The second region without a station, Enderby Land (eM^E), on the coast of east Antarctica, is delimited because of its high frequency of disturbances as opposed to the relatively low frequency of disturbances in the adjacent areas (fig. 3). This area is in the direct path of disturbances that enter the continent as a result of anticyclonic blocking east of South Africa. Moreover, the circulation at this same region stands out as one of the four main features in the Antarctic atmospheric circulation, in the form of a persistent low pressure that appears every month on the mean 700 mb. charts. It is assumed, therefore, that the circulation pattern of strong perturbations does create a distinctive climate with much weather activity at Enderby Land.

The third and last Marginal sub-region without a station is the Queen Maud Land region (eM^Q), which, like the Palmer Peninsula region (wM^P), lies between two regions of strong cyclonic activity, in this case Enderby Land (eM^E) and the Weddell Sea (wM^W). Queen Maud Land (eM^Q) itself, does not, however, experience a high frequency of disturbances and its climate is likely to differ accordingly from that of the regions to either side. Despite lack of data, therefore, it seems feasible to tentatively delimit seven Marginal climatic subregions.

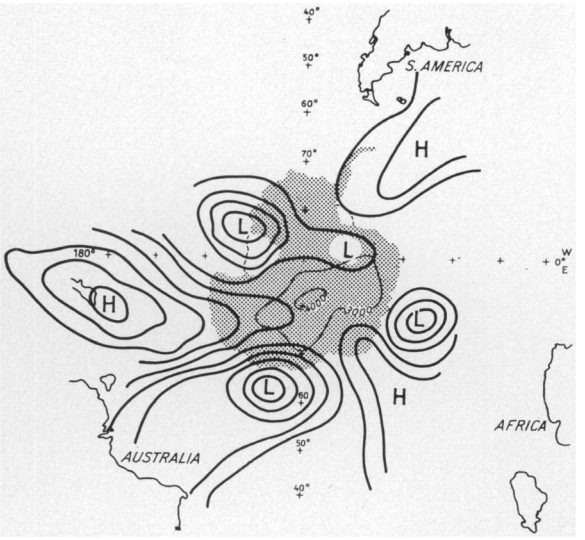


Fig. 14: Surface pressure pattern associated with temperature increase at Wilkes during 140th period (May 15—20)

SOME OBSERVATIONS ON DESICCATION IN NORTH-WESTERN NIGERIA

R. Mansell Prothero

With 4 Figures

Zusammenfassung: Einige Beobachtungen über Austrocknung im nordwestlichen Nigerien.

In den nördlichen Teilen Westafrikas sind die Niederschläge gering, veränderlich und unverläßlich. Die durchschnittliche Bevölkerungsdichte ist niedrig — weniger als acht Einwohner pro qkm. In einigen Gebieten hat jedoch die Kombination örtlich günstiger naturräumlicher Faktoren, besonders ausreichender Wasserversorgung, mit sozialen und historischen Einflüssen viel höhere Bevölkerungsdichten — bis über 80 Einwohner pro qkm — hervorgerufen. Eine charakteristische Erscheinung dieser Gebiete sind Bevölkerungsbewegungen. Es gibt kaum Anzeichen einer Klimaverschlechterung und eines Vordringens der Wüste nach Süden; menschliches Einwirken mag jedoch eine Verschlechterung der naturräumlichen Bedingungen hervorrufen. Anbaumethoden waren und sind nicht immer in ausreichender Weise auf die Bedürfnisse der zunehmenden Bevölkerung abgestimmt und mögen ein Abnehmen der Bodenfruchtbarkeit und Bodenzerstörung hervorrufen. Diese Fragen werden in dem vorliegenden Aufsatz für die Provinz Sokoto im nordwestlichen Nigerien untersucht.

Only in comparatively recent times has man come to modify the environment of West Africa significantly, and there is little evidence of human modifications of the environment to consider before the present century. Although the last sixty years are but a fraction of the ages through which the West African environment has passed the changes and modifications that have taken place in recent times are of the greatest importance. They have created many problems for which solutions are urgently required. Amongst these problems are those which result from increases in the numbers of people who, in turn, exert increasing pressure on resources to provide for their needs. In West Africa where the internal and external economies still depend very largely on farming it is obvious that increasing human needs will exercise very important modifying influences both directly and indirectly on the environment. More land is required for cultivation and for grazing and the demand for timber for fuel and other purposes increases. Depending on the man/land relationships in different areas changes may become necessary in agricultural practices. These are only the more important of the influences at work.

