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## SOCIAL AND ECONOMIC CHANGE AND THE INTENSITY OF LAND USE IN THE MANDARA MOUNTAINS REGION OF NORTH CAMEROON

by

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### *Introduction*

The relationship between demographic change, land availability and land use is a major focus of studies of African agricultural systems. As rural populations have increased, societies have adapted in a variety of ways, including intensification of land use in existing areas of settlement, movement to more sparsely populated regions, and rural to urban migration. The implications of demographic change for rural systems have been reviewed from widely different perspectives and the debate continues between those who, following Boserup (1965) and Gleave & White (1969), suggest that population growth stimulates production in African agriculture through promoting more intensive forms of land use and others who view many rural societies in Africa as struggling to maintain production in the face of the demands of a growing population with environmental degradation as the outcome of the more intensive land uses which are employed (Grigg 1979).

There is evidence to support both positions. Examples of intensive land use under high population densities are to be found throughout Africa under different ecological conditions (Prefol & Delepiepierre 1975; Netting 1968; Ludwig 1968; Mortimore 1967), and a more recent study by Turner *et al.* (1977) concluded that intensity of land use is directly related to population density.

It noted however that other factors, including environmental conditions and the prevailing type of cropping and livestock systems, influenced the intensity of land use, though less strongly.

The dangers associated with increasing population and intensity of land use, such as disruption of food production and environmental degradation have also been widely documented (Pitot 1966; Pelissier 1951; Dresch 1959; Kates *et al.* 1977). A variety of causal factors have been identified. These include improved medical facilities, which have resulted in a rapid decline in the death rate and a corresponding increase in population; restrictions on land availability and productivity due to land alienation, the presence of disease vectors (Hunter 1980), boundary demarcation, and a less productive agricultural environment in areas of settlement (Mbithi & Barnes 1975; Bernard & Thom 1981). Economic and social factors such as labor availability, the need to maintain risk avoidance strategies which might be threatened by changing land use, and the availability of alternative economic opportunities also contribute to this process.

Proponents of both positions recognize the existence and importance of these factors. Porter suggests the major difference between the two may be the question of time: the amount of time it takes for viable intensive land uses to develop that can accommodate increasing numbers of people. He writes (1977, p. 201) that in recent decades there has been a

rapid increase of population and a sudden and intense build-up in land pressure, rather than a slow sustained pressure, such as Mrs. Boserup

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postulates as instrumental in effecting agricultural intensification. The responses in land use have been erratic and volatile—characterized by migration, land fragmentation, moves to marginal areas unsuited to the agricultural system, and attendant land devastation, social upheavals (Mau Mau being one example), and a variety of attempts to re-establish a balance in land use—schemes which have had both good and indifferent results.

In those areas, such as in the Jos Plateau (Netting 1968), around Kano (Mortimore 1967), and on Ukara Island (Ludwig 1968), intensive systems were able to develop over time to meet the needs of their people. But in other cases, where rapid population growth has coincided with other economic and social changes, insufficient time has been available for adaptation, and the consequences for these areas have been detrimental.

The contrasting positions in the debate are important to the preparation of a development strategy for the Mandara Mountains region of north Cameroon. This is an upland area in which intensive patterns of land use developed over centuries in response to slow population increase in societies whose access to land was restricted by the presence of hostile neighbors in the surrounding lowlands. Over the past thirty years conditions have changed: population growth has been rapid, the political pressures which restricted access to the lowlands have weakened, and economic opportunities have become available beyond the mountains. In consequence there is an ongoing adjustment in land use practices which entails both opportunities for and constraints on the ability of the region to support its population in the future. It is the purpose of this paper to discuss the evolution of the contemporary land use patterns in the region and to assess their future viability in the light of existing socio-economic and environmental trends. Such an assessment is important in that the Mandara Mountains area is seen by the Government of Cameroon as a priority area for development assistance, and an understanding of current processes is essential to the preparation of an appropriate development strategy<sup>1</sup>.

