THE FACTORS AFFECTING SETTLEMENT DISTRIBUTION IN THE SUDAN

BY EL-SAYED EL-BUSHRA

Department of Geography, University of Khartoum

The distribution of settlements in the Sudan is affected mainly by physical, political and socio-economic factors. The physical ones such as those of rainfall and geology, which have a direct bearing on the availability of water, determine the limits of permanent settlements, but within that social, cultural, historical, technological and economic factors affect their number and distribution. The physical factors are nature-given and, although acted upon and modified by man, definitely affect the pattern of settlement distribution and, therefore, the choice of man. The political and economic factors, however, are man-made and certainly reflect man's political and economic behaviour in dividing his territory into political and economic units.

In the Sudan, the influence of the political factor became evident after the reconquest (1898), the result of which was the establishment of administrative centres at various points in the country. On the other hand, the introduction of agricultural schemes and the concomitant colonization of the once vacant cultivable land has given birth to completely new settlements and has also boosted the growth of the existing ones. Moreover, with the advent of rail and automobile transportation, numerous new settlements have emerged, and others have witnessed an overall increase in population together with the acquisition of new functions.

Physical Factors. In a tropical continental type of climate settlements are generally associated with water sources. In its present context water includes all surface and subsurface sources, and forms the key to economic development. Given the present level of economic and technological development in the Sudan it is recognized that north of the 25 mm. (1") isohyet life clings very strongly to the Nile, since beyond both banks of the river the land is occupied by barren, lifeless desolate sandy deserts. All settlements in this region, save for the very few oases settlements, depend entirely for their existence on the Nile and are, therefore, located on its banks. Even the wells and oases in the desert draw their water by seepage from the Nile. The river has also produced the fertile strips along its banks which made possible their economic development. Life, therefore, is much controlled by the regime of the river.

Between the 25 mm. (1") and the 100 mm. (4") isohyets it has been found that life begins to free itself from the dominating control of the Nile, but permanent settlements are still attached to it. The amount of rainfall in this area is too little to raise agricultural crops and therefore does not support settled life. In this zone the camel-owning tribes move north and south according to the movements of the rain belt in search of water and pasture for their animals. Here some temporary camps are made by nomads wherever grass and water are found. Between the 100 mm. (4") and the 300 mm. (12") isohyets the production of agricultural crops is chancy and therefore large settlements are absent. Here rainfall is still too little to support large-scale agricultural schemes or towns and so small agricultural villages are found. To the south of the 300 mm. (12") isohyet the amount of rainfall becomes sufficient to raise crops and so settled life begins to detach itself gradually from the all-pervasive influence of the Nile. Between the 300 mm. (12") and the 800 mm. (32") isohyets villages and towns are found away from the river, where a permanent source of water is found together with the favourability of the economic and social factors.¹

Fairly large towns, such as El Obeid, El Fasher, Nyala, Kassala, Gedaref and Port Sudan developed and gained in importance away from the Nile, because of the availability of an assured

¹ J. D. Tothill, editor, Agriculture in the Sudan, 1948, pp. 62—83.
THE FACTORS AFFECTING SETTLEMENT DISTRIBUTION IN THE SUDAN

water supply. Nevertheless, the Nile is dominant in attracting settlements, especially large towns, not only in providing ample supplies of water, but also as an important artery of trade and communication. Its direct effect on trade and communication was unsurpassed before the advent of modern transport. Even in the Gezira, where the largest agricultural scheme is located, large settlements, especially towns, are associated with the Blue and White Niles. In general terms, although settlements tend to develop to the east and west of the Nile, small peasant villages are the

Fig. 1. Sudan distribution of population 1955.
Fig. 2. Sudan, geological map. 1 Quaternary Red Sea Deposits. 2 Umm Ruwaba Series (Plio-Pleistocene). 3 Tertiary Effusive Rocks. 4 Tertiary Red Sea Marine Deposits (Miocene). 5 Hudi (Chert) Series (possibly Oligocene). 6 Nubian Series (Mesozoic). 7 Yirol Beds (Mesozoic). 8 Nawa Series (Pre-Mesozoic). 9 Palaeozoic Sandstone (Continental Tassilian). 10 Pre-Cambrian Basement (Undifferentiated).
THE FACTORS AFFECTING SETTLEMENT DISTRIBUTION IN THE SUDAN

general rule. The small quantities of water which can be obtained either by tapping the underground supplies or by using the surface streams and wadis can support only a small group of people, therefore, giving rise to small settlements. In other words, the size of settlements is largely governed by the amount of water available for domestic and animal use.

