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SYSTEMS OF LAND USE IN THE *FIRGI* PLAINS OF THE CHAD BASIN

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Studies on land use in Africa have usually been carried out by ethnologists or human geographers and were rarely concerned with data on the physical conditions of soil. There is hardly any issue, however, where interdependencies between natural and cultural factors are as evident as in the topic of land use. For this project the approach of three ethnologists, Braukämper, Kirscht and Platte, was therefore combined with the analysis of Thiemeyer as physical geographer.

The area of research is the Local Government Area of Marte in the Nigerian State of Borno. As part of the Chad Basin this region is mainly characterised by clay sediments which are commonly labelled *firgi* by its inhabitants. Beside this general term, however, the local peasants clearly distinguish five types of soil (Kanuri: *katti*), to which different physical conditions and qualities with respect to their cultivation are attributed. The question arose how far can this popular knowledge, accumulated by agricultural experiences over generations, be correlated with scientific data. That is why samples of the mentioned types of soil were collected by the members of our team and analysed in the laboratory of the Frankfurt Institute of Physical Geography. The detailed presentation of this analysis has to be preceded by the classification of the respective soil types in the terminology of the indigenous farmers.

Ethnological studies are carried out among the two major ethnic groups of eastern Borno, the Kanuri and the Shuwa Arabs. The Kanuri have been settlers of the *firgi* plains for as long as they appeared in history as an identifiable ethnic unity in the 16th century. They preserved a legendary tradition that they adopted the *Sorghum* varieties, called *Masakwa* or *Masawa* in some areas, from the ancient population of the Sao whom they mixed with. With the crop itself, which became their henceforth most important staple food, they introduced its techniques of cultivation peculiar for the *firgi* soil (cf. below). Whereas the Kanuri are autochthonous peasants of the Chad Basin, the Shuwa immigrated into the Borno region as semi-nomadic pastoralists from the east during the 18th and early 19th centuries. It is thus obvious that they adopted a considerable part of the know-how concerning the conditions and the terminology of soils as well as the practices of land use from the Kanuri. The following list presents the indigenous names of five types of soil, which are usually differentiated by the Kanuri and the Shuwa, and a brief description of their relevant characteristics (tab. 1).

Tab. 1: Classification of Soil Types in the Chad Basin of Eastern Borno

Vernacular Names in: Kanuri	Shuwa	Relevant Criteria and Characteristics
*ces*a	*goz*	yellow sandy soil (frequently aeolian dunes), into which rain water penetrates quickly and deeply
kafe	*nega*[c]	mixture of clay and sand; a reddish type (*kafe shinowu*) absorbs water and can be cultivated, whereas a white and extremely hard type (*kafe kumbu*) is useless
kerel	*kerel*	dark hard clay soil with small cracks (in dry season); does not absorb water; cultivation of crops with short roots possible during rainy season
firgi	*kerga (firgi*)	clay soil of mostly very dark colour with big cracks (in dry season); absorbs water well and is good for cultivation; allows grazing but no vegetation of shrubs and trees
motosku	*motosku*	clay soil of a much lighter colour than *firgi* with a considerable mixture of sand; is weaker and has less cracks than *firgi*; esteemed for cultivation

Before entering a more detailed discussion on the various aspects of land use, let us have a look at the results of the scientific analyses which were carried out in the laboratory of the Geographical Institute. The aeolian sands called *cesa* will not be considered, because they are a soil type outside the rubric of clay soils labelled *firgi* in a general sense. (As we have seen, the term *firgi* also refers to a special category of clay soil.) Because of its different natural characteristics, *cesa* favours the cultivation of long-rooted crops such as *Pennisetum*, which demand their adequate techniques of tillage.

Our analyses were particularly made with regard to texture, to cation exchange capacity (CEC), to pedogenic iron and manganese oxides, to pH, to available nutrients phosphorus (P) and potassium (K), and to the contents of calcium carbonate ($CaCO_3$) and organic matter.

The results of the investigations, which have so far just entered their pioneer stage, reveal that there is a high correlation between the cation exchange capacity and the content of the clay. From this particular correlation it can be concluded that vermiculite and smectite prevail, both of them clay minerals with a high exchange capacity. Some relevant characteristics of the soil types can be summarized as follows:

Kafe is a transitional soil type between *cesa* and *motosku*, i.e. it is a mixture of clay and sand. One can recognise a calcium penetration into the lower parts of the profile, which led to a soil reaction of the upper parts to become slightly acid.