These influences are particularly significant, and the changes that result from them often all

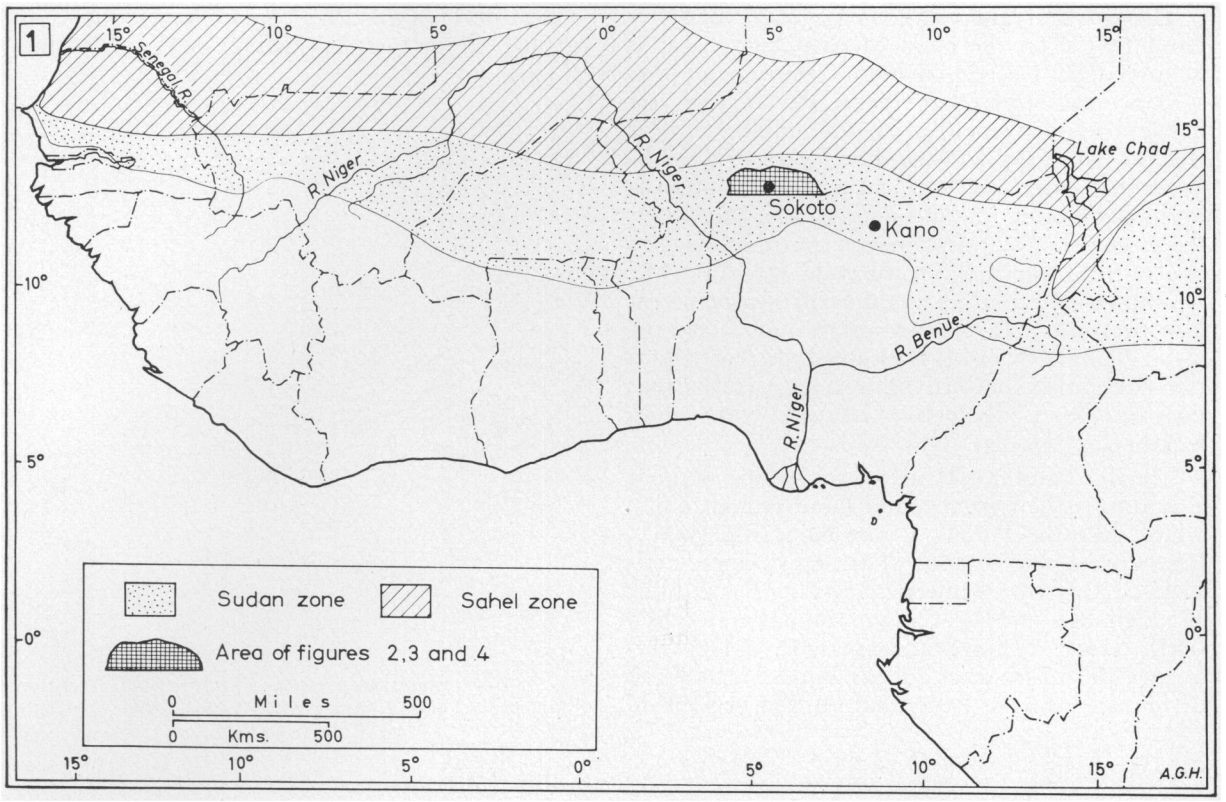


Fig. 1

too apparent, in the northern parts of West Africa, on the northern fringes of the Sudan Zone and throughout the Sahel Zone (Aubreville 1937, Dundas 1938). (Figure 1.) These areas are characterized by low totals of annual rainfall (under 750 mms., c. 30 inches) which is uncertain and variable in amount and incidence. The fall is concentrated into periods of from two to five months with almost complete dryness for the rest of the year. For several months desiccating winds blow down from the Sahara. The contrasts between wet and dry seasons in these areas are remarkable and it is possible to obtain an erroneous impression of conditions if the changes in the appearance of the landscape from one part of the year to another have not been observed. The rainfall of these areas presents problems to both cultivators and pastoralists, restricting the activities of the former to a limited period of the year and requiring the latter to move seasonally with their flocks and herds in search of pasture and water. Under normal conditions successful cultivation is possible during the few months of the rains without supplementary irrigation. But it is virtually impossible to designate what are normal conditions. Average rainfall is of no significance where totals may vary by up to 50 per cent from the average from one year to another. Incidence is of far greater importance than amount. At Sokoto in north-western Nigeria (Figure 2) with an average rainfall of about 675 mms. (c. 27 inches) good harvests have been recorded with a well distributed annual total of only 400 mms. (c. 16 inches); while near-famine conditions have resulted from a poor harvest with an annual total of 1,000 mms. (c. 40 inches) which has been badly distributed. The problems of these areas are not confined to variable and uncertain rainfall, during the dry season there is also the problem of water supplies for human and animal populations and to allow a comparatively small, but nevertheless important, amount of dry season cultivation by irrigation.