Between the 800 mm. (32") and the 1400 mm. (56") isohyets in the southern Sudan (land between 4° and 10° N.) water is no longer a problem from the agricultural point of view, and a wide range of crops can be cultivated. The Nilotic tribes who live in this area are cattle owners and, therefore, pay little heed to crop husbandry. The life of the primitive tribes is completely dominated by the regime of the rivers. Permanent settlements are found in the highlands or flood-free areas, and the cattle herders are forced to move to these settlements during the rainy season (April to December) because of the floods and the biting insects. In the flood plain, however, only temporary huts or camp-camps are erected during the dry season when the land is being used for grazing. The settlements of the Nilotes whether permanent or temporary seem to be closely associated with the river system.

After all, the river provides water for both man and beast, it produces the toich grass which is used for grazing, it provides the people with fish and also acts as an important medium of transportation between the villages. The villages of the southern Sudan are small in size, not exceeding a few hundred inhabitants and are generally of the dispersed type. In other words, the nucleated agricultural village which is typical of the northern part of the country does not exist here.

The availability of water, however, is not only governed by the amount of rainfall, but also by geology, which affects the amount of rain water that can be stored in underground pockets and that can be utilized and brought to the surface. This, in turn, affects settlement distribution. Rainfall alone is not a true measure to the amounts of water which can be utilized, because the quantities which are of real value are those stored and left behind after the losses by evaporation, transpiration and runoff.

The solid geology of the Sudan falls into two main formations, namely, the Nubian Sandstone and the Basement Complex. The Nubian Series which cover parts of the desert in the north and the centre is a water-bearing formation and its existence acts as a guide to settlement distribution away from the perennial streams. To the north it is covered by a thin mantle of loose sand, while to the south the cover is a layer of varying thickness of clay and sand. In certain parts of the central clay plains (the area to the east of the Nuba Mountains between latitudes 10° N. and 15° N.) the clay is more than one hundred feet in thickness. The thickness of the clay affects to a large extent the supplies of water. To the north of latitude 19° N. the amount of rainfall is small, amounting to less than 25 mm. (1") in certain parts, and although the Nile supplies the nearby wells, rich underground supplies are lacking as one moves away from the river. But still the amount supplied by wells near the Nile (wells at a distance of between two and three miles on either bank of the river) are just enough to support small villages. Similarly, the wells that lie between latitudes 15° N. and 19° N. supply small amounts for the nomadic tribes.

The superficial deposits of sands and clays that cover the Nubian Series in the central Sudan (the land between latitudes 10° N. and 15° N.) both inhibit the availability of ground water. Ground water is very meagre over the clay plains, because the heavy clays are impermeable and, therefore, obstruct the penetration of rain water to underground reservoirs. The cracking clays absorb water for a few feet, then expand so causing water on the surface to be lost by evaporation and transpiration. The sands, on the other hand, although better than the clays in allowing water to percolate, are too porous and so lose large quantities of water through capillary action. It is also very difficult to dig deep wells in sandy areas because of the loose nature of sands.

The volume of ground water is very much affected by the seasons, and the largest volume is attained during the rainy part of the year (July to September). This has much bearing on the level of water and, consequently, on the amount of effort needed to bring it to the surface. Again, fluctuations in the water-table are brought about when a source of water is being tapped for a long time, in which case the water-table will be deeper. Some of these water sources are abandoned.

completely when they cease to furnish adequate supplies. People then have to move to the nearest water source causing increased demands on existing supplies and by grazing their animals also bring about overgrazing and soil deterioration. Some of the villages in eastern Sudan have to be abandoned completely during years of poor rainfall, while some of the villagers have to go daily for a distance of about 20 miles or 32 kilometres to bring water from the nearest watering
point. In short, water shortages lead to settlement dislocation.

