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## CHANGE IN POPULATION AND LAND USE INTENSITY UNDER THE ASPECT OF THE PHYSICAL ENVIRONMENT AND ACCESSIBILITY

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Introduction: Spatial change, accessibility, and environment in  
the agricultural landscape of the Tangale-Waja area

### Basic geographical categories

The existing spatial patterns of human life on earth can be explained by the help of two basic geographical categories:

Firstly, the character of a region is a result of the spatial interaction of manifold agents - as men, culture, labour, capital, politics, and last but not the least, environment.

The second elementary category is defined by distance. In our case low quality of road access as well as cultural and natural differentiation are important to the speed of cultural change.

It is generally acknowledged by development theories that accessibility means exchange of information, goods and manpower which leads to a change in the techniques of production, of social structure, and culture. If this is true, inaccessibility means persistence of traditional economic, social and cultural features. This persistence of or change in traditional features is the main topic of our research programme.

### Traffic system

The development of the modern traffic system in Nigeria is of colonial origin. The first main rail trunk line was constructed in 1905 from a railhead at Ibadan northward reaching Kano in 1911 and was soon connected with the tin mines of the Jos Plateau (K.M. BUCHANAN & J.C. PUGH 1966). For the period of five decades Jos-Bukuru was the railhead for Bauchi State in NE-Nigeria where the Tangale-Waja area is situated. The present regional economic centre is Gombe, a town which was until the end of the Second World War a backward place. An all-season motorable gravel road connecting Gombe with Yola, another Fulani headquarter on the river Benue, was not constructed until the 1960s to cut through the mountainous Tangale-Waja territory. There, the insufficient provision of

transport facilities conserved traditional forms of land use as well as the physical and human environment (W. FRICKE 1965).

Extensive investments in railway and road construction in NE-Nigeria in the second half of the 1960s connected the Gombe Division to interregional and international markets. Population growth and intraregional migration as well as constant immigration of farmers from other parts of the country modified major economic incentives of the autochthonous population resulting in remarkable dislocations in the structure and spatial pattern of physical, socio-economic and socio-cultural characteristics (M. TIFFEN 1976).

Increasingly, the major economic interest of the smallholder focused on the supply of close urban markets with food stuff, and national and international markets with raw material. Market-oriented agricultural production at high environmental risks replaced traditional methods of farming, frequently supporting effective measures for the reallocation of resources.

### The historical spatial structure

In the pre-colonial period the Savanna Zone of Nigeria was structured into two large-scale spatial organizations with a well developed communication network: the emirates of the Fulani-Hausa Caliphate of Sokoto in the west and centre of northern Nigeria and the Sheikdom of Kanem-Borno in the east near Lake Chad. Within both empires accessibility had to be guaranteed as the living standards of the aristocratic hierarchy and the urban population were based on a surplus of food stuffs and raw materials from the rural areas of their territory. These goods were produced by the clientage and bondage of the ruling Fulani village heads. As land was either ample or when necessary conquered, this system simply required manpower which was recruited by slave raids in areas marginal to the empires mentioned. Here besides a few divine kingdoms, e.g. the Jukun in Wukari and the Bolewa in Fika and Dukku, the majority of the population was divided into numerous small ethnic units, either not related or even hostile to each other. These "acephalous" ethnic groups were lacking a clear cut societal hierarchy and territorial organization beyond a tribal relationship.

As the resistance against disturbing influences from outside was the basis of their freedom, inaccessibility was the most demanded prerequisite for a secure life. In the zone with numerous independent ethnic groups from the Jos Plateau in the centre of Nigeria to the Mandara Mountains on the border to the Cameroons the people were able to use the advantages of a defensive hilly relief.

