May and June when there is too much work to do in the fields, and the Azande often have too little food to sustain them properly, but a more serious nutritional danger comes from an excessive reliance on cassava, which is easy to grow but of poor nutritive status.

All the crops listed above are grown for domestic consumption, with the exception of Indian hemp (*Cannabis sativa*), a forbidden plant in which there is still a small contraband trade between Equatoria and central Sudan. The one important cash-crop that has been introduced to the area is cotton, which has been grown with government support since 1926. The story of its introduction and expansion well illustrates some of the difficulties facing the administration of a remote and backward area² (Plate XL).

¹ G. M. Culwick, *A Dietary Survey among the Zande of the South Western Sudan*, Sudan Government, 1950.

² J. R. Catford, 'Cotton as a Cash Crop in the Maridi Area', *S.N. & R.*, 34 (1953).

Maridi, the original centre of cotton growing in this part of Sudan, lies near the border between the territory of the Zande and Moru tribes, and was, in fact, the headquarters of an administrative district in Mongalla province (now Equatoria) until 1931. Cotton of a very inferior kind had been introduced into southern Sudan by Arab traders in the nineteenth century, and so it was known that conditions were fairly favourable to the crop. In 1926 the British authorities, feeling that something must be done to bring revenue to the province and wanting to introduce the idea of production for money, distributed seed through the village chiefs, and gave orders for land to be cleared and cotton to be sown. The cotton was shipped in bulk to the north for ginning, and lump sums were given to the chiefs to distribute between their followers.

When it had been established in this way that the Maridi area was favourable for cotton (Amadi was also tried and found unsuitable), a ginnery was erected in 1928, and the people were required by the administration to grow within their own holdings about half a *feddan* per householder. In fact, the degree of compulsion employed can never have been very great, for the area required by the regulations was never attained, and after 1936 compulsion was formally abandoned. This led to a marked fall in production, for prices were very low, and during the war years cotton growing almost came to an end.

TABLE XII

Production of Seed Cotton in the Maridi Area in Small Kantars (100 rolls)

1935-6	.	.	.	.	32,800
1937-8	.	.	.	.	10,200
1940-1	.	.	.	.	6,000
1942-3	.	.	.	.	2,500

Subsequently, Moru production has risen slightly, but there has been a great advance in Zandeland, in association with the Zande scheme.

3. *The Zande Scheme*

The Zande scheme owes its origin to an unpublished memorandum which was circulated

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in Sudan in 1943 by Dr. J. D. Tothill, formerly Director of Agriculture in Uganda and at the time Director of Agriculture in Sudan. There had been a feeling prevailing in the country for some years that an attempt should be made to develop the resources of the southern provinces, and it was obvious that in so vast a region there would have to be an initial concentration upon a relatively restricted area. To quote Major J. G. W. Wyld, the District Commissioner in Zandeland who played a large part in persuading the Azande to accept resettlement, and later in carrying it out: 'Broadly speaking Dr. Tothill proposed an experiment on a grand scale in social emergence for a remote Central African tribe, by making the fullest possible use of natural resources. Self-sufficiency was to be developed to the utmost, and overhead expenses on exports, to provide funds for essential imports, were to be reduced as far as possible. In Dr. Tothill's view the solution lay in exporting processed or manufactured articles, rather than raw material. Imports should be reduced to such articles as could not conceivably be manufactured locally, or local substitutes provided. Zandeland was selected for the experiment because it was an area where the food problem did not cause anxiety. There are, unfortunately, many areas in southern Sudan where crops and food supplies are produced on a meagre subsistence basis only. It was clear that no area could be selected for such an experiment if the people did not at least feed themselves properly'.¹

The commodities which it was initially hoped to produce locally were cotton cloth, soap, sugar, and coffee. Of these the most important were cotton cloth and soap, while coffee has since dropped out. All these commodities except coffee require the setting up of factories and machinery, the appointment of skilled officials, and in fact the expenditure of a considerable sum of capital. Clearly no commercial firm could be interested in so speculative a venture, and the initial capital had to come from the government, which in 1946 set aside the sum of £1,000,000 towards the scheme from the sum received as a gift

from the British Government after the war. The scheme was to be managed by a semi-independent organization known as the 'Equatoria Projects Board', which was also charged with the quite separate responsibility of providing bush shops throughout the province to supplement the meagre stocks offered by native traders, and so to stimulate the production of cash-crops.

It was recognized from the beginning that even though the Board's capital had come from non-commercial sources, there would be little purpose in beginning the social experiment unless it could eventually pay its way. This meant in particular that if cotton spinning, cotton-weaving, and soap-making machinery were to be installed, it was essential that they should receive a regular and sufficient supply of their raw material to keep them running. For this the interest and sympathy of the people's chiefs would hardly be enough, even though there was no point in undertaking the scheme at all until it had won the support of the local inhabitants. When the scheme was inaugurated the Azande had begun to move back into the bush from the roadside settlements to which they had been brought as an anti-trypanosomiasis measure. The task of effectively supervising their cultivation of cotton or other industrial crops, distributed in a quite irregular manner in woodland where the grass grows 2-3 m. tall, would have been hopelessly difficult.

The momentous decision was therefore taken that the Azande would have to be resettled yet again, according to an orderly layout of roads, paths, and field boundaries. Thus each farmer could have a regular-shaped plot of 25-40 acres, wherein the crops he grew could also follow a regular pattern, and could succeed one another in a fixed rotation. The area given to each man should allow for sufficient periods of bush fallowing. With remarkable political skill, Major Wyld and others were able to persuade the Azande to co-operate in the resettlement, which began in 1946 and lasted five years, and by 1951 about 1,000 villages, having approximately 50,000 families or almost 200,000 inhabitants, had been resettled. The new settle-

¹ J. G. W. Wyld, 'The Zande Scheme', *S.N. & R.*, 30 (1949).

ments consisted of individual holdings fronting on tracks, known as *gbaria* lines, and running back about 1,000 metres into the bush (Figs. 42 and 98). Since the resettlement cotton has been grown by many of the Azande without the need for any compulsion. In the first few years, before the cotton-mill was ready to begin weaving, the cotton was exported, this being made possible by the exceptionally high cotton prices that prevailed in 1950-2; subsequently, cloth, cotton-seed oil, and soap have been produced at the industrial site at Nzara in increasing quantities, and coarse jaggery sugar has also been produced. Some recent figures of production are as follows:

TABLE XIII

*Equatoria Projects Board—Industrial Section
Statistics of Production, 1956-7*

	<i>Volume</i>
Cotton, Plain-yards . . .	1,635,868
Cotton-seed Cake—tons . . .	510
Cotton-seed Oil—tons . . .	122
Soap—tons . . .	118 (1953-4, since discontinued)
Sugar—tons . . .	216 (1954-5, since discontinued)

The success of these manufactures, simple as they are at present, has shown that there is no inherent reason why the Azande should not be trained as industrial workers. As yet they are sheltered by tariffs and transport charges from competition with the products of India or the Far East, at least within their own area. It is very doubtful, however, whether any of their products can bear the cost of transport to the markets of central Sudan and still compete with foreign goods. If they cannot, it is hard to see how the mills can continue to be operated except as a subsidized service, saving some foreign exchange but constituting in times of peace a source of weakness rather than strength to the country as a whole.

Despite these misgivings there is no doubt that there is something rather spectacular about passing through miles of dense woodland and suddenly coming on the extremely modern

and well-laid-out industrial site at Nzara. Yet it may well prove that the most significant governmental work that has been done in Zandeland has been at the Yambio Agricultural Experimental Centre. Here two principal lines of research have been pursued. The former is the investigation of potential cash-crops, and the breeding of better varieties of existing ones; among those which have been tried are coffee, oil-palms, tung-oil, and other oil-seeds. The second line of investigation has been into actual Zande practices in agriculture, in the hope of discovering a means of adapting the traditional bush-fallowing to a more permanent and productive type of land rotation. The success of such work will clearly depend, not merely on the wisdom and industry of the officers involved, but also on whether mutual confidence can be maintained between the Azande and the political authorities.¹

4. *Yei District*

To the east of the Zande district lies that of the Moru. The cotton growing that was initiated along the boundary between the two districts has already been discussed. The subsistence crops of the Moru are generally the same as those of the Azande, but there is a difference in the traditional manner of siting cultivations. The *katiri* system, as it is called, is a practice whereby each clan of closely related families co-operates in clearing a circular piece of land whose radius may vary from 200 to 400 m. or more. From the central point, a convenient tree or termite mound, segments are then marked out as the portions of the women of the tribe, who do most of the cultivating. A hedge is planted as the outer ring to the whole *katiri*, and within each segment typical crop associations are grown: *dhura* and eleusine the first year, *dhura* and sesame, with some beans later, in the second; and then sometimes a third cropping, the same as that of the second year. The land is then allowed to fallow. The system has its disadvantages, in that the exposure of a large open area to rain and sun probably encourages soil erosion and deterioration, while the insistence on the circular

¹ In *S.N. & R.*, 36 (1955), de Schlippe has put forward an elaborate proposal for Hedge Strip Farming in Zandeland, to provide a framework for successive plantings and reduce fire risks by dividing farmers' holdings by hedges and marking them with useful trees. The scheme is derived from the Corridor System described in *F.A.O. Studies No. 4, 1948.*

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pattern leaves considerable wasted areas in between the *katiri* circles, a point of some importance since fallow periods are often rather short.¹

The Yei area is very similar to Zandeland, except that the dry season is slightly longer, the vegetation is rather less luxuriant, and the grass fires are exceptionally severe. The settlement of the population along the roads by administrative decree has been very stringent, and there has been no subsequent resettlement by authority. Many signs of overcultivation have been noted, perhaps made more severe by the fact that the inhabitants usually cultivate in the latter part of the rainy season only, because the soil is liable to water-logging at the height of the rains. Chillies are the only regular cash-crop, and honey, shea butter nuts, and beeswax are collected in the drier country to the north. The southern part of the district contains the Kagelu Agricultural Station, where native agricultural officers used to be trained, and many fruit trees, especially citrus, have been propagated for distribution throughout the area. The station is now run by the Forestry Department.

In the extreme southern part of this district lies the Aloma plateau, which rises to 1,200 m. above sea-level. Here are situated the only two commercial plantations in southern Sudan, established by a Greek merchant, Mr. George Haggard. These are of 300 *feddans* on the plateau and 250 at its foot, and grow *robusta*-type coffee with considerable success, irrigation being used in the dry season. There is also a small cigarette and tobacco factory under the same management at Iwatoka. Tobacco is grown on the plantations, and seed is also distributed to farmers in the Yei and Kajo Kaji areas, from whom leaf is bought at 10 *milliemes* per *roll* (= 1 lb. approx.) green. These plantations have led various people to deduce that there are great prospects for the production of plantation crops in southern Sudan. For political reasons, however, it would scarcely seem possible today to lease any large areas to private firms, while the high costs usually involved in government participation in any

enterprise would be a serious drawback to schemes with far more favourable prospects.

In the south-east of Yei district lie the areas occupied by the Kuku around Kajo Kaji, which is of interest as the one part of the green belt² of the Ironstone Plateau where cattle are kept successfully. It is an area of about 100 sq. km. which has been almost entirely cleared of trees. In consequence, the numbers of tsetse flies have been very much reduced, and in addition to cultivating the land the people are able to keep cattle, sheep, and goats. In the past they have been hit by rinderpest and trypanosomiasis, which official action has not been wholly successful in suppressing, despite the use of antyicide and other modern drugs. It cannot be said that a successful type of mixed farming has been evolved, for beasts are not used for ploughing, and animal manure does not enter into the system of maintaining soil fertility. Re-infection of cattle with trypanosomiasis from the reservoir of the disease in wild game, particularly buffaloes, frequently occurs. The absence of trees in the area, while good for human and animal health, makes for difficulties in the supply of firewood, and some steps have recently been taken to establish plantations of *Acacia* and teak. Mangoes have been widely planted or else have seeded themselves along the roads, which are also marked by fine lines of eucalyptus. Some cotton is grown and taken to Uganda for ginning, but the most important cash crop is tobacco, sold uncured to the Haggard tobacco factory.