On the whole, more of the shallow wells that support a few people are found on the sands rather than on the clays. *Khor* or *wadi* beds provide ample supplies of water during the dry season from wells known locally as *tumuds*, and the larger the supply the bigger is the settlement. The fact behind all this is that *khor* beds are made of softer materials which allow water to percolate

Fig. 4. Elongated settlement on the western bank of the Nile, north of Khartoum. North is to the right.
and be stored in large quantities. The immediate result is that throughout the central Sudan settlements are attracted to these khor and wadi beds. Numerous peasant villages are located near such torrents as Wadi Azum, Wadi Nyala and the water courses that drain to Jebel Marra and the Nuba Mountains in western Sudan, while in eastern Sudan such streams as the Atbara, Rahad, Dinder and Khor el Atshan serve as examples.¹

Again, in the central clay plains and the Nuba Mountains, settlements are attracted to hilly areas, the reason being that hills present more porous formations than the surrounding clays. Settlements are, therefore, found at the foot of the hills, where water can be tapped easily, e.g. along the Managil and Gedaref Ridges. For example, Gedaref, one of the largest towns in Kassala

THE FACTORS AFFECTING SETTLEMENT DISTRIBUTION IN THE SUDAN

Fig. 6. The Gezira (land between the Blue and the White Niles) settlements are spaced at an interval of five miles approximately. Note the field pattern and the canalization. Example of nucleated settlements.

Province, lies on the Gedaref Ridge for the same reasons. Otherwise, deep bores are sunk through the clays, sometimes for more than 100 feet, to tap the rich aquifers found in the Nubian Series. These aquifers draw their supplies through the exposed parts of the Nubian Sandstone.

The second geological formation is the Basement Complex, which is part of the hard ancient Archaean Plateau of Africa, and is practically poor as a waterbearing formation. It covers large tracts of the Sudan and is exposed in certain areas, in which ground water is lacking and settlements disappear, except where there are surface streams as in the southern Sudan. In other instances, the Basement Complex is found beneath the Nubian Series and acts as a lower ceiling to the penetration of water. Nevertheless, small quantities of water can be obtained, where the hard rock has been softened and affected by the forces of denudation.

According to the 1955/56 Census, out of the 10.3 million people who were living in the Sudan over 6 millions lived in the central area between latitudes 10° N. and 15° N., where water is one
of the most crucial problems. The construction of dams, hafirs (artificially excavated surface reservoirs) and wells is needed on a larger scale to collect and store water, and a more thorough geological survey is called for to assess the underground potential. In this way, numerous settlements will develop and expand, and a large number of nomadic tribes will find it advantageous and far more economical to settle down. The Tenth Annual Conference of the Philosophical Society of the Sudan, held in Khartoum in 1962, proved that wherever the question of water is being tackled and solved, provided that educational programmes are carried out, some nomads have shown an inclination to settle themselves. It is also expected that most of the population growth in the Sudan will take place within this central area, because of its agricultural potential. The Umm Ruwaba Series of clays and sands is both rich in ground water and soils and is therefore well suited to settlement and agricultural development.

On the whole, it seems that the effect of the Nile in attracting settlements, especially large towns, will continue to be strong, and the river and its tributaries will be the main centres of urban development. This is not only because of the water needed for domestic use, but also because of the very large quantities and ever increasing demands for civic amenities such as sewerage and sanitation, and for industry. But it will be recognized that within the framework of physical geography certain political developments in the Sudan have favoured the development of some new towns and enhanced the growth of others.

Political Factors. The first practical division of the country into administrative units started after the reconquest (1898), the immediate results of which have been the establishment of government posts throughout the country. Peace and order were to be maintained in a country which was dominated by the Mahdists. The imprint of the new regime on the political status of the country and consequently on settlement distribution was twofold.

