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A SOCIO-ECONOMIC ANALYSIS OF STALL-FED CATTLE PRODUCTION AND MARKETING IN THE MANDARA MOUNTAINS REGION OF NORTHERN CAMEROON

By

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ABSTRACT

A SOCIO-ECONOMIC ANALYSIS OF STALL-FED CATTLE PRODUCTION AND MARKETING IN THE MANDARA MOUNTAINS REGION OF NORTHERN CAMEROON

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Unlike most semi-arid regions of West Africa, the Mandara Mountains region of Northern Cameroon is characterized by intensive agricultural and livestock production. Typically, producers enclose and hand-feed bull calves during the crop growing season and then release animals to graze during the dry season. This cycle is followed for two years, and finished cattle have traditionally been slaughtered for consumption by the extended family at post-harvest festivals. It is also becoming increasingly common for producers to sell beef or live bulls to rural butchers and cattle traders.

In 1978-79 the World Bank began financing a stall-feeding loan scheme, whereby the Cameroonian parastatal FONADER would eventually disburse 1,000 loans per year to farmers who would adopt the practice of stall-feeding. In 1980-81 this research evaluated the loan program and the performance of the stall-fed cattle subsector. The study approach focuses on productive transformation and exchange linking the participants vertically in the commodity subsector. Key participants and processes were surveyed, including input supply, stall-feeding practices,

red meat consumption, rural and urban butchers' slaughter and procurement patterns, seasonality of cattle and beef prices and the livestock trade.

The research shows that financial returns to stall-feeding using the existing technology are below returns to cash cropping. Stall-feeding does improve the long-run economic viability of intensive farming systems in the Mandara Mountains, because using cattle manure as a fertilizer improves soil characteristics. Producer returns could be higher if cattle acquisition and sale were better timed, and if supplemental dry season feeding were successfully introduced.

Economic analysis of the project shows that returns to promoting stall-feeding are above the opportunity cost of capital. Moreover, an expanded applied research and extension program could increase project returns and benefit producers not receiving loans. The research also shows that retail beef price ceilings in urban areas need to be relaxed in order to stimulate competitive bidding for stall-fed cattle as offtake expands. Urban demand for beef would also be satisfied increasingly through slaughter of locally produced stock rather than by importing cattle into the region.

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To Gladys,

who allowed her only son
to go to Cameroon, despite
terminal illness, and to

Arthur,

who provided continual
support and encouragement.

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MAFA AGRICULTURAL CALENDAR

1. October . . . . . First month of year and of the millet beer festival. Millet is almost ripe.

2. November . . . . . Month during which millet ripens. This is celebrated by dancing by the light of the moon.

3. December . . . . . Month of the harvest.

4. January . . . . . Month of the Marai festival.

5. February . . . . . Month of the festival hudok, during which there is dancing by the light of the moon.

6. March . . . . . Month of field clearing.

7. April . . . . . Month of field preparation.

8. May . . . . . Month during which sorghum/millet is sown.

9. June-August . . . . Months of heaviest agricultural labor. During July, the festival melebi of the rains occurs and young people in the village weed the chief's fields.

10. September . . . . . Month of bean harvest.

SOURCE: Translated from Jean-Yves Martin, Les Matakam du Cameroun: Essai sur la dynamique d'une société pré-industrielle, Mémoires ORSTOM, No. 41, ORSTOM, Paris, 1970, pp. 19-20.

CHAPTER ONE

THE RESEARCH PROBLEM

A. THE EVOLUTION OF CATTLE STALL-FEEDING IN THE FARMING SYSTEMS OF THE MANDARA MOUNTAINS

Stall-feeding of cattle is concentrated in the mountainous zones of the Mandara Mountains region and on the high plateau to the east of Mokolo (see Figure 3-2). The population density in these areas is higher than in the plains or plateau in the southern part of Margui-Wandala Department. Population pressure has made arable land an increasingly scarce resource in the mountainous zones and agricultural holdings are consequently smaller than in the plains and plateau areas. Both crop and livestock production are therefore intensive with respect to labor allocated per unit of land and per livestock unit. Since very little land is available for grazing during the rainy season (May through November), livestock have to be hand-fed or grazed far from areas where crops are growing.

There is evidence that the Mandara Mountains, particularly the areas inhabited by the Mafa, have been settled and intensively cultivated for centuries.[1] Mixed farmers had been practicing terraced agriculture in

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[1] A. Marliac, Contribution a l'étude de la préhistoire au Cameroun septentrional, Travaux et documents de l'ORSTOM, No. 43, Paris, ORSTOM, 1975.

the mountains long before the Fulani arrived in Northern Cameroon (early nineteenth century) and drove Mafa farmers into the mountains from plateau areas to which they had been moving in increasing numbers in search of uncultivated land.[2] Although there is no proof that enclosed feeding of cattle has taken place for as long as mixed farmers have carried out terraced agriculture in the mountains, it is highly likely that population growth, which was forcing farmers to resettle two centuries ago, made rainy season enclosure of livestock the predominant mode of livestock production in most areas of the mountains. ILCA suggests that farmers in the Mandara Mountains have stall-fed cattle for many years, although they used to raise humpless breeds rather than the Zebu Peul cattle that have been acquired from Fulani herders and traders for feeding in recent years.[3]

Hand-feeding of cattle and goats requires substantial labor inputs and therefore competes with cropping enterprises during the rainy season. Yet intensive livestock and crop production also have important complementarities. Livestock produces manure that is piled and stored in enclosures and spread on fields close to the household compound. This manure helps to maintain and in many cases augment soil fertility and cereal production. Cropping enterprises complement intensive livestock production in that agricultural by-products are used to finish cattle and goats for post-harvest slaughter or sale and are stored for late dry

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[2]Jean-Yves Martin, Les Matakam du Cameroun; Essai sur la dynamique d'une société pré-industrielle, Mémoires ORSTOM No. 41, Paris, ORSTOM, 1970, pp. 29-40.

[3]International Livestock Center for Africa, Trypanotolerant Livestock in West and Central Africa, Monograph 2, Vol. II, Addis Ababa, ILCA, 1979, p. 240.

season and early rainy season (April through June) maintenance feeding of enclosed livestock. Therefore, crop and livestock production are well integrated in the intensive farming systems of the Mandara Mountains.

Traditionally, rural households that stall-feed cattle have slaughtered their bulls after two to three years of feeding at the annual harvest festival (November through December) or the bi- or tri-annual festival of the bull, the Marai (January through February). Wealthier farmers in the village, who are able to acquire and stall-feed cattle, distribute the beef from slaughtered bulls to members of the extended family and to friends and neighbors in the village. The older, more tradition-bound farmers still follow this custom.

More recently, this traditional practice has begun to undergo change. Many of the younger farmers who stall-feed cattle are beginning to feed cattle for commercial sale. Some farmers sell their bulls to local cattle traders or to rural butchers. Others slaughter the bulls, reserving some of the beef for traditional distribution and household consumption. These farmers often sell at least one quarter of the slaughtered bull to other villagers, including local butchers, or to buyers from neighboring villages. It is not uncommon for stall-feeding households to sell three quarters or more from the carcass, thereby generating enough revenue to reinvest in another bull, buy clothing, pay taxes, or make other necessary purchases.

Although increasing commercialization is taking place very gradually in some isolated villages, it appears to be occurring quite rapidly in other less isolated areas. Greater sales of cattle and beef have accompanied the increasing monetization of the economy of the Mandara Mountains region, which is considered a backwater even by Cameroonian

standards. Furthermore, cattle price inflation during the 1970s, fueled by rising oil revenues and urban incomes in Nigeria and the West African cattle supply contraction in the wake of the Sahelian drought, compelled many stall-feeding farmers to sell at least some beef in order to acquire cattle for reinvestment. The effect of inflation on the trend toward greater commercialization of stall-feeding has been especially marked in the Mandara Mountains region, where food deficits are common and alternative sources of income are limited.

B. RECENT POLICY INTERVENTIONS IN CATTLE STALL-FEEDING

Recognizing the trend toward increasing commercialization of cattle stall-feeding, a Cameroonian parastatal agency, FONADER (Fonds National de Développement Rural) in conjunction with the World Bank has undertaken a pilot production credit scheme involving small farmers in the Mandara Mountains. FONADER began to disburse loans of 45,000 FCFA to farmers in early 1979, 39,000 FCFA of which was earmarked for cattle acquisition and 6,000 FCFA of which was supplied as a feed supplement (rice bran) in kind. As of March 1981, over 700 loans had been extended to Mafa farmers in the mountainous and high plateau areas around Mokolo and Koza. Although most of the loan recipients had intensively fed cattle at least once before applying for a loan, the pilot project aims to provide capital, to as great an extent as possible, to rural households that have never had the opportunity to stall-feed. Loan recipients are required to reimburse 10,000 FCFA after one year and the remaining 43,000 FCFA at the end of two years. The interest rate of 10 percent is about the same as the rates of inflation in livestock and meat prices that prevailed in the late 1970s and beginning of the 1980s.

The FONADER stall-feeding scheme is a pilot project. It is experimental in that it is attempting to graft a new technology, supplementary feeding of a concentrated input (rice bran), on a well-established mode of animal husbandry. The bran is a rice processing by-product bought from SEMRY (Société d'Expansion et de Modernisation de la Riziculture de Yagoua), whose headquarters in Yagoua is 187 kilometers east of Mokolo over nonpaved roads. If the experiment proves to be successful, then FONADER will expand the loan program.

Although this activity was identified as a promising area of intervention in the Mandara Mountains, little applied research and economic analysis preceded the pilot project. The project designers estimated loan recipients' probable costs and returns of stall-feeding cattle for two years, assuming that the Zebu bulls would gain 220 kilograms and increase in value by 38,000 FCFA. There was little consideration of the strength of alternative sources of demand for stall-fed cattle and other factors which might affect additional production and marketing opportunities for all participants in the stall-fed beef subsector. These participants include farmers who practice stall-feeding, rural and urban butchers who slaughter and retail stall-fed cattle, traders who sell these animals to Nigeria, and those who supply supplemental feeds and other inputs. The project appraisers assumed that demand for higher quality feed was potentially strong enough to justify promotion of stall-feeding. Little systematic analysis has been done of alternative marketing strategies.

In order to understand the long run economic viability of the loan scheme, it is necessary to study both supply and demand forces acting on

the whole set of beef subsector participants. It is important to analyze the set of vertical linkages among these participants, as well as the institutions, standard operating procedures and policies which determine the effectiveness of these linkages. The analysis should focus on how well these linkages and institutional arrangements function as supply and demand forces affect the different subsector participants.

FONADER has ignored the above linkages and institutional arrangements in designing and implementing the stall-feeding project. Moreover, the parastatal has not closely monitored the loan scheme in order to evaluate the potential for expanding it beyond the pilot stage.[4] Consequently, there is need to assess the likely economic profitability of increased stall-feeding for all of the participants in this production-marketing subsystem.

C. RESEARCH OBJECTIVES

The general objective of this dissertation is to analyze the economic viability of the production and marketing of stall-fed cattle in the Mandara Mountains. There may be potential for expanding the FONADER loan program, but a rigorous analysis of the returns to stall-feeding and marketing enterprises and of the likelihood of improving the performance of input and product markets is needed in order to assess this

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[4]Although FONADER has not evaluated stall-fed beef subsector performance as it is affected by linkages among participants and by institutions and policies, it has sponsored a two-year study of stall-feeding by the Veterinary School of Maroua. Degree candidates at the school are monitoring animal nutrition and health practices of 20 stall-feeding households at Mofole, a Mafa village adjacent to Mokolo. These 20 households received FONADER loans in October 1980. Within three weeks the 20 participants had bought bulls for stall-feeding, which were weighed using a livestock scale transported from Maroua. The bulls were weighed again after one year and at the end of two years.

potential. Factors that affect present and projected stall-fed cattle production and marketing need to be identified and analyzed in such a way that concrete policy recommendations can be made.

Specific research objectives of this study are:

1. To review past and present research on cattle production and marketing in Northern Cameroon and in other (mainly semi-arid) regions of Africa. Emphasis will be on intensive cattle feeding and marketing.
2. To describe the operations of the cattle and beef subsector of the Mandara Mountains of Northern Cameroon. This will involve description of subsector participants' input procurement, productive transformation and marketing procedures and strategies.
3. To assess key factors influencing the supply and demand situation for cattle, beef and stall-feeding production inputs.
4. To analyze costs and returns to selected producers and butcher /retailers under alternative input procurement and marketing practices.
5. To prescribe areas of applied research and policy interventions with potentially high payoffs in improving the performance of the stall-fed beef and cattle subsector in this area.

D. CONDUCT OF THE FIELD RESEARCH

The Agricultural Economics Department at Michigan State University was contracted to help develop a Project Identification Document (PID) for an integrated rural development project in the Mandara Mountains in

September 1979. This set in motion a one and one-half year process by which applied researchers from Michigan State University were able to study the farming and livestock systems, agricultural marketing, land use and tenure, and household consumption/nutrition in the Mandara Mountains region. This applied research was designed to identify potential interventions which might improve rural households' livelihood and increase their incomes.

The author participated in the field research from April 1980 through March 1981, concentrating on stall-fed cattle production by mixed farmers and cattle and beef marketing in the Mandara Mountains region. He wrote two preliminary reports of research findings, which served as background documents in preparing a comprehensive report for USAID/Yaounde.[5] This dissertation draws upon those papers, informal interviews with government officials and subsector participants, and formal surveys of stall-fed cattle production, livestock and meat marketing, cattle slaughter, and cropping enterprises carried out in the Mandara Mountains.

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[5]John Holtzman, Livestock Production and Marketing in the Mandara Mountains, with Special Attention to Stall-Fed Cattle, MSU/USAID Mandara Mountain Research Report No. 10, Michigan State University, Department of Agricultural Economics, East Lansing, 1980; John Holtzman, L'élevage et la commercialisation des bovins dons les Monts du Mandara, MSU/USAID Mandara Mountain Research Report No. 17, Michigan State University, Department of Agricultural Economics, East Lansing, 1981; Tom Zalla, David J. Campbell, John Holtzman, Larry Lev and David Trechter, Agricultural Production Potential in the Mandara Mountains in Northern Cameroon, MSU Rural Development Working Paper No. 18, Department of Agricultural Economics, Michigan State University, East Lansing, 1981.

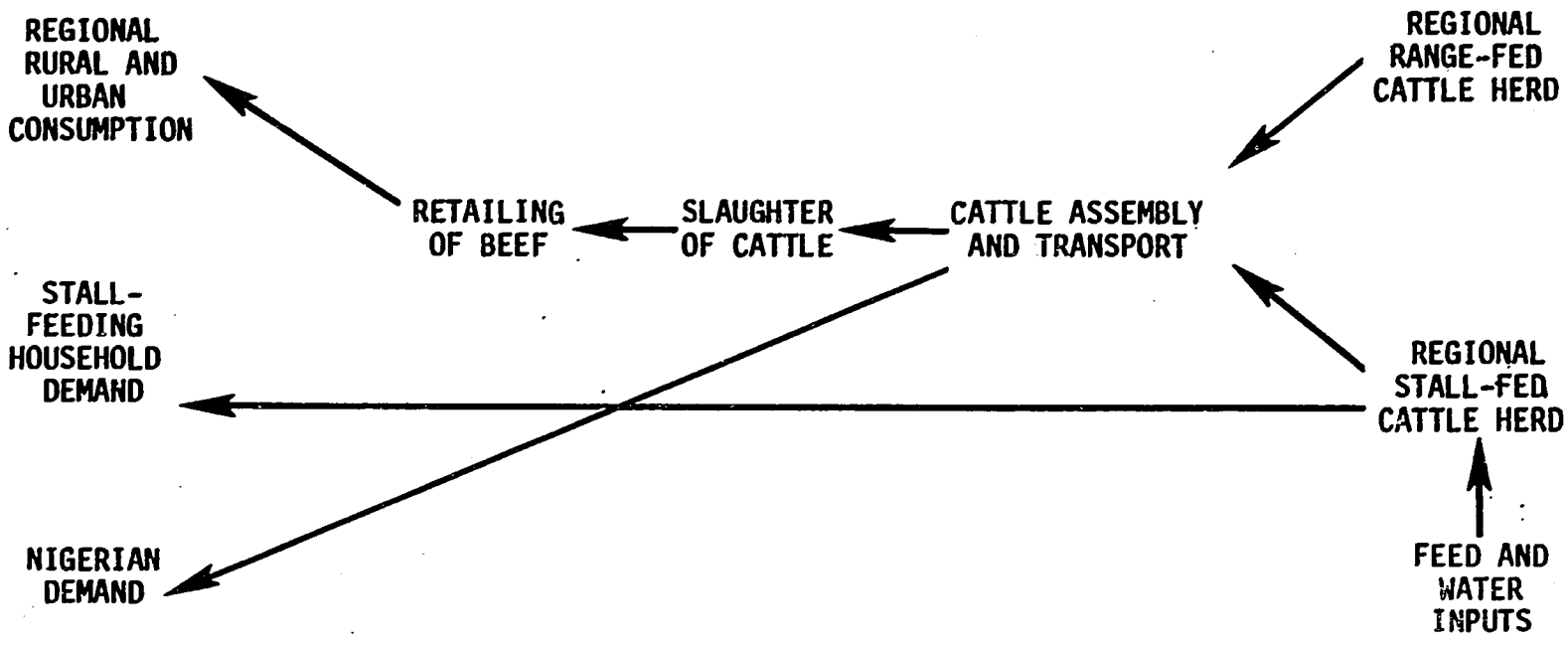
E. ORGANIZATION OF THE DISSERTATION

As elaborated in greater detail in the following chapter, this dissertation uses a subsector framework to analyze the economic viability of expanding stall-fed cattle production and marketing in the Mandara Mountains region. Figure 1-1 is a schematic representation of the cattle and beef subsector, which shows the linkages between input supply, stall-fed and extensive cattle production, home slaughter and consumption, assembly and transport, export, commercial slaughter, retailing, and purchase of beef for consumption. The scheme depicts the flow of inputs and outputs of different levels of the channel from production input supply (right-hand side of figure) to final consumption of beef within and outside of the Mandara Mountains region (left-hand side of figure).

In the same way that Figure 1-1 illustrates different stages of the cattle and beef subsector, the dissertation is organized so that the different subsector participants and their functions in the subsector are analyzed in separate chapters before examining the economic viability of stall-fed cattle production and marketing. Separate treatment of the supply and demand factors, linkages, institutions and government policies that affect participants' activities at different stages of the subsector provides the necessary context in which analysis of the viability of expanding stall-feeding can be carried out and policy recommendations can be made. Without careful analysis of the interrelationships between stages in the subsector and the manner in which the current set of institutions and policies affect participants' incentives and risks in carrying out productive transformation and exchange, it

FIGURE 1-1

THE CATTLE AND BEEF SUBSECTOR OF THE MANDARA MOUNTAINS REGION



is easy to overlook potential constraints to expanding production and sale of a commodity.

Following the problem statement in Chapter One, Chapter Two reviews the literature on intensive cattle production in Africa and justifies the choice of the subsector focus. Chapter Three then describes the geography, population, farming systems, and livestock production of the Mandara Mountains region.

After these preliminary chapters, Chapters Four through Eight analyze the different stages of the cattle subsector. Chapter Four analyzes the environmental and historical forces that have shaped stall-feeding as an enterprise in the mixed-farming systems of the Mandara Mountains. The inputs and outputs of stall-feeding are discussed in considerable detail and returns to stall-feeding using traditional feeding practices are analyzed.

In Chapter Five urban and rural consumption of beef and small ruminant meat is estimated for 1980. Survey data from stall-feeding households is also analyzed to show the sources and seasonality of rural red meat consumption. Finally, urban and rural demand for beef is projected for 1985 and 1990.

Butchering and retailing activities are described and analyzed in Chapter Six, with particular attention to seasonal variation in cattle and small ruminant supply, butchers' slaughter cattle acquisition practices, and the magnitude of alternative sources of slaughter cattle supply. Returns to urban and rural slaughter of range-fed and stall-fed cattle are then estimated and compared.

Chapter Seven describes the organization and conduct of the cattle trade. Participants in the trade are identified, cattle markets are classified, interregional and international flows of slaughter and trade cattle are discussed, and trends in cattle and beef prices are examined. In Chapter Eight the present and projected supply and demand for traditional stall-feeding input, agro-industrial by-products, and veterinary and extension services are examined.

Chapter Nine analyzes the economic viability of producing and marketing stall-fed cattle using rice bran as a dry season feeding supplement. The costs and returns to producers are estimated and compared to the costs and returns of stall-feeding using existing methods. A sensitivity analysis of producers' financial returns to labor and management is carried out, whereby key parameters are varied, such as the average daily rate of gain, the cost of supplemental feed, cattle acquisition and sales prices, and incremental cereals production due to application of cattle manure. Economic analysis is also conducted of the overall FONADER project, both with and without an expanded applied research and extension component. The potential effects of retaining and removing export restrictions and retail price controls on producers' marketing opportunities and the economic viability of the stall-feeding project are then anticipated. The effect of the non-marginal expansion in stall-fed cattle supply upon cattle and beef prices and regional supply and demand for beef will be analyzed under alternative subsector policies.

The concluding chapter, Chapter Ten, summarizes the principal findings and themes of the preceding chapters and draws policy conclusions regarding expansion of stall-fed cattle production and marketing. In

addition, it outlines a program of applied research that could upgrade the performance of the stall-feeding project and subsector in the Mandara Mountains region.

CHAPTER TWO

LITERATURE REVIEW AND RESEARCH METHODOLOGY

A. INTRODUCTION

Most livestock production in semi-arid regions of Africa is extensive, range-fed production. Population density is low in these regions, and large expanses of land are available for grazing. Intensive cattle production is becoming increasingly common, however, in semi-arid regions inhabited by agriculturalists, where population density has increased. In some areas this intensive cattle production is a dry season enterprise that generates income for seasonally underemployed farmers. These farmers utilize agricultural by-products to feed cattle over a three to six month period, selling the finished animals to butchers and traders who supply nearby urban areas. In other areas, such as the Mandara Mountains, intensive cattle production is an integral part of the farming system, where cattle are enclosed during the growing season and manure is a highly valued output. In the following section examples of the two types of intensive cattle feeding enterprises will be described and compared to stall-feeding in the Mandara Mountains. Then typical approaches to studying intensive cattle feeding will be discussed, and the framework which this study will follow is outlined.

B. REVIEW OF THE LITERATURE ON INTENSIVE CATTLE PRODUCTION

1. Intensive Cattle Production by Small Farmers in Other Parts of Africa

Intensive cattle production is not restricted to the Mandara Mountains region in Africa. It is also practiced by mixed farmers on the slopes of Mount Kilimanjaro, in the savannah and sahelian zones of Northern Nigeria and Southern Niger, along the Niger River near Niamey, in the hills of Madagascar, in the Shire Highlands and on the Lilongwe Plains of Malawi, outside Dakar, Senegal and in the Harrar mountains of Ethiopia. Each of these regions is characterized by high population density, relatively small holdings and intensive cropping, and continuous or near-continuous cultivation. With the exception of the dairy enterprises of the Chagga in Tanzania, these cattle production systems are all commercial beef enterprises. Farmers buy male cattle, ranging from bull calves of one to two years up to bulls exceeding eight years of age, for three to nine months of intensive feeding. Cattle procured for intensive cattle production are readily available, as are nearby markets for finished cattle. In all of these systems farmers feed agricultural by-products to the cattle. Manure is a highly valued joint product which augments crop yields.

Intensive dry season feeding of cattle is an important dry season activity for small farmers in the West African countries of Niger, Nigeria and Senegal. Hausa farmers in Nigeria and Niger purchase bulls and steers at low cost at the end of the rainy season or at the beginning of the dry season when cattle are plentiful at local

markets.[1] They then feed out these cattle for three to six months on agricultural by-products, crop residues, and standing hay, selling the finished animals late in the dry season when beef supplies are short on local markets and cattle prices per unit liveweight are typically high. Intensive cattle feeding during the dry season is also practiced by small farmers along the Niger River near Niamey, the capital of Niger.[2] In this case the availability of river grass, an important source of forage, cheap cattle at nearby markets during the early dry season, and an expanding urban market provide smallholders with good income-earning opportunities. Finally, small farmers near Dakar, Senegal feed out bull calves, old and worn out oxen, and infertile cows for three to nine months during the dry season for sale early in the rainy season.[3]

Short-term intensive cattle production for commercial gain is also practiced in Southern Africa. Small farmers in Malawi have increasingly adopted stall-feeding with the encouragement of government research stations.[4] Most stall-feeding is carried out during the winter months

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[1]Philippe Blanc, "De l'embouche intensive des zébus africains et Malagache," Thèse pour le Doctorat No. 17, Ecole Nationale Vétérinaire de Toulouse, 1974, pp. 23-38; and Randall Thomas, "The Stratification of the Production and Marketing of Livestock in Southeastern Niger in the Department of Zinder," Unpublished Ph.D. Dissertation, University of Michigan, Department of Economics, 1982.

[2]Christopher Wardle, Promoting Cattle Fattening Among Peasants in Niger, Pastoral Network Paper 8c, Overseas Development Institute, London, July 1979.

[3]Philippe Blanc, op. cit., pp. 28-29.

[4]D. Thomas and B. L. Addy, "Stall-Fed Beef Production in Malawi," World Review of Animal Production, Vol. XIII, No. 1, January-March 1977.

(dry season) when agricultural by-products like maize stover and stored groundnut, cowpea, and sweet potato vines are available and labor is not a constraint, as it normally is during the growing season. Farmers buy two- to three-year-old bulls after the harvest and sell them at the end of the dry season or early in the rainy season when cattle prices are high. Unlike beef production enterprises in West Africa, the availability of young bulls for fattening constrain expansion of stall-feeding in Malawi.

Stall-feeding of old bulls and steers has expanded steadily in hillside villages surrounding Tananarive, the capital of Madagascar.[5] This feeding takes place during the growing season and usually for a good part of the dry season. Cattle are fed freshly-cut grasses during the rainy season, and then manioc and rice straw after the harvest.

Intensive cattle feeding for commercial gain is also carried out in East Africa in the Harrar highlands of Ethiopia.[6] Adult cattle, especially former traction animals, are fattened on cut and carried grasses and agricultural by-products and also grazed on pasture by farmers who hold the cattle for periods averaging one year. Several thousand fattened head of cattle are sold each year and transported by rail for slaughter at Addis Ababa and Djibouti.

Whereas intensive cattle feeding in Niger, Nigeria, Senegal, Malawi, Ethiopia and Madagascar is a relatively recent and explicitly commercial phenomenon, stall-feeding in the Mandara Mountains has been going on

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[5] Henri Serres, "L'engraissement des zébus dans la région de Tananarive selon la technique du 'boeuf de fosse'", Révue de'Elevage et de Médecine Vétérinaire des Pays Tropicaux, 1969, 22, 4 (529-539).

[6] Philippe Blanc, op. cit., p. 31.

for decades as an integral part of the farming system. Manure has been an important joint product of stall-feeding in the Mandara Mountains, and fattening takes place over at least a two year period, unlike the shorter, more concentrated embouche practiced in more recently adopted commercial schemes in West Africa.

As in the Mandara Mountains, intensive cattle production has been fully integrated in the farming system of the Chagga of Mount Kilimanjaro for decades, although the reasons for having first enclosed livestock after years of extensive grazing are unclear.[7] Mixed farmers raise cows and female goats for milk and manure production. The milk supplements a diet of bananas, maize and beans, while the manure augments crop production. Some milk is also sold to households not owning cattle or milk-producing goats. Male cattle are generally not kept, although a few bulls are fed out for slaughter. Although livestock are enclosed during the rainy season, as in the Mandara Mountains, there is no need to stock grasses for dry season feeding. Green forage is available all year. During the rainy season the forage ration comes from grasses from nearby farms, the plains at the foot of the mountain, and forest reserves. During the dry season banana leaves are fed to the cattle.

The main difference between this farming system and that of the Mandara Mountains is the important role played by dairy production. Although the Mandara Mountains and slopes of Kilimanjaro are both heavily populated areas, the demand for dairy products may be stronger at

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[7]Zalla, Tom, "Economic, Technical and Political Aspects of Small Holder Milk Production in Northern Tanzania," Unpublished Ph.D. Dissertation, Michigan State University, Department of Agricultural Economics, 1982.

Kilimanjaro. The soils at Kilimanjaro are more fertile than those in the Mandara Mountains, and hence agricultural production is greater. The Chagga are able to grow cash crops such as coffee and bananas that provide them with disposable income for purchasing commodities such as dairy products and for acquiring heifers and cows.

In contrast, most farm households in the Mandara Mountains produce little for sale; a very high proportion of their farmland is devoted to grain production.[8] Cash crop production is limited to small quantities of groundnuts and patches of sweet potatoes in well-watered areas. Since agricultural income is so low, most farmers do not have the resources to buy heifers and cows or livestock feed. Good female breeding stock is rarely for sale in Northern Cameroon; traditional herders do not sell cows that are capable of bearing calves, and female cattle for sale at cattle markets are usually old or infertile. Farmers in the Mandara Mountains are able to obtain bull calves for half to two-thirds the price of female breeding stock. The wealthier farmers often own cows but such an investment is beyond the means of most mixed farmers.[9]

An important historical development that works against dairy production by mixed farmers in the Mandara Mountains is that the Fulani have traditionally sold or exchanged dairy products for grain, cowpeas and other produce grown by farm households. This specialization and

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[8]The proportion of total land holdings of farmers in four villages in the mountainous and high plateau areas of the Mandara Mountains that was devoted to sorghum production in 1980 ranged from a village average of 75 percent at Madakonay to 89 percent at Magoumaz. These data are based on actual field measurements of from 6 to 23 farms in each of the four villages.

[9]In Magoumaz, the wealthier of the two villages where the survey of cattle stall-feeding was conducted, 3 of 30 farmers in the sample own female cattle.

exchange is prevalent in semi-arid zones throughout West Africa. Dairy production has traditionally been dominated by the Fulani, whereas agricultural production has been the province of settled farmers. Mixed farmers who own cattle typically invest more heavily in male cattle. In recent years the use of bulls and steers as oxen has increased in the plateau and plains regions of the Mandara Mountains and many parts of West Africa. Given the traditional specialization of labor between agriculturalists and pastoralists in the Mandara Mountains, it is easier for mixed farmers to think of livestock in terms of their impact on agriculture. Bulls tend to make better oxen, and they produce more manure for use as fertilizer than do cows.

Intensive animal husbandry is also practiced by the Ukaru on a densely populated island in Lake Victoria (Tanzania).[10] Cattle are kept in huts most of the year and hand-fed grass, leaves, weeds and crop residues. Cows and calves graze on the limited available pasture during the dry season, while bulls only leave their stalls for watering. Unlike the Mafa and the Chagga, the Ukaru cultivate fodder, consisting primarily of elephant grass, in "water meadows" along upland river courses and in excavated channels close to the lake shore. This system of feeding is comparable to that practiced by Nigerien farmers, who feed grasses from the Niger River to cattle during the dry season. While the Mafa, Chagga and other groups that raise livestock intensively apply manure to household gardens, seed-beds and fields close to the compound, the Ukaru apply manure at least once every two to three years to all unirrigated

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[10] Ludwig Heinz-Dieter, "Permanent Farming on Ukaru: The Impact of Land Shortage on Husbandry Practices," in Smallholder Farming and Smallholder Development in Tanzania: Ten Case Studies, edited by Hans Ruthenberg, Müchen, 1968, pp. 87-135.

fields. Four to five tons of manure are worked into a household's fields every year, which permits permanent cultivation of holdings that average only 4.20 acres of arable land per household of 10.9 people.

SEMRY, a parastatal organization that promotes irrigated rice production in Northeastern Cameroon, is introducing dry season fattening of cattle to smallholders.[11] Paddy is processed in the rice-growing areas at Yagoua and Maga, so rice milling by-products are available for cattle feeding. The parastatal has conducted several years of 90-100 day feeding trials with Zebu cattle of different breeds, ages and sex. Cattle weighing 200 to 270 kilograms at the beginning of the feeding trials typically gain 80-120 kilograms by the end of the feeding period. Although high-energy feed is available in abundance and at low cost, the absence of nearby markets and adequate roads for trucking to distant markets threatens to constrain the expansion of intensive cattle production in Northeastern Cameroon.

2. Previous Approaches to Studying Intensive Cattle Production

Most of the research on intensive cattle production in Africa has been conducted by animal scientists and production economists. They have focused primarily on the feeding regimes practiced by smallholders, comparing rates of gain with those attainable in controlled experiments or feedlot settings. The production process and technical input-output coefficients have received most of the attention, while marketing has been considered as a constraint to promoting intensive cattle production, almost as an afterthought. Rather than viewing demand for beef and

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[11] See Annex 5 for a more detailed discussion of the SEMRY program.

animal by-products as the driving force behind small farmers' decisions to feed cattle intensively, animal scientists and production economists have regarded demand as an exogenous force external to the production process. Production and marketing are therefore not seen as interrelated but as distinct and separable.

The assumption underlying most of these studies is that intensive cattle production should be promoted if agricultural by-products, forage resources and agro-industrial by-products are available. That is, the existence of a feeding technology justifies its implementation, at least on a trial basis. Demand has not been systematically assessed prior to feeding trials and interventions at the farm level. In the Mandara Mountains the World Bank/FONADER scheme for promoting stall-feeding was preceded by little analysis of the potential demand for stall-fed beef.

In this study of intensive cattle production, marketing will not be treated merely as a constraint to increasing production. Farmers' decisions to produce and market cattle are essentially the same decision. Using the term marketing is somewhat misleading in that it implies commercial sale. Perhaps disposal, distribution or use of the outputs of intensive cattle production are more appropriate labels for the process by which demand both internal and external to the producing household is satisfied. Marketing or distribution opportunities for farmers are created by demand for livestock products, which is dynamic and multi-faceted. Demand for cattle and beef can come from the producing unit, other households in the village, consumers at rural markets, or urban consumers. The different types of demand for livestock products create incentives, which may be conflicting, for producers.

Since demand plays such a critical role in motivating smallholders to produce livestock and other commodities, it merits initial and primary consideration. Unlike earlier studies of intensive cattle production, which have been carried out by animal scientists and production economists, we will attempt to assess the forces of demand for stall-fed cattle, beef and manure, and hence marketing opportunities for mixed farmers. Without adequate incentives to produce stall-fed beef, there is little justification for promoting intensive cattle production in the Mandara Mountains.

C. CHOICE OF ANALYTICAL FRAMEWORK

1. The Subsector Approach to Studying Livestock Production and Marketing

This dissertation uses the subsector approach to analyze the economic viability of producing, slaughtering and trading stall-fed cattle. A subsector is an economic unit of analysis specific to a particular commodity or commodity group (cattle, livestock, vegetables, grain). Rather than focusing horizontally on producers or traders, which are the conventional units of analysis in traditional production or marketing research, the subsector approach forces the analyst to examine the vertical set of activities (input supply, production, marketing, trading, retailing, consumption) that facilitate productive transformation and exchange at each stage of the value-adding process.[12] The subsector approach is a dynamic analytical framework that compels the researcher to examine the processes of productive transformation, exchange, risk-taking and sharing, and information dissemination. Different subsector participants are

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[12] James Shaffer, "On the Concept of Subsector Studies," American Journal of Agricultural Economics, May 1973, pp. 333-335.

actively involved in each of these processes, carrying out what are more conventionally thought of as production and input and product marketing functions.

The set of institutions and processes by which information and preferences (quality specifications) are communicated throughout the subsector, exchanges are timed, risks are shared, and future prices are predicted constitutes vertical coordination.[13] Good coordination in a subsector leads to allocative accuracy or a good matching of the quantity, quality, timing and location of products supplied with those demanded.[14] Therefore, good coordination in a subsector ensures good performance. In contrast, poor coordination undermines subsector participants' incentives to transform and move a commodity from the farmgate to the consumer.

Some of the performance attributes of a subsector, whose attainment is influenced by the degree of vertical coordination in the subsector, are:

1. Output, price and profit stability of subsector participants,
2. Equity of returns to different participants when weighed against their investments and risks undertaken and the control they exercise at various stages in the vertical channel,
3. Technical and operational efficiency at each stage and among stages of the subsector,

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[13] Bruce Marion, Application of the Structure, Conduct, Performance Paradigm to Subsector Analysis, N.C. Project 117, Working Paper No. 7, March 1976.

[14] Bruce Marion, "Vertical Coordination and Exchange Arrangements: Concepts and Hypotheses," in Coordination and Exchange in Agricultural Subsectors, N.C. Project 117, Monograph 2, January 1976.

4. The adequacy, accuracy and equity of information distributed,
5. Waste and spoilage in the process of productive transformation,
6. The level and type of employment in the subsector,
7. Subsector adaptability,
8. Progressiveness (technological innovation),
9. The extent to which consumer preferences are communicated back through the subsector,
10. Wholesome nutrition and improvement of diets.[15]

The list of attributes can be extended; it is not meant to be exhaustive.

One performance dimension, subsector adaptability, is particularly important in a developing country context, where demand for more specialized agricultural commodities, such as beef, fruits, vegetables and dairy products is highly income elastic. Marion suggests that subsector adaptability is influenced by such forces as the growth of demand for output, the extent of government regulation and risk-sharing, the distribution of power between different stages in the subsector, and the degree of cooperation and market coordination among participants. The forces contributing to subsector coordination are usually different from those leading to improved synchronization or fine-tuning of the subsector.[16]

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[15] Bruce Marion, Application of the Structure, Conduct, Performance Paradigm to Subsector Analysis, N.C. Project 117, Working Paper No. 7, March 1976 and Campbell, Gerald R. and Marvin L. Hayenga, eds. Vertical Organization and Coordination in Selected Commodity Subsectors, N.C. Project 117, Working Paper No. 20, August 1978, see the Appendix "A Comparative Outline of Structure, Coordination and Performance in Selected Commodity Subsectors."

[16] Bruce Marion, "Vertical Coordination and Exchange Arrangements: Concepts and Hypotheses," in Coordination and Exchange in Agricultural Subsectors, N.C. Project 117, Monograph 2, January 1976.

In the African context subsector adaptability deserves more attention than synchronization, because there is little possibility of fine-tuning in the uncertain and dynamic environments of most African countries. Weather-induced variability in agricultural and livestock production, particularly in semi-arid regions, is the most disruptive and destabilizing of forces that make fine-tuning difficult to implement. Infrastructural improvements that facilitate specialization and exchange, and rapid urbanization that generates increased demand for agricultural commodities lead more to the fundamental changes and adjustments that characterize the adaptation process rather than the incremental changes involved in synchronization.

The subsector approach is an especially appropriate framework for analyzing livestock systems, because it emphasizes the role of internal household and external demand for livestock products in guiding production and marketing decisions. Demand for livestock products, such as meat, milk, manure, skins and labor power, is both internal to the producing unit and external, i.e., arising from other rural households or from urban centers of demand. The lower the degree of monetization and commercialization of a rural economy, the relatively greater the role of internal household demand in guiding the distribution and use of various outputs of livestock production. As a developing country becomes increasingly urbanized and as commercial exchange increases, the external demand for livestock products increases relative to internal household demand. This has important implications for mixed farmers' production and marketing decisions, which in turn affect the allocation of household resources, such as labor, cash for purchase of material inputs, and management skills, to alternative household

enterprises. In this dynamic environment, mixed farmers' changing perceptions of the risks and returns from emphasizing alternative modes of agricultural and livestock production will usually lead them to reconsider and modify their goals as farm managers. When this occurs, patterns of resource allocation are altered and the mixed farming unit is fundamentally transformed. It is important to emphasize that demand is usually the impetus for this change.

As long as the farming system is driven only by internal demand for livestock products and unaffected by external demand forces, it will move toward a more-or-less stable equilibrium, despite the external shocks of climate, pestilence and warfare. In most parts of the developing world, however, population pressure, urbanization and increasing monetization of rural economies have augmented external demand for livestock products. As a result, mixed farmers have been compelled to reassess their goals as farm managers. If they decide to respond to external demand, then they will allocate scarce managerial skills, household labor, and cash resources to alternative farm and non-farm enterprises so as to satisfy the new mix of subsistence and income-generating objectives. Since the demand for livestock products has such a high income elasticity, livestock enterprises will often receive relatively greater emphasis than they did when internal demand drove the farming system. Or at the very least livestock production will become increasingly market-oriented. This does not mean that internal demand for livestock products will be neglected. Rather, it may not be satisfied to the extent that it was when the rural economy was less monetized. The opportunity cost of consuming livestock products in the household

becomes greater with increasing external demand, since livestock products have higher value in alternative uses than previously.

In the case of cattle stall-feeding, internal demand for manure and some beef is met by producing households, but external demand arising from other households in the village also provides producers with incentives to produce and sell some beef. Therefore, mixed farmers have to balance resource allocation and distribution of the outputs of the different farm and non-farm enterprises in accordance with their goals as farm managers, which are shaped by the forces of internal and external demand.

In conclusion, the subsector approach is a flexible framework of analysis that focuses on the role of (internal and external) demand in guiding mixed farmers' resource allocation and distribution decisions. The nature of demand for agricultural and livestock products provides producers with signals regarding what to produce, at which time, and in which quantities, for whom. In adopting the subsector approach, it is necessary to analyze the incentives to produce and exchange livestock products, the coordination processes that facilitate risk-sharing and exchange, and the returns to different subsector participants relative to the costs and the risks they assume. Moreover, the types and strength of different levels of demand for livestock products must be identified and assessed.

2. Using the Subsector Approach to Assess the Viability of Promoting Stall-Feeding in the Mandara Mountains

In assessing the financial viability of stall-feeding enterprises at the farm level, partial budgeting will be used. Although the analysis

of the profitability of stall-feeding by small farmers will receive primary emphasis, it alone is not sufficient for assessing the viability of expanding production and marketing of stall-fed cattle. It is useful to carry the budgeting analysis through to other key participants in the cattle/beef subsector. Stall-fed cattle production and marketing must generate high enough returns at all levels of the subsector for participants to have incentives to provide inputs, produce, butcher and retail, and trade stall-fed bulls. A sensitivity analysis of producers' returns to stall-feeding under alternative procurement arrangements and marketing strategies links the producing unit to input suppliers and marketing agents, although not formally and recursively.

The economic viability of expanding stall-feeding from a macroeconomic or regional perspective will be assessed. The economic costs and returns of the FONADER project need to be analyzed, and the likely consequences of the non-marginal expansion in stall-fed cattle offtake need to be anticipated. It is also important to analyze the effect of livestock subsector policies, particularly export restrictions and retail price controls, on the stall-fed cattle and beef subsector. Ill-conceived policies could constrain expansion of stall-feeding and producers' marketing opportunities in the Mandara Mountains region and Nigeria.

The performance of vertical coordination processes in the cattle/beef subsector is also important. Institutional arrangements and standard operating procedures that govern exchange, risk-sharing, information dissemination, input procurement, and distribution of outputs at each stage of the value-adding process have to be analyzed in order to evaluate subsector performance. For example, if the

distribution of market price information is highly inequitable among subsector participants, favoring butchers and traders to the detriment of producers, then stall-feeding households may obtain unsatisfactory returns, reducing incentives to sell stall-fed bulls. Poorly timed distribution of inputs, such as concentrated feedstuffs, to farmers and of outputs of stall-feeding enterprises (cattle, beef) will also lower returns to producing households. Furthermore, butchers and traders should not be unduly constrained by government regulations, inadequate marketing infrastructure, and costly exchange processes if they are to buy, slaughter and trade stall-fed bulls. These and other subsector coordination issues need to be addressed before useful policy recommendations can be advanced.

The strength of the subsector approach is its emphasis of the role of internal and external demand in driving productive transformation and exchange. It is therefore of critical importance to assess the nature and strength of existing types of demand for stall-fed cattle, higher quality (stall-fed) beef, and manure. Moreover, it is necessary to project potential demand for the outputs of stall-feeding enterprises. By logical extension, demand for inputs into stall-feeding and the supply of these inputs available to farmers need to be assessed and projected. In the final analysis, a good understanding of the dynamic evolution of stall-feeding enterprises, input supply and demand, slaughter and retailing, cattle trading and demand for beef and other livestock products is essential in order to make informed judgements that are useful to policy-makers.

The primary data collection instruments used in carrying out a subsector analysis of cattle stall-feeding were:

1. An initial extensive survey of 288 randomly sampled farmers in 36 villages of the Mandara Mountains region,
2. An intensive longitudinal survey of the principal cropping and livestock enterprise expenditures, food consumption, and sources of revenue of 110 households in five purposively selected villages in the mountain and plateau zones of the Mandara Mountains,
3. A survey of 52 stall-feeding households in two Mafa villages,
4. Surveys of three cattle markets, four retail markets and two slaughter slabs, and
5. Informal interviews with subsector participants, including knowledgeable government officials.

These research activities and supplementary data collection methods are discussed in Annex 1.

Although this dissertation weds certain aspects of farming systems research to the subsector approach, it is not a farming systems study. There is no attempt to analyze systematically returns to alternative cropping, livestock and non-farm enterprises, using a holistic analytical framework such as linear programming or whole farm budgeting. Preliminary results of the farming systems study carried out in the Mandara Mountains region from June 1980-February 1981 do permit comparisons of returns to stall-feeding and selected cropping enterprises, however. Moreover, preliminary findings regarding slaughter and consumption of livestock, and purchases of livestock products from the farming systems and consumption/nutrition surveys are useful in assessing demand for beef, small ruminant meat, fish and other animal products. Finally, it is important to note that participation in the design and implementation

of the initial exploratory survey, the farming systems research, and the survey of cattle stall-feeding broadened the researcher's perspective, giving a greater understanding for mixed farmers' perceptions, attitudes, goals, management strategies and constraints. Repeated informal interviews with farmers in the course of the research enabled the researcher to assess the role that stall-feeding plays in intensive mixed farming systems.

CHAPTER THREE

OVERVIEW OF THE GEOGRAPHY, FARMING SYSTEMS, ETHNIC COMPOSITION AND LIVESTOCK PRODUCTION OF THE MANDARA MOUNTAINS

A. BRIEF DESCRIPTION OF THE MANDARA MOUNTAINS REGION[1]

The Mandara Mountains is one of the more environmentally, agriculturally and ethnically diverse regions of West Africa. It is located in the semi-arid tropics between the latitudes of 10° and 11.5^{o}. This falls within the sudano-sahelian belt, a zone which is wetter and more highly vegetated than the sahelian zone lying to the north. Figure 3-1 shows the location of the Mandara Mountains region in Northern Cameroon. The climate of the region is characterized by a six-month rainy season (May through October) and a six-month dry season (November through April). The Mandara Mountains can be divided into three or four geographically distinct regions: the mountains, the plateau, the plains and the piedmont, as shown in Figure 3-2. The piedmont is a transition zone between the mountains and the adjacent areas and it covers a much smaller area than the other three, more easily recognizable zones.

Table 3-1 shows the land area, population and population density of the arrondissements in the Mandara Mountains region. The Mokolo arrondissement is located primarily in the mountains and on the high plateau,

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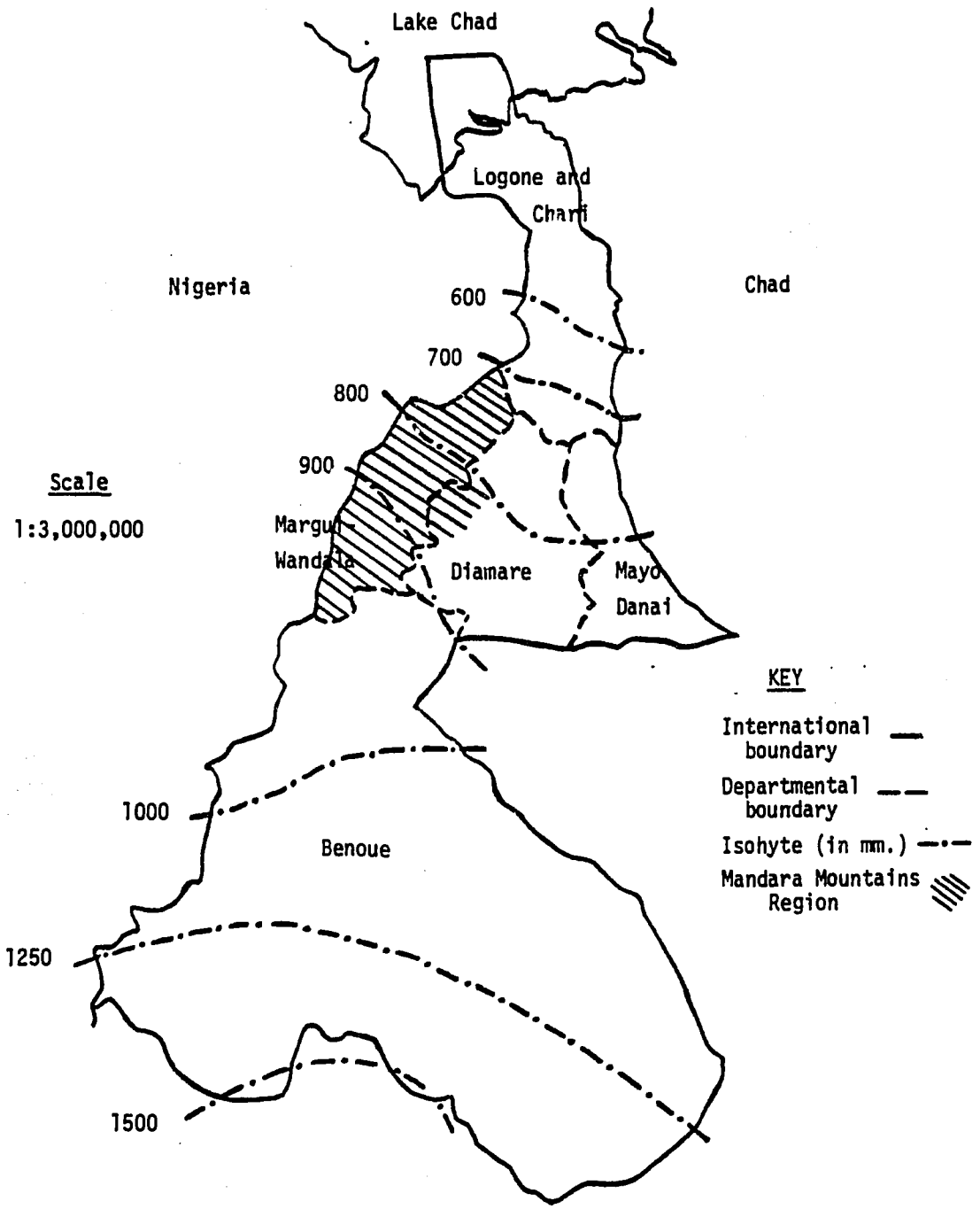
[1]See David J. Campbell, Soils, Water Resources and Land Use in the Mandara Mountains of Northern Cameroon, Mandara Mountain Research Report No. 14, February 1981 for a more detailed analysis of the geographic and resource diversity of the region.

FIGURE 3-1

NORTHERN CAMEROON



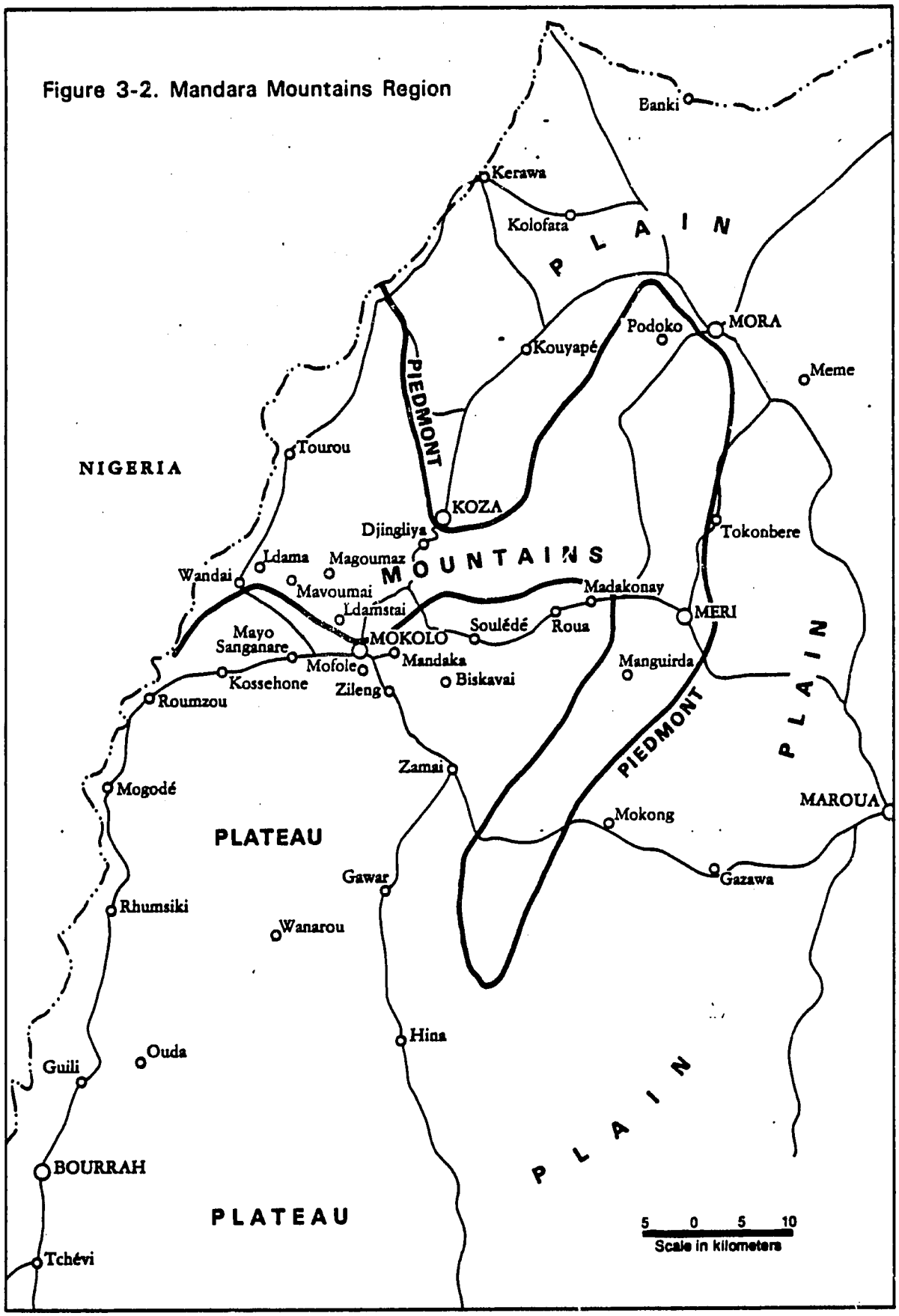


Figure 3-2. Mandara Mountains Region

TABLE 3-1

POPULATION OF PROJECT AREA IN 1980 BY ARRONDISSEMENT

Arrondissement	Area Km^2	Population	Density/Km^2
Mokolo	3,230	224,925	69.64
Bourha	660	30,000	45.45
Koza	637	70,000	109.89
Mora	2,408	118,141	49.06
Tokonbere[1]	498	53,244	106.91
Meri	460	51,438	111.82
Total	7,893	547,748	69.40

[1]Tokonbere is an Administrative District.

Sources: Délégation d'Agriculture, Département du Margui-Wandala; Budget Communal 1979-80, Meri Arrondissement.

although it also includes areas in the plans around Hina, Mokong and Moufou Sud. Bourha is situated at the southernmost part of the region on the plateau. Koza comprises both mountains and plains, as does Mora. Tokonbere and Meri are located primarily in the mountains, although they do include adjacent plains areas.

Table 3-2 illustrates how rainfall varies across zones in the Mandara Mountains. The recorded rainfall figures are highest for Bourha and Mokolo, as rainfall tends to be higher on the plateau and in the mountains than in the other zones. Rainfall in the plains, as shown by the figures for Mora and Hina, is significantly lower than in other geographic regions.

TABLE 3-2

AVERAGE ANNUAL RAINFALL IN THE PROJECT AREA
(in millimeters)

Station	Mean Rainfall	Standard Deviation	Standard Deviation as % of Mean
Bourha[1]	1057.03	200.15	18.9
Hina[2]	873.5	199.67	22.9
Mora[3]	720.7	183.46	25.5
Mokolo[4]	951.22	288.93	30.4

[1]Data based on 1954-1973 with that for 1969 missing.

[2]Data based on 1957-1978.

[3]Data based on 1949-1973.

[4]Data based on 1948-1963 with data missing for 1951, 1955.

Source: Service Départemental de l'Agriculture de Margui-Wandala, Rapports Annuels.

The mountainous zone comprises perhaps as much as one-third of the land area in the region. The mountains range from 3,000 to 4,500 feet in altitude; they have been greatly eroded through the course of millenia. The mountain soils are generally coarse, granular and incohesive. Rainfall varies widely within the mountains from year to year and across villages. The early rains are usually torrential, washing away large quantities of topsoil. Most of the rainfall is concentrated during the months of July and August, as shown in Table 3-3.

Population density in the mountains is two to three times that of the plateau or the plains. In many areas, permanent cultivation is the

TABLE 3-3

MEAN MONTHLY RAINFALL, MOKOLO; 1948-1959 AND 1963-1979
(millimeters)

Month	Ministry of Agriculture, 1948-59[a]			Catholic Mission, Ouro-Tada, 1963-79[b]		
	Mean Rainfall	Standard Deviation	Standard Deviation as % of Mean	Mean Rainfall	Standard Deviation	Standard Deviation as % of Mean
January	0.0	--	--	0.0	--	--
February	0.0	--	--	0.0	--	--
March	8.7	17.1	196	0.7	2.0	283
April	19.5	17.6	90	29.5	24.5	83
May	106.1	67.8	64	92.2	38.8	42
June	153.2	34.6	23	143.9	43.1	30
July	245.9	91.3	37	286.8	86.3	30
August	228.3	64.5	28	299.0	83.7	28
September	153.6	82.7	54	158.6	61.1	38
October	27.1	28.4	105	44.0	41.1	93
November	0.0	--	--	0.4	145.5	412
December	0.0	--	--	0.0	--	--
Total	947.8	142.8	15	1060.2	153.7	14.5

Source: David J. Campbell, Soils, Water Resources and Land Use in the Mandara Mountains of North Cameroon, Mandara Mountain Research Report No. 14, Department of Agricultural Economics, Michigan State University, 1981.

[a]Location is 10°48'N, 13°45'E, altitude is 770 m. and data for all of 1951 and Aug-Dec, 1955 are missing.

[b]Location is 10°44'N, 13°47'E and altitude is 850 m.

norm. Land holdings per household are smaller than on the plateau or in the plains, leading to intensive modes of agricultural and livestock production. In the mountain villages cultivation takes place on the terraced hillsides as well as in the valleys. Terrace construction and maintenance require tremendous labor inputs, but terracing is necessary to reduce soil erosion. Since virtually all arable land is cultivated, livestock must be enclosed during the growing season. The scarcity of arable land and forage limit livestock holdings, since grasses must be hand-cut and carried to enclosed livestock for at least four months of the year (July-October) and stored fodder must be fed to the enclosed livestock before sufficient grass regrowth has taken place (May-June).

A second large part of the Mandara Mountains region is a high plateau, located principally to the south of Mokolo, the prefectoral seat for the Department of Margui-Wandala, which is the administrative unit including most of the Mandara Mountains region. The plateau is undulating and interspersed with rocky hillsides; it lies at an altitude of between 500 and 1,000 meters. It receives 1,000 to 1,200 mm. of rainfall, and the soils are more fertile than the soils in the mountains or plains. Consequently, crop yields are generally higher than in the other zones. Despite this, population density is lower on the plateau than in the mountains. This is due in part to lack of surface water and easily exploitable subterranean water resources during the dry season. Since population density is low, larger land areas are cultivated per household and extensive livestock raising predominates.

The third principal zone of the Mandara Mountains region, comprising over one-third of the land area, is the plains, which are similar in

soil type and structure, vegetation, rainfall and modes of agricultural and livestock production to most of Northern Cameroon. The plains lie below 500 meters and are the driest of the three principal zones, receiving less than 750 millimeters of rainfall per year. The soils are generally of poor quality and sandier than in the other regions, although there are fertile areas along river valleys. Cotton production is being promoted in a number of these more productive areas. Population density is lowest in the plains, probably due again to the unavailability of water during the dry season. As on the plateau, agricultural and livestock production are generally extensive. Labor tends to constrain agricultural production far more than land, which has led to the increasing adoption of animal traction and to the hiring of seasonal labor during peak periods of labor demand in the cropping cycle.

There are at least 20 ethnic groups in the Mandara Mountains region, which comprises 7,893 square kilometers. The greatest ethnic diversity is found in the chain of the mountains running along a north-south axis from Mora to Roua. The multitude of languages and cultures has left the Mandara Mountains politically, socially and economically fragmented, in contrast to the adjacent areas of the plains, where large areas have been dominated by more politically unified and cohesive Moslem groups such as the Fulani, the Mandara and the Bournoua.

Relations between the pagan groups of the mountain and plateau areas and the Fulani of the plains of Northeastern Nigeria and Northern Cameroon have often been strained during the past two hundred years. The Fulani, who arrived relatively recently (late eighteenth century) in Northern Cameroon and quickly became the politically dominant group in

the region, generated considerable animosity among the kirdi, the pagan mountain people, whom they unsuccessfully attempted to subjugate on numerous occasions.[2] Despite the traditional animosity between the montagnards and the Fulani, there is specialization in the performance of agricultural tasks in areas where the montagnards and the Fulani live side by side. While mountain groups concentrate on crop production, Fulani herders raise livestock. Settled farmers sometimes entrust their cattle to Fulani graziers. At the same time the Fulani hire settled farmers as seasonal laborers to cultivate their maize and sorghum fields. Furthermore, specialization in the performance of agricultural tasks leads to exchange, not only of labor services, but of grain and dairy products as well. In areas where population density in the mountains is forcing farm households to resettle in the plateau or plains, crop production is spreading to lands reserved for grazing. This has led to crop damage and bitter conflict over usufructuary rights to such land.[3] Increasing occurrence of these types of incidents is inevitable, given population growth and pressure upon the land.

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[2]Jean-Yves Martin, Les Matakam du Cameroun: Essai sur la dynamique d'une société pré-industrielle, Mémoires ORSTOM No. 41, ORSTOM, Paris, 1970; Victor Azarya, Dominance and Change in North Cameroon: The Fulbé Aristocracy, Sage Research Paper in the Social Sciences, Series/Number 90-030, Sage Publications, Inc., 1976; Eldridge Mohammadou, Introduction Historique aux Populations des Monts du Mandara, Mandara Mountain Research Report No. 13, January 1981.

[3]See James C. Riddell, Land Tenure and Access to Land in the Margui-Wandala Project Area, Mandara Mountains Research Report No. 3, June 1980;and David J. Campbell and James C. Riddell, Patterns of Land Tenure and Land Use in the Mandara Mountains in North Cameroon, Mandara Mountain Research Report No. 15, March 1981.

B. POPULATION OF THE MANDARA MOUNTAINS REGION

The most recently available census figures for the Mandara Mountains are for 1976, the year during which a comprehensive national census was conducted. These figures are broken down by arrondissement in Table 3-1. The population density is higher in the arrondissements located primarily in the mountains, such as Koza and Meri, and far lower in arrondissements on the plateau, such as Bourha (and to a large extent, Mokolo), and in the plains (Mora).

An earlier national census was carried out in 1968, which offers a benchmark for calculating the rate of population growth. According to Beauvilain, the population of the Mandara Mountains increased at a rate of 4.3 percent per annum, which is extraordinarily high.[4] It is probable that population was underreported during the 1968 census. We shall assume that the population of the Mandara Mountains has increased at an annual rate of 2.5 percent. This rate of population growth is not uncommon in Africa.[5]

There are two outstanding characteristics of the population in the Mandara Mountains. The first is its ethnic diversity, which is especially marked in the mountainous areas. Podlewski estimated the population

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[4] Alain Beauvilain, "Les migrations au Nord Cameroun," Révue de Géographie du Cameroun, I, 1980, pp. 1-14. Beauvilain reports that the population of Margui-Wandala increased by 135,000 between 1968 (330,679) and 1976 (465,679), at an average annual rate of slightly over 4.3 percent.

[5] According to the World Bank's World Development Report 1981, the highest reported annual rate of population growth in Africa over the period 1970-79 was 5.5 percent in Ivory Coast. This figure is probably inflated due to migration from neighboring countries. It is not unusual for population to increase at 3 percent of more per annum in Africa, however. From 1970 to 1979 population increased at 3.4 percent per year in Kenya and Tanzania, at 3.3 percent per year in Zimbabwe and Liberia, and at 3.0 percent per year in Zambia, Ghana and Uganda.

of some of the principal ethnic groups in 1965 and used demographic data to calculate the rate of population increase for each group.[6] Table 3-4 shows Podlewski's estimates by group in 1965 and our projections of the 1980 population using his middle estimate of the population growth rate. The Mafa are the most populous ethnic group in the region. Podlewski estimated that the Mafa population increased at an annual rate of 2 percent during the first half of the 1960s and projected that it would increase at a rate of 2 percent during the 1970s despite some outmigration. As illustrated in Figure 3-3, the Mafa population is concentrated in the mountains to the north of Mokolo, on the high plateau to the east of Mokolo, and in the plains near Koza.

TABLE 3-4

ESTIMATED POPULATION OF PRINCIPAL ETHNIC GROUPS IN THE MANDARA MOUNTAINS, 1965 AND 1980

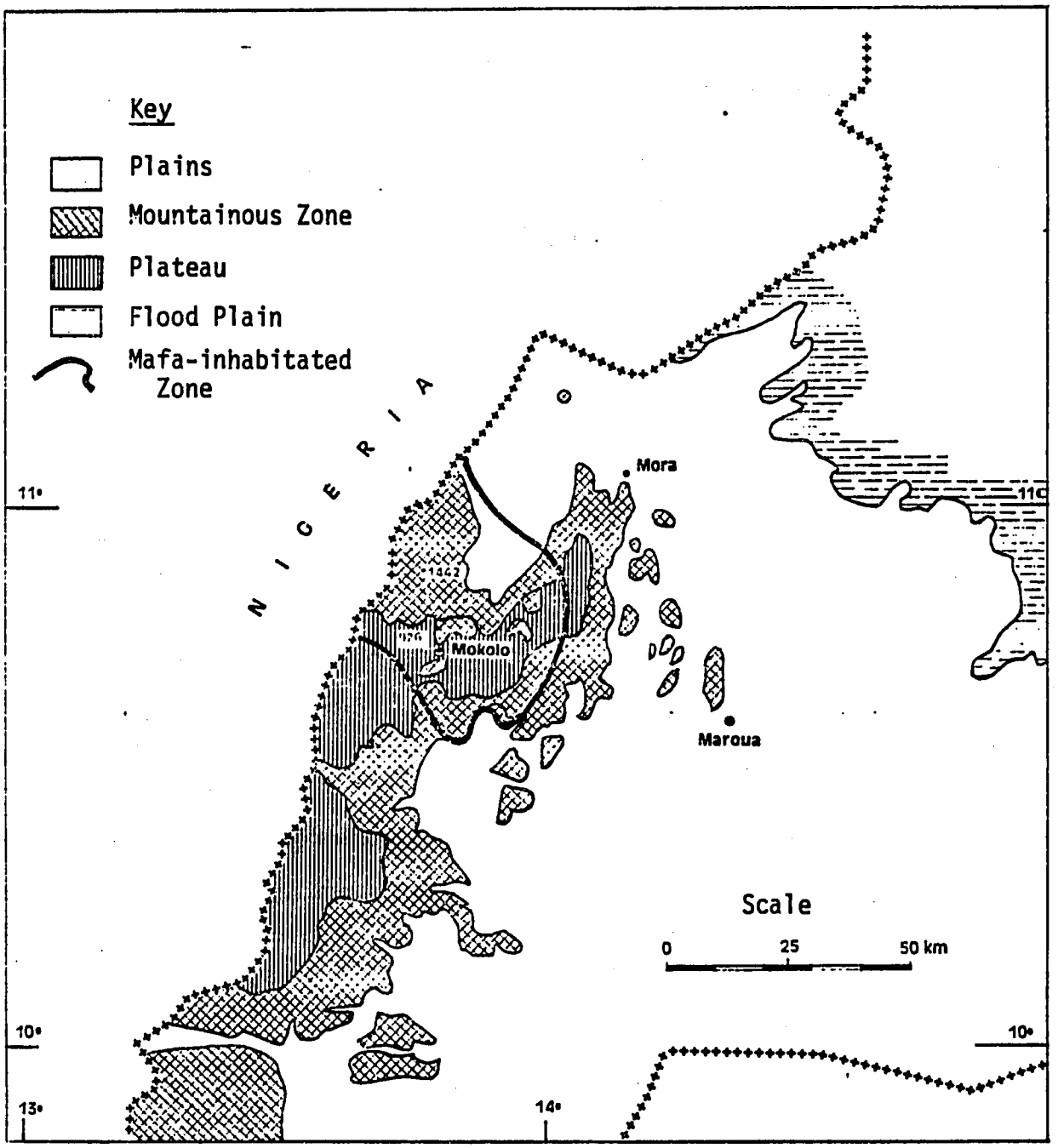
Ethnic Group	1965	1980	Assumed Annual Growth Rate, 1965-1980
Mafa	116,000	156,000	2.0%
Mofou	42,000	49,000	1.0%
Kapsiki	25,000	25,000	0.0%
Mandara	17,000	20,000	1.0%
Goude	15,000	15,000	0.7%
Hina	10,000	11,000	0.0%

Source: Podlewski, André Michel, La dynamique principale des populations du Nord-Cameroun, Cahier ORSTOM, Série Sciences-Humaines, Vol. III, No. 4, 1966.