5. *The Mountain Masses*

East of the Nile the soils and agricultural practices of the Acholi who live around the south-west flanks of the Imatong mountains are very similar to those of the Yei district. The Acholi are keen cultivators, and surpluses are regularly produced of sesame and *dhura*. Before the Second World War, cotton was grown and ginned at Torit, but since the ginnery has been closed the cotton is now being taken across the border for sale in Uganda. Wild coffee grows in the natural forests of this area, and some of the local inhabitants have

¹ J. R. Catford, 'Katiri Cultivation in the Moru District', *S.N. & R.*, 32 (1951).

² The 'Green Belt' is a local ecological term given to the wettest part of Equatoria. To the north of it lie the blue and red belts. See de Schlippe, *op. cit.*, pp. 4 and 256.

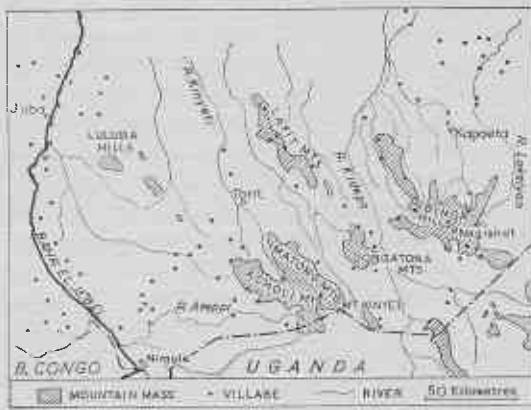


FIG. 99. Southern Hill Masses. The streams draining northwards from these mountains make no contribution to the Bahr el Jebel, but are important for the grazing they support when they peter out in the plain. From *The Equatorial Nile Project*, Map A 26.

made attempts, hitherto unsuccessful, to establish coffee plantations.

Farther east the broad simplicity of the physical geography disappears (Fig. 99). The hills and mountains of the south-east are more extensive and more numerous than those to the west of the Nile, and they introduce a complicated pattern of soils and vegetation, while the prospects of agriculture and the distribution of the population reflect this diversity. In the Latuka-Lango-Jebel Lafon area the cultivated land consists principally of aprons of rich, dark brown to black soils of the alkaline catena, which receive much ground moisture from the run-off of the hills. Cropping patterns are much simpler than in the moist Zande area, and large quantities of *dhura* are grown, whilst cotton can be cultivated successfully in many parts. The adjacent clay plains afford dry-season grazing for cattle and other animals, which in the wet season are brought up on to the aprons to graze; here they compete with the cultivations for the limited land available. Particularly in the Dongatona mountains the anti-erosion measures are often rudimentary and quite inadequate. To quote from Jackson: 'According to native traditions, the Dongatona only moved up into the hills relatively recently,

perhaps little more than a century ago. If this is true, it would help to explain the obvious unsuitability of their system of agriculture to the steep and rocky places which they inhabit; it would also explain the fact that there is any cultivable land left at all, for if erosion had been continuing at its present rate for a long period the whole of the Dongatona hills would now be barren rock.'¹

In a brief survey of agriculture in the Dongatonas, carried out in 1954 (by a party from the School of Agriculture of the University College of Khartoum), it was found that the main fields were occupied by a *lubia-dhura-dukhn*-sesame association, and that cucurbits and tobacco were also cultivated, the latter around the cattle enclosures where there were quantities of animal droppings. Manure was never used on the main cultivations. A feature, by no means unusual, of this survey was that attempts to count the cattle, sheep, and goats were wholly frustrated by the suspicious nature of their owners.

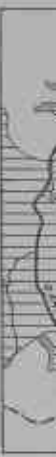
6. The Extreme South-east

In the extreme south-east of Sudan the territory of the Toposa and Turkana tribes contains elements that might warrant grouping either with the southern clay plains or with the mountain masses of the southern frontier. In fact, it resembles neither very closely, and a recent investigation of the grazing conditions and movements of nomads has revealed that its nearest affinity is with the extreme northern province of Kenya. The centre and north-west of the administrative district of eastern Ekuatoria consist of a plain of dark cracking clay; in the south-east there are the Didinga and Boya Hills, which are very much like the Dongatona mountains, though somewhat drier; in the north-east the area of basaltic rocks is marked by numerous plateaux and deep gorges; while in the south-east there are low hills separated by undulating stretches of well-drained clay loam which continue through the Ilemi triangle² into northern Kenya.

Agriculture among the Toposa is rudimen-

¹ J. K. Jackson, 'The Dongatona Hills, Sudan', in *The Empire Forest Review*, 29 (1950), pp. 139-42. Reprinted as Memoir of Forestry Division No. 1, Ministry of Agriculture, Khartoum, 1950.

² The Ilemi triangle is a part of Sudan which is for convenience administered from Kenya, since the Turkana who inhabit it cross regularly into the Northern Province of Kenya. Access is rather easier from the south.



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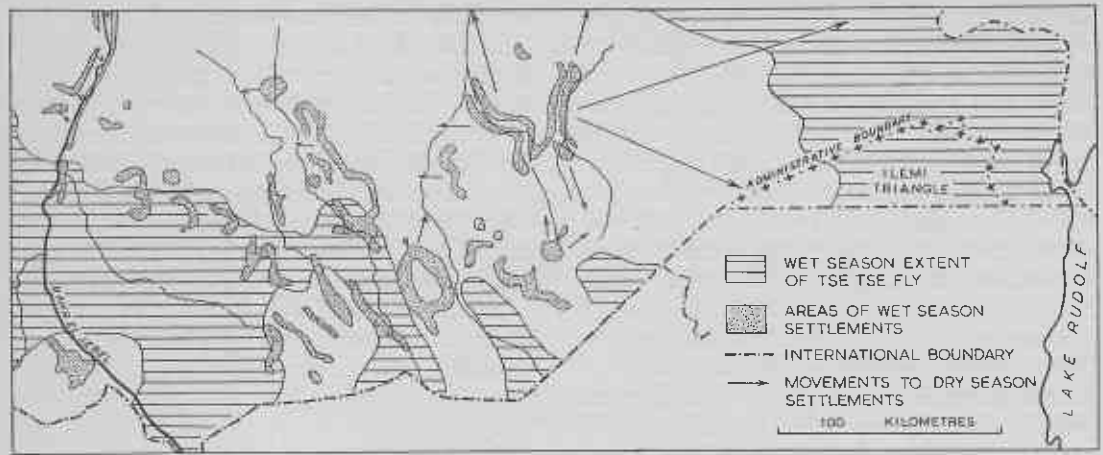


FIG. 100. Seasonal movements of animals and men in eastern Equatoria. Source as for Fig. 95.

tary, and is a recent addition to their way of life, for when they entered Sudan in about 1870 they were a wholly pastoral people. They took to growing millet about twenty-five years ago at the suggestion of the local District Commissioner. Cultivation is almost entirely in the hands of the women, though the men occasionally give some help in opening up new ground. The main crop of millet is sown broadcast in about June on the sandy soils beside the rivers Singaita and Lokalyan (also known as the Lotillet), to which the tribes migrate during the rains. There is also a little cultivation in the depressions, which dry out in about February. The quantity of grain grown is not very large, and tribes which for any reason wish to buy some will obtain it from merchants in Kapoeta in exchange for bulls, which they are otherwise reluctant to sell.

Animal Husbandry

Within much of the Ironstone Plateau tsetse flies make regular animal husbandry impossible, except in the Kajo Kaji area, where the population is relatively dense and almost all the natural bush has been cleared for cultivation. The herd of cattle which is kept to supply milk for government officials at Yambio requires constant re-inoculation against trypanosomiasis, and even so owes its continuous existence to government subsidy and to the presence of a number of consumers with a purchasing power quite exceptional for

the region. In the north-west some of the Baqqara Arabs drive their animals on to the plateau margins to graze in the dry season, but they have to retreat as soon as the rains begin and the fly returns. The Jur own cattle, which they entrust to the Dinka to care for during the rainy season. The Mandari, whose territory round Tali Post lies on the fringe of the plateau where there are no flies, can keep cattle in the rains, but in the dry weather they have to lead them down to the *toich* of the Aliab Dinka.

In the south-east, where tsetse flies are less prevalent, several of the tribes have strong pastoral traditions, and so the inhabitants of the Lafon and Liria hills can keep cattle, which are of the Didinga-Latuka type, like those of the Mandari. They make fairly short seasonal movements to and from the surrounding plains. The Acholi, Lokoro, Didinga, and Boya keep appreciable numbers of livestock. Certain of the stream valleys contain tsetse fly, especially in the rainy season, but by bringing the animals short distances into the hills or away from the streams, the tribesmen can keep their stock in good condition. In general, it is limitations on drinking water rather than on grazing that appear to be effective in keeping down the numbers of stock (Fig. 100).

The Toposa are still essentially pastoralists. They have large herds of cattle, estimated at 180,000 or more beasts for a human population of 126,000. Yet the number kept is by no means

the maximum that their territory could support, for the shortage of dry season water supplies restricts their numbers. Until quite recently rinderpest also was a limiting factor. At present animals and men all move to the banks of two rivers, the Singaita and the Lokalyan, during the rains. There they find well-drained sandy soils, which unfortunately show signs of overcultivation and accelerated erosion from the competition between men and cattle during the wet weather. In the dry weather most of the Toposa move away from their villages, leaving behind only a few of their number to prepare new cultivations and guard the grain stores. Some cattle or sheep and goats in milk are left behind to support them, since the Toposa prefer a diet of milk, meat, and blood to any other. In their migrations the Toposa seek out the depressions and ill-drained areas in the plains, as far as the borders of Upper Nile Province, Ethiopia, and Kenya, and then move slowly homewards as their water-points dry up. The quality of the water with which both men and animals have to be content is exceptionally poor. This is the more unfortunate since much of the district is occupied by 'sweet' perennial grasses such as *Chrysoporon aucheri* and *Bothriochloa insculpta* which stay green until the end of the year or even later, and are palatable when dry. The reason for the good quality of the grazing appears to be that the rains, while uncertain, continue with scarcely a break throughout the year, so that quite often there is no marked dry season.

In the 1951-6 Development Programme it was proposed to remedy the scarcity of watering-points in the district by the excavation of a number of *hafirs*, for which the clay soils of the north-west are well suited. Subsequent investigations and reflection have shown that at present there is virtually no off-take of animals from the district at all, a mere 300-500 head per year. Apart from tobacco, which they obtain by bartering sheep, the Toposa appear to have no needs at all which would make them wish to sell their cattle, and the chief effect of improving their water supplies

would be to increase the size of their herds. If in the future it is going to prove necessary to persuade the Toposa to accept the limitation of their herds, whether by voluntary restriction or by decree, it might be a mistake to give away in advance the government's most valuable bargaining counter—its ability to put in extra water supplies. It has also become apparent that in many parts of the district the soil is unsuitable for *hafir*-digging. Investigations are going on into cheaper means of providing extra water, which would be very beneficial in the dry season.^{1,2}

Communications

Throughout the south-west and extreme south of Sudan the primitive state of commerce is apparent. With the exception of the private plantations in the Aloma plateau and the government's forestry work in Loka, the Imatongs, and elsewhere, there is hardly any production directed principally to consumption in other parts of the country. In consequence, there has been little local demand for a greatly improved system of communications, and in view of the low overall densities of population both east and west of the Nile, it is hard to see how much greater expenditure on roads or waterways could be sustained. At present there are two trunk roads west of the Nile, and they traverse the main populated belts, i.e. the humid strip near the south-west border from Yei to Yambio and the margin of the Ironstone Plateau from Juba to Aweil.