## The area of investigation

In the Tangale-Waja region of NE-Nigeria, a synclinal of Cretaceous sandstone north of the Benue-trough forms plateaus and cuestas with escarpments. Domes and shields of granite as well as interspersed cones formed by basalt and trachyte pipes have been used for fortified hill settlements. North of the mountainous areas, pediments and peneplains form a transitional zone towards the central Gongola basin. This flat to undulated area can be distinguished into older and younger pediments probably of pleistocene and holocene origin. Both are covered with thin sediments and only shallow developed soil. At the confluence of the river Kaltungo and the river Waja, Dogon Ruwa, a large market village, is situated. It developed during the past 30 years because of the fertile vertisols of the Yolde Formation. The site of this rural market represents the most recent use of heavy soils which were formerly difficult to cultivate by hoe.

The traditional location of the settlements of the acephalous ethnic groups are mountainous areas. For example, hundred and fifty years ago the Ture people moved from a flat outcrop of granite south of the river Kaltungo which was reachable to mounted Fulani slave raids to a cliff of an outlayer of a Bima Sandstone plateau nearby which is rather difficult to climb. The price paid for this security was high: by the lack of springs and only small home farms, carved into the sandstone surface; water and the land under cultivation could only be reached after exhaustive climbing downwards to the outfields under shifting cultivation on the pediments.

East of Ture, the Tula people, we will deal with later in more detail, enjoyed a somewhat better environment: the greater extension of the Tula Plateau and the existence of impermeable layers in the sandstone which give rise to several springs and water courses. The variation of erodable and resistant layers in the Bima Sandstone Complex is the reason for a sequence of steep and flat slopes. The latter as well as the surface of the plateau offer some farming plots when soil is carefully preserved by intensive agricultural techniques, e.g. mulching, manuring and terracing. Frequently the soil is of anthropogenic origin, this means transported to its present site and protected there by men (cumulic Anthrosols)<sup>1</sup>.

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<sup>1</sup> See Th. Krings 1991, p. 186; J. Heinrich 1992, p. 47.

## The development of communication and administration

### Pre-colonial communication systems

We do not know since when independent ethnic groups were forced to look for shelter in inaccessible areas like the Tangale-Waja region marginal to the centralized powers of the north. Soil samples suggest settlement activities 500 years ago (J. HEINRICH 1992). Isolated mountains or ranges have been favourite locations of this early spontaneous agricultural expansion in relatively empty lands. In physical, cultural and economic isolation, the farmer's interest was first of all to satisfy the subsistence needs of his family and his kinship group. Interethnic exchange relations were limited to barter trade as the development of a connective communication system failed to appear. Continuing intertribal wars are reported (T.F. CARLYLE 1910). The micro-spatial pattern of settlement and land use in connection with an area-oriented social structure reinforced this tendency. Ethno-centric, kinship as a basis of social and political organisation and a very low degree of commercialization in terms of agricultural production and marketing were the main features of the basic cultural image of repressed minorities in West Africa.

The establishment of the Gombe Emirate in the early 19th century as a centralized and well organized state adjacent to the study area did not affect the regional economic and social structure positively. On the contrary, the imperialistic policy of the Islamic emirates even increased the encapsulation of the local independent ethnic units. Fulani towns like Akko and Kumo north of the Tangale-Waja region are founded on land which is even today regarded as belonging to the Tangale people. The same is told about Kashere and Futuk which became already conquered under British rule about 50 years ago by Bauchi people.

The area was excluded from the traditional feudal system of the north as well as the modern colonial system penetrating from the southern part of Nigeria via Niger and Benue and establishing their factories not before the turn of the century outside our area, too.

### The establishment of modern transport under colonial rule

The state of independence achieved through inaccessibility is mirrored in an old British map of 1905 just after the conquest of Northern Nigeria by Lugard.

In the first decade of the 20th century the population of the Tangale-Waja region consisted mainly of farmers and few herders producing exclusively for their subsistence needs (M. TIFFEN 1976). British-German boundary commissions had explored the Mandara-Chad area. The valleys of the Benue and Gongola were already well known to the factories of the

Royal Niger Company. Institutions like the Government Niger Transport Service commercialized transport on the Niger up to Jebba as well as on the Benue to Yola and on the Gongola to Nafada (W.D. WAGHORN 1912).