[6]André Michel Podlewski, La dynamique principale des populations du Nord-Cameroun, Cahier ORSTOM, Série Sciences-Humaines, Vol. III, No. 4, 1966.

FIGURE 3-3

GEOGRAPHIC CONCENTRATION OF THE MAFA POPULATION
IN THE MANDARA MOUNTAINS



Source: Martin, Jean-Yves, Les Matakam du Cameroun: Essai sur la dynamique d'une société pré-industrielle, Mémoires ORSTOM No. 41, ORSTOM, Paris, 1970.

The second most populous group of the Mandara Mountains region is the Mofou, who number some 49,000-56,000 people. The Mofou inhabit the mountainous and piedmont zones (in the Meri-Arrondissement) to the east of the Mafa-dominated areas and the plains contiguous to the Mokolo-Maroua route and at the eastern edge of the Mandara Mountains. The other groups in the mountains zones include the Podoko, the Mouktele and the Mada. The principal groups of the plateau and plains areas are the Fulani, the Kapsiki, the Bana, the Goude, the Mandara and the Hina. The Fulani and the Mandara are Moslem, while the other ethnic groups of the Mandara Mountains region are non-Moslem.

The second important characteristic of the population of the Mandara Mountains is that it is overwhelmingly rural. The 1976 national census data show that 85.2 percent of the population of the Northern Province of Cameroon resides in rural areas. The National Census Bureau has projected that the population of Northern Province will remain primarily rural through 1981 (83.1 percent) and 1986 (80.5 percent). At least 90 percent and perhaps as much as 95 percent of the population of the Mandara Mountains is rural. There are only a few towns with over 5,000 inhabitants, as shown in Table 3-5. The 1976 census figures show that there are more than fifty localities in the region with populations surpassing 2,000 inhabitants. Most of these localities are not urban agglomerations, however. They are non-nucleated rural villages spread over vast areas as large as seven to eight kilometers in diameter.

TABLE 3-5

POPULATION OF PRINCIPAL TOWNS IN THE MANDARA MOUNTAINS

Town	1976 Census Figures	Local Government Estimates 1979-1980
Mokolo	5,196	10,722
Mora	4,487	
Meme	3,755	
Koza		2,000-3,000
Bourha	5,212	
Meri	1,330	
Gazawa[1]	8,787	10,280

[1]Gazawa is actually located in the Diamare Department and not in the Mandara Mountains. It is included, because cattle and beef prices were monitored at the Gazawa market, which supplies cattle to the Mandara Mountains region.

Source: Recensement Général de la Population et de l'Habitat d'Avril 1976, Ministère de l'Economie et du Plan, Direction de la Statistique et de la Comptabilité Nationale, Bureau Central de Recensement.

C. AN OVERVIEW OF LIVESTOCK PRODUCTION IN THE MANDARA MOUNTAINS REGION

1. Livestock Population Estimates

Using Livestock Service estimates of the livestock population of the Mandara Mountains, which are shown in Table 3-6, it is calculated that there are slightly more than 203,000 livestock units in

TABLE 3-6

LIVESTOCK POPULATION IN MARGUI-WANDALA DEPARTMENT, 1975-80[1]

Year	Number of Head						
	Cattle	Sheep	Goats	Horses	Donkeys	Pigs	Total Live-stock Units[2]
1975	140,092	224,593	256,226	411	7,153	393	166,368
1976	153,343	232,503	236,643	1,810	12,619	287	181,552
1977	149,123	226,396	275,163	1,900	5,764	308	176,127
1978	157,033	235,256	285,378	1,147	6,338	840	184,075
1980	176,612	242,974	308,556	1,381	5,518	1,751	202,588

[1]The Livestock Service was reorganized in 1979. Before 1979 there was one subsector office for all of Margui-Wandala. This was split into two subsectors, one based at Mokolo and the other at Mora, in 1979. There are no livestock population data for 1979, as estimates for Mora are not available.

[2]The following conversion factors are used in calculating total livestock units: horses, 1.0; cattle, donkeys, 0.8; pigs, 0.2; sheep and goats, 0.1.

Source: Livestock Service, Subsector Office, Mokolo.

Margui-Wandala and 211,000 livestock units in Margui-Wandala/Meri.[7] The livestock population, expressed in livestock units, increased at an average annual rate of 4 percent from 1975 to 1980. The cattle population grew at an average annual rate of 4.7 percent from 1975 to 1980. Although the progression has been uneven, this rate is exceptionally high for Africa. A large part of the growth in the regional herd is probably due to inflows of young bulls from the Diamare Plains for stall-feeding. These inflows do not represent growth of the regional cattle herd but rather additions to it from outside. The sheep population increased at an average annual rate of 1.6 percent, while the goat population expanded at the rate of 3.8 percent. Although goats and sheep have a shorter generation interval than cattle and multiple births are common in small ruminants, mortality rates are far higher for small ruminants than for cattle in the Mandara Mountains region.

The estimates of average livestock holdings per household obtained from the extensive survey of the Mandara Mountains region are compared with estimates obtained using Livestock Service figures for Margui-Wandala Department in Table 3-7. Although household estimates derived from the Livestock Service figures are slightly lower than the extensive survey estimates, both sets of figures show that the average household owns approximately two head of cattle and six or seven small ruminants.

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[7]The Livestock Service estimates the cattle population from vaccination records. Small ruminant numbers are estimated by counting sheep and goats and the human population in selected villages and adjusting upward proportionally to arrive at regional estimates. The population figures for horses, donkeys and pigs are based upon region-wide counts and are probably far less accurate than the cattle and small ruminant estimates.

TABLE 3-7

AVERAGE NUMBER OF LIVESTOCK HELD PER HOUSEHOLD
IN MARGUI-WANDALA/MERI IN 1980

Area	Average Number of Head Per Household			
	Cattle	Goats	Sheep	Donkeys
Margui-Wandala/Meri[1]	1.8	3.9	3.2	0.2
Margui-Wandala Department[2]	1.9	3.3	2.6	0.1

[1]Extensive survey household averages.

[2]Estimated by dividing the Livestock Service's 1980 livestock population figures for Margui-Wandala by the estimated number of households in Margui-Wandala in 1980 (93,328). The number of households was obtained by dividing the estimated 1980 population of Margui-Wandala (547,833), which was calculated by projecting the 1976 census estimate (496,310) out four years at an assumed growth rate of 2.5 percent per year, by the average household size (5.87) found for the survey households in Margui-Wandala Department and Meri Arrondissement.

2. Livestock Ownership by Household by Geographic Region

The proportion of households in each geographic region that own different types of livestock is shown in Table 3-8. Stall-feeding is concentrated in the mountains where one in four households owns stall-fed cattle. At least one-fifth of the households in the plains and the piedmont and nearly half the households on the plateau own other bovines, which are invariably range-fed cattle. In the two intensive survey sites on the plateau (Roumzou and Ouda) over half of the randomly sampled households own range-fed cattle or oxen (see Table A6-1). Roughly the same percentage of households surveyed in the plains, piedmont and plateau own traction cattle. There is some evidence that oxen ownership

is increasing rapidly and spontaneously in flatter areas of the Mandara Mountains where available labor and not land constrain the area cultivated. Oxen are used primarily for plowing of fields to be planted in cotton, peanut and sweet potatoes and for transporting harvested crops. Weeding with oxen is not yet widely practiced. Oxen cultivation is, of course, poorly suited to terraced agricultural production on rocky hillsides, whereas it is better adapted to agricultural production in the more fertile lowlands. Lower population density and abundant pasture on the plateau and in the plains make grazing feasible.

While less than half (38 percent) of the households in the survey area own cattle, nearly nine of ten of the sample households own small ruminants. Goats are owned more widely than sheep in all of the regions except the plains, where Moslem populations predominate. Moslems slaughter sheep instead of goats for their religious festivals. In addition, sheep raising is generally easier in the plains than in more elevated zones, because sheep can be grazed on the succulent and moist grasses of well-watered, low-lying areas. In contrast, goats are better adapted to feeding under confinement and to browse feeding in more rugged, hilly areas than sheep. Chicken ownership is also very widespread, as shown in Table 3-8, while pig and horse ownership are rare. Over a third of the survey households on the plateau own donkeys, which provide traction and transport services. In addition, 27 percent of the households interviewed in the extensive survey rented donkeys, primarily for transport (99 percent) but also for plowing (19 percent). Donkey ownership is practically non-existent in the mountains and piedmont, as households in the mountains find it difficult enough to feed their enclosed cattle and small ruminants during peak agricultural periods.

Only the largest households in the mountains are able to provide the necessary labor to hand-feed more than one stall-fed bull.

As Table 3-8 illustrates, only 11 percent of the households in the survey area own neither small ruminants nor cattle. Even the poorest of households generally own at least one small ruminant or a few chickens. In the final analysis, livestock is an important asset for virtually all households in the Mandara Mountains region.

TABLE 3-8

PERCENTAGE OF HOUSEHOLDS OWNING SPECIFIC TYPES OF LIVESTOCK IN MARGUI-WANDALA DEPARTMENT AND MERI ARRONDISSEMENT, BY GEOGRAPHIC ZONE, 1980

Type of Livestock	Zone				Survey Area
	Mountain	Plateau	Plains	Piedmont	
Stall-fed Cattle	26	2	2	4	11
Traction Cattle	0	15	13	14	9
Other Bovines	14	45	22	21	22
Any Cattle	40	46	33	42	38
Goats	74	85	39	71	63
Sheep	58	52	49	50	53
Any Small Ruminant	89	88	84	88	88
No Cattle or Small Ruminants	9	15	16	9	11
Donkeys	1	38	13	5	11
Pigs	1	2	0	2	1
Horses	0	0	8	2	3
Chickens	88	94	68	73	80

Source: Extensive Survey Sample Estimates

Overall livestock holdings are considerably larger on average for households on the plateau than for those in the other geographic regions, as shown in Table 3-9. Range-fed cattle numbers are also far greater among plateau and plains households than in households in the mountain and piedmont zones. The larger cattle holdings in the plains and the greater total livestock numbers per household on the plateau are due in part to the greater availability of pasture and browse for feeding cattle and small ruminants but also to the availability of more fertile and productive cropland than in the mountains and piedmont. As a result, the mixed farmers are able to produce saleable surpluses of crops such as sorghum, peanuts and sweet potatoes. At worst, most households on the plateau are able to meet their own needs, whereas households in deficit regions of the mountains must often sell small stock in order to buy grain to fulfill subsistence requirements. Production and sale of surplus grain and cash crops enables households on the plateau to acquire additional livestock. Cattle are especially important as an investment for mixed farmers on the plateau, and they are used as a dowry in acquiring wives and farm labor power. Finally, it is important to note that stall-fed cattle comprise only 7 percent of the cattle population recorded in the extensive survey.

3. Extensive Versus Intensive Modes of Livestock Production[8]

Livestock production in the Mandara Mountains can be broadly classified as either extensive or intensive with respect to land and labor. A purely extensive livestock production system is one where cattle and

[8]See Annex 4 for a more detailed discussion of extensive livestock production in the Mandara Mountains region.

TABLE 3-9

AVERAGE NUMBER OF LIVESTOCK HELD PER HOUSEHOLD IN MARGUI-WANDALA

	Stall-Fed Cattle	Traction Animals	Other Bovine	Total Bovine	Goats	Sheep	Donkeys	Pigs	Horses	Chickens
Total Mountain	.3	0	.2	0.5	3.2	2.8	.03	.2	0	12.8
Plateau	.02	.3	5.2	5.5	8.2	5.5	.6	.04	0	16.4
Plain	.07	.2	2.6	2.9	2.5	3.0	.2	0	.2	4.4
Piedmont	.04	.2	.45	0.7	4.4	2.5	.1	.1	.02	5.4
Survey Area	.14	.15	1.7	2.0	3.9	3.2	.2	.1	.1	9.3

SOURCE: Extensive survey estimates.

NOTE: The above estimates are for all of the households in the extensive survey sample.

small ruminants are able to graze throughout the year on pasture and crop stubble surrounding the village. Cattle are typically entrusted to traditional herders, who are often Fulani and paid in cash or kind for their services. Small children also often herd mixed farmers' cattle and small ruminants, especially during the cropping season. After the harvest cattle and small ruminants are grazed on crop residues or on the standing hay and browse near the village. Since crop damage can no longer be inflicted during the dry season, herding often becomes a more casual and part-time activity.

In contrast to this system of purely extensive livestock production is the intensive mode of production, where livestock are enclosed and hand-fed throughout the year. In practice, purely intensive livestock production does not take place in the Mandara Mountains. Rather, there are elements of both extensive and intensive modes of livestock production in all of the farming systems of the Mandara Mountains region. Livestock are not enclosed during the entire year, even in the most geographically isolated, densely populated and intensively cultivated of mountain villages. Cattle and small ruminants are released by farmers in mountain villages after the harvest to graze on the crop stubble and lowland pasture. Similarly, it is not uncommon for farmers on the plateau or in the plains to stake small ruminants during at least part of the growing season. When this occurs, children usually cut and carry grasses for the small stock. Finally, it is important to note that all livestock, whether raised by the Fulani or mixed farmers, are enclosed during the night regardless of the season. Extensively grazed cattle and small ruminants are brought back to the household

compound at night or penned in thorn, wooden or stone enclosures adjacent to the compound. Traditional Fulani herders pen their cattle and sheep in thorn corrals alongside their encampments during the night.

Although pure modes of extensive and intensive livestock production are rarely found in the Mandara Mountains region, it is true that livestock production in plateau and plains areas is largely extensive, whereas it tends to be intensive during the cropping season in mountainous areas of the region. Farm households in the mountains enclose most of their cattle and generally all of their goats from mid-April through mid-November. In mountain villages bordering plateau or plains areas, entrusting of cattle to traditional herders is commonly practiced. If a farmer owns large numbers of livestock relative to his family size, he may entrust some of them to relatives or neighbors. In this way labor inputs into livestock production, which compete with cropping activities during peak periods, are reduced to a more manageable level.

4. Estimated Number of Cattle Raised Extensively and Intensively

The 1980 Livestock Service estimates of the cattle population in Margui-Wandala and Meri and data on livestock holdings from the extensive survey are used to calculate in a rough way the numbers of different types of cattle in each zone. The estimates shown in Table 3-10 are meant to be suggestive though not highly accurate, since the weighting scheme for different geographic regions used in tabulating the extensive survey data reflects the geographic distribution of villages and not necessarily the distribution of population by zone.

Nearly 160,000 of the 185,000 cattle in Margui-Wandala/Meri are grazed extensively in plateau, plains and piedmont areas. These cattle

TABLE 3-10

ESTIMATED CATTLE OWNERSHIP BY CATTLE TYPE
AND GEOGRAPHIC REGION

Geographic Region	Stall-Fed Cattle		Oxen		Range-Fed Cattle		All Cattle	
	Survey[1] Sub Total	Regional[2] Sub Total	Survey[1] Sub Total	Regional[2] Sub Total	Survey[1] Sub Total	Regional[2] Sub Total	Survey[1] Total	Regional[2] Total
Mountains	34	9,275	0	0	20	5,456	54	14,730
Piedmont	4	1,091	11	3,001	25	6,819	40	10,911
Plateau	1	273	15	4,092	248	67,649	264	72,014
Plains	8.2	2,237	23.4	6,383	289.3	78,915	320.9	87,535
Margui-Wandala/Meri	47.2	12,875	49.4	13,475	582.3	158,840	678.9	185,190

SOURCES: Annual Reports, 1979, Livestock Service, Mokolo, Mora and Maroua Subsectors; Extensive Survey Estimates.

[1]These figures are extensive survey totals, weighted to adjust for totals. The figures for the mountains and plains are weighted upward to adjust for the underrepresentation of villages from these regions in the extensive survey sample of 36 villages.

[2]The regional subtotals and total are calculated by multiplying the total cattle figure (185,190) by the proportion $\left(\frac{\text{Survey Subtotal or Total for the Particular Geographic Region}}{\text{Total Number of Cattle Enumerated in Survey (678.9)}}\right)$.

are owned by traditional Fulani, Bournoua and Arab Shuwa herders and by prosperous mixed farmers, especially the Kapsiki, the Bana, the Mandara and the Guiziga. Some mixed farmers in the mountains also raise cattle extensively through entrusting arrangements with local herders or by employing children to herd the animals during the rainy season. By using extensive survey figures as a base, we have calculated that there are about 12,300 cattle that are grazed extensively yet owned by mountain and piedmont households (see Table 3-10). Most of these households are adjacent to plateau and plains areas.

The extensive survey figures also allow us to estimate the number of stall-fed cattle in the Mandara Mountains region. There are approximately 12,900 stall-fed cattle in the entire region, of which 85-90 percent are raised in mountainous or piedmont areas. The remaining 15-20 percent are most often raised by mixed farmers living at the foot of the mountains in semi-intensively cultivated areas of the plains, such as the region around Koza.

Population data on the Mafa and other ethnic groups in the Mandara Mountains, combined with extensive survey results, also enable us to calculate the number of stall-fed cattle. Using Martin's 1965 estimate of the Mafa population in the Mandara Mountains as a base, the 1980 population attained 156,000 assuming a 2 percent annual rate of population growth.[9] Podlewski's estimate of the Mofou population in 1965 was 42,000, which would have reached 56,500 by 1980, assuming a 2 percent

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[9] Jean-Yves Martin, Les Matakam du Cameroun: Essai sur la dynamique d'une société pré-industrielle, Mémoires ORSTOM No. 41, ORSTOM, Paris, 1970, p. 60.

population growth rate.[10] Finally, the combined population of the Podoko, the Mouktele, the Mada and other mountain groups near Mora was estimated at 51,849 in 1976, which would have increased to 56,100 by 1980.[11] The total projected population of these ethnic groups which practice stall-feeding was about 170,000 in 1980. The average household size for mountain dwelling households was found to be 6.41 in the extensive survey. By dividing the projected 1980 population of the relevant groups by 6.41, we arrive at an estimate of 42,100 households. The extensive survey data on livestock show that 26 percent of the mountain households stall-feed an average of 1.1 cattle.[12] Hence, approximately 12,050 stall-fed cattle were being raised by mixed farmers in the Mandara Mountains in 1980, which falls in the same range as the estimate obtained from using extensive survey and Livestock Service figures.

5. Summary

Livestock are an important asset for mixed farmers in the Mandara Mountains region. Households in the region own an average of nearly two

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[10]Podlewski, André Michel, La dynamique des principales populations du Nord-Cameroun, Série Sciences Humaines, ORSTOM, Cahier Vol. III, No. 4, 1966, pp. 87-97.

[11]The 1976 estimate is based upon census figures for the cantons of Podoko Sud, Podoko Centre, Podoko Nord, Mora Massif, Mouyengué, Ouldemé, Palbara and Mada, which are located principally in the mountains and the piedmont. The projected 1980 estimate assumes a 2 percent annual population growth rate.

[12]In conducting a survey of 298 households at Magoumaz in 1964-65, Jean Boulet found that households owned an average of 0.5 cattle. Assuming that the average holdings of cattle were 1.1 head, then 47 percent of the households at Magoumaz owned cattle in 1964-65. This proportion falls to 33 percent if we assume that the cattle-owning households at Magoumaz own an average of 1.6 head, as they did in 1980-81 (see Table A6-1). Whatever the average cattle holdings per owning household, we can safely conclude that cattle ownership is more common at Magoumaz than for the mountainous zone as a whole.

head of cattle and six to seven small ruminants. Most livestock production in the mixed farming systems of the Mandara Mountains has both extensive and intensive aspects. Over 85 percent of the cattle in the Mandara Mountains region are grazed extensively in plateau, plains and piedmont areas and rarely enclosed. In the mountainous and piedmont zones livestock are enclosed during the growing season to minimize damage to crops and grazed extensively after the harvest. Approximately 13,000 cattle are stall-fed, of which about 90 percent are raised in mountainous or piedmont zones.

Although there are far fewer stall-fed cattle than range-fed cattle in the Mandara Mountains region, stall-feeding is an important income-generating enterprise for 26 percent of the households in the mountains. These enterprises have become increasingly commercialized during the past decade. Moreover, the manure produced by stall-fed cattle helps to maintain soil fertility and cohesion in mountainous areas of high population density, poor soils and considerable erosion. Manure application results in higher yields of cereals, augmenting grain production in a region where cereals' deficits are common, except in years following very good harvests.

The next chapter will analyze the evolution, principal characteristics, inputs, outputs, costs and returns of stall-feeding cattle using existing production technologies in the Mandara Mountains region.

CHAPTER FOUR

PRODUCTION OF STALL-FED CATTLE

A. INTRODUCTION

Stall-feeding of cattle has evolved over several centuries as an intensive mode of livestock production that is well-adapted to the densely populated, land scarce zones of the Mandara Mountains region. It complements intensive crop production in the mountainous areas, as the outputs of each set of enterprises (manure, agricultural by-products) serve as inputs into the other set. At the same time stall-feeding competes with cropping enterprises, demanding approximately 900 man-hours of labor per year, at least half of which fall during peak periods of crop production.

While stall-feeding is an enterprise of economic significance in the mixed farming systems of the Mandara Mountains, it has also traditionally served as an important political and social institution. Beef from bulls slaughtered at post-harvest festivals is distributed in accordance with traditional practice to members of the extended family, friends, and (actual or potential) political allies in the village. Although traditional slaughter and distribution of beef from stall-fed cattle is still widely practiced in isolated villages, it has become increasingly common to sell some of the beef to other villagers or live bulls to rural butchers and cattle traders.

As stall-feeding becomes commercially oriented, it becomes more relevant and appropriate to analyze the inputs and outputs of stall-feeding enterprises and to calculate costs and returns for representative enterprises utilizing existing technologies. An assessment of the economic viability of stall-feeding for individual producers must precede any evaluation of the potential for promoting stall-fed cattle production in the Mandara Mountains region on a greater scale.

B. THE ANNUAL PRODUCTION CYCLE

In the mixed farming systems of the mountainous zones livestock are enclosed during the rainy season. Grasses are cut and carried to livestock, usually twice a day. During the hotter and earlier part of the rainy season, water must also be provided. Once the rains become regular, there is usually enough moisture in the grass to make hauling water no longer necessary. This intensive mode of livestock production limits livestock holdings. It is uncommon for households to own more than two stall-fed bulls and twenty small ruminants.[1] The labor required to feed and provide water for larger livestock holdings can only be provided by the largest households.

At the beginning of the rainy season, before much grass regrowth has taken place, it is usually necessary to feed livestock grasses which were cut, dried and stored at the end of the preceding rainy season. Farmers cut and dry grasses after the second weeding until the harvest

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[1]The extensive survey of the Mandara Mountains carried out by Michigan State University in May 1980, indicated that 26 percent of the randomly sampled households in villages located in mountainous areas stall-fed cattle. These households owned 1.1 bulls on average. The average number of small ruminants held per surveyed household was 7.1.

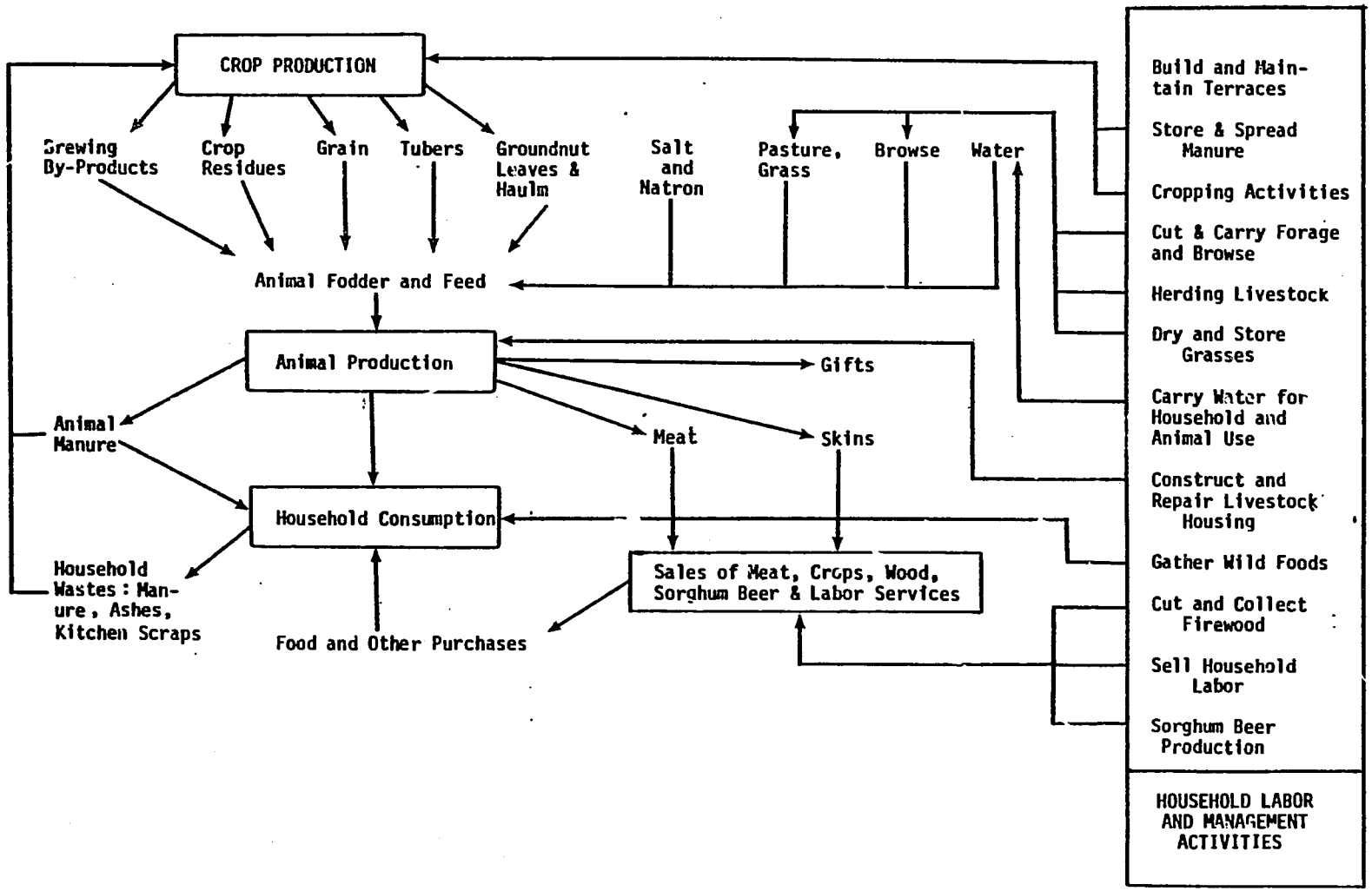
(mid-August through mid-October), when labor inputs into cropping enterprises are minimal. This stored fodder usually supplements late dry season grazing resources, which can become exhausted by March in villages where there are many cattle and small ruminants, and where dry season pasture is limited. The fact that fodder is required to maintain livestock during periods of nutritional stress is a second factor limiting the number of livestock that a household in the mountains can own and feed.

Storing fodder for later use during periods of feed constraint is an exceptional practice in Northern Cameroon, where most livestock raisers, such as the Fulani, rely on range resources which become progressively more scarce during the dry season. Although transhumance enables many graziers to maintain their herds during the dry season, standing hay loses most of its nutritional value toward the end of the dry season. As a result, farmers in the Mandara Mountains recognize the importance, from the viewpoint of livestock nutrition, of storing as much fodder as possible for late dry season and early rainy season feeding. Fodder is stored in huts, on hangars and in trees near the compound. In addition, farmers also cut browse during the late dry season to provide small stock with protein-rich leaves that supplement the high roughage diet characteristic of that time of the year.

C. INTERACTIONS AND LINKAGES BETWEEN CROPPING AND LIVESTOCK ENTERPRISES

Figure 4-1 illustrates many of the linkages between cropping and livestock enterprises on small farms in the Mandara Mountains region. Rainy season labor activities are deliberately emphasized, for it is during the growing season that the crucial labor resource allocation

FIGURE 4-1 SCHEMATIC REPRESENTATION OF THE INTENSIVE FARMING SYSTEMS OF THE MANDARA MOUNTAINS



decisions are made. Family labor has a far lower opportunity cost during the dry season, when few income earning opportunities are available. Consequently, most dry season labor activities are not included in the figure.

Although crop and livestock production are not the only enterprises on mixed farms in the region, they are by far the most important ones. Other enterprises which generate income are sorghum beer production, collection and sale of firewood, sale of dried and stored grasses, sale of agricultural labor services within the village, in neighboring villages and in Moslem areas in the plains, and the sale of non-agricultural labor services in larger towns, principally during the dry season.

1. Competition for Labor between Cropping and Livestock Enterprises

Household labor is in short supply, particularly during the growing season, when intensive cropping and livestock enterprises demand heavy inputs. Both men and women perform agricultural labor, although there is some specialization in tasks. Men, for example, clear the fields and cut and carry grasses to livestock more often than do women. Women, on the other hand, maintain the terraces, carry water for household and livestock use, and prepare food for livestock more often than men. Perhaps one-third of the children in the mountain villages go to school. Most primary schools let out by noon each day to allow children to help their families in the fields. Furthermore, children become full-time laborers during school recess, beginning in June.

2. Complementarities between Cropping and Livestock Enterprises

Although crop and livestock production compete for household labor, they have important complementarities. Agricultural by-products such as

groundnut leaves, sweet potato vines and by-products of sorghum beer brewing are used as animal fodder. Furthermore, crop residues are grazed by farmers' livestock. The primary outputs of cropping enterprises, such as grain and tubers, are fed to livestock in limited quantities, when farmers are trying to finish their cattle and small ruminants.

Manure is one of the joint products of livestock production which serves as a direct input into crop production. Livestock manure is highly valued as a fertilizer. Farmers prefer small ruminant manure to cattle manure, claiming that it decomposes more rapidly, is less apt to encourage noxious weed growth,[2] and leads to greater yield increases.[3]

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[2]John F. Schultz also found that Hausa farmers in North-Central Nigeria prefer to apply small ruminant manure to fields around the compound. Schultz reports that application of cattle manure leads to a big increase in weed growth, making extra weeding necessary. (See John F. Schultz, "Population and Agricultural Change in Nigerian Hausaland; The Infield-Outfield System of Land Use in Soba District, Kaduna State," Unpublished Ph.D. Dissertation, Columbia University, 1976, pp. 186-202.) John Lichte, an agricultural economist who has studied intensive cattle production in Southern Mali, also reports that some households are reluctant to apply cattle manure to their fields, because it greatly augments weed growth and therefore labor inputs into crop production during peak periods when household labor is already fully employed (personal communication, October 1981).

[3]There is evidence that small ruminant manure is superior to cattle manure as a fertilizer. Tobit claims that sheep and goat manure is richer in fertilizing elements and compounds than cattle manure and ferments rapidly. The chemical composition of sheep, goats, and cattle manure is shown below. All figures are in kilograms per ton of manure.

Type of Animal/ Components	Nitrogen	Phosphoric Acid (P_2O_5)	Potash (K_2O)	Water	Lime/ Magnesium
Sheep	7	8.5	3		15
Goat	4 - 8	2 - 5	3 - 11	524 -750	--
Cattle	2 - 3	2 - 3	5 - 6		

Tobit, "La production des petits ruminants en République Unie du Cameroun," These de Diplôme d'Etat, Faculté de Médecine et de Pharmacie, Ecole Inter-Etats de Sciences et Médecine Vétérinaires de Dakar, No. 14, 1980, pp. 79-80.

Small ruminant manure production is usually less than cattle manure production, however. Therefore, its economic value is generally lower, unless a household owns large numbers of small ruminants. In many villages children herd sheep during the growing season as well as during the dry season, so a good deal of sheep manure is not systematically applied to the fields. Small ruminant droppings are, of course, captured during the night, when livestock are enclosed. Some of the cattle manure--perhaps as much as one-third of the total cattle manure produced--is actually burned and used as cooking salt.

Unlike other areas of West Africa, such as the Zinder Department of Southcentral Niger, cattle manure is generally not sold in the Mandara Mountains region of Northern Cameroon.[4] In areas adjacent to the plateau, however, farmers sometimes pay Fulani herders in kind to have their crop residues grazed by large cattle herds. Payment is usually in the form of grain, legumes or prepared meals. In farming villages of the mountainous zone, we found no evidence of manure sale. Rather, rural households systematically collect, conserve and apply manure produced by cattle, small ruminants and poultry to fields close to the family compound. The very fact that commercial sale of manure does not take place suggests that it is a highly valued output of livestock enterprises and input into crop production.

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[4]Randall Thomas found that Hausa farmers who feed cattle intensively during the dry season (for an average of four months) are able to sell the cattle manure produced during the embouche for roughly 3000 FCFA. See Randall Thomas, "The Stratification of the Production and Marketing in Southeastern Niger in the Department of Zinder: Preliminary Report of Results," CRED-INRAN Study, Zinder, Niger, May 1981.

D. EVOLUTION OF STALL-FEEDING ENTERPRISES OVER TIME

1. The Traditional Role of Stall-Feeding

Stall-feeding of cattle has a sound basis in traditional social practice. Stall-fed cattle are traditionally slaughtered immediately after the harvest or at the festival of the Marai, which takes place in the middle of the dry season (February). J. Y. Martin describes the role played by the Marai, in celebration of which most stall-fed bulls were slaughtered before 1970.

> Le Maray, par des biens qu'il fait circuler, manifeste toutes les instances de la societe. Il est economique, politique, social, religieux, et autre le fait qu'il reproduit la structure villageoise, il met en jeu la quasi-totalite des rapports sociaux institutionnalises. C'est le phenomene social total.[5]

Beef from slaughtered cattle is distributed to the extended family or to friends. Households that are able to buy and stall-feed a bull are generally wealthier, larger and more politically influential in the village than households that do not stall-feed cattle.

Farmers who slaughter stall-fed cattle may sometimes give beef with the expectation that those who receive beef will help out in times of need. If someone in the family falls sick, social capital can be drawn upon to muster supplementary labor for crop production. Or in years of production shortfalls, a relative or friend who benefitted from a stall-feeding household's generosity will be inclined to help out by giving grain or small stock which can be sold in order to purchase grain. The

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[5] Jean-Yves Martin, Les Matakam du Cameroun; Essai sur la dynamique d'une société pré-industrielle, ORSTOM, Paris, 1970, p. 129.

gift of meat, especially beef, during the traditional post-harvest festivals may, then, generate the expectation that receivers can be called upon to contribute labor, grain or livestock.[6] The traditional slaughter of bulls and distribution of beef may have originated as a means of repaying those members of the extended family and friends who helped out during the planting, weeding and harvesting.

It is also important to emphasize the political motivation for giving gifts. Most of the farmers who stall-feed cattle for traditional post-harvest slaughter and distribution of the beef are at least 30 years old and relatively well-off. The capital required to purchase a bull is prohibitive for many farmers, particularly younger ones with few assets and sources of cash income. It is not uncommon for village chiefs and sub-chiefs to raise two or sometimes three bulls at the same time for traditional slaughter. Slaughtering bulls for wide distribution of the beef is clearly associated with political capital in the village or within a section of the village. Many stall-feeding households do not expect that other villagers who receive some of the beef ever repay them in kind. They often do expect, however, political allegiance. Giving gifts of beef can therefore be considered as a means of building and maintaining political capital in the village or within a section of the village.

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[6]Gifts of meat may also be given with no expectation of reciprocity. In particular, gifts of small stock, chickens, and small ruminant meat are often made on the spur of the moment, when visitors arrive unexpectedly or when a visit is made to the household of an in-law in a neighboring village. These gifts are made in accordance with established social practice; they require no reciprocal gift-giving on the part of the receivers.

2. The Absence of Daily Production

The mixed farmers of the mountainous zone of the Mandara Mountains region do not obtain dairy products from their cattle and small ruminants. The vast majority of the cattle that are stall-fed are bulls or steers. Only the wealthiest farmers own cows. Heifers and cows that are able to reproduce are difficult to find in cattle markets in Northern Cameroon. Fulani herders are extremely reluctant to sell their breeding stock. Instead, they cull out infertile cows or poor milk producers (whose calves die more often than survive) for sale. As a result, the markets of Northern Cameroon are filled with old cows. Even in cases where farmers own a cow or two, or large numbers of ewes and she-goats, the livestock generally do not provide milk for the household. Milk production is invariably low, given the low level of livestock nutrition, and all that is produced is reserved for the offspring.

The historical basis for not having dairy enterprises in the Mandara Mountains can only be surmised. Since the population density has been high in the Mandara Mountains for several centuries and most arable land has been cultivated, forage resources have been limited and may not have permitted a high enough level of nutrition for surplus milk production. Fodder crops are not produced in the Mandara Mountains, since labor allocated to the principal cropping enterprises is devoted to sorghum,peanut and sweet potato production. Evidently food crop production yields higher returns to labor than fodder crop production. More importantly, it enables rural households to meet subsistence constraints in a deficit region where food crop shortfalls are common. In addition, mixed farmers may not have concentrated on dairy production in

the Mandara Mountains, at least since the late nineteenth century, because the Fulani have specialized in dairy herding and exchanged surplus dairy products for grain and legumes with the farming population. Trechter's consumption/nutrition data and informal interviews with farmers revealed that dairy products are not an important part of the diet of farming households. This may be due to low rural incomes during the rainy season, the only period of the year during which Fulani cows produce more than enough milk to meet the subsistence needs of the herding households and the nutritional needs of calves. Low consumption of dairy products by farm households may also reflect the tastes and preferences of agriculturalists, which is perhaps related to an inability to digest milk and butter.[7]

Milk which is produced by settled farmers' cows is invariably reserved for calves and not consumed by the owning household. Rural households do not usually slaughter calves or immature cattle, because they would then forego the future manure production of the slaughtered animal. In a region where soils are generally poor and land holdings are small, manure may well be the more important joint product of stall-fed cattle production. Slaughtering young stock also results in foregone benefits in the form of additional beef production. The higher value of older cattle allows the rural household to earn additional income from slaughter or sale or to distribute the beef on a wider basis or in greater quantities to a limited number of households than possible with smaller, less mature stock.

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[7]There is no scientific evidence of any inherited inability of the Mafa and other agricultural groups in the Mandara Mountains to digest dairy products.

3. Increasing Commercialization of Stall-Fed Cattle Production

Informal interviews conducted with stall-feeding households in Magoumaz and Mavoumai during the course of the survey of stall-fed cattle production revealed that bulls were enclosed and hand-fed prior to 1970 primarily for traditional slaughter. With the advent of the 1970s stall-feeding cattle for commercial sale started to become more and more prevalent, although intensive cattle production for traditional slaughter still predominates in more isolated villages.

A number of factors are responsible for the increasing commercialization of stall-feeding. Beginning in the 1960s the Mandara Mountains became the focus of the Cameroon government's efforts to resettle people of overpopulated regions such as the mountains in sparsely settled areas of the plains in Northern Cameroon. As a result, the montagnards had increasing contact with the government and other external forces. At the same time, spontaneous commercialization of the region led to increasing monetization of the mountain economy, although production is still largely subsistence-oriented in many villages.

A third factor more directly responsible for the increasing commercialization was the rapid growth of the Nigerian economy beginning in the early 1970s. This expansion increased trade between Cameroon and Nigeria. Exports of legumes such as cowpeas and tigernuts from Cameroon increased, as did exports of cattle. When Nigeria began to earn billions of dollars in foreign exchange from sales of petroleum in the mid-1970s, demand for livestock products (for which the income elasticity of demand is high) increased. Meanwhile, the Sahelian drought, which was coming to a close, had depleted the Sahelian countries of at least 25 percent

of their cattle. As demand increased and supply contracted in the early and mid-1970s, cattle prices rose dramatically not only in Nigeria but in the neighboring countries of West Africa (Chad, Cameroon, Niger, Mali, Upper Volta, Benin) as well.

In order to purchase young bulls, farmers were increasingly compelled to sell part of the beef after slaughtering a mature bull during the dry season. Rather than distributing beef freely to other villagers and people visiting from other villages, farmers sold them beef. Largesse was still possible, but it became increasingly limited to the extended family and close friends in the village.

As profitable opportunities from sales of cattle to traders increased, younger and less tradition-bound farmers responded by selling their bulls. Farmers also sold bulls to local butchers who slaughtered the animals at rural markets. This slaughter was (and still is) confined to the post-harvest period when rural income flows are highest.

A final factor that has contributed to the increasing commercialization of cattle stall-feeding has been cattle price inflation during the 1970s and beginning of the 1980s. Simply holding cattle led to considerable appreciation in their value. Whether the price trends of the 1970s will continue in the 1980s is difficult to predict, but it is certain that inflation helped to make stall-feeding financially attractive in the 1970s. Without this inflation it is likely that fewer sales of cattle and beef would have taken place, and that fewer younger and commercially oriented farmers would have undertaken stall-feeding for monetary gain.

E. INPUTS INTO STALL-FEEDING ENTERPRISES

1. Bull Calves

a) Estimated Age and Weight at the Time of Acquisition

In carrying out the survey of stall-feeding in the villages of Magoumaz and Mavoumai, mixed farmers were asked to estimate the age of bull calves acquired for stall-feeding at the time of purchase. The farmers reported that the bull calves ranged in age from one and a half to three years and averaged 2.4 years. These young bulls weigh 158-168 kilograms at the time of acquisition and are generally slaughtered or sold two years later at a liveweight of 308-326 kilograms.[8]

b) Means and Cost of Acquisition

The mean acquisition price for cattle acquired entirely in cash was 35,840 FCFA for 21 survey households at Magoumaz and 31,340 for 21 survey participants at Mavoumai. The average purchase price was 35,117 FCFA in 1980 and 32,900 FCFA in 1979 for a larger sample of households in five villages close to Mokolo, as shown in Table 4-1.

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[8]Although scales were not available for weighing live cattle, carcasses were weighed at Mokolo and Soulede, from which we can infer liveweights. The average carcass weight of 1.5-2.5 year-old males slaughtered at Mokolo and Soulede was 79 kilograms. Assuming a dressing percentage of 47-50 percent for young bulls, we estimate liveweight to be 158-168 kilograms. The average carcass weight for stall-fed bulls slaughtered at Mokolo and Soulede was 154 kilograms. Assuming dressing percentages ranging from 50 percent, which is typical for range-fed cattle, to 53 percent, which is attained by well-fleshed animals, we estimate the final liveweight to be 308-326 kilograms.

TABLE 4-1

STALL-FED CATTLE ACQUISITION PRICES PAID BY FARMERS IN FIVE VILLAGES NEAR MOKOLO[1]

Year	Prices Paid[2] in Cash in Plains' Markets		Prices Paid in Cash in all Locations		Acquisition[3] Value of all Cattle	
	Mean Price	N	Mean Price	N	Mean Value	N
1972	17,500	6	18,000	7	19,600	10
1973	17,643	7	21,688	8	20,000	10
1974	25,625	8	24,800	10	25,583	12
1975	22,750	16	22,900	20	26,524	25
1976	29,895	19	27,750	28	30,630	37
1977	30,261	38	30,868	53	31,771	64
1978	33,912	34	33,369	48	34,656	58
1979	32,586	35	32,900	47	34,422	60
1980	35,054	33	35,117	54	34,703	62
1981	-	-	39,000	3	39,000	3
		196		278		341

[1]The five villages are Magoumaz, Mavoumai, Zileng, Mandaka and Ldamstai, all located within 12 kilometers of Mokolo. Prices reported in FCFA.

[2]Ninety-eight percent of the cattle purchased in the markets of the Diamare Plains for stall-feeding were acquired at Gazawa. The other two percent were bought at Maroua.

[3]This category includes 63 cattle which were acquired partially or entirely in kind. The remaining 278 bulls were obtained through cash payment (see column 2).

Farmers who paid for their bulls partially in kind typically spent 10-15 percent more than producers who paid in cash.[9] The former typically exchange small ruminants for the bull in addition to providing some cash. The 10-15 percent premium is demanded by cattle traders as compensation for the additional labor costs and risks incurred in selling or butchering and retailing the exchanged goats and sheep. Partial payment in kind is more common in isolated mountain villages such as Magoumaz, where many farmers speak little or no Fulfulde, than at more commercially oriented villages, such as Mavoumai, Zileng and Mandaka, where producers know Fulfulde and are better able to bargain with Fulani sellers in the cattle markets of the Diamare Plains.

c) Inflation in Acquisition Prices

The prices paid by small farmers in the Mandara Mountains for young bulls rose steadily during the 1970s, as shown in Table 4-1.[10] The average annual rate of increase in prices for stall-fed cattle bought in the markets of the Diamare Plains was 9.1 percent during the period

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[9]Nine of the 30 sample households at Magoumaz paid for their bulls partly in kind. Using farmers' valuation of exchanged small stock, we estimate that these households paid an average of 40,280 FCFA per head. Recall data from a larger sample of households at Magoumaz, Mavoumai, Zilent, Mandaka and Ldamstai show that those households that paid for bulls partly in kind acquired cattle at an estimated cost of 38,148 FCFA from 1978 to 1980, which was about 4,300 FCFA more than the average price paid for bulls acquired exclusively with cash. Over the three year period producers paid 12.7 percent more on average for bulls when payment was partially in kind than when payment was in cash.

[10]The data should be interpreted cautiously, since the recall period is in some instances extremely long. In addition, the cattle were not weighed at either the time of acquisition or the time of slaughter or sale, so we cannot analyze how liveweight prices per kilogram have evolved in recent years. Furthermore, there are few observations for the period 1972-74. Nonetheless, cattle purchases are such an extraordinary expenditure for most small farmers that they tend to be remembered clearly.

1972-80 but only 4.1 percent from 1976 to 1980. When the sample is expanded to include stall-fed cattle purchased in areas other than the Plains' markets the annual rise in prices changes to 8.7 percent and 6.1 percent over the same periods. Finally, the acquisition values of all stall-fed cattle in the sample, including cattle obtained partially (or entirely) in kind, increased at more modest rates of 7.4 percent (1972-80) and 3.2 percent (1976-80). The estimated values of cattle acquired at least partially in kind in earlier years are probably biased upward, as farmers probably valued small ruminants exchanged for a stall-fed bull in the past at current (1980-81) prices.

The annual rate of increase in acquisition prices may also be understated by the survey data for another reason. Some producers reported that they used to acquire older and larger bulls for stall-feeding but that rapid inflation in cattle prices during the 1970s forced them to acquire less mature and considerably lighter animals. The survey data may, therefore, be misleading in that they may be comparing two different inputs (2.5-4 year-old bulls bought before, say, 1975 with 1.5-3.0 year-old bulls bought from 1976 on). If this is so, then the inflation in acquisition prices on a per kilogram basis was probably significantly higher than 9 percent per annum.

d) Seasonality of Acquisition

Two-thirds to three-quarters of the bulls acquired for stall-feeding are bought during the dry season and early rainy season (December-May), as shown in Table 4-2. While 74 percent of the bulls in the sample of households at Magoumaz and Mavoumai were obtained from December through May, 68 percent of a larger sample of households at Magoumaz, Mavoumai,

TABLE 4-2

ACQUISITION OF STALL-FED CATTLE BY MONTH
IN VARIOUS SAMPLE HOUSEHOLDS

Month of Acquisition	Magoumaz		Mavoumai		Ziling, Mandaka and Ldamstai		Entire Sample	
	No.	Percentage of Total No.	No.	Percentage of Total No.	No.	Percentage of Total No.	No.	Percentage of Total No.
January	9	7	6	4	0	0	15	4
February	27	20	25	18	3	3	55	15
March	8	6	15	11	7	9	30	8
April	28	20	32	23	8	10	68	19
May	10	7	13	9	17	21	40	11
June	13	9	2	1	5	6	20	6
July	9	7	7	5	14	18	30	8
August	4	3	14	10	8	10	26	7
September	3	2	8	6	1	1	12	3
October	4	3	2	1	13	16	19	5
November	3	2	4	3	0	0	7	2
December	20	14	14	10	4	5	38	11
TOTAL	138	100	142	100[a]	80	100[a]	350	100[a]

Source: Survey of stall-feeding households in selected villages within a 12 km. radius of Mokolo. In addition to the 52 stall-feeding households in the survey samples at Magoumaz and Mavoumai, other stall-feeding households were interviewed in the two villages to obtain larger samples.

Note: The data were obtained, for the most part, from farmers who had acquired stall-fed cattle since 1974, except in a few cases where individual farmers' power of recall enabled us to obtain information about cattle acquired before 1975. The month of acquisition was determined by reference to a traditional Mafa calendar, which is based upon the annual cycle of agricultural and ceremonial activities.

[a]The sum of the monthly percentages does not equal 100 due to rounding errors.

Zileng, Mandaka and Ldamstai were procured during this period. Farmers are better able to acquire bulls during this period, because they have income from the sale of livestock or cash crops, such as sweet potatoes and peanuts, and they have time to go to Gazawa, where over half of the cattle for stall-feeding in villages near Mokolo are procured.

2. Labor

Stall-feeding of cattle is a labor-intensive enterprise that demands particularly high labor inputs during the growing season, when labor inputs into cropping enterprises are also greatest. Labor data were collected by activity at two-week intervals for a sample of 30 households at Magoumaz and 22 households at Mavoumai during the survey of stall-feeding households. The survey results indicate that total labor inputs into stall-feeding are 12 percent greater at Mavoumai than at Magoumaz, as shown in Table 4-3. On average households allocate slightly more than 900 hours per year to stall-feeding. Labor devoted to herding is excluded from the calculation of total hours, since cattle are herded by children during the dry season and their labor has a very low opportunity cost.

a) Comparison of Labor Allocation Patterns at Magoumaz and Mavoumai

The principal labor activities, cutting and carrying grasses and hauling water, demand 61 percent of the time devoted to stall-feeding at Magoumaz and 75 percent at Mavoumai. Roughly equal proportions (40-45 percent) of total labor inputs are allocated to procuring fresh grasses in both villages. This is somewhat surprising, since population density is higher at Magoumaz, which makes uncultivated arable land scarce and

TABLE 4-3A

AVERAGE HOUSEHOLD LABOR INPUTS BY AGE-SEX CATEGORY[a] TO ACTIVITIES ASSOCIATED WITH STALL-FEEDING AT MAVOUMAI, MARCH 1980-FEBRUARY 1981

Activity	Total Hours	% Enterprise Total	Adult Male		Adult Female		10-15 Years Old		< 10 Years Old	
			Hours	% Total	Hours	% Total	Hours	% Total	Hours	% Total
1. Cutting Grass	425.5	44.5	346.6	81.5	17.7	4.2	48.6	11.4	12.6	3.0
2. Giving Grass[b]	37.0	3.9	30.0	81.1	6.7	18.1	0.3	0.1	0.0	0.0
Sum: 1 + 2	462.6	48.3	376.6	81.4	24.4	5.3	48.9	10.6	12.6	2.7
3. Stocking Grass[c]	55.9	5.8	52.0	93.0	0.8	1.4	3.1	5.5	0.0	0.0
4. Hauling Water	294.6	30.8	158.8	53.9	123.7	42.0	12.1	4.1	0.0	0.0
5. Giving Water[d]	17.8	1.9	14.4	80.9	3.4	19.1	<0.1	0.6	0.0	0.0
Sum: 4 + 5	312.4	32.6	173.2	55.4	127.1	40.7	12.1	3.9	0.0	0.0
6. Preparing/Giving[e] Feed Minerals	78.9	8.2	61.6	78.1	16.7	21.2	0.6	0.8	0.0	0.0
7. Piling and Removing[f] Manure	21.1	2.2	13.9	65.4	6.4	30.3	0.9	4.3	0.0	0.0
8. Stall Construction and Repair	19.6	2.0	19.5	99.5	0.0	0.0	0.1	0.5	0.0	0.0
9. Other[g]	6.6	0.7	4.3	65.6	1.9	30.2	<0.1	-	0.4	4.2
Annual Mean[h]	967.1	100.0	701.1	73.3	177.3	18.5	65.7	6.8	13.0	1.4
10. Herding	541.8	100.0	0.0	0.0	0.0	0.0	306.7	56.6	235.1	43.4

Source: Survey of cattle stall-feeding at Mavoumai, 1980-81.

Note: Some of the category totals are not equal to the sum of the individual elements in their respective categories due to rounding errors.

TABLE 4-3B

AVERAGE HOUSEHOLD LABOR INPUTS BY AGE-SEX CATEGORY[a] TO ACTIVITIES ASSOCIATED WITH STALL-FEEDING AT MAGOUMAZ, MARCH 1980-FEBRUARY 1981

Activity	Total Hours	% Enterprise Total	Adult Male		Adult Female		10-15 Years Old		< 10 Years Old	
			Hours	% Total	Hours	% Total	Hours	% Total	Hours	% Total
1. Cutting Grass	345.5	40.5	198.2	57.4	104.1	30.1	40.0	11.6	3.2	0.9
2. Giving Grass[b]	56.2	6.6	40.9	72.8	14.4	25.6	0.9	1.6	0.0	0.0
Sum: 1 + 2	401.7	47.1	239.2	59.5	118.5	29.5	40.9	10.2	3.2	0.8
3. Stocking Grass[c]	95.5	11.2	86.4	90.5	9.1	9.5	0.0	0.0	0.0	0.0
4. Hauling Water	173.0	20.3	71.4	41.3	100.1	57.9	1.3	0.8	0.2	-
5. Giving Water[d]	45.0	5.3	27.0	60.0	17.0	37.8	0.7	1.6	0.3	0.7
Sum: 4 + 5	218.0	25.5	98.4	45.1	117.1	53.7	1.9	0.9	0.5	0.2
6. Preparing/Giving[e] Feed Minerals	91.1	10.7	37.5	41.2	53.5	58.7	<0.1	-	<0.1	-
7. Piling and Removing[f] Manure	19.6	2.3	16.8	85.7	2.4	12.2	0.4	2.0	0.0	0.0
8. Stall Construction and Repair	23.1	2.7	23.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0
9. Other[g]	4.7	0.6	4.7	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Annual Mean[h]	853.7	100.0	506.1	59.3	300.6	35.2	43.2	5.1	3.7	0.4
10. Herding	555.3	100.0	149.0	26.8	0.2	-	340.6	61.3	65.5	11.8

Source: Survey of cattle stall-feeding at Magoumaz, 1980-81.

Note: Some of the category totals are not equal to the sum of the individual elements in their respective categories due to rounding errors.

Footnotes to Table 4-3A and 4-3B

[a]The following weights are assigned to the different age-sex categories: sixteen or older = 1.0; ten to fifteen = 0.75; under ten = 0.5.

[b]Handfeeding stored fodder during the late dry season and early rainy season is included in this category, as well as handfeeding of freshly cut forage during the growing season.

[c]Labor inputs into this activity are probably underestimated. It is difficult to distinguish between time spent cutting and carrying grasses to meet stall-fed bulls' maintenance requirements during the late rainy season and labor allocated to cutting, carrying, drying and storing grasses for late dry season and early rainy season supplemental feeding. Jean Boulet reported that his sample of 12 households at Magoumaz spent an average of 42 hours more per month collecting fodder during the months of August, September and October than during months when only the maintenance requirements of livestock were being met (see Magoumaz, pays Mafa (Nord Cameroun): étude d'un terroir de montagne, Cahier ORSTOM No. 11, Série Sciences Humaines, Paris. Labor allocated to agricultural activities is reported in the annex.

[d]Some households put water in calabashes, which are held while the stall-fed cattle drink. Labor inputs for this activity appear underestimated for Mavoumai, as it is likely that a large proportion of these inputs were recorded in the category "Hauling Water."

[e]This category includes preparation of grain and mixtures of grain, salt and natron in water as cattle feed, as well as handfeeding of agricultural by-products after the harvest (such as melons and sweet potato tubers) and sorghum beer brewing by-products.

[f]Labor allocated to spreading the manure and working it into the soil of fields adjacent to the compound is not included in this category.

[g]The category "Other" includes tick removal and cutting leaves from trees to serve as cattle feed.

[h]The annual mean labor input does not include herding, since this activity is performed almost exclusively by children during the dry season. The opportunity cost of this labor, although not zero, is quite low.

would presumably force households to walk farther in search of fresh forage. Many of the households at Mavoumai have moved out of the mountains and resettled on the adjacent plateau, where uncultivated land is less scarce than at Magoumaz. Therefore, one would expect producers at Mavoumai to spend less time walking to areas on the plateau where fresh grasses are available. These hypotheses are not supported by the data, however.

Procuring water demands the second highest labor inputs at both villages but it demands proportionally and absolutely more time at Mavoumai (31 percent of total labor inputs) than at Magoumaz (20 percent of total labor inputs). Dry season water supplies are extremely scarce at Mavoumai, due partly to competition between stall-fed cattle and the cattle herds of Fulani graziers and also to the absence of springs or mayos (rivulets). The closest inexhaustible supply of water to Mavoumai is the recently constructed dam behind Mokolo, which is a minimum of one hour on foot from the closest households in the village. On the other hand, Magoumaz is well-supplied with water from mountain springs, which feed into a rivulet that runs through the valley in the middle of the village throughout the year. Consequently, households at Magoumaz do not have to walk as far nor wait as long to use water holes as households at Mavoumai.

Two other notable characteristics of the pattern of labor allocation to stall-feeding enterprises at Magoumaz and Mavoumai are the greater importance of drying and stocking fodder and the preparation and hand-feeding of cattle feed at Magoumaz. Since dry season grazing resources are limited at Magoumaz, stall-feeding households have to collect, dry and stock large quantities of grasses and agricultural by-products for

late dry season and early rainy season feeding of livestock. Hence, producers at Magoumaz allocate a good deal of labor to gathering and storing fodder during the two to two and one-half month slack period that follows the second weeding and precedes the harvest.

In contrast, cattle-owning households at Mavoumai depend more heavily on the more abundant standing hay on the plateau near the village. Livestock graze for a longer period during the dry season and children herd livestock far from areas planted to crops early in the rainy season. In addition, a higher proportion of cattle are entrusted to Fulani graziers during the rainy season, making it less necessary to stock fodder.

More labor is generally allocated to preparing and providing cattle feed at Magoumaz than at Mavoumai for several reasons. First, producers at Magoumaz spend more money on inputs into stall-feeding (see Table 4-4) and these inputs are often prepared (mixed in water or cooked) before being given to the cattle. Second, the farming systems found at Magoumaz are generally more intensive and better integrated than the farming systems at Mavoumai, nearly half of which are located on the plateau and hence quasi-extensive. Consequently, livestock are more closely managed at Magoumaz than at Mavoumai. Although labor inputs per hectare are higher at Magoumaz than at Mavoumai, overall labor requirements for cropping enterprises are probably somewhat lower at Magoumaz, since less land is cultivated. As a result, producers at Magoumaz are able to allocate more time to watching, feeding and managing their cattle.

Manure management, stall construction and repair, tick removal, and cutting leaves from trees for feed account for less than 5 percent

TABLE 4-4

PURCHASED FEED, MINERAL AND LABOR SERVICE INPUTS AT MAGOUMAZ AND MAVOUMAI, MARCH 1980-FEBRUARY 1981[1]

Input	Magoumaz			Mavoumai		
	Mean Per Buying Household	N	SD	Mean Per Buying Household	N	SD
cut grass	5000	1	--	4350	3	1344
melon	800	1	--	0	0	--
stored grass	3356	16	3179	2200	4	216
millet grain	4357	7	3791	0	0	--
natron	3337	30	1964	2527	22	2323
salt	2578	23	3301	1241	11	570
herder	3000	1	--	3270	5	2636
laborer	1125	4	629	2267	3	252
brewing by-product	1425	4	1216	0	0	--
sorrel flour	2400	1	--	0	0	--
Mean Expenditure per Household	8833	30	6440	4798	22	3593

Source: Survey of stall-feeding, September 1980-February 1981

[1]Prices reported in FCFA.

of labor inputs at both villages. Herding absorbs significant amounts of child labor, but most of this labor is required during slack periods and hence has a low opportunity cost. Nevertheless, households with children have a decided advantage in meeting dry season herding requirements.

b) Seasonal Distribution of Labor

Nearly three-quarters of the labor required for stall-feeding cattle is allocated during the growing season, when labor inputs into cropping enterprises are also highest. Only about 50 percent of all labor inputs are required during peak periods, however, which occur from May through mid-August and from mid-October through mid-November. During the first two months of the growing season (May and June), most of the labor allocated to stall-feeding is devoted to carrying and giving water to the bulls, as shown in Table 4-5.[11] From July through the end of the rainy season (October-November) 70-80 percent of the labor devoted to stall-feeding goes to cutting and hand-feeding grasses.

During the two-month growing period that follows the final weeding and precedes the harvest, households generally allocate more labor to stall-feeding, particularly to cutting, drying and storing forage and agricultural by-products, such as groundnut leaves and sweet potato vines. Total labor inputs into stall-feeding and stocking forage were highest during September and October at Magoumaz and during October at Mavoumai in 1980, as shown in Table 4-5 and by Figure 4-2.

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[11]Sixty percent of labor inputs into stall-feeding during May and June at Magoumaz and 80 percent at Mavoumai are for hauling water.

TABLE 4-5

MONTHLY BREAKDOWN OF LABOR ALLOCATED TO STALL-FEEDING ENTERPRISES, BY PRINCIPAL ACTIVITY

	Magoumaz						Mavoumai					
	All[a] Activities	Cut, Carry and Feed Grasses	Cut, Dry and Store Forage	Haul and Give Water	Misc.[b]	Herding	All[a] Activities	Cut, Carry and Feed Grasses	Cut, Dry and Store Forage	Haul and Give Water	Misc.[b]	Herding
March	32.8	5.7	0.0	43.6	5.7	89.3	49.6	5.5	0.0	28.2	4.2	85.0
April	56.8	8.8	0.0	45.2	9.3	92.4	86.8	8.2	0.0	56.4	5.9	77.5
May	80.2	9.2	0.0	49.8	13.1	25.3	108.1	8.7	0.0	86.5	7.4	17.4
June	83.3	12.0	0.0	50.0	13.5	14.8	118.0	14.0	0.0	95.2	6.8	12.3
July	102.2	85.2	0.9	7.7	4.9	0.0	108.9	95.9	0.0	5.9	5.1	0.0
August	108.2	85.4	14.1	0.2	5.4	0.0	105.7	96.0	0.0	0.0	6.9	2.0
September	125.8	85.9	30.6	0.2	6.2	0.0	107.3	93.3	2.7	0.0	8.7	2.0
October	120.0	66.3	35.4	9.8	6.7	2.7	138.5	81.2	30.3	12.1	12.8	2.0
November	77.0	32.7	14.4	20.3	8.7	33.3	105.4	56.8	21.6	14.5	11.7	40.5
December	33.2	4.7	0.0	17.1	10.5	84.1	13.0	1.2	1.4	6.4	3.2	87.3
January	20.4	3.3	0.0	11.5	3.9	103.8	9.1	1.1	0.0	3.9	3.6	108.3
February	13.9	2.5	0.0	7.1	3.2	109.1	6.6	1.0	0.0	3.1	2.6	107.5
TOTAL	853.8	401.7	95.4	218.3	91.1	555.3	957.0	462.7	56.0	312.2	78.9	541.8

Source: Survey of stall-feeding households at Magoumaz and Mavoumai.

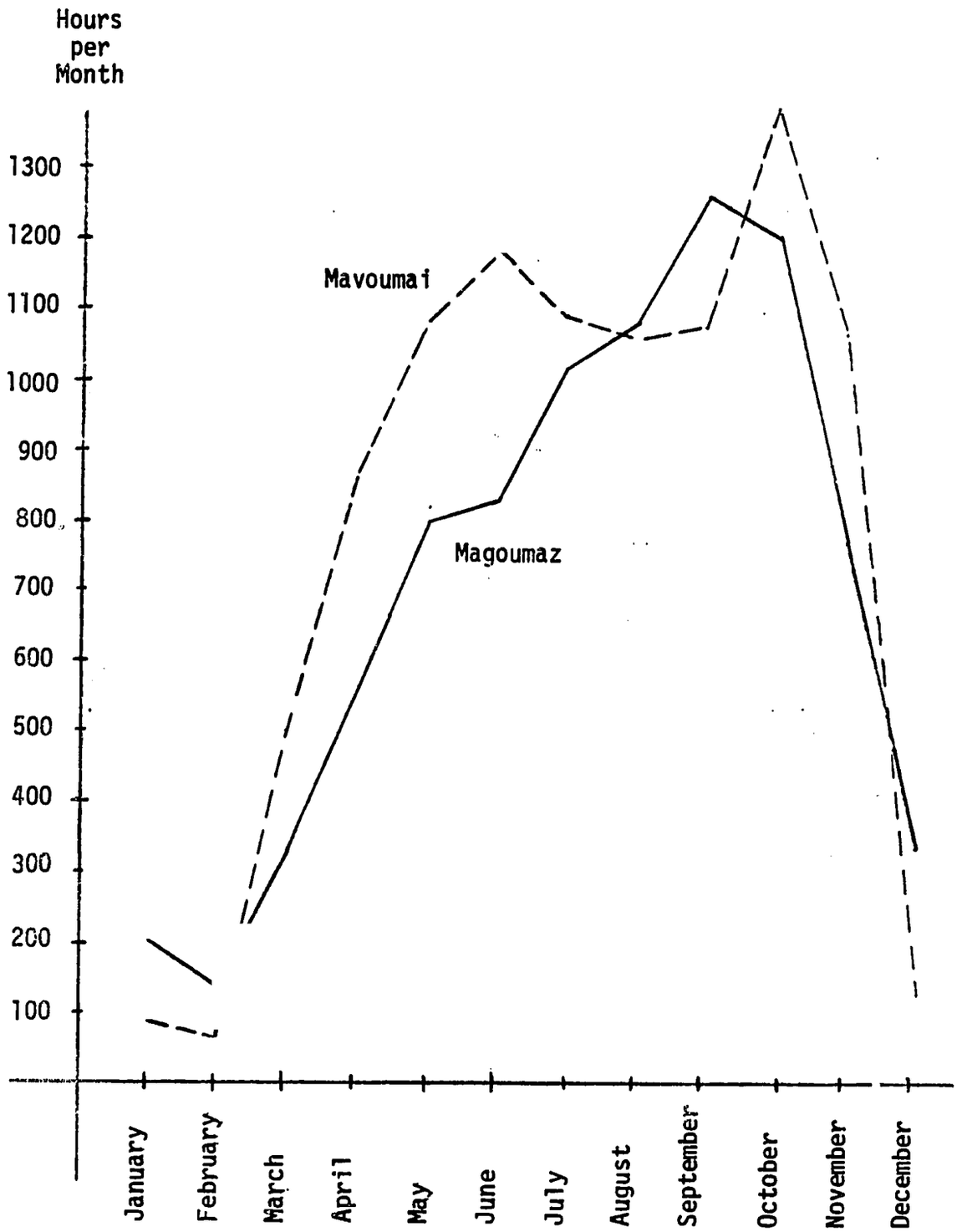
Note: Some of the category totals are not equal to the sum of the individual elements in their respective categories due to rounding errors.