These two lines naturally converge near the province headquarters of Juba, which lies approximately at the head of navigation of the Bahr el Jebel. In the last hundred years there have been several shifts of the site of the local administrative headquarters, for both political and military reasons as well as those connected with the physical conditions, and Mongalla, Lado, Gondokoro, Rejaf, and Dufle have all been used as capitals at different times (Fig. 101). The present site at Juba became the headquarters in 1930, having been chosen mainly on account of the spur of high ground which runs down to the river on the west bank and pro-

¹ A secondary effect of increasing Toposa water supplies might well be to increase the 'bride-price', which even now often attains 100 head of cattle. Contrast this figure with the 10 cattle demanded commonly among the Nuer.

² A. W. Peers, *Eastern District, Equatoria*, Report to Director of Sudan Veterinary Service, 1954.

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vides a suitable dry site for the construction of permanent buildings. The choice of Juba as provincial capital represents a compromise between the needs of east-west road communications, which call for an easy approach to the river free from flooding, and the necessity to maintain river communication between Equatoria and the rest of Sudan. As a river port Juba presents several disadvantages, since when the river-level is low navigation by Nile steamer is possible as far as Mongalla only, and the conveyance of goods and passengers from there to Juba involves considerable expense. There has been little tendency for the local Bari from around Juba to migrate to the town, perhaps because they are not sure that the government will not one day move its capital again. Despite the possibility of using the Nile for irrigation, there has been virtually no development of market-gardening in the vicinity, and Juba market is very poorly provided with fresh vegetables and fruit.

East of the Nile one road goes through Torit to Kapoeta, to link the administrative headquarters together, and another goes to Nimule on the Uganda border and serves as a link in the Nile route from Lake Victoria to the Mediterranean. Because of the Fola and other rapids, navigation on the Nile is quite impossible between Nimule and Juba. All these roads in the ironstone-red loam areas are of excellent quality by Sudan standards. They are surfaced with lateritic material which is excavated locally, and hardens on exposure to sun and water so that it stands up well to wear. After much use, the roads become corrugated, but they can be used at all seasons, even during heavy rain, and are thus far superior to the graded roads over the clays of central Sudan.

Economic Development

In the more prosperous years since the war, when the Sudan Government has been able to devote considerable sums to internal investment, it has become increasingly obvious that southern Sudan has fallen behind the rest of the country. At the same time there has been a general feeling that the southern mountain masses and the well-watered area along the



FIG. 101. The Bahr el Jebel from Nimule to Terakeka.

south-western border should be capable of becoming a source of wealth rather than weakness to the economy of the country at large.

A committee known as the Southern Development Investigation Team, with members drawn from several government departments, was therefore appointed to inquire into the prospects of developing the resources of southern Sudan as a whole, and towards the end of November 1954 it submitted its report.¹ The report covered a wide field, including Communications, Trade and Marketing,

¹ Sudan Government, 'Natural Resources and Development Potential of the Southern Provinces of the Sudan', *Preliminary Report by the Southern Development Investigation Team, 1954*.

Cash Crop Production, the Animal Industry, Fisheries, Water Resources, Forestry, Mineral Resources, and other possibilities, including the establishment of industries. A wide range of prospects was touched on, and a number of recommendations was made, but the impression remained that for one reason or another it was unlikely that any one line of investment would bring outstanding results or materially affect the prosperity of southern Sudan as a whole.

On the physical plane the extreme separation of southern Sudan from the markets of the rest of the country, and even more from the markets of the world, was recognized as a fundamental disadvantage. The recommendation that the western extension of the railway system should also include a branch southwards through Aweil and Wau to Juba was a reflection of this point of view, for it was hoped that with better communications peasant production of cash-crops for sale would be encouraged, probably the best means in the long run of stimulating agriculture.

At the same time it was admitted that there were serious human problems to be faced. The lack of interest of the Nilotes and Nilo-Hamites in selling their cattle is a common-place; policies of improving animal husbandry are, therefore, largely irrelevant from the point of view of developing trade. There are virtually no extensive areas of good uncultivated soils that could easily be used for the development of plantations, and even if there were, political

considerations would make it very difficult to recommend their alienation to foreign companies. As for government participation in commercial crop production, the example of the Gezira Scheme shows that exceptionally favourable conditions and a very valuable crop are needed if all parties are to be satisfied for long. Moreover, the crops that might be grown—coffee, tea, palm-oil—would have to face severe competition from established producers in inherently more favourable areas.

The investigation team has not admitted it, but the rather depressing conclusion is that there are parts of Africa, just as there are of Europe or of any other continent, where the natural conditions are not favourable to economic development. As long as the inhabitants of the various countries of the continent feel tied to their tribal systems and are unwilling to migrate to the few areas where their efforts can be more highly rewarded than in their native territories, their lowly way of life will persist. In southern Sudan it is the clay area which, when water control has been established, should constitute the most fertile and productive part of the country. Yet at the present time there seems to be little prospect of the exploitation of its potentialities, either by the Nilotes or by the inhabitants of the Ironstone Plateau. The former remain wedded to an indolent pastoral life, the latter to bush fallowing on soils of limited fertility, and it is hard to see how a growing demand for a higher standard of living can be satisfied by either.¹

¹ A similar problem is discussed in the *Report of the Royal Commission on East Africa, 1953-5*, pp. 35-6.

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THE GROWTH OF A MODERN STATE IN SUDAN

THE several regions of Sudan that have been described in the preceding chapters differ from one another not only in topography, climate, and population but also in the degree to which their economies have been brought out of isolation and integrated with one another and the world at large. On the one hand, there are cotton-growing areas by the Blue and White Niles where the daily rise and fall of world cotton prices are followed and discussed by interested tenants and proprietors; on the other hand, there are villagers in Jebel Marra or tribesmen in south-eastern Equatoria whose occasional sale of some grain or an animal to pay their taxes is almost their only contact with money throughout the year.

This integration of local economies to those of Sudan and the world beyond is frequently described as economic and social development, partly because of the new commodities that money enables the individual to purchase, and partly because of the various administrative, medical, educational, and other services that an increased supply of money makes it possible to set up. The production of new commodities, moreover, and the extension of trade in existing products can not only raise the standard of living of the area in question but also often bring to the whole country resources of foreign currency of great value. For these reasons development has come to be regarded as one of the most important functions of government in backward countries. It not only provides a touchstone to assess the effectiveness of past administrations, but also constitutes a justification for demands for political and economic dependence. The examples of India or of Syria since they have attained independence have convinced many observers and local politicians that a national government will display more vigour, inventiveness, and resolution in this direction than one composed of foreigners.¹

THE FOREIGN CONTRIBUTION TO THE ECONOMIC DEVELOPMENT OF SUDAN

For many years it was the custom, particularly among those connected with the British administration of Sudan, that in speaking of the development of Sudan's economy the country's history would be divided sharply into two periods: the first was that before 1898, when only rudimentary administrative machinery existed, if any, and the second that since the Battle of Omdurman, when the British exercised the real power behind a fiction of Anglo-Egyptian condominium. Yet if the factors that really brought about economic expansion be studied, it may prove truer to say that parts of Sudan were already beginning to be affected by world trade when the Egyptians ruled the country before the Mahdi's revolution, while other areas were scarcely touched by fifty years of British rule. The change has not been from total isolation to total participation in world trade, but rather a gradual spread of money economies along the lines of communication, with many intervening areas still unaffected.

The gradual exploitation of the country's resources has taken place in several ways. These comprise the search for mineral resources, the spasmodic efforts to improve the country's system of communications, the increase of agricultural production, the improvements of the trade in animal products, and to a slight extent the establishment of industries. In addition the effect, since the Second World War, of a greatly increased supply of money in government hands will be discussed, with particular reference to the establishment of a Development Branch of the Treasury and the inauguration of two specific five-year development programmes.

¹ T. Balogh, *F.A.O. Internal Reports*, Parts 1-5. 'Mediterranean Development Project: Two Country Studies', 1957.

The Nineteenth Century

Sudan was explored, conquered, and administered by a foreign power rather earlier than most of central equatorial Africa. Beginning in 1820 the Egyptians under Ismail Pasha, son of Muhammad Ali, marched up the Nile, overran central and northern Sudan, and set up an administration with its capital at Khartoum. In 1869 the Bahr el Ghazal area was explored, and in 1871 Egyptian forces penetrated up the Nile as far as the limit of navigation at Gondokoro, and established a garrison there. For a brief period (1872) their rule may even be said to have stretched as far south as Lake Albert.¹

The Egyptian role in the development of southern Sudan may be quickly outlined. They established a government monopoly in the ivory trade, and actively pursued, at least at first, the trade in slaves, whom they transmitted to the markets of Egypt and Arabia. Later, a perfunctory effort was made in 1854 by Said, Viceroy of Egypt, to suppress the slave trade, but nothing very much was achieved in this direction until 1874, when Gordon was appointed to be governor of Equatoria. His work was certainly aided by the fleet of Nile steamers which had been brought to Khartoum after 1864.

In central and northern Sudan the Egyptians showed more enterprise, especially when Ali Khurshid was serving as Governor in Khartoum (1826-38) during Muhammad Ali's rule in Egypt, and later in Ibrahim Ismail's viceroyalty (1863-79). They introduced new crops of considerable value, including sugar-cane, barley, and various fruits for local consumption, as well as indigo and cotton which afforded exports. They encouraged the wider use of the ox-drawn *saqia* in the north, and generally developed boat-building and navigation along the Nile. They stimulated the export of ostrich feathers, cattle, and camels to Egypt and of gum arabic to the markets of the world, and they also made unsuccessful attempts to introduce opium, coffee, and rice cultivation, and to develop an iron industry using deposits occurring in the Nuba Mountains.

The fleet of Nile steamers referred to above was to play an important part in exploration,

administration, and war in the years to come,² and the postal services introduced from 1867 onwards speeded communications with the outside world. Telegraphic communication was established in 1870 when a line reached Khartoum from Cairo. An earlier cable laid by a British contractor along the Red Sea from Suez to Suakin had proved a failure. The Egyptians also tried to build a railway up the Nile valley from Wadi Halfa, but this came to nothing because of the financial crisis which engulfed the country in 1883 when less than 50 miles had been laid.

It was, in fact, lack of money, lack of communications and lack of continuity of effort that kept the Egyptians from developing Sudan's resources more fully. To illustrate the way in which personal initiative played an important part in getting things done in this period, mention may be made of two individuals who showed particular keenness to promote production in the latter part of the Egyptian rule. Both were at some time governors of eastern Sudan.

The former, and more effective, was Ahmed Mumtaz Pasha, Governor of Suakin and eastern Sudan from 1865 to 1871. By the time he was appointed, the Suez Canal had been cut, and communication between the Red Sea coast and the markets of the world was immeasurably better than that from any other part of Sudan. Observing the fertile soils of the Tokar and Gash deltas, Ahmed Mumtaz proposed that cotton-seed be brought from Egypt and sown in these two areas; this was in fact done with a considerable measure of success after 1870, only to be abandoned during the Mahdiya. His ambition to set up a cotton ginnyery at Kassala failed because camels could not transport the necessary machinery, but the growth of the cotton itself proved a profitable venture.³

The second was Werner Munziger, a Swiss adventurer who served as Khedive Ismail's Governor of the eastern Sudan and Eritrea between 1873 and 1875. In 1871, shortly before his occupation of Keren as part of a plan to secure control of the headwaters of the Nile for Egypt, Munziger dispatched from Massawa a memorandum concerning the general wealth

¹ R. L. Hill, *Egypt in the Sudan, 1821-1881*, 1959. S. Baker, *Ismailia*, 1874.

² Hill, *op. cit.*, p. 123.