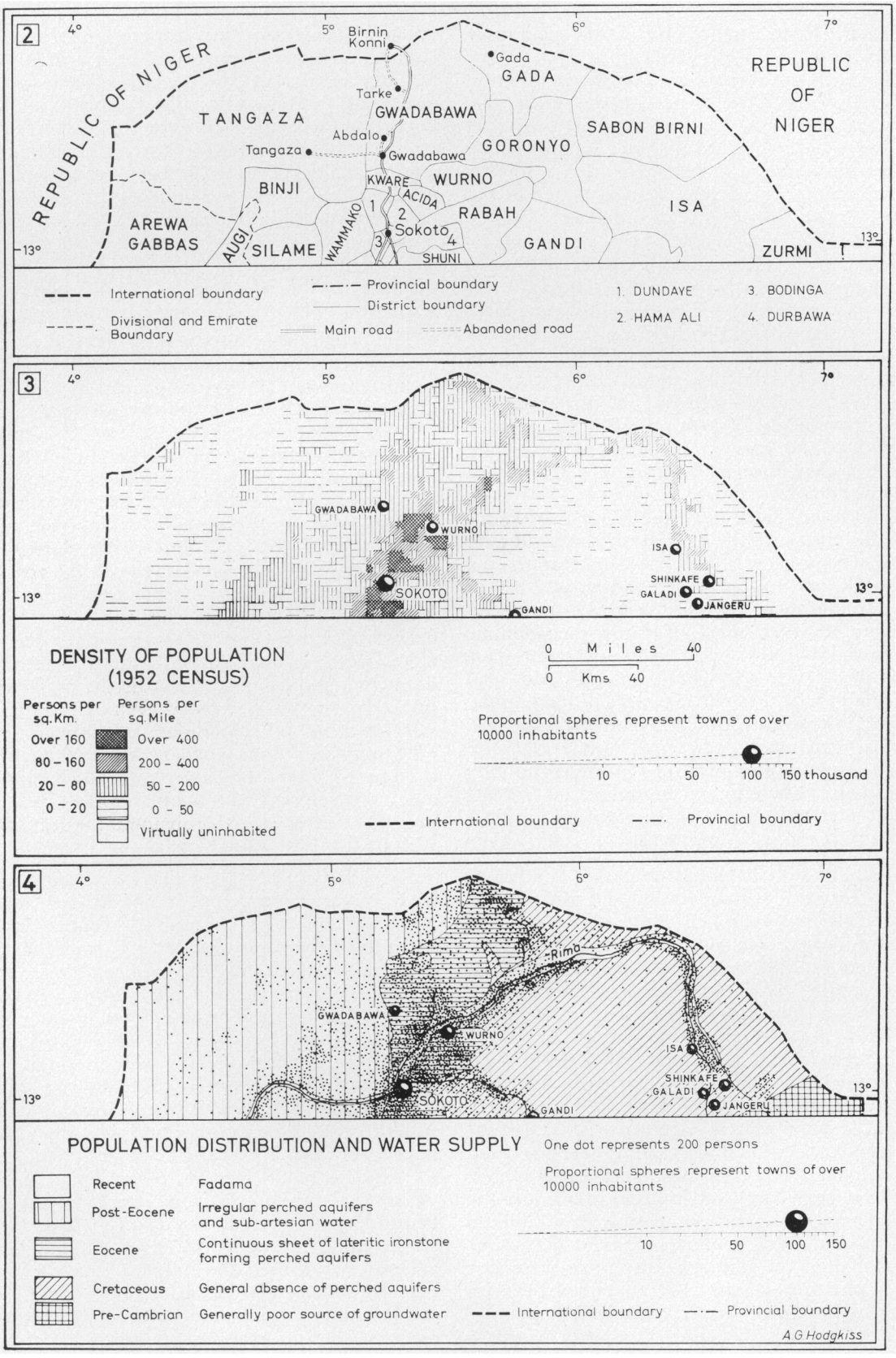
From the average density of population (under 8 per square km., c. 20 per square mile) these areas would appear to be only sparsely populated. Average figures, however, have very little meaning and in some parts there are relatively dense concentrations of people in spite of the difficult physical conditions. To some extent these concentrations occur in areas which are relatively better endowed from the point of view of the physical environment, but political, historical, social and economic factors have also influenced their development. In the northern parts of

Sokoto Province, particularly in the vicinity of Sokoto town and northwards from there to the frontier with the Republic of Niger, population densities average over 80 per square km. (c. 200 per square mile) and rise in limited areas to over 160 per square km. (c. 400 per square mile). (Figure 3.) There is a marked tendency for the population to concentrate near to water in the valleys of the Sokoto River and its tributaries. At the same time the whole of this area is underlain by sedimentary formations which yield water in varying amounts from perched aquifers near the surface and from the permanent water table which generally lies at depths of less than 30 metres (c. 100 feet). (Figure 4.) Although the physical environment is relatively favourable it has by no means been exclusively responsible for attracting the large numbers of people. Sokoto town was founded as the capital of the powerful Fulani Empire which flourished during the nineteenth century and in this role must have exerted a great focal influence. Since the establishment of European administration in the area at the beginning of the present century and the demarcation of a Franco-British frontier which had no physical or ethnic significance, there has been very considerable immigration from what is now the Republic of Niger into Nigeria. This immigration is a continuing process and between 1944 and 1954 accounted for part of the increases in the populations of Gwadabawa, Gada and Sabon Birni Districts which were between 25 and 35 per cent. The changes and modifications brought about by increases in population over the last sixty years have been considerable and have brought in their train a wide range of problems.