#### *The Mandara Mountains region*

The Mandara Mountains extend along the border between north Cameroon and northeast Nigeria (Fig. 1). They are a range of hills rising to 1400 meters made up of pre-Cambrian and Cambrian formations surrounded by the lowlands of the Lake Chad basin. The area has a climate typical of the Sahelian-Sudanic ecologi-

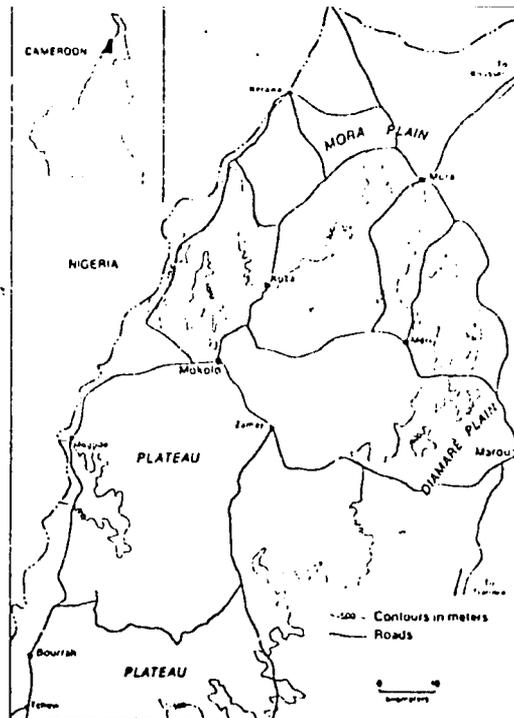


Fig. 1. *The Mandara Mountains Region.*

cal zones of West Africa, modified by elevation. The rainfall is low and decreases from south to north and from the hills to the plains (Table 1; Fig. 2). The soils of the region are generally of poor quality (ONAREST 1971; USDA 1978). Fertility is highest along river valleys and where the traditional intensive application of manure is made. Agricultural production is limited not only by low rainfall and poor soils but also by recurrent drought and infestation by insects such

Table 1. *Average annual rainfall in Margui Wandala (in millimeters).*

Station	Ecological zone	Mean rainfall	Standard deviation	Coefficient of variation
Bourrah <sup>1</sup>	S. Plateau	1057.03	200.15	18.9
Hina <sup>2</sup>	Plateau/ Plain	873.5	199.67	22.9
Mora <sup>3</sup>	Plain	725.6	168.9	23.3
Mokolo <sup>4</sup>	N. Plateau	1060.2	153.7	14.5

Notes: <sup>1</sup> Data based on 1954-73 with that for 1969 missing.

<sup>2</sup> Data based on 1957-78.

<sup>3</sup> Data based on 1949-78.

<sup>4</sup> Data based on 1963-79.

Sources: Catholic Mission Ouro-Tada for Mokolo and Service Departmental de l'Agriculture de Margui-Wandala, *Rapports Annuels* for the other locations.

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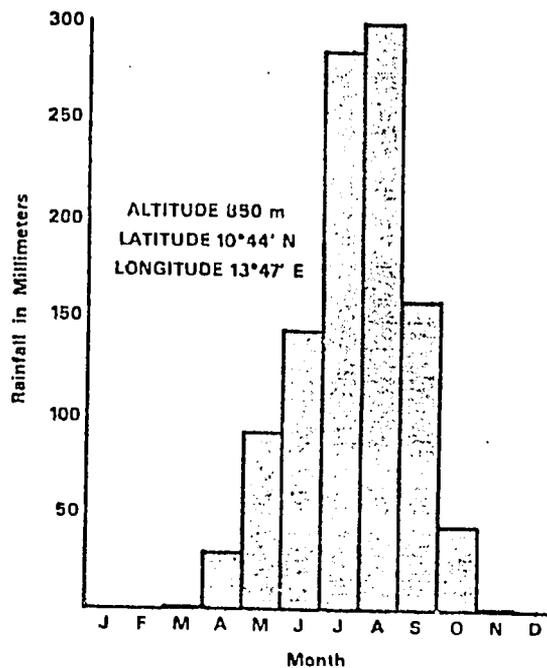


Fig. 2. Mean monthly rainfall, 1963-1979, Catholic mission, Ouro-Tada, Mokoko.

as caterpillars and weeds such as *Striga hermonthica*.