[a]Herding is not included in "All Activities."

[b]Misc. refers to assorted activities involving the preparation and feeding of grain, minerals and agricultural by-products to stall-fed cattle.

FIGURE 4-2

MONTHLY LABOR INPUTS INTO STALL-FEEDING AT MAGOUMAZ AND MAVOUMAI, MARCH 1980-FEBRUARY 1981



In a classic monograph on the Mafa of Magoumaz, Jean Boulet noted that inputs into cutting and carrying forage increased three-fold during the months of September and October (1964) at Magoumaz.[12] The data collected in the survey of 30 stall-feeding households at Magoumaz in 1980-81 do not support this observation, as labor allocated to cutting and carrying grasses increased by no more than 50 percent during September and October over July and August. Although the data collection methodology employed in the survey may have failed to capture the full magnitude of the increase in labor devoted to obtaining forage (principally for storing) during September and October, Boulet appears to have exaggerated the increase. It is more likely that such inputs increased by 50 percent to 100 percent during these months.

Labor allocated to stall-feeding enterprises during the dry season (November-April) represents about 25 percent of all labor inputs. During most of this period the bulls are grazed and watered in or near the villages by children, whose labor devoted to herding has not been included in the analysis, since its opportunity cost is so low. The bulls are stall-fed during most of November before being released daily for grazing from December through early to mid-April. By the end of April nearly all the bulls are enclosed once again and labor allocated to carrying water increases markedly. From March through May progressively more time is spent procuring water, as it becomes hotter and drier and as more and more bulls are enclosed.

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[12] Jean Boulet, Magoumaz; pays Mafa (Nord Cameroun): étude d'un terroir de montagne, Cahier ORSTOM No. 11, Série Sciences Humaines, Paris, 1975, Annexe.

c) The Breakdown of Labor by Age-Sex Category

Although most of the labor allocated to stall-feeding is provided by men in Magoumaz (59 percent) and Mavoumai (73 percent), women contribute far more labor to stall-feeding enterprises in Magoumaz than Mavoumai. While women provide less labor than men for all activities associated with stall-feeding at Mavoumai, as shown in Table 4-3, women devote more labor than men at Magoumaz to hauling water and to preparing food and handfeeding agricultural by-products to stall-fed cattle. Children between 10 and 16 and children less than 10 years old provide relatively insignificant labor inputs to stall-feeding, although they do 70 percent of the herding at Magoumaz and all of the herding at Mavoumai.

Adult labor inputs into stall-feeding activities are proportionately greater than labor inputs for the two non-adult age categories, since most of the activities associated with stall-feeding are strenuous and demand the strength and endurance of an adult laborer. Moreover, adult producers have a lot invested in stall-fed cattle, and they prefer to manage this asset carefully. Hence, the household head allocates proportionately more adult labor to stall-feeding than child labor. By doing this, he can be sure that the stall-fed bull is receiving enough feed, water and care than if children, who are less experienced livestock raisers, were to undertake more of the labor or to manage the enterprise. In contrast, herding can be performed by children, who often group cattle together and play with one another while watching over small cattle herds during the dry season (when there is no danger of damaging crops). In addition, children provide greater labor inputs

into small ruminant enterprises. The adult producers have less invested in individual goats or sheep than they do in the one or two stall-fed cattle owned by the household. Consequently, they manage small ruminants less closely than the cattle stall-feeding enterprise and allocate far less labor (both absolutely and proportionally) to small ruminant production.

3. Feed and Water

The five principal sources of livestock feed for households that stall-feed cattle in the Mandara Mountains are:

1. Hand-cut and carried grasses that grow in and around the village;
2. Agricultural by-products, such as legume leaves, sweet potato vines, sorghum leaves, and crop stubble;
3. Standing forage that is grazed during the dry season;
4. Dried and stored grasses and agricultural by-products; and
5. Salt and natron.

Throughout the growing season livestock are enclosed, so grasses are cut and hand-fed to cattle and small ruminants from late June through mid-November. Toward the end of the rainy season farmers begin to feed agricultural by-products, melons, sweet potato tubers and limited quantities of grain to their cattle, particularly if they intend to slaughter or sell the animals after the harvest. This continues as long as additional produce and agricultural by-products are available, which is usually until December. Once the cattle are released to graze after the harvest, which occurs in late October and early November, they graze first on crop stubble and then on standing grasses. This forage becomes

increasingly dry and decreasingly nutritious as the dry season progresses, causing cattle to lose weight during this period, but the forage does provide a sub-maintenance ration that keeps the cattle alive until late in the dry season. By mid-April most stall-feeding households have begun to feed stored grasses and agricultural by-products to their cattle, which are once again enclosed. This stored fodder is collected, dried and stored from mid-August through the end of October, once the weeding has been completed and while the household awaits the harvest. The fodder is fed to the cattle until late June, after which there is sufficient grass regrowth to enable households to cut and carry fresh forage to the enclosed cattle. Some stall-feeding households provide their cattle with minerals throughout the year, if they are able to afford them, but most households are only able to use mineral supplements toward the end of the rainy season and after the harvest. This is the period during which stall-fed cattle are finished for slaughter or sale. Salt and natron are usually dissolved in water and often mixed with grain when offered to cattle.

In addition to providing feed to cattle, stall-feeding households must provide water during the late dry season and early rainy season (April-June) and also at the end of the rainy season (mid-September to mid-November), before the cattle are released following the harvest. During these periods the cattle are enclosed. Their feed is quite dry, making it necessary to provide water usually twice per day. When the rains are longer and more regular (July to mid-September), there is generally sufficient moisture in the freshly cut grasses fed to the cattle so that hauling and providing water is unnecessary. During the

dry season cattle are free to graze and take water at rivulets and water holes, so water does not need to be provided.

4. Purchased Mineral and Feed Inputs

Stall-feeding households that follow the above feeding and watering practices buy few of their inputs, with the exception of salt, natron, and stored grasses. Table 4-4 shows that all of the households in the stall-feeding survey at Magoumaz and Mavoumai purchased natron over the period March 1980-February 1981, with households at Magoumaz spending an average of 3,337 FCFA and households at Mavoumai spending 2,527 FCFA on average. While over three-quarters of the farmers at Magoumaz bought salt (at an average value of 2,578 FCFA) for their bulls, only half of the producers at Mavoumai purchased salt, spending less than half (1,241 FCFA) what producers at Magoumaz spent.

In addition, stall-feeding households at Magoumaz were far more likely to buy stored grasses and agricultural by-products from other households for feeding during the period April-June. While over half of the producers at Magoumaz purchased stored fodder valued at 3,356 FCFA on average, only four of the 22 households at Mavoumai bought stored feed. This difference in purchasing patterns is due to the fact that stall-feeding households at Magoumaz are generally wealthier than their counterparts at Mavoumai. There is also less pasture available at Magoumaz, so producers are obliged to feed cattle stored grasses over a longer period than at Mavoumai. Hence, many need to buy additional stored fodder in order to maintain their cattle during the period of greatest nutritional stress (April-June). Since Mavoumai borders the plateau, where large tracts of dry season pasture are available, fewer

households need to buy supplementary stored fodder. Cattle can be grazed up until the moment they are enclosed without having to provide supplementary feed.

Two other differences in input purchasing patterns between stall-feeding households at Magoumaz and Mavoumai are evident. Nearly one-quarter of the households at Magoumaz fed purchased grain to their cattle while none of the producers at Mavoumai did. This again reflects the greater wealth of the households at Magoumaz, where sorghum production averaged 10.2 sacks per stall-feeding household in 1980, as opposed to 6.5 sacks at Mavoumai. The households at Magoumaz were also more likely to feed sorghum beer brewing by-products to stall-fed bulls than producers at Mavoumai. While roughly an equal proportion of the households in the two villages paid seasonal laborers to cut and carry grasses during peak agricultural periods, far more producers at Mavoumai entrusted their stall-fed cattle to herders at some point during the growing season. Entrusting arrangements are far more common in Mafa villages adjacent to plateau zones, where Fulani herdsmen are present, than in isolated mountain villages such as Magoumaz, which are far from the Fulani and rainy season grazing areas.

Stall-feeding households purchase mineral inputs at town and rural secondary markets, such as Mokolo, Koza, Soulede, Tourou, and Roumzou. While producers typically buy salt in small quantities (50-200 FCFA per visit), they usually buy natron in sizable chunks, paying from 500 to 5,000 FCFA per visit. Natron is often bought at Madagali market in Nigeria, so producers buy larger quantities in order to economize on the number of visits they must make.

In contrast, other inputs into stall-feeding are bought invariably within the village. Producers buy additional stored fodder from other livestock producers who are able to cut, dry and store more fodder than needed to meet their own livestock's maintenance requirements during the late dry season and early rainy season. The demand for stored feed generates employment for rural households, especially for those that may not have large livestock holdings, during a slack period in the rainy season. If the number of stall-fed cattle increased considerably in the Mandara Mountains as a result of, say, an expanded loan scheme, the demand for stored fodder would also increase, which would generate additional employment for households that do not stall-feed cattle.

5. Veterinary Inputs

Stall-fed cattle receive little veterinary care in the Mandara Mountains, particularly in the more isolated and less accessible villages. In villages near the veterinary centers most stall-fed cattle are vaccinated annually against rinderpest and hemorragic septicemia. In more isolated villages many cattle owners are unaware of the existence of the veterinary service. Virtually no stall-fed cattle are treated for ecto- or endo-parasites, which may be the principal reason for poor growth performance in some animals. Livestock extension services are not provided to stall-feeding households, with the exception of some participants in the FONADER loan program.[13]

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[13]See Chapter 8, Section C.2 for details.

6. Livestock Housing

Stall-fed cattle are enclosed in circular huts within the household compound that are about three meters in diameter. The huts are constructed of mud and clay and covered with roofs made from dried sorghum and millet stalks and grasses. The floor of the hut is usually one to two feet below the surface and can be one and a half meters deep. This is designed to prevent the bull from escaping from the enclosure. The entrance of the hut is also usually barricaded with logs. There is usually an aperture of half a meter or less in diameter opposite the entrance, through which the owner discharges cattle manure. At the entrance there is often a hollowed out shelf that serves as a feeding trough.

The hut is typically repaired and reroofed every second dry season. Since the huts are constructed using locally available materials and household labor, it is difficult to value the housing. Probably the best way to determine the value of the housing would be to value the household labor (at its dry season opportunity cost) that went into the gathering of the locally available materials and stall construction.

7. Management

Economists pay a good deal of attention to labor that goes into cropping and livestock enterprises. Labor inputs can be quantified relatively easily. Moreover, if cost and return data are collected, then it is possible to estimate daily or monthly returns to household labor. It is very important, however, not to neglect management, which cannot be easily measured. Good management is required in order to obtain satisfactory livestock weight gains and crop production under a

complex and integrated system of intensive agricultural and livestock production. Farmers need to know about livestock nutrition, health and housing, as well as seasonal variations in livestock prices, in order to ensure acceptable returns to livestock production. Knowledge of what constitutes a balanced ration of grasses, agricultural by-products, minerals and grain is necessary for optimal feeding. Farmers who stall-feed also need to know how to conserve fodder for late dry season and early rainy season use. From the standpoint of animal health, it is important for producers to remove ticks periodically from their cattle. Neglecting to do this will lead, at best, to inferior weight gains. At worst, it may contribute to cattle mortality. Along these same lines, sound construction and periodic repair (reroofing) of the stalls (huts) in which cattle are enclosed can contribute to superior weight gains. Excessive moisture in the stall can lead to parasite and disease problems, which may lead to inferior weight gains or in some cases to actual losses.

Not only must producers know a good deal about animal husbandry, but they must also know something about marketing conditions. Farmers who buy bull calves when prices are highest and sell finished bulls when prices are lowest are not practicing sound management. Poor timing of purchases and sales may make it difficult for producers to raise enough capital to reinvest in new cattle after sale. Finally, good management is required in employing livestock manure as a fertilizer. The manure has to be protected from the sunlight and rainfall, which cause the minerals to be evaporated or leached from the manure, before it is spread on the fields at the end of the dry season. Knowing when and how to

spread the manure and work it into the soil is also critical in realizing maximum yield-augmenting effects.

F. OUTPUTS OF STALL-FEEDING ENTERPRISES

1. Cattle/Beef

a) Disposal of Stall-Fed Cattle and Beef

After an average of 26 months of stall-feeding, cattle are slaughtered in the village or sold to rural butchers or cattle traders. In accordance with traditional social practice, stall-fed cattle are slaughtered at the time of the harvest festival (November) or the Marai (February). Most of the beef is consumed by the extended family and given to friends. Traditionally, beef was not sold during these festivals. In more isolated villages such as Magoumaz, where traditional slaughter of stall-fed cattle is still widely practiced, no beef was sold after slaughter for 41 percent of the slaughtered stall-fed cattle from 1977 through March 1981 (see Table 4-6). In more commercially-oriented villages such as Mavoumai, Zileng and Mandaka, it is far less common for households to consume and distribute all the beef from slaughtered stall-fed bulls.

In fact, it has become increasingly common for producers to sell stall-fed cattle or beef. Twenty-eight percent of the 272 stall-fed bulls disposed of by a sample of households in five villages near Mokolo from 1977 through 1981 were sold to rural butchers and cattle smugglers. Almost half of the bulls in the Mavoumai sample were also sold. The vast majority of cattle sales take place in the producers' villages, although some farmers trek their cattle to markets at Mokolo, Tourou

TABLE 4-6

DISPOSAL OF STALL-FED CATTLE RAISED IN VILLAGES NEAR MOKOLO[1]

	Magoumaz		Mavoumai		Zileng		Entire Sample		Estimated
	No. of Bulls	Cumulative Percentage	No. of Bulls	Cumulative Percentage	No. of Bulls	Cumulative Percentage	No. of Bulls	Cumulative Percentage	Breakdown of Regional Offtake[2]
Sold Live	8	7.5	46	42	7	25	75	28	1,655
Sold All Beef	12	19	7	48	11	64	40	42	882
Sold Three Quarters	10	28	40	85	4	79	55	63	1,213
Sold Two Quarters	3	31	5	89	0	79	9	66	199
Sold One Quarter	18	48	2	91	1	82	21	74	463
No Sale of Beef	52	97	10	100	5	100	69	99	1,522
Beef Exchanged for Livestock	3	100	0	100	0	100	3	100	66
								Total	6,000

SOURCE: Survey of stall-feeding households, September 1980-March 1981.

[1]The sample includes households from Magoumaz, Mavoumai, Zileng, Ldamstai and Mandaka, which are villages within 12 kilometers of Mokolo. The sample is purposive in that it includes only stall-fed cattle sold or slaughtered from 1977 through March 1981. Bulls that died or were stolen are not included in the sample. The sample was not randomly selected from stall-feeding households. Rather, certain sections of villages were completely enumerated (or close to being enumerated). The sample is also not entirely representative in that the villages were chosen for their accessibility. Stall-feeding households in isolated villages are not included in the sample.

[2]An estimated 6,000 head of stall-fed cattle are slaughtered or sold each year, assuming a regional stall-fed herd of 12,800 head and an average feeding period of 25.7 months. The proportional breakdown of the regional offtake corresponds exactly to the breakdown of the entire sample (column 8).

and Nigeria (generally Mitchika). In addition to sales of live bulls, it has become increasingly common for stall-feeding households to sell beef from slaughtered bulls. In over half of the cases (104 of 197) where stall-fed cattle were slaughtered by producers, at least two quarters of the animal were sold to other villagers and rural butchers. In 36 percent of the cases where cattle were slaughtered was no commercial sale involved. Stall-feeding of cattle is becoming commercially oriented in some villages of the Mandara Mountains, particularly those near larger towns and the Nigerian border.

Assuming that the regional offtake of stall-fed cattle corresponds to the pattern observed for the entire sample, producers sell 61 percent of the annual offtake or 3,622 head.[14] Forty-five percent of this commercialized offtake is sold on the hoof to butchers and traders. The remaining 55 percent is sold as quarters of beef. Roughly half of this beef is sold to rural butchers, while the other half is retailed by the producers. The strong basis of stall-feeding in traditional practice is reflected in the large proportion of regional offtake (39 percent or 2,388 head) consumed by the producing household and distributed to the extended family.

b) Final Value of Stall-Fed Cattle

Prices obtained by producers at Magoumaz, Mavoumai, Zileng, Ldamstai and Mandaka who sold their stall-fed cattle (or all of the beef from

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[14]The commercialized proportion of regional offtake is calculated as follows:

No. of stall-fed cattle equivalents = No. sold live + No. sold all beef + 3/4 (No. sold three-quarters) + 1/2 (No. sold two-quarters) + 1/4 (No. sold one-quarter)

slaughtered bulls) are broken down by years in Table 4-7, as are the estimated values of slaughtered cattle whose beef was not entirely sold. The stall-fed cattle were held for an average period of 25.7 months, during which the value added was 22,036 FCFA, unadjusted for inflation, or 966 FCFA per month. The stall-fed cattle prices and final values increased at an average annual rate of 8 to 10 percent during the years 1977 to 1981, as shown in Table 4-7. The increase in the value of cattle during the 1970s made stall-feeding an attractive investment and income-generating opportunity for those households that could muster the necessary capital and labor.

c) Seasonality of Slaughter and Sale

Stall-fed cattle slaughter and sale is concentrated during the late rainy season and early dry season, as shown in Table 4-8. Ninety-three percent of all slaughter and sale occurs from September through March in five villages near Mokolo. Nearly three-quarters (73 percent) of slaughter and sale takes place from October through January in these villages. Two-thirds of slaughter and sale, most of which is traditional slaughter, occurs in December and January at Magoumaz, while 75 percent of slaughter and sale, a large part of which is commercial sale, takes place from October through December at Mavoumai.

2. Cattle Manure

a) Producers' Estimates of the Economic Value of Manure

Cattle manure is an important joint product of stall-feeding enterprises that is not sold in the Mandara Mountains. The value of this manure as a fertilizer can be estimated by comparing farmer's reports of

TABLE 4-7

SALE PRICES/FINAL VALUES OF STALL-FED CATTLE SOLD OR SLAUGHTERED BY FARMERS IN VILLAGES NEAR MOKOLO (in FCFA)

Year	Sales Price[1]		Final Value[2]		Entire Sample[3]	
	Mean Price	N	Mean Value	N	Mean Value	N
1977	44,333	9	45,731	13	45,159	22
1978	50,255	11	55,563	16	53,400	27
1979	51,063	16	53,389	18	52,294	34
1980	58,910	17	52,267	15	55,796	32
1981	64,600	6	63,000	4	63,960	10
		73		66		139

Source: Surveys of stall-feeding and cattle owning households, September 1980-March 1981.

[1]These are prices obtained by farmers who sold their bulls live or sold all the beef from slaughtered bulls.

[2]These are the final estimated values of slaughtered stall-fed cattle whose beef was partly or entirely sold. The farmers estimated the value of the unsold portion of beef.

[3]This sample is the combined sample of all observations in the previous two categories.

TABLE 4-8

SLAUGHTER AND SALE OF STALL-FED CATTLE BY MONTH
IN FIVE VILLAGES NEAR MOKOLO[1]

Month	Magoumaz		Mavoumai		Ziling, Mandaka and Ldamstai		Entire Sample[2]	
	No.	Percentage of Total No.	No.	Percentage of Total No.	No.	Percentage of Total No.	No.	Percentage of Total No.
January	24	26	4	4	4	8	32	13
February	7	8	4	4	6	12	17	7
March	7	8	6	6	1	2	14	6
April	0	0	0	0	1	2	1	0.4
May	2	2	1	1	2	4	5	2
June	0	0	0	0	0	0	0	0
July	1	1	2	2	0	0	3	1
August	2	2	3	3	2	4	7	3
September	3	3	6	6	10	20	19	8
October	6	7	17	16	7	14	30	12
November	2	2	23	22	3	6	28	11
December	37	41	38	37	14	28	89	36
Total	91	100	104	100[3]	50	100	245	100[3]

SOURCE: Survey of stall-feeding and cattle owning households, September 1980 through March 1981.

NOTE: The data were obtained from farmers who had slaughtered or sold stall-fed cattle from 1977 to March 1981. In addition to the 52 stall-feeding households in the survey samples at Magoumaz and Mavoumai, other stall-feeding households were interviewed in the two villages to obtain larger samples. Single-visit interviews were also conducted with farmers in Zileng, Mandaka and Ldamtsai. The month of slaughter/sale was determined by reference to a traditional Mafa calendar, which is based upon the annual cycle of agricultural and ceremonial activities (see Annex 1, Section B).

[1]Magoumaz, Mavoumai, Zileng, Mandaka and Ldamtsai.

[2]The sample size differs from the sample size in Table 4- due to the inability of certain respondents to recall the month of slaughter/sale.

[3]The sum of the monthly percentages does not equal 100 due to rounding errors.

crop production (with manure application) with their estimates of production in the absence of manure application. Although this approach should be used cautiously, it does seem to yield quite plausible estimates. Stall-feeding households at Magoumaz and Mavoumai estimated that application of cattle manure from their stall-feeding operation augmented millet production in 1979 by 1.3 and 1.8 sacks, respectively, and sorghum production in 1980 by 2.9 and 3.3 sacks, as shown in Table 4-9. Using 6,500 FCFA as the average value of a sack of grain in the post-harvest periods of 1979 and 1980, cattle manure application led to additional millet production valued at 8,450-11,700 FCFA in 1979 and additional sorghum production valued at 18,850-21,450 FCFA in 1980. Other methods of estimating the value of manure, which are discussed below, show that these estimates of the value of increased crop production are perhaps conservative. It is interesting to note that farmers at Magoumaz reported that cereal production was augmented by 40-50 percent due to manure application, while farmers at Mavoumai estimated that manure application increased grain production by 70-100 percent.

b) Estimating the Economic Value of Manure from Yield Plot Data

A second way to value cattle manure spread on fields around the compound is to compare yields on fields that receive bi-annual or tri-annual applications of cattle manure with yields on fields that receive no manure. The practical difficulty encountered in making this comparison, however, is that it is impossible to separate out the individual yield-augmenting effects of cattle manure, small ruminant manure, poultry manure, household sweepings, ashes, human manure and organic matter that decomposes in the fields. An analysis of the separate

TABLE 4-9

ESTIMATED INCREMENTAL GRAIN PRODUCTION (IN 94 KG. SACKS) DUE TO MANURE APPLICATION

	Millet (1979)		Sorghum (1980)	
	Magoumaz[a]	Mavoumai[b]	Magoumaz[a]	Mavoumai[b]
Reported Grain Production	3.9	4.4	10.2	6.6
Estimated Grain Production Without Manure Application	2.6	2.6	7.3	3.3
Estimated Increment of Grain Production Due to Manure Application	1.3	1.8	2.9	3.3

[a]Twenty-six of the 30 survey households at Magoumaz responded.

[b]Nineteen of the 22 survey households at Mavoumai responded.

Source: Survey of stall-feeding households at Magoumaz and Mavoumai, September 1980-March 1981.

effects of these is possible only under tightly controlled experiments. We have no way of performing this type of analysis. Nonetheless, it is instructive to assess the combined effect of these separate influences on crop yields. Among other things these estimates allow us to carry out a sensitivity analysis of returns from stall-feeding, where assumptions can be made about the amount of additional crop production resulting from the application of cattle manure.

Plots were selected on five farms in each of four villages in the Mandara Mountains region for yield measurement after the sorghum had been growing for several months. This ex post selection of the best plots, most of which had received manure and were near the households' compounds, was made in order to obtain data on the agronomic potential

of local sorghum varieties under the best of conditions. The equivalent yield per hectare, calculated from the ten three-by-four meter plots (two per farm) in each village, was 5,964 kilograms at Magoumaz and 4,510 kilograms at Ldama for the same sorghum variety (Matakamri).[15] Yield data are not available for Mavoumai, but it is adjacent to Ldama and the topography, soils and farming systems of the two villages are sufficiently similar to permit us to assume that data on farm size, cropping patterns, yields and production for Ldama are valid approximations for Mavoumai.

The above estimates of sorghum yields on well-manured fields near the compound should be compared to the average yields per hectare for the same variety in each of the two villages. They should not be compared to one another, since agricultural production is generally more extensive at Ldama, where the average size holding is 2.77 hectares, than at Magoumaz, where the average holding of 1.23 hectares is more intensively cultivated.[16] Labor inputs per hectare of cultivated area are therefore considerably higher at Magoumaz, which is one of the principal reasons for the higher sorghum yields. Yields may also be higher at Magoumaz, because manure and household waste application rates are possibly higher per hectare than at Ldama or Mavoumai.

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[15] Tom Zalla, David J. Campbell, John Holtzman, Larry Lev and David Trechter, Agricultural Production Potential in the Mandara Mountains in Northern Cameroon, MSU Rural Development Series Working Paper No. 18, Department of Agricultural Economics, Michigan State University, East Lansing, 1981, pp. 12-15.

[16] These estimates of average farm size are based on actual measurements of all of the fields on 23 randomly sampled farms at Ldama and 8 randomly sampled farms at Magoumaz.

Average sorghum yields per hectare on farms in the four different villages are shown in column 3 of Table 4-10. These were obtained by projecting sorghum yields per hectare based on farmers' reports of production on fields measured during the intensive survey (see columns 1 and 2). On farms in villages of the plateau (Roumzou, Ouda), where land is relatively abundant and crop production is extensive, yields on well-manured plots are over twice those on average plots. In contrast, yields on well-manured plots are seven to eight times as large as yields on average sorghum fields in the more intensive cropping systems of the two villages in the mountainous zone. This significant difference in crop production is due largely to the more systematic and abundant application of livestock manure and household wastes by households in the mountainous zone. Since livestock are enclosed during the rainy season by mountain households, a larger proportion of the manure is captured and used as a fertilizer than on the plateau or in the plains, where livestock are grazed far from the compound. Moreover, farmers in the mountains tend to cultivate more intensively on fields near the compound that receive more manure and household wastes than on outlying fields that receive no manure input. Terraces are better maintained, manure is spread and worked into the soil, and labor inputs into weeding are higher. Hence, a large but unknown part of the increase in yield on well-manured fields is the result of significantly higher labor inputs per unit of land area.

It is interesting to note that sorghum yields on average plots are higher on farms in the plateau villages than on farms in the mountains, because the soils in the plateau are generally more fertile and rainfall is usually higher. In addition, farmers on the plateau own more

TABLE 4-10

FARMER ESTIMATES OF SORGHUM YIELDS ON AVERAGE FIELDS AND PROJECTIONS OF SORGHUM YIELDS ON WELL-MANURED LAND FOR REPRESENTATIVE VILLAGES IN THE MANDARA MOUNTAINS REGION

Village/Zone	Average Size[a] of Sorghum Field (in Square Meters)	Average Production Per Sorghum Field (in Kilograms)	Average[b] Sorghum Yield (kg./ha.)	Average of Ten[c] Well Manured Yield Plots (kg./ha.)	Average High Yield/ Average Yield (col. 4/col. 3)
Magoumaz/Mountain	6,939 (10)	517	715	5964 (1969)	8.3
Ldama/Mountain Plateau	10,143 (19)	578	570	4510 (948)	7.9
Roumzou/Plateau	6,221 (9)	924	1486	3220 (701)	2.2
Ouda/Plateau	5,857 (15)	573	978	2490 (603)	2.5

Source: Intensive Survey, July 1980-February 1981.

[a]Figures in parentheses are the number of fields measured.

[b]These yield estimates are the unweighted averages of observations for two or more varieties in Ldama, Roumzou and Ouda.

[c]Although virtually all of the yield plots were near the compound, they were not necessarily on well-manured land. Land near the compound generally receives applications of manure every second or third year, however. Figures in parantheses are standard deviations.

livestock, particularly cattle, which are generally enclosed in corrals near the compound at night during both the rainy and dry season.[17] These corrals are moved periodically, usually every few months, to fertilize as much land as possible. Hence, a larger proportion of the land around the compound is fertilized by cattle droppings than in the mountains, where a lower percentage of the households own cattle, and those who do own cattle raise only one or two head. Manure and household wastes are typically applied to a smaller proportion of the area around the compound in mountain households, and applications to particular plots are bi- or tri-annual.

Yet yields on well-manured plots are considerably higher on mountain farms than on farms on the plateau. This is due to better manure management by mountain households, who pile cattle manure in the stall during the rainy season and keep it inside the stall during the dry season until a month or two before the principal cereal crop is sowed. In this way the manure is not exposed to the elements and remains moist. The management practices of mountain households ensure that little of the value of the manure as a fertilizer is lost, while plateau households leave cattle droppings in the fields, exposed to the sun, wind and rain, which dry and leach minerals from the manure. This lack of manure management by households in extensively farmed areas depletes the manure of much of its value as a fertilizer. In conclusion, although large land areas receive cattle manure on plateau farms, this manure is not well-conserved nor worked into the soil, as in the mountains. Sorghum yields on average plots tend to be higher on the plateau, but yields on well-manured plots are lower than in the mountains. This leads to a more

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[17]Some cattle are entrusted to Fulani herders and are not brought back to the farm each evening.

circumscribed range of land productivity on the plateau than in the mountains, where productivity varies greatly due to large intra-farm differences in soil fertility, manure application rates and labor inputs.

Using the data in Table 4-10 we can estimate the yield-augmenting effect of manure application, household sweepings, and seepage and drainage of wastes on cereals production. The yield plot estimates are misleading in that they represent per hectare projections of yield based upon data from very small plots (0.0012 of a hectare). In most instances, these natural fertilizers are applied to areas within 20 to 25 meters of the compound. An area of no more than .13-.20 hectare (1178-1184 square meters) receives manure and wastes.[18] If we assume that average yields for well-manured land are one-half as great as yields on the very best yield plots, then we calculate that manure application leads to increased sorghum production of 265 to 418 kilograms per year at Magoumaz and 174-269 kilograms per year at Ldama.[19] At average post-harvest market prices (6,500 FCFA per 94 kg. sack), this additional production has an annual economic value of 18,324-28,904 FCFA at Magoumaz and 12,032-18,601 FCFA at Ldama. Not all of this added value can be attributed to application of cattle manure. Several of the households in the yield plot sample at Ldama did not own cattle but instead owned large numbers

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[18] If we assume that a circular area around the compound with a radius of 20-25 meters receives manure, household sweepings, and other wastes, then the total area receiving these fertilizers is equal to πr^2, where r is the radius of the circle, less the circular area occupied by the compound. (The compound is assumed to have a radius of five meters.)

[19] Increased sorghum production = (Average yield on well-manured land - Average yield) x (Proportion of hectare to which manure applied).

of goats, which are staked and enclosed during the growing season. Since cattle manure is the largest component of manures and wastes that are spread or that seep on to fields near the compound for most of the households in the sample, perhaps two-thirds to three-quarters of the increase in yields is due to cattle manure application.

c) Estimating the Economic Value of Manure from Experiment Station Data

A final method for estimating the value of cattle manure has been developed by Zalla.[20] Zalla estimates that 3.8 tons of usable manure is produced annually by one adult stall-fed zebu bull. Since bulls are enclosed seven months of the year, the annual output of usable manure averages at least 2.2 tons per stall-fed head of cattle.[21] Zalla concludes that the 2.2 tons of manure can augment cereals production by 185 kilograms per year, valued at 19,707 FCFA.[22]

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[20]Ton Zalla, "Economic, Technical and Political Aspects of Small Holder Milk Production in Northern Tanzania," Unpublished Ph.D. Dissertation, Department of Agricultural Economics, Michigan State University, 1982. See Appendix H, "The Economic Value of Manure."; Tom Zalla, David J. Campbell, John Holtzman, Larry Lev and David Trechter, Agricultural Production Potential in the Mandara Mountains in Northern Cameroon, MSU Rural Development Series Working Paper No. 18, Department of Agricultural Economics, Michigan State University, East Lansing, 1981, pp. 28-29.

[21]The annual output of usable manure is probably higher, because cattle are brought back to their stalls for the night during the five months of the dry season when extensive grazing takes place. Zalla argues that the process of standing up and lying down in the stall causes the animal to excrete a greater proportion of daily manure production in the stall than on the range.

[22]Studies from Mali (Shulman, 1979), and Nigeria (Lombin and Abdullahi, 1977) show that one ton of manure increases cereal production by about 200 kilograms per year on experiment stations under conditions of adequate moisture when applied at a rate of five tons per hectare or less. The rate of application on farms in the Mandara Mountains is

Estimates of yield increases due to the application of cattle manure from one stall-fed animal on intensively cultivated farms in the Mandara Mountains are summarized in Table 4-11. From the range of estimates, we can conclude that annual cattle manure production has an economic value of 10,000-20,000 FCFA, which should not be disregarded in estimating returns to stall-feeding. In analyzing the profitability of stall-feeding, we will calculate returns under varying assumptions of the beneficial impact of applying manure.

G. RETURNS TO STALL-FEEDING USING EXISTING TECHNOLOGIES

Using data obtained in the survey of stall-feeding households at Magoumaz and Mavoumai and shown in Table 4-12, it is estimated that the return per man-day of labor is 127 FCFA for stall-feeding enterprises. Gross enterprise returns are roughly equally divided between manure production and the added value of beef produced during two years of feeding. The principal components of cost are the initial investment in a bull calf and cost of sinking equity capital over a two-year period in cattle, livestock housing and working capital.

The daily return to stall-feeding is below the typical wage paid to seasonal agricultural laborers, who receive 250-300 FCFA per man-day during the planting, weeding and harvesting periods. Robust and highly

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typically less than five tons per hectare, as the manure output of stall-fed enterprises is 4.2 tons per stall-feeding household (3.8 tons/bull x 1.1 stall-fed bulls/household). Given field conditions on farms, rainfall variability, and less than ideal manure handling techniques, the actual increases in yield due to manure handling techniques are probably lower. It is important to note that average cereal production increases as the period over which manure is applied lengthens. Zalla, et al. revised the estimate of increased cereal output due to manure application downward to 130 kilograms per ton of manure.

TABLE 4-11

ALTERNATIVE ESTIMATES OF CEREAL PRODUCTION INCREASES RESULTING PRINCIPALLY FROM THE APPLICATION OF MANURE FROM ONE STALL-FED BULL TO FIELDS ON INTENSIVELY CULTIVATED FARMS

Source of Estimate	Increase in Annual Production (kg.)	Value of Increased Production (FCFA)
Farmers' Estimates		
1. Magoumaz	273	18,850
2. Mavoumai	310	21,450
Holtzman[a]		
1. Magoumaz	265-418 (177-279)	18,324-28,904 (12,216-19,269)
2. Ldama (Mavoumai)	174-269 (116-179)	12,032-18,601 (8021 - 12,041)
Zalla	285	19,707

[a]Holtzman's estimates are for the additional production due to all animal and household wastes. Figures in parentheses represent increased production resulting from applying manure from stall-fed cattle enterprises, assuming that two-thirds of the total increase is due solely to the cattle manure. This assumption is arbitrary and made for illustrative purposes.

TABLE 4-12

REPRESENTATIVE COSTS AND RETURNS OF STALL-FEEDING CATTLE USING TRADITIONAL TECHNOLOGY, 1979-1981

Cost and Return Categories	Amount (FCFA)		
		Year	
	0	1	2
Gross Enterprise Returns:			
Cattle sale[a]			60,396
Estimated value of manure[b]		16,750	16,750
Sub-total		16,750	77,146
Costs:			
Production Costs			
Acquisition price of two-year old bull[c]	33,137		
Variable costs[d]			
Cattle feed			
Natron and salt		2,200	2,200
Stored fodder		600	600
Sorghum grain		295	295
Misc. (cut grasses, agric. by-products)		175	175
Sub-total		3,270	3,270
Wage Labor Inputs			
Laborer (who cuts and carries grasses)		110	110
Herder[e]		185	185
Sub-total		295	295
Total Variable Costs		3,565	3,565
Fixed Costs			
Housing depreciation[f]		750	750
Housing repairs[g]		-	-
Mortality risk/insurance[h]		700	700
Sub-total		1,450	1,450
Cost of Equity Capital (10%)			
Cattle[i]		3,755	5,037
Housing[j]		375	375
Working capital[k]		178	178
Sub-total		4,308	5,590
Total Costs	33,137	9,323	10,605
Net Enterprise Returns to Household Labor and Management	-33,137	7,427	66,541
Discounted Net Enterprise Returns[l]		28,577	
Total Labor Inputs[m]		1,800	
Net Return per Man-Day of Labor[n]		127	

[a]This was the mean sales price for 23 stall-fed bulls from five villages near Mokolo, which were sold on the hoof in 1980-1981.

[b]It is assumed that a stall-fed bull produces 2.2 tons of usable manure per year and that each ton augments sorghum production by 130 kilograms. Sorghum is valued at its average market price over the year (70 FCFA/kg.), and the cost of harvesting the increased sorghum production equals 15% of its sale value and is not a benefit to the stall-feeding enterprise.

[c]This was the mean acquisition price paid in cash for immature bulls by 95 households in five villages near Mokolo in 1978-79.

[d]The variable cost estimates were obtained from the survey of 52 stall-feeding enterprises conducted at Magoumaz and Mavoumai.

[e]Six of the 52 households at Magoumaz and Mavoumai paid an average of 3,225 FCFA for entrusting their bulls to herders during at least part of the growing season.

[f]This assumes an investment cost of 6,000 FCFA, four cycles of stall-feeding of two and one-half years each, and a salvage value of zero.

[g]The cost of housing repairs are included in labor time since all costs were labor costs.

[h]This assumes a 6% probability of dying before sale and that meat from the carcass of the dead bull would be sold at 50% of liveweight prices. Calculated as follows: $\left(\frac{\text{acquisition value + sale value}}{2}\right)$ X mortality rate X loss on dead animal as a proportion of live animal.

[i]The capital cost of cattle is calculated on the average value of the cattle investment for each year, adjusted for mortality. The opportunity cost of farmers' equity capital is assumed to be 10% in real terms. It is also assumed that the cattle appreciate by equal amounts each year. The calculation of the capital cost for each year is as follows: $\left(\frac{\text{value at beginning of year + value at year end}}{2}\right)$ X survival rate X .1

[j]The capital cost of livestock housing is calculated on the average value of the investment in housing over a ten year period assuming zero salvage value and a two and one-half year investment period for each cycle of stall-feeding. It is calculated as follows: $\left(\frac{\text{investment cost}}{2}\right)$ X .1 X $\frac{30}{12}$. The capital cost of housing is divided equally between the two years.

[k]The opportunity cost of the working capital which is used for the purchase of variable inputs is calculated on the average value of working capital required each year as follows: $\left(\frac{\text{variable costs}}{2}\right)$ X .1

[l]A discount factor of 10% is used to calculate net enterprise returns.

[m]An annual average of 900 man-hours of labor is used in the calculation. This estimate excludes dry season herding labor.

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productive male agricultural laborers are able to earn a daily wage of 700 to 1,000 FCFA in the Mandara Mountains region for cultivating sweet potatoes, a key cash crop in the area. Returns to stall-feeding are also lower than returns to cropping enterprises in villages in the mountainous zone, which range from 190 to 330 FCFA per man-day for sorghum production and are generally at least 500 FCFA per man-day for sweet potato production.[23]

1. Possible Upward Adjustments of Returns to Stall-Feed Enterprises

The disparity in returns to stall-feeding and cropping enterprises is surprising given the popularity of stall-feeding. One possible explanation for this apparent contradiction is that the returns to stall-feeding have been underestimated. The results of a sensitivity analysis of producer returns are shown in Table 4-13, where several return-augmenting continencies are displayed.

The enterprise budget for stall-feeding assumes that the cattle are sold on the hoof, while it is quite common for households to slaughter the cattle and retail the beef themselves. In this case it is not unreasonable to assume a retail margin of 10-20 percent for an additional 15 hours of household labor, which would increase the return 17-35 percent or 21-44 FCFA per man-day. The retailing margin may be higher than 20 percent if producers are able to attain returns that are comparable to returns obtained by rural butchers for slaughtering and retailing stall-fed cattle (see Chapter Six, Section F.1).

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[23]Tom Zalla, David J. Campbell, John Holtzman, Larry Lev, and David Trechter, Agricultural Production Potential in the Mandara Mountains in Northern Cameroon, MSU Rural Development Series, Working Paper No. 18, 1981.

TABLE 4-13

SENSITIVITY ANALYSIS OF PRODUCER RETURNS TO STALL-FEEDING USING EXISTING TECHNOLOGY

Contingency	Producer Return (FCFA)	Proportional Change Over Base
0. Base budget	127	-
3. Asset appreciation[a]	145	14%
1. Retailing margin[b]		
a) 10% margin	148	17%
b) 20% margin	170	34%
2. Varying incremental cereal production[c]		
a) 15% increase	146	15%
b) 30% increase	166	31%
c) 15% decrease	108	-15%
4. Varying the discount rate		
a) 12% discount rate	118	- 7%
b) 15% discount rate	105	-17%

[a]Price indices available for a basket of consumer goods and for beef retailed at Yaounde show that cattle prices increased 4% per year in real terms from 1969 to 1980. It is assumed that this secular appreciation will continue to prevail (in Northern Cameroon).

[b]Additional labor inputs of 15 hours are assumed for slaughtering and retailing.

[c]As in the base budget, sorghum is valued at its average market price over the year (70 FCFA/kg). The cost of harvesting (or of not harvesting) the increased (decreased) sorghum production equals 15% of its sale value and is not a benefit to the stall-feeding enterprise.

Returns to stall-feeding may also be understated, due to an underestimation of additional cereals production resulting from manure application. Repeated application of cattle manure to fields near the household compound builds up soil fertility over time, particularly in villages such as Magoumaz, where very intensive cultivation and high rates of manure application are common. As a result, the rate of manure application may be considerably higher than the rate assumed in calculating the benefits of manure production. If the additional sorghum production due to manure application is 15-30 percent higher than initially estimated, the return to stall-feeding rises 15-31 percent or 19-39 FCFA per man-day.

Another factor which increases returns to stall-feeding is the appreciation of cattle over time. Livestock appreciated in real terms at an annual rate of 4 percent from 1969 through 1980 in Cameroon, which may not continue in the 1980s. Nevertheless, this appreciation contributed to the profitability of stall-feeding during the 1970s. Returns to stall-feeding rise 14 percent or 18 FCFA per man-day if the continuation of 4 percent annual appreciation is assumed.

By combining several return-augmenting contingencies, producer returns to stall-feeding increase significantly. One plausible scenario would be for producers to obtain a 10 percent retailing margin, 15 percent higher incremental cereals production, and annual appreciation in the value of cattle of 4 percent. In combination these contingencies would increase producers' returns to 187 FCFA per man-day of labor, a 47 percent increase over the base return. A second, more favorable scenario, whereby producers would obtain a 20 percent retailing margin,

incremental cereals production would be 30 percent higher, and the value of cattle would appreciate 4 percent per year, would cause producer returns to rise 81 percent to 230 FCFA per man-day. Returns to stall-feeding resulting from the above scenarios are competitive with returns to sorghum production (190 FCFA per day of labor) in two of the three villages in the mountainous zone that were included in the intensive survey.[24]

2. Reasons for the Widespread Practice of Stall-Feeding Despite Relatively Low Returns

Even after making the above adjustments, however, the returns to stall-feeding do not approach returns to sweet potato production or peak season agricultural wage labor.[25] In villages such as Mavoumai and Ldama, which are adjacent to the plateau, where large and well-watered tracts of land are available for sweet potato cultivation, many farmers expressed an interest in acquiring bulls for animal traction. Indeed, acquisition of oxen for traction purposes is already taking place spontaneously in parts of the Mandara Mountains region where access to fertile and well-watered lowland soils is not restricted. About one-third of the sample of stall-feeding households at Mavoumai stated that they would prefer loans for animal traction to loans for stall-feeding.

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[24]Returns to sorghum production were estimated to be 190 FCFA per man-day at Ldama and Madakonay and 330 FCFA per man-day at Manguirda See Tom Zalla, David J. Campbell, John Holtzman Larry Lev, and David Trechter, op. cit., p. 44.

[25]Returns to sweet potato enterprises may be overestimated by 15-25 percent, since labor allocated to feeding, watering and grazing oxen used for plowing and weeding by some producers was not accounted for in the calculation of returns.

In more densely populated villages of the mountains, such as Magoumaz, where the supply of well-watered bottomland for sweet potato production is limited (as is nearby pasture for grazing), animal traction is not a feasible alternative to stall-feeding.

Although returns to sweet potato production were 500 FCFA per man-day in Ldama in 1980, promoting sweet potato production on a wider scale could significantly lower returns. Most of the sweet potato crop is presently sold after the harvest, since sweet potatoes are highly perishable and store poorly.[26] Producers also require cash income at that time to pay taxes. The market is therefore flooded to such an extent that in many locales sweet potatoes are a cheaper source of calories than sorghum in the month or two following the harvest. By increasing sweet potato production, farmgate prices could be significantly lowered. Moreover, it might be difficult to transport any additional production from the Mandara Mountains, where post-harvest demand is satisifed under present levels of production, to the large urban markets of Maroua and Kousseri.

In isolated villages of the mountainous zone of the Mandara Mountains region with little arable land and few off-farm employment opportunities, investment in livestock, particularly in cattle for stall-feeding is the only readily available means for productively utilizing surplus household labor. Stall-feeding enterprises generate about 900 man-hours

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[26]See John Holtzman and Michael Weber, An Assessment of the Supply and Marketing Situation for Agricultural Commodities in the Mandara Mountains Integrated Development Project Region, MSU/USAID Mandara Mountain Research Report No. 6, August 1980, for a more detailed discussion of the marketing of sweet potatoes.

of employment per year, which is equivalent to .7 man years.[27] Although slightly more than 50 percent of this labor is required during peak agricultural periods and competes directly with crop production, the other 50 percent of the labor requirements are met during slack periods.

Returns to off-farm employment outside the village are generally higher during slack periods, but many of these employment opportunities are found in large towns such as Maroua, Garoua, Mubi or Maiduguri, which are far from the Mandara Mountains and many other opportunities are available only in Nigeria. Hence, male household members incur significant travel, lodging, food and psychic costs in seasonally migrating to distant areas for slack period employment. Many men in the Mandara Mountains, particularly household heads, are unwilling to incur these costs, despite the attractive potential returns to seasonal migration.

Stall-feeding also generates employment for some households that lack the labor or capital to participate in stall-feeding enterprises. Nearly 40 percent of the stall-feeding households in the survey at Magomaz and Mavoumai had to purchase dried forage and agricultural by-products for late dry season and early rainy season feeding. Other households hire laborers to cut and carry grasses during the growing season, particularly when all available household labor is allocated to weeding, or pay herders to watch over their cattle.

In many villages of the Mandara Mountains, capital is accumulated in the form of livestock, which has proven to be an inflation-proof investment since the 1960s. Livestock is also a form of insurance

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[27]Derek Byerlee, Carl K. Eicher, Carl Liedholm and Dunstan S. C. Spencer, Rural Employment in Tropical Africa: Summary of Findings, African Rural Economy Working Paper No. 20, Michigan State University, East Lansing, 1977.

against grain production shortfalls. Yet livestock acquisition is not only a capital accumulation process; it also enables rural households in the Mandara Mountains to maintain intensive farming systems in long-run equilibrium. Erosion and declining soil fertility are serious problems in many areas of the Mandara Mountains region, particularly where terraces have not been constructed or are poorly maintained and where manure is not systematically collected and applied to the fields. In maintaining the long run viability of intensive farming systems in the Mandara Mountains, terrace maintenance and systematic application of livestock manure to the fields are necessary. By applying cattle manure to fields around the compound, stall-feeding households can build up soil fertility, which is an investment in an ongoing durable. Moreover, there are few opportunities for households capable of generating a surplus to consume this surplus or to convert it to other consumer goods, which are in short supply. Yet in some villages in the Mandara Mountains region, particularly those near the Nigerian border, alternative investment and consumption opportunities are becoming increasingly available. A higher proportion of the households near the border have put corrugated iron roofs and doors on at least one room or hut in their compounds. Bicycles and iron frame beds are also more common. In addition, more of the villages have diesel-powered grain processing units, which generate handsome returns over a several year period. Nevertheless, the above investments and consumer durables are still relatively uncommon in the Mandara Mountains region, which is characterized by low incomes, grain deficits, a low level of commercialization, and isolation from the rest of Northern Cameroon.

As the region becomes increasingly commercialized in the remainder of the twentieth century, it is difficult to predict whether households will continue to invest earnings from surplus crop production and off-farm employment in livestock to the same degree as in the past. Households' intertemporal choices between present and future consumption may be significantly altered as the region is opened increasingly to outside economic forces, as has happened in other regions of Africa and the world. The important complementarities between livestock and crop production in the intensive farming systems of the Mandara Mountains, as well as the likely continued existence of a profitable market for livestock in Nigeria, will probably continue to encourage households to invest in livestock, however.

H. SUMMARY

In this chapter the various components of cost and typical benefits to traditional stall-feeding enterprises have been analyzed in some detail. Returns to the existing enterprise are quite low but may be significantly higher under several plausible scenarios. There is also thought to be scope, however, for improving stall-fed cattle production through supplemental dry season feeding of concentrates (such as rice bran and cottonseed cake). This will be examined further in Chapter Nine.

Stall-feeding for traditional slaughter during post-harvest festivals will continue to be important in the Mandara Mountains, particularly for producers in isolated villages with limited marketing opportunities. Yet in many areas of the Mandara Mountains, stall-feeding enterprises are undergoing change, as producers are selling more beef from slaughtered

animals and more animals on the hoof to rural butchers and traders. FONADER has already attempted to foster greater commercialization of stall-feeding by extending loans to producers for the acquisition of bull calves and supplemental dry season feed (rice bran).

In the following four chapters (Chapters Five through Eight), different levels of the subsector will be examined critically to assess demand for slaughter cattle and beef, present sources of slaughter cattle supply, and the potential for expanding stall-feeding as a means of satisfying present and projected demand for beef. In Chapter Five rural and urban demand for red meat, particularly beef, will be estimated for 1980 and projected for 1985 and 1990. Chapter Six will then analyze rural and urban butchers' procurement practices, sources of slaughter cattle supply, and costs and returns to slaughtering and retailing. The livestock trade in Northern Cameroon will be discussed in Chapter Seven, especially as it affects the supply and demand for slaughter cattle in the Mandara Mountains. Seasonal and secular trends in cattle prices will also be analyzed, as they have an important effect on producers' returns to stall-feeding. The supply and demand for traditional stall-feeding inputs, supplemental feedstuffs, and livestock extension and veterinary services will be assessed in Chapter Eight, particularly as stall-feeding is expanded during the 1980s. In Chapter Nine the effects of changes in stall-feeding technology, in the costs and timing of input supply, and in marketing strategies on producers' financial returns will be analyzed. This will be followed by an economic analysis of the viability of promoting stall-feeding in the Mandara Mountains through the FONADER loan scheme.

CHAPTER FIVE

CONSUMPTION OF BEEF AND SMALL RUMINANT MEAT

A. INTRODUCTION

In Chapter Three estimates of the livestock and human population of the Mandara Mountains region were presented, and annual offtake from the regional stall-fed herd was estimated in Chapter Four. This chapter uses that information and urban slaughter data to estimate urban and rural consumption of beef and small ruminant meat for 1980. Demand for beef in both urban and rural areas in 1985 and 1990 is projected by assuming rates of population growth and ranges for income elasticity of demand and the rate of per capita income growth.

It is important to examine urban and rural demand for beef, because these are the forces that drive the cattle subsector. Urban and rural demand for beef in the Mandara Mountains, as well as the demand for beef in Nigeria, influence stall-fed cattle producers' choices to produce, market and consume stall-fed beef. Moreover, by projecting future demand for beef, it is possible to estimate the upper bounds on the potential for expanding production of stall-fed cattle.

B. URBAN CONSUMPTION OF LIVESTOCK PRODUCTS

1. Urban Beef Consumption

It is possible to estimate beef consumption in the major towns of Margui-Wandala since the Livestock Service keeps faily accurate records of urban cattle slaughter. All of the veterinary centers and posts are located in towns where inspection of slaughtered cattle takes place. There is some unrecorded slaughter and sale of beef from cattle slaughtered outside of the towns, but this probably amounts to no more than 10 to 15 percent of total urban slaughter. In contrast, most slaughter of small ruminants goes unrecorded, since it takes place in the compound. Official slaughter statistics for small ruminant slaughter are useful, however, in that they reflect the seasonality of cattle and small stock supply. Town butchers tend to slaughter more small ruminants in the dry season and early rainy season when slaughter cattle are not as readily available as during other periods.

Cattle slaughter fell off dramatically in 1975 and 1976, but has trended upward steadily since 1976, as shown in Table 5-1. Unfortunately, slaughter data are not available for the years before 1973. One hypothesis that would be useful to test is that cattle slaughter was exceptionally high in 1973 and 1974, far above the trend for the 1960-1980 period, because herders and farmers were forced to liquidate their herds at the end of the great Sahelian drought. As a result of these distress sales, cattle offtake in Northern Cameroon declined in the two years following the drought. Herders were reconstituting their herds and could ill-afford to sell their remaining stock, which in many cases was barely sufficient for herd maintenance purposes.

TABLE 5-1

RECORDED CATTLE SLAUGHTER AT SELECTED TOWNS IN MARGUI-WANDALA, 1973-1980, AND OTHER TOWNS IN NORTHERN CAMEROON, 1977-1980

Year	Mokolo	Mora	Bourha	Koza[a]	Hina[b]	Kolofata[b]	Total Margui-Wandala[c]	Gazawa	Maroua	Yagoua
1973	2,065	1,936	467	n.a.	1,053	329	5,850			
1974	1,652	1,204	815	n.a.	1,477	333	5,481			
1975	1,242	664	525	n.a.	569	306	3,338			
1976	1,279	401	445	97	461	98	2,782			
1977	1,554	430	422	202	229	343	3,185	738[d]	7,399[d]	
1978-79[e]	1,627	646	502	144	242	164	3,438	816	8,162	2,012
1979-80[e]	1,736	1,279	514	298	280	271	4,378	971	12,143	2,037

SOURCE: Annual Reports of the Livestock Service Subsector Office at Mokolo (1973-1980) and Mora (1979-1980 only).

[a]The veterinary post at Koza was created in 1976. Before 1976 slaughter at Koza town was unrecorded.

[b]The slaughter data are not only for the towns of Hina and Kolofata but also for other small towns within the areas served by the Hina and Kolofata veterinary posts.

[c]This total is for recorded slaughter in towns and villages of Margui-Wandala. The total does not equal the sum of the figures in the other six columns for several years, because slaughter was recorded at Limani, another veterinary post in the Mora Arrondissement during these years.

[d]These figures are for slaughter at Gazawa and Maroua for 1977-78 (July 1977 through June 1978).

[e]Beginning in 1978 the Livestock Service assembled slaughter statistics for annual reports for the fiscal year, which runs from July 1 of one year through June 30 of the following year.

Margui-Wandala is not in the Sahel, but the effects of the 1968-1973 drought were devastating for cattle raisers in the moister (though still semi-arid) zones to the south of the Sahel. Rather than lose cattle to dehydration, famine, and the parasitic and disease problems that are exacerbated by poor nutrition, herders probably sold off large numbers of cattle at the end of the drought. Fulani herders interviewed on the plateau around Mokolo in 1980 reported that cattle mortality was far higher in 1973 than in any other year in recent memory. The slaughter figures for 1973 and 1974 do seem exceptionally high, but there is no way of testing whether these years were far above the trend.

Cattle slaughter in the towns of Margui-Wandala has increased steadily at an average annual rate of 12 percent since 1976, as herders were able to recoup their losses due to the drought in the early 1970s and an increasing town population has led to higher demand for beef. Urban beef consumption per capita is calculated in Table 5-2 by converting the slaughter figures from Table 5-1 into kilograms of beef and edible offals and dividing these estimates by the 1976 census figures.

Beef consumption per inhabitant appears to have stabilized in 1975 from an initially higher level in 1973 through 1974. As implied above, consumption in 1973 through 1974 may have been far above trend as a result of sales of weak and emaciated stock.

Mokolo is the largest town in Margui-Wandala, and it has more higher income consumers than the other towns. As a result, beef consumption appears higher than in other urban areas of Margui-Wandala. Yet the figures may be misleading, because population density is higher in the rural area around Mokolo than it is at Mora or Bourha. Hence, a greater proportion of the beef may be consumed by rural inhabitants who

TABLE 5-2

TOTAL CONSUMPTION OF BEEF PLUS OFFALS,[a] POPULATION[b] AND PER CAPITA CONSUMPTION OF BEEF PLUS OFFALS IN SELECTED URBAN AREAS OF NORTHERN CAMEROON

Year	Mokolo			Mora			Gazawa			Maroua[d]		
	Total Kg.	Population	Kg./Capita	Total Kg.	Population	Kg./Capita	Total Kg.	Population	Kg./Capita	Total Kg.	Population	Kg./Capita
1973[c]	263,288 (227,150)	4,483	58.7 (50.7)	246,840 (212,960)	4,095	60.3 (52.9)						
1974	210,630	4,709	44.7	153,510	4,222	36.4				1,595,000	45,000 (56,594)	35.4 (28.2)
1975	158,355	4,947	32.0	84,660	4,352	19.5						
1976	163,073	5,196	31.4	51,128	4,487	11.4		8,787			62,445	
1977	198,135	5,456	36.3	54,825	4,711	11.6	111,069	9,227	12.0	1,113,550	65,567	17.0
1978-79	207,443	5,870	35.3	82,365	5,069	16.2	122,808	9,927	12.4	1,228,381	70,567	17.4
1979-80	221,340	6,164	35.9	163,073	5,323	30.6	146,136	10,423	14.0	1,827,522	74,095	24.7

(Continued)

SOURCES: Rapports Annuels, Sous-Secteur d'Elevage du Margui-Wandala and Secteur d'Elevage du Diamaré, Ministère de l'Elevage, des pêches et des Industries Animales; Recensement Général de la Population et de l'Habitat d'Avril 1976, Ministère de l'Economie et du Plan, Direction de la Statistique et de la Comptabilité Nationale, Bureau Central de Recensement; and SEDES (Société d'Etudes pour le Développement Economique et Social), J. Sarniguet, et al., Etudes préliminaires à la création d'une communauté économique du bétail et de la viande dans les pays de l'Union Douanière et Economique de l'Afrique Centrale, Mars 1976, p. 95.

[a]A carcass weight of 127.5 kilograms (beef plus offals) was assumed for Mokolo, Mora and Margui-Wandala urban areas. This figure is the mean carcass weight obtained for 250 carcasses weighed at Mokolo and Souledé from September 1980 through March 1981. In contrast, a higher carcass weight of 150.5 kilograms was assumed for Maroua and Gazawa, both in the Diamaré Plains, based upon data collected from October 1979 through March 1980 by the Veterinary School in Maroua. They obtained a mean carcass weight (four quarters plus tail) of 116 kilograms, which was augmented proportionally to incorporate the weight of the fifth quarter. The fifth quarter was found to be 23 percent of the combined weight of the four quarters plus offals for cattle slaughtered at Mokolo and Souledé. Hence, the estimated weight of the carcass and the fifth quarter for the cattle slaughtered at Maroua (and Gazawa) can be calculated according to the following formula: $\frac{x}{116+x} = .23$, where x equals the offals.

Finally, a carcass weight of 180 kilograms per head was assumed for Northwest Province, where the dry season is shorter and range conditions are better than in Northern Cameroon.

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TABLE 5-2 (Continued)

Year	Margui-Wandala: All Urban Areas			Northwest Province: Urban Areas		
	Total Kg.	Population	Kg./ Capita	Total Kg.	Population	Kg./ Capita
1973[c]	745,875 (643,500)	40,335	18.5 (16.0)			
1974	698,828	41,565	16.8	2,973,600	132,611	22.4
1975	425,595	42,812	9.9	3,007,800	136,589	22.0
1976	354,705	44,096	8.0	2,143,980	140,687	15.2
1977	406,088	45,419	8.9	2,535,660	144,907	17.5
1978-79	438,345	47,479	9.2	2,482,740	149,254	16.6
1979-80	558,195	48,903	11.4			

[b]The 1976 population figures were obtained from the National Census. It is assumed that the populations of Mokolo and Mora grew at an average rate of 3 percent before 1976 and at a rate of 5 percent thereafter. The populations of Maroua and Gazawa are assumed to have grown at a rate of 5 percent per annum since 1974, while the urban populations of Margui-Wandala and Northwest Province are assumed to have increased at a 3 percent annual rate since 1973. It is estimated that 10 percent of the population of Margui-Wandala resides in urban areas.

[c]The figures in parantheses for 1973 are estimates based upon the assumption that the average carcass weight of cattle slaughtered in the towns of Margui-Wandala was 110 kilograms rather than 127.5 kilograms. There were a lot of distress sales by herders and farmers in 1973, the most serious year of the Sahelian drought. Cattle slaughter was higher in urban areas in 1973 than in the following years. There is some evidence that many of the cattle sold were in poor condition. The assumption of a carcass weight of 110 kilograms is arbitrary; a lower carcass figure was chosen to arrive at an estimate of urban beef consumption that closer approximates reality than the estimate obtained from slaughter cattle that had been grazed on good pasture.

[d]The data for Maroua for 1974 are SEDES estimates of cattle slaughter, population and beef consumption. The figures in parantheses are the estimated 1974 population of Maroua, based upon the 1976 census figure, and the estimate of beef consumption per capita based on this higher population estimate. See page 7-9 for further details.

come to the market from nearby villages, especially on large market day, to purchase beef and other commodities. That is, beef consumption per capita is probably overstated for Mokolo, although it is difficult to estimate by what amount.

In estimating the proportion of beef sold at Mokolo consumed by rural market goers, it is important to note that Wednesday (large market day) is when rural people are most likely to attend the Mokolo market, which meets every day. Two hundred and twenty head of cattle were slaughtered on Wednesdays over a six month period (September 1980-March 1981). If we assume that twice as many cattle were slaughtered on market day during the year March 1980 thru March 1981, then 440 head were slaughtered. The total number of cattle slaughtered at Mokolo for 1980 (the closest comparable period for which the data are complete) was 1,845 head. Slaughter on large market day accounts, therefore, for roughly 25 percent of total slaughter at Mokolo (440/1,845 = 23.8 percent). If it is assumed that rural people who attend the market buy at least half the beef retailed on large market day, then at least 12.5 percent of the beef consumed at Mokolo is consumed by rural non-residents. Rural people come to the market on days other than large market day, but not in great numbers, so it is probably safe to assume that 15 to 20 percent of the beef sold at Mokolo is bought by non-residents.

In calculating urban beef consumption per capita in Margui-Wandala, we assume that 10 percent of the Department's population resides in towns, such as Mokolo, Mora, Bourha, Koza, Meme, and Hina. Although it was discovered that 14.8 percent of the population in the Northern Province lived in urban areas in 1976, it is unlikely that more than 10 percent of the population of Margui-Wandala lives in towns, since the

Mandara Mountains is one of the least urbanized regions in Northern Cameroon. By using recorded slaughter figures for towns in the entire Department, it is estimated that urban beef consumption in Margui-Wandala is 8.0-11.4 kilograms per capita from 1976-1980, which is lower than estimated beef consumption for urban areas in the Diamare Department and Northwest Province (see Table 5-2).[1] This level of beef consumption reflects the lower urban incomes in Margui-Wandala. Per capita beef consumption in Maroua was double beef consumption in urban areas of Margui-Wandala from 1977 to 1980, roughly the same as beef consumption in Mora, and lower than beef consumption in Mokolo. Per capita beef consumption was slightly higher in Gazawa than in urban areas of Margui-Wandala but lower than in Mokolo and Mora.

Estimated beef consumption for Maroua was 23.4 kilograms per capita in 1979-80, which is substantially lower than the SEDES estimates of 1969 (35.0 kilograms per capita) and 1974 (35.4 kilograms per capita).[2] The SEDES estimates were calculated using population figures that were probably far lower than the actual figures. If the 1976 census figure for Maroua is used as a base and the population is projected backward, assuming a 5 percent rate of growth per annum, estimated beef consumption per capita falls to 28.2 kilograms (1974) and 26.8 kilograms (1969).

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[1]Actual urban beef consumption was probably about 20 percent higher than these estimates. The Livestock Service does not record slaughter at all urban markets. See section C.1.c. in Chapter Six.

[2]J. Sarniguet, et al., Etudes préliminaires à la création d'une communauté économique du bétail et de la viande dans les pays de l'Union Douanière et Economique de l'Afrique Centrale, S.E.D.E.S., 1976, p. 95.

2. Urban Consumption of Small Ruminant Meat

Consumption of small ruminant meat is important in urban diets, although recorded slaughter statistics capture only a fraction of urban slaughter of small ruminants. The Livestock Service reported the controlled slaughter of 2,069 goats and sheep at urban slabs in Margui-Wandala for 1979-80. Although slaughter statistics for small ruminants are not available for Meri, controlled urban slaughter probably reached 2,400-2,500 head for towns in the Mandara Mountains region. Assuming that 10 percent of the population of the region reside in towns and that the official slaughter statistics are accurate, then per capita consumption of small ruminant meat equalled 1.3 kilograms in 1979-80 for the urban population of the entire region and 1.2 kilograms for the towns of Mokolo and Mora.

Recorded slaughter of small ruminants probably represents only 20-25 percent of actual slaughter in urban areas, however. Most small ruminants are slaughtered in the compound without veterinary inspection. The predominantly Moslem population of the towns slaughters sheep in large numbers for the Moslem festivals of Ramadan and Tabaski. In addition, some uninspected slaughter of small ruminants is carried out by small-scale butchers, who grill the meat and sell it at the marketplace or at the lorry park. Accounting for this additional slaughter of goats and sheep, urban consumption of small ruminant meat is estimated to be 5.2-6.5 kilograms per capita per annum. This quantity is approximately the same as estimated consumption for rural areas (see Table 5-3), but below estimated urban consumption of beef.

C. RURAL CONSUMPTION OF LIVESTOCK PRODUCTS

1. Introduction

Rural consumption of livestock products far outweighs urban consumption, since the rural population is about nine times the urban population of the Mandara Mountains region. In this section of the chapter estimates of per capita red meat consumption for 1980 will be derived for rural areas of the entire region, using livestock population data and assuming rates of offtake for different types of cattle and small ruminants. These estimates will then be compared to estimates based upon data collected during a six month period for stall-feeding households in the survey villages of Magoumaz and Mavoumai. Finally, sources of rural red meat consumption by rural households will be identified. The survey data for the stall-feeding households will be used to show the comparative importance of these sources and illustrate the seasonality of red meat consumption.