³ R. L. Hill, *A Bibliography of the Anglo-Egyptian Sudan*, 1939.

of Sudan, including the following striking statement: 'To give a short resumé of what I am going to explain, I will state that in the Sudan there is no dead desert. There is rain enough for any cultivation. There are rivers and torrents easy to be made use of for irrigation and navigation. The population is large and active—over 5 millions. The Sudan ought to be one large cotton-field.' He also expressed the view that much of Sudan was virgin forest or prairie, overrun by immense herds of cattle, while the main natural products of the country—gum, ivory, ostrich feathers, timber, and gold—were of importance also. It seems likely that these views influenced Ismail in his desire to extend and maintain his control over Sudan, but they did not lead to any practical developments.¹

During this period of Egyptian rule, often known as the 'Turkiya' because the Khedive of Egypt was a nominal subject of the Turkish Sultan, there was a small number of Greek and other foreign merchants in Khartoum, and they and various northern Sudanese merchants penetrated southwards into southern Sudan. They were not interested in the investment of capital in the country, but were engaged in the purchase and export of local products, which were dispatched down the Nile. The Mahdiya brought all such trade to an end, since during his reign the Khalifa was at war with the British who held Suakin and the lower Nile valley.

The Re-conquest: Railway Building

After the reconquest in 1898 an early resumption of trade with Egypt was possible, since an essential feature of Kitchener's campaign was the construction of the desert railway from Wadi Halfa to Abu Hamad, the line being continued south to Atbara in July 1898 and reaching Khartoum North, then known as Halfaya, by December 1899. Not long afterwards a line was built from Atbara to the Red Sea, the Blue Nile was bridged and the line was extended south to Sennar and then westward across the Gezira and White Nile and so to El Obeid, which it reached in 1912. Apart from assisting the export of grain, gum, and hides, this line had a strategic object in that it enabled the old

garrison town of El Obeid to be quickly reached from the capital at all seasons. This was the last piece of railway building west of the White Nile until the beginning of the line to Darfur, which was undertaken in 1955 just as Sudan attained independence. In the east a line was built in 1923-4 to link Kassala and the Gash cotton-growing area with Port Sudan, and this was extended through Gedaref to cross the Blue Nile and meet the existing line at Sennar in 1929. The line from Sennar to Er Roseires is very recent, having been completed in 1955 (Plate XXXI).

Looking at the matter today, it must seem remarkable that after so rapid a beginning railway construction was wholly abandoned for a period of some thirty years, only to be resumed just at the time when the British rule in Sudan came to an end. The explanation seems to have lain partly in a loss of faith by the administration, so that it no longer seemed prudent to borrow large sums for railway construction when it was not absolutely certain that the necessary traffic would be developed to pay for them, partly in the alternation of boom and slump in the inter-war period, which made long-term schemes of investment seem excessively risky, and partly in the improvement of the motor lorry, which is at once more flexible and calls for a much smaller initial outlay.

For the carriage of any considerable quantity of goods rail transport is undeniably cheaper than road, but it calls for a considerable expenditure of public funds, whereas lorries can be bought one by one by private persons as the trade seems to warrant it. In most countries of the world lorry transport calls for considerable government expenditure on the construction of roads and their maintenance, but in the semi-arid conditions of central Sudan, and even more so in the north, a lorry can usually be used on a track that has involved very little expense indeed. In sandy areas like the Qoz rain may actually improve the surface rather than spoil it, whereas in the clay plains heavy rains make roads quite impassable. Though many of the roads now in use in the clay areas have been created by government policy and are maintained by regular scraping and grading with heavy machinery, an impor-

¹ F. J. Cox, 'Munziger's Observations on the Sudan, 1871', *S.N. & R.*, 33 (1952).

tant number of feeder roads and others serving small communities owe their existence to 'bush bashing' by lorry drivers setting off into the plains on their own initiative. The lack of stones and the high cost of bitumen in Sudan make the construction of permanent all-weather roads prohibitively expensive, and it is only in the south on the Ironstone Plateau, where laterite is readily available, that tolerable roads are to be found.

When the administration was first set up, however, such considerations were still far in the future. To begin with, newly reconquered Sudan needed an annual subsidy from the Egyptian Treasury, since the few taxes that could be imposed on the native population and on the country's trade were insufficient to pay the salaries of officials and the expenses of maintaining a military garrison. To make possible any regular exports of worth-while quantities of goods, speedy and cheap transport to the Red Sea and to world markets was required. It was decided in 1906, therefore, to abandon Suakin, where the harbour is small and inconvenient, and to replace it by Port Sudan, which was large enough to take ocean-going vessels. The steady growth of the country's important and export trades since that date clearly illustrates the wisdom of this decision (Table XV).

Prospecting for Minerals

One of the first means by which it was hoped to pay for the opening of the country was by the exploitation of minerals. Despite the failure of the Egyptians, the prospects seemed good, for this was really the first time, since the great discoveries of diamonds, gold, and other minerals in southern Africa, that Sudan had been under the control of a stable administration capable of maintaining law and order and of ensuring the safety of travellers in remote areas. Between 1900 and 1910 a succession of applications was made for prospectors' licences in the country, and these were granted on terms reserving to the state a reasonable share of the proceeds of any discoveries.¹

¹ Since 1911, 113 prospecting licences and 32 mining leases have been issued. These are very small numbers in comparison with countries where mining is a major industry. See S. C. Dunn, *Notes on the Mineral Deposits of the Anglo-Egyptian Sudan*, Bulletin No. 1 of the Geological Survey, Khartoum, 1911.

² C. B. Tracey, 'The Zeidab Scheme', Appendix to Chapter 26, *Agriculture in the Sudan*, 1948. A. Gaitskell, *Gezira: a story of development in the Sudan*, 1959.

The principal area investigated was the Red Sea hills, where numerous ancient workings for gold bear witness to the thoroughness of early Egyptian prospecting. Prospecting licences were also issued for Dongola, the Nuba Mountains, the lands beside the Blue Nile near the Ethiopian border, and the south-west. Elsewhere, the mantle of clay and sand which covers the country proves an effective bar to the search for precious stones and metals. Unfortunately, no considerable lodes or deposits were found. Small gold-mines were worked for a time in the heart of the Nubian desert and in the northern Red Sea hills, but all these are now closed and the country's export of gold is very small, being made up of alluvial gold panned in various streams and some small amounts from the Nuba Mountains. Since there is a considerable internal demand for gold to make ornaments and jewellery for women, the current exports probably bear little relation to production.

The Development of Irrigated Agriculture by the Nile

Failing the discovery of significant mineral deposits, it seemed reasonable to suppose that the country's best prospects of increased wealth lay in the extension of agricultural production, side by side with an increase in the number of animals kept in the thinly stocked nomad areas. As early as 1904, therefore, the government consented to give a lease of a large uncultivated basin near Atbara to an American philanthropic scheme for the resettlement of freed negro slaves. When this project failed, for non-agricultural reasons, the 11,000 *feddans* of land involved were leased to an English company, the Sudan Plantations Syndicate, to grow cotton.²

This was a venture fated to have far-reaching results, for the syndicate showed that the growing of cotton in Sudan's autumn and winter, when the high level of the Nile makes for ease of irrigation and the plants' need for water is relatively low, could be as successful as the summer cultivation practised in Egypt.

Already in 1904, Sir William Garstin, in his *Report upon the Basin of the Upper Nile*, had drawn attention to the existence in the Gezira of extensive land suitable for irrigation, with a population sufficient to provide an initial labour force. While he had envisaged the growing of wheat and other winter crops, so as not to compete with Egypt's demand for summer water, the Zeidab scheme showed that cotton was a possible crop that would be much more profitable. The idea of a dam at Lake Tana was suggested, only to be abandoned as impracticable, and a much simpler proposal for a barrage at Sennar was put forward in its place.¹

The story of how the Sennar Dam was built, and how irrigation based on it prospered, has been told in Chapter XIII. Apart from the period of railway building, this was the only occasion when the Sudan Government took the risk of borrowing very heavily from abroad, and in the long run it has proved highly successful. Yet the low cotton and grain prices of the early thirties came at a time when the Gezira Scheme was experiencing a run of very poor cotton yields, and its success and continuation were endangered. Subsequently, the scheme has grown, but the preoccupation of the government with war and defence during the early forties, and the extreme difficulty of obtaining staff and machinery for development in the immediate post-war years, have militated against the very rapid growth of schemes of equal magnitude. It is difficult to believe that even if the Sudan Government had borrowed considerable sums abroad for investment in communications, education, or agriculture, the rate of development could have been much more rapid in the unfavourable economic climate of the twenties and thirties. The inherent economic conservatism of the British administration made it very unlikely to incur large unproductive debts such as caused Egypt and Morocco to lose their independence in the previous century.

The problem of how to increase the national wealth was further complicated by the fact that the safest means, irrigated agriculture, required the use of Nile water, whose consumption in Sudan was regulated by the Nile Waters Agreement. This had been negotiated at a

time when Anglo-Egyptian relations were still rather strained after the 1924 crisis, and made extremely conservative provision for Sudan's water requirements, presumably to avoid incurring further Egyptian suspicion or hostility. In fact, the water allotted to Sudan continued to be sufficient for a number of years. Since 1945 cotton growing has proved much more profitable than it was before the war, and there has been a rush of applications for licences to set up private pumping schemes. While economists have warned that too great a dependence on one crop is dangerous to a primary producer's economy, Sudanese public opinion has remained convinced that the safest and easiest way to enrich the country would be to inaugurate another great irrigation project comparable with the Gezira Scheme.

For such a development the first need was a modification of the Nile Waters Agreement to increase Sudan's share. Yet with a state of hostility and suspicion prevailing between the British and Egyptian Governments, conditions were not favourable for reopening a matter about which Egyptian public opinion must always be extremely sensitive. Irrigation developments were hanging fire at the end of the period of British rule, with the exception of the Guneid Pump Scheme on the right bank of the Blue Nile, since the credit balance in the Sennar water account was almost exhausted. The Manaqil extension was at first made possible by a reduction of the watering period throughout the Gezira; such a limitation could not have been borne for many years, however, without giving rise to much dissatisfaction among the Gezira tenants, who have already shown themselves to be a well-organized and vocal body.

When the Sudanese became independent there were approximately 1 million *feddans* commanded by the Gezira canalization and 750,000 *feddans* elsewhere laid out to irrigation. The latter figure had increased very rapidly in the previous ten years. It represented in the Northern Province partly a shift from *sagya* to diesel-pump irrigation, and partly the extension of irrigation to areas previously too high to be watered economically. Along the Blue and White Niles, however, the lands now irrigated had previously been devoted to shift-

¹ Sir W. Garstin, *Report upon the Basin of the Upper Nile*, Ministry of Finance, Egypt, 1904.

ing cultivation or rough grazing, and so a major transformation of the settlement pattern and of the level of the economy was taking place. Government, Sudanese, and foreign private capital was employed in these schemes, the latter sources being largely self-financing, in that the high profits made by the early entrepreneurs were lent to any reliable persons who could obtain pump licences. The borrowers' profits, in turn, were so high that the usual period for the return of the capital sum was three years only, and some lucky and skilful scheme owners were clear of debt within one season.^{1,2}

Other Cotton-growing Areas

In the other main cotton-growing areas of Sudan—the Gash and Baraka deltas and the Nuba Mountains—the investment required from the government or from individuals has been less than in the Gezira. The Gash area needed the most expenditure: the railway line from Haiya to Kassala was originally built with the express purpose of transporting Gash cotton to Port Sudan; canals and regulators were needed to distribute the flood effectively, and roads, houses, and water supply were required for the administration of the scheme. At Tokar very little flood control was attempted except to protect the town, and the Suakin ginners has represented the only considerable item of expenditure. In the Nuba Mountains three ginners were built as soon as it had been established that cotton would grow satisfactorily, and an agricultural research station was set up at Kadugli. It has not yet proved necessary, however, to build a railway line into the Jebels area, since cheap dry-season roads can be cleared across the clays along which lorries can take the ginned cotton to the railway at Semeiha. By 1957 there were 9 ginners in operation in the Nuba Mountains.

Land Policy and Peasant Agriculture

Apart from the Zeidab Concession, the British in Sudan were unwilling to dispose of blocks of land to foreigners, and so there have been

no settler-owned plantations established to form potential sources of political dissatisfaction. In the areas where extensive agriculture is possible without irrigation, native cultivation and grazing rights had to be respected. Even had the authorities been willing to allow foreign settlers to enter the country, the harsh climate would have been a sufficient discouragement to keep them from occupying the countryside. The northern Sudanese themselves, accustomed as they are to extremely high temperatures, are loth to move to the central clays where land in plenty awaits them. Settlers of European stock would find the conditions wholly unattractive.