Before the establishment of settled conditions under European administration the greater part of the districts mentioned above and nearly the whole of Tangaza District, which remains sparsely populated to the present day because of poor water supply, were covered with woodland. Gwadabawa town was founded only in 1875 and in 1905 it was reported that settlement in the district was for the most part restricted to near the road which runs northwards from the town to Birnin Konni. People concentrated for protection in or very near to large towns. The areas which could be farmed with safety were restricted and comparatively intensive farming methods must have been employed in order to produce the food required by the population from limited areas of land, even if allowance is made for the fact that then the numbers of people were less than at the present day. The advent of peaceful conditions coupled with increases in the population have led to a dispersal of settlement over a much wider area. This dispersal has been accompanied by a widespread clearance of land for farming so that today the areas of woodland remaining are very small. Farming methods appear to have changed with this dispersal, becoming more extensive on the greater amounts of land available. They have been responsible for much indiscriminate and unnecessary clearing. In the early stages of the dispersion of population there was sufficient land available to accommmodate extensive cultivation, but with a steady increase in the numbers of people population pressure and land hunger have become apparent.

The people have responded in several ways to these changed circumstances. There has been some permanent emigration to sparsely populated districts in the south of Sokoto Province though this has been more than balanced by further immigration from the north. More significant is the large scale seasonal migration of labour from these areas prompted, in part at least, by the need to conserve food supplies and to supplement incomes (PROTHERO 1957 and 1959). Particularly disastrous in the districts have been the attempts to meet the needs of the increasing population by keeping the land under cultivation for longer periods and reducing the length of recuperative fallow without providing any alternative means of maintaining fertility. In the districts adjacent to Sokoto town which carry an even denser population (over 160 per square km., c. 400 per square mile) and have done so for a much longer time, though there are problems of population pressure much of the farmland is cultivated each year with provision being made for maintaining fertility by various forms of manuring.

Evidence of the evils which may occur during these stages of transition is not hard to find in northern Sokoto. For example, around Gwadabawa town the top soil, having become unstable through complete clearing, has been eroded away leaving the less fertile sub-soil. In other areas even the sub-soil has been eroded down to the underlying indurated ironstone which is useless for agriculture. A short distance to the west of Gada town an area of between one and two square miles of good farmland is being eaten away by a system of erosion gullies developed on a slope no steeper than 2^0 to 3^0. The main gullies are up to 3 metres (c. 10 feet) deep and up to 9 to 12 metres (c. 30 tp 40 feet) wide. Far from anything being done to prevent extension of this erosion all the land right up to the edges of the gullies is cultivated and where the gully walls have slumped they have been planted also. Such examples of active gully erosion are fortunately not very common but in many areas paths and tracks,


2
4°
5°
6°
7°
Birnin Konni
Gada
GADA
REPUBLIC OF NIGER
REPUBLIC OF NIGER
Tarke
TANGAZA
GWADABAWA
SABON BIRNI
Abdalo
Tangaza
Gwadabawa
GORONYO
BINJI
KWARE
WURNO
ACIDA
1
2
RABAH
ISA
AREWA GABBAS
AUGI
SILAME
WAMMAKO
3
Sokoto
4
SHUNI
GANDI
ZURMI
13°
International boundary
Divisional and Emirate Boundary
Provincial boundary
District boundary
Main road
Abandoned road
1. DUNDAYE
2. HAMA ALI
3. BODINGA
4. DURBAWA
3
GWADABAWA
WURNO
ISA
SHINKAFE
GALADI
JANGERU
SOKOTO
GANDI
DENSITY OF POPULATION
(1952 CENSUS)
Persons per sq. Km.
Persons per sq. Mile
Over 160
Over 400
80 – 160
200 – 400
20 – 80
50 – 200
0 – 20
0 – 50
Virtually uninhabited
0 Miles 40
0 Kms. 40
Proportional spheres represent towns of over 10,000 inhabitants
10
50
100
150 thousand
International boundary
Provincial boundary
4
Rima
POPULATION DISTRIBUTION AND WATER SUPPLY
One dot represents 200 persons
Proportional spheres represent towns of over 10000 inhabitants
Recent
Fadama
Post-Eocene
Irregular perched aquifers and sub-artesian water
Eocene
Continuous sheet of lateritic ironstone forming perched aquifers
Cretaceous
General absence of perched aquifers
Pre-Cambrian
Generally poor source of groundwater
A.G. Hodgkiss

Figs. 2, 3, 4

particularly those used by cattle, develop as minor eroded areas.