2. Estimating Rural Beef and Small Ruminant Meat Consumption as a Residual

Consumption of beef and small ruminant meat in the Mandara Mountains region can be estimated using livestock population figures as a base. It is necessary to estimate the breakdown of the regional cattle herd into the categories of range-fed cattle, stall-fed cattle and oxen, make assumptions about offtake, mortality, export and import for each category of cattle and for small ruminants, and use actual carcass weights obtained at the Mokolo and Soulede slabs in order to calculate total meat production for the region. By netting out urban consumption, which

is calculated from recorded slaughter statistics, estimates of rural red meat consumption in the Mandara Mountains region are obtained as a residual. This method of estimation has been used by S.E.D.E.S. in generating estimates of rural red meat consumption in African countries as well as regions within those countries.[3] Provided the assumptions embodied in such an approach are plausible, this method will yield reasonably accurate estimates of rural consumption. No one particular estimate should be taken too literally. Rather, all of the figures in Table 5-3 should be viewed as representing rough orders of magnitude.

Rural beef consumption in the Mandara Mountains can thus be estimated to be 8.3 kilograms per capita in 1980, as shown in Table 5-3. This assumes offtake rates of 11 percent for the regional extensive cattle herd, 46.7 percent for stall-fed cattle, reflecting the average feeding period of 25.7 months, and 25 percent for oxen, based on the assumption that oxen are held for four years before slaughter or sale. It is also assumed that 25 percent of the annual offtake of range-fed cattle and oxen and 15 percent of the offtake of stall-fed cattle were exported to Nigeria. In areas within 15-20 kilometers of the Nigerian border this proportion is probably considerably higher. It is further estimated that 1,720 head of cattle taken off the regional herd were slaughtered in urban areas. Finally, an estimated 5,800 head of cattle were imported from the Diamare Plains for slaughter by rural butchers.[4]

[3]S.E.D.E.S. Recueil Statistique de la Production Animale, République Francaise, Ministère de la Coopération, 1975.

[4]This estimate is derived in Chapter Six from survey data, which show that rural butchers procure approximately 30 percent of the cattle slaughtered at rural markets from the Diamare Plains. Slaughter at rural markets is estimated by assuming that 90 percent of the range-fed cattle and oxen slaughtered intentionally in the region are slaughtered by rural butchers. Roughly 10 percent of the annual offtake of stall-fed cattle is also slaughtered in rural markets.

TABLE 5-3

ESTIMATED RURAL CONSUMPTION OF BEEF, SMALL RUMINANT MEAT AND OFFALS IN THE MANDARA MOUNTAINS REGION

Category of Livestock / Subcategory of Consumption	Livestock Population, 1980	Assumed Rates of Off-Take and Mortality	Total Off-Take/Mortality	% Exported[j] to Nigeria/ Consumed After Death	Estimated[k] Town Slaughter	Inflows[l] from Diamare Plains	Estimated[m] Rural Slaughter and Mortality	Average[n] Carcass Weight (Kg.)	Total Rural Supply of Meat (Kg.)	Rural[o] Meat Consumption Per Capita (Kg.)	Proportion of Total
Range-Fed Cattle											
Offtake	158,840	11%[b]	17,472	25%	1,410	5,780	17,474	122.2	2,135,323	4.3	52
Mortality											
calves	31,768[a]	11.3%[c]	3,590	50%			1,795	42	75,390	0.9	11
cattle ≥ one year	127,072	6.1%[d]	7,751	50%			3,876	91.7	355,429		
Stall-Fed Cattle											
Offtake	12,850	46.7%[e]	6,000	15%	230	0	4,870	185.7	904,359	1.8	22
Mortality	12,850	6.3%[f]	810	90%			729	122.2	89,084	0.2	2
Oxen											
Offtake	13,500	25%[g]	3,375	25%	80	0	2,451	183.0	448,533	0.9	11
Mortality	13,500	6.1%[d]	824	60%			494	122.2	60,367	0.1	2
All Cattle											
Offtake	185,190		27,272	15%	1,720	5,780	24,795	140.7	3,488,215	7.1	86
				25%					580,280	1.2	14
Mortality				50-90%			6,894		4,068,495	8.3	100
Total											
Small Ruminants											
Offtake	566,800	30%[h]	169,824	5%	12,000	5,000	154,333	14.4	2,222,395	4.5	81
Mortality		15%[i]	85,020	70%	-		59,514	8.9	529,675	1.1	19
Total							213,847		2,680,070	5.6	100

SOURCES: Sous-Secteurs de Mokolo et de Mora et Centre Vétérinaire de Maroua, Ministère de l'Elevage, des Pêches et des Industries Animales, Rapports Annuels, 1979-80; Surveys of Butchering and Retailing, Stall-Feeding, and Extensive Livestock Production, May 1980-March 1981; S.E.D.E.S., Recueil Statistique de la Production Animale, République Française, Ministère de la Coopération, Paris, 1975.

[a]The breakdown of the regional cattle herd is as follows: 20% calves and 80% cattle at least one year of age. This proportion was obtained by averaging data on herd composition for 37 extensively raised cattle herds near Mokolo and S.E.D.E.S. estimates of the composition of the regional herd in Northern Cameroon (see Recueil Statistique, p. 837).

[b]The offtake rates of 11% and 13% are the lower and upper bounds for most extensively raised regional or national cattle herds. S.E.D.E.S. estimated off-take as 11.1% of the Cameroonian cattle herd north of the Adamaoua Plateau in 1970 (see Recueil Statistique, p. 838).

[c]Calf mortality was found to be 11.3% in 1979-80 for Fulani cattle herds on the plateau near Mokolo. The mortality data were obtained from 37 single visit interviews with Fulani herders.

[d]Over one year mortality was 6.1% for the year 1980-81 in Fulani cattle herds near Mokolo. This rate of mortality is also assumed to hold for oxen, although oxen mortality may be considerably higher due to the subjection of oxen to additional stress (traction) during the early rainy season, when cattle are generally weakest and feed resources are most limited in the semi-arid tropics.

[e]Since stall-fed cattle are held an average of 25.7 months, it is assumed that 46.7% (12/25.7) of the regional stall-fed cattle herd is slaughtered or sold each year.

[f]6.3% of the stall-fed cattle in the villages of Magoumaz and Mavoumai died during the period 1975-1981. This estimate may be on the low side.

[g]It is assumed that oxen are held an average of four years in the Mandara Mountains region, after which they are sold or slaughtered. Hence, off-take is calculated to be 25% per annum.

[h]The off-take rate for small ruminants is taken from S.E.D.E.S. 1975 estimates for Northern Cameroon (see Recueil Statistique, p. 838).

[i]The mortality rate of 15% per annum is chosen arbitrarily, although it is known that under one year mortality was 25-30% for goats and sheep included in a survey of small ruminant production in three representative villages of the Mandara Mountains region.

[j]a) Since the Mandara Mountains region borders on Nigeria, substantial numbers of cattle are trekked to Nigerian markets for sale or sold to Cameroonian and Nigerian butchers and traders who sell or slaughter the cattle in Nigeria. It is assumed that 25% of the annual off-take of range-fed cattle and oxen is exported. 15% of the offtake of stall-fed cattle is also assumed to be exported. Exports for each category are then subtracted from total offtake for each category. The same procedure is repeated for small ruminants, although it is assumed that only 5% of annual off-take of small ruminants is exported to Nigeria.

b) It is assumed that 50-90% of the dead cattle are consumed in the Mandara Mountains region, depending on the cattle category. A lower proportion of dead range-fed cattle and oxen are assumed to be consumed, since these types of cattle are often owned by Moslems, who will not eat meat from an animal that died without receiving the customary last rites. We assume that 70% of the dead small ruminants are consumed. While almost all of the small stock that dies is eaten in Magoumaz and Mavoumai (and other non-Moslem villages), consumption of dead goats and sheep is lower in Moslem areas.

[k]The number of animals from the regional herd that are slaughtered in urban areas was calculated using slaughter statistics recorded by the Livestock Service as a base. Actual data on the origin of slaughter cattle were used to determine the number of head obtained for slaughter in Mokolo from the regional cattle herd. The proportion of cattle slaughtered at other towns was estimated from informal interviews with town butchers, direct observation, and knowledge of slaughter cattle trade flows in Northern Cameroon. Note that only 32% of the cattle slaughtered in the towns of Margui-Wandala/Meri were estimated to be taken from the regional cattle herd. The other 68% were imported from the Diamare Plains.

Urban slaughter of small ruminants was calculated using official slaughter statistics as a base. While 46% of the small ruminants slaughtered at the Mokolo slab during our survey were bought at Gazawa, we assumed that 25% of the small stock slaughtered in the towns in the Mandara Mountains were imported from outside the region. Hence, somewhat less than 2000 of the 2500 goats and sheep slaughtered in urban areas were taken from the regional herd. Recorded slaughter of small stock greatly underestimates urban slaughter, and we assume that it represents only 20% of urban slaughter. Consequently, we estimate another 10,000 small ruminants were slaughtered in the towns of Margui-Wandala/Meri, virtually all of which are taken off the regional herd.

[l]It is estimated that 30% of the cattle slaughtered at regional rural markets are procured in the Diamare Plains. See Chapter Six for an analysis of rural butchers' procurement patterns. In addition, inflows of small ruminants from the Plains are estimated to be 5000 animals.

[m]Estimated rural slaughter = Total off-take - exports - estimated town slaughter + inflows.

[n]The average carcass weights were obtained from actual weighings of different types of livestock at the Mokolo and Soulede slaughter slabs from September 1980 through March 1981. We define carcass weight to include the four quarters plus offals. Lower carcass weights were used for stall-fed cattle, oxen and small ruminants that died rather than for those animals that were slaughtered, because many of the livestock (in these categories) that die are younger, less mature animals. In estimating the carcass weight of small ruminants that die, actual data for immature animals slaughtered at the slabs where research was conducted were heavily weighted in the calculation, reflecting the disproportionately high mortality among young stock.

[o]Rural meat consumption per capita is calculated by dividing the total supply of meat in rural areas by the estimated rural population of the Mandara Mountains region. The rural population is estimated to be 492,973 inhabitants, assuming that 90% of the regional population of 547,748 lives outside towns for which recorded slaughter figures are available.

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The results displayed in Table 5-3 also show that intentional slaughter of cattle provides 86 percent of the rural beef supply in the Mandara Mountains region, while mortality provides the remaining 14 percent. Sixty-three percent of the rural beef supply comes from range-fed cattle, 24 percent from stall-fed cattle and 13 percent from oxen.

Rural consumption of small ruminant meat is somewhat less than beef consumption in rural areas. The estimate is that 5.4 kilograms of mutton and goat meat were consumed in 1980, with 20 percent of that consumption resulting from small ruminant mortality. Mortality is assumed to be 15 percent per annum, although it may be higher in some areas.

3. Estimated Consumption of Animal Products at Magoumaz and Mavoumai

The survey data presented in Table 5-4 show that per capita consumption of animal products was estimated to be less than half as high at Mavoumai (9.1 kilograms) as at Magoumaz (22.0 kilograms), reflecting the lower per capita incomes at Mavoumai.[5] Moreover, red meat consumption is 40 percent higher at Magoumaz (19.4 kilograms) and 40 percent lower at Mavoumai (8.4 kilograms) than estimated rural red meat consumption for the entire Mandara Mountains region (13.9 kilograms). This finding is not surprising in light of the wealth of farmers in these villages relative to the regional average. In addition, red meat

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[5]Although data on crop production other than cereals production are not available, households' relative income status can be estimated by including sorghum production, livestock sales and gifts, and livestock slaughter in the calculation of a proxy for income. By calculating this proxy for per capita income on an adjusted annual basis, we find that the average income at Magoumaz (30,635 FCFA) is double the average income at Mavoumai (15,283 FCFA). The consumption of livestock products varies nearly in the sample proportion.

TABLE 5-4

CONSUMPTION OF ANIMAL PRODUCTS AMONG SURVEY HOUSEHOLDS AT MAGOUMAZ AND MAVOUMAI, SEPTEMBER 1980-FEBRUARY 1981 (KILOGRAMS PER CAPITA)[1]

Animal Product	Magoumaz			Mavoumai		
	Consumption During Survey Period	Projected Annual Consumption	Proportion of Total Consumption	Consumption During Survey Period	Projected Annual Consumption	Proportion of Total Consumption
Beef[3]	4.89	5.50	25%	1.83	2.52	28%
Small Ruminant Meat[4]	8.83	13.86	63%	3.75	5.91	65%
Total Red Meat Consumption	13.71	19.36	88%	5.58	8.43	93%
Chicken[5]	1.28	2.24	10%	0.24	0.42	5%
Dried Fish[6]	0.13	0.26	1%	0.10	0.20	2%
Sardines[7]	0.07	0.14	1%	0.01	0.02	<1%
Eggs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Dairy Products	nil.	nil.	nil.	n.a.	n.a.	n.a.
Total	15.19	22.00	100%	5.93	9.07	100%

Source: Survey of stall-feeding at households at Magoumaz and Mavoumai, September 1980-February 1981.

[1]Animal products include meat from the carcass plus offals for beef, small ruminant meat and chickens.

[2]Consumption of small ruminant meat is adjusted downward to compensate for larger than average goat and sheep holdings by stall-feeding households. Projected annual consumption of small ruminant meat is multiplied by 0.73 to arrive at adjusted annual consumption of small ruminant meat at Magoumaz and by 0.82 at Mavoumai. These weights are calculated by dividing average small ruminant numbers at Magoumaz and Mavoumai for a large sample of households, including those that stall-feed cattle and those that do not, by average small ruminant holdings for households that stall-feed cattle.

[2]Consumption of animal products was projected for an entire year using data for the survey period as a base. Over two-thirds of annual consumption of livestock products is concentrated during the harvest and post-harvest period, when income is available and traditional slaughter of cattle and small ruminants takes place. Consumption was projected according to the following formula, where data for the base period are enclosed in parentheses:

Projected Consumption = (slaughtered beef) + 1.33 (purchased beef) + 1.25 (slaughtered small ruminants) + 2.0 (dead small ruminants) + 2.0 (purchased small ruminant meat) + 1.75 (chicken) + 2.0 (dried fish) + 2.0 (sardines).

[3]Beef consumption was estimated by dividing reported expenditures by retail beef prices prevailing in local markets during each month of the survey. Consumption of non-purchased beef was calculated by dividing farmer estimations of the value of the beef consumed by the average retail beef price over the course of the survey in local markets.

[4]Small ruminant consumption has three components: purchases, home slaughter and consumption of meat from stock that dies. The quantity of small ruminant meat consumed was calculated by dividing reported expenditures by average monthly retail goat meat and mutton prices at local markets. Consumption of goats and sheep that were slaughtered or that died in the compound was calculated by using carcass weights obtained at the Mokolo slaughter slab and at the Soulede market for animals of different age-sex categories.

[5]This figure represents liveweight consumption per capita. The average liveweight per chicken, based upon a sample of 13 chickens weighed at the foodstuff markets at Mokolo, Tourou and Soulede, is 1.32 kilograms.

[6]Dried fish is generally sold in 100 FCFA piles, which weigh 75 grams.

[7]Sardines are purchased in 60 FCFA cans, which contain 169 grams of fish (and tomato sauce).

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consumption is estimated to be 88 percent of the total consumption of animal products per capita at Magoumaz and 93 percent at Mavoumai, illustrating its importance relative to other sources of animal protein.[6]

The samples at Magoumaz and Mavoumai are also not representative in that only households that stall-feed cattle are included. Since, these households are generally wealthier and have higher incomes than households without cattle, their consumption of animal products should be above the mean, at least for their villages. The finding that consumption of livestock products at Mavoumai is below the estimated rural mean for the region is plausible in that incomes there may be lower than average incomes for the region. Per capita incomes are higher in villages on the plateau or in the plains, where more land is available for cultivation and grazing.

4. Sources of Red Meat for Consumption in Rural Areas

There are four principal means of acquiring animal products for consumption in rural areas: household slaughter, purchase of meat or animals at secondary markets or from other rural households, animal mortality, and receival of gifts of meat or animals from friends. Each of these means of acquisition follows a seasonal pattern, which will be discussed below.

a) Expenditures on Livestock Products

Expenditures on beef, mutton, goat meat, fish and chickens are greatest during and immediately after the harvest, when families have

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[6]It is important to note that the data for consumption of eggs and dairy products are incomplete.

income at their disposal. Table 5-5 shows that expenditures on beef and small ruminant meat were markedly higher during the months of November and December than during the months of January and February among survey households in the villages of Magoumaz and Mavoumai. Sales of peanuts and sweet potatoes provided the survey households with discretionary income for purchases of meat, a luxury item for households in the Mandara Mountains region.

Rural markets in the Mandara Mountains region are most animated during the dry season, when rural people are least occupied with farming activities and have income for discretionary purchases. Slaughter of cattle is most frequent at secondary markets in rural areas during the first four months of the dry season, while small ruminant slaughter substitutes for cattle slaughter during the middle and late dry seasons. Once the rains return in May and June, slaughter at rural markets falls off, partly because rural households are preoccupied with cropping activities and have little time to spend on leisure activities (such as going to the market). More importantly, families have little income for purchases of luxury items such as meat.[7] Some households begin to sell small ruminants by June in order to acquire cash to buy grain, having already drawn down grain stored in their granaries to very low levels. During the rainy season slaughter is restricted to a few small ruminants at rural markets, and most households consume meat and other animal

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[7]See David Trechter, Nutrition and Health During the Hungry Season in the Mandara Mountains of Cameroon, MSU/USAID Mandara Mountain Research Report No. 12, Department of Agricultural Economics, Michigan State University, January 1981. Trechter notes that little meat was consumed during the height of the rainy season in three survey villages in the Mandara Mountains region, particularly in Madakonay and Ldama, the two Mafa villages in the survey.

TABLE 5-5

MEAN PURCHASES AND ESTIMATED CONSUMPTION OF PURCHASED BEEF AND SMALL RUMINANT MEAT BY HOUSEHOLDS AT MAGOUMAZ AND MAVOUMAI BY MONTH, SEPTEMBER 1980-FEBRUARY 1981

Month	Magoumaz						Mavoumai					
	Expenditure Per Household (FCFA)		Consumption[1] Per Household (Total Kg.)		Consumption[2] Per Capita (Kg./Cap.)		Expenditure Per Household (FCFA)		Consumption[1] Per Household (Total Kg.)		Consumption[2] Per Capita (Kg./Cap.)	
	Beef	SRM[4]	Beef	SRM[4]	Beef	SRM[4]	Beef	SRM[4]	Beef	SRM[4]	Beef	SRM[4]
September[3]	423	27	0.95	0.05	0.13	0.01	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
October	1208	83	2.86	0.14	0.39	0.02	514	0	1.22	0	0.15	0
November	1474	213	2.94	0.46	0.40	0.06	1534	0	3.06	0	0.37	0
December	2018	27	3.74	0.05	0.51	0.01	3218	350	5.96	0.60	0.71	0.07
January	1005	223	1.65	0.32	0.22	0.04	314	55	0.52	0.08	0.06	0.01
February	898	440	1.40	0.57	0.19	0.08	483	61	0.55	0.08	0.07	0.01
March[3]							0	223	0	0.31	0	0.04
Total	7054	1013	13.54	1.58	1.84	0.21	6063	689	11.50	1.05	1.38	0.13

Source: Stall-feeding survey at Magoumaz and Mavoumai, September 1980-February 1981.

[1]The estimated quantity of meat purchased per household was obtained by dividing monthly expenditures by an unweighted average of mean monthly retail meat prices per kilogram at Soulede and Tourou.

[2]Estimates of per capita consumption of purchased meat were obtained by dividing the estimated quantity of meat purchased per household by average household size (7.37 in Magoumaz and 8.36 in Mavoumai).

[3]Data are available for the second half of September 1980 for Magoumaz but not for Mavoumai. The expenditure survey got underway later at Mavoumai, so data were not collected for September. Data were collected during the first half of March 1981 at Mavoumai, however, though not at Magoumaz.

[4]SRM = Small ruminant meat.

products infrequently. By the end of the rainy season cattle slaughter again increases at rural markets.

An arc income elasticity of demand for purchased beef by stall-feeding households at Magoumaz and Mavoumai can be calculated using data on actual expenditures over the period September 1980-February 1981. Household purchases of beef and small ruminant meat were not weighed, but retail price data available for two secondary markets (Soulede and Tourou) can be used to estimate the approximate quantities bought. Dividing the 45 households for which income data are available into three income groups, we obtain arc income elasticities of demand for beef of 0.15 and 0.52. These estimates appear low, but they do show that the income elasticity of demand increases in moving from lower to higher income groups.

One probable reason for the low estimates is that the arc income elasticities are calculated from expenditure data and hence do not capture home slaughter of beef and small ruminant meat. If actual quantities of all red meat purchased and slaughtered for consumption by rural households were available, the estimates of income elasticity would probably be higher. Stall-feeding households have larger average livestock holdings than households not owning stall-fed cattle (see Annex 4), so a greater proportion of the farmer's red meat consumption is obtained from home slaughter. It is also likely that the income elasticity estimates would be higher if the expenditure data used in the calculation were obtained from a random sample that included households that do not stall-feed.

Nonetheless, the income elasticity of demand for beef is probably significantly below one in rural areas of the Mandara Mountains, because

additional increments to income are often converted to grain in this cereals deficit region. Incomes are so low and grain production shortfalls are so frequent that most households are preoccupied with food security. Additional income is invested in grain that is stored for rainy season consumption or in small ruminants, which can be held as a reserve or sold during the rainy season when grain reserves are low. The income elasticity of demand for beef is probably higher for the higher income earning households, since they are better able to meet their food security requirements and therefore have additional income for purchasing beef.[8]

b) Slaughter of Livestock for Household Consumption

Rural households slaughter different types of livestock for different reasons at alternative times of the year. Stall-fed cattle are slaughtered at the annual post-harvest festival and at the biannual or triannual Harai, a traditional dry season festival that is celebrated by villages in the mountains. The wealthier households that can afford to buy and stall-feed cattle distribute most of the beef from slaughtered bulls to relatives and friends in the village and from other villages. Most of this beef is consumed within the space of several days. The

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[8]Food expenditure data from urban households in Ghana collected during the 1950s did not show that increases in income were accompanied by increases in purchases of more expensive commodities, notably meat products. Thomas Poleman found that meat and fish made up about one-third of the total food budget for urban consumers in Accra, Kumasi and Sekonki-Takonadi, regardless of their income. He reports income elasticities of demand for meat products that range from .72 to .92, which is roughly equal to the income elasticity of demand for starchy staples. See Thomas T. Poleman, Food Economies of Urban Middle Africa: The Case of Ghana, Food Research Institute, Stanford University, California, 1961.

household that slaughters the bull and those that receive gifts of beef may smoke and store some beef, which permits additional consumption over a period that normally does not exceed a month. Cattle slaughter is rare during other periods of the year. Moslem households on the plateau and in the plains occasionally slaughter diseased or weakened cattle as a precaution to avoid the complete loss represented by the death of an animal without customary last rites.

In contrast to cattle, small ruminants and chickens are slaughtered more regularly throughout the year. Small ruminants are slaughtered at marriages and funerals, as a sacrifice to ancestors, and when relatives, particularly those from other villages, pay visits on the household. Other events for which small stock are slaughtered tend to be concentrated during the dry season, when rural people are freer to fulfill traditional social obligations. Finally, chickens are also slaughtered when relatives visit the household or when the household wants a change from the drab sorghum and sauce regime.

Table 5-6 shows monthly consumption of beef and small ruminant meat from slaughtered livestock over the period September 1980-February 1981 by stall-feeding households at Magoumaz and Mavoumai. Beef consumption was heavily concentrated during the month of December in the two villages, when the harvest festival took place. Since the Marai was not celebrated in either village in January or February of 1981, beef was not consumed during these months. Mean per capita consumption of beef from cattle slaughtered in the compound by the survey households was higher at Magoumaz than at Mavoumai. Traditional slaughter of cattle is still common at Magoumaz, while commercialization has increased more rapidly at Mavoumai, significantly reducing slaughter for home

TABLE 5-6

ESTIMATED HOUSEHOLD AND PER CAPITA CONSUMPTION OF BEEF AND SMALL RUMINANT MEAT AND OFFALS FROM SLAUGHTERED AND DEAD ANIMALS AT MAGOUMAZ AND MAVOUMAI BY MONTH, SEPTEMBER 1980-FEBRUARY 1981

Month	Magoumaz							Mavoumai					
	Mean Consumption Per Household (Total Kg.)				Mean Consumption Per Capita (Kg./Capita)			Mean Consumption Per Household (Total Kg.)			Mean Consumption Per Capita (Kg./Capita)		
	Beef[2]		SRM[3]		Beef[2]	SRM[3]		Beef[2]	SRM[3]		Beef[2]	SRM[3]	
	Home Slaughter	Gifts Received	Home Slaughter	Dead Stock		Home Slaughter	Dead Stock		Home Slaughter	Dead Stock		Home Slaughter	Dead Stock
September	0	0	8.43	6.52	0	1.14	0.88	0	3.16	3.97	0	0.38	0.47
October	2.49	0.03	8.21	13.28	0.34	1.11	1.80	0.35	3.13	1.80	0.04	0.37	0.22
November	0	0.20	7.70	3.40	0.03	1.04	0.46	0.57	6.85	3.19	0.07	0.82	0.38
December	13.74	4.19	3.96	0.78	2.43	0.54	0.11	2.87	0	0.86	0.34	0	0.10
January	1.69	0.01	1.72	0.42	0.23	0.23	0.06	0	3.06	0	0	0.37	0
February	0	0.12	7.09	1.89	0.02	0.96	0.26	0	1.53	2.73	0	0.18	0.33
Total	17.91	4.55	37.11	26.30	3.05	5.04	3.57	3.80	17.72	12.54	0.45	2.12	1.50

Source: Survey of stall-feeding at Magoumaz and Mavoumai.

Note: SRM = small ruminant meat.

[1]Estimated consumption per capita was obtained by dividing mean consumption per household by the average number of people per household in each of the two villages (7.37 in Magoumaz and 8.36 in Mavoumai).

[2]Beef consumption estimates were obtained by dividing farmer estimates of the value of consumed beef by the unweighted average of mean beef prices per kilogram for a seven-month period at the retail markets at Soulede and Tourou.

[3]Small ruminant meat consumption estimates were obtained by using carcass weights for animals of different age-sex categories. These carcass weights, where the carcass includes offals, were obtained from slaughtered stock at the Nokolo and Soulede slabs.

consumption (see Table 4-6). Consumption of small ruminant meat from slaughtered stock was lowest over the six-month period in the two villages during the month of the harvest festival (December) and in the following month (January), when the supply of home-slaughtered beef was greatest. Consumption of dried and stored beef from slaughtered stock, although not shown in Table 5-6, was probably high at Magoumaz during the month of January, as households are able to conserve some of the surplus beef available at the time of the harvest festival. Consumption of small ruminant meat at Magoumaz was constant, averaging slightly over one kilogram per capita, during the months of September-November and February. In contrast, home slaughter of small ruminants was greatest during the month of November at Mavoumai and lower (though nearly equal) during the months of September, October and January. The high consumption of small ruminant meat by households at Mavoumai in November is probably due to substitution of small ruminant slaughter for cattle slaughter by many households following the harvest, since commercial sale of stall-fed cattle has become more common than traditional slaughter.

In contrast to the regional estimates of rural consumption, the survey data estimates show that consumption of small ruminant meat is greater than consumption of beef in both villages. This is especially true for Mavoumai, where consumption of small ruminant meat was over four times beef consumption from slaughtered stock during the September 1980-February 1981 period. This finding is somewhat surprising in that the survey households also produce stall-fed cattle. In many instances, however, these households sell the live animals or slaughter the bulls and retail most of the beef, leaving little or no beef for home consumption.

c) Consumption of Meat from Dead Livestock

Consumption of meat from dead small ruminants is over two-thirds the level of consumption of small ruminant meat from intentionally slaughtered animals at Magoumaz and Mavoumai, as shown in Table 5-6. Mortality during the six months of survey data collection was highest during the month of September and lowest in December and January, when small ruminants reach their maximum liveweights during the year, after having grazed on the relatively abundant range resources following the harvest. Consumption of meat from dead livestock is probably higher during the six-month period from March to August, since nutritional stress is greatest during the late dry season and early rainy season. The lower liveweights of the animals probably offset, however, the greater mortality during this period, providing balance across seasons to consumption of meat from dead stock.

Consumption of meat resulting from small ruminant mortality is perhaps over-estimated, particularly at Magoumaz. Carcass weights for small ruminants of different age-sex categories slaughtered at the Mokolo and Soulede slabs were used in calculating per capita consumption. Slaughtered stock are generally heavier than animals that die, which are more apt to be emaciated on account of sickness and weakness. Moreover, intentionally slaughtered animals are usually at least a year old, so there are fewer observations of carcass weight for younger animals. On the other hand, a high proportion of small ruminants that die are kids and lambs less than one year old. Meat from these animals is consumed, but their carcass weights were probably over-estimated.

d) Gifts of Livestock

Households in the Mandara Mountains sometimes give livestock or meat to other households in order to fulfill traditional social obligations or to help needy households satisfy their subsistence requirements. Beef from slaughtered stall-fed cattle is distributed to members of the extended family and to friends and neighbors. Small ruminants and chickens are usually given to relatives, particularly in-laws, in order to satisfy social obligations, and to friends or relatives who need the livestock as a reserve or as a liquid asset that can be converted into cash for the purchase of grain.

The data collected on gifts of small ruminants and chickens for stall-feeding households at Magoumaz and Mavoumai show that these households give more small stock and beef than they receive. This is plausible, since these households are wealthier than those without cattle, so they can afford to be generous or to help out poorer friends and neighbors. During the survey research in the Mandara Mountains, it was found that households are generally less willing to report receiving gifts of livestock than giving gifts.

e) Breakdown of Rural Consumption of Red Meat

In both Magoumaz and Mavoumai home slaughter of cattle and small ruminants accounted for about half of total red meat consumption for stall-feeding households, as shown in Table 5-7. Consumption of meat from dead livestock comprised about one-quarter of red meat consumption, while purchases accounted for 15-27 percent and gifts for 5 percent or less of red meat consumption. Therefore, 75 percent or more of the red meat consumed by stall-feeding households in the two survey villages is

TABLE 5-7

PROPORTIONAL BREAKDOWN OF RED MEAT CONSUMPTION BY CONSUMPTION CATEGORY AT MAGOUMAZ AND MAVOUMAI, SEPTEMBER 1980-FEBRUARY 1981

Type of Meat/ Subcategory	Magoumaz		Mavoumai	
	Consumption Per Capita	Proportion of Total Consumption	Consumption Per Capita	Proportion of Total Consumption
Beef				
Purchases	1.84	33%	1.38	75%
Slaughter	2.43	55%	0.45	25%
Gifts Received	0.62	11%	0	0%
Total	4.89	100%[1]	1.83	100%
Small Ruminant Meat				
Purchases	0.21	3%	0.13	3%
Slaughter	5.04	57%	2.12	57%
Mortality	3.57	40%	1.50	40%
Total	8.82	100%	3.75	100%
All Red Meat				
Purchases	2.05	15%	1.51	27%
Slaughter	7.47	54%	2.57	46%
Gifts Received	0.62	5%	0	0%
Mortality	3.57	26%	1.50	27%
Total	13.71	100%	5.58	100%

Source: Survey of stall-feeding households at Magoumaz and Mavoumai, September 1980-February 1981.

[1]The percentages do not sum to 100% due to rounding errors.

estimated to come from intentionally slaughtered stock and from livestock mortality. Relatively little is purchased by these households, since they own larger numbers of livestock than households that do not stall-feed cattle. It is likely that the latter purchase a significantly higher proportion of their red meat, since they have fewer livestock and are less willing to slaughter livestock for home consumption. Households in the mountainous zone typically hold livestock, particularly small ruminants, as a reserve.

D. PROJECTED CONSUMPTION OF BEEF FOR THE MANDARA MOUNTAINS REGION

Using the 1980 estimates of urban and rural beef consumption, it is possible to project regional beef consumption in 1985 and 1990. It is necessary to assume likely ranges for key variables such as income elasticity of demand for beef and rates of population and per capita income growth for urban and rural areas. Increases in beef consumption can be projected using the following FAO formulation:

$$d = pop + n \cdot y$$

where d = the percentage change in consumption of beef between 1980 and 1985 (or 1990)

pop = the percentage change in population between 1980 and 1985 (or 1990)

n = the income elasticity of demand for beef, and

y = the percentage change in real per capita income between 1980 and 1985 (or 1990)

For the purposes of this analysis, urban areas include 10 percent of the population of the Mandara Mountains region. Rural areas include the remaining 90 percent of the population in the region. It is

assumed that the urban population will grow at an average annual rate of 5 percent during the 1980s and the rural population at the rate of 2 percent, reflecting outmigration from the Mandara Mountains to other regions of Cameroon and to Nigeria. The income elasticity of demand is assumed to fall in the 0.6-1.0 range for urban areas and 0.2-0.5 for rural areas. Real per capita income growth is first assumed to be 2 percent and then 5 percent per year for both urban and rural areas.[9] Projected incremental beef consumption, expressed in metric tons and stall-fed cattle equivalents, is shown in Table 5-8.

These estimates show that an additional 227.0-332.1 metric tons of beef will be consumed in the urban areas of the Mandara Mountains by 1985 and an additional 510.2-844.0 metric tons by 1990. If this additional demand were met entirely by slaughtering locally produced stall-fed cattle, then 1,123-1,642 additional bulls would need to be slaughtered by 1985 and 2,523-4,174 animals by 1990. As will be discussed in Chapters Six and Nine, the actual magnitude of stall-fed cattle slaughter in urban areas will be greatly affected by pricing policies regarding retail beef sales.

The demand estimates also show that an additional 453.3-744.7 metric tons of beef will be consumed in rural areas of the Mandara Mountains region by 1985 and an additional 916.7-1,861.0 metric tons by 1990. If incremental rural demand were satisfied solely by slaughter of stall-fed cattle, an additional 2,153-3,683 animals would have to be slaughtered by 1985 and an additional 4,534-9,204 head by 1990. This is unlikely to occur, since approximately half of the regional population resides

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[9]The reasons for making these assumptions are detailed in the notes to Table 5-8.

TABLE 5-8

PROJECTED BEEF CONSUMPTION IN THE MANDARA MOUNTAINS REGION, 1985 AND 1990

	Income[2] Elasticity of Demand	Rate of Income Growth	Incremental Beef Consumption[3] (metric tons of beef and offals) 1985	1990	Incremental Cattle Slaughter[4] (stall-fed cattle equivalents) 1985	1990
Urban[1]	0.6	2%	227.0	510.2	1123	2523
		5%	273.3	675.2	1352	3339
	1.0	2%	255.0	568.4	1261	2814
		5%	332.1	844.0	1642	4174
Rural[1]	0.2	2%	453.3	916.7	2153	4534
		5%	515.6	1202.7	2550	5948
	0.5	2%	544.2	1145.9	2691	5567
		5%	744.7	1861.0	3683	9204

[1]The urban population comprises 10 percent of the regional population, and urban areas absorbed 5300 head of cattle in the base year of 1980. Estimated urban beef consumption was 670.9 metric tons in 1980. The rural population is the remaining 90 percent of the regional population, which absorbed an estimated 3488.2 metric tons of beef in 1980.

[2]Lower and upper bounds on the income elasticity of demand for beef are used in projecting demand. Higher estimates for the urban areas reflect greater purchasing power and hence the ability to make discretionary purchases The lower estimates for rural areas are based upon expenditure data obtained from sample households at Magoumaz and Mavoumai.

[3]Incremental beef consumption is calculated using 1980 estimates of beef consumption in rural and urban areas as a base.

[4]The incremental beef consumption is converted to stall-fed cattle equivalents by using the average weight of the four quarters plus offals (202.2 kg.) for stall-fed cattle slaughtered at Mokolo.

outside of stall-feeding production zones and slaughter of stall-fed cattle is uncommon in plateau and plains areas.

It is important to note that incremental demand for beef in rural areas will be 2-2.2 times the incremental demand for beef in urban areas by 1985 and 1990, even though the projected ranges of population growth and income elasticity of demand are lower for rural areas than for urban areas. The reason for this is that the regional rural population is nine times larger than the urban population.

An analysis of the feasible magnitude of increases in demand for stall-fed cattle for slaughter in 1985 and 1990 will be discussed in Chapter Nine, where a sensitivity analysis of producers' returns to stall-feeding under alternative input procurement and marketing strategies is conducted. Before this assessment can be made, rural and urban butchers' procurement practices are analyzed in Chapter Six to determine present sources of slaughter cattle supply. Pricing policies regarding retail sales of beef in urban areas will also be analyzed in order to understand why so few stall-fed cattle are presently slaughtered in towns. In Chapter Seven interregional and international trade flows will be discussed in order to assess supply and demand conditions prevailing in Northern Cameroon and Nigeria which will affect the future disposal and flows of stall-fed cattle.

CHAPTER SIX

BUTCHERING AND RETAILING IN THE MANDARA MOUNTAINS REGION

A. INTRODUCTION

A common perception among government administrators is that butchers receive unduly high profits to the detriment of consumers. Urban meat consumption is perceived to be too low, due to the high prices demanded by urban butchers. In order to rectify this perceived injustice, government officials in many developing countries try to protect consumers through retail price controls on sales of meat. Northern Cameroon is no exception, as administrators set retail prices for their localities. Unlike many parts of the developing world, these price controls are enforced in the larger towns of Northern Cameroon. In the Mandara Mountains the control prices have been set at low levels in urban areas, encouraging urban butchers to slaughter low quality animals from the Diamare Plains, a livestock surplus region, rather than well-fleshed, locally available stall-fed cattle. Slaughter of locally produced stall-fed cattle is common in rural areas of the Mandara Mountains, because retail meat prices are not controlled at rural markets.

In this chapter urban and rural butchers' procurement, slaughter and retailing practices will be examined. An analysis of the costs and returns to butchering and retailing at urban and rural markets will demonstrate that slaughter of stall-fed cattle is profitable at rural

markets but generally unprofitable at urban markets where price controls are enforced.

B. STRUCTURE OF BUTCHERING/RETAILING

1. Urban Areas

In Mokolo, the largest town in the Mandara Mountains region, there are seven wholesale butchers who slaughter cattle regularly, four wholesale butchers who slaughter cattle infrequently and 20-25 butchers' aides. There are also at least ten butchers who slaughter small stock. Many of these are butchers' aides who lack the capital to buy cattle for slaughter. There are also butchers who specialize in slaughtering small stock; they usually grill mutton or goat meat and sell it at the marketplace or the taxi station. Among the cattle butchers there are only three who are exclusively wholesale butchers, while all of the others retail at least some of the meat from the slaughtered animals. The butchers' aides perform a number of functions for the wholesale butchers. They lead the slaughter cattle to the slab, dress out the slaughtered animal, transport the beef from the slab to the marketplace, and retail the beef (usually by quarter). Most of the above described butchers, even in a town as large as Mokolo, are part-time butchers and part-time farmers. The larger a butcher's volume of slaughter, of course, the less time he devotes to farming and the more he depends upon his wives and other members of the household to cultivate the crops.

From September 1980 through March 1981, cattle slaughter data were collected on large market day (Wednesday) and non-market days at Mokolo. The four largest butchers with the largest volume of slaughtered cattle

captured 64 percent of the total market share, as shown in Table 6-1. Although these four wholesale butchers slaughtered nearly two-thirds of the cattle at Mokolo over a six month period, there is little evidence of collusive behavior or unethical practices that characterize moderate to high levels of market concentration. Most slaughter cattle are acquired at markets in the Diamare Plains where bidding is open and competitive. Retail beef prices are kept low (300 FCFA per kilogram of beef with bones) by official control prices. Seven months of retail price data show that these prices were closely observed.[1]

Capital is probably the greatest barrier to entry into wholesale butchering. Most of the cattle slaughtered at Mokolo are procured at the Diamare Plains market of Gazawa. A few of the established Mokolo butchers are able to buy some of their slaughter cattle on credit from a Gazawa cattle trader, but most of the butchers are required to pay cash on the spot. Although there are a few intermediaries at the Gazawa market, most transactions take place directly between buyers (butchers, farmers, traders) and sellers (herders, traders). Unless the buyer knows the seller well, credit is generally not extended. Hence, Mokolo butchers who buy at Gazawa need a minimum of 30,000 FCFA per animal. In order to spread the costs of making the trip to Gazawa, butchers usually purchase at least two or three cattle for slaughter. Therefore, 60,000-70,000 FCFA is sufficient working capital. This sum ($250-$450) may seem insignificant by western standards, but it is considerable in a region where per capita incomes usually fall in the same range.[2]

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[1]See Table 6-9.

[2]Several of the Mokolo butchers who slaughter a low volume of cattle said they wanted to slaughter cattle on a more regular basis but that they lacked the capital to do this.

TABLE 6-1

MARKET SHARES OF PRINCIPAL BUTCHERS AT MOKOLO, SEPTEMBER 1980-MARCH 1981

Butcher Number	Total Slaughter		Ethnic Group	Religion
	Number of Cattle	Market Share		
1.	153	19.4%	Mafa	Non-Moslem
2.	143	18.1%	Mafa	Moslem
3.	108	13.7%	Mafa	Non-Moslem
4.	99	12.6%	Mafa	Moslem
Four largest butchers	503	63.8%		
5.	87	11.0%	Mafa	Moslem
6.	82	10.4%	Mafa	Non-Moslem
7.	67	8.5%	Kapsiki	Moslem
8.	17	2.2%	Mabas	Moslem
Eight largest butchers	756	95.9%		
All butchers	788	100.0%		

SOURCE: Survey of butchering and retailing.

Capital is not, however, the only barrier to entry into wholesale butchering. Knowledge of cattle prices and an ability to judge how much revenue an animal will yield are two prerequisites to successful butchering. These skills come only with practice; virtually all the wholesale butchers entered the trade by serving first as apprentices to established butchers. By accompanying their mentors to cattle markets and to Fulani encampments in the bush, they observed many transactions before ever buying their first animal for slaughter.

Unlike the cattle trade, ethnicity and religion do not constrain entry into butchering. Although many of the butchers in larger towns are Moslem (seven of eleven at Mokolo), most of them are members of indigenous agricultural groups. Seven of the eleven cattle butchers at Mokolo are Mafa, three of whom have become Moslems. Nearly all of the butchers' aides and small ruminant butchers are Mafa. The head butcher, who slaughters few cattle and is not one of the largest eight butchers, is Hausa, which is typical of many towns in West Africa. Butchering is a trade that has been historically controlled by the Hausa in West Africa. The Hausa are Moslem, so one might hypothesize that the greater the extent to which the Hausa dominate wholesale butchering in a particular town, the more difficult it would be for a non-Moslem to enter butchering. Religion clearly does not constrain entry into wholesale butchering in Mokolo, however, as two of the three largest butchers are Mafa and non-Moslem.

Although detailed information about slaughter volume was not collected at Koza and Mora, two other principal towns in the Mandara Mountains region, structured single-visit and informal interviews with the butchers at these towns revealed that the structure of butchering and

retailing is quite similar to that of Mokolo. There are four to five wholesale butchers in each of these towns and ten to twenty butchers' aides and small stock butchers. While the wholesale butchers at Koza are non-Moslem Mafa, those at Mora are Mandara and hence Moslem. The volume of cattle slaughtered at these two towns is significantly lower than at Mokolo, although small ruminant slaughter substitutes in part for cattle slaughter. Even though wholesale butchering is more highly concentrated at Koza and Mora than at Mokolo, there is little evidence of non-competitive behavior. Butchers are compelled to retail beef at the official control prices. Data collected over a several month period (October 1980-February 1981) show that the control prices are observed, which suggests that wholesale butchers' profits are modest (as at Mokolo).

2. Rural Areas

Rural secondary and tertiary markets draw far fewer consumers than the larger markets in the towns, so fewer animals are slaughtered per week. As a result, there are fewer butchers at the rural markets. At Soulede, an important secondary market, there are two principal wholesale butchers, who slaughtered 32 of the 37 cattle from September 1980 through March 1981. One of these butchers slaughters cattle only during the late rainy and early dry seasons. There is only one wholesale butcher at Ziver, a tertiary market near Mokolo, who procured 34 of the 39 head of cattle slaughtered from October 1980 through March 1981. The tertiary markets at Wandai and Ziver are also served by only one wholesale butcher, while the large border market at Tourou has three or four wholesale butchers.

Most of these villages are close enough to Mokolo so that the wholesale butchers compete with their Mokolo counterparts in procuring cattle from neighboring herders and farmers. They also descend periodically to the plains market of Gazawa to acquire slaughter cattle, where they must compete with a large number of buyers from the area around Gazawa, the Mandara Mountains and Nigeria. Unlike urban butchers, the wholesale butchers at rural markets are not compelled to sell beef at control prices. Retail data collected at Soulede and Tourou show that rural butchers are able to sell beef at nearly two times the price that Mokolo, Koza and Mora butchers are forced to observe. Yet the butchers at the rural markets do not possess oligopoly selling powers. There are substitutes for beef at these markets, such as small ruminant meat, chicken, dried fish and sardines. Consumers dissatisfied with high beef prices are able to purchase one of these substitutes, although the substitutes tend to be more expensive than beef on a per kilogram basis.

Rather than exercising oligopoly selling powers, rural butchers sell beef at prices that consumers are willing to pay. There is rarely any beef left over after the market; rural butchers claim they rarely have unsold beef that has to be smoked for storage and sold for a loss or that has to be consumed by their families. In contrast, control prices at Mokolo and the other towns distort the workings of supply and demand. Butchers are required to acquire inferior cattle for slaughter at low prices. Consequently, they cannot buy and slaughter enough animals to meet urban demand. In fact, it is common for urban consumers who want to buy higher quality beef to attend rural markets where retail

sales are uncontrolled. Since there are so few wholesale butchers at the secondary and tertiary markets and they are not forced to sell at low control prices, they can coordinate supply so that it matches demand. More cattle are slaughtered at the end of the rainy season and during the first half of the dry season, when rural people have more disposable income, than during the late dry season and most of the rainy season, when little income is available for discretionary purchases and people are preoccupied with farming, therefore having little time to go to periodic markets.

Capital constrains entry into wholesale butchering in the rural areas as well as the towns. Enough capital to acquire one animal is usually sufficient for entry, however. During most of the year demand for beef is so low that cattle slaughter is not economically viable. Small ruminants are slaughtered in place of cattle during the late dry season and throughout most of the rainy season. Since a goat or sheep can be bought for as little as 4,000-5,000 FCFA, entry into butchering of small stock is relatively easy. While capital restricts cattle slaughter in rural markets, association with a particular ethnic group or religion is unnecessary. Rural butchers are invariably full-time farmers and part-time butchers who are members of the local agricultural groups.

C. BUTCHERS' LIVESTOCK PROCUREMENT AND SLAUGHTER PRACTICES

1. Urban Butchers' Procurement Practices

a) Cattle Slaughter at Mokolo, 1973-1980

The Livestock Service keeps quite accurate statistics regarding cattle slaughter at the abattoir in Mokolo. Its figures probably capture

at least 85 percent of all cattle slaughter in the urban area, since slaughter without veterinary inspection is subject to heavy fine, which serves as a deterrent to clandestine slaughter.

Cattle slaughter trended upward from the middle of 1975 through the end of 1980, as shown in Table 6-2 and Figure 6-1. Mokolo's population grew significantly during the 1970s, from an officially estimated size of 6,196 in 1976 to 10,722 inhabitants in 1980-81.[3] The establishment of a secondary school (lycee) in the mid-1970s also contributed to the increased demand for beef, since most of the new teachers were brought in from Southern Cameroon and their incomes are far above the mean for Mokolo.

Seasonal variation in slaughter at Mokolo from 1973 through 1980 is captured by the monthly indices appearing at the right hand side of Table 6-2, which were calculated using the ratio to moving average procedure. The indices generally bear out the seasonal pattern of slaughter observed in 1980-81 and described by Mokolo butchers. Slaughter increases during the months of September, October and November, as herders seek to sell inferior stock before embarking on transhumance, farmers occasionally sell stall-fed cattle to urban butchers, and larger numbers of cattle, many of which are trekked from Chad, are offered for sale in the markets of the Diamare Plains. The monthly indices for February, March and April appear high, however. Slaughter at the Mokolo slab fell off during this period in 1981, as small ruminants substituted in large part for the decreased cattle slaughter.

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[3]The 1976 estimate was obtained during the national census (Recensement Général du Cameroun). The 1980-81 figure was provided by the Mokolo municipal authorities.

TABLE 6-2

MONTHLY INSPECTED SLAUGHTER OF CATTLE AT MOKOLO, 1973-80

Month \ Year	Number of Head Slaughtered								Monthly Index[1]	Monthly Index[2]
	1973	1974	1975	1976	1977	1978	1979	1980		
January	125	108	95	82	124	158	144	143	.99	1.01
February	117	139	117	89	134	148	149	181	1.11	1.08
March	131	142	108	86	142	175	149	180	1.12	1.11
April	386	119	98	93	130	143	160	170	1.04	1.05
May	539	230	84	93	138	137	93	108	1.02	.88
June	107	188	68	81	100	135	116	102	.89	.81
July	112	118	92	93	101	130	125	184	.87	.89
August	117	137	103	87	123	133	105	183	.91	.91
September	117	108	104	122	133	127	145	188	.97	1.03
October	112	98	106	128	153	136	186	180	1.04	1.13
November	98	116	137	126	140	123	152	195	1.05	1.10
December	55	149	89	99	146	155	139	131	.98	.99
TOTAL	2065	1652	1201	1179	1564	1700	1663	1845	12.00	12.00

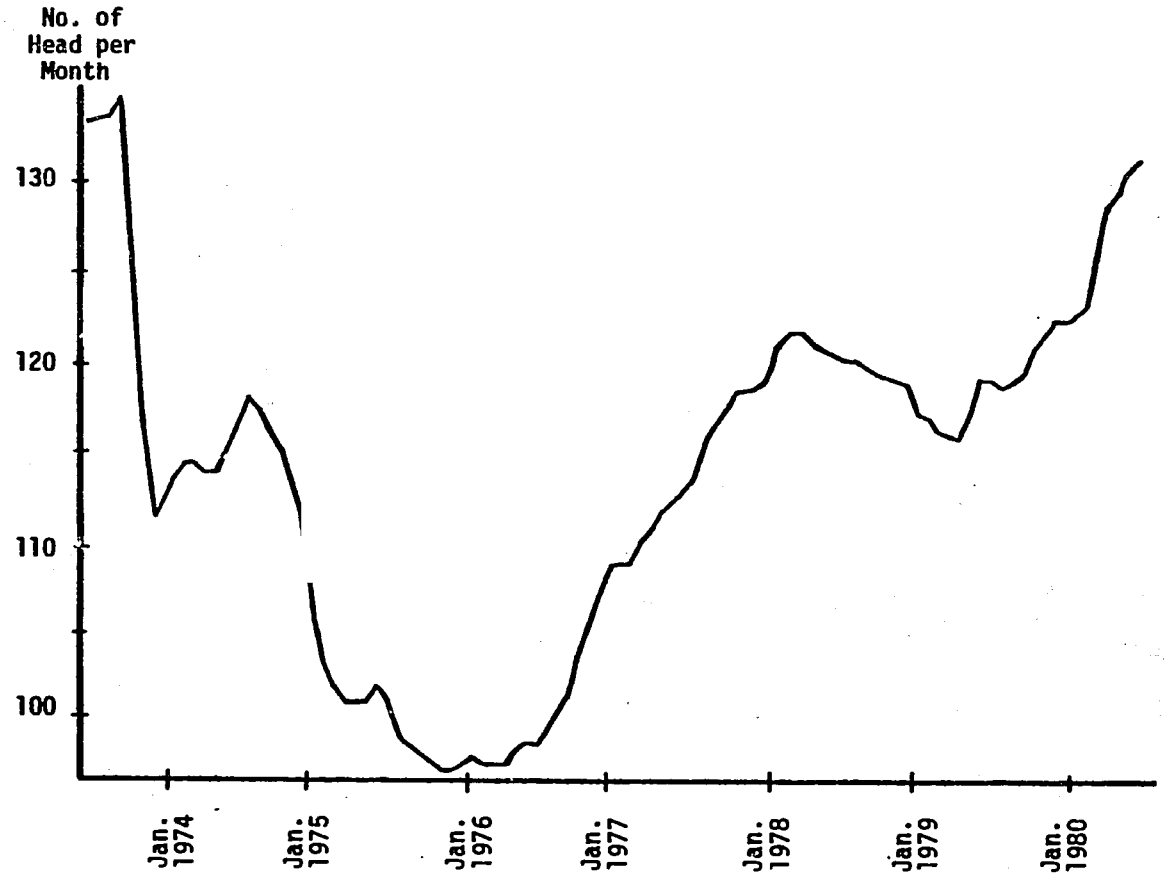
SOURCE: Bureau du Sous-Secteur Elevage de Mokolo.

[1]The first set of monthly indices were calculated by using the ratio to moving average technique on the data for the period 1973-1980.

[2]The second set of monthly indices were calculated by using the ratio to moving average procedure on the data for the period 1975-1980. The first two years of data were dropped on account of several implausibly high monthly entries (see April and May 1974). The head of the Livestock Service Subsector office in Mokolo said that the outlying observations were probably the results of inaccurate reporting of slaughter by the Livestock Service under the direction of his predecessor. Although the magnitude of slaughter during the months of April and May 1973 and in May 1974 is doubtlessly too great, these months may be outliers for good reason. 1973 was the worst year of the Sahelian drought, which affected livestock production in the Sudano-Guinean zone as well (the Mandara Mountains are located in the Sudano-Guinean zone and not in the Sahel, which begins several hundred kilometers to the north). Interviews with Fulani herders around Mokolo revealed that cattle mortality was unusually high during the late dry season of 1973. It is possible that herders sold off large numbers of weakened stock at this time, attempting to minimize their losses.

FIGURE 6-1

TREND IN MONTHLY CATTLE SLAUGHTER AT MOKOLO, 1973-1980



Note: The graph is a plot of centered twelve-month moving averages from July 1973 through July 1980. Moving averages could not be calculated for the first six and the last six months of the time-series.

The monthly indices for May and June are the lowest for the year, because the Fulani herds do not arrive on the plateau around Mokolo before late June and low numbers of trade cattle arrive at the cattle markets of the Diamare Plains during these months. Trekking cattle over long distances is extremely taxing and risky at this time, for pasture and water are in scarce supply. It is the hottest and most uncomfortable period of the year. The slaughter indices for July and August are below the mean, because herders and farmers prefer to keep their cattle off the market while the animals are steadily gaining weight. Forage and water resources are abundant at this time. In addition, the road between Mokolo and Gazawa (Maroua, Bogo) becomes close to impassable at the height of the rainy season, which increases the time and monetary costs of acquiring cattle in the Diamare Plains. Trade cattle routes from Chad to Bogo and from Bogo to Gazawa are also often blocked by rainy season flash floods. When the Mokolo butchers are unable to make the weekly trip to Gazawa, they are forced to acquire slaughter cattle from herders around Mokolo. Since there are not a large number of cattle herds close to Mokolo, supplies of slaughter cattle are limited. Hence, cattle slaughter tends to be low during the rainy season. Although relatively greater numbers of cattle are purchased from herders around Mokolo during the rainy season than during other periods of the year, overall slaughter declines as the principal source of supply becomes decreasingly accessible.

b) Seasonal Pattern of Livestock Procurement and Slaughter, 1980-81

Over the course of seven months the carcasses of cattle slaughtered at the Mokolo <u>abattoir</u> were weighed each week on Wednesday, the day of

the large market. In addition, data concerning the type, age, and sex of cattle slaughtered, the place of acquisition, the type of seller, and the acquisition price were obtained. Table 6-3 summarizes the principal findings of this data collection effort.

Two-thirds (67 percent) of the cattle slaughtered at Mokolo from September 1980 through March 1981 were females, principally older cows. Most of the male cattle slaughtered were either young bulls of one and a half to three years or mature bulls at least four years old that were culled from Fulani herds or sold by Mafa farmers who practice stall-feeding. Only 9 of the 220 cattle slaughtered were stall-fed bulls, which is surprisingly low given the prevalence of stall-feeding by Mafa farmers in the villages around Mokolo. In contrast, 96 percent of the cattle slaughtered were range-fed animals, 83 percent of which were bought in the Diamare Plains markets of Gazawa, Bogo, and Meme.

While nearly 20 percent (25 of 131) of the range-fed cattle slaughtered during the time period September through December 1980 were acquired from herders and farmers around Mokolo, butchers bought only 4 of 81 slaughter cattle around Mokolo during the dry season period of January through March. This nearly total reliance on the Diamare Plains markets for Mokolo's dry season supply of slaughter cattle is due to the fact that Fulani herders in the region around Mokolo leave for the Koza and Diamare Plains on transhumance beginning in November. By January there are very few herds still grazing on the plateau to the west, east and south of Mokolo. Moreover, few stall-fed cattle are offered for sale after December by local farmers.

Although slaughter data were not collected from April through August at Mokolo, the seasonal pattern of slaughter can be inferred from

TABLE 6-3

CATTLE SLAUGHTER AT MOKOLO ON THE DAY OF THE LARGE MARKET, SEPTEMBER 1980-MARCH 1981

Month	Number of Carcasses Weighed	Number of Males	Number of Females	Number of Stall-fed Cattle	Number of Range-fed Cattle	Number of Cattle Bought in Markets of Diamaré Plains[1]	Number of Cattle Bought Around Mokolo	(1) Mean Carcass Weight (kg.)	Standard Deviation	(2) Mean Offals Weight (kg.)	Standard Deviation	(3) Mean Weight of Carcass Plus Fifth Quarter (kg.)	Standard Deviation	(4) Mean Acquisition Price (FCFA)	Standard Deviation	(5) Mean Price Paid per kg. of Beef (4)÷(3)	Standard Deviation
September[3]	24	13	11	0	24	16	8	95.9	27.1	29.0	7.7	124.9	33.4	39,165	13,222	314	64
October[4]	33	12	13	3	30	26	7	114.7	38.3	32.8	7.8	147.5	45.1	43,896	14,070	304	39
November	35	12	23	5	30	24	11	109.0	33.3	33.1	7.3	142.1	38.7	42,776	15,026	299	41
December	48	14	34	1	47	40	8	96.6	23.3	29.9	7.0	126.5	28.9	39,552	9,203	317	55
January	37	7	30	0	37	36	1	87.9	16.5	28.6	6.2	116.5	20.9	39,257	7,359	338	49
February[3]	20	7	13	0	20	18	2	88.0	22.2	27.7	6.6	115.7	28.2	38,475	8,359	337	47
March[3]	23	6	17	0	23	22	1	83.0	14.0	26.9	5.0	109.9	18.2	39,108	6,643	357	30
Total	220	71	141	9	211	182	38	96.6	27.2	30.0	7.8	12[illegible].6	32.9	40,443	10,959	323	53

SOURCE: Survey of butchering and retailing.

[1]The vast majority (179 of 182) of the cattle bought in the Diamaré Plains were acquired at Gazawa (147) and Bogo (32). The remaining three were purchased at Méné.

[2]Mokolo butchers bought these cattle from traditional Fulani herders and Mafa farmers living in villages within fifteen kilometers of Mokolo, such as Sirak, Goraï, Biskavaï, Mofolé, Mokola Kirdi, Mavoumaï, Wandeï and Zileng.

[3]Carcasses were weighed three market days instead of four during the months of September, February and March.

[4]Data regarding the sex of the cattle slaughtered were not obtained on October 1, 1980.

secondary data and informal interviews with butchers. Beginning in January and continuing through June, cattle slaughter declines at Mokolo, as supplies of slaughter cattle contract and the acquisition price per unit of liveweight rises. From March through June small ruminant slaughter substitutes in part for cattle slaughter. Although recorded estimates of small ruminant slaughter at the Mokolo slaughterhouse are not available, evidence from other urban areas in Northern Cameroon, which is presented in Annex 3, illustrates the substitution of small stock for cattle during the middle and late dry season. In addition, we observed that four cattle were slaughtered at the weekly Koza market (Sunday) during the month of November and on the first market day in December. By the end of February no cattle were being slaughtered, even though the grain and cowpea markets were very active. Instead, 14 sheep and goats were slaughtered on one market day in late February. Since Koza is one of the principal towns in the Mandara Mountains and its market rivals that of Mokolo in terms of commodity flows, weekly attendance and market shed, this is an important finding.

By late June Fulani herders return to the high plateau around Mokolo to graze their cattle on the early growth of grasses. Butchers are able to buy at least some of their slaughter cattle from herders. Prices per unit of liveweight begin to decline during the rainy season, as herders are compelled to sell some cattle in order to buy grain, salt and clothing.

The data collected at the Mokolo slaughterhouse show that cattle attain their maximum weights from October through December, when pasture is relatively abundant and the fresher grasses contain a higher proportion of protein and water than the dried out standing forage remaining

later in the dry season. By January carcass weights start to fall off steadily until sometime in June or early July, when pasture regrowth follows the onset of the rains.[4] Cattle mortality also tends to be highest in the late dry season and early rainy season, when the emaciated stock is weakest and hence most vulnerable to disease and internal parasites. The butchers in Mokolo complain that slaughter cattle acquisition is especially risky at this time, for weakened and diseased cattle bought at Gazawa sometimes have to be sold for a loss en route.

The Mokolo slaughter data show that cattle prices are highest from October to December, when cattle are in their best condition, but the price per kilogram (carcass weight plus offals) is lowest in October and November and rises progressively during the dry season, beginning in December. Three factors are responsible for this trend. First, cattle liveweights and carcass weights decline steadily during the dry season. In addition, fewer and fewer cattle are offered for sale in the area around Mokolo and in the cattle markets of the Diamare Plains as the dry season progresses.[5] Finally, demand for beef remains strong

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[4]The Mokolo secondary school, which regularly buys beef for its boarding students, weighed cattle carcasses over a five-year period. These data show the same seasonal trends as the slaughterhouse data. In addition, the Veterinary School of Maroua weighed cattle carcasses at the Maroua abattoir from October 1979 through March 1980 and found a similar seasonal pattern. See Annex 3 for details.

[5]By June the acquisition price per kilogram probably reaches its zenith, although it may be that distress sales by herders offset at least partially the upward pressure on prices. Unfortunately, the data to test this hypothesis are lacking; hence, it can be neither supported or disconfirmed. According to Mokolo butchers, cattle prices per kilogram (carcass weight) begin to ease during the rainy season, after Fulani herders have returned from transhumance and need to sell off some of their stock in order to buy grain, clothing and other necessities.

during most of the dry season, particularly in rural areas, where farmers have disposable income from crop sales.

c) Sources of Urban Slaughter Cattle Supply

In this section the magnitude and sources of urban cattle slaughter will be estimated. The slaughter cattle supply is first examined for the three principal towns of the region, for which slaughter statistics are collected by the Livestock Service and survey data are available. The magnitude of cattle slaughter for secondary towns is then estimated, using official statistics and our own estimates. This slaughter of cattle in secondary towns is then broken down by source of supply. Finally, the slaughter magnitude and source of supply estimates are aggregated for the two urban subgroups.

The butchers at Mokolo, Mora and Koza, the three principal towns of the Mandara Mountains region, depend heavily on the cattle markets of the Diamare Plains for their supply of slaughter cattle. During seven months (September 1980-March 1981) of survey research on cattle slaughter at Mokolo, butchers obtained 663 or the 795 animals (83 percent) in the plains' markets, as shown in Table 6-4. These butchers acquired 556 slaughter cattle (84 percent of the 663) at the Gazawa market alone. Mokolo butchers probably procure about 75 percent of the cattle they slaughter annually in the markets of the Diamare Plains.[6] Hence,

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[6]During the months of April, May and June, butchers at Mokolo procure virtually all of their slaughter cattle in the plains' markets. By July and August, Fulani cattle herders have returned from dry-season transhumance or, in some cases, they have come on rainy-season transhumance to the grazing areas on the plateau near Mokolo. At this time Mokolo butchers obtain one-quarter to one-third of their slaughter cattle from local herders, judging from data available for the months of September and October 1980, when the Fulani are still grazing their herds near Mokolo.

TABLE 6-4

SELECTED CHARACTERISTICS OF CATTLE SLAUGHTERED AT ONE URBAN AND TWO RURAL MARKETS IN THE MANDARA MOUNTAINS, SEPTEMBER 1980-MARCH 1981

Market	No. of Cattle Slaughtered	No. of Males	No. of Females	No. of Stall-Fed Cattle	No. of Oxen	No. of Range-Fed Cattle	No. of Cattle Bought in Diamaré Plains Markets	No. of Cattle[3] Acquired Locally	Average Age of Cattle Slaughtered	Acquisition[4] Price (FCFA)		Weight of Four Quarters[4] (Kg.)		Weight of Offals[5] (Kg.)		Economically Useable Carcass Weight[5] (Kg.)		Price Paid Per Kg., Carcass Weight[6] (FCFA)	
										Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Souledé	37	27	10	11	2	24	2	35	4.2	42,716	18,519	107.8	36.2	25.8	11.1	133.6	45.4	317	53
Ziver	39	31	8	21	2	16	12	27	5.1	49,577	18,336								
Mokolo[1]	220	71	141	9	0	211	181	39	5.3	40,443	10,959	96.6	27.2	30.0	7.1	126.6	32.9	323	53
Mokolo[2]	575	196	379	25	3	544	482	93	6.1	41,505	10,211								
Total[7]	871	325	538	66	7	795	677	194	5.8	41,654	11,453								
Total[8]	257	98	151	20	2	235	183	74	5.2	40,774	12,238	98.0	28.7	29.5	7.8	127.5	34.6	322	53

SOURCE: Survey of butchering and retailing.

[1]This category includes only cattle slaughtered on market day (Wednesday) in Mokolo.

[2]This category includes cattle slaughtered on days other than market day in Mokolo.

[3]Local acquisition is defined as purchase within a 20 kilometer radius of the market. Butchers often buy cattle from Fulani herders at Zamai, Biskavaï, Gorai, Vamaï, Mayo Sanganaré, Wandaï and Kossehone and from Mafa farmers at Mofolé, Sirak, Mandaka, Ziling, Mendezé, Mokolo Kirdi, Mavoumaï, Ldamtsaï, Souledé and Baou.

[4]This refers to the price paid for the stall-fed cattle, as reported by butchers.

[5]Carcass weights were obtained using 200 and 300 pound hanging scales. The weight in pounds was then converted to kilograms.

[6]This is <u>not</u> a weighted mean. Each observation is equally weighted.

[7]These figures are totals for the entire sample.

[8]These figures are a subtotal of the entire sample. Carcass weights and therefore the price paid per kg. were obtained only for cattle slaughtered at Soulede and at Mokolo on market day (Mokolo[1]). Thus, the figures in Total[8] are for the sample of 257 cattle composed of the Soulede and Mokolo market day subsamples.

roughly 1,300 of the 1,736 head slaughtered under veterinary inspection at Mokolo in 1979-80 were acquired in the plains. Although data on cattle slaughtered at Mora or Koza were not collected weekly over the course of the Mokolo survey, enumerators did visit the Sunday markets in these towns several times during the field research (April, June, July, August and November, 1980; February 1981) and obtained data about slaughter cattle acquisition. From these observations and butchers' responses in structured interviews, it also appears as if roughly three-quarters of the cattle slaughtered at Mora and Koza were procured in markets of the Diamare Plains (including Meme).[7] Therefore, we estimate that 960 of the 1,279 cattle slaughtered at Mora and 225 of the 298 cattle slaughtered at Koza during 1980 were obtained from outside the region. In conclusion, approximately 2,485 of the 3,313 cattle slaughtered in the three principal towns of Margui-Wandala in 1979-80 were acquired in the Diamare Plains.