The population is composed of over twenty different ethnic groups which vary in size from the largest, the Mafa, with a population of over one hundred thousand, to smaller ones, such as the Bana, who number only a few thousand (Hallaire & Barral 1967). The Mandara Mountains region is among the most densely populated in Cameroon and the population is growing rapidly (Beauvilain 1980)<sup>2</sup>.

One would not normally anticipate these population concentrations in an area with such major constraints on agricultural production. This can be explained by the fact that over the past few centuries the people of the mountains have been subject to hostile activity by the strong polities which formed in the surrounding lowlands. The Wandaia and Fulani saw the *montagnards* as a source of slaves (Mohammadou 1981), and as the population increased the people had to occupy even the most remote hillsides.

European colonization did little at first to alter the situation. The Germans conquered the area in 1902 and administered it through indirect rule relying on the traditional rulers such as the

*lamidos* (Chauleur 1936; Rudin 1938), and it was only late in the period of French administration, after World War II, that serious attention was paid to the needs of the *montagnards*. Both the Germans and the French tried, with little success, to move the people from the mountains to the plains where they would be more accessible to administrative control and to the services provided by the colonial authorities.

**Land use and land tenure** - This long history of hostility and distrust between the people of the mountains and those of the lowlands explains much of the contemporary land use and land tenure arrangements in the region. This history also indicates many of the difficulties in promoting socio-economic changes which imply greater interaction between different groups.

The mountains were settled over a long period of time. As land and food shortage arose in one area young men were encouraged to leave and settle new ones. Those who founded new villages assumed the status of 'chief' (a headman), a position most clearly defined by his right to grant to others permission to settle (Riddell 1980). Through this process even the more inaccessible mountains gradually became populated and a distinctive settlement pattern emerged. The limited availability of cultivable land on steep hillsides led to the building of houses on rock outcrops unsuitable for cultivation. Thus the area does not have many nucleated villages but rather scattered settlements related to each other by lineage. In the absence of a strong village structure the government has often had to administer the region through interactions with individual families rather than on a community basis.

Land use in the mountains is based upon strategies for conserving soil and soil fertility. The hillsides are steep and an intricate system of terracing supported by soil building actions has been developed to provide an adequate physical resource base for crop production (Boulet 1971). The terraces require constant maintenance, and the soil they protect is improved by the addition of household and animal wastes and crop residues.

The impact on crop production of the application of manure and household wastes to fields on the mountains and the plateau has been assessed by Holtzman, who compared yields with varying degrees of manuring (1982, pp. 103-111). He found that plots receiving average amounts of manure in the plateau had higher grain yields than those of the mountains due to the greater

soil fertility, higher rainfall, and the practice of extensive manuring by the regular relocation of cattle corrals in the former area. However, intensive application of manure increases yields much more in the mountains than on the plateau. Those fields which are intensively manured in the hills produced 7-9 times more than average plots, while yields on heavily manured fields on the plateau were double those of average plots. Holtzman explains this by the

more systematic and abundant application of livestock manure and household wastes by households in the mountainous zones. . . more intensive cultivation on fields near the compound that receive more manure and household wastes. . . (and) terraces are better maintained, manure is spread and worked into the soil, and labor inputs into weeding are higher (1982, p. 106).

Crop rotation and intercropping also play an important role in maintaining sustained yields. Many Mafa farmers participate in a two-year sorghum rotation cycle with millet. This not only rotates the demands on the soils, but also alters the breeding habitat for pests. Cereals are also rotated and interplanted with nitrogen-fixing legumes, of which peanuts are the most popular today because of the cash market and promotion introduced by the colonial powers. *Acacia albida* are highly prized and are recognized for beneficial effects on the surrounding soil.

Despite this variety of activities designed to increase productivity, farm production is regularly diminished by the impact of insects and the parasitic weed *Striga hermonthica*. Farmers may be able to replant in an attempt to overcome pest damage, but little can be done to prevent the losses due to *Striga* as the infestation does not show itself until the later growing stages of the grain.