The coarse sandy soils which are found over the greater part of these districts are inherently of low fertility. The amounts of potash and phosphorous in them are on the whole good, probably because there is insufficient rain to leach them out, and it is due to these that growth is possible. Crop yields are low and fall off very rapidly if inadequate provision is made to maintain what little fertility the soils possess. An insidious practice is the burning of animal manure and crop refuse for fuel, due either to the shortage of wood or, as is sometimes the case, to laziness on the part of the people. Small areas of woodland which remain have been reserved by the Forestry Department as Communal Forest Areas to be cut on a rotational system for fuel supplies, but in these it is a common practice for the people to cut indiscriminately outside the parts which have been demarcated for cutting.

The combined effects of these malpractices are to reduce the carrying capacity of the land to a very low level or to render it incapable of production or even to make the restoration of fertility virtually impossible[1]). In areas where cultivation has been abandoned the extent of deterioration is evident from the very sparse and poor fallow cover that is established. Such land may have the appearance of semi-desert in the dry season and may seem to indicate that natural processes of desiccation are at work if the history of land use and agricultural practices in the area are not known. Indeed to an observer who has not seen the cultivated land during the rains much of it may seem to be in the same category at the height of the dry season. The soil is completely dried out and bare and soil particles drift on the surface if there is a strong wind blowing.

On several occasions in the last half century various evidence of desiccation in northern Sokoto has been presented and consideration given to the factors producing it[2]). Bovill (1921), discussing "*the encroachment of the Sahara on the Sudan*", offered particular evidence of this fact from Sokoto Province. He referred to a regular decline in rainfall since records were begun in 1903 and the reduction of water in lakes and wells. His inferences cannot be substantiated from the available rainfall records which are few and fragmentary. With regard to water supplies from wells he was writing at a time when they were undoubtedly at their poorest, not because of deficiencies in the rainfall and inadequate replenishing of the aquifers but because of changes in social conditions. Prior to the establishment of British rule the digging and maintaining of wells was carried out by slave labour because of the risks involved. With the abolition of slavery this labour was no longer available and there seems to have been a consequent decline in the yield of water from wells due to lack of attention (Jones 1938). In the latter years of the 1920's the construction of permanent concrete-lined wells was commenced by the Geological Survey in Sokoto Province and these activities were extended subsequently throughout Northern Nigeria. Surveys prior to construction suggested, and from the construction of wells it was proved, that ample supplies of groundwater existed in northern Sokoto, both in perched aquifers (many of the native wells tapped these only and were liable to be exhausted during the dry season) and from the permanent water table (Raeburn 1928, Jones 1938). Well construction has continued on an increasing scale[3]). Since 1945/46 it has been controlled by the Rural Water Supplies section of the Public Works Department and was financed very considerably by money from the Colonial Development and Welfare Fund. Now water supplies from wells are without any doubt, incomparably better than at any time in the past not only in Sokoto Province but throughout Northern Nigeria. The majority of the wells are sunk to the permanent water table and yield water throughout the year. It is a fact, however, that even when provided with a deep well people may prefer to obtain their water from stagnant pools or from shallow wells which are very liable to pollution in order to avoid the effort of hauling up water fifty feet or more.

Bovill (1921) maintained that a general southward drift of people was taking place as a result of increasing aridity. Certainly Sokoto Province and particularly the northern districts have gained very considerably in population as a result of immigration from further north but these migrants have been attracted by the economic possibilities and amenities (particularly the provision of permanent wells in the last thirty years) available here, rather than being driven by any intensification in aridity. A bad season with a poor harvest may cause a temporary acceleration

[1]) Experiments by the Department of Agriculture from 1940 to 1950 to restore the fertility of a farm established on degraded and eroded soils at Tarke in Gwadabawa District proved abortive and were abandoned. Annual manuring was found to be neither practical nor economical: in 1945 1.6 hectares (c. 4 acres), manured in the previous season with 2 tons of animal manure per acre, produced a total of only 250 kilos (c. 500 lbs.) of millet.

[2]) Renner (1926) and Stamp (1940) present critical summaries of various published papers.

[3]) 447 wells were constructed in Sokoto Province between 1929 and 1946; 1437 were constructed in the decade 1947—56. For the whole of Northern Nigeria the figures are 1992 and 7520 respectively.

in the numbers of migrants but often people who move in response to such conditions will return to their villages when conditions are better (GROVE 1957). There is certainly no large scale movement from the overcrowded northern districts of Sokoto Province to the comparatively empty areas in the south (PROTHERO 1957 and 1959). The Adarawa people are found on either side of the northern frontier between Sokoto Province and the Republic of Niger and they move freely backwards and forwards across it; but there is no evidence that they are moving progressively further south and being replaced by Buzai and Tuareg people as BOVILL (1921) said was happening.