The Livestock Service reported that 1,067 cattle were slaughtered in 1979-80 in towns other than Mokolo, Koza and Mora in Margui-Wandala Department. This figure includes recorded slaughter at Boukoula, Bourha, Tchevi, Guili, Hina, Wanarou, Gawar and Kolofata, but slaughter was not recorded at Mogode, Roumzou, Zamai, Mokong, Meri, Tokonbere, Meme and Dogba. Based upon actual observations of slaughter at town markets during different periods of the year and structured interviews

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[7]It is important to note that the cattle market at Meme, where Mora butchers procure most of their animals for slaughter, is located in the northeastern part of Margui-Wandala Department. Although technically not in the Diamare Plains, Meme resembles the towns and cattle markets of Diamare Department. Moreover, most of the cattle offered for sale at Meme are brought from Bogo market, which meets the day before the market at Meme, or are owned by Fulani herders from nearby grazing areas.

with town butchers, it is estimated that an additional 920 head of cattle were slaughtered in urban areas but unrecorded (see Annex 3). Therefore, nearly 2,000 head of cattle were slaughtered in towns other than Mokolo, Mora and Koza.

Butchers from the secondary towns also procure a large proportion of their slaughter cattle from the Diamare Plains markets at Gazawa, Bogo, Maroua and Meme. Although the exact proportion obtained in these markets is unknown, it is estimated to be roughly 55 percent, based on observations at selected markets and interviews with town butchers. Butchers in towns closer to the Diamare Plains (e.g., Zamai, Meri, Dogba, Meme, Tokonbere) rely more heavily on the plains' cattle markets for slaughter cattle than do butchers in towns farther away (e.g., Roumzou, Guili and Bourha). Therefore, an estimated 1,100 head of cattle were procured for slaughter in the secondary towns from the Diamare Plains. The remaining 900 head, or roughly 45 percent, were acquired from local herders and farmers.

Aggregating across the two subgroups, it is estimated that 5,300 head of cattle were slaughtered by urban butchers in the towns of the Mandara Mountains region in 1980. As shown in Table 6-5 urban butchers procured 3,580 head or about two-thirds of the 5,300 slaughter cattle in markets of the Diamare Plains. The remaining third was obtained from the regional extensive herd and from producers of stall-fed cattle. While nearly 1,500 head were taken off the regional extensive herd for urban slaughter, only 230 were stall-fed animals.[8] As will be shown

[8]This figure was obtained by assuming that stall-fed cattle slaughter in all urban areas was the same proportion of total slaughter (4.3 percent) as at Mokolo from September 1980 through March 1981.

TABLE 6-5

BUTCHERS' SOURCES OF BEEF AND SLAUGHTER CATTLE

	Urban Butchers		Rural Butchers	
	No. of Head	% Total	No. of Head	% Total
Offtake from Regional Extensive Herd	1,490	28	12,730	63
Stall-Fed Cattle on the Hoof	230	4	590	3
Beef from Stall-Fed Cattle Slaughtered by Owners (in Stall-Fed Cattle Equivalents)	0	0	1,005	5
Imports of Live Cattle from the Plains	3,580	68	5,780	29
Total	5,300	100	20,105	100

Sources: Livestock Service statistics, survey data, author estimates.

in Section D of this chapter, stall-fed cattle represent such a low proportion (4.3 percent) of total urban slaughter, because retail price controls on the sale of beef in urban areas make slaughter of stall-fed cattle unprofitable during most periods of the year.

2. Livestock Procurement and Slaughter at Two Typical Rural Markets

a) Rural Butchers' Procurement Practices

Two rural markets where cattle slaughter was monitored in the course of the survey research were Soulede, a medium-sized consumption-redistribution market where grain debulking and groundnut assembly take place, and Ziver, a tertiary consumption market located less than ten

kilometers from Mokolo. It is quite common for Mokolo consumers to purchase beef at the Sunday Ziver market, where higher quality stall-fed beef is often available.

While the cattle markets at Gazawa, Bogo and Meme are the principal sources of supply for urban butchers, the butchers in the rural secondary markets of the Mandara Mountains procure a far greater proportion of their slaughter cattle from local farmers and herders. As shown in Table 6-4, 35 of the 37 cattle slaughtered at Soulede and 27 of the 39 cattle slaughtered at Ziver were acquired locally. Local acquisition of slaughter cattle is especially prevalent during the late rainy season and post-harvest period when sales of stall-fed cattle are quite common. Over the period September 1980 through March 1981 nearly one-third of the cattle slaughtered at Soulede (11 of 37 head) and over one-half (21 of 39) of the cattle slaughtered at Ziver were stall-fed cattle. This contrasts markedly with Mokolo, where only 9 of the 220 cattle slaughtered on market day were stall-fed bulls.

While only 2 of the 37 cattle slaughtered at Soulede from September 1980 through March 1981 were acquired in the markets of the Diamare Plains, the head butcher at Soulede reported that he depends heavily on the Gazawa market for his supply of slaughter cattle from April through June. At Ziver market 12 of 39 (31 percent) of the cattle slaughtered from October 1980 through March 1981 were procured in the plains. The wholesale butcher at Ziver also reported that he relies on the Gazawa market for his slaughter animals from April through June.

Tables 6-4 and 6-6, which show selected characteristics of cattle slaughtered at Soulede, Ziver and Mokolo, merit additional comment. The

TABLE 6-6

SELECTED CHARACTERISTICS OF STALL-FED CATTLE SLAUGHTERED AT ONE URBAN AND TWO RURAL MARKETS IN THE MANDARA MOUNTAINS, SEPTEMBER 1980-MARCH 1981

Market	Number of Cattle Slaughtered	Age		Number of Cattle Slaughtered, October to January	Acquisition Price[3] (FCFA)		Weight of Four Quarters[4] (Kg.)		Weight of Offals[4] (Kg.)		Weight of Saleable[4] Beef Plus Offals (Kg.)		Price Paid Per Kg.,[5] Carcass Weight (FCFA)	
		Mean	S.D.		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Souledé	11	4.8	1.0	9	57,395	16,928	139.3	25.3	31.5	9.9	170.8	30.2	350	58
Ziver	21	4.5	1.4	16	58,238	15,524								
Mokolo[1]	9	4.6	1.0	9	62,250	19,470	162.3	47.9	39.4	8.9	202.2	47.3	326	46
Mokolo[2]	25	5.2	1.2	25	55,940	12,474								
Total[6]	(66) 20	(4.8) 4.7	(1.2) 1.0		(58,075) 60,703	(15,106) 17,958	150.4	35.3	35.3	10.0	185.7	41.4	339	53

SOURCE: Survey of butchering and retailing.

[1]This category includes only stall-fed cattle slaughtered on market day (Wednesday) in Mokolo.

[2]This category includes stall-fed cattle slaughtered on days other than market day in Mokolo.

[3]This refers to the price paid for the stall-fed cattle, as reported by butchers.

[4]Carcass weights were obtained using 200 and 300 pound hanging scales. The weight in pounds was then converted to kilograms.

[5]This is <u>not</u> a weighted mean. Each observation is equally weighted.

[6]The values in parentheses are calculated from the entire sample, whereas all other values were obtained only for those stall-fed cattle slaughtered at Soulede and at Mokolo on market day (for which slaughter weights were obtained).

cattle slaughtered at Soulede were reported as younger but weighed more than cattle slaughtered at Mokolo. This is due to the greater number of stall-fed cattle in the Soulede sample, whereas cattle slaughtered at Mokolo were nearly always range-fed cattle and commonly older females (67 percent). The average acquisition price was slightly higher for the Soulede slaughter cattle, but the average price paid per kilogram of saleable beef plus offals was slightly lower at Soulede than at Mokolo. The average price paid per kilogram of beef plus offals was higher, though, for stall-fed cattle slaughtered at Soulede than at Mokolo. In testing the difference between the two sample means, however, it was found that they are not significantly different at the 10 percent level ($t = .95 < t_{0.1} = 1.75$).

b) Seasonal Pattern of Livestock Slaughter and Red Meat Consumption

Slaughter of stall-fed cattle is concentrated during the months of November, December and January at rural markets. Local farmers, typically sell stall-fed bulls during the first few months of the dry season when the animals attain their maximum liveweights. Butchers at villages such as Ziver, Mandaka, Magoumaz and Roua slaughter stall-fed bulls during the post-harvest period, or they purchase beef from farmers who slaughter their own stall-fed cattle.[9] These butchers occasionally slaughtered range-fed cattle acquired at Gazawa, even though their original intent was to sell the cattle, which were invariably young bulls,

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[9]Producers in the villages near Mokolo procured over half (56 percent according to survey data) of their bulls for stall-feeding themselves at Gazawa, Maroua and Bogo. Moreover, at least half of the remaining bull calves were originally acquired in the plains by small-scale tranders from the Mandara Mountains, who resell the animals to producers. From a regional perspective, 80 percent or more of the stall-fed cattle, initially obtained in the plains, represent inflows.

to local farmers for stall-feeding. The extent to which this practice occurs in other villages of the high plateau and mountainous zones is unknown, but it is probably uncommon. These butcher-traders often sell young bulls that they cannot sell in their villages to producers in other villages or at local markets, such as Tourou.

Beginning in January, slaughter of small ruminants increases significantly, as the supply of slaughter cattle declines in the Mandara Mountains region. These seasonal patterns are shown in Table 6-7 as well as by the slaughter data for Tourou in Annex 3. There are actually two seasonal patterns affecting the slaughter of small stock. First and most important, small ruminants substitute for cattle slaughter in rural markets as the dry season progresses and cattle become increasingly difficult to obtain locally. A second influence, which is shown by the Ziver data, is that small stock slaughter increases markedly in some villages in December. Although the Mandara Mountains is not a highly Christianized region, there are several active missions in the area around Mokolo. Overall demand for livestock products tends to increase, then, at Christmas time and for New Year's celebration. Disposable income also tends to be relatively higher at this time than later in the dry season and during the rainy season. Hence, small ruminant slaughter is significantly higher in some villages in December than during the preceding months.[10]

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[10]The data for slaughter in December at Soulede are misleading in that no slaughter was recorded on the market day after Christmas (the 27th). The head butcher reported that he chose not to slaughter any livestock at this time, because he feared that village-level slaughter of cattle and small ruminant slaughter in household compounds during the Christmas week had already saturated the local meat market. In addition, data concerning small stock slaughter were not collected three weeks earlier (12/6/80), as mechanical problems with a motorcycle greatly delayed the enumerator's arrival at the market.

TABLE 6-7

MONTHLY DISTRIBUTION OF CATTLE AND SMALL RUMINANT SLAUGHTER FOR TWO RURAL MARKETS

Month	Soulede					Ziver				
	Stall-Fed Cattle	Oxen	Range-Fed Cattle	Goats	Sheep	Stall-Fed Cattle	Oxen	Range-Fed Cattle	Goats	Sheep
September	1	0	5	2	1					
October	0	0	7	2	3	3	0	2	0	1
November	4	0	1	1	1	8	1	2	4	1
December	2	0	1	0	0	2	1	4	7	3
January	3	2	2	7	13	3	0	2	10	8
Feburary	0	0	3	10	11	3	0	3	2	4
March	0	0	2	5	4	2	0	2	10	5
Total[1]	10	2	21	27	33	21	2	15	33	22

SOURCE: Survey of butchering and retailing.

[1]The totals for range-fed cattle are slightly lower than those reported in Table 5.5, because Table 5.5 includes cattle data for August (Soulede) and for September (Ziver). Since these data were collected several weeks after the actual slaughter and comparable data on small ruminant slaughter were not obtained at that time, the earlier observations on cattle slaughter were excluded from the above crosstabulation.

While most rural households tend to have greater income at their disposal early in the dry season, following the sweet potato harvest, some households sell peanuts throughout the dry season. These sales provide income for discretionary purchases such as expenditures on livestock products, later in the dry season. Moreover, cash remittances from able-bodied males in many rural households who migrate to Maroua, Garoua or Nigeria for slack period employment, contribute to the continuing strong demand for red meat during the mid- to late-dry season in rural areas. The effect of high demand for beef during the period when the supply of slaughter cattle undergoes contraction is rising beef prices from January through June. Small ruminants substitute in part for cattle during the second half of the dry season, but the overall quantity of animal protein offerred for sale declines; yet a good part of the goat meat and mutton that is bought at rural markets is grilled by butchers' aides and consumed at the marketplace along with ample quantities of sorghum beer. In contrast, beef is rarely grilled by butchers' aides and sold for immediate consumption at the marketplace. Beef bought at the market is usually reserved for household consumption at the compound: as such, it represents a planned expenditure for most buyers.

c) Sources of Rural Slaughter Cattle Supply

Total rural slaughter of cattle is estimated in Chapter Five by calculating regional offtake, netting out urban slaughter of regionally produced cattle, and adding estimated net imports into the region. As was shown in Table 5-3, this yielded an estimate that approximately 24,800 head of cattle were slaughtered in rural areas in 1980. Rural

butchers slaughtered 20,105 head or 81 percent of these animals. The remaining 5,755 head were slaughtered by rural households who have either stall-fed or range-fed animals.

Let us now examine the source of these cattle slaughtered by rural butchers and farm households. Using the data from the stall-feeding survey presented in Table 6-5, it is possible to estimate that some 4,280 head of stall-fed cattle were slaughtered directly by rural households with stall enterprises. The remainder (1,500) of the 5,755 estimated cattle slaughter by rural households comes from household offtake of the regional extensive herd.

As shown in Table 6-5, most of rural butchers' beef supply is obtained by slaughtering cattle acquired on the hoof. Based upon survey findings, observations at secondary markets, it appears that rural butchers obtain some 66 percent of their live slaughter cattle from herders and farmers within the region. Butchers living in stall-feeding production zones also procure an estimated 1,005 stall-fed cattle equivalents from rural households by buying quarters from producer slaughtered animals. This beef acquired "on the rail" represents 5 percent of rural butchers' total supply (see Table 6-5). The remaining 29 percent of rural butchers' supply is obtained by purchasing live animals from markets of the Diamare Plains.

D. RETAIL BUTCHERS' SELLING AND PRICING PRACTICES

1. Urban Retailing and Pricing Practices

Most retailing of beef is done by butchers' aides in Mokolo and other towns in the Mandara Mountains. These apprentices agree on a

wholesale price with their mentor (one of the wholesale butchers) for a quarter of the carcass or for the offals of the slaughtered animal. This wholesale transaction is made on one-day credit. After retailing the beef, the butcher's aide pays the wholesale butcher the agreed-upon sum. Any additional revenue is then the apprentice's return to retailing. Each wholesale butcher has from two to four "boys" who retail the beef, although most of the wholesale butchers retail some of the beef (usually no more than a quarter) themselves. In the larger towns like Maroua and Garoua this practice is rare. Most wholesale butchers are wholesale specialists who do not retail beef.

Butchers' apprentices also perform a number of functions other than retailing meat, for which they are often paid by the task. For example, a wholesale butcher will normally pay his apprentices to trek cattle bought from Fulani herdsmen or Mafa farmers in the bush to the Mokolo area. In addition, wholesale butchers pay their aides to dress out carcasses and to transport the carcass quarters to the marketplace, which is about two kilometers from the Mokolo abattoir. The main source of income for the butchers' apprentices is, however, the revenue earned from retailing the beef. Some of the wholesale butchers would complain that theft of meat by aides is also an important source of the latter's income.

It is not uncommon for wholesale butchers to employ their sons or brothers as assistants. This is the case for three of the wholesale butchers at Mokolo. Other apprentices are often brothers-in-law or friends of the family. Most of the wholesale butchers at Mokolo are middle-aged or older men who are grooming a successor to follow them in the business. They do not hesitate to entrust large sums of money for

cattle acquisition to their closest associates. Several of the wholesale butchers rarely make the trip to Gazawa or Bogo to buy cattle; they send their apprentice-associates instead. The young successor who purchases cattle in the plains' markets for his wholesale mentor usually has grown up in the butchering and retailing trades. Consequently, these associates have considerable experience in estimating returns from individual cattle and in following seasonal price trends.

In the larger towns of the Mandara Mountains region, such as Mokolo, Mora and Koza, two grades of beef are weighed and sold by the kilogram: beef with bones and beef without bones. The control prices in Margui-Wandala are 300 FCFA for the former and 350 FCFA for the latter. The filet, tongue, head, hooves and skin are not sold by the kilogram but rather as one piece or unity. The offals are cut up and sold in small piles at higher prices per kilogram than beef with bones. These piles are never weighed. Small ruminant meat is usually sold by the quarter or cut into small pieces and grilled for consumption at the marketplace of taxi station. It is not subject to price control.

The determination of retail beef price ceilings is left to the jurisdiction of prefectoral administrations in Northern Cameroon, who set prices independently of one another and disregard regional supply and demand factors in the process. As shown in Table 6-8, retail price controls are set at a higher level at Maroua, Garoua and Yagoua than in the principal towns of the Mandara Mountains. Price controls are also less vigorously enforced in the towns outside the Mandara Mountains. Yet cattle prices, which are unregulated in the markets of Northern Cameroon, are lower in the markets of the eastern half of Northern

TABLE 6-8

RETAIL BEEF CONTROL PRICES IN EFFECT AT THE PRINCIPAL TOWNS OF NORTHERN CAMEROON, MARCH 1981 (FCFA/Kg.)

	Mokolo, Koza, Mora	Maroua[1]	Yagoua	Garoua	Kousseri
Beef with Bones	300	400	350	500	300
Beef without Bones	350	450	400	600	350

Source: Prefectoral authorities and Livestock Service officials in Northern Cameroon.

[1]The Maroua authorities were reconsidering price controls on the retail sale of beef in March 1981. There was some discussion of raising the price ceilings to levels corresponding more to those of Garoua.

Cameroon (Mayo-Danai, Diamare Plains) than the western half (Mandara Mountains). Hence, butchers in Mokolo, Koza and Mora generally pay higher wholesale prices per kilogram than Maroua and Yagoua butchers, while being forced to retail beef at lower control prices. This discriminatory price policy has evoked numerous protests from Mokolo butchers, who are forced to bid for slaughter cattle in the Diamare Plains with butchers from Maroua and Gazawa. The effect of alternative retail price policies on urban and rural butchers' procurement practices and on producers' marketing alternatives and returns will be analyzed in Chapter Nine.

2. Rural Retailing and Pricing Practices

As in the towns of the Mandara Mountains region, meat retailing is carried out by wholesale butchers' aides at rural markets. Butchering and retailing enterprises at secondary markets are even more likely to involve fathers and sons than in the towns. The sons or relatives of the wholesale butcher perform a number of functions, such as leading livestock from the bush to the market and dressing out the carcass, in addition to retailing the meat. Whereas urban wholesale butchers often depend upon trusted associates to procure cattle for them, especially at Gazawa, the rural wholesale butchers usually buy slaughter cattle themselves. Wholesale butchers at some of the secondary markets such as Tourou, Mandaka and Magoumaz, who purchase cattle at Gazawa, sometimes resell the animals to other wholesale-retail butchers for slaughter on market day or to farmers who intend to stall-feed the cattle.

Sons, relatives and brothers who perform services for the wholesale butchers are usually recompensed. The revenue earned from retail sales

usually goes to the family caisse. It is less common for rural butchers to sell quarters to apprentices than it is for their urban counterparts. This practice does take place, though, especially in the larger secondary markets. While half of the beef may be retailed by the wholesale butcher and his son(s), the other half may be sold on one-day credit to retail butchers.

In the absence of retail price controls at rural markets, beef is sold at far higher prices per kilogram than at urban markets. Most beef is sold bone-in by the pile and not by the kilogram. Sales of beef without bones are uncommon and made only at the insistence of relatively wealthy consumers. Moreover, it is quite common for rural butchers to sell piles of offals and beef mixed together. Small ruminant meat is nearly always grilled and sold in small quantities to consumers at the marketplace.

E. SEASONAL VARIATION IN RETAIL BEEF AND SMALL RUMINANT MEAT PRICES

Purchased beef and small ruminant meat were weighed weekly at three periodic markets in the Mandara Mountains (Mokolo, Tourou and Soulede) and at one market in the Diamare Plains (Gazawa). Table 6-9 summarizes the average monthly retail prices for the different types of meat, which were calculated by taking the monthly average of the mean values for each week.[11] The average monthly prices for beef with bones, beef without bones, and offals are plotted in Figures 6-2 through 6-4.

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[11]The weekly mean retail prices were calculated by dividing the total sum paid for purchased meat in the sample observations by the total weight of that purchased meat.

TABLE 6-9

AVERAGE MONTHLY RETAIL BEEF PRICES (FCFA/kg.) AT FOUR REPRESENTATIVE MARKETS, SEPTEMBER 1980-MARCH 1981[a]

	Beef with Bones				Beef without Bones				Offals (Beef)[b]		
Month	Mokolo	Souledé	Tourou	Gazawa	Mokolo	Souledé	Tourou	Gazawa	Mokolo	Tourou	Gazawa
September	269	444		544	323	463		631	316		606
October	281	435	408	549	336	650	450	654	308	390	569
November	294	442	563	736	354	558	792	856	348	482	401
December	278	425	654	756	356	549	972	586	325	564	382
January	295	607	611	568	391	889	775	620	328	531	398
February	298	701	585	565	412	720	694	778	414	450	434
March	298	746	683	640	355	976	1033	705	338	546	530
Unweighted 6-7 Month Average	288	543	584	623	361	686	786	690	340	494	474

[a]The average monthly retail prices were obtained by taking an unweighted average of the weekly average prices, which are weighted.

[b]Cattle offals are not retailed alone at Souledé. Rather, they are sold together with beef. This is a separate category, which is not included in the table.

FIGURE 6-2

AVERAGE MONTHLY RETAIL PRICES FOR BEEF WITH BONES AT FOUR RETAIL MARKETS, SEPTEMBER 1980-MARCH 1981

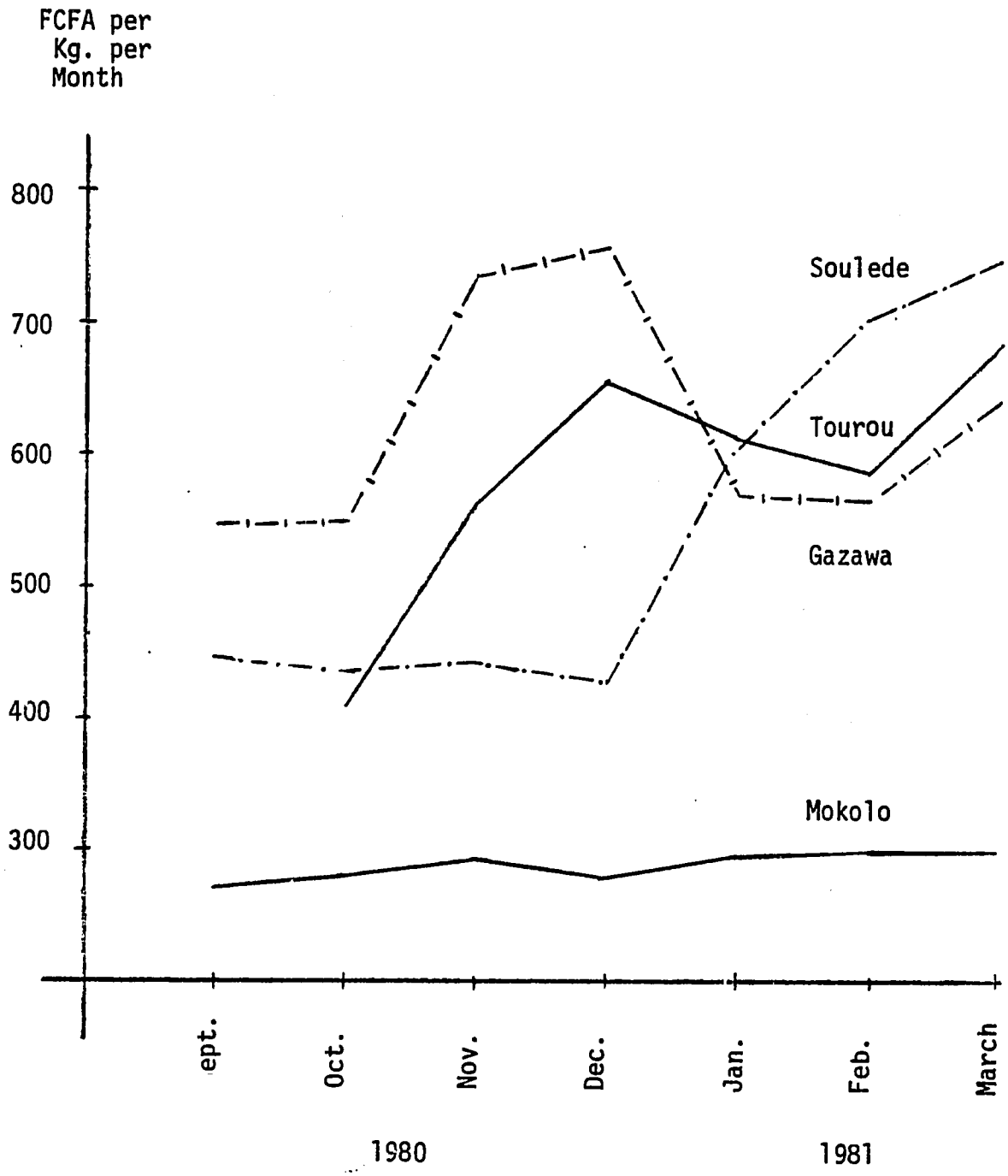


FIGURE 6-3

AVERAGE MONTHLY RETAIL PRICES FOR BEEF WITHOUT BONES AT FOUR RETAIL MARKETS, SEPTEMBER 1980-MARCH 1981

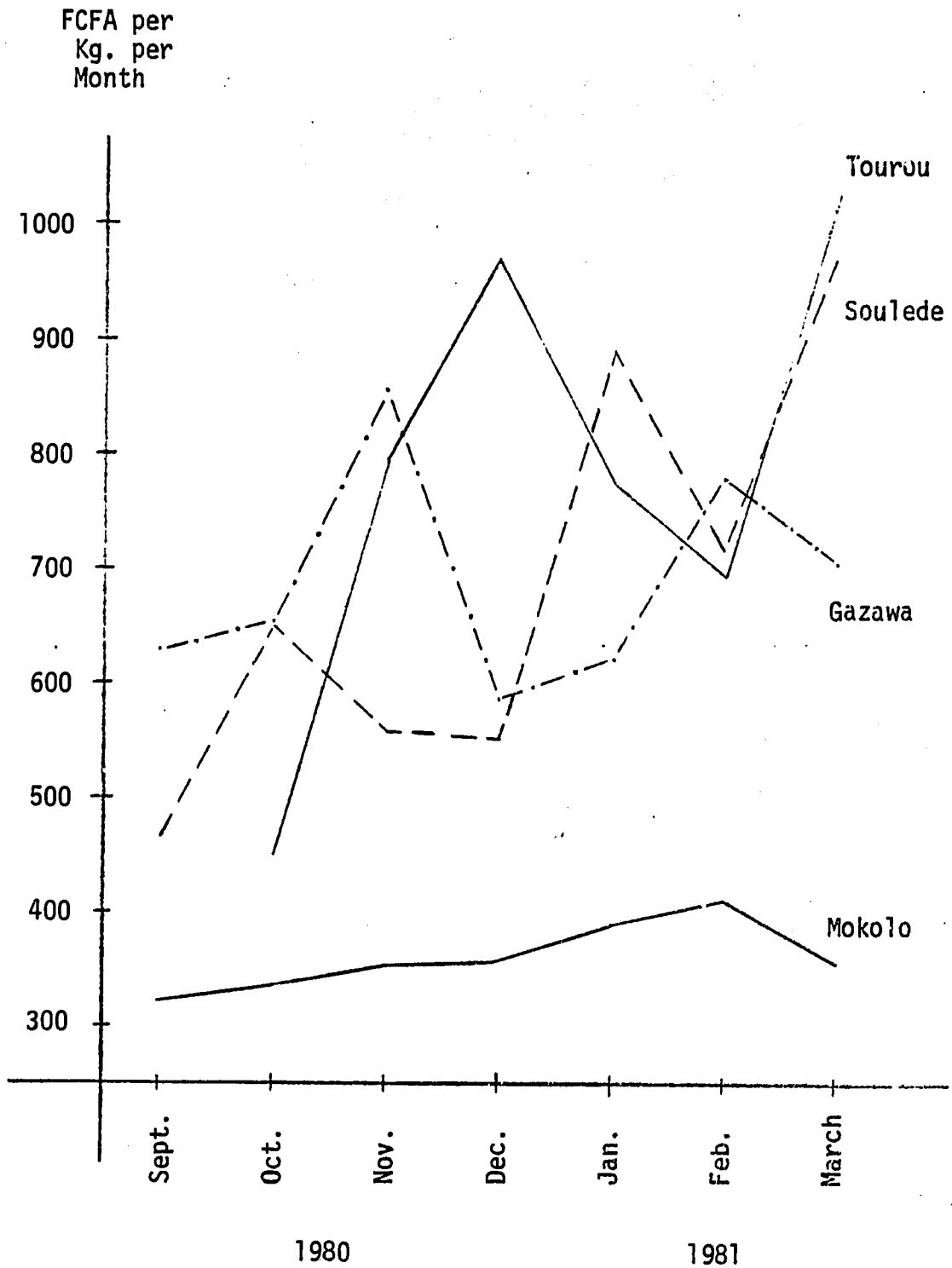
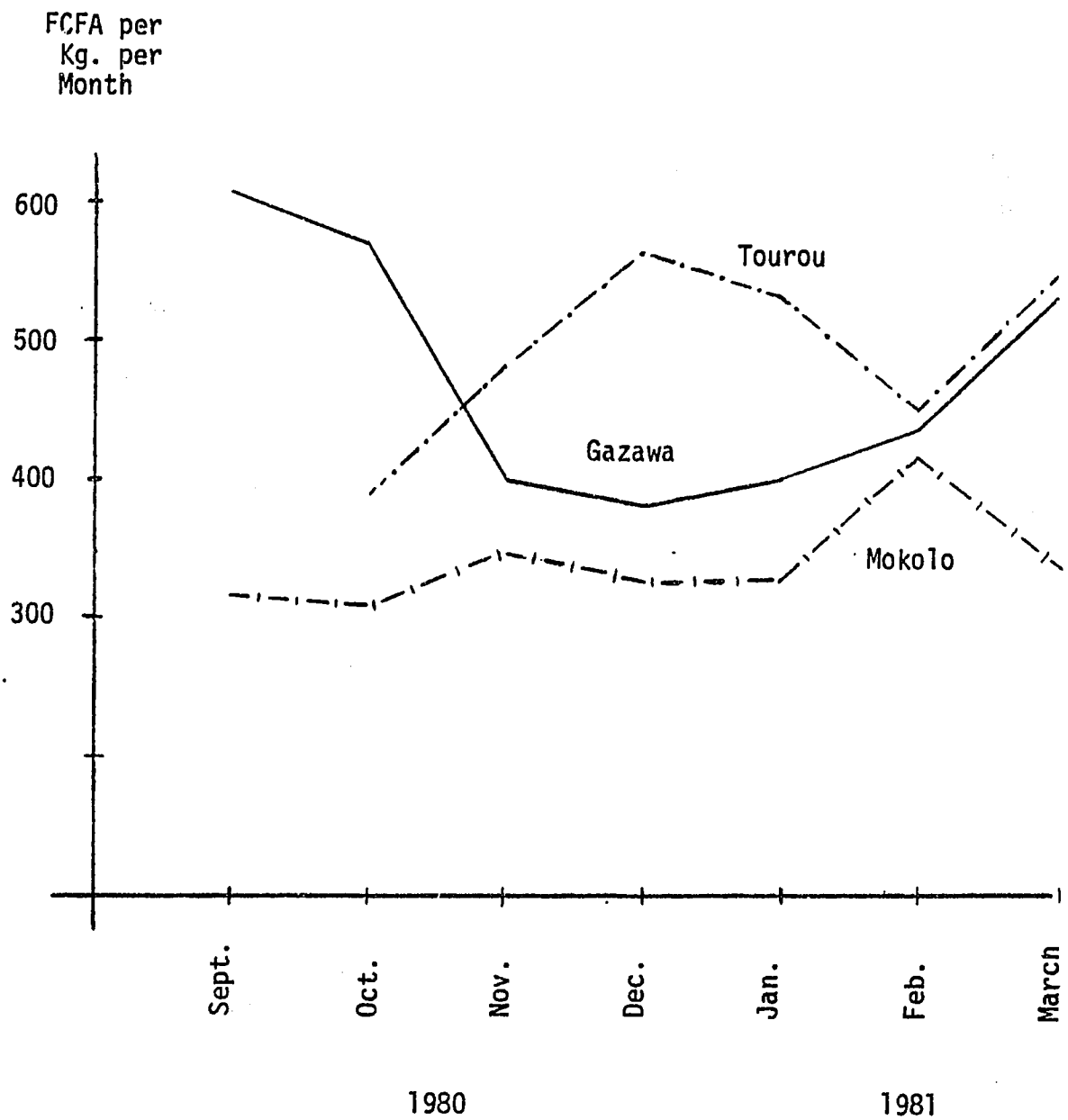


FIGURE 6-4

AVERAGE MONTHLY RETAIL PRICES FOR OFFALS AT THREE RETAIL MARKETS, SEPTEMBER 1980-MARCH 1981



The most striking characteristic of the data is how low beef prices are in Mokolo compared to the other markets. Retail price controls of 300 FCFA for beef with bones and 350 FCFA for beef without bones are enforced, and our data show that the Mokolo butchers respect the controls when weighing beef for sale. Offals are not subject to price control, and butchers sell them by the pile at prices per kilogram that are somewhat lower than prices for beef without bones. As a result of the retail price controls, there is little seasonal variation in beef prices at Mokolo. Prices trended upward very gently from September 1980 to March 1981.

While beef prices at Mokolo (and Koza and Mora) were maintained artificially low by price controls, retail prices for beef with and without bones at Soulede, Tourou and Gazawa were roughly double those at Mokolo, when averaged over the six to seven month period. During the months of September and October 1980, the retail beef prices at Soulede and Tourou ranged between 34 percent and 93 percent higher than prices at Mokolo, though they tended to average around 50 percent higher. Retail beef prices at Soulede remained lower than prices at Tourou and Gazawa from September 1980 until January 1981, at which point they were more than double the Mokolo prices. Beef prices at Tourou increased sharply in November and December 1980 as a result of rising demand for beef. This was due to greater attendance at the market by Cameroonian and Nigerian farmers, who had time to come to the market following the harvest and whose disposable income was highest on account of cash crop sales. Although beef prices dipped somewhat at Tourou in January and February, they reached their highest levels in March.

While the seasonal rise in prices during the dry season is clear at Soulede and Tourou, beef prices (with the exception of offals) varied within a narrower range at Gazawa. Gazawa is a far larger town than Soulede or Tourou, and its market attracts a larger number of participants. Consequently, demand for beef is less variable at Gazawa than at rural markets such as Soulede or Tourou, where seasonal variation in market attendance causes demand to swing widely.[12]

F. BUTCHERS' COSTS AND RETURNS UNDER PRESENT PROCUREMENT STRATEGIES

1. Rural Butchers

Rural butchers procure most of their cattle locally, only buying at Gazawa when local supplies of slaughter cattle are unavailable. Although they pay slightly less per kilogram for their animals than urban butchers, they are able to pay more if necessary. This is because they are able to pass on the higher acquisition cost to rural consumers, who paid nearly twice the amount per kilogram than urban consumers at Mokolo paid from September 1980 through March 1981.

Table 6-10 shows rural butchers' average costs and returns of slaughtering and retailing range-fed cattle at Soulede over a seven month

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[12]A seasonal factor that does affect the demand for beef at Gazawa, however, is the cotton harvest. Although cotton is harvested in November, it is often not sold until March or April of the following year. In the region around Gazawa (especially toward Mokong) cotton was weighed and bought by SODECOTON shortly after the harvest in 1980. As a result, farmers attending the Gazawa market had more cash available than usual, which permitted them to make discretionary purchases such as the purchase of beef. Retail prices for beef with and without bones were highest at Gazawa during the month of November. The price of beef with bones, the category for which the number of observations is greatest, remained high in December at Gazawa. This was probably due to the strong demand for trade cattle in Nigeria before Christmas. Since butchers at Gazawa sometimes slaughter large, well-fleshed cattle that they buy at the Gazawa cattle market, they were forced to compete with cattle traders in order to acquire higher grade animals for slaughter.

TABLE 6-10

COSTS AND RETURNS FOR RURAL BUTCHERING AND RETAILING OF RANGE-FED CATTLE AT SOULEDE, SEPTEMBER 1980-MARCH 1981

Cost and Return Categories	Amount (FCFA)	Percentage of Total Costs
Costs:		
1. Purchase of animal with carcass weight of 108.5 kg. near Soulede at 310 FCFA/kg.[1]	33,645	89.0
2. Payment to apprentices for leading animal from the bush to Soulede	500-1,000	1.3-2.6
3. Slaughter tax	400	1.1
4. Payment to Mallam to cut throat	200	0.5
5. Payment to apprentices for dressing out animal[2]	750-900	2.0-2.4
6. Retail marketing tax	100	0.3
7. Amortization of butcher's license[3]	368	1.0
8. Loss through condemnation, death, flight, etc.[4]	1,230	3.3
9. Opportunity cost of capital[5]	294	0.8
Total Costs	37,487-38,137	100
Receipts:[6]		
1. 80 kilograms of beef sold bone-in at 543 FCFA/kg.	43,440	
2. 5 kilograms of beef sold bone-out at 3,430	3,430	
3. 2.8 kilograms of filet sold at 657 FCFA/kg.	1,840	
4. Head	1,000-1,500	
5. Hide	400-500	
6. Tail (1 kg.)	250-300	
7. Hooves	800-1,000	
8. Hump (2 kg.)	2,000	
9. Tongue	500-1,000	
10. Other offals: intestines, spleen, heart, liver, kidneys, lungs (19.5 kg. sold at 447 FCFA/kg.)	8,717	
Total Receipts	62,377-63,727	
Net Return to the Butcher's Labor and Management and to the Labor of the Apprentices	24,240-26,240	
Net Returns/Total Receipts	38.9-41.2%	

[1]The mean acquisition price for range-fed cattle slaughtered at the Soulede market whose carcasses were weighed was 33,645 FCFA. The mean carcass weight was 108.5 kilograms, of which 87.8 kilograms were the four quarters and 20.7 kilograms were offals. The head, hide and hooves are not included in the carcass weight.

[2]Payment to apprentices for dressing out slaughtered cattle is often in kind.

[3]The head butcher at Soulede paid 12,500 FCFA for his license in 1980. He slaughtered 24 head of cattle from mid-August 1980 through mid-March 1981. In the remaining five months we estimate that he slaughtered 10-12 more head, based upon informal interviews and knowledge of the seasonality of cattle slaughter at rural markets in the Mandara Mountains.

[4]The head butcher reported that he had no losses due to mortality, theft or flight of cattle. Veterinary inspection does not take place at the Soulede market, so no slaughter cattle were condemned. It is assumed, however, that two animals among the estimated 34 acquired for slaughter during the year by the principal butcher died before slaughter and that sales of beef from the dead animals generated half as much revenue as normal slaughter and sale.

[5]The wholesale butcher has an estimated 100,000 FCFA invested in the butchering and retailing enterprise at an opportunity cost of 10% per year. The opportunity cost of the butcher's capital is therefore 10,000 FCFA per year or 294 FCFA per animal.

[6]The retail prices of different parts of the carcass are based upon data collected during the survey of retailing at Soulede. None of the prices were controlled, as at Mokolo.

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period. Most of the range-fed cattle slaughtered at Soulede are lightweight animals bought from local farmers and herders, acquired at an average price of 33,645 FCFA per head, which is nearly 6,000 FCFA below the average acquisition price for range-fed cattle slaughtered at Mokolo. The butchers retail almost all of the beef bone-in at an average price of 543 FCFA per kilogram. Net returns average 24,200-26,200 FCFA per head, which is 39-41 percent of total receipts. Not all of this sum is a return to the wholesale butcher who bought the live animal. Rather, it is common for the wholesale butcher to retail one to two quarters of beef and sell the other quarters and the offals to apprentices on one-day credit. Hence, the 24,2000-26,700 FCFA are a net return to the labor and management of several individuals. The wholesale butcher is able to capture most of the net return, but the apprentices are usually able to earn a return of at least 1,000 FCFA for their retailing efforts.

At Soulede three apprentices usually assisted the chief wholesale butcher. Assuming that each apprentice earned an average of 3,000 FCFA per week for retailing beef, then the wholesale butcher netted 15,200-17,700 FCFA per head. The head butcher slaughtered 14 range-fed cattle from mid-August 1980 through mid-March 1981. We estimate that he slaughtered ten more head of cattle from mid-March through mid-August 1981 and that these were all range-fed animals. Total annual returns to slaughter of range fed cattle were, therefore, 364,800-412,800 FCFA ($1,520-$1,720, where $1.00 = 240 FCFA).

Table 6-11 shows that stall-fed cattle and oxen slaughtered at Soulede were acquired at an average price of 61,374 FCFA, nearly twice

TABLE 6-11

COSTS AND RETURNS FOR RURAL BUTCHERING AND RETAILING OF STALL-FED CATTLE AND OXEN AT SOULEDE, SEPTEMBER 1980-MARCH 1981[1]

Cost and Return Categories	Amount (FCFA)	Percentage of Total Costs
Costs:		
1. Purchase of stall-fed bulls and oxen with an average carcass weight of 173.3 kg. near Soulede at 354 FCFA/kg.[2]	61,375	93.6
2. Payment of apprentices for leading animal from the bush to Soulede	500-1,000	0.8-1.5
3. Slaughter tax	400	0.6
4. Payment to Mallan to cut throat	200	0.3
5. Payment to apprentices for dressing out animal[3]	750-900	1.1-1.4
6. Retail marketing tax	100	0.2
7. Amortization of butcher's license[4]	358	0.6
8. Loss through condemnation, death, flight, etc.[5]	1,230	1.9
9. Opportunity cost of capital[6]	294	0.4
Total Costs	65,217-65,867	100
Receipts:[7]		
1. 125 kilograms of beef sold bone-in at 543 FCFA/kg.	67,875	
2. 10 kilograms of beef sold bone-out at 686 FCFA/kg.	6,860	
3. 45 kilograms of filet sold at 637 FCFA/kg.	2,957	
4. Head	1,500	
5. Hide	500	
6. Tail (2.25 kg.)	300	
7. Hooves	800-1,000	
8. Hump (2.3 kg.)	2,000	
9. Tongue	500-1,000	
10. Other offals: intestines, spleen, heart, liver, kidneys, lungs (31.5 kg. sold at 447 FCFA/kg.)	14,081	
Total Receipts	97,673-98,373	
Net Returns to the Butcher's Labor and Management and to the Labor of the Apprentices	31,806-33,156	
Net Returns/Total Receipts	32.6-33.7%	

[1]Oxen are included in the calculation of costs and returns to stall-fed cattle slaughter, because they are large, well-fleshed cattle of comparable weight and price to stall-fed bulls. Including the oxen in the calculation of costs and returns to slaughter of range-fed cattle would bias the results, since most range-fed cattle are underweight old cows or young males.

[2]The mean acquisition price for the ten stall-fed bulls and two oxen slaughtered at Soulede market whose carcasses were weighed was 61,375 FCFA. The mean carcass weight was 173.3 kilograms, or which 139.5 kilograms were the four quarters and 33.8 kilograms were offals. The head, hide and hooves are not included in the carcass weight.

[3]Payment to apprentices for dressing out slaughtered cattle is often in kind.

[4]The head butcher at Soulede paid 12,500 FCFA for his license in 1980. He slaughtered 24 head of cattle from mid-August 1980 through mid-March 1981. In the remaining five months we estimate that he slaughtered at most 16 more head, based upon informal interviews and knowledge of the seasonality of cattle slaughter at rural markets in the Mandara Mountains.

[5]The head butcher reported that he had no losses due to mortality, theft or flight of cattle. Veterinary inspection does not take place at the Soulede market, so no slaughter cattle were condemned. It is assumed, however, that two animals among the estimated 34 acquired for slaughter during the year by the principal butcher died before slaughter and that sales of beef from the dead animals generated half as much revenue as normal slaughter and sale.

[6]The wholesale butcher has an estimated 100,000 FCFA invested in the butchering and retailing enterprise at an opportunity cost of 10% per year. The opportunity cost of the butcher's capital is therefore 10,000 FCFA per year or 294 FCFA per animal.

[7]The retail prices of different parts of the carcass are based upon data collected during the survey of retailing at Soulede from September 1980 through March 1981. None of the prices were controlled, as at Mokolo.

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the price of range-fed cattle. The per kilogram cost (carcass weight) was 14 percent higher for the stall-fed bulls and oxen. The wholesale butcher slaughtered ten of these well-fleshed animals during the survey, for which the average net return to the labor and management of the butcher and his apprentices was 31,800-33,200 FCFA. Assuming that the apprentices were able to earn 5,000 FCFA each from retailing the higher quality stall-fed beef, we estimate that the net return to the wholesale butcher's labor and management was 16,800-18,200 FCFA per head or 168,000-182,000 FCFA for the ten stall-fed bulls and oxen. The annual net return to the wholesale butcher's labor and management is, therefore, 532,800-594,800 FCFA for 1980-1981.

We further estimate that the wholesale butcher spends 73 man-days procuring and supervising the slaughter of the cattle and retailing part of the beef.[13] Therefore, the net return to the wholesale butcher's labor and management is 7,300-8,150 FCFA per man-day.

It is possible that net returns per head are lower for range-fed cattle slaughtered during the late dry season and rainy season (April-August). Acquisition costs per kilogram are probably higher from April through June than during the period of data collection, as the supply of slaughter cattle declines. Farmers and herders are reluctant to sell when their animals are lightest and in poor condition. By the time the rains have become regular, rural income flows fall off, and farming occupies cultivators, market attendance drops and demand for beef decreases.

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[13]The wholesale butcher spends an estimated average of two working days per head in procuring and slaughtering cattle and retailing the beef for animals acquired in the Soulede area. Two and one-half working days are assumed for butchering and retailing each of the estimated seven head procured at Gazawa during the year.

As a result, rural butchers probably have to lower the retail price of beef in order to sell all of it.

The retail price data for Soulede show that beef without bones was sold at an average price of 437 FCFA per kilogram from September through December 1980, significantly below the seven month average of 543 FCFA. This suggests that rainy season (July-September) beef prices are lower than mid-dry season prices, which would cause the wholesale butcher's net returns to decline. During the late dry season and early rainy season (April-June), higher cattle acquisition costs might be offset by higher retail prices for beef, which trended upward from December 1980 through March 1981. Without data for April-June 1981, we can only speculate on the effect of the simultaneous contraction of supply and demand on butchers' returns.

If it is assumed that the wholesale butcher's net returns are only 8,000 FCFA per head of range-fed cattle slaughtered during the period for which we lack data, then net returns to labor and management fall to 6,300-6,900 FCFA per man-day. If the apprentices earn returns twice as high as initially assumed (and the above assumption is retained), then the wholesale butcher's return to labor and management drops to 3,800-4,400 FCFA per man-day. Despite the above adjustments, returns to labor and management remain high.

2. Urban Butchers

In contrast to rural butchers, urban butchers procure most of their slaughter cattle at markets in the Diamare Plains. As shown in Table 6-4, butchers at Mokolo acquired 83 percent of their slaughter cattle from September 1980 through March 1981 in the plains and 84 percent of

this proportion at Gazawa. Thirteen percent of their slaughter cattle were range-fed cattle from around Mokolo, while 4 percent were stall-fed bulls. Tables 6-12 and 6-13 show representative costs and returns for butchering and retailing of range-fed and stall-fed cattle at Mokolo from September 1980 through March 1981.

The principal difference in cost between slaughter of range-fed and stall-fed cattle is that acquisition cost is a larger proportion of total cost for stall-fed cattle slaughter. Moreover, there is no loss through condemnation, forced sale, mortality, obligatory trucking of weak and diseased stock, or flight for stall-fed cattle. Based upon informal interviews with the principal butchers at Mokolo, we estimate that they lose two to ten of the head bought each year at Gazawa, Bogo and Maroua. Losses occur most frequently during the late dry season and early rainy season, when pasture and water resources between Gazawa and Mokolo are depleted. In contrast, it is rare for butchers, whether urban or rural, to lose stall-fed cattle to mortality or to be forced to sell bulls en route from neighboring villages to market. Stall-fed cattle are bought for slaughter during the late rainy season and early dry season, when they are in fine condition and grazing and water resources are adequate. Treks from local villages to Mokolo are short and can be made in less than three hours.

a) Returns to Slaughtering Range-Fed Cattle

The range of net returns to butchers' labor and management and to the labor of the apprentices is quite variable for range-fed cattle and depends upon the prices butchers are able to obtain for the parts of the carcass not sold at a fixed price per kilogram. The liver, hide, tail,

TABLE 6-12

URBAN BUTCHERS' COSTS AND RETURNS FOR BUTCHERING RETAILING RANGE-FED CATTLE AT MOKOLO, SEPTEMBER 1980-MARCH 1981

Cost and Return Categories	Amount (FCFA)	Percentage of Total Costs
Costs:		
1. Purchase of animal with carcass weight of 123.4 kg. at Gazawa at 320 FCFA/kg.[1]	39,513	91.7
2. Market tax at Gazawa plus cattle movement permit	200	0.5
3. Transport of butcher to and from Gazawa cattle market	700	1.6
4. Convoying of animal from Gazawa cattle market to Mokolo	150-300	0.3-0.7
5. Trucking of weak or injured cattle to Mokolo[2]	127	0.3
6. Payment to herder for herding animal from time of arrival at Mokolo (Saturday) and slaughter (Wed.)	200-400	0.5-0.9
7. Slaughter tax	100	0.2
8. Retail marketing tax	400	0.9
9. Payment to Mallam to cut throat	100	0.2
10. Payment to apprentices for dressing out animal[3]	500-1,000	1.2-2.3
11. Transport of meat from slaughter slab to market	300	0.7
12. Amortization of butcher's license[4]	99	0.2
13. Loss through condemnation, death en route (Gazawa-Mokolo), flight of animal[5]	834	1.9
14. Opportunity cost of capital[6]	63	0.1
Total Cost	42,714-43,564	100
Receipts:[7]		
1. 80 kilograms of beef sold bone-in at 300 FCFA/kg.	24,000	
2. 11 kilograms of beef sold bone-out at 350 FCFA/kg.	3,850	
3. 2.8 kilograms of filet sold at 525 FCFA/kg.	1,470	
4. Liver (3-5 kg. at 400 FCFA/kg.)	1,200-2,000	
5. Head	700-2,000	
6. Hide	500-700	
7. Tail (1-2 kg.)	250-400	
8. Hooves	600-1,000	
9. Hump	500-1,200	
10. Tongue	500-1,000	
11. Other Offals: intestines, spleen, heart, kidneys, lungs (23 kg. sold at 350 FCFA/kg.)	8,160	
Total Receipts	42,730-46,780	
Net Return to the Butcher's Labor and Management and to the Labor of the Apprentices	-834-4,066	
Net Return/Total Receipts	-1.9-8.7%	

[1]The mean acquisition price for cattle slaughtered at the Mokolo slab on the day of the big market (Wednesday) from September 1980 through March 1981 was 40,443 FCFA. The mean carcass weight was 123.4 kilograms, of which 93.8 kilograms were the four quarters and 29.5 kilograms were offals. The head, hide and hooves are not included in the carcass weight.

[2]During the late dry season and early rainy season (March-June), there is little or no forage and water along the road from Gazawa to Mokolo. Butchers are sometimes compelled to pay 2,000-4,000 FCFA per head to truck weak or injured cattle from points along the road to Mokolo. In addition, Mokolo butchers occasionally buy unhealthy or injured cattle from Fulani herders near Mokolo during the rainy season. Sometimes these animals have to be trucked from the bush to Mokolo. It is assumed that ten head of cattle were trucked to Mokolo at an average cost of 3,000 FCFA per head in 1980-81.

[3]Payment to apprentices for dressing out slaughtered cattle is often in kind.

[4]23,360 FCFA was the average sum paid for a license in 1980 by the seven principal butchers of Mokolo. These seven butchers accounted for 93.7% of the cattle slaughtered during the course of the survey research. These butchers accounted for at least 90% of the slaughter during 1980, when 1845 head of cattle were slaughtered at Mokolo, or for 1661 head. Hence, each butcher slaughtered an average of 237 head during 1980.

[5]Condemnation of slaughter cattle at Mokolo is not unusual, since the Veterinary Service inspects slaughtered animals each day at the Mokolo slab and butchers frequently buy unhealthy stock at a discount for slaughter. In addition, it is not uncommon for Mokolo butchers to lose several head per year on the road from Gazawa to Mokolo. This problem is especially serious during the late dry season and early rainy season, when weakened and diseased cattle trekked 55 kilometers are vulnerable to the heat and inadequate water and grazing resources along the road. Based upon Mokolo butchers' reports, an average of five head were condemned or died before slaughter in 1980-81.

[6]Wholesale butchers have an estimated 150,000 FCFA invested in butchering and retailing enterprises at an opportunity cost of 10% per year. The opportunity cost of the butchers' capital is therefore 15,000 FCFA per year or 63 FCFA per animal.

[7]The retail prices of different parts of the carcass are based upon data collected during the survey of retailing at Mokolo. We chose to use 300 FCFA per kilogram as the retail price of beef with bones and 350 FCFA per kilogram as the retail price of beef without bones, since these are the official control prices enforced at Mokolo. Our data show that these prices were closely observed by the butchers (288 FCFA/kg. for beef with bones and 361 FCFA/kg. for beef without bones) from September 1980-March 1981.

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TABLE 6-13

AVERAGE COSTS AND RETURNS FOR URBAN BUTCHERING AND RETAILING OF STALL-FED CATTLE AT MOKOLO, OCTOBER-DECEMBER 1980

Cost and Return Categories	Amount (FCFA)	Percentage of Total Costs
Costs:		
1. Purchase of stall-fed bull with carcass weight of 200.1 kg. at 326 FCFA/kg.[1]	65,250	95.4
2. Transport of butcher to village near Mokolo where bull acquired[2]	200-500	0.3-0.7
3. Payment to apprentices for leading bull from village to Mokolo	500-1000	0.7-1.5
4. Payment to herder for herding bull near Mokolo	200-400	0.3-0.6
5. Slaughter/retail marketing taxes	400	0.6
6. Payment to Mallam to cut throat	100	0.2
7. Payment to apprentices for dressing out animal[3]	500-1000	0.7-1.5
8. Transport of meat from slaughter slab to market	300	0.4
9. Amortization of butcher's license[4]	99	0.1
10. Loss through condemnation[5]	0	0
11. Opportunity cost of capital[6]	63	0.1
Total Costs	67,612-69,112	100
Receipts:[7]		
1. 125 kilograms of beef sold bone-in at 300 FCFA/kg.	37,500	
2. 30 kilograms of beef sold bone-out at 350 FCFA/kg.	10,500	
3. 5.8 kilograms of filet sold at 525 FCFA/kg.	3,045	
4. Liver (5 kg. at 400 FCFA/kg.)	2,000	
5. Head	2,000	
6. Hide	700	
7. Tail (2-3 kg.)	400	
8. Hooves	1,000	
9. Hump	2,000	
10. Tongue	1,000	
11. Other offals: intestines, spleen, heart, lungs, kidneys (34.5 kg. sold at 340 FCFA/kg.)	11,730	
Total Receipts	71,875	
Net Return to the Butcher's Labor and Management and to the Labor of the Apprentices	2,763-4,263	
Net Return/Total Receipts	3.8-5.9%	

[1]Nine stall-fed bulls were slaughtered on market day at Mokolo from October 1980 through January 1981. These animals were purchased at an average acquisition price of 62,250 FCFA and their carcasses weighed an average of 200.1 kilograms, of which 162.5 kilograms were the four quarters and 37.6 kilograms were the offals. The head, hooves and hide are not included in the carcass weight

[2]Several of the principal butchers own a motorcycle or motorbike, which they use when buying cattle for slaughter from farmers or Fulani herders who live within 20 kilometers of Mokolo. The others borrow or rent motorbikes when they need to visit nearby villages or herds. We estimate that the fuel, rental and depreciation costs range from 200 to 500 FCFA per trip, depending on the distance travelled and the condition of the roads over which the butchers must travel. All of the stall-fed cattle acquired for slaughter at Mokolo on market day were bought from farmers residing within ten kilometers of Mokolo.

[3]Payment to apprentices for dressing out slaughtered cattle is often in kind.

[4]23,360 FCFA is the average sum paid for a license in 1980 by the seven principal butchers of Mokolo. These seven butchers accounted for 93.7% of the cattle slaughtered during the course of the survey research. These butchers accounted for at least 90% of the slaughter during 1980, when 1845 head of cattle were slaughtered at Mokolo, or for 1661 head. Hence, each butcher slaughtered an average of 237 head during 1980.

[5]Stall-fed cattle acquired for urban slaughter are invariably in excellent condition. Furthermore, the bulls are trekked short distances during the early dry season, when pasture and water resources are adequate. They lose little or no weight and do not become weak and vulnerable to disease, as do some range-fed cattle trekked from Bogo or Gazawa to Mokolo during the late dry season or early rainy season.

[6]Wholesale butchers have an estimated 150,000 FCFA invested in butchering and retailing enterprises at an opportunity cost of 10% per year. The opportunity cost of the butchers' capital is therefore 15,000 FCFA per year or 63 FCFA per animal.

[7]The retail prices of different parts of the carcass are based upon data collected during the survey of retailing at Mokolo. We chose to use 300 FCFA per kilogram as the retail price of beef with bones and 350 FCFA per kilogram as the retail price of beef without bones, since these are the official control prices enforced at Mokolo. Our data show that those prices were closely observed by the butchers (288 FCFA/kg. for beef with bones and 361 FCFA/kg. for beef without bones) over a six-month period (September 1980-March 1981).

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hooves, hump and tongue fetch higher prices for larger animals than for smaller ones. An average return for butchering and retailing of range-fed cattle is approximately 1,600 FCFA per head. This return is divided between the wholesale butcher and his apprentices, who buy parts of the carcass from the wholesale butcher on one-day credit and retail the beef. Assuming that two apprentices each earn 300 FCFA per animal, then the average return to the wholesale butchers' labor and management is 1,000 FCFA per head, which is only 2.5 percent of the average acquisition price paid for range-fed cattle.

From the Mokolo survey data and Livestock Service slaughter statistics, it appears that each of the principal butchers at Mokolo slaughters some 237 head per year of which 231 head are range-fed cattle. If the average net return to wholesale butchers' labor, and management is 1,000 FCFA per head of range-fed cattle, then their annual income from slaughtering range-fed cattle is 231,000 FCFA (or $963 at an exchange rate of $1.00 = 240 FCFA).

Butchers at Mokolo report that returns to slaughtering range-fed cattle are generally highest during the rainy season, especially from May through July. Although cattle prices per kilogram are not lowest during the rainy season, Fulani herders return to graze their herds on the plateau near Mokolo, increasing the locally available supply of cattle. Herders invite butchers to bid on cull cattle, which they sell in order to pay seasonal laborers to cultivate their fields. Herders sometimes send urgent messages to butchers, pleading them to quickly buy and slaughter diseased or weak stock. In the event of distress sales, herders accept low prices in order to avoid the total loss that mortality

represents. At the same time, butchers take on the risk that the animal will die before it is slaughtered. In a few instances butchers pay local transporters to haul weak or diseased cattle bought from herders to Mokolo. This costs 3,000-4,000 FCFA per head, even though the distances are usually less than ten kilometers.

b) Returns to Slaughtering Stall-Fed Cattle

Only 9 of the 220 cattle slaughtered at Mokolo on market-day from September 1980 through March 1981 were stall-fed bulls, so our estimates of costs and returns are based on a small sample.[14] Stall-fed cattle are only slaughtered at Mokolo from October through December, when the supply of slaughter cattle is plentiful and butchers are able to procure cattle at relatively low prices per kilogram.[15] The Mokolo butchers paid 326 FCFA per kilogram (for the four quarters plus offals) for eight stall-fed bulls, while they paid 320 FCFA per kilogram for the 211 range-fed cattle. Butchers at Soulede paid 350 FCFA per kilogram for stall-fed bulls, which is the price Mokolo butchers would have to pay in order to compete with rural butchers in the bidding process. If Mokolo butchers had paid 350 FCFA per kilogram for their stall-fed bulls, their returns to butchering and retailing would have been negative.[16]

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[14]The slaughter data are complete for only eight of the nine animals. The sample means are calculated from these eight head.

[15]Producers prefer to sell stall-fed cattle when the bulls are heaviest, which is during the early months of the dry season. Prices per kilogram are lowest for all types of cattle at that time.

[16]If Mokolo butchers paid 350 FCFA per kilogram of beef and edible offals for stall-fed cattle, as paid by Soulede butchers, then net returns to urban butchers' labor and management and to the labor of the apprentices would be 1,257-1,757 FCFA.

Net returns to the labor, management and capital of the wholesale butcher and the labor of the apprentices averaged 3,500 FCFA per stall-fed bull. Assuming that the apprentices to the wholesale butcher earn a return of 500 FCFA each from retailing stall-fed beef, the return to the wholesale butcher's capital, labor and management is 2,500 FCFA per head or 3.8 percent of the average acquisition price for stall-fed cattle. Each of the seven principal wholesale butchers at Mokolo slaughters at most six head of stall-fed cattle per year.[17] Assuming an average net return of 2,500 FCFA per head of stall-fed cattle, the wholesale butchers earn 15,000 FCFA from slaughtering the stall-fed bulls.

The return to slaughtering stall-fed bulls is higher than returns to slaughtering range-fed cattle, reflecting the experience and good judgement of the Mokolo butchers, who responded to the opportunity to procure these cattle at low prices during the immediate post-harvest period (October-December) of abundant supply. The Mokolo butchers report, however, that these opportunities arise infrequently. Rural butchers, whose offer prices are not constrained by retail price controls, and local smugglers are able to offer higher prices than urban butchers, who must sell most of the carcass at 300-350 FCFA per kilogram. Therefore, Table 6-13 is misleading in that it illustrates the maximum return urban butchers are able to earn when opportunities arise to procure stall-fed cattle at low cost. At average acquisition prices paid by

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[17]Thirty-four stall-fed cattle were slaughtered from September 1980 through March 1981. We assume that only 25 percent as many stall-fed bulls were slaughtered from the end of March 1981 through September 1981 as during the period of data collection. Hence, about 42 head or six head per principal butcher, are slaughtered annually.

Soulede butchers (350 FCFA per kilogram), urban slaughter of stall-fed cattle is not profitable.

c) Annual Return to Labor and Management

By combining returns to slaughtering stall-fed cattle and range-fed cattle and estimating the number of days wholesale butchers allocate to butchering and retailing enterprises, their daily return to labor and management can be derived. The total net returns to slaughering the 237 range-fed and stall-fed cattle are 246,000 FCFA (or $1,025 at an exchange rate of $1.00 = 240 FCFA). The surveys show that urban butchers work five full days per week for 50 weeks during the year. Therefore, wholesale butchers earn a net return to labor and management of 984 FCFA per day. This return is relatively low in light of the risks assumed by butchers and the considerable skills required in acquiring slaughter cattle at the lowest possible cost per unit of liveweight and in coordinating urban slaughter with demand. It is higher than the average peak agricultural season wage rate of 300 FCFA per man-day, however.

In conclusion, the returns to the urban wholesale butchers' labor and management are estimated to be quite modest. Rather than earning excessive profits, as some policy-makers are quick to charge, the urban butchers earn a barely acceptable return to slaughtering cattle. In order to compete successfully in urban butchering and retailing enterprises, butchers must be skillful in judging the returns a live animal will bring once it is slaughtered. They must also absorb the risk of mortality or forced slaughter and sale, which is quite high during periods of nutritional stress and inadequate water supply.

Urban butchers' returns may be higher if gross returns to slaughtering range-fed cattle are higher than estimated from April through August, when some herders are forced to sell diseased or weakened cattle. In addition, slaughter of small ruminants from March through June generates income for the wholesale butchers, who have difficulty procuring slaughter cattle when cattle prices per kilogram are seasonally highest. The retail sale of mutton and goat meat is not controlled, so butchers can sell the meat at prices above the control prices for beef.

3. Conclusion

The budgeting exercise for rural and urban butchers show that rural butchers' returns to labor and management are considerably higher than those of urban butchers.[18] Assuming that our estimate of rural butchers' earnings per man-day (3,800-4,400 FCFA) is correct, their annual returns to labor and management are only 277,400-321,200 FCFA. This return is comparable to an extension agent's annual salary and lower than the annual earnings of primary school teachers in Cameroon. In light of skills required and the risks undertaken, rural butchers' returns do not appear to be unduly high.

In reviewing the research results policy-makers might be tempted to conclude that the far higher retail beef prices in rural markets than

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[18]Rural butchers' returns are attractive yet may have been overestimated. As pointed out, rural butchers report that returns are generally lower during the rainy season when far fewer people attend the market and demand is therefore lower. These butchers are forced to reduce retail prices in order to sell all of the beef, and occasionally they must consume some of the beef within the household, attempt to sell the remaining beef the day following slaughter, or smoke the beef for future sale. In addition, it is possible that certain cost categories or the labor requirements of butchering enterprises have been underestimated.

in Mokolo are evidence of collusive behavior and therefore prescribe retail price controls for rural markets. However, it is important to note that retail beef prices at Gazawa were comparable to prices at Soulede and Tourou during the survey research.[19] There are five or more wholesale butchers at Gazawa and at least a dozen retail butchers, which results in competitive behavior and pricing. The similarity of prices between Gazawa and the two other rural markets suggests that rural butchering and retailing is reasonable competitive in the Mandara Mountains. Producer slaughter of stall-fed cattle and retailing of the beef is one practice that increases competition in rural areas and thereby disciplines rural butchers in markets that are potentially oligopolistic.

The analysis shows that rural butchers' returns are attractive but not unduly high and that retail beef prices in two rural markets are comparable to prices in known competitive markets. On the other hand, urban butchers' returns and urban beef prices are low. Artificially low retail beef prices provide urban butchers with incentives to procure low grade cattle for slaughter at low prices per unit liveweight. The retail price data and butchers' budgets for Mokolo (as well as slaughter data for Mokolo and Soulede) show that urban butchers are unable to earn acceptable returns by acquiring stall-fed cattle for slaughter, except during the immediate post-harvest period.[20] They

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[19]Retail prices at Gazawa were higher than prices at Soulede and Tourou from September through November but somewhat lower from January through March.

[20]As discussed in section F.2.b., Mokolo butchers would receive negative returns to labor and management if they acquired stall-fed cattle at the average price per kilogram carcass weight paid by rural butchers at Soulede.

simply cannot afford to compete with rural butchers in the acquisition of stall-fed cattle.

Retail price controls have the perverse effect, therefore, of restricting urban slaughter of stall-fed cattle. Urban markets are not allowed to be viable marketing alternatives for producers of stall-fed cattle as long as restrictive pricing policies are in force. This is also reflected in survey results showing the stall-fed cattle slaughtered in urban relative to rural markets. Yet the urban areas, which are characterized by higher per capita incomes and population growth rates than rural areas, are presently and potentially attractive outlets for large numbers of stall-fed cattle. Pricing policy will play an important role in determining the success of expanding stall-feeding in the Mandara Mountains and the tapping of alternative markets. The effects of alternative pricing policies will be examined in Chapter Nine.