A second south-north-corridor from the Benue valley through the central Jos Plateau - then called Bauchi Plateau - to Kano west of the Tangale-Waja area reflects the accessibility of the regions under Fulani-Hausa administration.

The area of investigation in SE-Bauchi Province west of the river Gongola which was not included in their territory shows neither place names nor roads, its eastern margin is characterized by some symbols for hills named "Yam-Yam", a vernacular for man-eaters. There is no equidistant traffic network because the hostile ethnics had no demand for communication and exchange.

The tendency for isolation among the independent ethnic groups of the Tangale-Waja region and the difficult relief resulted in the evolution of communication networks of low connectivity and dimension.

According to the policy of "indirect rule" the British Administration of Northern Nigeria mainly relied on the control of the emirates and invested only marginal efforts on the so called Pagan Belt. In the case of the study area chief-like relations of Waja and Tangale to the Emir of Gombe gave the opportunity to establish dependent sovereigns. In 1910 it became necessary to defend them by military patrols against parts of the population not acknowledging their rulers.

Touring District Officers assessed the population for the payment of taxes. In 1917 the penetration of the Sudan Interior Mission into the Tangale-Waja region started and it settled down in Tula in 1931 where already a District Office and a prison had been installed. In those days a steep mountain track from Deba Habe (in the Tera-Tangale Lowlands southeast of Gombe) to Lau in the Benue valley passed Tula. It was presumably constructed to open up the core of the natural fortress with its resisting hill dwellers and the altitude of 665 m above sea level, which provided to the British officers some relief against the hot and moist climate of the Gongola basin.

According to a report of a Touring District Officer 1931/32 there existed a considerable labour migration to the tin mines of Jos in the west, but up to 1939 the main transport line went around the Tangale-Waja region following the old track via Gombe Aba and Dukku to Dadin Kowa and Yola. The weakness of the external trade relations may be seen by the fact, that some Tangale from Billiri bought donkeys to transport their groundnuts to Dadin Kowa, which became the major regional inland port after the shift of the divisional administration from Nafada to Gombe in 1919. There, the Royal Niger Company paid twice the price the Hausa

traders in the Billiri market were willing to give. The Gongola and the Benue were still the backbones of the import-export trade of NE-Nigeria.

With the establishment of a direct motor road between Bauchi and Gombe in 1939 the distance to the tin mines of Jos as an important inter-regional market with road and rail connection to central markets in Eastern Nigeria and at the coast was reduced.

In 1962 the colonial administration completed the rail and road connection of the Gombe region with the national communication network of Nigeria. The eastern extension of the railway reaching Gombe in 1962 and Maiduguri one year later highlights the beginning of the economic boom of the Gombe region based on the diffusion of two major agricultural innovations which enabled the settled Fulani to use the virgin vertisols with the help of the introduced plough for the growing of cotton.

Besides the improvements of regional transport facilities and increas-

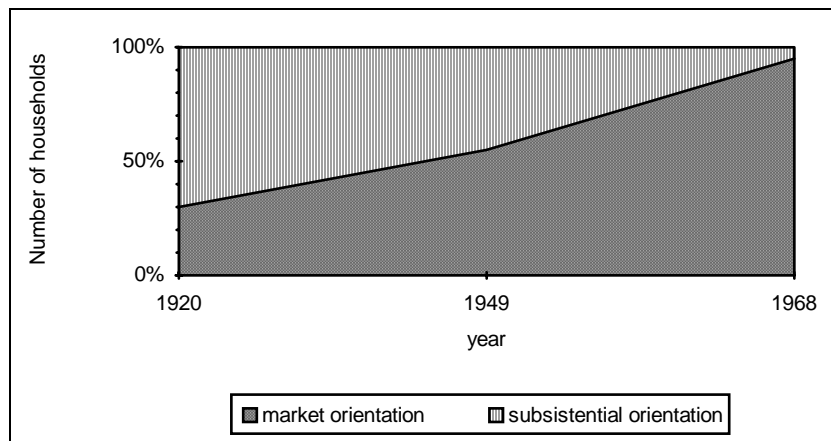


Fig. 6: The development of market-oriented agricultural production in Kumo (M. TIFFEN 1976)