By contrast with its large-scale plantation-type irrigation, in which the government was deeply interested, peasant agriculture received little direct assistance before the Second World War, as is reflected in the scant attention paid to it in *Agriculture in the Sudan*. It has benefited most from the development of communications, for where these are available to carry away surplus crops, production for sale in addition to subsistence has been encouraged. The stimulating effect which results is well illustrated by considering the distribution of population in the central clay plain, where the higher density along the railway line between Gedaref and Es Suki is as marked as that along the Blue Nile from Er Roseires to Sennar.

The Development of Animal Husbandry

The development of animal husbandry and of a steady trade in animals and animal products goes ahead, but it has been retarded by a number of factors so that it by no means attains the maximum of which the country is capable. To begin with, the good grazing areas on either side of the Nile have for hundreds of years been the territory of numerous Arab tribes, and modern commercial ranching, or anything approaching it, cannot, therefore, be introduced. All that can be hoped is that the nomads may be persuaded to sell increased numbers of their flocks and herds, and that these herds may gradually be improved in

¹ The banks also lent a little money for the development of pump schemes, despite their general reluctance to provide long-term agricultural credit. In such cases large producers would act as intermediaries to guarantee the sums lent and to supervise operations.

² K. M. Barbour, 'Irrigation in the Sudan; its growth, present development and potential extension,' *Trans. Inst. Brit. Geog.*, 26, 1959.

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quality. Secondly, the various intestinal and intra-muscular diseases of cattle prevalent in the tropics make Sudanese carcasses unacceptable to the markets of Europe, where the best prices might be secured. Thirdly, the scarcity of permanent water supplies means that much grazing has to go uneaten each year because animals cannot reach it, yet at the same time the length of the dry season and the unreliability of the rains are such that animals are often checked in growth and permanently stunted.

Before 1939 a Veterinary Service was set up which provided sera and carried out campaigns for the mass immunization of cattle against rinderpest, bovine pleuro-pneumonia, and similar diseases, and some educational work was also undertaken to improve the quality of hides and skins exported. The measure of success attained by these efforts may be assessed by considering the following figures supplied by the Ministry of Animal Production, which shows the (admittedly very approximate) totals of animal population over the past forty years:

TABLE XIV
TOTALS OF ANIMAL POPULATION

Year	Camels	Cattle	Sheep	Goats
1917	233,955	752,971	1,266,788	1,215,660
1926	410,000	1,500,000	2,000,000	2,000,000
1936	420,000	2,700,000	2,500,000	2,000,000
1946	1,200,000	3,400,000	5,000,000	4,000,000
1956	2,000,000	6,907,000	6,946,000	5,748,000

Attempts to develop fisheries and artificial pearl production in the Red Sea were not successful. Since the war the programme of development of rural water supplies, conducted under the general title of Soil Conservation, has assisted both animal rearing and peasant agriculture by making perennial water available in many hitherto little used areas of potential grazing and cultivable land.

Private Enterprise

The part played by private individuals and commercial firms in developing the country's resources was for the most part less spectacular. In the absence of valuable mineral deposits there was no prospect of establishing a successful extractive industry, while the principal raw material that Sudan afforded, cotton,

especially of long staple, could certainly not provide a sufficient incentive for foreign firms to set up spinning and weaving mills when so many other factors were unfavourable to the establishment of manufacturing industries in Sudan. In general, the small local market for manufactured articles, and the absence of a local tradition of manual skills, discouraged the introduction of any kind of large-scale manufacturing. Among the riverain Sudanese, as in many countries of the Middle East, a man with a little capital generally likes to put it to use by opening a small shop, while on a larger scale he will turn to the import and export business, employing agents to work for him in producing areas, and himself seeking agencies from foreign firms wishing to export to Sudan.

Traditional crafts such as carpentry, boat-building, pot-baking, slipper-making, and gold- and tin-smithing have persisted; local weaving has declined. For the most part, however, the craftsmen have not been able to adapt themselves to modern methods and so reap the benefit of the greatly increased demand for their products.

The Foreign Communities of Sudan

The foreign communities in Sudan are by no means a homogeneous block. The Egyptians, Levantines, and Indians accept Sudan as their permanent home, even if they do not seek Sudanese nationality, but the British, with a few others, who come as the representatives of various banks and commercial houses, expect to return eventually to their native lands on retirement. The Levantines and Indians usually engage in import and export trade, for which their wider knowledge outside the country gives them obvious advantages over the Sudanese. They also set up as skilled artisans, and run bakeries, ice factories, garages, and similar enterprises. General inquiry suggests that the separate communities, especially Greeks, Syrians, and Armenians, keep very close together, lending one another money, employing compatriots, keeping business among their friends, and doing all they can to avoid allowing one of their number to descend to extreme poverty. For the most part these communities have brought no capital into Sudan from outside, and their contribution to Sudan's and

their own prosperity is to work hard, to avoid needless extravagance, and to invest their savings in whatever business they are pursuing.

Of the British firms, some, such as Gellatly Hankey and Company, are members of a large organization with branches in other African or Middle East territories, and they engage in an extremely wide range of business, including importing and exporting, dealing in motor vehicles and machinery, shipping, insurance, ice and mineral water manufacture, and even the retail sale of foodstuffs. Some firms, such as the Sudan Mercantile Company, confine themselves to importing; others, like Boxall and Company, are mainly exporters.

These companies have been interested in Sudan for upwards of fifty years, and while in a few instances they began their operations by introducing sufficient capital to set up offices and warehouses, they have for the most part financed their operations by the ploughing back of their profits. In view of the inevitable lack of experience among the Sudanese in engineering, shipping, and similar matters, these firms have played a very necessary part in the country's development. Some have gone farther, as for instance the Sudan Mercantile which, by supplying numerous pumps for irrigation from the Nile and by maintaining the trained engineers and the spares required to keep them running, has ensured that schemes once begun do not fall into disrepair through neglect. The export trade in gum, hides, grain, and live animals requires less expert knowledge than importing, and so the foreign companies are in competition with Sudanese merchants in these lines.

The major part of all petroleum imports is in the hands of the Shell Company of Sudan, which has been established in the country for more than twenty-five years. Shell have invested capital in erecting bulk storage tanks for benzine, kerosene, and diesel fuel according to the demand. Their products are of great importance for pumps and road vehicles, and for the oil-burning locomotives of Sudan Railways.

Foreign companies have hitherto been permitted to remit their profits abroad without hindrance, but would probably not be allowed to realize their assets and remove their capital.

At present they have little inclination to do so, since the possession of a few good agencies gives them an assured income, and there have as yet been no signs that an independent Sudanese Government would wish to despoil them. Now that Sudan's education system is starting to produce more graduates and literate young men than can easily find employment in the government service, there is a growing demand for the Sudanization of posts in foreign firms. Hitherto, the firms have generally paid less for longer hours than the government, and thus have not attracted the most ambitious of the young Sudanese.

The Five-year Development Programmes

In the first forty years of its existence the Sudan Government was chronically short of funds, and the maintenance of a limited range of essential services, such as police, the law courts, some education, and the medical and veterinary departments, used almost the whole of its revenues. Setting up the Gezira scheme needed a considerable loan from abroad, and there were never any surplus funds available for speculative schemes of development.

The Second World War brought a considerable change in this state of affairs. First there had already emerged from the Graduates' Congress (founded in 1938) an increasing public demand for self-government and independence, and the British administration was regularly criticized for its handling of affairs, a frequent charge being that it was reprehensibly tardy in the development of the national resources. Secondly, as the price of its products rose and the possibility of importing goods declined, Sudan found herself accumulating unspent balances, both private and public. Moreover, at the end of the war a sum of £2,000,000 was granted by the British Government to Sudan in recognition of the Sudanese contribution to the allied war effort.

The Sudan Government, therefore, resolved in 1946 to undertake a definite programme of development, to be spread over a period of five years, and later a second development programme was planned from 1951 to 1956. Rather than promote new activities, the first programme 'sought to meet the deficiencies in building and equipment and in the existing

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services of government which arose from the shortage of money for government spending in the 1930's, and from the shortage of imported and other materials and of labour for civil works in the war years.¹ Nevertheless, certain sums were set aside for the extension of irrigated agriculture, a virtually assured means of increasing the national income, and for the more speculative introduction of mechanized agriculture in the central clay plains, provision of rural water supplies by *hafir*-digging and well-drilling, and establishment of the Zande scheme in Equatoria. The large proportion devoted to education included a gift of £1,000,000 to the Gordon Memorial College in Khartoum, which was being expanded and turned into a University College. The proportions of the total development fund that were devoted to various services and projects are indicated in Table XVI.

The second development programme was introduced to ensure the best use of the very considerable surpluses of revenue that accrued in the years of high cotton prices. £E32,000,000, later increased to £S45,500,000,² were set aside, and government departments were invited to put forward proposals of how they would like to spend more money and increase their activities. The second programme may be seen in Table XVI.

It would not be practicable to attempt here a complete analysis of these two programmes, but certain comments may help to illuminate them. First regional rivalries and the powerful public demand for improved social services, particularly education, made it impossible to devote a very high proportion of the development funds to the most profitable form of investment, namely, irrigation. Even if it had been considered desirable, moreover, the terms of the 1929 Nile Waters Agreement forbade it. Of the other sums spent on agriculture, those devoted to mechanical crop production are beginning to show a return as private individuals are buying tractors and agricultural machinery for use in the clays. The sums spent

on agricultural research, though considerable, may yet be regarded as less than the optimum. Nevertheless, in both instances it should be remembered that Sudan undertook its development programmes at a time when many other territories were doing the same, so that the recruitment of suitable staff, even at generous salaries, was difficult.³

The same problem of inadequate staffing presented many difficulties to the Public Works Department, charged with the erection of public buildings and the construction of roads. Some fine buildings were produced, but there were many delays, and examples of ill-founded or poorly finished work which revealed inadequate supervision. The dispersal of effort produced some isolated stretches of good road and some valuable bridges and culverts, but left the country's road network virtually unchanged. There is still no all-season, let alone all-weather, road from the capital to any of the frontiers, and even between the principal cities of Khartoum and Wad Medani vehicles merely follow a corrugated track across the clay that becomes quite unpassable after rain. Many stretches of road were cleared through the bush of central Sudan and graded by the Ministry of Agriculture's *hafir*-digging teams. Their maintenance will depend on the importance attached to them by local councils and provincial officials.

The sums spent on modernizing and extending the country's telephone and telegraph services, and on buying new equipment for the railways, were necessary for an expanding economy. Since there is little demand in the country for gilt-edged investments which can provide an assured income and yet be readily convertible into cash, departments and municipalities cannot raise internal loans, and it is necessary to use the general development fund to finance improvements in communications and urban amenities. The railway extension to Er Roseires will, it is hoped, encourage further cultivation of grain and other crops in the southern Gezira. The line newly built to Nyala should bring Darfur more closely into economic

¹ Sudan Government, *Development Budget Estimates, 1946-51 and 1951-56 Programmes*, 1953.

² On attaining independence the Sudanese decided to introduce their own currency, the Sudanese Pound (£S), to replace the Egyptian coins and notes hitherto in use. The change-over was effected in 1956, the £S being of the same face value as the £E. For some time there still remained an appreciable quantity of Egyptian coinage in circulation, and English shillings and florins were until 1958 accepted as worth 5 and 10 piastres respectively, though the cupro-nickel 'silver' has never been legal tender.