CHAPTER SEVEN

ORGANIZATION OF THE CATTLE TRADE, CATTLE FLOWS, AND SEASONAL AND HISTORICAL PRICE TRENDS FOR BEEF AND CATTLE IN NORTHERN CAMEROON

A. INTRODUCTION

In order to examine the questions of potential sales of stall-fed cattle in a broader regional context, this chapter begins with an analysis of the organization of the cattle trade, the role of the principal cattle markets, and the magnitude of slaughter and trade cattle flows to and from the Mandara Mountains region. In order to understand the nature and evolution of producers and butchers' procurement practices, it is important to analyze the direction, volume and seasonality of cattle flows affecting the Mandara Mountains region. It is also necessary to show how seasonal and historical price trends have encouraged these flows. Hence, a discussion of recent trends in live cattle and beef prices and seasonal price variation follows. The increase in real cattle prices during the 1970s was a major impetus for the increasing commercialization of stall-feeding enterprises since the 1960s. Moreover, seasonal variation in cattle prices per kilogram has a potentially important effect upon the profitability of stall-feeding for individual producers. The chapter concludes with an analysis of cattle price variation across space in Northern Cameroon and Northeastern Nigeria, which induces outflows of stall-fed cattle and mature range-fed animals to Nigeria.

B. ORGANIZATION OF THE CATTLE TRADE

1. Participants in the Cattle Trade in Northern Cameroon

There are several types of cattle buyers in the markets of Northern Cameroon. Wholesale butchers from the towns and villages of the Diamare Plains and the Mandara Mountains purchase cattle for slaughter. Butchers procure cattle directly from herders at markets such as Bogo, Gazawa and Meme and from Cameroonian traders who buy in markets such as Bogo and Moulvouday. A second group of participants is small-scale traders who come from villages in the Mandara Mountains to buy small numbers of young and immature bulls for resale to mixed farmers who practice stall-feeding. Farmers who are willing and able to procure their own bulls in the plains' markets usually make the trip to Gazawa or Meme themselves (or perhaps with a small group of friends). There are also small to medium scale traders, principally from the towns of the Diamare Plains, who buy cattle at assembly markets such as Bogo and Moulvouday for resale to butchers, farmers and traders at Maroua, Gazawa and Meme. Finally, there are cattle exporters who buy up large numbers of trade cattle, which are usually bulls and steers that are at least four years old, for resale in the Nigerian markets of Mubi, Lassa, Bama and Maiduguri.

The participants in the cattle trade differ in ethnic background, financing, scale of operations and ability to assume risks. We have already examined in Chapter Five wholesale butchers from the towns of Northern Cameroon, who procure from two to ten head of cattle for slaughter or resale to other butchers each time they visit a market such as Gazawa or Meme. They are usually members of the ethnic groups dominating

the areas in which their towns are located and often though not necessarily Moslem. They slaughter two to seven head of cattle each week and wholesale quarters of beef to retail butchers in their towns.

The small-scale traders of the Mandara Mountains, who sell young bulls to their neighbors or to households from nearby villages, are seldom able to buy more than three or four head at a time. These men are usually successful mixed farmers who invest revenues from sweet potato or groundnut production or from butchering and retailing in cattle. They attend the Diamare Plains' markets late in the rainy season, after the final weeding, and during the dry season, when on-farm activities are limited. It is not unusual for them to hold cattle purchased in the plains for several weeks, waiting for the most remunerative offer. If they do not receive an acceptable offer, they usually slaughter the cattle at a local rural market, or they may trek the animals to Tourou or Michika (Nigeria), hoping to sell to a farmer or to a Nigerian butcher or trader for a profit.

The traders who buy cattle at Bogo, Gazawa, Meme, Moulvouday and Doumrou for resale to butchers, farmers and other traders are a mixed group of small-scale and larger-scale merchants. Young Fulani traders who have not amassed large sums for cattle acquisition typically carry out this commerce. Successful wholesale butchers also engage in this trade. Some of the smaller-scale international traders also participate when profitable opportunities arise. The larger-scale smugglers find the transaction costs too high for isolated exchanges, however. They prefer to buy and sell in wholesale lots.

The international cattle trade is dominated by wealthy Fulani, Guiziga and Mandara cattle merchants who may purchase as many as 30 to 40 head per shipment to Nigeria. The capital requirements of this trade are high--on the order of one to four million francs CFA ($4,000-$20,000) per trip. The traders usually own large numbers of cattle or have accumulated capital through trade in grains, peanuts or manufactured commodities (which come mostly from Nigeria). Their considerable assets enable them to bear risks that would be unthinkable for smaller traders. The barriers to entry are clearly lowest for prospective entrants into small-scale butchering and trading in Mandara Mountains villages and highest for those attempting to become international traders. While small-scale buying of cattle at Gazawa and Meme for resale in mountain villages demands relatively little capital and knowledge of temporal and spatial price relationships for different types of cattle, large-scale smuggling requires large sums of capital, very good knowledge of cattle prices across time and space, the ability to estimate accurately the value (weight) of individual animals, shrewdness in bargaining, fluency in Fulfulde, and preferably proficiency in Hausa.

2. Cattle Markets in Northern Cameroon and Northeastern Nigeria

There are two basic types of cattle markets in Northern Cameroon: assembly markets and consumption-redistribution markets. Assembly markets attract cull animals from local producers and imported trade cattle. Traders buy these animals and resell them at consumption-redistribution markets to butchers, farmers, and other traders. While assembly markets are typically located in rural areas or small towns, consumption-redistribution markets generally serve urban areas.

Most of the assembly markets are located in the Diamare Plains, closer to Chad than to Nigeria. Bogo, Moulvouday, Doumrou, Djaoude and Papata are the most important assembly markets in the north. The consumption/redistribution markets are situated in the western part of the Diamare Plains and in the Mandara Mountains region. Gazawa, Meme, Kouyape, Mokolo and Tourou are the important consumption/redistribution markets for the Mandara Mountains region (see Figure 7-1).

a) Cattle Markets in the Mandara Mountains Region

There are four cattle markets in the Mandara Mountains region, located at Meme, Kouyape, Tourou and Mokolo. These markets are held weekly on the same day as the foodstuff markets in each of these towns.

The important consumption-redistribution cattle market for the Mora Arrondissement is held Friday at Meme, which is located on the northeastern edge of the project zone. Butchers in Mora, Meme, Tokonbere, Kourgui, Banki and Kerawa buy most of their slaughter cattle at Meme from local Fulani herders, Mandara farmers and traders from Bogo and Maroua. Fifty to one hundred head of cattle are offered for sale each week at the Meme market, although the Livestock Service Subsector office at Mora reported only 911 sales for the fiscal year July 1979-June 1980, or an average of only 18 head per week.[1] Reported sales were higher in 1978-79 (1,326 head), averaging 26 head a week.[2]

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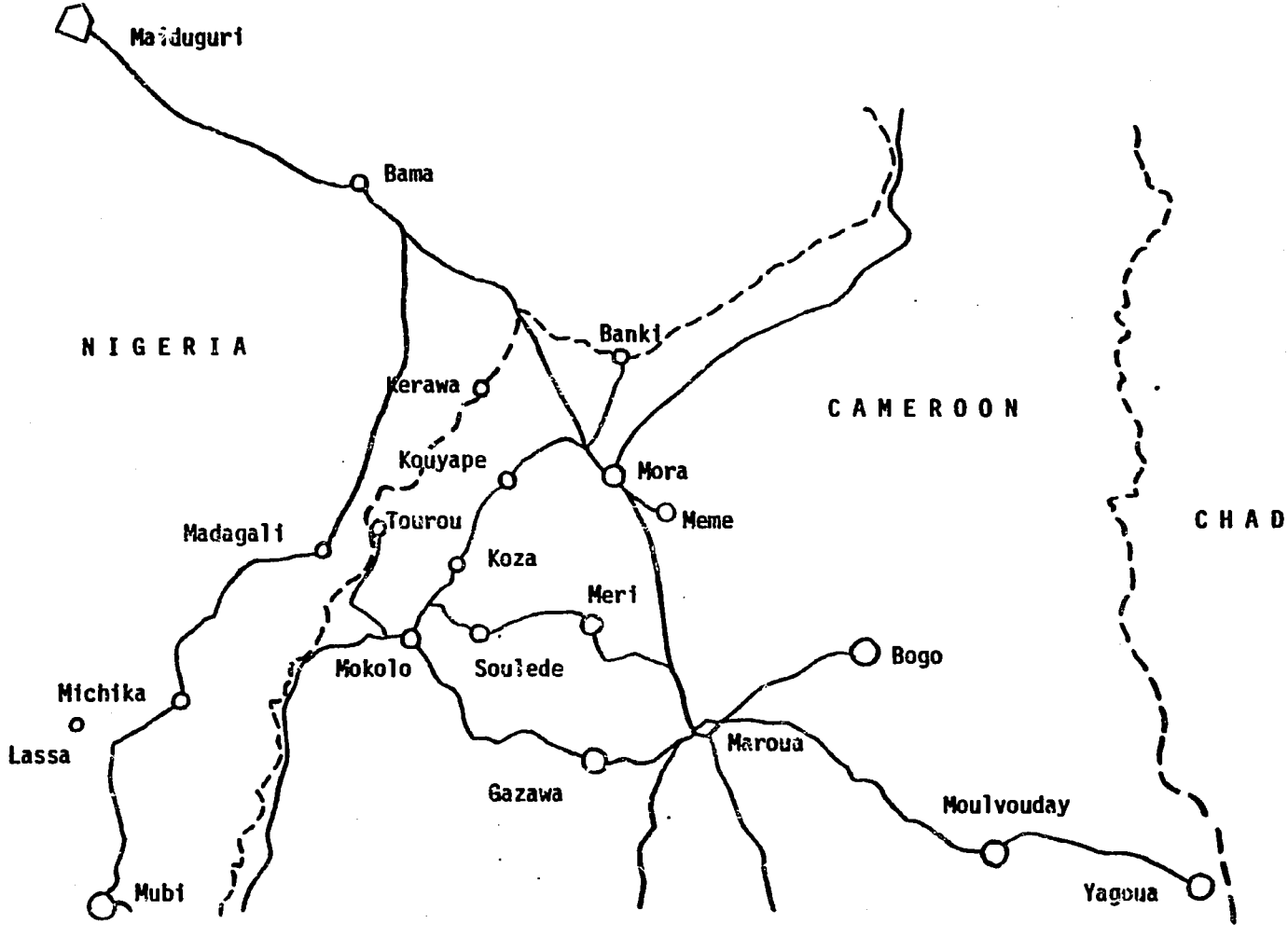
[1]Sous-Secteur de l'Elevage, des Pêches et des Industries Animales de Mora, Rapport Annuel, 1979-80.

[2]Sous-Secteur de l'Elevage, des Pêches et des Industries Animales de Mokolo, Rapport Annuel sur le Fonctionnement du Sous-Secteur pour l'Année Budgétaire 1978-79.

FIGURE 7-1

CATTLE MARKETS IN NORTHERN CAMEROON AND NORTHEASTERN NIGERIA



The other cattle markets located within Margui-Wandala are modest consumption-redistribution markets that serve in part as assembly markets for small-scale traders wishing to trek cattle to Nigeria. Kouyape is a plains' cattle market that is held on Friday along the main north-south axis from Mokolo to Mora. This market supplies part of butchers' needs in the surrounding area and allows Cameroonian traders to sell to other traders willing to trek the cattle to Nigeria. The two cattle markets in the Mokolo area are held at Tourou and Mokolo.

Tourou attracts sellers principally from villages along the Nigerian border, including farmers who offer stall-fed bulls for sale and small-scale butcher-traders, based in Tourou, Magoumaz and Mokolo, who purchase cattle at Gazawa. Over 80 percent of the sellers (219 of 263) at the Tourou market from the end of July 1980 through mid-March 1981 were butchers or traders, while 14 percent were farmers and 3 percent herders from the plateau west of Mokolo. The vast majority (86 percent) of cattle offered for sale were range-fed animals, predominantly male (270 of 305), and acquired originally at Gazawa market (70 percent). Thirteen percent of the cattle for which the genre was recorded (25 of 190 head) were stall-fed bulls. Twenty-four of the twenty-five stall-fed bulls offered for sale were brought to the market in the months of November, December and January. Ninety percent of the cattle were Zebu Peul, the Fulani breed that predominates in the Diamare Plains. The buyers at Tourou are a mixture of local butchers, farmers wishing to acquire bulls for stall-feeding, and Nigerian butcher-traders hoping to purchase cattle at lower prices than those prevailing in markets across the border.

The cattle market at Mokolo was created by the Livestock Service in September 1980. FONADER was instrumental in opening the Mokolo market as an organized outlet for stall-fed cattle raised by local farmers who have received FONADER loans. These loans began to fall due in late January 1981, and it was anticipated that the level of sales of locally raised cattle would increase because of the loan program. In the two months following the opening of the Mokolo market, the number of cattle offered for sale varied from 20 to 47 head per week. By the end of November 1980 less than a dozen head of cattle were offered for sale at the Mokolo market each week. The market remained relatively inactive through the end of March 1981, when the survey research was completed. Moreover, only 47 of the 333 cattle offered for sale from September 1980 through March 1981 were actually sold. Potential buyers complained that the asking prices were far higher than those prevailing in the markets of the Diamare Plains.

The cattle presented for sale at the Mokolo market from September 1980 through March 1981 were predominately male (285 of 333). Over two-thirds were young bulls under three years of age, and most of the cattle were Zebu Peul (86 percent). During the survey 85 percent of the cattle in the marketplace were acquired by Mokolo wholesale butchers in the Diamare Plains' markets of Gazawa and Bogo and trekked to Mokolo for sale. The butchers were able to sell few of these cattle, however, so they slaughtered most of the animals by default. In addition to wholesale butchers, some farmers from villages around Mokolo and a few local herders from Zamai and Biskavai tried to sell cattle at the Mokolo market.

It is important to note that only one of the 333 cattle brought to the Mokolo market was a stall-fed bull. However, farmers offered 22 cattle for sale, including 15 during the month of November alone. It is likely that some of these animals were stall-fed during at least part of the growing season but misclassified as range-fed cattle by the enumerators. Nonetheless, it appears as if the cattle market at Mokolo did not initially satisfy the objective of serving as a marketing outlet for stall-fed cattle in the villages around Mokolo. Although transactions were monitored at the Mokolo market for a period of only six months, stall-fed cattle are typically sold during these very months, which immediately precede and follow the harvest.

So few stall-fed cattle were offered for sale, partly because FONADER loans did not begin to fall due until late January 1981 and the FONADER officials at Mokolo were not pressuring the loan recipients to repay on the exact due date during the first three months of 1981. More importantly, however, retail price controls at Mokolo prevented urban butchers from offerring competitive prices for stall-fed cattle. Producers are able to realize higher returns by selling finished cattle to rural butchers and traders or by slaughtering the animals and retailing the beef themselves. Hence, there is little incentive for them to trek stall-fed cattle to the Mokolo market.

b) Cattle Markets in the Diamare Plains that Supply the Mandara Mountains Region

The principal sources of supply for butchers and farmers of the Mandara Mountains region are the cattle markets of Gazawa and Bogo. Gazawa is a large consumption-redistribution market held weekly on

Friday and located 23 kilometers west of Maroua and 55 kilometers east of Mokolo. Bogo is an immense assembly market that is centrally located in the Diamare Plains. It meets on Thursday in a town that is about 35 kilometers northeast of Maroua. The Bogo cattle market is the largest in Northern Cameroon, drawing cull cattle from Fulani herds in the surrounding rangeland and Chadian trade cattle that arrive in great numbers during the dry season.

Gazawa is the more important of the two principal plains' markets for the Mandara Mountains region. There are generally more cattle at Gazawa during the late rainy season (September-October) and early dry season (November-December), when as many as 500 head may be offered for sale, than during the late dry season (March-April) and rainy season (May-August), when the number of cattle at the marketplace varies greatly, seldom exceeding 250 head. Cattle numbers are low late in the dry season, because Fulani graziers have taken their herds on transhumance to the lowland grazing lands adjacent to the Logone River, which forms the border with Chad. Cattle numbers remain low until the end of the rainy season, because heavy rains cause the Logone and the adjacent lowlands, the yaeres, to flood, making it infeasible to trek cattle from Chad. There are also flash floods in the plains of Mayo-Danai and the Diamare. The roads and trek routes are in poor condition at this time, making travel difficult and risky. Fractures can lead to forced sales, which generally result in losses. Finally, many herders and traders, particularly smaller-scale operators, are farmers who have little time for cattle trading during the growing season.

Over three-quarters of the cattle offerred for sale at the Friday market in Gazawa are trekked from Bogo all day Thursday, Thursday night and early Friday morning.[3] Hence, most of the cattle sold at Gazawa are owned by traders rather than herders.[4] Most of the cattle for sale are old cows and young bulls, which often lose weight during two to three consecutive days of trekking from Bogo to Gazawa and from Gazawa to Mokolo and other towns in the Mandara Mountains region, especially from March through June. The price differential between Gazawa and the Mokolo-Tourou area is roughly 1,500-3,000 FCFA per head. This is enough incentive to induce most butchers in Mokolo, Koza, Tourou, some of the towns on the plateau to the south of Mokolo (Roumzou, Mogode, and Bourrha) and towns along or near the Maroua-Mokolo road (Mokong, Zamai and Gawar) to buy most of their slaughter cattle in the Diamare Plains.

c) Cattle Markets in Northeastern Nigeria

The four principal Nigerian cattle markets in the Chad-Cameroon-Nigeria trade are Mubi, Lassa, Bama and Maiduguri. The cattle market at Mubi is larger than the market at Bogo, which is the largest cattle market in Northern Cameroon. The market at Mubi meets two consecutive days each week (Tuesday-Wednesday) and is supplied primarily by Chadian and Cameroonian cattle traders. Most of the buyers are Ibo and Yoruba merchants from Southern Nigeria, who sometimes own but usually rent large

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[3]Eighty percent of the cattle at Gazawa that were included in our sample during the cattle market survey from late July 1980 to mid-March 1981 had been trekked from Bogo.

[4]In our sample of cattle offerred for sale at Gazawa, 74 percent of the animals were owned by traders, 18 percent by Fulani herders, and the remaining 8 percent by local farmers and butchers.

trucks for shipping trade cattle south. The trip generally takes two to three days. The Nigerian merchants buy cattle wholesale at Mubi and also at Maiduguri, which meets daily and is the largest terminal market in Northeastern Nigeria.

The cattle markets at Bama and Lassa are medium-sized assembly markets, which are attended by small- and large-scale traders. Most of the cattle are trucked from Bama to Maiduguri or points in Southern Nigeria. Cattle are also trucked from Lassa, but many are trekked to Mubi for resale. Bama, Mubi and Maiduguri are linked to Southern Nigeria by paved roads.

C. CATTLE FLOWS IN NORTHERN CAMEROON

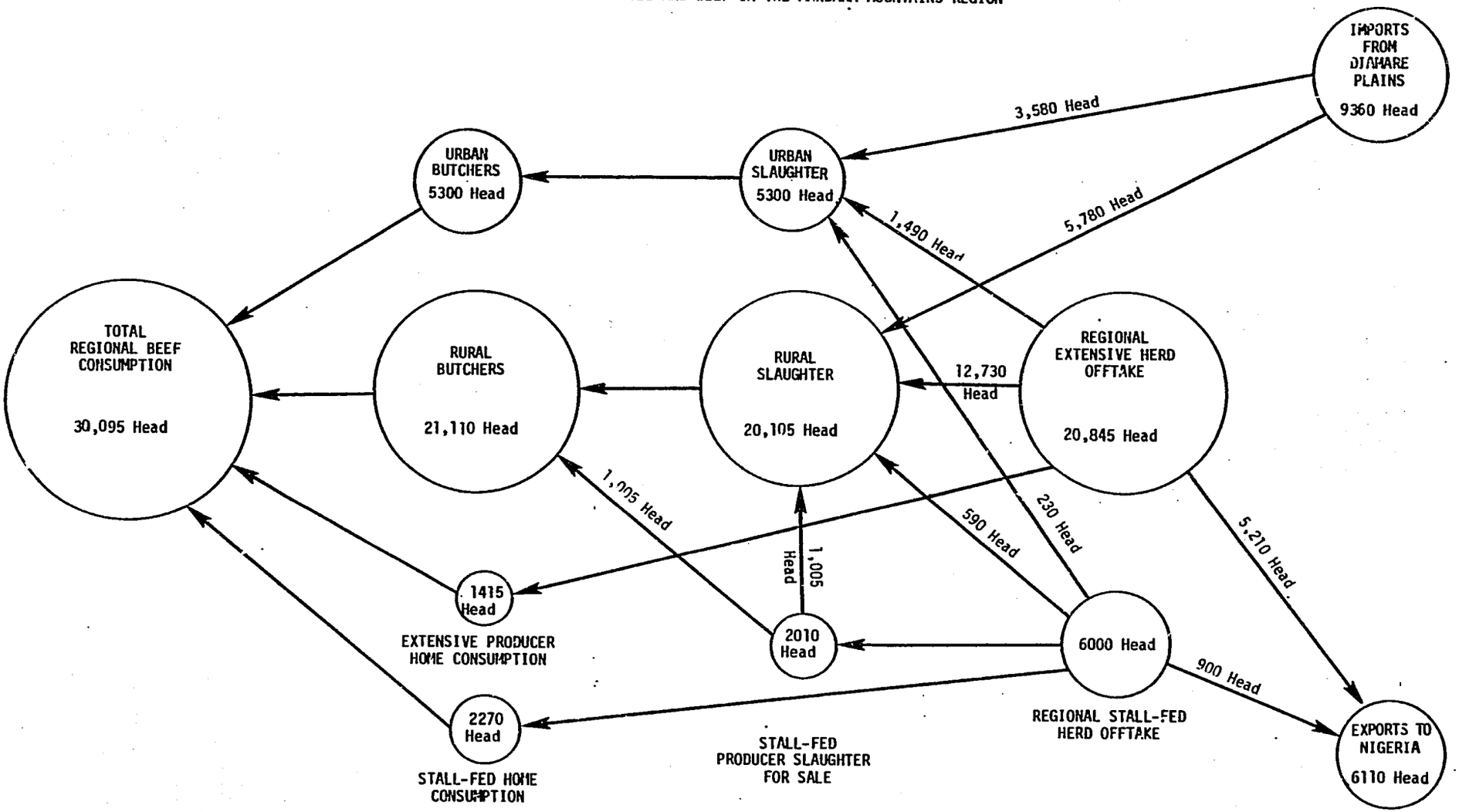
Disposal of stall-fed cattle and the procurement practices of rural and urban butchers have been discussed in Chapters Four and Six. This section attempts to integrate the principal findings of those chapters in order to show the relative magnitude of alternative sources of beef supply for the region in 1980, and to gauge the potential importance of stall-feeding in a regional context. Imports of slaughter cattle from the Diamare Plains and the disposal of cattle produced within the Mandara Mountains region are shown schematically in Figure 7-2, which is drawn to scale to indicate the relative importance of the different flows.

1. Interregional Flows

As the analysis in Chapters Five and Six shows, the Diamare Plains supply the urban and rural butchers in the Mandara Mountains region with a significant proportion of their slaughter cattle. Butchers procure in

FIGURE 7-1

MARKET CHANNELS FOR CATTLE AND BEEF IN THE MANDARA MOUNTAINS REGION



the plains some 3,580 head or 68 percent of the cattle slaughtered in the urban areas and some 5,780 head or 29 percent of the cattle slaughtered in rural markets. Cattle from the plains comprise 68 percent of total urban slaughter and 23 percent of total rural slaughter.

2. Intraregional Flows

The principal source of beef for the rural areas of the Mandara Mountains region is offtake from the regional extensive herd. Fifty-seven percent or 14,145 of the estimated 24,795 head of cattle slaughtered in rural areas are taken off the extensive herd. It is assumed that 90 percent of this offtake (12,730 head) is slaughtered at rural markets while the other 10 percent (1,415 head) is slaughtered by producers for household consumption. The regional extensive herd also supplies 28 percent, or 1,490 head, of the cattle slaughtered in urban areas.

Although the regional herd of stall-fed cattle comprises only an estimated 12,850 head or 7 percent of the regional cattle population, offtake of stall-fed cattle is an important source of beef for rural areas, particularly in the mountainous zones. Approximately 20 percent of the cattle slaughtered in all rural areas are stall-fed animals. Since stall-fed cattle weigh on average 52 percent more than slaughtered range-fed stock, the former provide a higher proportion (27 percent) of the total rural beef supply.

In contrast to rural areas, only 4 percent of the cattle slaughtered in urban areas are stall-fed animals. Since the beef from stall-fed cattle is generally of higher quality than the beef from range-fed cattle, this finding is paradoxical. Average per capita incomes are

significantly higher in urban areas, so one would expect that a far greater proportion of the stall-fed cattle slaughtered in the Mandara Mountains region would be slaughtered in urban areas than the present 230 of 5,300 head. The principal source of supply for urban areas, as outlined above, is the Diamare Plains, from which an estimated 3,580 head are obtained. In the absence of retail price controls on the sale of beef in urban areas, it is likely that stall-fed cattle would substitute in part as a source of supply for range-fed cattle from the plains. Hence, locally produced stall-fed cattle remain a largely untapped potential source of supply for urban markets. If exploited, this potential market could allow for a significant increase in stall-fed cattle production, as will be discussed in Chapter Nine.

3. International Flows

The driving force behind the international cattle trade in Northern Cameroon and in other nearby West African countries is the demand for cattle in Nigeria, particularly in the cities of Nigeria, where the average annual growth rate in the urban population was 4.7 percent over the period 1960-1980.[5] Nigeria has over ten times the population (82.6 million) of its most populous neighbor (Cameroon; 8.2 million inhabitants), with an increasing proportion (20 percent) of this population concentrated in urban areas.[6] The inflow of oil revenues, which accelerated in the mid-1970s, has increased urban incomes and the demand for beef,

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[5]World Bank, World Development Report 1981, Oxford University Press, New York, 1981.

[6]Ibid. The population estimates are for mid-1979. The proportion of the total population in urban areas is a 1980 estimate. This represents a significant increase over 1960, when 13 percent of the total Nigerian population was estimated to reside in urban areas.

for which the income elasticity of demand is high. Although Nigeria has a large national cattle herd (12.3 million head in 1980), it cannot possibly meet present and projected demand for beef at present rates of offtake.[7] Consequently, Nigeria imports a large proportion of its slaughter cattle (21 percent) from Niger, Cameroon, Chad, Mali, Upper Volta and Benin.[8]

Most of the cattle sold for export in Northern Cameroon are Chadian trade cattle, which appear in great numbers at the principal assembly markets from October through March. The trade cattle are generally

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[7] F.A.O. Production Yearbook, 1980, F.A.O. Statistics Series No. 34, Food and Agriculture Organization of the United Nations, Rome, 1981.

S.E.D.E.S., Recueil Statistique de la Production Animale, République Française, Ministère de la Coopération, Paris, 1975, p. 636. S.E.D.E.S. estimated the offtake rate from the cattle herd in Northern Nigeria as 11.0 percent in 1966 and 13.0 percent in 1970. The latter figure is high for a region in Africa and is probably the result of the strong demand for beef in Nigeria, particularly in urban areas.

Werner Fricke, Cattle Husbandry in Nigeria: A Study of its Ecological Conditions and Social-Geographic Differentiations, Heidelberger Geographische Arbeiten, Im Selbstverlag des Geographischen Institutes der Universitat Heidelberg, Heidelberg, 1979, pp. 262-263. Fricke estimated that offtake from the Nigerian cattle herd in 1974 was 11.2 percent.

[8] Werner Fricke, op. cit. Although there are no precise data on Nigerian cattle imports and slaughter, probably at least 20 percent of the cattle slaughtered in Nigeria are imported from Niger, Chad, Cameroon, Benin, Upper Volta and Mali. Fricke reports (p. 250) that 64,000 of the 285,000 (23 percent) cattle offered for sale (recorded transactions) in Bornu Province, which is located in the northeastern corner of Nigeria and borders Niger and Cameroon, were imported in 1974.

Using 1980 F.A.O. estimates for the Nigerian cattle population and cattle imports into Nigeria, and assuming that offtake has remained at 11.2 percent, as estimated by Fricke for 1974, the proportion of slaughter cattle that were imported can be calculated as follows: No. of Nigerian cattle slaughtered in 1980 = cattle population x offtake rate = 12.3 mill. head x 11.2% = 1.38 mill. head. Total slaughter = local slaughter + imports = 1.38 mill. head + .36 mill. head = 1.74 mill. head. Therefore, imported cattle comprised 20.7 percent of cattle slaughtered in Nigeria in 1980.

mature males and steers of the Mbororo breed. Although large numbers of Chadian cattle change hands in Cameroonian markets such as Bogo, Mouvoulday, Doumrou and Gazawa, many other Chadian cattle destined for Nigeria are trekked directly across Northern Cameroon to Nigerian markets. There are some official statistics and unofficial estimates of cattle transit, imports from Chad for slaughter in Northern Cameroon, export of Chadian cattle sold in Northern Cameroon, and export of Cameroonian cattle from the North, but these figures are of questionable reliability. In addition, mature range-fed cattle taken off the Northern Cameroonian herd are exported in large numbers to Nigeria.

Although unrestricted export of Cameroonian cattle was outlawed by the Cameroonian government in 1976 in response to the alarming increase in outflows in the mid-1970s, cattle smuggling is widely practiced. Under present regulations exporters are supposed to petition the Ministry of Livestock for export licenses. Annual export is limited to 360 head per licensed trader, and the traders must pay a tax of 3,000 FCFA per head. These regulations have done little to deter cattle exports, however, as most of the trade is carried out illegally. Herders and farmers near the border often sell cattle at Nigerian markets or to traders who assemble in Cameroon for sale in Nigeria, because returns are generally higher than returns to sales of cattle for local slaughter.

As shown in Figure 7-2, an estimated 6,110 head of cattle were exported from the Mandara Mountains region to Nigeria in 1980. This assumes that 25 percent of the offtake from the regional extensive herd and 15 percent of the offtake of the stall-fed cattle are exported. The stall-feeding survey data show that 9 of the 52 households (or 17 percent

of the sample) had sold their bulls to local smugglers or to Nigerians at Tourou by the close of the survey. Eight of the nine households had received FONADER loans for stall-feeding. Since the sample of stall-feeding households included 30 loan recipients, nearly 30 percent of the FONADER bulls were sold for export to Nigeria. Only one of the remaining 22 farmers had sold his bull to a smuggler or Nigerian buyer by the end of the survey.

It is unlikely that 30 percent of the region-wide annual offtake of stall-fed cattle is exported. The loan recipients are generally more commercially oriented than farmers who have not received loans, so we would expect them to sell their finished bulls to traders more frequently than non-recipients. Indeed, loan holders have greater incentives than other stall-feeding households to obtain the highest possible return on their stall-fed cattle, since they are obligated to repay FONADER 10,000 FCFA after one year and 43,500 additional FCFA at the end of two years. If more FONADER loans are disbursed in the future and an increasing proportion of bulls for stall-feeding are acquired using government funds, the overall percentage of finished cattle exported to Nigeria will likely increase.

A second reason for treating the 30 percent estimate of stall-fed cattle export with caution is geographic. The two villages selected as sites for the stall-feeding survey are only about ten kilometers from the Nigerian border. In fact, loans have been disbursed in only one village that is closer to Nigeria (Ldibam) than Magoumaz and Mavoumai. FONADER has extended loans to farmers in many villages near Mokolo and Koza that are within a day's trek of Nigeria, however. In recent years these villages have had a strong commercial orientation toward Nigeria.

At the same time, FONADER is granting an increasing proportion of its loans to farmers in villages east of Mokolo (Baou, Soulede and Roua), which are farther from the border and less tied commercially to Nigeria than villages west of Mokolo and Koza. It is likely that a lower proportion of stall-fed bulls from the villages east of Mokolo are and will be sold to Cameroonian smugglers or Nigerians.

D. SEASONAL AND SECULAR TRENDS IN CATTLE AND BEEF PRICES IN NORTHERN CAMEROON

1. Seasonal Variations in Cattle Prices

The seasonal variation in cattle prices in Northern Cameroon is due to the seasonal variation in cattle flows, the demand for cattle and beef, and range conditions. Cattle price variation can be analyzed on a per animal or on a per kilogram basis. In the next section, cattle price variation per animal is analyzed at the Gazawa market for the period July 1980-March 1981. Cattle price variation per kilogram is then analyzed for slaughter cattle acquired by Mokolo and Soulede butchers from September 1980 through March 1981.

a) Cattle Price Data Obtained at Gazawa Market

Cattle prices were monitored weekly at the Gazawa and Tourou markets from late July 1980 through mid-March 1981 and at the Mokolo cattle market from September 1980 through mid-March 1981. Average monthly acquisition and offer prices for aggregared categories of cattle (entire sample, all males, all females) and for selected categories of cattle (immature males, mature males, old cows) are reported for each market in Annex 3. For certain months, few or no observations of cattle purchase

and offer prices are available for the markets of Tourou and Mokolo, but there are generally sufficient data for different age-sex categories of cattle sold and offered for sale at Gazawa, which are presented in Table 7-1.

When aggregated by month over the period July 1980 through March 1981, the cattle price data illustrate seasonal price variation quite clearly. The unavailability of data for the four month period from the middle of March to the middle of July prevents the drawing of firm conclusions, however. The purchase prices for most categories of cattle dropped significantly from seasonally high levels during the height of the rainy season (July-August) to lower late rainy season and early dry season levels (September-November). Prices then rose considerably in December, remaining at roughly the same level through mid-March.

The magnitude of seasonal price variation for the different categories of cattle is captured by the ratios at the bottom of Table 7-1. An unweighted nine-month mean price is used in calculating the magnitude of seasonal highs and lows. This mean is probably slightly higher than a twelve-month mean, as cattle traders and butchers report that cattle prices drop from March through June in Northern Cameroon. It can be seen that cattle prices vary upward and downward between 10 percent and 26 percent of the nine-month mean.[9] Half of the calculations reveal that seasonal variation exceeds 20 percent of the nine-month mean. Clearly, seasonal price variation in a semi-arid region such as Northern

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[9]The price variation is less than 10 percent only in the case of the category female cattle, where the mean price in the highest month exceeds the nine-month mean by only 6 percent.

TABLE 7-1

MEAN ACQUISITION PRICES FOR DIFFERENT CATEGORIES OF CATTLE AT GAZAWA MARKET, BY MONTH, JULY 1980-MARCH 1981 (in FCFA)

	Entire Sample: All Cattle		All Male Cattle		All Female Cattle		Male Cattle < 3 Years		Male Cattle ≥ 3 Years		Cows ≥ 6 Years	
Month	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
July	37,536	(14)	33,000	(11)	54,167	(3)	23,500	(6)	44,400	(5)	52,500	(2)
August	38,381	(109)	36,223	(74)	42,943	(35)	33,717	(53)	42,548	(21)	44,867	(15)
September	33,433	(119)	31,110	(91)	40,982	(28)	26,837	(49)	36,095	(42)	39,548	(21)
October	29,413	(149)	28,126	(101)	32,120	(48)	24,520	(60)	33,402	(41)	30,699	(34)
November	34,867	(30)	32,413	(23)	42,929	(7)	23,950	(10)	38,923	(13)	35,375	(4)
December	41,006	(77)	41,149	(37)	40,875	(40)	28,000	(5)	43,203	(32)	44,021	(24)
January	40,283	(100)	40,914	(70)	38,808	(30)	24,167	(21)	48,092	(49)	40,875	(22)
February	42,553	(91)	43,135	(46)	41,959	(45)	28,962	(13)	48,718	(33)	37,629	(29)
March	42,238	(37)	42,186	(29)	42,425	(8)	26,333	(6)	46,322	(23)	37,000	(1)
Mean of all Observations	36,828	(726)	35,383	(482)	39,681	(244)	27,514	(223)	42,159	(259)	38,563	(152)
Unweighted Nine Month Mean	37,746		36,473		40,380[a]		26,665		42,411		38,752[a]	
Highest Monthly Mean/Nine Month Mean	112.7%		118.3%		106.3%[a]		126.4%		114.9%		115.8%[a]	
October 1980 Mean/Nine Month Mean	77.9%		77.1%		79.5%		89.8%		78.7%		79.2%	

SOURCE: Survey of Cattle Markets, July 1980 through March 1981.

[a]Although the mean prices were highest during the month of July for these two categories, we did not use the July prices in calculating the ratio. The mean July price observations for each category are considerably higher than expected, probably due to the small sample size.

Cameroon is an important factor to take into account in analyzing livestock production and marketing and the potential benefits of promoting particular types of livestock production.

Our data, although incomplete, suggest that cattle prices attain their highest levels during the annual cycle at the height of the rainy season, when cattle trek routes are impracticable, farmers rarely sell their stock, and few trade cattle arrive at Cameroonian cattle markets from Chad. By the end of the rainy season and beginning of the dry season (September-November), large numbers of cattle are offered for sale, coming principally from Chad. This depresses prices despite the higher level of demand for cattle and beef that follows the harvest. Higher demand for beef beginning in November and continuing through the middle of the dry season (February) does push up cattle prices, even though cattle continue to arrive at Gazawa and other cattle markets of Northern Cameroon in large numbers, and cattle lose weight steadily during this period. Beginning in March it appears as if cattle acquisition prices decline, probably through June, even though the reduced supply of cattle offered for sale in the markets of Northern Cameroon during these months causes prices per unit of liveweight to rise significantly.[10] Although buyers pay more per kilogram at this time, cattle liveweights are far lower than during the immediate post-harvest period, resulting in lower cattle prices.

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[10]Fewer cattle are trekked from Chad during the late dry season and early rainy season than during the early and mid-dry season. The former period is the hottest and driest period of the year, during which long treks are risky, resulting in considerable weight losses, forced sale and mortality. This decline in the supply of Chadian trade cattle is partially offset, however, by distress sales of cattle by herders in the Diamare Plains, particularly in May and June.

b) Cattle Price Data Obtained from Butchers at Mokolo, Soulede and Ziver

The seasonal variation in cattle prices per animal unit is also illustrated by the acquisition prices paid for different types of cattle by Mokolo area butchers, which are shown in Table 7-2. These butchers paid the lowest prices during the month of November, as opposed to the combined sample of butchers, traders and farmers that acquired cattle most cheaply during the month of October at the Gazawa cattle market. Cattle acquisition prices were seasonally higher from December through March, as were the prices paid at Gazawa in the cattle marketing survey.

Weekly weighing of cattle carcasses at the markets of Mokolo and Soulede permit analysis of the seasonal variation in the prices butchers pay per kilogram (carcass weight basis). Butchers clearly paid the lowest prices per kilogram during the months of October and November, while prices per kilogram rose from December through March. As cattle lose weight during the dry season, butchers pay more per kilogram for slaughter cattle, which is reflected in higher retail beef prices. According to butchers in the Mandara Mountains region, this trend persists throughout the dry season and into the early rainy season. Once the rains return, along with the Fulani cattle herds, cattle begin to gain weight and the price per kilogram paid by butchers declines progressively during the rainy season and into the early dry season.

Fréchou noted that cattle prices per kilogram during the late dry season exceeded those during the rainy season by 20 to 25 percent.[11] A

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[11]Hubert Fréchou, L'élevage et le commerce du bétail dans le Nord du Cameroun, Cahier ORSTOM, Série Sciences Humaines, Vol. III, No. 2, 1966, pp. 83-84.

TABLE 7-2

SLAUGHTER CATTLE ACQUISITION PRICES PAID BY MOKOLO, SOULEDE AND ZIVER BUTCHERS, SEPTEMBER 1980-MARCH 1981 (in FCFA)

	All Slaughter Cattle						All Female Cattle Bought at Gazawa[1]						Range-Fed Male Cattle < Four Years					
	Acquisition Prices			Price/Kg.[2]			Acquisition Prices			Price/Kg.[2]			Acquisition Prices			Price/Kg.[2]		
	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N
September	37,734	13,918	44	310	59	27	32,786	8,313	14	287	22	6	33,282	11,879	17	299	46	13
October	42,752	15,229	92	299	39	31	36,379	9,018	29	298	33	12	34,453	10,890	18	287	38	9
November	41,767	13,938	154	303	42	40	34,958	6,191	59	283	39	20	26,875	12,194	8	329	-	1
December	42,234	10,369	176	317	54	50	39,551	7,526	94	318	62	24	21,500	1,291	4	338	-	1
January	44,097	8,741	178	343	51	43	40,555	5,814	79	330	47	18	35,700	7,080	5	299	62	2
February	38,983	9,886	146	331	52	23	36,079	8,137	75	328	19	9	29,833	10,068	6	351	142	3
March	40,833	7,459	65	355	29	25	38,974	7,397	19	338	25	6	35,700	6,399	5	374	33	5

	Range Fed Male Cattle ≥ Four Years						Stall-Fed Cattle					
	Acquisition Prices			Price/Kg.[2]			Acquisition Prices			Price/Kg.[2]		
	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N
September	50,625	14,407	4	364	-	1	80,000	-	1	335	-	1
October	48,303	16,756	33	336	41	6	54,333	16,733	9	276	39	2
November	41,313	11,511	40	312	33	7	56,733	16,265	30	332	37	9
December	41,973	10,695	39	315	54	12	57,038	11,573	13	348	62	3
January	44,988	9,938	38	357	36	7	67,392	9,524	6	398	68	3
February	38,341	7,545	33	319	44	6	71,333	3,215	3	-	-	-
March	44,111	8,418	9	341	15	3	57,000	9,899	2	-	-	-

Source: Survey of butchering and retailing, September 1980-March 1981.

[1]All of the female cattle acquired at Gazawa for slaughter were at least four years old, except for one heifer.

[2]The prices per kilogram were obtained by weighing 238 cattle carcasses at the Mokolo slaughter slab and Soulede market. The price per kilogram was calculated by dividing the acquisition price reported by the butcher by the weight of the four quarters plus offals.

B.D.P.A. study of cattle marketing and trade in Chad reports that rainy season cattle prices were 6 to 40 percent higher than dry season prices at Chadian cattle markets and averaged about 20 percent higher.[12] This degree of seasonal variation in Chadian cattle prices is similar to what Frechou discovered in Northern Cameroon in the early 1960s and to survey results for three cattle markets in Northern Cameroon obtained from July 1980 through March 1981. In a longitudinal survey of cattle and meat marketing carried out in Upper Volta in 1976-77, Herman also found that cattle prices per kilogram (liveweight) were highest for bulls, steers and cows sold at the Ouagadougou cattle market during the months of May and June and lowest in September and October.[13]

The survey of butchering and retailing was conducted from September 1980 through March 1981, so data are not available for cattle slaughtered during the late dry season and most of the rainy season. However, it is possible to compare cattle prices per kilogram during the seven month period for which data are available. Comparing the maximum prices per kilogram, which generally occurred during the month of March 1981, with the minimum prices per kilogram, which occurred during the months of October or November 1980 shows that late dry season prices were 10-30 percent higher than early dry season prices, depending on the cattle

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[12]Bureau pour le Développement de la Production Agricole, Programme de développement rural 1977-1981, production animale, tome 1, commercialisation du bétail bovin et des viandes bovines au Tchad, Ministère de l'Economie, du Plan et des Transports, République du Tchad, pp. 35-39.

[13]Larry Herman, "The Livestock and Meat Marketing System in Upper Volta: An Evaluation of Economic Efficiency," Unpublished Ph.D. Dissertation, Department of Economics, University of Michigan, 1981.

age-sex category. This difference would probably be greater if price data for the months of April, May and June could be compared with early dry season prices. Even after adjusting the 1980-1981 prices for inflation, the seasonal variation in cattle prices that prevails in the Mandara Mountains region and Northern Cameroon today is probably higher than Frechou's estimates.[14]

It is particularly important to note that the season variation in the prices of stall-fed cattle is greater than seasonal price variation for all other types of cattle. January 1981 was the last month stall-fed cattle were slaughtered at Mokolo or Soulede during the study. The January price per kilogram was 44.2 percent higher than the October price per kilogram. Although the sample size is far too small and our findings should therefore be treated cautiously, there is evidence that seasonal variation in the prices (per kilogram) of stall-fed cattle could work greatly to the advantage of producers. The very fact that there are far fewer observations for the months of February and March than for November and December suggests that stall-fed cattle prices per kilogram continue to rise after January, creating incentives for butchers to seek alternative sources of supply.

The magnitude of seasonal price variation has important implications for production and marketing of stall-fed cattle and for government policies regarding retail price controls on the sale of beef. As will be shown in the sensitivity analysis of Chapter Nine, the timing of

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[14]A monthly index of general prices was not available for the Mandara Mountains region or for Maroua during the survey research. During the six month period from September 1980 through March 1981, inflation in cattle prices was probably 5-6 percent.

acquisition and sale has a potentially great effect on the profitability of stall-feeding. By buying feeder calves when prices per kilogram are seasonally low (September-November) and selling finished bulls when prices per kilogram are seasonally high (March-June), producers are able to augment returns by as much as 40 percent over average annual returns (see Table 9-3). In order to benefit from the seasonal appreciation in prices, however, it will be necessary to raise or remove retail price controls on the sale of beef in urban areas. Purchasing power remains strong in the towns throughout the year, and urban consumers appear to be willing and able to pay higher beef prices during the periods of seasonally high cattle prices.

2. Retail Beef Price Trends during the 1970s

Cattle price time-series data for Northern Cameroon are very limited. Price statistics on sales of livestock have never been systematically collected. Bits of data can be gleaned from Livestock Service Annual Reports over the years, but there are no time-series data for the 1960s and 1970s. The statistics that are available are of little utility, however, since the cattle are classified by broad age-sex categories (bulls, steers, young bulls, cows, heifers, calves) and liveweights, or a proxy for liveweight such as girth, are generally not available. Time-series data are available, however, for retail sales of beef in the largest cities in Cameroon, which are generally the provincial capitals. Local officials of the Ministry of Economics and Planning purchase beef with and without bones, tripe, pork and sometimes live chickens twice monthly, weigh the sample observations and record the purchase prices. Unfortunately, for the purposes of this study,

time-series data for retail meat prices are available only for Garoua among all the towns in the Northern Province and only as an uninterrupted series since 1977. Nonetheless, these data do give us an idea of recent trends in cattle and beef prices in Northern Cameroon, even if the conditions affecting supply and demand for cattle and beef in the region around Garoua are somewhat different than those influencing prices in the Bogo-Gazawa-Mokolo axis.

Retail beef prices at Garoua rose steadily during the period 1977-1980, and probably at a higher annual rate of increase than the overall inflation rate for the late 1970s (see Table 7-3). The price of beef with bones rose at an average annual rate of 19 percent, while the price of beef without bones increased by 15 percent per year. Earlier data show that the nominal retail price of beef with bones rose by only 35 percent over the period 1969-1975, increasing slightly more than 5 percent per year. Yet the price of beef with bones increased by 70 percent from 1975 to 1977 at Garoua, representing the greatest change during any period for which data are available.

Similar trends in retail beef prices occurred in other regions of Cameroon, as illustrated by the price data for the 1970s for Bamenda (Northwest Province) and Yaounde in Annex 3. The price of beef with bones rose at an average annual rate of 11 percent in Bamenda and 15 percent in Yaounde from 1977 to 1980. The most rapid retail price increases took place from 1974 to 1977, when beef prices increased at an average annual rate of 25 percent in Bamenda and 18.5 percent in Yaounde.

Deflating retail beef price data from Bamenda and Yaounde during the 1970s by the consumer price index shows that beef prices appreciated by 4 percent per year. Assuming this appreciation prevailed in Northern

TABLE 7-3

RETAIL BEEF PRICES AT GAROUA, 1977-1980 (FCFA PER KG.)

	Beef With Bones			Beef Without Bones			Beef Tripe	Chicken[2]	
Year	Retail Price[1]	% Change From Year to Year	Index 1971=100	Retail Price[1]	% Change From Year to Year	Index 1977=100	Retail Price[1]	Retail[1] Price	Index 1977=100
1969[3]	122			160					
1975[3]	165						150		
1977	281		100	375		100		560	100
		26.6			15.5				
1978	356		127	433		115	250	601	107
		11.2			9.7				
1979	396		141	475		127	246	650	116
		18.7			22.7				
1980	470		167	583		155	285	646	115

Source: Ministère de l'Economie et du Plan, Direction de la Statistique et de la Compatibilité Nationale, Yaounde.

[1]The annual retail prices are simple unweighted averages of all available monthly observations.

[2]The retail chicken prices are liveweight price per kilogram.

[3]These data were reported in Sarniguet, J. et al., Etudes préliminaires à la création d'une Communauté économique du bétail et de la viande dans les pays de l'union Douanière et Economique de l'Afrique Centrale, S.E.D.E.S., Paris, Mars 1976.

Cameroon, producers had an economic incentive to invest in stall-fed cattle during the 1970s. Simply holding the animals would lead to an appreciation in their value. If this real appreciation continues in the 1980s, returns to stall-feeding will increase, as is shown in the sensitivity analyses of Chapters Four and Nine.

E. CATTLE PRICE VARIATION ACROSS SPACE IN NORTHERN CAMEROON AND NORTHEASTERN NIGERIA

Cattle prices are clearly higher in Northern Cameroon the farther one moves westward from the Chadian border toward Nigeria. Cattle prices were not monitored in any market east of Gazawa during the survey research, so it is not known how much higher cattle prices are on the Nigerian border than on the Chadian border. Data were collected, however, that show differences between prices paid at the Gazawa cattle market and those obtained by herders, farmers and traders at Mokolo, Tourou and border markets.

The offer prices for male cattle less than three years old averaged nearly 2,000 FCFA per month more at the Mokolo cattle market than at Gazawa over the period September 1980 through March 1981. These young bulls are typically acquired for stall-feeding. Offer prices for immature males at Tourou were almost 5,000 FCFA higher on average than at Mokolo. This price differential represents in part a return to the labor, management and capital of small-scale cattle traders for trekking young bulls acquired at Gazawa cattle market to villages such as Magoumaz, Mandaka and Mofole, where they are not sold, and then on to the Tourou market. Depending on the season and the age, sex and weight of the animals, cattle prices are alleged to be anywhere from 2,000

to 20,000 FCFA higher per head in Nigeria than in the Diamare Plains and the Mandara Mountains region. Since Nigerian butchers and small-scale traders often attend the Tourou market, prices for well-fleshed, mature male cattle ranged from 5,000 to 30,000 FCFA higher than at Gazawa.

Cattle acquisition and resale price data obtained from several cattle smugglers during the months of February and March 1981 reveal that cattle prices in major Nigerian assembly markets (Mubi, Lassa, Maiduguri and Bama) were 10,000-20,000 FCFA higher per head than prices prevailing in the markets of the Diamare Plains. The average acquisition price paid in Cameroon for these mature trade cattle, which were all bulls and steers, was 87,140 FCFA per head, while the sale price in Nigeria averaged 102,020 FCFA per head.[15] The difference in cattle prices is, of course, proportionally less for younger and less well-fleshed stock. For example, a bull bought at Gazawa for 40,000 FCFA would rarely fetch more than 50,000 FCFA in Nigeria and might fetch substantially less, depending upon the supply of trade cattle offered for sale at the Nigerian markets on any given week. In addition, a small-scale cattle smuggler from Roumzou, which is less than five kilometers from the Nigerian border and 25-30 kilometers from Michika, a small to medium size consumption-redistribution market in Nigeria, reported gross margins of 5,000-10,000 FCFA per head on cattle acquired for 60,000 FCFA from herders near Roumzou.

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[15]The FCFA prices for trade cattle sold in Nigeria for Naira, the Nigerian currency, were calculated by using an exchange rate of 1,000 FCFA = N 3.5, which was the current black market rate in March 1981. Cameroonian cattle traders claim they are able to sell large sums of Naira to other Cameroonian merchants who buy cloth, shoes, canned goods and other consumer goods in Nigeria for resale in Cameroon.

As a general rule of thumb, sale prices in Nigeria are usually 10-20 percent higher than acquisition prices in Cameroon for individual animals. The existence of profitable marketing opportunities for cattle producers who live close to the Nigerian border has important implications for the viability of stall-feeding enterprises. The returns from the sale of well-fleshed, mature male cattle at Nigerian markets or to Cameroonian smugglers are generally higher than the returns from sale to local butchers, as will also be shown in the sensitivity analysis of Chapter Nine. Continued expansion of demand in Nigeria will potentially absorb large numbers of stall-fed cattle produced in the Mandara Mountains, providing a safety valve as well as lucrative marketing opportunities for producers.

CHAPTER EIGHT

THE SUPPLY AND DEMAND FOR STALL-FEEDING PRODUCTION INPUTS

While Chapter Four examines inputs into stall-feeding enterprises from a microeconomic perspective, this chapter analyzes some of the macroeconomic consequences of expanding production of stall-fed cattle. The chapter begins with a discussion of the sources and flows of feeder calves and the likely effects of increasing the demand for feeder calves. In the second section the available supply of forage and water resources is assessed, and the probable macroeconomic consequences of expanding production on the supply and demand for forage and water are analyzed. Alternative sources of feed are then identified and discussed. Finally, the institutional capabilities and programmatic emphases of the Livestock Service and FONADER are examined. FONADER's ability to provide adequate extension and veterinary inputs to stall-feeding enterprises is also critically discussed.

A. THE EFFECTS OF EXPANDING STALL-FED CATTLE PRODUCTION ON THE SUPPLY AND DEMAND FOR TRADITIONAL INPUTS

1. Flows of Feeder Calves

In Chapter Three it was estimated that the offtake of stall-fed cattle was 6,000 head in the Mandara Mountains in 1980. Assuming that all of the disposed stock were replaced within a several month period

by the original producers or new stall-feeding households, approximately 6,000 bull calves were acquired for stall-feeding in 1980.

Nearly 90 percent of the feeder calves are procured in the Diamare Plains. The survey of stall-feeding households in five villages near Mokolo showed that respondents purchased 56 percent of their bulls for stall-feeding at Gazawa, Maroua or Bogo. If this proportion holds for the entire region, then approximately 3,350 feeder calves are procured by producers in the Diamare Plains. Yet this figure is clearly an underestimate of the inflow of cattle for stall-feeding from the plains. Mixed farmers obtained 42 percent of their feeder calves from local traders or farmers in their villages. The proportion of these animals procured initially in the plains' markets is unknown, but it is probably at least two-thirds. If three-quarters of the bull calves purchased in the villages were trekked from the Diamare Plains, then 1,900 additional head or a total of 5,250 feeder calves were imported into the Mandara Mountains in 1980.

The remaining 750 feeder calves were obtained from the regional extensive cattle herd. Some of the wealthier farmers own cows which produce calves that enter stall-feeding enterprises. Other households buy bull calves from Fulani herders. Occasionally oxen are acquired for stall-feeding.

If stall-feeding expanded significantly in the Mandara Mountains, prices of feeder calves would be bid up in the markets of the Diamare Plains. This could lower producers' returns to stall-feeding. In order to minimize the upward pressure on prices, proportionally more loans should be disbursed during the period of abundant supply (September-December), when feeder calf prices are relatively low. At the same time

relatively few loans should be disbursed during the period March-June, when prices per unit of liveweight are seasonally highest. Alternativ more feeder calves could be taken off the regional herd if stall-feedi expanded significantly.

2. Forage and Water Resources

a) Carrying Capacity of the Mandara Mountains Region

Schillhorn argues that the Mandara Mountains region is already overstocked.[1] He assumes that 40 percent of the 5,400 km^2 of pasture, woods and undeveloped land can be used for grazing and calculates that roughly 700,000 metric tons of dry matter are available as livestock feed each year.[2] Approximately 29 percent of this dry matter is available in the form of crop residues, 64 percent as pasture and 7 percent as browse. Assuming an annual dry matter intake of three metric tons per livestock unit, he calculates the carrying capacity of the region to be roughly 230,000 livestock units. As the analysis in Chapter Thre showed, there are an estimated 211,000 livestock units in the region, using Livestock Service population figures as a base. According to these estimates, the region could support a 10 percent increase in the

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[1]Tjaart Schillhorn van Veen, Notes and Observations on the Livestock Sector in the Margui-Wandala Area of North Cameroon, MSU/USAID Mandara Mountain Research Report No. 4, Department of Agricultural Economics, Michigan State University, East Lansing, June 1980, pp. 16-17

[2]In calculating dry matter availability, Schillhorn employs the USDA/FAC estimates of land use, which are found in the Resource Inventory of North Cameroon, Africa, and C. R. C. Hendy's technique for calculating available forage, found in "Animal Production in Kano State," Land Resources Report, No. 21, Land Resources Division, O.D.A.

livestock population (as expressed in livestock units), or another 27,500 bovine units. It should be emphasized, however, that both the estimates of available pasture and livestock population may not be accurate. Moreover, even if the carrying capacity of the region has not been reached, it is possible that areas within the region (such as the mountainous and piedmont zones) are already overstocked.

b) The Effect of Expanding Stall-Fed Cattle Production on Forage Resources

Increasing the production of stall-fed cattle would augment demand for traditional inputs, such as hand-cut forage, water, minerals, stored fodder and agricultural by-products. In many villages where stall-feeding is practiced, population density is high, permanent cultivation is the norm and hence little land is available for grazing or forage production. If the number of stall-fed cattle increased significantly in these villages (such as Magoumaz), existing forage resources would be strained. Households would probably be able to obtain the additional forage necessary to feed an extra head of cattle, but the labor required to cut and carry fresh grasses might increase considerably. Since forage has to be cut and carried during peak agricultural periods, any additional labor needed to obtain grasses would compete with crop production.

As pointed out in Chapter Four, increasing the number of stall-fed cattle would create additional employment opportunities for households having more than enough labor during the agricultural slack period (mid-August through mid-October) to collect and dry fodder for use in the dry season. Allocating more labor to obtaining forage for storage would

detract from other income-generating activities during the slack period. Household heads would spend less time making twine from local grasses and their wives might not be able to prepare as much sorghum beer for sale.

Expanding stall-fed cattle numbers would probably increase the cost of acquiring stored feed for stall-feeding households that have to buy at least some of their fodder for late dry season and early rainy season feeding. Households that sell surplus stored fodder would allocate more time to collecting and stocking grasses and hence expect a higher return to their labor. In addition, these households might construct additional storage shelters, thereby increasing their cost of providing storage services to fodder-buying households.

If cattle stall-feeding were expanded greatly, then there might be an economic incentive to introduce fodder crop production. This would only be profitable if the pressure on existing forage resources were so great that livestock owners were unable to collect and store sufficient forage or to buy enough stored fodder for their own use. In a region where cereals deficits are common, however, it is unlikely that farmers would devote much land to fodder crop production unless the returns were very high. Presently, most land is put under cereal cultivation, and there is little or no surplus land that could be used (at low opportunity cost) for fodder production. In less densely populated villages where more surplus land is available, as in villages bordering the plateau or plains, land could be more easily shifted to fodder crop production. In these villages it is more likely, however, that the availability of uncultivated land, which is used for dry season grazing, would reduce

producers' incentives to grow fodder crops. Furthermore, successful introduction of fodder crop production presupposes that returns to cultivating fodder crops surpass those to growing cotton, peanuts, sweet potatoes, sorghum, and other crops. This is unlikely in the forseeable future in the Mandara Mountains region.

c) The Effect of Expanding Stall-Fed Cattle Production on Water Resources

Water is another input that would be in short supply in some villages if stall-feeding expanded significantly in the Mandara Mountains region. Mavoumai is an example of such a village. During the late dry season and early rainy season (April-June) stall-feeding households in Mavoumai allocate from two to three hours per day obtaining and head-carrying water. There is little surface water left near the village during this period. The presence of Fulani graziers on the plateau west of Mokolo contributes to the rapid depletion of water resources. The closest unlimited source of water supply for the stall-feeding households at Mavoumai is the dam to the north of Mokolo. For most households in the village, a round trip to the dam requires at least one and one-half hours.

During the months of May and June, allocation of more labor to obtaining water would compete with cropping activities such as sowing and the first weeding. This could lower agricultural output in a region where many households do not produce enough grain to last through the hungry season without selling small ruminants or cutting back to one meal per day. If cereals production were lowered and households were increasingly compelled to sell livestock in order to purchase grain during the rainy season, they would be drawing down assets (in the form

of livestock) that reduce the risk of famine and give rural households greater flexibility in coping with grain shortfalls. The above scenario would probably not occur unless stall-fed cattle numbers increased dramatically. If the expansion in stall-feeding were moderate, the additional pressure on water resources during the late dry season and early rainy season would increase labor inputs into stall-feeding but should not create any undue hardship for livestock owners. The availability of water in villages within 5-20 kilometers of the dam near Mokolo could be increased by piping water from the dam to central points in the villages. This would significantly reduce labor inputs for stall-feeding households.

B. PRESENT AND PROJECTED SOURCES AND USES OF AGRO-INDUSTRIAL BY-PRODUCTS IN NORTHERN CAMEROON

1. Rice Processing By-Products

a) Production and Uses of Rice Processing By-Products

Rice bran and flour are by-products of rice-milling that serve as an energy-rich feedstuff for cattle, pigs and chickens. During the 1970s SEMRY (Société d'Expansion et de Modernisation de la Riziculture de Yagoua) began to promote irrigated rice production in the lowlands along the Logone River near Yagoua in Northeastern Cameroon. SEMRY constructed a rice-processing plant in Yagoua which mills participating farmers' paddy, producing 1,000 metric tons of rice flour and 400 tons of rice bran a month over the course of eight to ten months of the year.[3]

[3] M. Larguier, head of the marketing division of SEMRY, graciously provided me with most of the information about production and marketing of rice-milling by-products.

Roughly three-quarters of the rice flour is exported from the region to commercial livestock producers and firms in Southern Cameroon. These enterprises use modern technology in producing pork and poultry for urban consumption in such cities as Yaounde, Douala, Nkongsamba and Bafoussam. The rest of the rice flour is sold to local pig producers, fed to cattle that are held for 90 to 100 day feeding trials at the SEMRY livestock center, or bought by local Massa and Fulani cattle owners who feed the flour to weak and vulnerable stock during the late dry season and early rainy season. In addition, SEMRY is beginning to promote short-term intensive cattle production by smallholders around Yagoua, albeit on a very modest scale.

In early 1981 SEMRY was selling 70 kilogram sacks of rice flour and bran for 900 FCFA, although the head of the marketing division predicted that the price per sack would attain 1,200 FCFA by the end of 1981. The rice straw has never been sold. Instead, SEMRY has allowed local herders and farmers to take whatever straw they need.

During the first few months of 1981 SEMRY was having difficulty selling its rice to local merchants. These merchants had signed marketing contracts with SEMRY but decided to renege on their contractual obligations in light of increases in the price of rice. Without a stable and regular outlet for its rice, SEMRY had shut down the rice processing mill. Whenever the mill is shut down for more than a few weeks, rice-milling by-products become increasingly scarce. While I was visiting the SEMRY livestock farm in March 1981, the director of the feeding trials was compelled to modify the ration fed to the cattle at the livestock farm so that it included more forage and less rice bran. This /

uncertain rice-milling and marketing situation threatens to make SEMRY an unpredictable and unreliable source of supply for possible users in the 1980s.

b) Projected Expansion of Rice Production and Rice-Milling By-Products in the 1980s

Even though SEMRY is having difficulty selling rice produced around Yagoua, it has already set in motion plans to more than double rice production in Northeastern Cameroon. SEMRY II, with its headquarters in Maga, which is located 80 kilometers northeast of Maroua, will actually produce twice as much rice as SEMRY I (Yagoua) by 1986. The director of the livestock division at SEMRY is reluctant to promote intensive feeding of cattle during the dry season around Yagoua, recognizing that demand for well-fleshed slaughter cattle is limited in that area and that it is not feasible to trek fattened cattle any more than 30 kilometers (or one full day) to market during the hot season, when sale prices are highest.[4] He argues, however, that intensive cattle production using rice-milling products and by-products has greater potential in the region around Maga, since the largest assembly market in Northern Cameroon is located at Bogo, which is less than 50 kilometers from Maga. He intends, therefore, to promote dry season cattle feeding around Maga.

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[4]Dr. Petot, livestock director at SEMRY, spent the better part of a day in March 1981, discussing SEMRY's cattle production and extension programs, showing me the SEMRY livestock farm, and accompanying me on a tour of several farms where farmers are feeding rice by-products to cattle. The SEMRY program is discussed in greater detail in Annex 5.

c) Potential Macroeconomic Consequences of Promoting Intensive Cattle Production in Northeastern Cameroon

From a macroeconomic perspective, it is important to anticipate the effect that expansion of intensive cattle production in Northeastern Cameroon might have on production costs and marketing opportunities for small farmers who stall-feed cattle over longer periods in the Mandara Mountains. Expanding intensive cattle production around Yagoua and Maga would bid up the cost of rice bran, which is presently provided to loan recipients in the FONADER scheme. Furthermore, increased late dry season and early rainy season marketings of well-fleshed cattle in the Diamare Plains at markets such as Bogo and Moulvouday would probably eliminate one possible profitable marketing opportunity for stall-feeding households in the Mandara Mountains. Although trucking of stall-fed cattle 70 or more kilometers to Maroua is presently not economically viable, the opening of a paved road in the next few years could make trucking of well-fleshed cattle to Maroua a profitable marketing opportunity. If intensive cattle production is promoted at the same time in the rice-growing areas of Northeastern Cameroon, then returns to trucking stall-fed cattle from the Mandara Mountains to Maroua would probably be greatly reduced.

d) FONADER's Experience with Using Rice Bran in the Pilot Stall-Feeding Loan Scheme of the Mandara Mountains

FONADER is experimenting with supplemental dry season feeding of rice bran to stall-fed cattle in the loan scheme that is being implemented in the Mandara Mountains. Participating farmers receive 6,000 FCFA of their 45,000 FCFA loan in kind. Four 70 kilogram sacks are

provided to loan recipients during the first year and two additional sacks are furnished during the second year. FONADER bought the rice bran for 900 FCFA per sack in 1980-81, and charged farmers 1,000 FCFA per sack as part of the loan. The 100 FCFA per sack difference offset only 22.5 percent of the transportation costs incurred in 1980. The introduction of this new feeding technology is therefore heavily subsidized, presumably to facilitate its adoption.[5]

During the first three years (1979-1981) of the pilot credit scheme for cattle stall-feeding, FONADER purchased large quantities of rice flour and bran from SEMRY at Yagoua for distribution to loan recipients in the Mandara Mountains. FONADER transported the rice bran from Yagoua to Mokolo and Koza, where the sacks were stored in central depots and distributed to farmers who came to claim the bran. During the dry season of 1980 FONADER contracted a Maroua transporter to truck the 2,562 70-kilogram sacks of rice bran from Yagoua to Mokolo and Koza, paying 1,100,000 FCFA for the transport and 40,000 FCFA for unloading the bran at the Mokolo and Koza storage depots.[6] Therefore, FONADER paid 445 FCFA per sack or 6,357 FCFA per metric ton for transportation and handling which converts to 32.4 FCFA per metric ton per kilometer.

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[5]FONADER paid 2,305,800 FCFA in 1980 to acquire 2,562 70-kilogram sacks of rice bran at 14.3 FCFA per kilogram. The loan recipients were assessed 100 FCFA per sack above FONADER's acquisition price of 900 FCFA per sack, thereby contributing 256,200 FCFA to the cost of transporting and handling the bran (1,140,000 FCFA). The total cost of acquiring, transporting and handling the rice bran was 3,445,800 FCFA, of which participating farmers paid 2,562,000 FCFA. The subsidy to the loan recipients was, therefore, 345 FCFA per sack in 1980, which represented 25.7 percent of FONADER's total costs. The magnitude of the subsidy is, of course, far greater when FONADER agents' salaries, office overhead, and storage costs are included in the calculation.

[6]Most of the details concerning FONADER's procurement and distribution of rice bran were obtained in informal interviews with Pascal Stefan, an accountant and credit specialist at the FONADER agency in Maroua.

The rate FONADER paid the Maroua transporter per ton kilometer in 1980 is comparable to the author's estimates of transport costs per ton kilometer in Northern Cameroon. When compared to transport costs borne by sweet potato merchants, the costs incurred by FONADER in shipping rice bran from Yagoua to the Mandara Mountains region appear to be reasonable, especially when the differences in the quality of the roads travelled are taken into account.