ing market orientation, the investments in the road system reinforced massive immigration of farmers from areas under population pressure in the north (e.g. Kano and Sokoto), whose demand in agricultural land was competing with the comparatively late colonization interests of the Tula. Even today farmers are living and operating economically in the old hill settlements maintaining traditional methods of land use.<sup>2</sup>

### The process of down-hill settlement

The process of down-hill migration in the Tangale-Waja area was encouraged by the colonial administration for a number of reasons: In the

<sup>2</sup> Processes and consequences of recent out-migration can be studied in Tula Baule.

early 20th century it facilitated easier control of the resisting ethnic groups; after the pacification the down-hill expansion improved the access to modern educational and health facilities; and after World War II it enabled the already baptized Christian population to defend their land reserves against migrants from the north.

From the aspect of geography the down-hill movement can be classified as the spatial diffusion of an innovation spreading in north-south direction. Already in pre-colonial times people moved down from the hill sites either as a result of incorporation into the Fulani society (e.g. in central Bauchi, where the first Emir was of autochthonic offspring) or the ethnic group became powerful enough to withstand the Fulani raiders and other enemies. This was the case with the Waja people in the north-east of the study area, whose mounted warriors could keep their attackers in respectful distance. Besides their military resistance they had established regular connections with the Emir of Gombe. The Tangale in Kaltungo had similar tributary relations. There, the chief in 1902 built his palace at the foot of the Kaltungo-Kufai hills (Panmana Hill) about 600 m from the sacred grove where traditionally the male members of the different clans had their ritual meetings.

However, under the aspect of accessibility and the quality of communication networks, the consideration of the process of down-hill migration and taking possession of agricultural land on the plains must start with the "Pax Britannica" in the early 20th century. The Assistant Resident T.F. Carlyle, whose name is still remembered in the Tangale-Waja region, taught the hill people during the dry season 1910/11 the lesson of the low defence value of their fortified villages against the new ruler by means of a military patrol.<sup>3</sup>

First, the population left the defensive protection site on the hill top or slope to settle down permanently on the nearby pediments formerly cultivated as extensive outfields exclusively by men (W. FRICKE 1965).

Though the majority of the hill dwellers especially in Kaltungo and Billiri was leaving their mountainous locations already before the 1950s (R. MOHR 1961), the unplanned resettlement process in Tula Baule is still in progress. Here, the initial agricultural expansion was limited to the wide surface of the Tula Plateau, the resettlement of the plains did not start before the 1950s.

In Ture the down-hill migration started already in the 1920s because of the cooperation of the late Mai Yola Notto - the father of the present village head - with the Christian mission. He built his house on the foot of the slope in close contact to the school and mission's church. The layout of the farm strips was carried out by the British Surveyor in 1948 when the majority of the villagers followed the "early inventors". In 1961 the former settlement location on the hill top was completely abandoned.

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<sup>3</sup> See T.F. CARLYLE et al. 1910, NAK, SNP 7: 5158. Kaduna.

In the late 1940s, the British Administration started to resettle the hill farmers in the surrounding plains by means of land surveying and economic motivation. The process of selective agricultural expansion to the nearby pediments was followed by a phase of extensive migration into the wider plains of the study area throughout the 1950s. Besides these conducted resettlement schemes, there was still a spontaneous expansion in adjacent agricultural lands, which is active until today.

In some places it was like a trial and error as in Filiya in the south-west of the Tangale-Waja area. Already in 1930/31 part of the villagers moved down to a new place beyond the hills. After five years they changed the site to the plain, from where they moved in 1949 to their present location. Only the very broad main road was designed by the British Surveyor, Mr. Turner, who was operating in most of the resettled villages in 1948/49. The compounds were delineated by the village head. In 1961, a larger number of farmers was still living on the terraces than today.