Kerel has the lowest proportion of materials of exchange capacity (CEC). This fact can possibly be explained by a slightly higher content of clay minerals such as kaolinite, which are unable to exchange cations and to absorb water. From the investigated soil types, *kerel* has a higher content of sodium (Na), which led to a block structure of the soil with coarse cracks disadvantagous for water absorption.

Firgi shows the typical criteria of vertisols with cracks down to a depth of one meter. These cracks can be filled with aeolian sand. Very small and sharp polyeders allow a high reception of water by the clay minerals which is suitably stored and becomes available for plants at the beginning of the dry season.

Motosku cannot be classified as a vertisol. The proportion of sand of middle and fine grain size in its upper part reaches up to 80%, whereas the clay content is usually less than 26% in the top horizon. Vertisols are however defined by a clay percentage of more than 30. *Motosku* shows intensive biotic activity down to a depth of 1.2 meters below surface. It consists of a mixture of sand from elevations of fossil dunes with clay from the *firgi* plains probably caused by lagoonal water movement during one of the higher levels of the so-called Mega Chad in the past. In general, *motosku* combines physical characteristics of *kafe*, *kerel* and *firgi*, which prove to be suitable for agricultural use. (For further information on the results of the scientific analyses of the laboratory work cf. appendices.)

If we return to the human factor of our topic it becomes evident that the systems of land use are to a large extent dependent on the soil conditions. The realisation of this interdependency does not advocate a geographical determinism. Land use in the Chad Basin comprises cultivation, pastoral utilisation and a combination of the two.

Sand dunes scattered all over the *firgi* plains, which were either piled by aeolian activities or constitute the former beach ridges of Lake Chad,

serve as settlement mounds as well as for agricultural purposes. The *cesa* soil absorbs rain water rapidly and deeply. Inhabitants all over the Sudanic zone use it at the beginning of the rainy season mainly to sow the *Pennisetum* millet with its particularly long roots. In addition, three varieties of *Sorghum* (Kanuri: *mere*, *kolbiy*a, *dungoyi*), which also grow on *kafe* soil, can be cultivated on *cesa*. When the rains start, *cesa* is the first of all soil types to be covered with grass and is therefore employed as grazing resource at the beginning of the wet season.

The reddish (or *shinowu*) sub-type of *kafe* soil has a number of characteristics in common with *cesa*, and suits the same varieties of *Sorghum* in rain-fed cultivation. *Pennisetum*, however, can allegedly not be grown. The second sub-type, *kafe kumbu*, which is of white colour and extremely hard, is useless for any kind of cultivation and does not bear even grass.

The dark clay soil *kerel* is sometimes regarded by the local people as a sub-category of *firgi*, but a number of geological criteria suggest its classification as a separate type of soil. It is unable to store water and too hard for the roots of crops below a depth of 30 centimeters so that *Sorghum*, maize and cotton cannot be cultivated. During the rainy season, rice can be planted, which is, however, rarely done, because *kerel* is generally known as a poor soil that is utilised in case of urgent need only. For the same reason people do not like it for the production of irrigated wheat as long as enough fields of *firgi* and *motosku* soil are available. It provides fairly good grazing conditions for livestock after the end of the rainy season.

Firgi, the typical vertisol, is generally marked by its capacity of storing water, although differences exist in this respect. Rain water has to cover its surface for at least ten days, before cultivation becomes a profitable enterprise. The fields are usually surrounded by earth walls in order to extend the storage of water. Guinea-corn of the above-mentioned *Masakwa* or *Masawa* varieties are planted after all the liquid is absorbed into the ground. The technique of tillage which farmers employ is to poke holes in the wet earth with big digging-sticks at a distance varying from about 80 to 120 centimeters (according to the differences in the capacity of soils of storing water) and to put three seedlings in each of them. *Masakwa*, which is used in this context as a collective term for the regional "dwarf" varieties of *Sorghum* with an average length of the stalks of less than two meters, can be harvested after four months. In the Chad Basin, *Masakwa* cultivation is the core element of traditional economy and it reveals a high degree of adaptation to the local environment. It neither demands an advanced agricultural equipment, such as the plough, nor sophisticated methods of irrigation, and it perfectly fits to the conditions of a temporarily inundated habitat. It can thus be assumed that it has played a central role in the historical processes of occupation of this part of the Chad Basin by peasant populations. Further research of all the dis-

ciplines of our project is therefore intended to be focussed just on this subject.