Some of the towns in north and central Sudan have already established contacts with the outside world through caravan routes northward to the Mediterranean lands and eastward to Arabia and India by the 10th century, and so trading centres were developed. The newly introduced administrative system has added to the importance of the existing settlements, while centralization of administrative powers in the hands of the governor has enhanced the growth of such towns as Khartoum, Ed Damer, Kassala, Wad Medani, El Fasher and El Obeid which were chosen as centres of administration. For example, Khartoum which started as the new capital of the Sudan after the reconquest had a population of 14,000 by 1905 and in a period of forty-five years (1949) it became four times as large (a population of 62,000). By 1956 the town had a population of 93,000. The rapid increase in population was due to the newly created services and functions, as a result of which families of government officials had to move to the capital, and the men needed for police and army were recruited from the neighbourhood. Trade flourished as soon as peace and order were maintained. What has been said about Khartoum applies to other provincial and district capitals.

The situation in southern Sudan was completely different from that in the north for several reasons. Due to its isolation from the rest of the world, southern Sudan was very primitive and backward. The Nilotic tribes used to live in scattered hamlets and small villages in floodfree areas by the river banks. The new government established administrative posts in such places as Wau, Juba and Malakal, and later small district posts were installed. These administrative centres constitute the only towns at present, and did not exist as towns before the Condominium rule. As in other parts of the Sudan, the southern tribes are also village dwellers and so very few live in towns. For instance, Wau, which had a population of 2500 by 1907, grew only to a size of 8000 by the time of independence in 1956.

Commerce and trade between north and south has increased after independence when more northerners found easy access to the southern region. Moreover, the development of transport and the breaking of the political rift between north and south after independence has greatly increased the mobility of people between the two regions which will result in future in tremendous economic and cultural changes. The introduction of development schemes and the utilization of the resources will definitely affect the present pattern of population distribution. Centres other than the administrative ones will emerge and develop as a
THE FACTORS AFFECTING SETTLEMENT DISTRIBUTION IN THE SUDAN

Fig. 7. Khartoum, aerial view.

Fig. 8. Omdurman. The buildings in the foreground are part of the CBD. Buildings in the background are part of the residential quarters. Note congestion of buildings and absence of wide roads.
normal consequence of economic and cultural changes. Throughout the Sudan present population and settlement distribution has been affected to a certain degree by social and historical factors.

**Social and Historical Factors.** Although the southern Sudan has suffered a great deal from epidemic diseases such as malaria, sleeping sickness and bilharzia, its present population distribution is accounted for through the spectrum of historical and cultural factors. The slave trade practised up to the close of the 19th century led to the depopulation of large parts of the region, and, furthermore, tribal wars resulted in great population reductions. These two factors have disrupted and dislocated large sections of population. The control of tropical diseases, the prevention of slavery and the disappearance of tribal animosities have led to the rapid upsurge of population.

The northern part of the Sudan (the area north of latitude 15° N.) is generally poor in resources and supports only a small number of people. Severe desert conditions have channeled people into the Nile Valley, and the northwestern part of the desert is practically uninhabited. The central Sudan (land between latitudes 10° N. and 15° N.) has the largest concentration of people in the whole country. If looked upon purely through the spectacles of physical factors, one is bound to find more people southward with increasing rainfall. Similar conditions can be traced in Northern Nigeria, where more people tend to live with distance from the coast if one excludes the southwestern region. The northern emirates around Kano and similar regions have high population density. In Nigeria from the coast northward the density first is very high, then it becomes low in the middle belt and then high again in the north. The middle belt of Nigeria has suffered immensely from the ravages of the slave trade.1 Certain historical and cultural circumstances caused men to be concentrated in one region more than in another irrespective of the restrictions imposed by the physical milieu. Modern man, of course, is not controlled by the environment, and the ever increasing scientific and technical knowledge give him an upper hand in dominating and controlling the physical surroundings.

Furthermore, the Sudan belt that stretches across Africa from east to west (between latitudes 11° N. and 16° N.) has agricultural and grazing lands which constitute the mainstay of the population. Being a zone of easy movement, this belt has witnessed a very high degree of population movement throughout its long history.2 The central Sudan, as previously mentioned, belongs to this zone and has been the home of man throughout historic times.