Livestock are important to the farming systems of the Mandara Mountains and both cattle and smallstock are kept (Zalla *et al.* 1981). Some cattle are stall-fed year-round, but during the growing season most animals are penned and hand-fed to prevent crop damage. The manure is collected and, together with household wastes, applied to the land to improve fertility. Feeding and manuring occupy much time just when the demands on family labor are most tight, during the growing season, and thus availability of labor imposes a limit on the number of animals that a farm family can keep.

The agricultural systems of the Mandara Mountains are complex and could not support

the dense population in the absence of the wide variety of inputs made to the conservation of the soil and the maintenance of its fertility. Crop mixes, crop rotation and animal husbandry all play important roles in this process, and during the dry season terraces have to be repaired. These activities demand careful organization on the part of farmers to produce their food needs under difficult environmental conditions.

*Contemporary settlement and land use* Until very recently the distribution of the population remained similar to that imposed during the period of Mandara and Fulani conquest. During the French colonial period sporadic attempts were made to bring the mountain people under greater administrative control by resettling them in the valleys and plains of the region and were often resisted by the mountain people. Movement from the hills became voluntary as the reduction of the threat of attack or enslavement by the Fulani allowed people to descend in search of more fertile land, to seek opportunities to grow cash crops, or to work as laborers on the lowland farms or on settlement schemes (Podlewski 1961; Boutrais 1973, 1978). The expansion of the urban economies of towns such as Maroua and Garoua also encouraged rural to urban migration. In general, the data we collected reveal that in those mountain areas where resources are poor and the area's capacity to absorb the population, which may be increasing at over 3% a year, is low, spontaneous migration to more productive areas both within and beyond the region is an important demographic variable.

The majority of those leaving the villages in the mountains are young men aged between 15 and 30 years. A high proportion of them remain within the Mandara Mountains region. Many moved to the towns of Mora and Mokolo to find work. Others seek temporary employment as laborers on the cotton and *mousskouari*<sup>3</sup> fields in the plains, or move to the principal urban area of the region, Maroua. Some people move to Cameroonian towns farther from the area, such as Garoua, Ngaoundéré, and Yaoundé. These tend to be long-term migrants who have joined the urban flow which has contributed to the recent rapid growth of these emerging urban centers (Beauvilain 1980).

A process of more recent origin is the movement to Nigeria, where the Maiduguri area is the most important single destination. Village interviews revealed a surprising number of families from villages near the border that have moved to

Nigeria, and in these locations, such as Tala Gozèllè, abandoned terraces are widespread. This migration is not hindered by restrictions on movement, no national identity card is required, and is encouraged by the lower rate of taxation in Nigeria: 1000 cfa a year, as compared with 3200 cfa in Cameroon. Also, social barriers to movement are weak. Many families have members on both sides of the border, while in the towns previous migrants provide an hospitable environment.

While spontaneous migration is occurring in the area, official attempts at planned resettlement have not been well received. The government has long been attempting to move people from the mountains to the lowlands, but with little success (Boutrais 1978). The only continuing resettlement scheme is the Nord-Est Benoué Project. It is located in Benoué Division of the Northern Province and it is designed to attract both young married and middle-aged heads of families. A variety of incentives are provided. The villages have wells and schools, some have dispensaries. Agricultural and veterinary monitors are active. All migrants are volunteers, and the project provides a truck to ship them and their effects to the project area from their local *poste agricole* (RUC 1978).

The Mandara Mountains are designated by the Nord-Est Benoué Project as a potential source of migrants, and each November and December a campaign is undertaken after the harvest to recruit migrants. The resettlement has been active since 1976, and the scheme had a population of 35,784 on September 1978, of whom 1,021 were *montagnards* (ibid.). Migration from the region was at a fairly low level until 1980 when more migrants moved than in the previous four years combined. A contributory factor in this may have been the poor harvest over much of the area in 1979. However, the small numbers involved are unlikely to be any real help in reducing the pressure on the area's resources from a growing population.

The majority of population movements in the area are not organized by the administration but consist of spontaneous relocation of compounds from the steep mountainsides to adjacent valleys or to the neighboring plateau or plains. This relocation within the region has altered land use patterns both where settlement is taking place in the lowlands and in the mountain areas from which the settlers came. In some mountain areas movement of population away from the hills has had negative impacts on the effectiveness of the terrace system. Though farmers who move to

the lowlands may continue to cultivate fields on terraced hillsides they often pay less attention to terrace maintenance, because greater effort is required to travel to those fields and the household wastes and animal manure cannot easily be carried to them. Where terraces have been completely abandoned and left without maintenance, they are less able to retain soil and reduce run-off of rainwater, and so erosion increases.