In the 1930's the causes and problems of desiccation received the greatest attention; STEBBING (1935, 1937a, 1937b, 1938a, 1938b) wrote at considerable length, if not always with the greatest accuracy (and his observations were made in the dry season only), of the threat to the West African colonies of a southward moving Sahara desert resulting from a natural deterioration in the environment[4]). "*The people are living on the edge, not of a volcano, but of a desert whose power is incalculable and whose silent and almost invisible approach must be difficult to estimate.*"

On STEBBING's estimate (1935) the most northerly parts of Northern Nigeria should have been overwhelmed by Saharan sand by the present day. This has not happened. He noted (1937a) in these areas "... *real evidence of the desert — sand invasion with the typical goriba or dom palm (Hyphaene thebaica)* ..." There are areas in the northern districts of Sokoto Province, for example a few miles to the north of Gwadabawa town in the vicinity of the villages of Gwombilla and Melle, which exhibit these features at the present day. There is goriba scrub and little other vegetation during the dry season and the landscape has a desertic appearance. But this is no invasion of the desert for only a little distance to the north the goriba scrub disappears and the desertic scene changes[5]). Rather this is an overfarmed area of degraded soils which are blown about in the dry season because of the absence of vegetative cover. In the wet season they still yield crops and they receive small amounts of manure. This particular area has a population density of over 100 per square km. (c. 250 per square mile).

An Anglo-French Forestry Commission (1937) which investigated the evidence for desiccation in the most northerly area of Northern Nigeria and in the adjacent lands of the Republic of Niger, strongly refuted any ideas of climatic retrogression and placed the responsibility for any deterioration of the environment on human activities. They found no evidence of any large scale movement of sand or of any lowering of the permanent water table. Sand dunes occur in Sokoto Province in a zone some ten to fifteen miles wide south of the international frontier but they originated in conditions of much greater aridity in the Quaternary era (GROVE 1958). They are firmly anchored and frequently provide the sites for villages as the lower-lying land around them may be flooded periodically during the wet season.

Reference has already been made to the superficial displacement of the sandy soils. The drifting sand collects particularly on roads. The old motor road between Gwadabawa and Tangaza (Figure 1), along which the writer trekked in 1955 had been abandoned three years previously when a new road was built and in the meantime had become impracticable for all motor traffic due to the large amounts of sand which had accumulated on it from the surrounding land. For the same reason sections of the road from Birnin Konni to Dogon Doutchi were difficult to negotiate by car in 1955. Here the practice of clearing the land of vegetation for some distance back from the road plays an important part in allowing a freer movement of wind-borne material. These are examples only of the inconvenience that may be caused by sand drift, its effects are much more serious when it occurs on farmland. The Anglo-French Forestry Commission (1937) reported that this was occurring around Birnin Konni and around Tahoua further north. At this time also farmers in the northern districts of Sokoto Province were complaining that they were having to sow seed up to six times owing to the smothering of young sprouting corn by wind-blown sand. This menace can be counteracted by the planting of shelter-belts and the maintenance of trees on the farm-land to break the force of the wind. The planting of the boundaries of farm plots with gamba grass (*Andropogon Gayanus*), a feature of the farmlands in the intensively cultivated zone around Kano, is particularly effective. The cultivation treatment given to these light sandy soils is also important. Before the first rains of the wet season the land is too hard to be prepared for

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[4]) In a more recent work, following a visit to the Sudan in 1947 but concerned in general terms also with the zone between 13° and 15° N. latitude, STEBBING (1953) reaffirms his belief in desert encroachment but at the same time emphasizes more the influence of human activities in the processes of desiccation.

[5]) Collier and Dundas (1937) state, with reference to *Hyphaene thebaica*, *Ziziphus*, *Balanites aegyptiaca* and *Commiphora africana*, "*The species named are typical of their localities and show that one is approaching the desert and not that the desert is encroaching.*" and KEAY (1954) "*Hyphaene thebaica is a very conspicuous feature of the Sudan zone and sometimes forms pure stands, particularly where the soil is somewhat saline.*"

planting but after the first substantial fall of rain the ground is broken for each seed with a long-handled hoe, the seed is placed in the hole and covered over. If any extensive hoeing is carried out once the seed has sprouted, but before it has become a sturdy plant, there is the danger, if there is a period with no further rain, that the surface layers of the soil will dry out and in a friable condition will be liable to movement by the wind and may smother the plant. Late hoeing, when the plants have grown beyond the stage when they can be affected in this way, is an obvious solution which has been recommended and accepted by the people. In another respect, however, late hoeing is unsatisfactory. During the long dry season the surface soil dries out into a hard crust which the early rains in April and May are not able to penetrate easily unless it is broken up. With late hoeing, therefore, there is the danger that the moisture supply to the soil will be impaired at a time when this can be ill-afforded.