³ Republic of Sudan, *Development Budget Estimates 1957-58*, Development Budgets, 1957.

relations with the riverain areas, while the southern Qoz, through which the line is to pass, has great possibilities for grain, sesame, and ground-nuts. The whole Qoz region, which is outstandingly difficult for lorry transport, has the advantage of easy railway construction across it, since little bridging is required. The building up of Sudan Airways has been an immense boon. Between Khartoum and Juba it has reduced the time of travel from fourteen days to a morning, while between Khartoum and El Fasher the journey which used to take a week by rail and commercial lorry can now be completed in four and a half hours. Even where the railway competes on a route the airways are generally preferred by those who can afford the extra cost of flying, for they are swift, clean, and reliable, whereas wash-outs may delay a train for several days in the rains.¹

The sums spent on public utilities and social services have inevitably been concentrated in urban areas, especially those by the Nile where the most vocal, sophisticated, and prosperous elements of the population are to be found. In consequence, they tend to increase the existing contrast between the amenities of town life and the discomforts of the countryside. This has been deplored in some quarters as tending to produce an urban proletariat with 'no roots in the soil' and declining moral standards. It is, however, an inevitable feature of bringing civilized amenities to a large and thinly populated country that they must at first be concentrated in patches rather than evenly distributed, and in any case the urban population in Sudan is still very small, even when compared with other principally agricultural countries.

In terms of the country's needs, literary education has probably been over-emphasized at the expense of technical training. Moreover, the impact of the secondary schools may have been reduced for the sake of the University College, in that English has been the medium of secondary education. The large Technical Institute that was set up in Khartoum under the second development programmes should help to remedy this, as should the proposed

change to instruction in Arabic in the schools. On the other hand, it should be recognized that in all poorly developed countries, particularly those with severe climates, there is always a tendency to over-value literary as opposed to manual skills. This is a field in which the Catholic missions, particularly in the south, played a valuable part, and it will be the responsibility of the Sudanese Ministry of Education to ensure that in taking over the mission schools they do not sacrifice this tradition.

The end of the second development programme coincided with the advancement of the University College in Khartoum, originally built by subscription as the Gordon Memorial College, to the status of an independent university (Plates XLI and XLII). As an institution, the college has always been somewhat ahead of public opinion and the country's needs in its provision of faculties and courses. The only considerable changes in its functions now envisaged are the creation of a school of architecture and the establishment of an anthropological research centre for which Sudan has long been regarded as an outstanding field laboratory. The long-established Kitchener School of Medicine continues to attract many of the cleverest young Sudanese—too many, perhaps, if the relative value of medical officers and higher civil servants are assessed in other than purely financial terms. Courses are also available for training agricultural officers, veterinary surgeons, civil and mechanical engineers, and civil and Shari'a lawyers, in addition to the basic arts and science graduates.

THE ECONOMY OF AN INDEPENDENT SUDAN

Industrialization

In the opinion both of the highly nationalistic politician and of the observer apprehensive that Sudan might once again be cut off from external supplies, the absence of provision for manufacturing industries is the most serious omission from the list of development projects. Even though there is no overall land hunger in Sudan, there are parts of the Northern

¹ The loss of first-class traffic by the railways has been reflected in a decline in the profitability, and hence in the quality, of the first-class service.

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Province where there is insufficient employment to keep the male population fully occupied at home. These certainly constitute reservoirs of labour to be tapped. Moreover, the greater productivity per man-hour of factory over manual or field labour is well known, and constitutes a standing incentive for the establishment of factories.

In industry, so far as it exists, the dominance of east-central Sudan is as striking as it is in agriculture. Hitherto, virtually the only factories of any significance have been the salt-works at Port Sudan (1934), the cement factory at Atbara (1939), the meat-cannery at Kosti (1952), the cotton-mills at Nzara (1950), and some soap, mineral water, and tanning works in various urban centres. Since Sudan is a cotton-growing country further cotton-mills are an obvious choice for investment, and a cotton-mill is now being set up, partly with foreign capital, in Khartoum. In terms of market and labour this is an obvious site, and the raw material, medium staple cotton, could be grown locally or brought from the Nuba Mountains. Cotton weaving is unfortunately a field in which every under-developed country seems to compete as it emerges from the stage of primary production only, so there is little prospect of an export trade in cotton goods. In fact, it will be an appreciable achievement if the factory can eventually compete against the countries of the Far East with no more protection than the standard tariff of 25% (1957).

Recently, the new Sudanese Government has made its policy plain concerning 'the encouragement of local and foreign capital in the field of industry and its attitude towards foreign capital in general' by the publication of a pamphlet and the promulgation of an appropriate Act. It is its intention that all 'Industries other than Railways, Public Utilities, etc.' (this includes Ordnance Works) 'should be open to private enterprise'. When foreign industrialists wish to set up industries in Sudan they are promised the right to remit profits and *bona fide* individuals' savings abroad, and are assured fair and equitable compensation in the event of acquisition of any property for

nationalization. They are also assured that there will be no discrimination between foreign and local enterprise.¹

Certain industries, moreover, whether established by Sudanese or foreigners, may also be classified as 'approved' or 'pioneer' enterprises; for this they need, in general terms, to hold out a fair prospect of success and of benefit to the public interest (e.g. by saving foreign exchange), to perform a function not hitherto performed in the country, and to be in need of initial assistance or protection. If they fulfil these conditions, they are offered, for up to five years, a reduction of the rate of Business Profits Tax, a heightened depreciation allowance, certain privileges by way of reduced import duties, preferential railway rates, and other benefits, including 'protective duties on competitive articles from abroad on the basis of the recommendation of an impartial expert body'. It is always understood that foreign enterprises should provide 'reasonable facilities for the training . . . and progressive participation of Sudanese personnel in their establishments'.

How far foreign investors will be attracted by these conditions, and by assurances given in 1957 by the Minister of Finance, remains to be seen. It depends very much on the general political situation in Sudan and the Middle East in the coming years. At present light industries are springing up apace in the Three Towns and elsewhere. As far as Sudanese investors are concerned, cotton growing, building, and commerce remain among the most attractive kinds of enterprise, fields in which trade unionism has hitherto been less effective than in more closely organized industries. In passing, therefore, we may expect that the present ruling class in Sudan, which is a fairly close association through family ties and intermarriage of politicians, merchants, officials and army officers, and is fairly closely involved in cotton production, will show little sympathy for policies which keep down the price of cotton or strengthen the bargaining position of labour in the cotton-fields.

Yet economic development cannot be held to consist merely of the creation of manufacturing

¹ Republic of Sudan, *The Approved Enterprises (Concessions) Act, 1956*, and statement of 'Government Policy towards the encouragement of local and foreign capital . . .', 1957.

industries, whether with domestic or foreign capital. It is also intimately concerned with releasing and deploying the potential managerial and inventive ability of the Sudanese people, the diversification of their activities and the increase of the services that they can perform for one another. Thus a significant way of looking at the present state of development in Sudan is to consider what proportion of the gainfully employed population is occupied neither in agriculture nor in animal husbandry but in industry or services. Figure 102, therefore, which deals in effect with all persons not covered by Figs. 33 or 34, may be looked on as an indication of the present state of human development of the country.

The Economic Dilemma of Sudan

The people of Sudan are well aware of the dilemma that confronts them. On the one hand, they wish to rid themselves of their present dependence on cotton as an export crop, yet can find no other product that comes near to competing with it for ease of production or for price in the special conditions of Sudan. On the other hand, they wish to balance agriculture and animal rearing with factory industries, which generally enable the individual's productivity to be much higher and provide a buffer against wars, cotton slumps, and the cessation of imports. Yet successful Sudanese industrialists cannot be created by legislation, while at the same time it would be politically undesirable to give foreigners excessive influence in any one branch of the nation's economic life.

Moreover, there are today marked differences between the development prospects of the several regions of the country, tending to increase rather than reduce the existing disparity in wealth and opportunity between the lands along the Nile and the remainder of Sudan. Just as the Sudanese wish to catch up industrially with other more advanced countries, so the remoter and more backward parts of Sudan are not content to lag behind the rest. In so far as investment is controlled by the government, it will always be a tricky political problem whether money should be spent in the areas affording the best prospect of a good return, or whether it should be distributed

according to ideas of spreading the benefits equitably between provinces or regions.

In the Northern Region it cannot be expected that agricultural expansion will do more than keep pace with the growing number of mouths needing to be fed. Good rail communications, however, combined with the prospects of generating electricity from the Nile, suggest that the Shendi-Atbara-Berber reach affords a reasonably secure prospect of developing industrially. In western Sudan, on the other hand, there are immense prospects of increased agricultural and animal production, but industries are less hopeful, for apart from problems of fuel or markets the creation of cities must always present fundamental difficulties in securing fresh provisions or an adequate water supply.

In the central clay plains agricultural expansion is already well advanced, and through the Gezira Scheme and private pumping schemes it is financing much of the development taking place in the country at large. The industrial prospects are essentially the same as those of northern Sudan, with the added feature that the Three Towns, containing most of the foreign commercial population, are likely for some years ahead to show the most enterprise in exploring new lines of business. Eastern Sudan has by comparison fewer prospects. Agricultural production is unlikely to expand much, and while Port Sudan may grow industrially because imported raw materials are cheap, it has the disadvantage of being almost 800 km. from the capital where the best market is to be found.

In southern Sudan the potential value of much of the land is great, but so many human, social, and economic problems are present that it is impossible to foresee a speedy extension of production and trade. The Zande scheme and the industrial establishments at Nzara have shown that the Azande can be trained to grow cash-crops and work in factories, but they have not yet proved that this is a profitable form of investment. Reference to the work of the Southern Development Investigation Team has already been made in Chapter XVI.

These problems will have to be discussed and resolved by the Sudanese themselves, for the great political and social revolution of the

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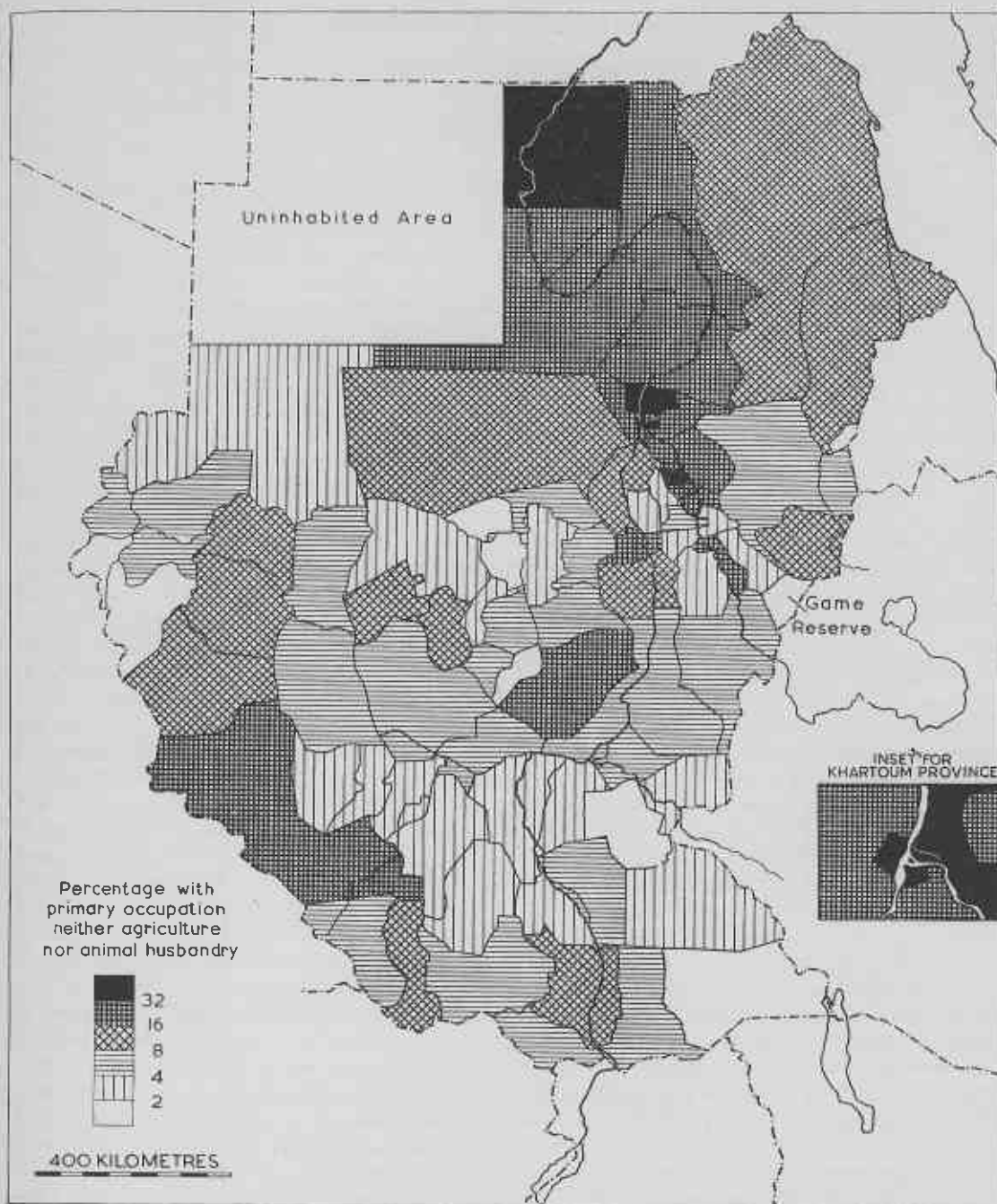