People moving from the mountains to flatter land in the valleys, plains, and on the plateau generally settle on land not incorporated in existing cultivation systems. Permission to settle is granted to those arriving in an area by a headman under the long standing rules of land tenure discussed above. The land so given may represent a loan in some areas such as Makalingay while in others, such as Mohour where people are resettling an area considered part of the ancestral lands, a tenure system associated with land-owning lineages has emerged.

The lowlands into which the *montagnards* are moving differ in their productivity from area to area due to variations in soil fertility and in rainfall. The plains of Diamaré, Koza and Mora have relatively poor agricultural potential. The rainfall is low (table 1) and the majority of the soils consist of infertile sandy alluvials and halomorphic clays (ONAREST 1971). However, alongside the seasonal rivers young, poorly developed but more fertile alluvial soils exist which, in conjunction with the high water table, permit cultivation. The settlement pattern in the plains reflects these ecological variations. The population is concentrated in villages located alongside the larger streams. Cotton, grown in rotation with sorghum, is the most important crop. The population of the villages and their cultivated area is increasing as people leave the neighboring mountains to settle in the plains, but the new arrivals are apportioned in the open land away from the rivers where the soils are less fertile and the water table much deeper and less accessible.

Resettlement on the plateau, which extends from Tchévi and Bourrah in the south to Mokoio and Souledé in the north, has been most active in the area to the east of Mokoio. This area has been the focus of migration, often forced migration, of people from the mountain area to the northwest of Mokoio, known as Ziver, and from the isolated hills of the plateau such as Mohour. While the productivity of the land was good immediately following bush cutting, the people found that fertility declined rapidly, and thus shifting cultivation systems have evolved. This

extensive form of land use has led to a neglect of the measures taken to protect the soil and conserve fertility, which are such important features of the mountain system. The removal of the vegetative cover and the relative lack of attention to terracing has reduced the protection afforded against soil erosion such that gullying along water courses and sheetwash on gentle slopes are occurring.

While land use changes may, over time, result in lowered productivity of the resource base and thus exacerbate the problems of land shortage and food deficits, they also entail the risk of social conflict. This is particularly the case in the valleys of the mountains, in the plains, and in the plateau where the expansion of the area under cultivation encroaches upon the grazing and water resources of adjacent herders<sup>4</sup>. Throughout the region from Guili to Mokolo and into the plains, there are increasing complaints of livestock damaging crops by grazing them or trampling them on their way to water<sup>5</sup>. In some cases the administration has established a boundary between cropland and grazing land, but frequently farmers continue to cultivate in the areas set aside for grazing. In the latter case, however, the administration has been forced to take action to protect the grazing rights of Fulani herders (Campbell & Riddell 1982).

It is evident that a number of restrictions exist in the area upon the long term ability of farmers to settle in the lowlands. The limited availability of fertile land has resulted in more extensive land use practices than those of the mountains, but in many areas of settlement the actual amount of land that can be incorporated into a fallow system is itself constrained by the claims of herders on land they use for grazing. The current trend towards more extensive farming practices may therefore be short-lived and in the future more intensive ones may have to be reinstated. (Fig. 3).

#### Discussion

The remarkable terraced landscape of the Mandara Mountains is a reflection of centuries of adaptation of the population to the limited availability of productive land secure from attack by hostile neighbors. The intricate terraces allow the accumulation of soil, and its fertility is promoted, particularly near the compound, by the application of manure and household wastes.