In the 1930's at the same time as evidence was being produced to illustrate the processes of desiccation at work, there were reports from the northern districts of Sokoto of excessive flooding in the valleys of the River Rima and its tributaries the Bunsuru and Gagere which necessitated the abandoning of farmland and the re-siting of settlements. The majority view at the time was that human changes and modifications of the environment were responsible for producing the features of desiccation and it is probable that this flooding was, paradoxically, a part of the same process. The streams of the Rima system have their headwaters in Katsina and Kano Provinces and flow through relatively narrow valleys cut in the crystalline rocks in the eastern districts of Sokoto Province. In the 1930's these areas were developing the cultivation of cotton and groundnuts for cash crops. These developments were attracting population and it seems likely that altogether there was considerable clearance of land taking place here at this time. This would result in increased run-off into the streams in their upper courses and so to flooding further downstream where the valleys, cut in softer sedimentary rocks, are wide with extensive flood plains.

In addition to seasonal fluctuations in the permanent water table, overall rises have been recorded in parts of Northern Nigeria over the last three decades[6]). In the northern districts of Sokoto Province there is ample evidence of the appearance of increased amounts of surface water[7]). This was noted in 1940 and was stated to have been occurring over the previous ten years though, at the same time, it was incorrectly stated that these were manifestations of a climatic change (BOND 1940). Increased amounts of water in fadama (the flood plains of rivers and low-lying areas which become water-logged or flooded during the rains) were making rice cultivation difficult. Low-lying areas with heavier soils which generally collected sufficient moisture to allow the cultivation of guinea corn (in an area where soil and moisture conditions are generally favourable for the cultivation of millet only) were being flooded and cultivation made impossible. At the same time the increased amounts of surface water meant the retention of soil moisture in the fadama for a longer time into the dry season and therefore increased the possibilities for the cultivation of sugar cane, sweet potatoes, cassava, onions and wheat, crops which depend on this soil moisture supplemented by irrigation. A particular instance of the increase in surface water has been observed over the years at Tarke, a village in Gwadabawa District. The Provincial Agricultural Officer noted at the end of December 1939 that "*Water is still lying in the fadama . . .*" and the following year that "*Water stood in the fadama all through the dry season for the first time seven years ago and this year it has risen higher than last year.*"

It is not known whether there has been a steady increase in the amount of water remaining throughout the dry season but in June 1955, after more than eight months without rain there was over an acre of open water in this fadama.

Increases in the amount of surface water remaining throughout the dry season have interfered with communications in northern Sokoto. The motor road from Sokoto town northwards to Birnin Konni had to be re-aligned in 1940/41 because the increase in the depth of water in a fadama immediately to the north of Gwadabawa town made the passage of vehicles impossible. (Figure 2.) In February 1955, along the line formerly taken by the road there was over six feet of water and the fadama could only be crossed by canoe. Further north along the old road the ford through the fadama at Abdalo was negotiable on horseback but would certainly have been impracticable for most motor traffic — in the middle of the dry season!

One obvious explanation for these increased amounts of water is that they are due to climatic change but the rainfall records for this area suggest that this explanation is unsatisfactory. Alternative explanations have been advanced. An Administrative Officer at Tarke in 1949 reported (MUFFETT 1949) ". . . *the fadama has not been in existence for more than twenty years and apparently owes its origin*

[6]) Personal communication from the Director, Geological Survey of Nigeria.

[7]) This feature has also been noted in western Bornu (GROVE 1961).

to the sinking of a native well which either struck a spring or a sub-artesian rise." This explanation is unsatisfactory for Tarke and certainly could not be applied to the other examples of increased surface water of which only a few are referred to here. There is very little sub-artesian water in Sokoto Province, the depths at which it occurs are unlikely to have been reached by a native well and if it were a subartesian rise the water not have reached the surface. These increases in surface water are not associated with climatic change but are indirectly related to human activity[8]). Like the flooding in the river valleys they are the result of increased run off due to widespread clearing of the land.

Although flooding in the wide river valleys may have serious effects on farm land and settlement advantage may be taken of the increased amounts of water in small fadama to increase the amount of land that can be cultivated during the dry season. There are many such areas in the northern districts of Sokoto which are either unused or which could be further developed for this purpose. Such development might require the construction of small scale earthworks, both drainage and irrigation channels, but the people should be able to construct them if given some direction in what was needed. There is, however, a human element in this development also to be considered. In one village where there was fadama that might be developed, when asked why this was not undertaken to reduce, at least to some extent, the need for a considerable proportion of the male population to migrate during the dry season in search of work, the reply was that aikin fadama (dry season cultivation) was arduous and demanding work and that they preferred to go away. The motives for seeking work in other parts of Nigeria are in fact much more complex than this (PROTHERO 1957 and 1959).