FIG. 102. Primary occupations in Sudan--the percentage of persons who are neither farmers, farm labourers, animal owners, nor animal herders. Within the individual regions of Sudan this map affords a valuable indication of the general state of economic development, and it clearly indicates the more advanced state of the economy in Blue Nile and Northern Provinces than elsewhere. Overall comparisons are unreliable, however, since in predominantly nomadic areas (e.g. Northern Kordofan) the percentage of animal owners and herders is much less than that of farmers and farm labourers in wholly agricultural areas. The exceptionally high figure for secondary activities in Western Bahr el Ghazal is to be ascribed to the training given by mission schools--principally Roman Catholic--in the area. Source as for Figs. 33 and 34.

past twenty years has resulted in the termination of the Anglo-Egyptian Condominium and in the installation of the educated Sudanese as the undoubted rulers of their country. As an indication of how things are likely to go, it is worth recording that while rejecting tribalism

or the rule of the Nāzirs, the Sudanese now in power are not seriously interested in socialism. It may require either a serious slump or the emergence of a considerable educated and unemployed class to undermine the social and economic structure of Sudan as it stands today.

TABLE XV
VALUE OF SUDAN'S IMPORTS AND EXPORTS

	<i>Imports</i>	<i>Exports and Re-exports</i>		<i>Imports</i>	<i>Exports and Re-exports</i>
1906	£E1,222,527 c.i.f.	327,823 f.a.s.	1940	£E5,633,889 c.i.f.	5,444,797 f.a.s.
1910	1,931,426 "	1,035,579 "	1950	27,266,865 "	33,112,853 "
1920	7,006,865 "	5,075,971 "	1959	57,046,000 "	66,787,000 f.o.b.
1930	6,117,410 "	5,246,013 "			

TABLE XVI
DEVELOPMENT PROGRAMMES

<i>Heading</i>	1946-51		1951-6	
	<i>Total</i>	<i>%</i>	<i>Total</i>	<i>%</i>
1. Health	30,191	0.2	3,452,390	7.7
2. University	1,262,235	8.6	821,599	1.8
3. Education	157,703	1.1	7,754,034	17.2
4. Agriculture	1,914,989	12.4	3,207,381	7.2
5. Irrigation	2,461,713	16.8	2,042,517	4.5
6. Animal Production	9,585	—	428,023	0.9
7. Works	1,380,514	9.8	2,633,619	5.9
8. Posts and Telegraphs	504,443	3.5	1,852,604	4.0
9. Surveys	47,636	0.3	320,628	0.7
10. Civil Aviation	123,000	0.9	478,229	1.0
11. National Guidance	13,176	0.1	333,700	0.7
12. Prisons	9,600	—	243,007	0.5
13. Mechanized Transport	433,500	3.0	1,082,390	2.4
14. Commerce, Industry, etc.	28,127	0.2	29,643	—
15. Provinces	23,975	0.2	54,000	0.1
16. Rural Water Supply	853,314	5.8	1,138,741	2.4
17. Public Works	4,500,000	30.8	1,694,545	3.8
18. Roads and Communications	500,000	3.5	2,318,080	5.1
19. Local Government	308,600	2.2	2,144,000	4.7
20. Sudan Airways	—	—	472,000	1.0
21. Sudan Railways	—	—	6,600,000	14.7
22. Development Branch	—	—	231,250	0.5
23. Customs	—	—	27,611	—
24. Stores and Equipment	—	—	53,434	0.1
25. Mint	—	—	70,000	0.1
26. Printing Works	—	—	100,000	0.2
27. Police	—	—	192,000	0.4
28. Judiciary	—	—	21,000	—
29. Geological Survey	—	—	80,941	0.2
30. Native Housing	—	—	156,500	0.3
31. Statistics	—	—	500,800	0.9
32. Sudan Light and Power	—	—	3,737,610	8.3
33. Gezira Board	—	—	350,000	0.8
34. Unallocated	81,065	0.6	877,724	1.9
35. Grand Total	14,620,000	100%	45,500,000	100%

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	8.3
	0.8
	1.9
	100%

Chapter XVIII

THE WAY AHEAD

It has proved possible in an earlier chapter (Chap. VII) to give an estimate of how Sudan's population is likely to grow over the coming years. The Sudanese are predominantly Muslims, whose faith forbids the use of birth control, and the people as a whole are intensely conservative in personal and domestic affairs. It seems reasonable to assume, therefore, that no type of family limitation will be adopted in the foreseeable future to falsify the prophecies of the demographer. It is more probable, in fact, that improved public health facilities will reduce avoidable deaths, particularly among children, and so increase the rate of growth of the whole population. This would complicate such already intractable problems as the provision of housing, schools, or hospitals, and is also likely to have far-reaching political effects, as the negroid tribes approach and attain numerical parity with the northerners.

Yet while the population rises we cannot be equally confident of the expansion of Sudan's economy, since this is dependent on less predictable factors operating both within and outside the country. On the political plane, Sudan would presumably stand to gain from a return to more settled conditions in the Middle East, since this would make the foreign investor readier to lay out his money on long-term projects and might reduce current expenditure on armaments. On the other hand, there are undoubted opportunities, in a disturbed period, of obtaining financial aid from rival foreign governments, and private nests can often be feathered when public business stagnates. Nothing would more effectively vitalize and speed up the growth of Sudan's economy than a decision to carry out the plans for Nile Control known as the Jonglei proposals, but since the new Nile Waters Agreement permits the Egyptians to go ahead with the High Dam, the prospect of starting work in Sudan seems remote.

Of more immediate importance, from Sudan's

point of view, would be a return to a more stable demand for her principal export, cotton. The successful marketing of the Gezira cotton crop is of such importance to the country that inevitably the politicians feel obliged to take part in the negotiations. Unfortunately, this brings the price, the nationality of the purchasers, and the means of disposal, whether by contract or by auction, into the realm of public dispute. Reproaches and accusations are bandied about in the Press, and the events of 1957 and 1958, when Sudan was left with almost a whole year's crop unsold on her hands, have shown that inexpert handling can cut off at the source almost the whole of the country's supply of foreign exchange.

Yet even the best sales policy can succeed only when there is a consistent demand for the product offered. Today artificial fibres or mixtures of artificial fibres with medium staple cotton are meeting much of the demand formerly supplied by long-staple cotton, and competition from this source is likely to increase. Though much of Egypt's cotton has been bought in recent years by the Soviet Union and other Communist countries, Sudanese cotton has not commanded a ready sale with its traditional buyers in the United Kingdom, France, and elsewhere. This is because these long-established users are going through a marked depression, particularly in Lancashire, while the many new textile industries that are being established in other parts of the world and are capturing the markets are generally buying cheaper cottons than Sudan's. When the Americans turn to disposing of stocks of American cottons at artificial prices, it is hard for small countries whose economies depend on cotton to compete on equal terms.

Such considerations, together with the fact that relatively minor changes in the terms of trade can have disastrous effects on a poor country's balance of payments, pose highly important political problems. Would it be to

Sudan's advantage to join a group or union of states which could speak with a louder voice on economic and other matters? And if so, does Sudan's destiny lie with the Arab states to the north, in many ways akin to her own northern provinces, or with the African states of the west and south, among whom there are mixtures of tribe, tongue, and creed comparable in complexity with those of Sudan herself?

These are not questions to which the geographer should try to find an answer, though he can scarcely help asking them as he surveys the Sudanese scene. Throughout this work an attempt has been made to give an account of

some of the ties of administration, of communications and commerce, and of common interest that hold Sudan together and give the country a distinctive personality. It will now be for the Sudanese and other inhabitants of Africa to determine their own destinies. They must choose whether they want to redraw the political map of the continent, or whether they are content to make use of a pattern of boundaries and states bequeathed to them by the Europeans. The white man set in motion revolutionary changes in Africa, but responsibility for the future lies in the hands of the Africans themselves.

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GLOSSARY AND ORTHOGRAPHY

*A glossary of Arabic and other non-English words employed
and a note on the system of spelling adopted*

THE demands of precision and brevity have made it virtually impossible to avoid the use of a number of foreign expressions in this work. In the glossary below all the words and expressions listed are Arabic, though not necessarily classical Arabic, unless otherwise stated. The system of transliteration used is R.G.S. II, which is also employed, with some inconsistencies, by the Sudan Survey Department. For all place-names and most tribal names, the *Gazetteer of the Sudan*, 1931 edition, has been followed.

anis	<i>Sorghum purpureo-sericeum</i> , a <i>hariq</i> grass.	dukhn	<i>Pennisetum typhoideum</i> , bul-rush millet.
ansora	<i>Hyparrhenia pseudocymbaria</i> , another <i>hariq</i> grass.	faki	Holy men.
'aradeib	<i>Tamarindus indica</i> .	fasulia	<i>Faseolus vulgaris</i> .
atamur	Sand-dunes stabilized by a small clay content.	fau	Dark, cracking clay soil, liable to shallow flooding, in southern Kordofan and Darfur.
atbai (Beja)	The plains to the west of the Red Sea hills.	feddan	A measure of area used in Egypt and Sudan, equalling 1.038 acres.
aulib (Beja)	The Red Sea hills.	ful masri	<i>Vicia faba</i> , the Egyptian bean.
balagh	Land accidentally flooded in the Gash Delta.	gbaria	Track joining huts in Zande area.
bamia	<i>Hibiscus esculentus</i> , okra or ladies' fingers.	gwineb (Beja)	The Red Sea coastal plain.
barchan	A crescent-shaped sand-dune.	hababai	A hot wind of late summer in the Red Sea coastal plain.
bersim	<i>Medicago sativa</i> , lucerne.	habub	A violent convectional dust-storm.
bidonville (French)	A collection of poor slums and shacks occupied by indigent urban workers.	hafir (pl. hafayir)	An artificially excavated surface reservoir.
Bilad es Sudan	The Lands of the Blacks, hence the Sudan: today the term 'Sudan' is increasingly being used in English instead of 'The Sudan'.	haraz	<i>Acacia albida</i> .
buda	<i>Striga</i> sp., especially <i>hermonthica</i> , the parasitic witchweed.	hariq	Fire, hence a system of preparing ground for cultivation by burning the grass upon it.
damira	The Nile flood, hence the cultivating season that immediately follows it.	hashab	<i>Acacia senegal</i> , also the gum arabic which it yields.
dar	A homeland or tribal centre.	hawasha	A tenancy in the Gezira or in other agricultural schemes.
darat	The warm season at the end of the rains before the north wind begins to blow.	inderab	<i>Cordia abyssinica</i> .
Darb el Arba'in	The caravan road from Darfur to Asyut, which traditionally takes forty days to traverse.	inselberg (German)	An isolated hill standing up from a plain.
dhura	<i>Sorghum vulgare</i> , millet.	jammeiz	<i>Ficus sycamorus</i> .
doleib	<i>Borassus aethiopicum</i> , a species of palm.	jebel	A hill.
dom	<i>Hyphaene thebaica</i> , the branching palm.	Jellaba	Northern merchants in Kordofan or the southern provinces.
		kantar	A measure of weight, especially of cotton. A large <i>kantar</i> of unginned cotton equals 315 rolls, a small <i>kantar</i> of ginned cotton is 100 rolls.