The evolution of this system of land use provides a clear example of the response of a growing population to land pressure suggested by

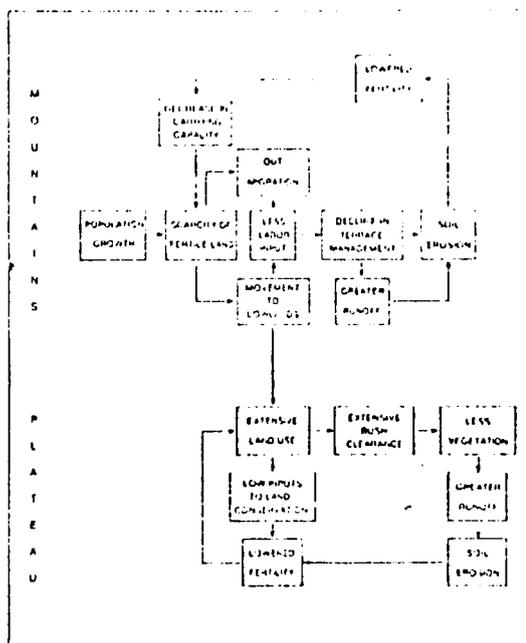


Fig. 3. Some implications of land use change in the Mandara Mountains.

Source: Campbell & Riddell 1982.

Boserup (1965), though as Brookfield (1972) points out, and as this study illustrates, increasing intensity of land use may also be a response to environmental conditions such as low soil fertility and the need for terracing on steep slopes. Recent events have also followed a pattern which she predicted. As the farmers have gained access to land previously deprived them in adjacent lowlands, people have moved, and in the more land-abundant circumstances, have adopted less intensive forms of land use incorporating the use of fallow. A consequence of the movement away from the mountains is that a process of disintensification has been set in motion (Brookfield 1972). In some cases where whole hillsides have been abandoned the terraces are no longer effective, and in other areas terraces are in a state of disrepair as younger people have migrated leaving to the elderly the burdensome task of maintenance.

The success of the extensive forms of land use in the lowlands depends upon a sufficient land area being available to meet the production needs of the population and the fallowing requirements of the soil. Currently this is the case over most of the region as the lowlands and plateau still have room for settlement. However, present trends in population growth and in the rate of migration to the mountain-adjacent low-

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lands suggest that productive land may soon become scarce, forcing the redeployment of more intensive practices or, in their absence, entailing a decline in productivity<sup>6</sup>.

The Boserup hypothesis would suggest that as the population-land ratio again changes towards limited land availability, intensification would occur. There is a long tradition of the use of intensive farming techniques in the region which would form an effective basis for successful adaptation to land shortage. However, the skills associated with intensive land use are not being used in the lowlands and are no longer being applied in some mountain areas.

Rehabilitation of the upland areas that have not been maintained<sup>7</sup> and intensification of lowland land use will take time; and time, as Porter (1970) has pointed out, is an essential component in the development of a viable intensive land use system. In the absence of determined efforts to maintain the conservationist practices on which the traditional intensive system was based, the ability of the area to accommodate ever greater population pressures may be limited.

The discussion has indicated that current trends in the area provide evidence of a potential for disruption of crop production and for environmental degradation in the future. The severity of such problems will depend upon a number of factors, among the most important of which are the extent to which skills of intensification are being lost by those who are not applying them in their new locations, and how quickly will the people be able to re-apply them and intensify production? Finally, as intensification implies substantial labor commitment, alternatives such as migration to towns and resettlement away from the area may prove more attractive.

Such questions imply that development planning for areas like the Mandara Mountains must take account of ongoing processes, many of which are the consequences of past attempts at outside intervention, and which may undermine the best intended initiatives taken by government planners. The problems of the area are

great, and it is undeniable that there is a need for action to reduce the existing poverty in the region. But, as Zalla *et al.* (1981) have shown, the inputs needed to upgrade the production systems of the area have yet to be identified. The diversity of cultural practices and the micro-ecological variations of the area mean that careful experimentation with selected inputs will have to be conducted before an active development program can be devised and implemented. However, it must be questioned whether relocation from hillside to lowland is an effective long-term strategy if, as at present, little effort is made to conserve those elements of the farming system which enabled the survival of the population in the past and which will, in all likelihood, be needed in the future.

It is not that development policy should try to recreate past conditions or ever maintain conservationist practices for their own sake. However, recognition should be given to those elements in the land use system which have provided a measure of security and which might be promoted within any future development strategy<sup>8</sup>.