Although transport rates from Yagoua to Mokolo and Koza appear to be competitive, distribution of the rice bran from FONADER storage depots in Mokolo and Koza to loan recipients in rural areas has proven to be a serious problem. Farmers are required to procure and transport the sacks of rice bran at their own expense. Most of the loan recipients acquired their four sacks of rice bran at the Mokolo and Koza storage facilities during the first dry season of the two-year program, but few bothered to procure the final two sacks during the second dry season.

There were several reasons for farmers' disenchantment with the rice bran feeding experiment. First, FONADER was late in transporting the rice bran to the Mokolo and Koza storage depots in 1980-1981 and slow in distributing the bran to farmers at these centers. During the extensive survey (May 8-9, 1980) three loan recipients at Mazai, a Mafa village only five kilometers to the west of Koza, reported that they had procured their four sacks of rice bran within two weeks of the survey. This was at least a month and a half later than desirable, since forage resources are generally seriously depleted in and around villages by mid-March. Other loan recipients claimed that they were not forewarned of the dates and times during the week when the rice bran would be

available for distribution. Some complained of making more than one trip to Mokolo or Koza to obtain the bran.

Upon procuring the rice bran, loan recipients are required to transport the sacks of rice bran from Mokolo or Koza to their villages. Although 6 of the 17 farmers and their wives in Mavoumai carried four 70-kilogram sacks distances less than five kilometers, the other loan recipients at Mavoumai and all the loan holders at Magoumaz paid transporters 400-800 FCFA to have bush taxis transport their four sacks of rice bran from Mokolo to their villages. Furthermore, loan recipients in villages farther from Mokolo, such as those along the Soulede-Meri road, will have to pay more to acquire their rice bran.

A problem stemming in large part from the slow, untimely, and incomplete distribution of the rice bran is spoilage. Only two of the 30 loan recipients in Magoumaz and Mavoumai reported that they fed the rice bran to their bulls for more than a few weeks, claiming that the rice bran was spoiled and insect-infested and hence either rejected by the bulls or ingested, causing diarrhea. A Belgian range agronomist and animal nutritionist who is on the faculty of the Veterinary School at Maroua argues that the insect problem is common and has no adverse effect on the cattle's health.[7] Spoilage is the more serious problem, since rice bran begins to deteriorate after six weeks of storage, or even sooner if the bran is stored under moist conditions.[8]

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[7]Mr. Dinner, Veterinary School, Maroua, personal communication, October 1980.

[8]Dr. Petot, head of the livestock division of SEMRY, claims that oxidization of the rice bran starts occurring after six weeks of storage (personal communication, March 1981).

Storage of the rice bran does not appear to be a serious problem. Loan recipients store the bran in large clay pots inside their huts, and the feed is dry and well-protected. The storage facilities at Mokolo and Koza are also satisfactory. Spoilage is primarily the consequence of long lags between initial procurement of the rice bran in Yagoua and final distribution to the farmers and transportation, as well as storage of the bran during the early part of the rainy season, when the humidity begins to increase. Transportation, handling, storage and distribution of concentrated feedstuffs are marketing functions that the private sector could probably perform far better than FONADER. If it can be shown that returns to the use of feeds such as rice bran, cottonseed cake and brewing by-products in intensive cattle production are sufficiently high, then as an alternative FONADER could organize the procurement and marketing of feed inputs, providing merchants and transporters with incentives to supply inputs to producers.

2. Cottonseed Cake

a) Present Sources and Principal Uses of Cottonseed Cake

Rice bran is not the only agro-industrial by-product available in substantial quantities in Northern Cameroon. Cottonseed cake is a by-product of cottonseed oil processing carried out by SODECOTON in Maroua and Kaele. The Maroua plant is capable of producing 15,000 metric tons of cottonseed cake and 6,000 tons of groundnut cake per year, while the Kaele plant is capable of producing 12,000 metric tons of cottonseed cake.[9] SODECOTON officials state that production of 10,000 tons of

[9]USDA, Soil Conservation Service and FAC, France in cooperation with USAID, Resource Inventory of North Cameroon, Africa, 1974.

cottonseed cake at the Maroua plant and 5,000 tons at the Kaele installation are more realistic estimates of processing capacity under present operating conditions.[10] Production levels are substantially lower than estimated plant capacity, however, as the figures for the Maroua plant shown in Table 8-1 indicate.

TABLE 8-1

PRODUCTION OF COTTONSEED OIL CAKE AND GROUNDNUT OIL CAKE AT THE SODECOTON OIL PROCESSING PLANT IN MAROUA, 1974-75 TO 1979-80

Year[2]	Cottonseed Oil Cake[1]	Groundnut Oil Cake[1]
1974-75	4110	730
1975-76	5150	1000
1976-77	4180	1200
1977-78	5120	1800
1978-79	6000	877
1979-80	7377	1200

Source: SODECOTON Huilerie, Maroua.

[1]All figures represent metric tons.

[2]The production period runs from August of one year through the end of July of the following year.

SODECOTON planned to open another oil processing refinery at Garoua in late 1981 that will be used to further extract oil from cottonseed cake (that has already been processed). According to SODECOTON's

[10]Most of the information on the production and uses of cottonseed cake was obtained in a February 1981 interview with Mr. Milo, Director General of Marketing for SODECOTON at Garoua.

marketing director, production of groundnut oil cake was discontinued in 1980-81. Groundnuts were bought from 1974-75 to 1979-80 to keep the oil processing plants running at minimally acceptable levels during periods when there were few or no cotton grains to process.

Until several years ago most of the by-products of SODECOTON's oil processing were exported to Western Europe, where they were used as livestock feed. Export quotas had to be fulfilled before local sales of by-products could take place. As the demand for protein-rich concentrates used in livestock feeding has increased in Cameroon in recent years, the quotas have been abandoned and increasing quantities of cottonseed cake have been used in Northern Cameroon and shipped to Southern and Central Cameroon.[11] Purchasers of cottonseed cake in Southern Cameroon are usually large-scale private firms, such as Compagnie Pastorale and Société Niabang, that are located near cities such as Yaounde, Douala, Nkongsamba and Bafoussam. These firms employ modern techniques of animal husbandry to raise pigs, chickens and small ruminants for urban consumption. FONADER/Yaounde also buys cottonseed cake for distribution to small-scale poultry and pork producers in Central South Province. The principal buyers of cottonseed cake in Central and Northern Cameroon are the Compagnie Pastorale production unit at Ngaoundere and the FONADER agencies in Ngaoundere and Garoua,

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[11] In 1981 SODECOTON was authorized by the Ministry of Livestock to export only 1,000 tons of cottonseed cake, even though the world market price (52-55 FCFA/kg in early 1981) and the price in France (60 FCFA/kg) were double the sale price in Northern Cameroon (23 FCFA/kg), which SODECOTON maintains is just sufficient to cover production costs. Sales of cottonseed cake in Cameroon have increased from virtually nothing in 1974-75 to 4,320 tons in 1978-79, 6,019 tons in 1979-80, and a projected 7,500-8,000 tons in 1980-81. The largest single client is the Centre d'Assistance Rurale, a livestock production organization run by the Presbyterian Church in Douala, which purchased 989 tons in January 1981.

which distribute the cake to herders who have received loans for upgrading their cattle operations and to the cattle ranch at Faro (near Ngaoundere). FONADER and commercial users of cottonseed cake have paid between 1,430 and 1,700 FCFA per 65 kilogram sack, or between 22 and 26 FCFA per kilogram, to acquire the cake at the factory gate. Hence, users bear all transportation costs from Maroua or Kaele to the point of destination. Even after transportation and handling costs have been accounted for, users of cottonseed cake in Cameroon pay far less than the world market price, which was 52-55 FCFA/kg in early 1981.

b) Present and Projected Expansion in the Use of Cottonseed Cake in Northern Cameroon

While demand for the cottonseed cake will clearly increase in regions of Cameroon outside the North, as urban population, incomes and demand for livestock products increase in Southern Cameroon, it will also expand in cotton growing areas of Northern Cameroon during the 1980s. SODECOTON had already begun to promote the expansion of animal traction among cotton farmers. FONADER/Garoua is providing loans to SODECOTON farmers for the purchase of heifers and plows.[12] Participants

[12]SODECOTON is promoting animal traction using heifers as a result of successful experimentation in Senegal and Ivory Coast. Not only are heifers used for plowing and weeding, but they are supposed to produce one calf per year. Therefore, the heifers' nutritional requirements will be high, especially during the first half of the rainy season when traction requirements are greatest and while the heifers must produce milk for their offspring. In order to ensure the success of this innovation, SODECOTON will employ 12 veterinary agents to monitor the health and nutrition of the increased number of traction animals in the Maroua sector (Diamare, Margui-Wandala). SODECOTON intends to hire these agents principally from the ranks of the Livestock Service, which may weaken the already limited capacity of the Livestock Service in Northern Cameroon to provide the livestock of herders and non-cotton growing farmers with adequate veterinary care. SODECOTON presently pays higher salaries and provides motorcycles and other incentives to lure extension agents away from the agricultural extension service.

in the animal traction program were paying only 1,000 FCFA per sack of cottonseed cake in 1980-81, which represents a 33 percent subsidy on the acquisition price alone. The subsidy is designed to encourage heifer and oxen owners to use the cake as a late dry season and rainy season feed supplement.

Although SODECOTON's internal demand for cottonseed cake will expand during the 1980s, SODECOTON is willing to sell more cottonseed cake in the region around Maroua than it currently is selling, since officials claim that SODECOTON loses less money when it incurs little or no transport costs.[13] These officials are willing to authorize trucking of cottonseed cake to SODECOTON posts for sale to local herders and farmers, provided there is sufficient demand for the concentrate and they will not be required to backhaul any unused cake. SODECOTON trucks presently run at least half empty en route to posts to which they carry fertilizer and from which they haul harvested cotton for processing in Maroua (and Kaele). Consequently, the marginal cost of hauling cottonseed cake to the posts for eventual distribution to farmers and herders is quite low. SODECOTON officials demand assurances by potential users, however, that the cottonseed cake transported to the posts will be purchased. Prospective users would have to place orders months (September-October) in advance of the critical feed constraint period (March-June) in order to ensure SODECOTON delivery. These procedures seem reasonable enough, but it is uncertain whether potential users would have the foresight to plan months in advance for late dry season and early rainy season supplemental feed requirements that are difficult to predict in advance.

[13]Mr. Escargeuil, chief of SODECOTON's operations in Diamare, Margui-Wandala and Mayo-Danai (the Maroua sector), explained SODECOTON's policy regarding possible uses of cottonseed cake in Northern Cameroon.

Presently sales of cottonseed cake to local farmers and herders in the Mandara Mountains region are limited. Cotton-growing farmers who use oxen for plowing and weeding purchase cottonseed cake from SODECOTON as a dry season feeding supplement. These users pay only 1,000 FCFA per sack, as SODECOTON subsidizes purchases of cottonseed cake by its own farmers. There are also some herders in the plains around Koza, Mora, Meme, Gawar, Hina and Mokong who buy the cake at SODECOTON posts in order to reduce late dry season mortality. Fulani herders who graze their cattle on the plateau around Mokolo during the rainy season and transhume to dry season grazing areas in the plains reported that they bought cottonseed cake to feed to 12 percent of their calves. Herders around Maroua also buy cottonseed cake to feed to weak, young and otherwise vulnerable stock during the late dry season, when little pasture is available. During the dry season of 1980, when cattle mortality was becoming a serious problem in the Diamare Plains, the Livestock Service of the Central Northern Sector bought 180 tons of cottonseed cake for 1,452 FCFA per sack and resold it to herders for 1,000 FCFA per sack. At a price of from 22 and 26 FCFA per kilogram, most herders who graze their cattle extensively are willing to purchase only small quantities of concentrates for feeding under dry season stress conditions.

c) Cottonseed Cake as a Possible Input into Cattle Stall-Feeding

Small farmers who stall-feed cattle in the Mandara Mountains region do not purchase cottonseed cake for supplemental feeding. Neither SODECOTON nor private marketing agents transport cottonseed cake to areas where stall-feeding is practiced. Moreover, there are no storage facilities in production areas, which are necessary for maintaining the

nutritional quality of a perishable input such as cottonseed cake. On the other hand, even if transport, storage and distribution services could make cottonseed cake available to stall-feeding households, it is doubtful whether farmers could afford to pay 22 to 26 FCFA per kilogram when other sources of dry season feed, such as dried hay, are available at far lower costs. Finally, small farmers are unfamiliar with cottonseed cake and unaware of its potential usefulness in helping to maintain livestock during the late dry season and early rainy season, when liveweight losses are typically greatest. Hence, any attempt to introduce supplemental feeding using cottonseed cake would require a substantial input of extension services.

In the original design of the stall-feeding credit scheme, it was proposed that farmers feed a dry season supplement of 150 kilograms of cottonseed cake to their cattle each year during a two-year fattening period.[14] If all of the 10,000 metric ton output of the Maroua SODECOTON plant were available for use in Northern Cameroon and cattle were fed 150 kilograms per year, over 53,000 head could receive a cottonseed cake feed supplement. This could be used to feed all the stall-fed cattle and oxen in the Mandara Mountains region as well as 27,000 oxen and range-fed cattle in the Diamare Department.

FONADER has never bought cottonseed cake as a supplement for stall-feeding enterprises, however, although the Maroua agency's credit specialists considered buying the cake in late 1980 for distribution to loan recipients. They decided to continue purchasing rice bran from SEMRY, however, strictly on the basis of financial as opposed to

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[14] World Bank, Cameroon: Appraisal of a Rural Development Fund Project, Report No. 1479-CM, May 1977.

nutritional and economic criteria. That is, they calculated that the cost of acquiring rice bran in Yagoua and transporting it to Mokolo was lower than the cost of buying cottonseed cake in Maroua and transporting it to Mokolo.[15] No comparison of the probable weight gains from feeding both rice bran and cottonseed cake to stall-fed cattle was made. Applied research that generates estimates of the costs, weight gains and returns from using the two different feeding technologies may reveal that employing cottonseed cake would be more profitable, assuming that extension services would be adequate enough to ensure realization of the possibly greater benefits from feeding cottonseed cake.

3. Brewing By-Products

A third agro-industrial by-product of Northern Cameroon, which has been exploited very little to date, is brewing by-products. Brasseries du Cameroun operates a brewery at Garoua hich produces 12,100 metric tons of brewing by-products per year.[16] Eighty percent of these by-products is water, while 20 percent is malt used in the brewing process. Almost all of these by-products are dumped in the bush around Garoua, although an Egyptian chicken producer in Ngaoundere and German missionaries in Pitoa (17 kilometers north of Garoua on the paved road to Maroua) have bought limited quantities for experimental purposes.

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[15]FONADER calculated the FCFA financial costs of buying and transporting rice bran and cottonseed cake as follows:

	Rice Bran	Cottonseed Cake
Cost of 65-70 kg sack of feed concentrate:	900	1500
Transport cost from processing plant to Mokolo:	445	250
	1345	1750

[16]Mr. Zurrer, the head of the marketing division of the Brasseries du Cameroun brewery at Garoua, provided detailed information about the Garoua installation's production and present and projected uses of brewing by-products.

One reason so little of these brewing by-products is commercially utilized is that their high water content makes transport and handling costs and storage losses very high. The director of the marketing division of the Garoua brewery said that Brasseries du Cameroun is considering installing compression and drying machinery that produces a flour from water-laden brewing by-products containing only 4-5 percent water. Compressors are operated at Yaounde and Bafoussam and the dried brewing by-products are sold to pork and poultry producers, which are primarily medium to large scale firms that buy concentrated feedstuffs and veterinary inputs. This type of equipment was also in operation for several years at the brewery at Douala, but high operating costs made continued drying and compressing uneconomic. Brasseries du Cameroun has hesitated to install a compression and drying unit at Garoua, because it is uncertain as to whether demand for dried brewing by-products is great enough to justify such an investment. The director of marketing was very interested, however, to hear of potential uses of brewing by-products in livestock feeding in the Mandara Mountains region. He estimated that dried brewing by-products would be sold for 28-40 FCFA per kilogram at Garoua.[17]

C. THE SUPPLY AND DEMAND OF VETERINARY AND EXTENSION SERVICES

1. Present Level of Veterinary Services in the Mandara Mountains Region

a) Personnel

There are two subsector offices of the Livestock Service in Margui-Wandala: Mokolo and Mora. The Mora Subsector office was created in

[17]This estimate is based upon the price at which the brewery at Yaounde sells its brewing by-products (35 FCFA/kg in early 1981).

1979 and was formerly part of the Margui-Wandala Subsector, which also included what is presently the Mokolo Subsector office. The Mokolo Subsector contains all the areas inhabited by the Mafa, where FONADER loans have been extended, so we shall limit our discussion to this subsector.

There are four veterinary posts in the Mokolo Subsector, located at Mokolo, Koza, Bourha and Hina. A fifth veterinary post was created at Mogode in 1979-80 but it had not been staffed as of March 1981. Each veterinary post is manned by a chief of post, who has usually received several years of specialized, post-secondary school training, a vaccinator, who is typically an individual recruited locally and trained on the job, and several unskilled laborers. In addition there are four FONADER credit/extension agents in the subsector (two at Mokolo and two in Koza), who have received specialized training comparable to the chiefs of post at the Veterinary School in Maroua. There were 25 employees of the Livestock Service working in the Mokolo Subsector in 1980-81. All of these employees are veterinarians or veterinary aides. There are no extension agents. The Livestock Service in the Mandara Mountains region does not provide extension services in the areas of livestock nutrition, housing and breeding or forage and fodder crop production.

Given the geographic area and the livestock population of the Mokolo Subsector, the Livestock Service is clearly understaffed. The subsector chief has proposed:

1. Increasing the number of trained personnel,
2. Constructing an office and hiring staff to man the recently created post at Mogode,

3. Increasing the number of vehicles at the disposal of the Subsector, as there is presently only one, and
4. Opening two new posts at Boula and Mofou Sud. Creation of veterinary posts at Roua and Tourou may also be warranted, since veterinary care is inadequate in the area east of Soulede.

b) Veterinary Services and Livestock Mortality

Despite its limited resources, the Mokolo division of the Livestock Service does a creditable job in preventing and treating diseases affecting cattle, particularly extensively raised cattle. Most of the cattle in the region are vaccinated annually against rinderpest, hemorrhagic septicemia, and contagious bovine pleuropneumonia. When periodic outbreaks of other cattle diseases, such as anthrax and blackleg, are reported, veterinary officials usually respond quickly with vaccination campaigns in the affected areas. All 37 of the predominantly Fulani, traditional herders who were interviewed on the plateau around Mokolo, praised the Livestock Service for its prevention and treatment of cattle diseases.

By concentrating its limited resources on veterinary care of extensively raised cattle, the Livestock Service necessarily allows other types of livestock to receive little or no treatment. Table 8-2 shows that households owning livestock in the mountainous zones are less likely to receive veterinary services than livestock owning households of the plateau and plains. Furthermore, households owning small ruminants and

TABLE 8-2

PERCENTAGE OF LIVESTOCK OWNERS IN THE SURVEY AREA WHO HAVE CONSULTED WITH VETERINARY AGENTS BY ZONE, 1980

Owner	Zone				Survey Area
	Mountain	Piedmont	Plateau	Plain	
Owners of Cattle and No Small Ruminants	0	50	100	0	44
Owners of Cattle and Small Ruminants	41	48	68	69	55
Owners of Small Ruminants and No Cattle	12	18	8	39	21
Owners of Neither Cattle nor Small Ruminants	0	0	0	20	10
Total	23	29	33	46	33

Source: Extensive survey sample estimates.

Owners of "only" cattle or "only" goats and/or sheep may raise other types of livestock, such as donkeys, poultry, pigs and horses.

no cattle or only poultry have consulted veterinary agents far less frequently than cattle owning households.

The emphasis given by the Livestock Service to the treatment of extensively raised cattle is reflected in differences in estimated mortality rates for range-fed cattle, stall-fed cattle and small ruminants. From the survey of traditional herders around Mokolo we obtained data on range-fed cattle mortality through herder recall over a one-year period. These data yielded mortality estimates of 6.1 percent for cattle over one year of age and 11.3 percent for calves under one year.[18] These figures can be compared to an estimated mortality rate of 6.3 percent obtained from stall-feeding histories provided by households surveyed at Magoumaz and Mavoumai.[19] The actual mortality rate for stall-fed cattle in these two villages is probably significantly higher, since the households selected for inclusion in the survey were those currently raising a stall-fed bull. This selection criterion was used to maximize the number of observations (households) of stall-feeding practices and labor inputs into stall-feeding. As a result, certain households whose bulls had died before the survey were not included in the samples selected at Magoumaz and Mavoumai. Had these households

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[18]John Holtzman, L'élevage et la commercialisation des bovins dans les Monts du Mandara, MSU/USAID Mandara Mountain Research Report No. 10, Department of Agricultural Economics, Michigan State University, July 1981.

[19]The mortality rate for stall-fed cattle at Magoumaz was 9.7 percent and only 2.0 percent at Mavoumai. This difference is plausible since Mavoumai is adjacent to an area of the plateau where there are Fulani cattle herds. Consequently, vaccinations are probably more regular than at Magoumaz and have undoubtedly been going on for more years. Hence, farmers at Mavoumai are more apt to take their cattle to receive vaccination treatment than at Magoumaz. If we include stall-fed cattle from a larger sample of stall-feeding households at Magoumaz, Mavoumai, Zileng, Mandaka and Ldamstai in the estimation of mortality, the mortality rate drops somewhat to 5.1 percent.

been included in the sample of households that had recently fed or was currently feeding bulls in stalls, then the mortality estimate would have been higher. Finally, Zalla et al. report that under one year mortality for kids and lambs is 25-30 percent in Margui-Wandala, which, although moderate by African standards, is considerably higher than under one year mortality for cattle.[20]

2. Veterinary Care and Extension Services in the Stall-Feeding Scheme

FONADER has employed four credit/extension agents to implement the pilot credit scheme in the Mandara Mountains region. Veterinary care of the cattle obtained by FONADER loans is supposed to be provided by the Livestock Service, but in practice this is difficult since the Livestock Service concentrates its limited personnel and budgetary resources on treatment of range-fed cattle. The Livestock Service attempts to vaccinate stall-fed cattle in the more accessible villages each year by informing village notables of the time and location of planned vaccinations. Usually these vaccinations take place in flat and clear areas that are easily accessible to as many of the villagers as possible.

Twenty-five of the 52 stall-feeding households surveyed at Magoumaz and Mavoumai reported that they had lost at least one bull to mortality over the years that they had been stall-feeding. Only three of these producers called upon the Livestock Service for veterinary care while

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[20]Tom Zalla, David J. Campbell, John Holtzman, Larry Lev and David Trechter, Agricultural Production Potential in the Mandara Mountains in Northern Cameroon, MSU Rural Development Series Working Paper No. 18, Department of Agricultural Economics, Michigan State University, 1981, pp. 38-39.

their cattle were ill. Sixteen of the farmers claimed that they did not know that the Livestock Service existed or was able to treat cattle at the time of their animals' illness. If this high a proportion of the stall-feeding households at Magoumaz did not obtain any veterinary care for their diseased cattle, then it is likely that an even higher percentage of stall-feeding households in more isolated villages (farther from Mokolo) has never had contact with the Livestock Service.

Although the Livestock Service has not been able to provide adequate veterinary care to stall-fed cattle in the Mandara Mountains, the FONADER credit/extension agents did visit half of the loan recipients taking part in the stall-feeding survey at least once. Since the credit/extension agents were trained primarily as veterinarians, they tended to inspect the general health of the cattle. All of the households that received loans in the stall-feeding survey at Magoumaz and Mavoumai reported that the credit/extension agents did not instruct them in the introduction and use of rice bran. The agents did urge the loan recipients to procure the rice bran and incorporate it in the diet of their bulls, but little in the way of specific instructions or demonstrations were provided as to how the farmers should introduce the rice bran into the ration. It is possible that better extension services could have facilitated adoption of the new feeding technology.

Institutionally, the inadequacy of extension services was probably the single greatest failing of the FONADER loan scheme.[21] In soliciting

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[21]This contrasts markedly with SEMRY's attempts to extend intensive dry season feeding of a balanced and concentrated ration of rice-milling by-products, cottonseed cake and minerals. SEMRY was extending the intensive feeding technology to a small sample of 18 farmers during the dry season of 1981 and providing excellent veterinary and extension services to those producers. SEMRY assigned one full-time extension agent

and processing loan applications, disbursing loans, and supervising the storage and distribution of the rice bran to over 700 loan recipients, the four credit/extension agents could not provide satisfactory veterinary and extension services. Unfortunately, the stall-feeding program was expanding rapidly during the first four years, so it is unlikely that extension services would improve as the number of loan applications and disbursements increased. In addition, the credit/extension agents had no incentive to devote any time to extension. FONADER paid the agents higher salaries than they had been earning in the Livestock Service, and they were provided with motorcycles. Rather than linking salary increases to job performance, the credit/extension agents were assured payment of the higher salaries regardless of performance. Providing incentive pay for each day spent in the field would probably have ensured at least marginally better extension services.

FONADER also failed to chose individuals who were well-suited to serving as extension agents in the stall-feeding scheme. Three of the four agents were Fulani recruits from the Livestock Service. Although the Fulani are highly knowledgeable about livestock raising under conditions of extensive range-fed production, they do not practice stall-feeding. Indeed, they tend to regard intensive livestock production as an inferior type of livestock raising which is practiced by agricultural groups, toward whom they are highly disdainful. One of the credit/extension agents is Mofou, and the Mofou do practice stall-feeding. It is important to note that there are few qualified and trained individuals from the Mandara Mountains who could be hired to serve as extension

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to monitor the on-farm feeding trials. In addition, the French director of the SEMRY livestock program, who is trained in animal nutrition and production, devoted a lot of time to the extension program.

agents for a stall-feeding project. Therefore, it is perhaps unfair to fault FONADER for going ahead with the project and staffing it with the best people available. This analysis clearly shows, however, that it is important not to overlook the potentially negative impact of ethnic cleavages in an area of the world where these have tended to be divisive and counterproductive.

3. Projected Changes in the Supply and Demand for Veterinary Inputs and Services

a) Veterinary School at Maroua

The Livestock Service in Northern Cameroon has been dominated by the Fulani and other ethnic groups that have traditionally owned cattle, such as the Massa, the Mandara and the Guiziga. The Mafa and other kirdi groups from the Mandara Mountains region are greatly underrepresented among livestock/veterinary assistants in the Livestock Service. Given the emphasis of the Livestock Service on prophylactic treatment of range-fed cattle, it is not surprising that groups that have traditionally raised range-fed cattle have dominated the Livestock Service.

In order to rectify imbalances in recruitment and hiring, the Veterinary School at Maroua has admitted greater numbers of degree candidates from a broader range of ethnic groups. While traditional herding of cattle is still the predominant mode of animal husbandry in Northern Cameroon, the Veterinary School is encouraging students to study other types of livestock production, such as stall-feeding of cattle in the Mandara Mountains and intensive dry season feeding of cattle in the rice-growing areas of Northeastern Cameroon. FONADER asked the Veterinary School to do a two-year study of stall-feeding by

20 loan receiving households in Mofole, a Mafa village adjacent to Mokolo. Several students are using this opportunity to conduct applied research on cattle health and nutrition.

In recent years the Veterinary School has also been putting more emphasis on animal nutrition, forage and fodder production, and other courses outside the animal health area in order to prepare its graduates better to provide extension services. Although the school still principally trains its students to be livestock/veterinary assistants, the emphasis of the program has begun to shift.

b) Sales of Veterinary Inputs

Before 1980 sales of veterinary inputs to producers did not take place in Northern Cameroon. All vaccinations and medicines were administered directly to producers by the Livestock Service free of charge. In 1980 the O.P.V. (Office Pharmaceutique Vétérinaire) opened a branch office in Maroua and began to sell vaccines and medicines to private livestock owners. The Livestock Service retains tight control over these sales, however, requiring buyers of veterinary inputs to obtain prescriptions from Veterinary Service officials. In addition, Livestock Service officials themselves must administer any vaccinations. The Livestock Service intends to open another O.P.V. branch office in Mokolo at some undetermined point in the future.

Although sales of veterinary inputs will benefit prosperous livestock producers whose animals require supplementary care, it is unlikely that many producers will be able to benefit from this innovation. Rigid veterinary service control over prescriptions and provision of certain types of treatment not only create opportunities for abuses, but they

threaten to overload Livestock Service officials with administrative work and additional travel. As discussed above, the Livestock Service is barely able to vaccinate range-fed cattle and keep outbreaks of cattle disease under control. It is questionable whether they will be able to provide supplementary services to individuals other than a wealthy minority who live near veterinary centers in the near future.

c) Increased Production of Veterinary Inputs

Since the end of the 1970s, the laboratories at Farcha near Ndjamena in Chad have been closed. Farcha supplied several Francophone countries in Central and West Africa with veterinary inputs during the 1970s. Vaccines and medicines have been imported at much higher cost from Europe since the civil war in Chad forced the shutdown of the Farcha laboratories. Consequently, funds allocated by the Livestock Ministry to acquisition of veterinary inputs have not gone as far as they did in the 1970s.

In order to improve this supply situation, the Cameroonian government decided, in cooperation with the French Ministry of Cooperation and the I.E.M.V.T. (Institut d'Elevage et de Médecine Vétérinaire aux Pays Tropicaux), to fund the construction of a complex of veterinary laboratories and vaccine production facilities that will be located seven kilometers south of Garoua.[22] Three billion francs CFA ($12 million at an exchange rate of $1.00 = 250 FCFA) were earmarked for the construction of this facility, which will replace Farcha as the principal supplier

[22]The Provincial Delegate of the Livestock Ministry, Dr. Mathieu Nsangou Nanji, provided the author with information about the construction of the proposed Garoua facility, during an informal interview in March 1981.

of veterinary inputs to countries in Central Africa. The new complex is expected to be in operation late in 1983.

By the second half of the 1980s production of veterinary inputs might increase sufficiently to permit an expansion of veterinary care and sales that would have more than a marginal impact on livestock production. Projected production levels of veterinary inputs at Garoua are not available, nor are projected allocations to the fulfillment of different countries' quotas. Several years of operation will probably be required before the Garoua laboratories attain the same level of production reached by the Farcha laboratories in the 1970s. In the final analysis, it is not certain whether the opening of the Garoua facility would augment the supply of the veterinary inputs in Northern Cameroon or merely replace previous and existing sources of supply.

d) Possible World Bank Initiatives

World Bank officials, expressing concern over low repayment rates in the FONADER loan scheme, have suggested that broader-based interventions, such as improvement of veterinary services in Northern Cameroon and other principal livestock producing areas, may do more to upgrade livestock production than specific interventions targeted to particular groups.

4. Farmer Willingness to Purchase Veterinary Inputs

Informal interviews with households participating in the survey of cattle stall-feeding at Magoumaz and Mavoumai revealed that the more knowledgeable producers were willing and able to pay for improved veterinary care for cattle and small ruminants. At a group interview at the

close of the survey research at Magoumaz in March 1981, the producers assembled claimed that they would be willing to pay 50 FCFA per small ruminant and 400 FCFA per head of cattle per year for better veterinary care, including vaccinations and deworming. Although the respondents' claims were probably influenced by the advent of the period during which nutritional stress, weight loss and mortality are greatest for livestock, it is encouraging to learn that they are willing to pay for improved services to reduce livestock mortality and disease-related factors that lead to poor growth performance.

Producers' ability to pay for veterinary care might be seriously limited during the late dry season and rainy season, when income flows are low, but the wealthier households in the region would be able to pay for better veterinary services. Effective demand for veterinary inputs does exist, although supply cannot meet this demand at present.

D. CONCLUSION

This chapter has examined the macroeconomic effects of expanding stall-feeding on the supply and demand for production inputs such as feeder calves, forage and water resources, agro-industrial by-products, and veterinary and extension services. In general, it has found that the expansion of stall-feeding during the 1980s could bid up the prices of feeder calves procured primarily in the Diamare Plains, but disbursement of loans during periods of abundant supply could minimize these price increases.

Although the Mandara Mountains region was not overstocked in 1980, expansion of stall-feeding will put pressure on forage and water resources. Yet the supply of these inputs is presently quite elastic in

most villages. However, producers will have to allocate more labor to cutting, carrying and stocking grasses and to hauling water, which will compete with crop production, or they will need to pay for the labor services of other rural households to meet forage and water requirements. The latter solution will generate additional employment for households that do not stall-feed. In the long run fodder crop production and the construction of watering ponds and small dams would expand the supply of feed and water, although these investments are not necessary or economically viable in the short to medium run.

Although agro-industrial by-products are not used in traditional stall-feeding enterprises, they will be required in increasing quantities as stall-feeding is expanded and the technology of supplemental dry season feeding is introduced. Rice bran, cottonseed cake and brewing by-products are produced in substantial quantities within 250 kilometers of Mokolo. The supply of both inputs will expand in the 1980s. Nonetheless, the demand for rice bran and cottonseed cake will probably increase as rapidly as the supply, as future uses of these feedstuffs will grow. SEMRY intends to promote intensive, dry season cattle feeding among rice-growing farmers, using rice-milling by-products. SODECOTON will supply cotton-growing farmers using animal traction with cottonseed cake for supplemental feeding. In addition, the FONADER offices in Maroua, Garoua, Ngaoundere and Yaounde plan to promote supplemental dry season feeding of cattle and intensive pork and poultry production. Demand for energy and protein-rich feedstuffs will also expand among commercial livestock producers in Southern Cameroon.

Any scheme to promote commercial production of stall-fed cattle will necessarily compete with alternative uses of concentrated feedstuffs for the available supply of feed. If stall producers are able to obtain these necessary inputs, distribution of the concentrates and extension services will have to improve markedly in order to introduce supplemental dry season feeding successfully. Transportation and distribution difficulties have plagued FONADER's attempt to promote feeding of rice bran to date. Moreover, loan recipients have received little training and supervision in use of this feedstuff. By improving extension services, FONADER could ensure that producers introduce supplemental feeding into the dry season ration successfully and monitor weight gains achieved through use of alternative feeds and feed combinations.

Veterinary inputs and services are also not widely available to mixed farmers who practice stall-feeding in the Mandara Mountains. The under-staffed and under-financed Livestock Service concentrates its limited resources on the vaccination and treatment of range-fed cattle, owned principally by Fulani herders. Although some stall-fed cattle are vaccinated annually, additional veterinary services are seldom provided. FONADER, which depends on the Livestock Service to treat stall-fed cattle in its loan scheme, offers little in the way of veterinary care to participating farmers. This will have to improve if the stall-feeding scheme is to be implemented successfully.

CHAPTER NINE

FINANCIAL AND ECONOMIC ANALYSIS OF RETURNS TO THE STALL-FEEDING LOAN PROGRAM

A. INTRODUCTION

In 1977 the World Bank helped to design and appraise a cattle stall-feeding subproject as part of several developmental interventions to be promoted by FONADER in Northern Cameroon. This included a financial analysis of producers' costs and returns to stall-feeding cattle over a two-year period, using cottonseed cake as a feed supplement.[1] The appraisal also included an economic analysis of a ten-year stall-feeding loan scheme in which 2,000 loans would be outstanding each year from year five to the close of the project. The stall-feeding scheme was funded by the World Bank and implemented by FONADER, based upon the high projected financial and economic returns.

This chapter will reanalyze the potential financial and economic returns of the stall-feeding loan program, using survey findings from the research carried out in 1980-81. First, a financial analysis of individual stall-feeding enterprises will be conducted in which it is assumed that cottonseed cake is used as the feed supplement. The results of this analysis will be compared with the financial projections

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[1] In implementing the project, FONADER chose to procure rice bran from SEMRY instead of cottonseed cake as the dry season feed supplement. See Chapter Eight for details.

of the appraisal document. This financial analysis will be repeated for enterprises using rice bran as the feed supplement and then extended by determining the effect of varying key parameters (contingency sets). These parameters include the rate of weight gain during the feeding period, the cost of livestock feed, acquisition and sale prices for cattle, the economic value of cattle manure production, the rate of appreciation in the value of cattle held over time, interest rates on loans, and seasonal differences in cattle prices per unit of liveweight. The effect of buying and selling cattle during alternative seasons will also be examined, since seasonal variation in rainfall, the quality of forage, the availability of surface water, cattle liveweights, and flows of cattle have an important influence on cattle supply, slaughter and prices. After examining the effect of varying the above single parameters on producers' returns, several possible scenarios (combinations of parameter changes) will be discussed.

The analysis of financial returns at the producer level will then be followed by an economic analysis of the overall viability of the FONADER loan scheme. This will include an analysis of the probable economic costs and returns of incorporating an expanded applied research and extension component into the project. Since the project will lead to a non-marginal expansion in slaughter cattle supply, potential demand for stall-fed cattle will be analyzed under alternative livestock subsector policies. In ticular, the probable effects of continuing to enforce (and of relaxing) export restrictions and retail price controls will be examined. As will be shown, it is especially important to gauge the potential for expanding stall-fed cattle production and slaughter as a means of satisfying existing and future demand for beef in urban areas.

B. THE ECONOMIC VIABILITY OF STALL-FEEDING CATTLE USING COTTONSEED CAKE AS A DRY SEASON FEED SUPPLEMENT

In 1977 a cattle stall-feeding subproject was designed as a part of a series of subprojects to be implemented in Northern Cameroon by the parastatal FONADER with World Bank financial assistance. FONADER would extend 8,000 loans over ten years to households for the purchase of bulls for stall-feeding over a two year period using cottonseed cake as a supplemental feed during five-month periods of the dry season. The project design assumed that bulls would be acquired at 180 kilograms liveweight and sold at 400 kilograms, representing an average rate of gain of 300 grams per day over the course of two years. This rate of gain is 35-70 percent higher than typical rates of gain under present feeding technologies.[2] It was intended that a dry season ration of one kilogram of cottonseed cake per day would increase rates of gain and prevent the weight losses that typically occur during the dry season.

In appraising the subproject, several assumptions were made that warrant reconsideration. First, it was assumed that only 20 additional man-days per year would be required for farm families to undertake stall-feeding. The analysis of Chapter IV shows that an average annual labor input of 112.5 man-days is required for stall-feeding. In addition, the appraisal assumed that the sale price per kilogram for stall-fed bulls would be equal to the acquisition price per kilogram. A sensitivity analysis of the potential effect of the seasonal movement in cattle

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[2]By comparing estimated liveweights of immature bulls with estimated liveweights of fattened cattle, which were obtained by weighing cattle carcasses at the Mokolo and Soulede slabs, daily rates of gain are found to vary from 174 grams to 220 grams.

prices (per kilogram) upon producers' returns was not included in the appraisal. If producers buy cattle for stall-feeding when prices per unit of liveweight are low and sell them when prices per kilogram are seasonally higher, then enterprise returns will be enhanced. Although the appraisal recognized the value of manure from stall-fed cattle as a fertilizer, it made no attempt to estimate the economic value of cattle manure nor to incorporate any such estimate in the producers' budgets. Finally, it was assumed that there would be sufficient demand for the increased quantity of stall-fed beef in the Mandara Mountains region without assessing the strength of alternative sources of demand and alternative producer marketing strategies. These assumptions will be examined critically in a later section of the chapter.

The farm budgets prepared for analyzing returns to stall-feeding as part of the World Bank appraisal were completed in 1977.[3] This budget is updated in Table 9-1 (part A), using 1980-81 prices, and can be compared with an enterprise budget (part B of Table 9-1) that incorporates costs and returns suggested by the survey research. The initial budget shows a net return per day of labor equal to 581 FCFA, while the revised budget shows a far lower return to labor of 176 FCFA per day. The principal reason for this difference is that the original appraisal grossly underestimated labor inputs required for stall-feeding.

Other important differences in the two budgets stem from including in the revised budget estimates of the economic value of manure, cottonseed cake, transport costs, expenditures on purchased feed and wage

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[3]The appraisal team prepared whole farm budgets with and without a stall-feeding enterprise in order to determine the incremental benefits of adding a stall-feeding component.

TABLE 9-1

ESTIMATED COSTS AND RETURNS OF STALL-FEEDING CATTLE USING COTTONSEED CAKE AS A DRY SEASON FEED SUPPLEMENT

Cost and Return Categories	Amount (FCFA)		
		Year	
A. APPRAISAL TEAM'S UPDATED BUDGET	0	1	2
Enterprise Income:			
Gross Enterprise Returns			
Cattle sale price[a]			83,125
Value of manure[b]			-
Sub-total			83,125
FONADER Loan[c]	35,850		
Gross Enterprise Income	35,850	-	83,125
Costs:			
Investment Costs			
Acquisition price of immature bull[d]	35,000		
Cottonseed cake[e]	-	3,465	3,465
Veterinary inputs[f]	500	250	
Sub-total	35,500	3,715	3,465
Variable Costs			
Cattle feed[g]			
Minerals[h]		900	900
Total Variable Costs		900	900
Fixed Costs			
Housing depreciation[k]		-	-
Insurance[l]	900		
Loan application fee[m]	900		
Cattle tax[n]		200	200
Sub-total	1,800	200	200
Loan Repayment[r]			43,380
Total Costs	37,300	4,815	47,945
Net Enterprise Returns to Household Labor and Management:	-1,450	-4,815	35,180
Discounted Net Enterprise Returns[s]		23,232	
Total Labor Inputs (hours)[t]		320	
Net Return per Man-Day of Labor[u]		581	
B. REVISED BUDGET			
Enterprise Income:			
Gross Enterprise Returns			
Cattle sale price[a]			81,700
Value of manure[b]		16,750	16,750
Sub-total		16,750	98,450
FONADER Loan[c]	36,800		
Gross Enterprise Income	36,800	16,750	98,450
Costs:			
Investment Costs			
Acquisition price of immature bull[d]	35,000		
Cottonseed cake[e]		4,035	4,035
Veterinary inputs[f]	500	250	
Sub-total	35,500	4,285	4,035
Variable Costs			
Cattle feed[g]			
Minerals[h]		2,205	2,205
Stored fodder		600	600
Sorghum grain		295	295
Misc. (cut grasses, ag. by-products)		175	175
Sub-total		3,275	3,275
Transportation of cottonseed cake from Mokolo to producer's village[i]		500	500
Wage labor inputs[j]		295	295
Total Variable Costs		4,070	4,070
Fixed Costs			
Housing depreciation[k]		750	750
Insurance[l]	900		
Loan application fee[m]	900		
Cattle tax[n]		200	200
Sub-total	1,800	950	950
Cost of Equity Capital			
Opportunity cost of capital invested[o]		701	701
Cattle housing[p]		375	375
Working capital[q]		204	204
Sub-total	1,281	1,281	
Loan Repayment[r]			44,530
Total Costs	37,300	10,585	54,865
Net Enterprise Returns to Household Labor and Management:	-500	6,165	43,585
Discounted Net Enterprise Returns[s]		41,105	
Total Labor Inputs (hours)[t]		1,870	
Net Return per Man-Day of Labor[u]		176	

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[a]Stall-fed cattle are sold at a liveweight of 380 kilograms and at a price of 218.75 FCFA/kg. liveweight in the updated appraisal budget and at 215 FCFA/kg. liveweight in the revised budget. Wholesale butchers at the rural market of Soulede paid an average of 215 FCFA per kilogram liveweight for stall-fed cattle from September 1980 through January 1981. It is assumed that the bulls gain an average of 300 grams per day over the course of two years.

[b]The economic value of cattle manure is estimated using sorghum yield plot data from farms in the Mandara Mountains region and from experimental data and estimates from other parts of Africa. The World Bank appraisal did not include an estimate of the economic value of manure.

[c]Loan recipients are required to contribute 16% of investment costs, while the remaining 84% is extended as credit. The total investment cost in the updated budget is 42,680 FCFA, of which 35,000 FCFA is for bull acquisition, 6930 FCFA for cottonseed cake and 750 FCFA for veterinary inputs. This investment cost increases to 43,820 FCFA in the revised budget, because transport costs are included in the valuation of the cottonseed cake.

Although part of the FONADER loan was disbursed in kind as cottonseed cake and veterinary inputs in years 1 and 2, the full value of the loan was assigned to year 0 for computational convenience. This has virtually no effect on the final calculation of returns.

[d]Immature bulls are acquired at a liveweight of 160 kilograms and at a price of 218.75 FCFA/kg. liveweight. The acquisition price of 35,000 was obtained from a sample of 54 producers in five villages near Mokolo who bought bulls for stall-feeding in 1980.

[e]Producers are supposed to feed one kilogram of cottonseed cake per day to the cattle during a five month period of the dry season and early rainy season. SODECOTON sold cottonseed cake produced at its Maroua oil processing plant for 23.1 FCFA per kilogram in 1980-81. Transport costs between Maroua and Mokolo were estimated to be 250 FCFA per 65 kilogram sack. The C & F cost of the cottonseed cake delivered to Mokolo was therefore 26.9 FCFA per kilogram.

[f]The World Bank appraisal assumed that vaccinations and treatments of stall-fed cattle cost 500 FCFA per head in 1977. Assuming an annual inflation rate of 15%, approximately 750 FCFA would be required to cover veterinary costs by 1980. Feeder calves are assumed to be vaccinated and dewormed shortly after acquisition and revaccinated at the end of one year.

[g]The World Bank appraisal included only an estimate of the cost of mineral supplements fed to the cattle and no estimates of the cost of additional feeds. The revised budget incorporates estimates obtained from the survey research.

[h]The World Bank appraisal assumed that producers would spend 600 FCFA per year on minerals. The same adjustment for inflation is made as in f. The survey data show that actual expenditures were significantly higher, as shown in the revised budget.

[i]Recipients of FONADER loans paid 150-200 FCFA per sack to transport rice bran from Mokolo to Mavoumai and Magoumaz. It is assumed that producers pay 200 FCFA per sack of cottonseed cake for 2 1/2 sacks per year. The cost of distributing the concentrate was not estimated and included in the World Bank appraisal.

[j]The estimated cost of wage labor inputs was obtained from survey data. The mean values used in the revised budget are low, because a small proportion of the survey households paid for labor services provided by individuals from outside the household.

[k]Straight-line depreciation of cattle housing from an initial investment cost of 6000 FCFA to a salvage value of zero is assumed over a ten-year period, during which four cycles of stall-feeding take place.

[l]FONADER requires all loan applicants to pay 900 FCFA for insurance against cattle mortality.

[m]FONADER requires all loan applicants to pay a non-refundable 900 FCFA application fee.

[n]An annual cattle head tax of 200 FCFA is levied by the Cameroonian government.

[o]Loan recipients must contribute 7010 FCFA toward investment costs. The opportunity cost of this capital is assumed to be 10% per year.

[p]The capital cost of livestock housing is calculated on the average value of the investment in housing over a ten year period, assuming a zero salvage value and a two and one-half year investment for each cycle of stall-feeding. It is calculated as follows: $\left(\frac{\text{investment cost}}{2}\right) \times .1 \times \frac{30}{12}$. The capital cost of the housing is divided equally between two years.

[q]The opportunity cost of the working capital required for meeting variable costs is calculated as 10% of the average value of working capital needed for each year.

[r]Loan recipients are required to repay 10,000 FCFA at the end of the first year of stall-feeding. The balance of the principal plus interest is repaid after two years. Interest charges are 10% per annum.

[s]A discount rate of 10% is used in calculating the benefit streams.

[t]Households allocated an average of approximately 900 hours of labor per year to stall-feeding enterprises in the survey villages of Magoumaz and Mavoumai. It is assumed that 35 additional hours are required per year for procurement and transport of the cottonseed cake from Mokolo to the producer's compound and for feeding the cottonseed cake to the bull over a 150 day period.

[u]An eight hour day is assumed.

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labor inputs, and capital invested in livestock housing and the stall-feeding enterprise. By estimating the economic value of the cattle manure and incorporating it in the revised budget, gross enterprise returns increase 35,000 FCFA over the initial budget. Yet net enterprise returns are only about 20,000 FCFA higher in the revised budget, because the initial budget greatly underestimated enterprise costs. Only the acquisition cost of the cottonseed cake was taken into account in the initial budget, while transport costs were ignored. Moreover, the original appraisal underestimated the quantity and cost of minerals fed to cattle. Components of variable cost such as transportation of the cottonseed cake from Mokolo to the village, wage labor inputs and purchased feed, including stored fodder, sorghum grain and cut grasses, were also left out of the initial budget, as was an estimate of the opportunity cost of investments in livestock housing, working capital and the producer's capital invested in the stall-fed animals.

Using cottonseed cake as a dry season feed supplement appears to be a promising technology, as the daily return to producer labor increases from 127 FCFA per day reported in Chapter Four, to 176 FCFA per day. This 35 percent increase in returns is attributable primarily to a daily rate of gain of 300 grams, which represents a proportionally significant increase (50 percent) over present levels of technology. If the rate of gain were only 250 grams per day, then producers' returns would fall to 147 FCFA per day. Producers' returns would decline to 120 FCFA per day if the daily rate of gain were no greater than 200 grams per day, which is typical under traditional feeding practices.

Increasing production by 50 percent would probably be possible only under greatly improved extension services, which are inadequate in the

ongoing project. Moreover, the cottonseed cake would have to be supplied to producers on a timely basis, and spoilage of the feed, which is highly perishable, would have to be reduced.

In implementing the stall-feeding project, FONADER never bought cottonseed cake for distribution to the farmers. FONADER officials in Maroua decided to procure rice bran as a dry season feed supplement in 1979-81, because the C & F Mokolo cost was considerably lower for rice bran than for cottonseed cake. No comparative analysis of potential returns was conducted to determine which feed supplement produced the highest net returns. Most feeding trials in developing countries test the effect of intensively feeding concentrated rations to livestock for short periods (typically 90-100 days). In contrast, supplemental dry season feeding in the stall-feeding project was designed to prevent weight losses in cattle during the period of greatest nutritional stress. In the absence of precise information concerning comparative rates of gain under less intensive feeding practices, FONADER could have conducted on-farm trials among a sample of loan recipients using both cottonseed cake and rice bran. An analysis of the actual gains, costs and returns from using the two feed supplements during a 120 to 150 day period of the dry season might have proven that the net returns from feeding cattle cottonseed cake are higher than those from using rice bran. Conducting this type of applied research and extension would have enabled FONADER to monitor the introduction of the new technology as well as facilitate its adoption. The actual implementation of the stall-feeding scheme was crippled by the absence of any applied research and extension.

C. THE ECONOMIC VIABILITY OF PROMOTING CATTLE STALL-FEEDING USING RICE BRAN AS A DRY SEASON FEED SUPPLEMENT

1. Returns to Stall-Feeding Enterprises Using Rice Bran as the Dry Season Feed Supplement

Since 1979 FONADER has been extending loans to smallholders for cattle stall-feeding. Although rice bran has been procured at Yagoua and transported to the Mandara Mountains for distribution to loan recipients, little rice bran has actually been fed to the cattle during the dry season. Consequently, the loan scheme has done little more than provide capital to producers at a rate below the opportunity cost of capital in Northern Cameroon and provide certain households lacking capital with the financial resources to procure a bull for stall-feeding. The project therefore has not provided a fair test of the economic potential of introducing supplemental dry season feeding of concentrates.

A synthetic budget for a two-year stall-feeding enterprise that uses rice bran as a dry season feeding supplement is shown in Table 9-2. The principal components of cost added to the rice bran synthetic budget (as was done for the cottonseed cake but not appearing in the traditional budget) are the cost of the rice bran, transportation of the bran and veterinary inputs, and payment of a loan application fee and debt service. Debt service substitutes in large part for the cost of investing owner capital in cattle during the two-year feeding period in traditional stall-feeding enterprises. While loan applicants are required to pay FONADER insurance in the synthetic budget, insurance is calculated for the traditional enterprise from cattle acquisition and salvage values and an estimate of cattle mortality obtained during the research. In addition, the acquisition price used in the traditional

TABLE 9-2

REPRESENTATIVE COSTS AND RETURNS OF STALL-FEEDING CATTLE USING RICE BRAN AS A DRY SEASON FEED SUPPLEMENT

Cost and Return Categories	Amount FCFA		
	Year 0	1	2
Enterprise Income:			
Gross Enterprise Returns			
Cattle sale price[a]			73,640
Value of manure[b]		16,750	16,750
Sub-total		16,750	90,390
FONADER Loan[c]	45,000		
Gross Enterprise Income	45,000	16,750	90,390
Costs:			
Investment Costs			
Acquisition price of immature bull[d]	35,000		
Rice bran[e]		4,035	4,035
Veterinary inputs[f]	500	250	
Sub-total	35,500	4,285	4,035
Variable Costs			
Cattle feed[g]			
minerals: natron and salt		2,205	2,205
stored fodder		600	600
sorghum grain		295	295
misc. (cut grasses, agri, by-products)		175	175
Sub-Total		3,275	3,275
Transportation of rice bran from Mokolo[h] to producer's village		600	600
Wage labor inputs[i]		295	295
Total Variable Costs		4,370	4,370
Fixed Costs			
Housing depreciation[j]		750	750
Cattle tax[k]		200	200
Insurance[l]	900		
Loan application fee[m]	900		
Sub-total	1,800	950	950
Cost of Equity Capital (15%)			
Housing[n]		375	375
Working capital[o]		218	218
Sub-total		593	593
Loan Repayment[p]		10,000	43,450
Total Costs	37,300	20,198	53,398
Net Enterprise Returns to Household Labor and Management	7,700	-3,448	36,992
Discounted Net Enterprise Returns[q]		35,121	
Total Labor Inputs (hours)[r]		1,870	
Net Return per Day of Labor[s]		150	

[a]Stall-fed bulls are assumed to gain an average of 250 grams per day or 182.5 kilograms during the two-year period. This results in a final liveweight of 342.5 kilograms. It is assumed that the stall-fed bulls are sold to rural butchers at an average price of 215 FCFA per kilogram liveweight, which was the actual price paid by wholesale butchers for stall-fed cattle slaughtered from September 1981 through January 1981. Although the cattle were not weighed on the hoof before slaughter, the liveweights are estimated by assuming that the price paid per kilogram on a carcass weight basis is twice the price paid per kilogram liveweight. Dressing-percentages are typically around 50% (47-53%) for Zebu cattle.

[b]It is assumed that a stall-fed bull produces 2.2 tons of usable manure per year and that each ton augments sorghum production by 130 kilograms. Sorghum is valued at its average market price over the year (70 FCFA/kg.), and the cost of harvesting the increased sorghum production equals 15% of its sale value and is not a benefit to the stall-feeding enterprise.

[c]FONADER was providing a loan of 45,000 FCFA in 1980-81 to participating farmers (39,000 FCFA for cattle acquisition and 6000 FCFA in kind for the six sacks of rice bran). No contribution other than 1800 FCFA for insurance and application fees was demanded of loan applicants. Loan applicants credit-worthiness was judged on the basis of the estimated value of the applicant's assets (livestock, crop production) and the appraisal of village chiefs and sub-chiefs.

Although part of the FONADER loan was disbursed in kind as rice bran and veterinary inputs in years 1 and 2, the full value of the loan was assigned to year 0 for computational convenience. This has virtually no effect on the final calculation of returns.

[d]It is assumed that immature bulls are acquired at an average liveweight of 160 kilograms for 35,000 FCFA or for 218.75 FCFA/kg. liveweight. The average acquisition price paid in cash for young bulls by 54 farmers in five villages near Mokolo was 35,117 FCFA in 1980.

[e]Six sacks of rice bran are provided as part of the loan. Although FONADER only charged loan recipients 1000 FCFA per sack for the bran, the acquisition cost of the bran plus the cost of transport was 1345 FCFA per sack in 1980 (or 19.2 FCFA/kg.). Four sacks are provided as feed during the first dry season and two sacks during the second dry season.

[f]Veterinary inputs include vaccination against rinderpest, CBPP and blackleg and treatment against internal parasites. It is assumed that vaccinations are administered annually and that antihelmintics are administered to the bull calves only at the beginning of the two-year feeding period.

[g]The estimates of the value of cash inputs are based upon survey research findings at Magoumaz and Mavoumai and are identical to the estimates used in the enterprise budget for stall-feeding using traditional technology.

[h]FONADER loan recipients in Mavoumai and Magoumaz paid 150-200 FCFA per sack of rice bran for bush taxi transport from Mokolo to the village. Transport costs of 200 FCFA per head are assumed.

[i]Wage labor inputs are assumed to be identical to those used in the enterprise budget for stall-feeding using traditional technology. The estimates were obtained from survey research findings at Magoumaz and Mavoumai.

[j]Straight-line depreciation of cattle housing from an initial investment cost of 6000 FCFA to a salvage value of zero is assumed over a ten-year period, during which four cycles of stall-feeding take place.

[k]The cost of housing repairs are included in labor time since all costs were labor costs.

[l]Each loan applicant is required to pay 900 FCFA of insurance. This sum is below the estimated economic cost of insurance per head, which is calculated as follows: $\left(\frac{\text{acquisition value + sale value}}{2}\right)$ x mortality rate x loss on dead animal as a proportion of live animal. Assuming a 6% probability of dying before sale and that meat from the carcass of a dead bull would be sold at 50% of the price of meat from the carcass of a slaughtered bull, the economic cost of adequate insurance coverage is 1649 FCFA / head. Since some loan applicants do not receive loans, however, the contribution of 900 FCFA per applicant to an insurance fund is sufficient.

[m]FONADER requires all loan applicants to pay a non-refundable 900 FCFA application fee.

[n]The capital cost of livestock housing is calculated on the average value of the investment in housing over a ten year period, assuming zero salvage value and a two and one-half year investment period for each cycle of stall-feeding. It is calculated as follows: $\left(\frac{\text{investment cost}}{2}\right) \times .1 \times \frac{30}{12}$. The capital cost of the housing is divided equally between the two years.

[o]The opportunity cost of the working capital used for the purchase of variable inputs is 10% of the average value of working capital required for each year.

[p]Annual interest charges are 10% on FONADER loans. FONADER requires loan recipients to repay 10,000 FCFA at the end of the first year of stall-feeding and the balance of the principal and interest after two years.

[q]A discount rate of 10% is used in calculating the benefit stream.

[r]Households allocated an average of approximately 900 hours of labor per year to stall-feeding enterprises in the survey villages of Magoumaz and Mavoumai. It is assumed that 35 additional hours are required per year for procurement and transport of the cottonseed cake from Mokolo to the producer's village and for feeding the cottonseed cake to the bull over a 150 day period.

[s]An eight hour day is assumed.

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stall-feeding budget, which is the average acquisition price paid in 1978-79 by survey households, is slightly lower than the acquisition price used in the synthetic budget, which is the average price paid in 1980. Finally, labor inputs in the synthetic budget are 35 hours higher per year than in the traditional enterprise budget, reflecting the additional labor required for procurement, transport and feeding of the rice bran.

The most important difference between the rice bran synthetic and traditional enterprise budgets is that the cattle are assumed to gain an average of 50 grams more weight per day during the two-year feeding period in the synthetic budget. This average daily rate of gain is approximately 25 percent higher than typical rates of gain under traditional regimes. It is assumed that more timely and rapid distribution of the rice bran and better veterinary and extension services would improve the rate of gain. The sale price in the synthetic budget is calculated by assuming that cattle are purchased for stall-feeding at a liveweight of 160 kilograms, gain 260 grams per day over two years, and are sold at the price per kilogram liveweight paid by rural butchers for stall-fed cattle in 1980-81. The sale price for the traditional enterprise is the average price received by producers in the survey villages in 1980-81.

The net return per day of labor for stall-feeding enterprises using rice bran as a dry season feed supplement is 22 percent higher than returns to representative enterprises using existing technologies (150 versus 127 FCFA). An analysis of the effect of possible changes in the key parameters of the base rice bran budgeting analysis was also completed. It was hypothesized that the most likely changes that would

lower net returns to producer labor and management would be a decrease in the daily rate of gain, an increase in the interest rate paid by loan recipients, higher procurement and transport costs for the rice bran, higher cattle acquisition prices, and lower cattle sale prices. On the other hand, it was hypothesized that producers' returns to labor and management would increase if the real value of cattle continues to appreciate during the 1980s, producers slaughter their own cattle and retail the beef, cereal production due to cattle manure application is higher than initially estimated, and producers obtain a premium from selling their cattle in Nigeria or to traders bound for Nigeria. The results of this sensitivity analysis are discussed below and displayed in Table 9-3.

2. Sensitivity Analysis of Producers' Returns to Stall-Feeding Under Alternative Sets of Contingencies

a) Contingency Set No. 1: Varying the Rate of Weight Gain

The first contingency set shows that producers' returns to labor and management would decline to 123 FCFA per man-day if the average daily rate of gain were no higher than the rate estimated for existing stall-feeding technologies (200 grams/day). This return is slightly below returns to traditional stall-feeding enterprises. Such a contingency is possible if procurement and distribution of the rice bran and extension services are no better than under the ongoing FONADER loan program.

A less likely contingency would be for the average rate of gain to rise to 300 grams per day. Although the World Bank appraisal assumes that such a rate of gain is possible with supplemental feeding of cottonseed cake, it is unlikely that the livestock extension services and

TABLE 9-3

SENSITIVITY ANALYSIS OF THE RETURNS TO STALL-FEEDING USING RICE BRAN AS A DRY SEASON FEED SUPPLEMENT

Contingency Set	Alternative	Return Per Man-Day (FCFA)	Incremental Change Relative To Base (FCFA)	Percentage Change Relative To Base
0	Base Result	150		
1	Change in the Average Daily Rate of Gain[a]			
	a) Increase to 300 grams/day	178	+28	+19%
	b) Decrease to 200 grams/day	123	-27	-18%
2	Increased Procurement and Transportation/ Storage/Distribution Costs for Rice Bran[b]			
	a) 25% for procurement, 50% for transportation/storage	140	-10	-7%
	b) 25% for procurement, 100% for transportation/storage	135	-15	-10%
	c) 50% for procurement, 100% for transportation/storage	130	-20	-13%
3	Change in the Acquisition Price of Bull Calves[c]			
	a) 10% increase (38,500 FCFA)	135	-15	-10%
	b) 20% increase (42,000 FCFA)	120	-30	-20%
	c) 5% decrease (33,250 FCFA)	158	+8	+5%
4	Change in the Sale Price of Finished Bulls[d]			
	a) 5% increase (226 FCFA/kg. liveweight)	164	+14	+9%
	b) 10% increase (236.5 FCFA/kg. liveweight)	176	+26	+17%
	c) 6% decrease (202 FCFA/kg. liveweight)	135	-15	-10%
	d) 10% decrease (193.5 FCFA/kg. liveweight)	124	-26	-17%
5	Change in Cereal Production from Applying Cattle Manure[e]			
	a) 15% increase	169	+19	+13%
	b) 30% increase	188	+38	+25%
	c) 15% decrease	132	-18	-12%
6	Appreciation in the Value of Cattle[f]			
	a) 4% per year	171	+21	+14%
	b) 8% per year	194	+44	+29%
7	Retailing Margin from Producer Slaughter[g]			
	a) 5% margin	163	+13	+9%
	b) 10% margin	176	+26	+17%
	c) 20% margin	202	+52	+35%
8	Change in Interest Rate Charges[h]			
	a) increase to 15%/year	138	-12	-8%
	b) increase to 20%/year	124	-26	-17%
9	Effect of Buying and Selling During[i] Different Seasons			
	a) Purchase in October, Sale in February	190	+40	+27%
	b) Purchase in October, Sale in April	210	+60	+40%
	c) Purchase in October, Sale in June	209	+59	+39%
	d) Purchase in February, Sale in October	113	-37	-25%
	e) Purchase in April, Sale in October	119	-31	-21%

[a]A daily rate of gain of 300 grams is comparable to the rate of gain assumed by the World Bank appraisal team in analyzing returns to feeding cottonseed cake as a dry season feed. The daily rate of gain of 200 grams approximates weight gains under traditional feeding practices.

[b]FONADER paid SEMRY 900 FCFA per 70 kilogram sack for the rice bran in 1980. SEMRY's director of marketing reported that the price per sack increased 25% to 1200 FCFA in March 1981, primarily due to limited production of rice-milling by-products, which was a consequence of below average sales of rice to Cameroonian merchants and processing of paddy at levels well below capacity. A 50% increase in the acquisition price of the rice bran is plausible if the demand for alternative uses in Northern and Southern Cameroon greatly exceeds supply.

FONADER paid a private transporter from Maroua 445 FCFA per 70 kilogram sack to haul rice bran from Yagoua to Mokolo and Koza in early 1980. Cost of transport data are unavailable for 1981, but it is probable that FONADER paid considerably more for transporting the bran in 1981. In an informal interview the Maroua transporter expressed dissatisfaction with his return on the 1980 contract and reported that he would require a substantial premium to haul the rice bran again in 1981. It is important to note, however, that FONADER paid the Maroua transporter a competitive rate per metric ton kilometer to haul the rice bran in 1980 (see Chapter 8, Section B, part 1d). Nevertheless, it is almost certain that costs to the producer would increase significantly if the private sector organized the procurement, transport, storage and distribution of the rice bran. It is assumed that producers would continue to obtain the rice bran at the regional distribution centers (Mokolo, Koza).

[c]In the initial budget, it is assumed that producers pay 35,000 FCFA for a 160 kilogram bull. Both estimates were obtained from survey data collected in 1980-81. Producers who buy cattle for stall-feeding partly by exchanging small ruminants paid an average of 13% more than producers who acquired their bulls by paying cash. Certain producers, who have little knowledge of cattle prices and the seasonal supply and demand factors that affect prices, pay a substantial premium for cattle. We have chosen to augment bull acquisition prices by 10% and 20% respectively to reflect these two possibilities. Although a decline in the real price of bull calves is unlikely in the next few years, a 5% decrease in acquisition price is a possible contingency.

[d]Cattle traders sold mature trade cattle in Nigeria for prices that averaged 17% higher than the acquisition prices they paid in markets of the Diamare Plains in February and March 1981 (see Chapter 7, Section E). A small-scale trader in the Mandara Mountains received 8-16% higher prices than he paid for selling smuggled cattle in Nigerian border markets. Nigerian buyers and Cameroonian traders would be willing and able to pay 5-10% more to acquire stall-fed bulls than butchers in the Mandara Mountains, judging from estimates of cattle traders' costs and returns.

The initial budget assumes that producers sell their bulls to rural butchers at a price of 215 FCFA per kilogram liveweight, which was the price paid by the wholesale butchers at Soulede for stall-fed cattle acquired from September 1980 through January 1981. Urban butchers at Mokolo paid 202 FCFA per kilogram for stall-fed cattle slaughtered in the last four months of 1980. They were able to earn an acceptable net returns (4-6% of total receipts) at this price, but they would be unwilling and unable to pay a higher price per kilogram, due to the enforcement of retail price controls on the sale of beef. The sensitivity analysis assumes that the urban butchers are able to pay no more than 202 FCFA per kilogram liveweight.

A 10% decline in the sale price of stall-fed cattle per kilogram liveweight is unlikely but could perhaps result from rigid enforcement of price controls at both urban and rural markets and more vigorous enforcement of the ban on cattle exports to Nigeria.

[e]It is assumed that the cost of harvesting the increased sorghum production is 15% of its sale value and not a benefit to the stall-feeding enterprise.

[f]Beef price increases outstripped increases in the general price index at Yaounde from 1969 to 1980 at an annual average rate of 4% (see Annex 3, Section C.2). Twice the secular appreciation in the value of the cattle is also assumed for purposes of analysis.

[g]It is assumed that a producer would receive 5-10% more for slaughtering and retailing his own bull. An additional 15 hours of labor are assumed to be required.

[h]FONADER charges 10% annual interest on its loans. A higher interest rate could help FONADER to cover administrative costs of the loan program and would probably be above the opportunity cost of capital.

[i]The acquisition and sale prices per unit liveweight used in the analysis are obtained from survey data for cattle slaughtered at Mokolo and Soulede from September 1980 through March 1981. The October price is 197 FCFA/kg. liveweight and the February price is 227 FCFA/kg. liveweight. It is assumed that the appreciation in prices continues during the dry season, leading to prices per unit liveweight of 240 FCFA in April and 250 FCFA/kg. in June.