katiri	System of cultivation in Moru area.		the direction of the prevailing wind.
kerrib	Severely eroded land by a river bank.		(b) The hot, dry summer season.
kharif	The rainy summer season.	seifi	Adjective from (b) above.
khør (pl. kheiran)	A short-lived stream or watercourse; also a back-water of the Nile or a narrow inlet of the sea.	seluka	A digging stick, hence land sown after wetting by the Nile flood because a digging stick is used for making holes for the seed.
<u>kiteih</u>	<i>Trigonella laciniata</i> , a grazing plant of the Kerma Basin.	semn	Clarified butter.
kitir	<i>Acacia mellifera</i> .	seyal	<i>Acacia spirocarpa</i> .
la'öt	<i>Acacia orfota</i> .	shadūf	A hand-operated lever for raising water.
lebad	The rich silt soil of the Gash Delta.	shari'a	Muslim law.
lubia	<i>Dolichos lablab</i> .	sheikh	A village headman or the leader of a group of nomads.
lulu	The shea butter nut, fruit of <i>Butyrospermum parkii</i> var. <i>niloticum</i> .	sheil	A system of loan, ostensibly without interest, secured against growing crops.
maya	A seasonal pool in central Sudan flooded by the overflow from a stream or river.	shitā	Winter.
mesa (Spanish)	A flat-topped hill formed of horizontal strata.	shitwi	Adjective from the above.
millième (French)	A thousandth part of a Sudanese pound, worth $\frac{1}{4}$ d.	siha	<i>Blepharis</i> sp. (?) <i>edulis</i> , a valuable fodder plant in the Butana.
misqa	A minor irrigation channel.	sudd	An obstruction, hence the floating vegetation which may obstruct navigation on the Upper Nile, and hence the swamps region itself.
nagana	Trypanosomiasis in animals, transmitted by tsetse flies.	sunt	<i>Acacia arabica</i> var. <i>nilotica</i> , often found by the banks of the Nile.
najil	<i>Cynodon dactylon</i> , a common grass in irrigated areas.	surret (also known	as seroot) <i>Tabanus</i> sp., a fly with a bite very painful to animals and men.
naqa'a	A flat-surfaced non-cracking clay.	talh	<i>Acacia seyal</i> .
nāzir	A tribal leader.	talha	A dark, cracking clay not liable to flood in southern Kordofan and Darfur.
neem (Indian)	<i>Azadirachia indica</i> .	tebeldi	The baobab tree, <i>Adansonia digitata</i> .
nimitti	<i>Simulium griseicollis</i> , a small and troublesome fly.	teras (pl. terūs)	An earth bank built to divide fields or to check the flow of rain-water.
'omda	A headman of a group of villages or of a section of a tribe.	terfa	<i>Tamarix articulata</i> .
'omodia	The territory or followers of the above.	tōb	A piece of cloth about 3 m. long worn as an outer garment by women.
piastre	One hundredth part of the Sudanese pound, worth $2\frac{1}{2}$ d.	toich (Dinka, sometimes written <i>toic</i>)	The flood-plain of the Nile which affords good grazing in winter after the flood subsides.
qardūd	A reddish sheet-eroded loam soil.	umm shutur	<i>Kigelia aethiopica</i> , the Sausage Tree.
qoz	A general term for sand-dunes.	'ushar	<i>Calotropis procera</i> , the Dead Sea Apple.
qubba (pl. qubbāt)	The tomb of a holy man, often a conspicuous dome.	wadi	A large river with a sandy bed which flows intermittently in the rainy season.
raqāba	A clay-bottomed meandering channel in southern Kordofan and Darfur.		
rotl	A measure of weight, equals 0.99 lb.		
saqia (pl. sawāqi)	An ox-drawn water-wheel.		
saqiya	A grassy stretch of clay soil, bare of trees, in <i>Acacia</i> woodland.		
seif	(a) A sword, hence a long sand-dune, lying roughly in		

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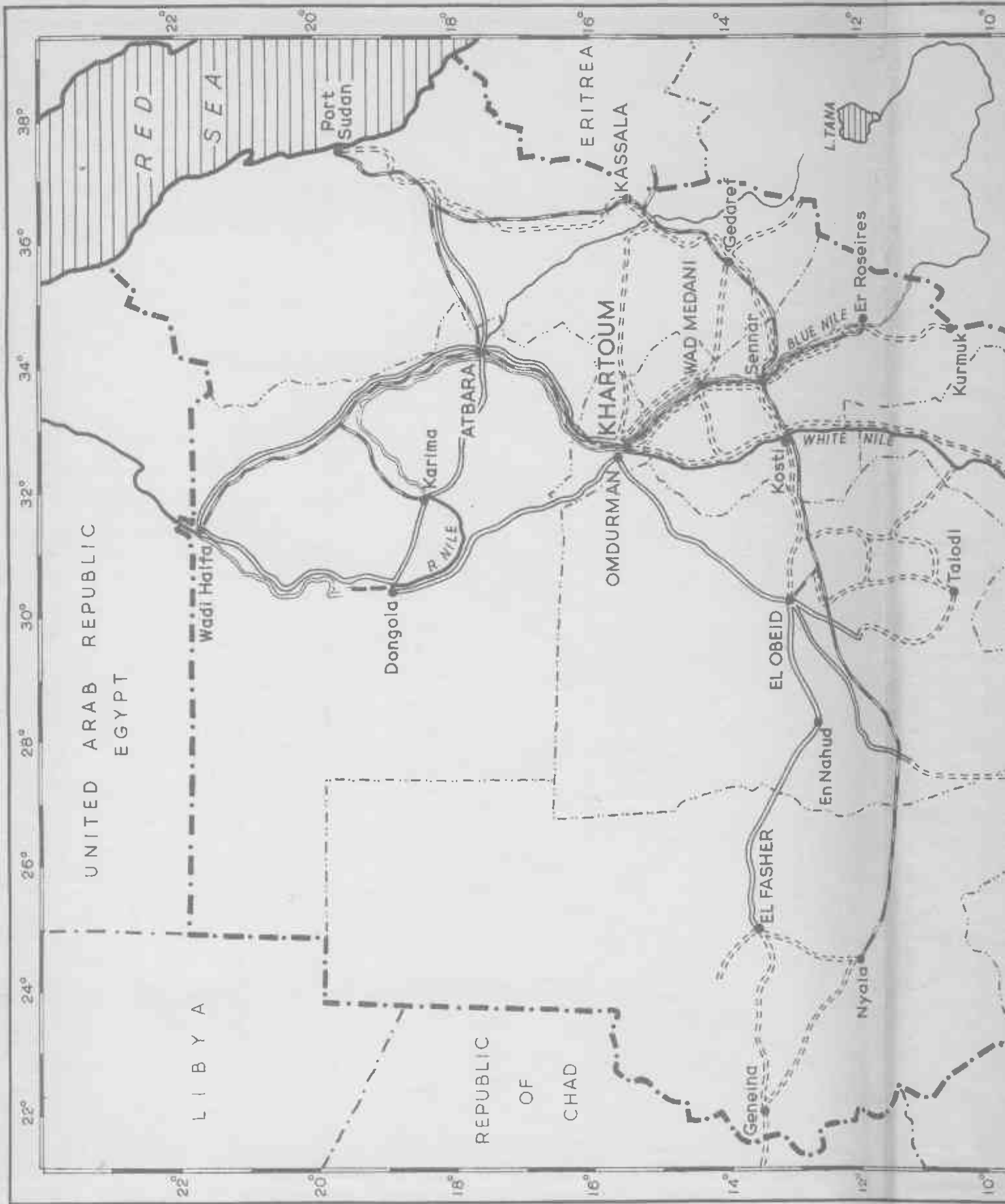
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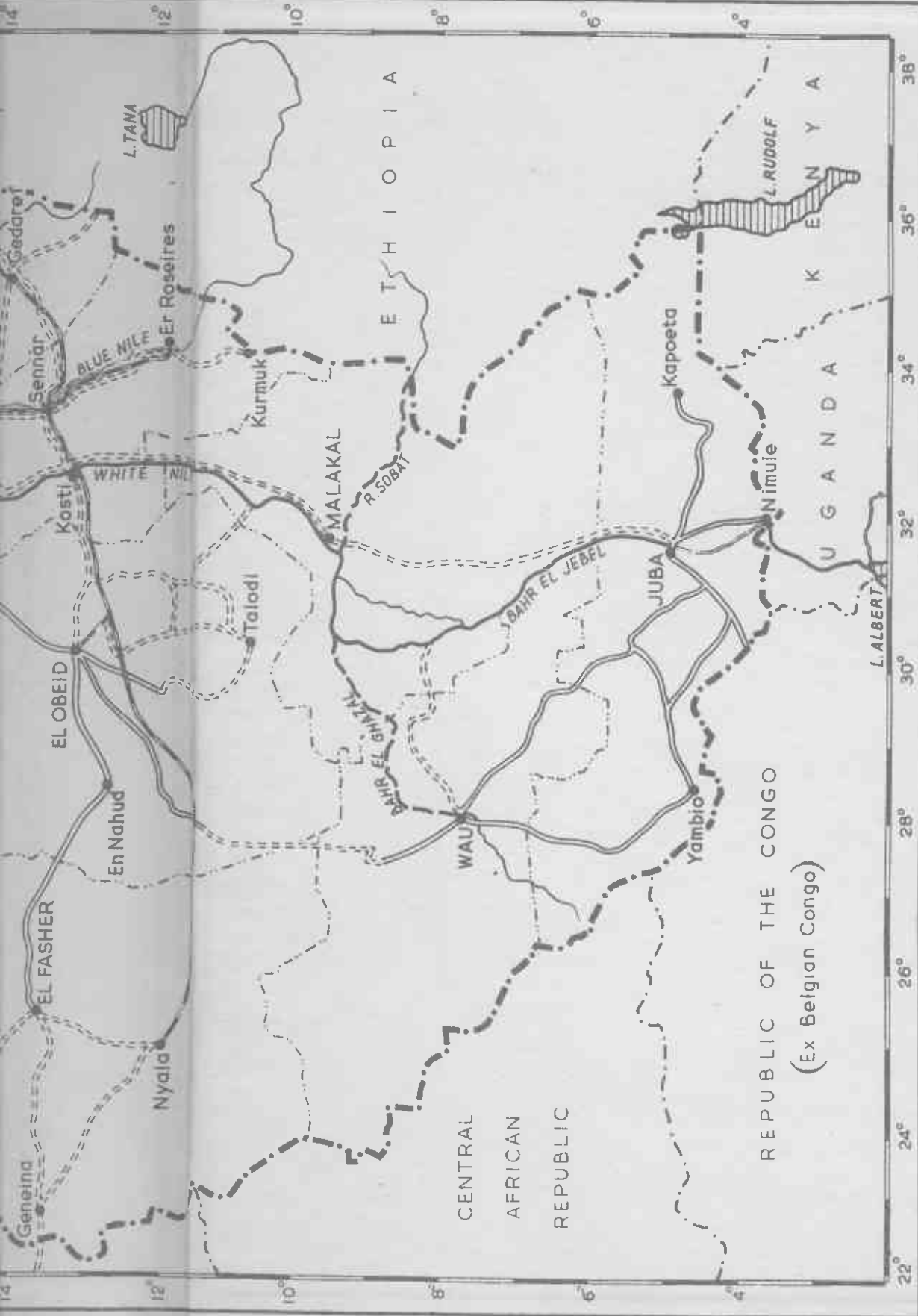
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