With respect to the natural vegetation it can be stated by observation as well as by communications of informants that big trees never grow on *firgi*. Bushes rarely occur, but there is plenty of grass and herbs at the beginning of the rainy season before the ground is completely covered with water. During this short interval of some weeks *firgi* provides a good pasture. As we have explained before, *motosku* is a lighter and weaker soil than *firgi* because of its predominance of sandy content. It therefore absorbs rain water more rapidly and efficiently, i.e. it minimizes the losses of evaporation. As Kanuri and Shuwa peasants put it "motosku needs less water than *firgi*", which proves to be a great advantage in years of sparse rainfall. In such a situation *motosku* is considered the superior type of soil. It offers a further advantage through the fact that the earth walls surrounding the fields to improve the storage of water need not be as high as on *firgi* soil. A height of 20-30 centimeters usually suffices. They remain uncultivated whereas the larger *firgi* walls are used by many farmers for planting Okra (*Hibiscus esculentus*), cotton etc. Trees and shrubs can grow on *motosku*, and various species of grass provide a rich pasture during their respective vegetation periods. *Motosku* offers a further advantage. Because of its relatively high porosity the process of tillage and respectively the harvest can usually start earlier than on *firgi*. This fact results in a greater flexibility of the farming activities and the whole agrarian calendar.

If we try to arrive at a comparative analysis of the esteem of the farmers with regard to the types of soil, the following hierarchy can be assumed:

Kafe and *kerel* are less esteemed because of their limited possibilities of agricultural use. *Firgi* offers the highest yields, but it demands much rain and a relatively high investment of labour. *Motosku* is apparently most liked, because it guarantees a good yield with less effort and quite a sufficient production in years of low precipitation. In comparison with the clay soils, *cesa*, the sand dunes, are considered a complementary system of land-use. They provide, at the same time, localities for the settlements. These differences are clearly reflected in juridical conventions and norms. Land on the *cesa* dunes is long-established individual property, whereas on the clay soils communal and private ownership occur in various combinations. This special topic is outside the scope of a detailed discussion here.

We have demonstrated a distinctive correlation between physical characteristics of soil on the one hand and the utilisation of crops and techniques of cultivation on the other hand. In this particular sphere the so-called telluric determinant is undoubtedly important. It can, however, not claim an undisputed priority, since men have gained a remarkable autonomy with respect to nature by establishing strategies in different

socio-economic sectors. There is first of all a system which can be labelled "ordinary village farming". It comprises the cultivation of *Pennisetum* on *cesa* dunes in the rainy season and of *Sorghum* on clay soil as well as gardening in and around the settlements. It constitutes the base of nutrition and usually provides - beyond the subsistence level - a limited surplus production. A new farming system for "cash crops", particularly wheat, was introduced in the 1970s, when the state-owned "Chad Basin Development Authority" established a vast irrigation scheme in eastern Borno. The local peasants have to invest a certain amount of labour and the scheme provides water, mechanised services and fertilizer. The employment of modern technical means reduces the dependency on natural conditions, for example *kerel* soil can be utilised for the cultivation of wheat, but it implies a tendency to overstrain the ecological potential.

A third farming system is dry season cultivation in areas of the Basin from which the waters of Lake Chad are gradually receding in its recent process of shrinking. Temporary camps and permanent settlements are established there to cultivate mainly beans, maize and cassava.

A fourth system is provided by agro-pastoralism, as it is practised by the Shuwa in particular. Herds of livestock are subsequently driven to areas, which are exempted from cultivation at different times; they utilize the rests of the crops after harvest and they provide dung for the fields.

The systems of land-use, as studied in the Chad Basin are to a large extent overlapping and complementary so that there is hardly a complete dependency on one single type. This strategy has secured a divergent and multi-facetted exploitation of the natural resources and has, thus, maintained - so far at least - the balance of an ecologically precarious environment.

References

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