Billiri first experienced a spontaneous down-hill migration when people scattered by moving to their distant bush farms. In 1949 they were resettled into the planned layout of the actual location. Also Kaltungo has experienced two stages of down-hill settlement, as beside the old settlement north of the Panmana Hill which is already mentioned, the present Kaltungo was designed in the north-east of the original hill site. Much more than Kaltungo, Billiri and Filiya, Tula Wange preserved the features of this type of planned settlement.

In a number of places, e.g. Kaltungo, Ture, and Tula Baule one can find a strip shape of farm layout, following the slope of a catena. It originates from the traditional sectorial division of land claims of the clans. This principle also existed in the terraced hill settlements from where the farmers originated.

Considering environmental aspects one has to lay stress on the selective and different character of this agricultural expansion, connected with the down-hill migration and a distinct pattern of population distribution.

## Change of population pattern in relation to physical setting

### The growth of population

The change in the relationship of population and resources can be explained by the comparison of population figures available. The absolute population figures of Bauchi State from 1952 to 1991 indicate a rapid increase in most of the Local Government Areas. According to the generally accepted experience the census in 1952/53 was the first comprehensive one in Nigeria. As the figures for 1963 in many cases - but apparently not in the study area - are inflated for political reasons we prefer to



compare the results of the first census with the data of the recent enumeration of 1991. Within 50 years the population of Bauchi State increased about 202%, in the study area 224%, but the adjacent Akko LGA in Kumo - the area with the in 1953 not yet settled black cotton soil - grew more than 300%!

As a basis of the investigation a map 1:50 000 with the topography and settlements was produced. In combination with the tax figures of Tula Baule it presents a clear picture of the process of down-hill migration and the spatial distribution of population in the Tula Baule settlement system.

The population increase in the Tangale-Waja area seems to be rather high. The tax figures for 1961 and 1989 for the Tula Baule region show the rapid change in the population distribution in less than one generation. The left columns represent the nine villages already existing in 1961, the right ones settlements founded up to 1989.

Only three of the nine villages are old hill settlements, the six other locations are a result of the spontaneous and selective down-hill expansion after World War II. But it has to be noticed that under the name of one taxation unit a number of small scattered hamlets of a large area was summarized. Nowadays these areas are subdivided into separate village wards. For example, Dogon Ruwa, the core settlement founded in 1963, is taxed by four different village fractions (Kurmi, Dinya, Kulitin, Sabon Garin) and itself part of the village unit Awak of Kaltungo LGA.

This market village with 5700 inhabitants is populated by different ethnic groups with a majority from the Kano-Sokoto area. Those settlers, having the experience of using animal traction became very much attracted by the fertile - up till then - uncultivated vertisols.

### The settlement system and the natural environment

A synthetic view of the Tula Baule settlement system reveals the importance of the physical setting.

The old settlement system and even the area of the early resettlement process were restricted to escarpments, steep relief, and pediplains of the Tula Plateau. The villages of the early and late down-hill expansion are mainly located on the border between older and younger pediments, with most of the farms on the younger pediments showing a high percentage of vertisols of the Yolde Formation. The tradition of kinship-related division of land along sections cutting a catena (A. SEMMEL 1980) equally, can be traced by the relationship between the younger and older settlements. In 1961, lowland farmers still had their part of farmland in the old hill settlement; today they give it to relatives and stay on the plain solely. In contrast, traditional hill farmers keep their claims on the former bush farms under shifting cultivation and farm them intensively at high envi-

ronmental risks. In some cases, when there were already immigrated producers of other ethnic groups (e.g. Hausa, Fulani, Waja) among the early plain settlements, the Tula Baule were forced to compete for their traditional land and do this hard even today.