Overall, in spite of continued population increases, environmental conditions in the northern districts of Sokoto Province do not appear to have progressively deteriorated during the last decade or so. An Administrative Officer, competent to assess the situation, reported (JOHNSTON 1952) "*Knowing Gwadabawa before the war and hearing that since then its population had increased by a third . . . I was apprehensive. On the whole I have been pleasantly surprised by what I have seen.*" At the same time it is not suggested that conditions have much improved but they seem to have reached their lowest level during the 1930's. There is room for much improvement in standards of living which are low and which are only maintained at their present level by the absence of between 30 and 40 per cent of the male population during the dry season. In years in which the harvest is poor near-famine conditions may still result, though with the facilities that now exist for buying in food from other areas the possibility of a devastating famine is very remote. The pressure of population on the land is so great that no land can be given over to the cultivation of cash crops and so there is no prospect of increasing income from them.

There is above all else the need for an increase in the amount of land which is cultivated each year and where fertility is maintained by manuring. At the present time most of the animal manure which gets on to cultivable land comes only from indiscriminate grazing over the stubble during the dry season. In the conditions of great heat and low humidity the manure is soon desiccated and its value greatly reduced. On the other hand in the wet season a large proportion of the cattle are taken northwards into the Republic of Niger where the population densities are lower and there is more land for grazing. Between the cultivators and the herdsmen who remain in the northern districts of Sokoto during the wet season there are frequent troubles due to cattle damaging crops. The much needed symbiosis between pastoralist and cultivator is lacking here as it is in so many other parts of tropical Africa.

The evidence indicates that farmers in Northern Nigeria and elsewhere in tropical Africa will intensify their methods of cultivation and adopt measures of conservation only when they are forced to by extreme population pressure on the land. These improved methods are in use on the intensively farmed lands in Kano Province where there are population densities which range from 200 to 400 per square km. (c. 500 to 1,000 per square mile). The real dangers of land deterioriation seem to be greatest where the population densities are between 80 to 100 per square km. (c. 200 and 250 per square mile), as in the areas which have been discussed[9]). These figures indicate a critical transition stage between lower densities which allow cultivation under a system of land rotation and higher densities which demand the permanent cultivation of a large proportion of the cultivable land. In this transition stage, in lands where the rainfall is low and uncertain, processes of desiccation, which are essentially induced by

[8]) JONES (1938) noted increases in surface water in other parts of Nigeria, suggesting that they were associated with a cycle of wet years though not with any climatic change.

[9]) cf. FARMER (1957) with reference to chena cultivation in Ceylon. "*To judge by the Kala Wewa area the critical density is about* 200—250 *per square mile; but further field research is needed.*"

human activities, will develop (WAYLAND 1940). If this development is allowed to proceed then the fertility and productivity of the land may be permanently impaired. In these circumstances there is much to be said for attempting to accelerate this stage in order to conserve land which is capable of supporting greater numbers of people under a more efficient system of cultivation.

Note

Field work on which this paper is based was undertaken while the author was a research fellow of the West African Institute of Social and Economic Research.

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BERICHTE UND KLEINE MITTEILUNGEN

KANN DIE SOZIALGEOGRAPHIE IN DER WIRTSCHAFTSGEOGRAPHIE AUFGEHEN?

HANS BOBEK

In seinem Vortrag über *„Die Gestaltungskraft der Gruppe und der Persönlichkeit in der Kulturlandschaft"* auf dem Kölner Deutschen Geographentag 1961 erhebt E. OTREMBA den Anspruch, die Pflege der *„Probleme, die sich bei der Erforschung der Kulturlandschaft aus den Wirkungen und Leistungen der Menschen und Menschengruppen herleiten"*, in die Wirtschaftsgeographie zu übernehmen. Damit soll die Aufstellung einer eigenen Sozialgeographie erübrigt werden, da sie nur zu einer unliebsamen weiteren Aufspaltung der ohnedies durch ihren *„Zerfallscharakter"* gefährdeten Geographie führen könne. Eingepackt in eine rückhaltlose Anerkennung der großen Bedeutung der gesellschaftlichen Tatsachen für die Wirtschaftsgeographie — *„diese Richtung* (die sozialgeographische) *ist schön und anregend, sie führt in die tiefere Problematik des Wirtschaftsraumes hinein und heraus aus der Langeweile der naturbezogenen Produktionsgeographie"* — findet sich als Kern der OTREMBAschen Ausführungen die doppelte lapidare Feststellung: Erstens, was die Sozialgeographie will ist gar nichts Neues, denn seit ihrem Bestehen beschäftigt sich die Geographie mit sozialgeographischen Objekten und seit 150 Jahren wird alles das, was wir heute theoretisch durchdenken, hier und dort schon praktisch ausgeführt; zweitens, was das systematisch ordnende Durchdenken dieses Komplexes anlangt, so brächte eine eigene Disziplin „Allgemeine Sozialgeographie" nicht nur den *„ersten Riß zu einer Aufspaltung der ganzen Geographie des Menschen"*, sondern sie ist überflüssig, da die Wirtschaftsgeographie das Erforderliche ohnedies tun muß. *„Wer die Wirtschaft erfassen will, muß auch ihre Akteure kennen."* *„Die Wirt-*