It is also a zone of contact between the desert north and the tropical rainforest of the south. Caravans coming from beyond the Sahara exchanged their commodities with those of the local people and the territories to the south. The zone has been generally active in commerce and trade since its early history. It is also a zone that joins two different economies and cultures and, indeed, two different outlooks. The Arabs, who moved in Africa and in the Sudan mainly during the 7th and 8th centuries A.D., preferred to settle in this central region because of its great affinities with their homeland. They found vast grazing lands for their camels and sheep and permanent water on the Nile. The arabization of the region of north and central Sudan went on till it reached its climax in the 13th century, when Amr Ibn el Aa’s, who was then in Egypt, ordered his troops to invade the region from the north. The idea of the Moslem Arabs was to introduce Islam to the Christian kingdoms of Nubia and Alowa, and also to settle down.

As the Arabs were more advanced culturally and economically than the indigenous people they were able to impose their culture and way of life. Islam was adopted as the new religion and people had to come in contact with the Arabs for Islamic teaching. These were the cultural and historical factors which influenced the present population distribution. In accordance with these facts, the bulk of towns and villages is found in the central Sudan, where the greatest economic, technological and cultural developments have taken place.

**Economic and Technological Factors.** Economic and technological developments, in modern times, have modified the physical surroundings, and large areas which were once empty, have been utilized and settled for the first time. Throughout history

---


man has had control over the physical milieu and is able through technological and scientific developments to play an outstanding role in dominating the environment. With different levels of technology are associated different levels of economic development, and the lower the level of technology the more primitive is the society. Water can be pumped from permanent streams and underground sources to desert areas and consequently settlements will develop. Such examples are provided by Australia and Peru, where water is pumped into desert areas to make possible the utilization of the resources. The availability of minerals and oil in desert regions attract water, because of their economic value. In other words, environment is a more dependent than an independent variable being continuously affected by the advances in technology. In the Sudan the growing efforts to improve the level of technology and bring about economic development will lead certainly to a change of population distribution, and, therefore, of settlements.

In a region which is economically dominated by agriculture and pastoralism, people are very much attracted and concentrated in the fertile plains. Man lived in those plains from earliest times depending largely on his animal products and at the same time practising a haphazard sort of agriculture. Nomadism was very much in use, and similar conditions could be traced in West Africa, where the Fulani of Northern Nigeria are so strongly attached to this way of life.1

The introduction of agricultural schemes at the turn of this century has transformed the once subsistence economy into a foreign-trade orient-ed one. Due to developments in technology and agricultural science, man is able to settle down in large groups and has, in turn, to abandon his previous nomadic life. It should not be assumed, however, that all people in the Sudan are now settled, because at least some 20 per cent of the population are grouped as nomads.2

Virgin agricultural lands have been tapped and settled as never before in history, the standard of living has improved greatly, and the control of epidemics has, in turn, contributed to the rapid upsurge of population. It has been estimated that the population of the country has doubled itself in the last sixty years, mainly due to improved sanitation conditions and the development of the economy. Furthermore, the stimuli given by the interaction of these factors to settlement development must not be underestimated.

Nevertheless, the Sudan is one of the most sparsely populated countries, and even in the irrigated schemes, such as the Gezira, a density of 40—150 persons per square kilometre (or 102—384 persons per square mile), is much lower than its counterpart in Northern Nigeria, where the density rises to over three times that of the Gezira.3

The economic development of the region has acted as an impetus in attracting people from West Africa, especially from Northern Nigeria, where there is locally some population pressure on the land. People from West Africa cross the central Sudan on their way to or from Mecca, but some of them settle in the Sudan, because of improved economic conditions and increased chances to gain a livelihood.4 It was estimated in 1947 that at least some 250,000 West Africans have settled in the Sudan, the majority of whom are concentrated in the central area. By 1956 their number had increased to about 500,000, so doubling itself in less than ten years.5

The utilization of new lands and the introduction of such schemes as the Gezira in 1925, the Managi in 1958, the Baraka, the Gash, the Ge-daref mechanized schemes in the 1940’s, and the new scheme at Kashmir el Girba, has stimulated the development of more water points and therefore of settlements. People are now settling in areas which were never settled before by the help of modern science and technology. Water has been made available through the digging of wells, hafirs, fulas (a natural depression in which rainwater is stored) and the construction of dams.