When more detailed census figures will be available in the future we can bring them down to the plots where the people are living. The superposition of correct population figures and the results of a thorough evaluation of SPOT panchromatic imagery - as we have already of Burkina Faso - will enable us to calculate the relation of population and land under cultivation exactly. But even at the present stage of our research, a shortage of land to cultivate and signs of over-farming of the soils on older pediments are identifiable which is indicated by *Striga* spp. It is still not clear, why an encroaching growth of *Striga* is destroying the roots of sorghum and other cereals, diminishing the yield on the farms especially on the older pediments. Soil analysis revealed serious lack of basic plant nutrients. But in contrast, on the hill farms *Striga* did not appear yet. The decline of soil fertility and the appearance of *Striga* have manifold reasons, all caused by a poor, mal-adapted farming practice. Not like the hill farms which are thoroughly hoed, manured, mulched, and benefit from intercropping of root plants, legumes and cereals of numerous varieties, the farms on the pediplain are constantly cultivated over years with a limited crop rotation. On the other hand, the fertile vertisols, derived from clay sedimentary rocks in some areas of the pediments, show - despite ploughing and intensive cropping - no parasitic weeds and still a high nutrient content.

The older pediments are used year by year without fallowing, fertilization and manuring. Just the intercropping of cereals with groundnuts or beans cannot maintain the fertility of the generally poor soil. After the destruction of the natural vegetation cover the bare soil becomes eroded especially by the early rains.

This status of an extensive degradation of land caused by accelerated soil erosion can be mapped by the satellite imagery. Systematic fallowing could prevent the process of considerable loss of soil material necessary to feed the population, as the plant cover would stop the transport of soil by the run-off.

But one can state that in these densely populated areas the size of the farms is already too small and in a number of villages almost 80% of the producers cannot leave parts of their farm fallow. Permanent cultivation, however, needs industrial fertilizer but the government distribution system is inadequate and the amount applicated is varying from 5 to 100 kg/ha - in direct proportion to accessibility. As a result of the existing "land hunger" no single hill farm lies fallow and even deserted places are cultivated.

Mechanic measures against soil erosion are blocked by the following facts:

Terracing in sandy soil is not possible.

Stones are not available and will not fit to ploughing.

Contour ploughing would need as a prerequisite a land consolidation as the shape of the fields is generally crossing the isohyets, because 30 years ago the farmers claimed their plots for hoe cultivation in the traditional way.

What may make the problem of soil erosion even irreversible is the fact that the older pediments were already the object of a natural denudation which becomes now accelerated by the cutting down of drainage channels and the exposure of the bare soil surface to rainfall run-off.

### Further aspects of cultural change

In contrast to a clear dating of resettlement, which has taken place under individual pull and governmental push factors, the diffusion of innovations cannot easily be reconstructed. Christianization, modern education, propagation of monogamy, the overthrow of the old deities, the changing way of agricultural production in order to earn the money for tax, are mentioned without any attempt of ranking. A Touring District Officer noted it in 1932 as the "shirt and trousers movement" and the SIM missionary Dr. Faust in Filiya remembered in 1961 that 30 years ago the males would go even without a leather shirt to the hunting parties. There, in 1940s the custom to divide the harvest upon the common working groups ended. Other changes in the farming practice became induced by an increasing pressure on land. Most down-hill settlers lost their annually farmed and manured home fields near the compound - only the Pero never farmed the hills because of traditional reasons (W. FRICKE 1965). They too changed from a fallow system, which was common to the former bushfarms, e.g. 7 years farming were followed by the same period of rest, to a permanent cultivation.

Certainly, a high quality of infrastructural equipment increases the access of the farmers to agricultural innovations (e.g. chemical fertilizers, improved seeds, credit facilities) as well as modern economic incentives. Food crops like Sorghum, Pennisetum and beans which have been cultivated exclusively for subsistence in the past, are now increasingly integrated in the market-oriented production process. The decision for market-oriented production of food crops for the intraregional and interregional demand is influenced to a large extent by the accessibility of an area. In Ture with a good road access, on more than 50% of the farm land Sorghum is cultivated, and 55% of the farmers are producing this formerly exclusive food crop for the market. In the villages of medium and

poor accessibility (Talasse and Filiya) only 37% respectively 10% of the farmers are marketing Sorghum.