The rapid rate of population increase in the region will, in all probability, give rise to a relatively swift transformation from the current land-abundant situation to one of land shortage. The alternative of migration to Nigeria or to the growing urban areas of southern Cameroon is unlikely to significantly alleviate the demand for farmland in the Mandara Mountains area. Thus, in the next decade the region will experience population pressure, and time may not be available for a slow sustained readjustment of land use practices. Should current trends continue, the conservative elements of the past system may have been sufficiently neglected that, rather than a successful intensive system being re-established, the pattern of environmental degradation and declining productivity witnessed in other parts of Sahelian Africa will appear. The dynamic Boserupian conditions of the past will be replaced by those discussed by her critics.

#### Notes:

<sup>1</sup> The research reported in this paper was conducted in the Mandara Mountains region between April and August 1980. The research formed part of the program of the proposed Government of the United Republic of Cameroon/USAID Mandara Mountains Integrated Development Project conducted by Michigan State University under the terms of the US Agency for International Development Contract No. 698-0135. We are grateful to John

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Cartographic Research, Michigan State University, for preparing the figures and to Harriet Ashbay for patiently typing the manuscript.

<sup>2</sup> The population of the Department of Margui Wandala according to the census of 1976 was 465,679. Beauvilain (1980) shows that the number of people in the Department increased by 135,000 between 1968 and 1976, representing an annual rate of increase of about 4%. These increases represent rates of population growth between the census of 1967-68 and that of 1976 of over 4% for the District of Mokolo and of nearly 4% for Margui Wandala as a whole. While the town of Mokolo has grown rapidly in recent years (Steck 1972), the very high estimated growth rate of about 4% for the District may reflect inaccuracies in the census data.

<sup>3</sup> *Mousskouari* is a dry season sorghum which is grown only in the plain. It is estimated that *mousskouari* accounted for one third of the cereal production in the plains during the 1979 growing season (Campbell, *et al.* 1980).

<sup>4</sup> The conflict between farmers and herders in semi-arid Africa has become a widespread problem, occurring under a variety of different circumstances (McCown *et al.* 1979). It has been documented both in the Sahelian countries of West Africa (Diarra 1975; Raynaud 1975; Swift 1975; Berry *et al.* 1977; Toulmin 1983) and in semi-arid areas of East Africa (Naveh 1966; Campbell 1981b). In the majority of cases the political context within which the competition is taking place biases its resolution in favor of the farmers. The situation in the Mandara Mountains, where the issue was resolved by a Moslem administration in favor of Moslem herders and against non-Moslem farmers, is thus unusual.

<sup>5</sup> In the Arrondissement of Mokolo most of the conflicts which arise are settled by agreement between the individu-

als concerned. When this is not the case the issue is brought before the village chief for his judgement. Should the problem not be resolved to the satisfaction of those involved, the village headman may refer it to the *tribunal coutumier*. This tribunal, which includes representatives of the canton chiefs, hears an estimated 40 cases a year. If the situation of conflict is such that a whole village brings complaint, then the *Sous-Prefet* is required by law (Decret No. 1.78-263 of 3rd July 1978, establishing procedures for resolving herder-farmer conflict) to set up a commission of enquiry to resolve the issue. (Interview with the *Ajouté Sous-Prefet*, Mokolo, August 1980.)

<sup>6</sup> The overall productivity of the soils of the region is poor. Those of the lowlands are generally more fertile than those of the mountains and the most fertile are found in river valleys (Campbell 1981a). Thus productive farmland is limited. Further, the presence of an often incompatible land use, namely herding, restricts the expansion of cultivation, and the conflict between herders and farmers which exists in the area (Campbell & Riddell 1982; footnote 8) can only be expected to increase should farmers continue to extend the area under crops.

<sup>7</sup> A number of factors may mitigate against such a movement back to the abandoned hillsides. Water is more scarce, more work is needed per unit of output than on the lower lying land, and once an area has been uninhabited there is a critical mass of people required to ward off the wild animals which may damage crops. (Larry Lev, personal communication).

<sup>8</sup> Such elements would include not only the skills associated with terrace construction and fertility maintenance through manuring but also other practices, integral components of the socio-economic system, which give protection against the impact of such events as drought or infestation by weeds or insects (Campbell & Trechter 1982).

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