The invasion and settlement of the clay plains was only made possible on a large scale in 1947

---


after the introduction of the hafir system by Dr. J. Smith, then Director of Agriculture. The hafir system was first started in eastern Sudan at Jebel el Ghadamambiya in the Gedaref District.

At present about 600 hafirs (total gross capacity of 16,000,000 cubic metres) are in existence, bringing more lands under cultivation and grazing, leading to the establishment of new settlements. The hafir system, now in common use in the central Sudan, is a useful device to utilize the clay plains which are generally poor in underground water supplies. For example, the development of rural water supply by well digging and hafir excavation has extended the land

---

THE FACTORS AFFECTING SETTLEMENT DISTRIBUTION IN THE SUDAN

Fig. 11. Khartoum, third-class mud-house, typical of Northern Sudan. Note that windows and doors are not yet fitted.

Fig. 12. Southern Sudan, fourth-class grass houses. Note the shape of huts and courtyards.

under cultivation in the Gezira, as a result of which about 1,000 villages have emerged within the scheme area supporting about half a million people. Again, the construction of *hafs* in the clay plains of the Nuba Mountains has encouraged some of the Nuba, who were exclusively confined to the hilly area, to move down to the clay plains. Most of the Nuba are still reluctant to move down to the plains, and were so confined to their traditional region for purposes of defence from the slave raiders, and because the hills were richer in ground water supplies than the clay lands. In other words, the disappearance of the first factor together with the ability to store rain water in reservoirs has led to the redistribution of some Nuba settlements on the plains.

---

Although there is no official information that shows the number of people who have settled down, it should now be evident throughout the central Sudan that whenever water sources could be captured and controlled, more people would be encouraged to settle down so increasing the number of permanent settlements. On the whole, the majority of those settlements are small in size, but with the ever growing efforts to tap the water resources, their size will enlarge and greater areas of land will be utilized.

So far the authorities have shown genuine inclination to develop water resources and the sums of £8 850,000 in 1946—51, £8 2,320,000 in 1951—56, £8 860,000 in 1957—58 and 1,983,776 in 1960—61, were used for this purpose.\(^1\) The government realizing the growing needs and higher demands for water is about to launch a £8 15,000,000 scheme in the financial year 1966—67 to assess and control both surface and subsurface waters. The money is to be spent over the next three years, mainly on drilling operations, equipments, geological surveys as well as on technicians and personnel. Nevertheless, it should not be assumed that the water question is being solved or adequately handled, and more work and effort is called for in this matter if increasing developments and higher standards of living are to be attained.

With an annual rate of natural increase of the population of 2.8 to 3 %, which is one of the largest by world standards, the population of the country is expected to double itself by 1975, according to the last census.\(^2\) It is generally assumed that the greatest part of the increase will take place in the central area, where economic development is proceeding. A small proportion 18 % of the cultivable land is now being utilized and an increase in population is expected to bring about more than proportional increase in economic development and raise the standard of living. Economic development is certainly a more vigorous factor than all other factors combined in changing the present pattern of population distribution.

The population and settlement distribution discussed here form a general background to urbanization in the region. The growing rural population is expected to stimulate the development of new service centres as well as enhancing the growth of some of the existing towns. Increased urban developments are expected to take place along the Nile and its tributaries and also within the central Sudan, where development schemes are introduced. For example, with the electrification of Sennar and Roseires dams cheap hydro-electric power will encourage the development of small-scale processing industries in the Gezira, and the efforts made to mechanize agriculture will release people from the farms to work in such industries. But most of the urban development is expected to take place first in large towns which have already established facilities; and services that attract both industry and people.

The author wishes to express his thanks to Sayed Osman Satti for the preparation of the maps accompanying this paper. He also thanks the Sudan Survey Department and the Ministry of Information and Labour for permitting the use of their photographs in illustrating this article.

---