Table 1: Percentage of farm land cultivated with selected crops in three villages of the Tangale-Waja area

	Cotton	Groundnut	Guineacorn
Filiya	34,6 %	15,1 %	50,3 %
Talasse	37,1 %	12,8 %	50,1 %
Ture	7,5 %	38,6 %	54,9 %

Another unanswered question is the exact date of the diffusion of cotton growing and mixed farming among the former hill settlers. In 1956, when the production of cotton in the Gombe Division was already booming, only small markets in Filiya, Gujuba and Talasse were mentioned, all village areas with access to vertisols. The low proportion of mixed farmers - farmers with an ox-plough - can be explained by the fact that besides very few herds with a small number of dwarf cattle kept by the village heads for ritual purposes only, no cattle was kept by the former hill dwellers.

In connection with all those diffusion processes one has to consider the role of the chiefs, a function originally unknown to an acephalous society. Quite often, there was a balance between two clans who were entitled to candidate for the political or for the ritual leadership in one ethnic group. Either by contact with the feudal system or by appointment by the colonial administration one of the families obtained the title of a village head which was inherited by one of the descendants. In which way did this change the traditional system of power and balance between leader, priest and elders? Of which influence are the new political positions in their role of distributing credits and fertilizer?

## Summary

The land use in the Tangale-Waja area is analysed according to the two basic categories of geography: Firstly the manifold interaction between men and environment which form the spatial characteristics of an area, and secondly the decrease of influence with increasing distance.

The importance of these two elementary factors is described by indicators as accessibility for the period from the pre-colonial situation until the time after World War II, when new roads were constructed through the mountainous area. Living in a hilly environment the self contained popu-

lation (formerly called "hill pagans") had developed special agricultural techniques which can be considered ecologically well adapted.

The opening up of the area after the pacification, Christianity and education, led to a considerable increase in population, the expansion of land under cultivation, and the change of settlement structure by down-hill population movement. This resulted in over-use of the fragile natural resources. The size of farm steads became too small for the family unit and the still low accessibility of the hinterland of the main interregional roads as well as inappropriate techniques of agricultural production are shortcomings causing heavy damage to the physical environment and decreasing living standards of the local population.

## References

- BUCHANAN, K.M. & J.C. PUGH (1966): *Land and people in Nigeria*. London.
- CARLYLE, T.F., et al. (1910): Waja District. Escort to Tangale patrol. *NAK, SNP 7, 5401*. Kaduna.
- FRICKE, W. (1965): Bericht über agrargeographische Untersuchungen in der Gombe Division, Bauchi Province, Nord Nigeria. *Erdkunde, XIX (3)*, 233-248.
- HEINRICH, J. (1992): Naturraumpotential, Landnutzung und aktuelle Morphodynamik im südlichen Gongola-Becken, Nordost-Nigeria. *Geoökodynamik XIII(1)*, 41-61.
- KRINGS, TH. (1991): *Agrarwissen bäuerlicher Gruppen in Mali/Westafrika*. Institut für Geographische Wissenschaften. Freie Universität Berlin. Sonderheft 3.
- SEMMEL, A. (1980): Geomorphologische Arbeiten im Rahmen der Entwicklungshilfe - Beispiele aus Zentralafrika und Kamerun. *Geoökodynamik I(1)*, 101-114.
- TIFFEN, M. (1976): The enterprising peasant. Economic development in Gombe Emirate North Eastern State, Nigeria, 1900-1968. Ministry of Overseas Development. *Overseas Research Publication, No.21*. London.
- WAGHORN, W.D. (1912): Report on the administration and working of the Government Niger Transport Service. *NAK, SNP 7: 2226*. Kaduna.