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producer knowledge of the new technology would improve sufficiently to realize the higher rate of gain. Inclusion of this contingency in the sensitivity analysis does permit, however, comparison with returns from feeding cottonseed cake, which are analyzed in Table 9-1. Assuming the same rate of gain from using either feed supplement, returns to feeding rice bran are slightly higher than returns to feeding cottonseed cake (178 FCFA as opposed to 176 FCFA per man-day).

b) Contingency Set No. 2: Increasing Feed Costs

The second set of contingencies analyzed is the cost of supplying the concentrated feedstuff to the regional distribution centers. In the initial budget it is assumed that FONADER procures the rice bran at Yagoua and pays a private transporter to truck it to Mokolo and Koza, as occurred in 1980. Producers are charged the full acquisition and transport costs in the base run, however, and not subsidized as in 1980.[4]

In this analysis both the acquisition price and the cost of transporting, storing and distributing the rice bran are increased to reflect probable contingencies resulting from greater private sector involvement. The demand for concentrated feedstuffs will probably increase due to expansion of livestock fattening schemes near Yagoua and in Southern Cameroon and will probably bid up the price of the rice bran during the 1980s. Moreover, producers in the Mandara Mountains will have to pay real market prices for the rice bran if the private sector is to have sufficient incentives to procure, transport, store and distribute the

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[4]The acquisition cost of the rice bran plus transport to Mokolo/Koza was 1,345 FCFA per 70 kilogram sack. Producers paid only 1,000 FCFA per sack in 1980, so the bran was subsidized 26 percent.

rice bran. The results in Table 9-3 show that higher feed costs would cause producer returns to fall 7-13 percent below the base level.

c) Contingency Set No. 3: Varying the Acquisition Price of Bull Calves

While the cattle acquisition price of 35,000 FCFA per head used in preparing the base budget was the average price paid by producers in five villages around Mokolo in 1980, it is not uncommon for producers to pay more. Farmers who lack the cash to buy bulls for stall-feeding outright are forced to exchange small ruminants in partial payment. These smallholders paid an average of 13 percent higher acquisition prices than producers who paid for their bull calves entirely in cash from 1978 through 1980 in five villages around Mokolo. In contingency set three of the sensitivity analysis, an acquisition price 10 percent higher than the base price of 35,000 FCFA per head lowers producers' returns 10 percent, while a price 20 percent above the base causes the daily return to labor to fall 20 percent to 120 FCFA.

A significant and non-marginal expansion in stall-feeding in the Mandara Mountains, following vigorous promotion of the loan scheme, would probably lead to feeder calf price increases. FONADER can help reduce the upward pressure on bull calf prices by disbursing loans continuously throughout the year. Encouraging producers to buy proportionally more bull calves during the late rainy season and early dry season (September-January), when the large supply of cattle at the markets of the Diamare Plains dampens cattle prices, would also help to minimize acquisition price increases.

Although a decline in the real price of feeder calves is unlikely in the short to medium run, a 5 percent decrease in the acquisition price would cause producer returns to increase by 5 percent to 158 FCFA per man-day.

d) Contingency Set No. 4: Varying the Sale Price of Finished Bulls

In the base budget it is assumed that producers sell finished cattle to rural butchers at a price of 215 FCFA per kilogram liveweight, which was the average price paid for stall-fed cattle by wholesale butchers at the rural market of Soulede from September 1980 through January 1981. The final sale price per kilogram varies, however, depending on the buyer and his capacity to pay. Survey data obtained at the Mokolo abattoir show that urban butchers, who are forced to retail beef at 300-350 FCFA per kilogram, paid an average of 202 FCFA per kilogram for stall-fed cattle from September through December 1980. On the other hand, cattle smugglers in the Mandara Mountains offer consistently high prices for well-finished stall-fed cattle than rural and urban butchers. Unfortunately, no stall-fed cattle exported to Nigeria were weighed during the survey research.[5]

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[5]In February and March of 1981, cattle traders paid an average of 87,140 FCFA per head for well-fleshed trade cattle in the markets of Northern Cameroon. Assuming that these animals weighed an average of 400 kilograms on the hoof, which is an unusually high liveweight, the traders paid 218 FCFA per kilogram liveweight. If these cattle averaged 375 kilograms per head, then the liveweight price per kilogram would rise to 232 FCFA per head. If the trade cattle weighed 350 kilograms on the hoof, which probably represents a lower bound for trade cattle trekked to Nigeria, then the price per kilogram liveweight would be 249 FCFA. The stall-fed cattle slaughtered at Mokolo in late 1980 weighed an average of 325 kilograms per head and would probably have commanded 90 percent of the price of the trade cattle purchased by traders for shipment to Nigeria. Assuming this to be the case, it is estimated that these stall-fed cattle would have fetched 241 FCFA per kilogram if sold for export.

The sensitivity analysis in Table 9-3 shows that a 5 percent increase in the final price of finished bulls leads to a 9 percent increase in producer returns, while a 10 percent increase would cause producer returns to rise 17 percent to 176 FCFA per man-day. Assuming that the producer sold his bull to an urban butcher who could offer only 202 FCFA per kilogram liveweight, producer returns would decline by 10 percent to 135 FCFA. The sale price could also decrease by as much as 10 percent if there were a significant increase in supply, retail price controls were enforced in both urban and rural areas, and cattle exports were effectively limited. This contingency would lower the sale price to 193.5 FCFA per kilogram and cut producer returns by 17 percent. FONADER can reduce the probability of this contingency occurring by encouraging producers to market finished bulls during periods when slaughter cattle are scarce (March-July) and prices per kilogram tend to be seasonally higher. Moreover, removal of retail price controls and relaxation of export restrictions would greatly lower the risk of realizing such disappointing returns.

e) Contingency Set No. 5: Varying Incremental Cereal Production Due to Application of Cattle Manure

The economic value of the cattle manure in the synthetic budget is estimated from yield plot data and estimates of the increase in grain production over several years due to cattle manure application in other regions of Africa. The estimated increase in cereal production from applying cattle manure in the Mandara Mountains is probably below potential yield increases on intensively farmed holdings where labor inputs per hectare are higher, terraces are well-maintained, and manure

application rates exceed those assumed in the initial estimates. Yield plot data from Magoumaz, where holdings average 1.2 hectares and manure application rates to fields around the compound are high, show that yields are 50 percent higher on well-manured fields than yields on superior plots in Ldama, a neighboring village where holdings are larger (2.8 hectares) and labor inputs and manure application rates lower per hectare.

In the sensitivity analysis it is assumed that higher rates of manure application could lead to 15 percent and 30 percent increases in incremental cereal production, which would augment producer returns by 13 percent and 25 percent respectively. Lower manure application rates in less intensively farmed areas could result in a 15 percent decline in incremental cereal production, which would lower returns per man-day by 12 percent to 132 FCFA. Both greater and lower incremental grain production are possible on some farms in the Mandara Mountains region, reflecting differences in producers' manure management skills, soil structure and fertility in different villages, and the number of years over which cattle manure has been systematically applied to fields.

f) Contingency Set No. 6: Appreciation in the Value of Cattle

During the 1970s the retail price of beef sold at Yaounde increased at an average annual rate that was 4 percent higher than the annual increase in the general price index (see Annex 3). The incomplete time series data available for Northern Cameroon, as well as informal reports by butchers and cattle traders, suggest that secular appreciation in the value of cattle also took place in Northern Cameroon during the 1970s. This appreciation was due primarily to the rapid expansion in demand for

beef in urban areas of Nigeria in the 1970s and the contraction in supply that occurred during the Sahelian drought.

While Nigerian oil revenues will probably not increase as rapidly during the 1980s as during the 1970s, rates of urban population growth in Northern Cameroon are high enough to keep the demand for beef rising. Although the supply of stall-fed cattle will increase significantly in the Mandara Mountains if stall-feeding continues to be promoted, the regional supply of cattle in Northern Cameroon is constrained by available range resources, which have deteriorated progressively in recent years. Therefore, it is quite possible that the real value of cattle will continue to increase in the 1980s. If this appreciation continues at a rate of 4 percent per annum, then producer returns to stall-feeding would increase 14 percent to 171 FCFA per man-day. An average annual appreciation of 8 percent, which is double the rate of appreciation that occurred during the 1970s, would augment producers' returns 29 percent to 194 FCFA per man-day.

g) Contingency Set No. 7: Increased Revenue from Producer Slaughter and Retailing of Stall-Fed Beef

While 27.5 percent of the stall-fed cattle raised by a sample of farmers in five villages near Mokolo from 1976 to 1981 were sold on the hoof, 35 percent of the producers slaughtered their own bulls and retailed at least three-quarters of the beef (see Table 4-6). By capturing the retailing margin, the producers are able to augment sale revenues by at least 5-10 percent. The sensitivity analysis shows that producer returns would increase 9 percent, assuming a 5 percent retailing margin, and 17 percent, assuming a 10 percent retailing margin. If

producers are able to earn returns comparable to butchers' returns to retailing, then they could augment sale revenues by 20 percent. In this event returns would rise 35 percent to 202 FCFA per man-day. If producers did as well as the wholesale butcher at Soulede in retailing the beef, returns would be 312 FCFA per man-day. It is unlikely that producers' returns to retailing would be as high as those of rural butchers', but attractive returns to retailing may explain why in 63 percent of the cases where stall-fed cattle were slaughtered by producers, at least one quarter of beef was sold. Three or more quarters of beef were sold in 76 percent of the cases of producer slaughter. This suggests that producers are able to earn higher revenues by slaughtering for home consumption by the extended family rather than by selling cattle on the hoof.

h) Contingency Set No. 8: Varying Interest Rate Charges

The base rice bran budgeting analysis assumes that FONADER requires producers to pay back loans for stall-feeding at an annual interest rate of 10 percent, which approximates the opportunity cost of capital in Northern Cameroon. The sensitivity analysis shows that an increase in interest rate charges to 15 percent would lower producer returns 8 percent to 138 FCFA per man-day of labor. Charging an interest rate of 20 percent for FONADER loans would reduce returns to producer labor by 17 percent to 124 FCFA per man-day.

3. The Effect of Buying and Selling During Different Seasons

In Chapter Seven the seasonal variation in cattle prices was analyzed. Data collected at the Gazawa cattle market and from butchers in the Mokolo area showed that cattle prices are lowest per kilogram in

the September-November period and appreciate during the dry season, probably reaching maximum levels in May or June.

Cattle prices paid by Mokolo and Soulede butchers rose from an estimated average of 197 FCFA per kilogram liveweight for the three month period September-November 1980 to an estimated average of 227 FCFA per kilogram for the months of January, Feburary and March.[6] Retail price data collected at the Soulede, Tourou and Gazawa markets also showed that beef prices are higher during the dry season than the harvest period. Finally, most cattle traders report that returns to selling cattle in Nigeria are highest during the late dry season and throughout the rainy season and lowest during the post-harvest period. It is clear that the seasonal movement in cattle prices per kilogram that occurs in Northern Cameroon can work to both the advantage and disadvantage of producers of stall-fed cattle.

a) Traditional Producer Behavior Regarding Price Seasonality

Many traditional producers of stall-fed cattle do not take advantage of the seasonal variation in cattle prices. In fact, the seasonal movement in cattle prices often has an adverse effect on the economic viability of stall-feeding enterprises. The survey data show that producers tend to buy immature bulls for stall-feeding when they are relatively dear on a per kilogram basis (February-May) and sell the finished animals when prices per kilogram are relatively low (September-December).

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[6]Cattle liveweights were not obtained before slaughter. The four quarters and offals were weighed and the acquisition prices per kilogram carcass weight were calculated. It is assumed that the carcass weight (four quarters) is equal to 50 percent of the liveweight.

Although this marketing strategy appears irrational, there are several reasons for its widespread practice.

First, it is important to note that producers typically sell stall-fed cattle at their maximum liveweights. This stems from the traditional objective of stall-feeding, which is to raise as large an animal as possible for traditional slaughter during one of the post-harvest festivals. The larger the bull, the more beef there is for distribution to family, friends, villagers who contributed labor services to cropping enterprises during the growing season, and political clients. Although it is becoming less common for producers to stall-feed bulls exclusively for traditional slaughter and distribution of the beef, many producers still slaughter their own animals and retain some beef for consumption by the extended family. The rest of the beef is retailed to other villagers or sold to local rural butchers. In this way, multiple social and economic objectives are satisfied. The commercial sale of beef generates income that can be reinvested in livestock or used to buy grain, clothing or pay taxes.

Sale or slaughter of stall-fed cattle when they are at their maximum liveweight also maximizes gross income in some instances, since increases in the price per kilogram of cattle during the dry season are sometimes more than offset by declines in liveweight.[7] By selling or slaughtering stall-fed cattle during or shortly after the harvest, producers finish the bulls on surplus agricultural produce and agricultural by-products. Moreover, surplus labor, which becomes available during the second half of August (following the last weeding), can be tapped for more intensive feeding of freshly cut forage.

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[7]See Tables 7-1 and 7-2, which show cattle prices for different categories of cattle during the period July 1980-March 1981.

Although producers pay more for bull calves on a per kilogram basis by buying during the period April-July, the overall acquisition price is often lower than during the late rainy season or early dry season (September-December). Producers who have a limited amount of cash for cattle acquisition may find the purchase of bulls when they are cheapest in absolute terms to be most sensible. A second advantage in buying a bull for stall-feeding in the late dry season, when higher per unit but lower absolute costs are common, is that dry season labor inputs are greatly reduced or eliminated. Hauling water for the enclosed cattle becomes especially time-consuming during the months of May and June. Moreover, a lower quantity of feed needs to be cut, dried and stored for feeding during the period March-June. The later a producer buys an animal during the year, the more he is able to reduce competition for household labor between cropping and stall-feeding enterprises. This is probably the reason why a surprisingly high 25 percent of the 360 bulls acquired for stall-feeding by a sample of households in five villages near Mokolo were bought in May, June and July.

Finally, many producers probably see little point to buying a heavier bull calf in September or October, although cattle are cheaper per unit of liveweight, because the animal will lose weight throughout the dry season, ending up in similar condition to the emaciated feeder calves available in the markets of the Diamare Plains by April-June. Supplemental feeding can, of course, offset liveweight losses during the dry season. Yet producers in the Mandara Mountains do not typically stock enough forage to maintain cattle at their post-harvest liveweights, and the use of concentrated feedstuffs was unknown before the debut of the FONADER loan scheme.

Although acquisition of bull calves during periods of high prices per kilogram and sale during periods of low prices per kilogram have a sound basis in traditional stall-feeding enterprises, these practices will have to be modified in efforts to promote stall-feeding using supplemental feeds. The increased production costs resulting from feeding of concentrates will require producers to maximize sales revenues in order to realize attractive returns. Hence, benefitting from seasonal variation in prices takes on greater importance as stall-feeding technology changes and the enterprise becomes more commercialized.

b) Sensitivity Analysis of the Effect of Seasonal Price Trends on Producer Returns

In carrying out the sensitivity analysis, it is assumed that producers hold the cattle for 16-20 months rather than the full two years. This has the effect of lowering the economic value of manure, the feed and wage labor components of variable costs, housing depreciation, the cost of equity capital invested in housing and used as working capital, debt service, and total labor inputs. If feeder calves are purchased during the period September-November, held 16-20 months, and sold before the rainy season, producers would hold stall-fed cattle during only one rainy season, which would greatly reduce labor inputs and competition between cropping and livestock enterprises.

This question of the timing of feeder calf acquisition and sale has a potentially important influence on producer returns. As shown in Table 9-3, producer acquisition of bull calves for stall-feeding in October and sale of the finished bulls in February after 16 months of feeding would raise returns to producer labor and management 27 percent

to 190 FCFA per man-day. Assuming that the sale price per kilogram in April rises to 240 FCFA per kilogram, then producers' returns increase 40 percent to 210 FCFA per man-day.[8] If the sale price continued to rise to 250 FCFA per kilogram liveweight by June, producer returns would be 209 FCFA per man-day.

In contrast, buying bull calves when they are relatively dear per kilogram and selling the finished cattle when they are relatively cheap per kilogram would significantly lower producers' returns. By buying in February, when cattle prices have begun to rise during the dry season, and selling in October, when cattle prices are lowest, producers' returns would fall to 113 FCFA per man-day. By buying in April, when cattle prices have appreciated to an estimated 240 FCFA per kilogram, and selling in October, producers' returns would also be far below returns in the base budget (119 FCFA as opposed to 150 FCFA). Clearly, the timing of acquisition and sale figures importantly in determining the level of returns to producers and should receive attention in the implementation of any credit scheme for promoting stall-feeding.

4. Plausible Scenarios Affecting Returns to Producers

In the previous section key parameters affecting returns to stall-feeding were allowed to vary independently. In implementing the stall-feeding project, it is far more likely that more than one contingency or parameter would change. The scenarios below link several possible

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[8]Butchers at Mokolo and Soulede paid an estimated average of 235 FCFA per kilogram liveweight for slaughter cattle in March 1981. Given the January-March 1981 average acquisition price of 227 FCFA per kilogram liveweight, a further appreciation of the acquisition price to 240 FCFA is not implausible.

contingencies, which combine to augment or lower producer returns more significantly than any one contingency.

a) Return-Augmenting Scenarios

One plausible scenario that would augment returns to stall-feeding using rice bran would result from the combined effect of higher incremental cereal production due to application of cattle manure, continued appreciation in the value of cattle, and increased revenues due to producer retailing of the beef or higher sale prices. Assuming a 15 percent increase in incremental cereal production, 4 percent annual appreciation in the value of cattle, and a retailing margin of 5 percent (or a 5 percent higher sale price), producer returns would increase 36 percent over the base to 204 FCFA per man-day of labor. If the appreciation failed to occur but the other two conditions were realized, returns to labor would rise only 21 percent relative to the base to 182 FCFA per man-day. A less plausible outcome, representing the probable upper bound on returns to stall-feeding, would be a 30 percent increase in incremental cereal production, 4 percent annual appreciation in the value of cattle, and a retailing margin of 10 percent (or 10 percent higher sale price), which would increase producer returns 58 percent to 237 FCFA per day. If appreciation in the value of the cattle did not take place, yet the other two conditions were realized, net returns to producers would increase 43 percent over the base to 214 FCFA per man-day.

Any increase in returns to labor of the above magnitude (21-58 percent) would take place only if the average daily rate of gain during the two years of stall-feeding were at least 250 grams. As noted above,

this level of production is possible only if producers were able to obtain the rice bran by late January during the dry season, when supplemental feeding should begin, and if good extension services were provided.

If it were possible to attain a daily rate of gain of 300 grams in combination with the above sets of contingencies, then producer returns would be further augmented. Returns to labor would rise from 204 and 237 FCFA per man-day to 236 and 270 FCFA per man-day if the three conditions were satisfied (increased cereal production, asset appreciation and a higher sale price). Assuming a daily rate of gain of 300 grams, greater incremental cereal production, and a higher sale price, but no asset appreciation, net returns to labor and management would be 211 and 226 FCFA per man-day. A significant increase in the rate of gain over the rate assumed in the base budget (250 grams/day) is unlikely, since supplemental feeding is a new technology and FONADER is presently unable to provide the rice bran on a timely basis with supporting extension services.

b) Return-Diminishing Scenarios

While returns to producer labor could increase significantly under plausible combinations of contingencies, producer returns could also decline markedly if several components of cost were higher and if revenue from the sale of the finished bulls declines. One plausible scenario would be for producers to pay higher prices for feeder calves and feed and receive lower prices for finished bulls. For example, paying a 10 percent higher acquisition price for an immature bull, 25 percent more for the rice bran and 50 percent more to private sector participants for transporting, storing and distributing the rice bran,

while receiving 6 percent less for the bull (presuming an urban butcher bought the animal), would lower producer returns 27 percent to 110 FCFA per day.

A less likely though still possible outcome would be for producers to pay 20 percent more for feeder calves, 50 percent more for the rice bran, and 100 percent more for the transportation, storage and distribution of the rice bran, while receiving 10 percent less per kilogram liveweight for the finished animal. This scenario results if producers timed acquisition and sale poorly, buying when bull calves are dear (April-June) and selling the fattened cattle when cattle prices are low (September-December), and if demand for the rice bran expanded greatly relative to the supply. The effect of this combination of contingencies would be to lower producer returns 51 percent to 74 FCFA per man-day of labor.

The worst scenario imaginable would be for the daily rate of gain to be no higher than 200 grams, which is typical for existing stall-feeding enterprises, in combination with the last set of contingencies. In this case producer returns would fall 67 percent to 49 FCFA per man-day. If the rate of gain were 200 grams, and the set of contingencies outlined in the first paragraph of this section took place, then returns to labor would be 84 FCFA per man-day. If FONADER fails to distribute the rice bran on a timely basis and the extension services do not improve, the rate of weight gain might be no greater than under traditional feeding practices. Given the significantly higher costs that producers must bear in the loan scheme, no improvement in animal production would lead to returns that are far below those for traditional stall-feeding enterprises (127 FCFA/man-day). Clearly, such a disastrous outcome must

be avoided if stall-feeding using a dry season feed supplement is to be promoted in the Mandara Mountains.

D. ECONOMIC ANALYSIS OF THE STALL-FEEDING PROJECT

In this section the broader economic viability of the FONADER loan scheme will be assessed, using findings from the individual farm financial enterprise analysis. The potential returns to adding an applied research and extension component to the loan scheme will also be estimated, assuming that the beneficiaries are, first of all, the 2,000 loan recipients and second, the loanholders plus other stall-feeding households. Finally, the potential effects of retaining and modifying livestock sector policies on producers' financial returns and project economic returns will be discussed.

1. Internal Rate of Economic Return to the FONADER Project[9]

In the original project appraisal it was assumed that the loan scheme would continue for ten years and that 1,000 loans per year would be extended by year four of the project.[10] Therefore, 2,000 loans would be outstanding each year by year five of the project. The implementation schedule and the overall project costs and benefits are shown in Table 9-4. The various components of incremental costs and benefits from the 1977 appraisal have been updated to reflect 1980-81 prices and new information from the present study.

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[9]The internal rate of economic return will be referred to as IRR in the following pages.

[10]World Bank, Cameroon: Appraisal of a Rural Development Fund Project, Report No. 1479-CM, May 1977.

TABLE 9-4

UPDATED WORLD BANK ECONOMIC ANALYSIS OF THE STALL-FEEDING PROJECT[1]

	Without Project	With Project									
	PY1-10	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10
1. Implementation											
New Credits (No.)	0	100	300	600	1000	1000	1000	1000	1000	1000	1000
Outstanding Credits (No.)	0	100	400	900	1600	2000	2000	2000	2000	2000	2000
2. Incremental Costs					FCFA Million						
Feeder calves (35,000 FCFA/head)	0	3.5	10.5	21.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Veterinary inputs	0	0.05	0.2	0.4	0.7	0.8	0.8	0.8	0.8	0.8	0.8
Cattle mortality (6.1%)[2]	0	0.2	0.9	1.9	3.4	4.3	4.3	4.3	4.3	4.3	4.3
Rice bran	0	0.4	1.6	3.6	6.5	8.1	8.1	8.1	8.1	8.1	8.1
Variable costs[3]	0	0.4	1.7	3.9	7.0	8.7	8.7	8.7	8.7	8.7	8.7
Farm labor[4]		1.5	5.8	13.1	23.4	29.2	29.2	29.2	29.2	29.2	29.2
Credit/extension agents (4)	0	2.4	3.6	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Credit manager[5]	0	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Vehicles	0	0.4	0.1	0.1	0.4	0.1	0.1	0.4	0.1	0.1	0.4
		11.3	26.8	51.2	83.6	93.4	93.4	93.7	93.4	93.4	93.7
3. Incremental Benefits											
Cattle sales (73,640 FCFA/head)		-	7.4	22.1	44.2	73.6	73.6	73.6	73.6	73.6	73.6
Value of manure[6]		1.7	6.7	15.1	26.8	33.5	33.5	33.5	33.5	33.5	33.5
		1.7	14.1	37.2	71.0	107.1	107.1	107.1	107.1	107.1	107.1
4. Net Incremental Benefits		-9.6	-12.7	-14.0	-12.6	13.7	13.7	13.4	13.7	13.7	13.4
Economic Rate of Return = 11.2%											

[1]The appraisal of the stall-feeding subproject is taken from the following World Bank document: Cameroon: Appraisal of a Rural Development Fund Project, Report No. 1479-CM, May 1977. The updated analysis parallels that of the World Bank.

[2]Cattle mortality was assumed to be 2.0% per annum by the World Bank appraisal, while the updated appraisal uses the survey finding of 6.1%. Cattle are valued at their acquisition price (35,000 FCFA/head) in estimating losses due to mortality.

[3]Producers' variable costs include expenditures on natron and salt, stored fodder and grain, labor services, and transport of the rice bran from the regional storage centers at Mokolo and Koza to producers' villages. These data were obtained from the survey research and are detailed in Table 9-2.

[4]Producer labor and management are not usually included as a cost in economic appraisal of projects. The internal rate of return typically represents the estimated return to producer and implementing agency capital and to producer labor and management. Producer labor is valued and incorporated as a cost to the stall-feeding scheme for comparative purposes, since the World Bank costed out farm labor in its initial appraisal. Our estimate of the cost of farm labor is an approximation of the annual economic wage rate in the mountainous zones of the Mandara region. It was calculated using monthly estimates of the opportunity cost of male and female labor and survey data of labor inputs by age-sex categories into stall-feeding enterprises. Each monthly estimate of the opportunity cost of labor was calculated by weighting the estimates for each age-sex category by the proportion of monthly labor inputs supplied by that category as follows:

$$EWR_i = (EWR_{i,j} \cdot L_{i,j}/TL_i) + (EWR_{i,k} \cdot L_{i,k}/TL_i) + (EWR_{i,l} \cdot L_{i,l}/TL_i) + (EWR_{i,m} \cdot L_{i,m}/TL_i)$$

where EWR_i = economic wage rate in month i

$EWR_{i,j-1}$ = estimated economic wage rate of age-sex category j through l for month i

$L_{i,j-1}$ = labor inputs into stall-feeding by age-sex category j-1 for month i

TL_i = total labor inputs into stall-feeding for month i

[5]The World Bank assumed that two-thirds of the cost of credit management would be allocated to stall-feeding and one-third to a market gardening subproject. This assumption is retained.

[6]The economic value of manure as a fertilizer is estimated to be 16,750 FCFA per year in the updated appraisal, but it is not quantified in the World Bank appraisal.

In updating the appraisal, feeder calf prices are increased from 30,000 to 35,000 FCFA per head. Cattle sales prices are also higher (73,640 FCFA vs. 68,000 FCFA per head), although the original appraisal assumes a higher rate of daily gain (300 grams vs. 250 grams). Rice bran and mortality costs are also higher in the updated appraisal, based upon survey findings. Moreover, the updated appraisal includes producers' variable costs, such as expenditures on wage labor, transportation of rice bran from regional storage depots to producer villages, and purchased stored fodder, grain, salt and natron.

Household labor was valued at 125 FCFA per man-day in the original appraisal.[11] In the updated appraisal household labor is also costed at 125 FCFA per man-day. While no explanation of the choice of the economic wage rate is provided in the original appraisal, the estimated wage rate in the updated appraisal is calculated as a weighted average of monthly estimates of the opportunity cost of labor for different age-sex categories in survey villages where stall-feeding is practiced.[12] The fundamental difference in the cost of household labor in the two appraisals arises from the higher annual labor inputs used in the updated analysis. The original appraisal assumed that only 20 additional man-days of labor are required for stall-feeding. In contrast, the survey findings show that 112.5 man-days are required per year for stall-feeding in the villages of Magoumaz and Mavoumai.

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[11] In appraising many development projects, the World Bank does not include farm family labor as an explicit item in financial and economic budgets. Stall-feeding enterprises are very labor intensive, demanding significant increases in on-farm labor requirements, so the World Bank was justified in including farm family labor costs in the original appraisal of the stall-feeding project. The updated appraisal also includes farm labor costs, which permits comparison of the estimated IRRs.

[12] See footnote four in Table 9-4 for a detailed explanation of the methodology used in calculating the economic wage rate.

The updated analysis reveals that the IRR is 11.2 percent, compared to the 1977 estimate of 34.5 percent. Two factors are responsible for this decline. First, labor costs in the updated appraisal are over five times higher than in the original appraisal. If the economic wage rate used in the analysis were 100 FCFA per man-day, the IRR would rise to 24.4 percent, as shown in Table 9-5. The IRR also declines, because the updated appraisal assumes a daily rate of gain of 250 grams, rather than the 300 grams per day assumed in the original appraisal. If the latter rate is used, the IRR increases to 26.4 percent. Average daily rates of gain above 250 grams are unlikely, however, under the existing level of extension services.

The analysis in Table 9-5 also shows that the IRR is sensitive to changes in cattle purchase and sale prices, and to estimates of the economic value of manure. If producers were able to sell finished bulls at 5 percent higher prices, the IRR would rise to 18.7 percent. The IRR would increase to 25.6 percent if loan recipients obtained 10 percent higher sales prices. Higher prices could result from sales to traders destined for Nigeria or from relaxation of price controls on retail sales of beef in urban areas. Pricing policy will play an important role in the success of any intervention designed to promote stall-feeding, as the expansion in offtake of stall-fed cattle will be non-marginal. The interrelationships between pricing policy and the demand and supply for stall-fed beef will be examined in the last section of this chapter. Finally, increases in the estimated economic value of manure by 15 percent and 30 percent would raise the IRR to 22.6 percent and 33.5 percent, respectively.

TABLE 9-5

SENSITIVITY ANALYSIS OF THE FONADER STALL-FEEDING PROJECT

Parameter Change	IRR (%)
0. Base Economic Analysis	11.2
1. Economic Wage Rate (Farm Labor Cost)	
a. 100 FCFA/man-day	24.4
b. 150 FCFA/man-day	-4.3
2. Average Daily Rate of Gain	
a. 300 grams/day	26.4
b. 200 grams/day	-10.9
3. The Cost of Rice Bran	
a. 25 Percent Increase	6.3
b. 50 Percent Increase	1.0
4. Feeder Calf Acquisition Price	
a. 10 Percent Lower Price (31,500 FCFA)	20.2
b. 5 Percent Lower Price (33,250 FCFA)	15.6
5. Cattle Sales Price	
a. 5 Percent Higher Price (77,322 FCFA)	18.7
b. 10 Percent Higher Price (81,004 FCFA)	25.6
c. 6 Percent Lower Price (69,185 FCFA)	0.7
6. Value of Cattle Manure as Fertilizer	
a. 15 Percent Higher Cereal Production	22.6
b. 30 Percent Higher Cereal Production	33.5

Although the IRR declines to 11.2 percent in the updated appraisal, the stall-feeding project still merits funding. The assumptions regarding the level of cattle acquisition and sales prices are conservative. Moreover, no attempt has been made to quantify indirect benefits that the project could generate, particularly the positive effects of expanding stall-feeding on the long-run economic viability of the intensive farming systems in the Mandara Mountains region. In addition, the demonstration effect of the project upon stall producers who are not loan recipients is not quantified, and no reduction in stall-fed cattle mortality is assumed. Yet if the project were only able to achieve the 11.2 percent rate of return, the World Bank and FONADER might want to examine other projects in Northern Cameroon, which could perhaps generate higher direct benefits.

2. Internal Rate of Economic Return to the FONADER Project with an Expanded Applied Research and Extension Program

a) Additional Costs

In order to conduct more effective applied research and extension that would benefit producers, it would be necessary to hire at least one research and extension specialist and ten extension agents.[13] The director of the applied research and extension program would hold a minimum of a Masters degree in agricultural economics, rural sociology or animal science. This individual would design the program, train the extension agents to implement it, supervise the implementation, analyze data

[13]Two thousand loans will be outstanding in years five through ten of the project. It is assumed that each extension agent will serve 200 loan recipients.

generated by the applied research, and communicate the findings to producers (via the extension agents) and other agencies. Ideally this individual would be Cameroonian and from the Mandara Mountains. The extension agents would have to be from the Mandara Mountains in order to communicate effectively with producers.

The applied research and extension specialist would be based in Mokolo. He would require office space and equipment (a desk, book shelves, and a typewriter), secretarial support, and a motorcycle to function as a professional. Office space would be made available at the Livestock Subsector Office in Mokolo. Research materials such as a programmable calculator, scales, a mimeograph machine, and paper would be needed to conduct applied research. The extension agents would be based in villages where stall-feeding is practiced. They would work out lodging arrangements with village notables and require bicycles to carry out their work. The hiring of the extension agents would be phased over a five-year period, maintaining a ratio of one agent to every 200 loan recipients or better.

The costs of the above activities are detailed in Table 9-6 (No. 3). It also shows the revised total incremental costs to loan recipients. Only two of the nine categories of incremental cost from the base analysis change in this revised economic analysis.

b) Direct Benefits

In the appraisal of the returns to a stepped up program of applied research and extension, it is first assumed that the 2,000 loan recipients are the sole beneficiaries of the program. Benefits accrue to producers in the form of 5 percent lower feeder calf acquisition costs,

TABLE 9-6

ECONOMIC ANALYSIS OF THE STALL-FEEDING PROJECT WITH AN APPLIED RESEARCH AND EXTENSION COMPONENT

	PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10
1. Implementation										
New Credits (No.)	100	300	600	1000	1000	1000	1000	1000	1000	1000
Outstanding Credits (No.)	100	400	900	1600	2000	2000	2000	2000	2000	2000
	FCFA Million									
2. Incremental Costs (loan recipients)										
Feeder calves (33,250 FCFA/head)[1]	3.3	10.0	20.0	33.3	33.3	33.3	33.3	33.3	33.3	33.3
Cattle mortality (3%)[2]	0.1	0.4	0.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Revised total	11.1	26.1	49.7	80.6	89.6	89.6	89.6	89.5	89.6	89.5
3. Cost of Expanded Applied Research and Extension Program										
Office furniture & equipment	0.5	-	0.1	-	0.2	-	0.1	-	0.2	-
Research materials	0.5	0.2	0.2	0.2	0.5	0.2	0.2	0.2	0.2	0.2
Applied research/extension specialist	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Extension agents (10)	1.2	2.4	3.6	4.8	6.0	6.0	6.0	6.0	6.0	6.0
Secretary	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Motorcycle and bicycles	0.8	0.2	0.2	0.2	0.8	0.2	0.2	0.2	0.8	0.2
Total	5.8	5.6	6.0	8.0	10.3	9.2	9.3	9.2	10.0	9.2
4. Incremental Benefits (loan recipients)										
Cattle sales (77,322 FCFA/head)[3]		7.7	23.2	46.4	77.3	77.3	77.3	77.3	77.3	77.3
Value of manure	1.7	6.7	15.1	26.8	33.5	33.5	33.5	33.5	33.5	33.5
Total	1.7	14.4	38.3	73.2	110.8	110.8	110.8	110.8	110.8	110.8
5. Net Incremental Benefits (loan recipients)	-15.2	-17.3	-17.4	-15.4	10.9	12.0	11.9	12.0	11.2	12.0
6. Incremental Benefits (non-loan recipients)[4]										
a. Higher sales price[5]	-15.2	1.0	2.0	4.0	6.7	10.0	10.0	10.0	10.0	10.0
b. Higher sales price plus higher rate of gain	-15.2	-3.2	3.9	6.4	9.5	11.6	11.6	11.6	11.6	11.6
7. Net Incremental Benefits (loan recipients and other producers)										
a. 5 +6a	-15.2	-16.3	-15.4	-11.4	17.6	22.0	21.9	22.0	21.2	22.0
b. 5 + 6b	-15.2	-20.5	-13.5	-9.0	20.4	23.6	23.5	23.6	22.8	23.6

Economic rates of return:
a) loan recipients only (No. 5) 1.4%
b) loan recipients and other producers (case 7a) 16.5%
c) loan recipients and other producers (case 7b) 18.3%

[1] It is assumed that one of the principal benefits of the applied research and extension program is better timing of sales. Loan recipients are assumed to pay 5% less for feeder calves.

[2] Cattle mortality is assumed to be cut in half from improved extension and distribution of veterinary inputs.

[3] Cattle sales prices are assumed to be 5% higher, resulting from better timing of sales or producer retailing of more of the beef from slaughtered stock.

[4] It is expected that producers of stall-fed cattle other than loan recipients would benefit indirectly from the applied research and extension program, which has loan recipients as its principal target group. In 1980 there were 12,850 producers of stall-fed cattle in the Mandara Mountains. From years six through ten of the project, 50% of these producers (6,425) are assumed to benefit from the applied research and extension program. The proportion of producers benefitting in earlier years is as follows:

	Year 1	2	3	4	5	6-10
% Producers	0	5	10	20	33	50
No. Producers	-	643	1285	2570	4283	6425

[5] One of the likely benefits of the applied research and extension program would be higher returns from selling cattle or beef. It is assumed that half of the producers using the traditional technology who receive extension benefits would obtain 5% higher revenues from sales of their cattle or beef from slaughtered stock.

[6] In addition to receiving 5% higher sales revenues, it is assumed that producers who do not receive loans but who do receive extension benefits purchase rice bran and other feed for supplemental dry season feeding of cattle, which would enable them to achieve higher rates of gain (250 grams/day) than under the existing technology. Higher costs of procuring and transporting supplemental feeds are also incurred. Since expanding supplemental feeding on a broad scale would bid up the cost of the rice bran or other concentrates, it is assumed that producers would pay significantly higher costs as increasing numbers adopted supplemental feeding, as shown in the table below:

	Year 2	3	4	5	6
% Increase over 1980 cost	10	20	33	40	50
FCFA cost/producer	5039	5442	5980	6249	6653

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50 percent lower mortality and a 5 percent higher sales price for finished animals. Under this set of conservative assumptions, the IRR for the project with the expanded research/extension program is 1.4 percent, which is significantly below the returns to the loan scheme without the applied research and extension input.

As shown in the first columns of IRR figures in Table 9-7, several plausible parameter changes could lead to a higher IRR. If the applied research and extension program led loan recipients to achieve the higher average daily rate of gain of 300 grams, the IRR would rise to 15.9 percent. In addition, sales revenues 10 percent above the price used in the base financial budgeting analysis (73,640 FCFA) would cause the IRR to rise to 8.4 percent. Finally, if incremental cereal production is 15-30 percent higher than originally estimated, then the IRR would increase to 11.4-20.5 percent. It is also possible, although less likely, that parameter changes such as lower rates of gain, higher feeder calf acquisition prices, and lower cattle sales prices would cause the IRR to become negative. Several of these possibilities are shown in Table 9-7.

The analysis reflected in Tables 9-6 and 9-7 is conservative in its assumptions regarding potential benefits of improved research and extension. While not all loan holders would achieve rates of gain of 300 grams per day or 10 percent higher sales prices, enough of them probably would so that the IRR would approach or exceed 15 percent rather than 1 percent. Despite the significantly higher project costs from including a research and extension component and the limited group of potential beneficiaries, the project would probably generate sufficiently high economic returns to merit its adoption.

TABLE 9-7

SENSITIVITY ANALYSIS OF THE FONADER PROJECT WITH AN EXPANDED APPLIED RESEARCH AND EXTENSION COMPONENT

Parameter Change	Internal Rate of Return (%)	
	Loan Recipients as Sole Beneficiaries	Loan Recipients and Other Producers as Beneficiaries
0. Base Economic Analysis	1.4	18.3
1. Economic Wage Rate (Farm Labor Cost)		
a. 100 FCFA/man-day	13.1	27.1
b. 150 FCFA/man-day	-13.9	8.5
2. Average Daily Rate of Gain		
a. 300 grams/day (Sale Price: 85,560 FCFA)	15.9	42.2
b. 200 grams/day (Sale Price: 69,080 FCFA)	-21.8	-229.5
3. Feeder Calf Acquisition Price		
a. Price Used in Base Run of Financial Analysis (35,000 FCFA)	-2.8	18.3
b. 5 Percent Higher Price than Base Price (36,750 FCFA)	-7.5	10.8
c. 5 Percent Lower Price than Base Price (33,275 FCFA)	1.4	24.6
d. 10 Percent Lower Price than Base Price (31,500 FCFA)	5.5	30.9
4. Cattle Sales Price		
a. Price Used in Base Run of Financial Analysis (73,640 FCFA)	-7.0	1.2
b. 6 Percent Lower Price than Base Price (69,185 FCFA)	-21.3	-229.7
c. 10 Percent Higher Price than Base Price (81,004 FCFA)	8.4	30.3
5. Value of Cattle Manure as Fertilizer		
a. 15 Percent Higher Incremental Cereal Production	11.4	34.5
b. 30 Percent Higher Incremental Cereal Production	20.6	48.5

Most well-implemented extension programs reach many more producers than those for whom the program is directly tailored. The demonstration effects are usually significant, as each benefitting producer can indirectly affect several other producers in the same village. Given the above, a second estimate of the internal rate of economic return was completed, assuming that 50 percent of the 12,850 existing producers in the region would eventually be affected by year six of the program. These non-loan recipients are assumed to benefit from extension services so as to be able to achieve a higher sales price for finished bulls. The IRR of the overall project would increase to 16.5 percent, as shown in Table 9-6. If these producers also adopted supplementary dry season feeding of rice bran, the IRR would rise to 18.3 percent.[14] These improved economic returns are above the opportunity cost of capital in Northern Cameroon and would justify the implementation of a well-managed applied research and extension component.

While the economic returns to the research/extension program are attractive, returns would be even higher if key parameters were changed. The IRR (in Table 9-7) to the expanded research/extension program would increase if the non-loan recipients achieved rates of gain of 300 grams per day, 5 percent higher bull calf prices, 10 percent higher cattle sales

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[14]The assumptions made to examine this alternative are that producers who adopted supplemental dry season feeding would bear the full acquisition, transport and distribution costs of the rice bran. The daily rate of gain for their stall-fed cattle would increase from approximately 195 grams to 250 grams, which is the rate assumed to be attained by loan recipients. It is also assumed that the feed costs would increase 50 percent by the time half of the stall-feeding households in the region adopted supplemental feeding (see footnote 6 of Table 9-6).

revenues, and 15-30 higher incremental cereal production from using cattle manure as fertilizer. The sensitivity analysis shown in the second column of Table 9-7 assumes that the loan recipients obtain the benefits used in calculating the initial economic returns to the research/extension program, and assumes that the non-recipients adopt supplemental feeding of rice bran. Since likely parameter changes could increase the IRR from 18.3 percent to 24.6-48.5 percent, there is further justification for implementing the expanded applied research and extension program.

c) Indirect Benefits

The economic analysis of returns to the loan scheme with an expanded applied research and extension component attempts to quantify only a few of the potential benefits of expanding stall-feeding in the Mandara Mountains. In this section we will discuss selected additional benefits.

By undertaking an active applied research and extension program, the institutional capacity of the Livestock Service and FONADER would be strengthened. The Mandara Mountains would receive a significant increase in trained manpower. Small farmers could receive veterinary and extension services in contrast to the present situation, where Fulani herders receive most of the attention and resources of the Livestock Service. Moreover, extension agents would be able to advise producers as to how to improve small ruminant production. If the agents were equipped with vaccines and medicines, small ruminant mortality could be reduced. In the final analysis, the distribution of veterinary inputs and services would be significantly improved and far more equitable.

Upgrading extension services in the Mandara Mountains would also have beneficial institutional linkages. Trainees at the Veterinary School in Maroua would have additional opportunities to do applied research and extension in a region that has been relatively neglected. Extension agents could periodically interact with the staff and students of the Veterinary School to communicate research and extension findings, and to help shape and direct the program of studies. Fecal, blood and tissue samples could be obtained from cattle and small ruminants in the Mandara Mountains for analysis in Maroua and at the proposed Veterinary Laboratories at Garoua. It would be possible to conduct disease surveys that could eventually result in prophylactic vaccination campaigns and parasite treatment programs that would significantly reduce regional livestock mortality and poor growth performance.

Research findings of the International Livestock Centre for Africa in Nigeria, Mali, Botswana, Kenya and Ethiopia (the five African countries where ILCA research programs are being implemented) could also be applied to the stall-feeding scheme and animal health and husbandry practices in the Mandara Mountains. Applied research and extension findings in the Mandara Mountains might also be instructive to the Ministry of Livestock and donor agencies implementing livestock projects in Cameroon.

3. The Potential Effect of Livestock Sector Policies on Economic Returns

As implied in the financial and economic analyses, livestock sector policies, particularly those affecting producers' marketing alternatives, will have an important effect on the economic viability of stall-feeding.

In this section the effects of retaining and removing export restrictions and retail price controls will be further examined.

a) Export Restrictions

As discussed in Chapter Seven, export restrictions do not effectively deter cattle exports from Cameroon to Nigeria, as most of the trade is carried out illegally. The demand for well-fleshed, mature cattle will remain strong in Nigeria during the 1980s, as the demand for beef increases in Mubi, Maiduguri and cities in Southern Nigeria. While a good part of this demand will be met by flows of mature trade cattle from Chad and Northern Cameroon, there is also potential for increasing exports of stall-fed cattle from the Mandara Mountains to satisfy the greater demand. The principal deterrents to increased exports in the 1980s will be the riskiness of cattle smuggling and barriers to entry in the cattle trade, such as capital and skill. More vigorous enforcement of the export restrictions could also reduce exports of stall-fed cattle, which would increase the relative importance of the domestic market.

Without an expanding international market, producers would probably earn lower returns, as butchers would have less incentive to offer attractive prices. If stall-fed cattle sale prices fell from the rate paid by rural butchers in 1980-81 (215 FCFA/kilogram), which was used in the base rice bran budgeting analysis, to the rate paid by urban butchers (202 FCFA/kilogram), then financial returns to producers would decline 10 percent to 135 FCFA per man-day. The internal rate of economic return to the stall-feeding project with a research/extension component would become negative.

On the other hand, if all restrictions on exports were removed, cattle traders and butchers would compete freely for the available supply of stall-fed cattle. This would prevent sale prices from falling and probably would induce producer returns to rise. A 5 percent rise in the sale price (from 215 FCFA to 226 FCFA per kilogram), which is possible under more competitive bidding, would allow producers' returns to increase 9 percent to 164 FCFA per man-day. The internal rate of economic return to the stall-feeding project would be 18.3 percent (as shown in Table 9-6). A 10 percent increase in the sale price would allow producers' financial returns to appreciate 17 percent to 176 FCFA per man-day and the project's IRR to rise to 30.3 percent. Clearly, easier access to the Nigerian market by stall producers and cattle traders could significantly enhance the financial and economic viability of stall-feeding.

b) Retail Price Controls

1). The Potential Effect of Continued Enforcement

Continued enforcement of comparatively low retail price controls on beef sales in urban areas will restrict producers' access to a potentially promising urban market. As shown in Chapter Six, this policy was distorting the normal workings of the forces of supply and demand in Mokolo in 1980-81, because urban butchers were able to procure very few stall-fed bulls for slaughter. Limiting access to the urban market while stall-feeding is being promoted will put downward pressure on stall-fed cattle prices.

2). The Likely Short-Run Effect of Relaxing Controls

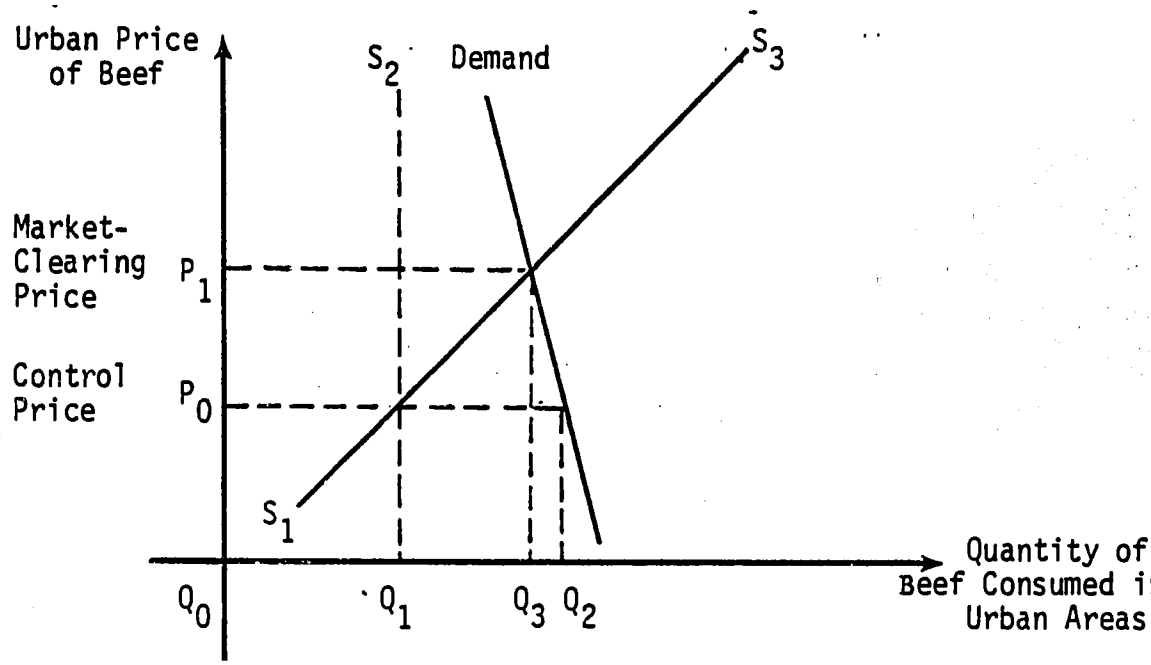
Removing, or at least increasing the level of, controlled prices in urban areas would allow urban butchers to compete with rural butchers and cattle traders for the higher quality, locally raised animals. This should result in higher prices for stall-fed cattle, thereby benefitting producers.

Urban consumers are willing to pay higher prices for beef, as demonstrated by the considerable numbers who often attend secondary markets near the urban areas in order to buy higher quality beef, which is retailed at prices well above the maximum retail price enforced in urban areas (see Chapter Six). Consumers in Mokolo complain about shortages of beef, particularly during the late dry season and early rainy season. This is exactly the period when high cattle acquisition prices per kilogram and the relatively low fixed retail prices on the sale of the beef compel the urban butchers to slaughter fewer cattle and far more small ruminants.

The short-run adjustment in urban beef consumption accompanying the rise in urban beef prices to market levels is illustrated in Figure 9-1. Demand for beef is assumed to be relatively price inelastic in urban areas. Price controls on the retail sale of beef constrain the supply of beef in the following way. Since urban butchers are unable to supply beef to consumers at a price higher than P_0, the retail price ceiling, the supply curve under price controls is S_1S_2. At price P_0 urban consumers are willing to buy Q_0Q_2 beef, but urban butchers are only willing and able to supply Q_0Q_1 beef. Therefore, urban demand for beef goes unsatisfied by the amount Q_1Q_2.

FIGURE 9-1

SHORT-RUN OF EFFECT OF RELAXING RETAIL PRICE CONTROLS



By removing price controls, the kink in the supply curve is eliminated, as the supply curve becomes S_1S_3. Urban butchers are able to slaughter more cattle and sell Q_0Q_3 beef at the market equilibrium price of P_1. Hence, the seeming paradox of greater urban beef consumption at higher prices is resolved. Unless the demand for beef is perfectly elastic or the supply curve for beef is negatively sloped or backward bending, the elimination of price controls on the sale of beef will always lead to greater consumption, despite the higher price that consumers must pay under control-free market conditions. This is because the urban demand for beef is only partially satisfied when price controls are enforced.

In Chapter Six the analysis revealed that only 4 percent of the cattle slaughtered in urban areas in 1980 were stall-fed. By removing

price controls and allowing urban butchers to bid competitively for stall animals, far more of the estimated 6,000 cattle taken off the regional stall-fed herd would be sold for urban slaughter. If 20 percent of the 1980 urban supply were to come from stall-fed cattle, an additional 845 head would be slaughtered. Raising the proportion to 30 percent would increase urban slaughter to 1,375 stall-fed cattle. Clearly, the potential short-run effect of relaxing price controls on urban butchers' present procurement practices should not be overlooked.

3). Possible Long-Run Effects of Relaxing Controls

In the long run, removing price controls will provide opportunities for producers of stall-fed cattle to satisfy the expanding demand for beef in urban areas. The demand projections in Chapter Five showed that urban demand for beef will expand by 1,123-1,642 stall-fed cattle equivalents by 1985 and 2,523-4,174 by 1990. Not all of this additional demand will be satisfied by slaughtering stall-fed cattle. The exact proportion will depend on the demand for higher quality beef in urban areas of the Mandara Mountains region, Northern Cameroon (Maroua and Garoua), and Nigeria (Mubi, Maiduguri, Southern Nigeria), which will affect stall-fed cattle prices. The regional supply and demand situation for cattle in the Diamare Plains will also affect the competitiveness of this very important existing source of slaughter cattle supply.

Although it is not possible to predict the exact magnitude of potential stall-fed cattle slaughter in meeting incremental demand for beef in 1985 and 1990, several possible scenarios can be outlined. Table 9-8 outlines three urban and three rural scenarios, which reflect existing procurement patterns and plausible changes in these patterns.

TABLE 9-8

ALTERNATIVE ESTIMATES OF THE VOLUME OF STALL-FED CATTLE SLAUGHTER TO SUPPLY INCREMENTAL URBAN AND RURAL DEMAND IN 1985 AND 1990

Area	Scenario	Alternative Proportion of Incremental Demand Supplied by Stall-Fed Cattle	Projected Slaughter (Head) 1985	1990
Urban	1	4.3% (present level)	63- 93	142-235
	2	15% (70% from Diamare Plains; 15% from regional extensive herd)	209-307	471-781
	3	50% (50% range-fed)	700-1024	1573-2602
Rural	1	8% (present level for region)	219-374	461-935
	2	30% for stall-fed production zones; 5% for other rural areas	431-736	907-1840
	3	50% for stall-fed production zones; 10% for other rural areas	677-1381	1425-2894

A worst case scenario would be for slaughter of stall-fed cattle in urban areas to satisfy 4.3 percent of the incremental demand for beef by 1985 and 1990. This reflects the present market share for stall-fed cattle in urban areas. This scenario could take place if retail price ceilings continue to be set well below market-clearing levels in urban areas. Additional slaughter of stall-fed animals would be only 63-93 head in 1985 and 142-235 head in 1990.

A second scenario would be for retail price controls to be relaxed but not removed altogether. In this instance it is likely that the Diamare Plains would continue to supply most of urban butchers' incremental needs. This is reflected in the assumption that 70 percent of the additional slaughter cattle would be imported from the plains in 1985 and 1990. It is further assumed that the remaining 30 percent of incremental slaughter is divided equally between stall-fed and range-fed animals. Under this set of assumptions, 209-307 additional stall-fed cattle could be slaughtered in urban areas by 1985, which is roughly double the magnitude for 1980. By 1990, 471-781 additional head of stall-fed cattle could be slaughtered than in 1980. The urban market by 1990 could therefore absorb about half to three-quarters of the annual stall-fed cattle output (1,000 head) from the ten year loan program.

A third scenario for urban areas, representing the upper end of possibilities would be for urban butchers to meet 50 percent of the incremental demand for slaughter stock by procuring stall-fed animals. This scenario could only be realized if retail price ceilings were above free market price levels or removed entirely. Under this scenario urban butchers could slaughter an additional 700-1,024 stall-fed animals by 1985 and 1,573-2,602 head by 1990.

By removing price controls, urban markets could offer as much potential for expanded slaughter of stall-fed cattle as rural areas by 1985 and 1990. As shown in Table 9-8, the incremental demand for beef in rural areas could be satisfied by slaughtering 8 percent more stall-fed cattle and 92 percent more range-fed cattle. This distribution reflects current sources of rural slaughter cattle supply. This scenario would result in the slaughter of 219-374 additional stall-fed cattle by 1985 and 461-935 head by 1990.

A second scenario for rural areas would be for 30 percent of the additional cattle slaughtered in stall-feeding zones to be stall animals and 5 percent of incremental slaughter in non-production zones. This would result in the slaughter of 431-736 additional stall-fed cattle by 1985 and 907-1840 more head in 1990.

A final scenario, representing more optimistic prospects for expansion of stall-feeding, would be for 50 percent of the incremental slaughter in stall-feeding zones to be stall animals and 10 percent in non-production zones. This scenario would result in the additional slaughter of 677-1,381 stall-fed cattle by 1985 and 1,425-2,894 head by 1990. The wide range of slaughter reflects the possible range of income elasticity of demand and the rate of income growth used in calculating incremental demand. This optimistic scenario would lead to demand increments that are comparable to scenario three for urban areas.

Combining urban and rural scenarios, the capacity of incremental demand to absorb additional stall-fed cattle from the loan scheme can be gauged. If 1980 procurement patterns are applied to incremental slaughter until 1990, only 282-467 additional stall-fed cattle could be absorbed per year by 1985 and 603-1,170 head by 1990. At these low rates of

projected utilization, roughly 30-45 percent of the annual output of the stall-feeding project would be slaughtered within the Mandara Mountains by 1985 and an estimated two-thirds by 1990. Such a non-marginal expansion in supply could lower prices if retail price controls remain below market-clearing levels and producers do not have ready access to the expanding Nigerian market.

If the second urban and rural scenarios were realized, then 640-1,043 additional stall-fed cattle would be slaughtered by 1985 and 1,398-2,621 head by 1990. This represents regional demand for approximately 65-105 percent of the additional planned offtake by 1985. If the third urban and rural scenarios were realized, stall-feeding could be expanded even more rapidly than planned under the present FONADER scheme and the additional supply could be absorbed within the region.

In the final analysis, it is clear that retail pricing policy in urban areas will have an important effect upon the degree to which stall-fed cattle production can be profitably expanded in the Mandara Mountains in both the short- and the long-run. Retaining price controls will limit regional absorptive capacity, necessitating export of surplus animals. By removing price controls or raising them nearer to market-clearing levels, urban markets will be able to absorb significant numbers of stall-fed cattle. These would displace some of the current imports from the Diamare Plains and meet part of the expanding demand for beef in urban markets of the Mandara Mountains. Under changed pricing and export policy it might even be possible to double the magnitude of the FONADER loan schemes.

CHAPTER TEN

SUMMARY AND POLICY CONCLUSIONS

A. PROBLEM SETTING AND RESEARCH OBJECTIVES

The principal objective of this study was to assess the potential for expanding stall-feeding in the Mandara Mountains. Producers in this region traditionally fed cattle for two or more years and then slaughtered them during dry season festivals. However, the inflation in feeder cattle prices during the 1970s and the expansion in profitable marketing opportunities, which was fueled by increased trade in cattle and agricultural produce with Nigeria, began to transform a non-monetized, traditional exchange relationship into a monetized one. By the beginning of the 1980s stall-feeding has become significantly commercialized, generating additional income for households that lack alternative employment opportunities, as well as continuing to have important complementarities with household cropping enterprises. A Cameroonian parastatal, FONADER, has received assistance from the World Bank to undertake a pilot project which extends loans for bull calf acquisition and the purchase of supplemental dry season feed for a two-year stall-feeding period.

In assessing the potential for expanding stall-feeding, past and present research on intensive cattle production and marketing in Northern Cameroon and other semi-arid regions of Africa was reviewed.

The Mandara Mountains livestock and beef subsector became the focus of study in order to analyze the input procurement, productive transformation, and marketing strategies of relevant producers, butchers and traders. In critically examining vertical linkages between stages of the livestock and beef subsector, standard operating procedures of key participants were examined. In order to evaluate whether incentives to produce, slaughter and trade stall-fed cattle are sufficient, the costs and returns of producing, butchering and trading stall-fed cattle were estimated. Returns to stall-feeding using alternative technologies and marketing strategies received special emphasis. Government policies affecting subsector participants' incentives to provide inputs, produce, market, slaughter and trade stall-fed cattle were also assessed.

B. THE ADVANTAGES OF USING THE SUBSECTOR APPROACH

In employing the subsector framework, it was possible to go beyond the farm gate and to conduct a broader sensitivity analysis of possible returns to producers of stall-fed cattle. Key parameters were varied independently (contingencies) and in likely combinations (scenarios) in order to examine the effect upon producers' returns. Although production variables receive most of the attention in appraisals of farm-level enterprises, they may not be the only important constraints in determining the success or failure of a development project. Input supply and product marketing may also restrict expansion of an enterprise or adoption of a new technology. In the long run, the costs and returns of alternative production and marketing strategies may be significantly affected by expansion of stall-feeding, so it is also important to consider the consequences of plausible changes in production and marketing

practices. Even if the exact probability of occurrence of alternative scenarios cannot be estimated, it is useful to outline likely outcomes to policy-makers.

The subsector approach and focus on policy is useful in identifying present and potential constraints to increasing commercial production of a commodity. For example, informal interviews with butchers during the stall-feeding study alerted the researcher to the policy issue of price controls on the retail sale of beef in the towns of the Mandara Mountains. By learning of this potential policy constraint early in the study, the researcher was able to document the adverse effect of enforcing price controls on urban slaughter of stall-fed cattle.

C. PRINCIPAL RESEARCH FINDINGS AND POLICY IMPLICATIONS

1. The Economic Viability of Stall-Feeding Enterprises Using Existing Feeding Technology

The enterprise budgeting analysis found net returns to cattle stall-feeding using traditional technologies to be 127 FCFA per man-day of labor and management. This return is lower than the peak season agricultural wage rate of 250-300 FCFA per day in the Mandara Mountains, as well as being lower than returns to production of cash crops such as sweet potatoes and Irish potatoes. Producers' returns are significantly higher (204 FCFA per man-day) if it is assumed that cattle appreciate in real terms at a rate of 4 percent per year, incremental grain production due to manure application is 15 percent higher, and producers earn a retailing margin of 5 percent on sold portions of their home slaughtered

stall-fed animals. These three contingencies are all highly plausible, so it is possible that returns to stall-feeding exceed 200 FCFA per man-day.

Although these returns to stall-feeding are below returns to cash crop production, they are acceptable to most households in a region where there are few alternative investments. While employment opportunities are available in Maroua, Garoua and Nigeria, particularly during the dry season, many household heads weigh the costs of separation from the family highly and prefer to remain in the village.

Stall-feeding enterprises are also important in maintaining the long-run viability of the intensive farming systems of the Mandara Mountains. By conserving manure produced by the stall-fed bulls and spreading it on the fields near the compound, households in the mountainous zones improve soil structure and augment soil fertility. The research findings are that cereal production increases by 285 kilograms per year, which is valued at 16,750 FCFA after adjusting for higher labor costs. In a region where erosion and depletion of soils through permanent cultivation are serious problems, utilizing the manure from stall-fed cattle enterprises is a necessary investment in a critical resource. In promoting stall-feeding, the Cameroonian government indirectly invests in the long-run viability of farming systems in a region that is prone to cereal shortfalls.

2. Consumption of Red Meat in Rural and Urban Areas of the Mandara Mountains

Demand for red meat in rural and urban areas of the Mandara Mountains, and in urban areas of Nigeria, is the driving force behind the

cattle subsector in the Mandara region. Demand for the joint products of stall-feeding enterprises (beef and manure) is both internal and external to production-consumption units. As external demand for stall-fed beef has expanded during the past 20 years, commercial sale of stall-fed cattle and beef has increased.

In Chapter Five urban consumption of beef in 1980 was estimated to be nearly 40 percent higher in urban areas of the Mandara Mountains (11.4 kilograms per capita) than in rural areas (8.3 kilograms per capita). Virtually all of the beef consumed in urban areas was purchased, as was some 81 percent in rural areas.

While incomes, income and population growth, and income elasticity of demand for beef are higher in urban areas, because 90 percent of the population is rural, the absolute incremental beef consumption in rural areas will be at least two times greater than in urban areas in the 1980s. The demand projections of Chapter Five show that 1,123-1,642 stall-fed cattle equivalents will be consumed in urban areas by 1985 and 2,523-4,174 stall equivalents by 1990. Rural beef consumption will expand by 2,153-3,683 stall-fed cattle equivalents by 1985 and by 4,534-9,204 stall equivalents by 1990. These estimates show that there is considerable potential for expanding commercial production of stall-fed cattle.

3. Slaughter of Stall-Fed Cattle in Rural and Urban Areas of the Mandara Mountains

The analysis has shown that the annual offtake from the stall-fed cattle herd to be 6,000 head in 1980. Approximately 900 head were exported to Nigeria, and some 820 head sold on the hoof to regional

butchers. The equivalent of some 2,270 were slaughtered by producers for home consumption, and the remaining 2,010 head were sold on the rail to rural butchers and consumers. Since the 1960s it has become increasingly common for stall producers to retail a good part of the beef from home slaughtered stock. Producers report that retail beef sales generate revenues for reinvestment in feeder calves, which appreciated in value in real terms during the 1970s.

The study of butcher procurement practices revealed that few stall-fed cattle (230 of 5,300 head) are slaughtered in the towns of the Mandara Mountains. Instead, urban butchers procure 68 percent of their slaughter cattle in the Diamare Plains and 28 percent from the regional extensive herd. The slaughter of stall-fed cattle in urban areas was found to be limited by retail price controls on beef sales. Artificially low price ceilings are enforced in Mokolo, Koza and Mora by local authorities in order to protect consumers, but they have the adverse effect of restricting slaughter of high quality cattle. While rural butchers and cattle traders in the Mandara Mountains region offer producers attractive prices for stall-fed cattle, urban butchers were unable to compete with other buyers, since they are compelled to retail beef at fixed prices per kilogram. These price ceilings are well below retail prices charged by rural butchers. Moreover, it was found that prices in rural markets paralleled prices in a known competitive market in the Diamare Plains (Gazawa).

Rural butchers procure 1,595 stall-fed cattle equivalents from the regional stall-fed herd, or 8 percent of their slaughter cattle. In addition, they acquire 12,730 head (63 percent) from the regional extensive herd and 5,780 head (29 percent) from the Diamare Plains.

As shown in Chapter Six, urban butchers' financial returns are relatively modest (984 FCFA per man-day), and they have an economic incentive to procure low quality slaughter stock in the Diamare Plains at low prices per kilogram. If urban butchers paid acquisition prices per kilogram typically paid by butchers at the rural market of Soulede, their potential returns to slaughtering and retailing these higher quality stall-fed cattle would be negative. If retail price controls were removed or raised to higher levels, there is little doubt that greater numbers of stall-fed cattle would be slaughtered in urban areas (compared to the estimated 230 head slaughtered in 1980). Urban consumers are willing to pay higher prices for the higher quality beef, as evidenced by their visits to rural markets where retail prices are not controlled.

4. Stall Producers' Marketing Strategies

Figure 10-1 summarizes what has been learned about cropping and livestock enterprises, as well as livestock and beef purchases and sales by producers, butchers and consumers in the Mandara Mountains region. As shown in the figure, producers of stall-fed cattle typically slaughter or sell their animals during the harvest and post-harvest periods (October-January), when the bulls have attained their maximum liveweights. Slaughter of the animals at this time enables producers to satisfy traditional social obligations because they distribute beef to the extended family. Since they also sell some of the beef, producers are able to raise revenue for reinvestment in livestock. In addition, producers sell stall-fed cattle on the hoof at this time,

FIGURE 10-1

ANNUAL CYCLE OF LIVESTOCK PRODUCTION AND MARKETING ACTIVITIES AND BEEF CONSUMPTION IN THE MANDARA MOUNTAINS REGION

Activities	Months											
	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Crop Production	→	field preparation	planting	←	weeding	→	slack period	←	harvest	→ ←	dry season	—
Livestock Enterprises	→	feeding of stored fodder		←	feeding of freshly cut forage			→	←	grazing	—	
		←		cattle enclosed				→				
Stall-Fed Cattle Acquisition/ Disposal	feeder calf acquisition						concentration of cattle slaughter/sale					
	→						←			←		
									harvest festival		Marai	
Regional Supply of Slaughter Cattle		short supply (high prices/kg)					abundant supply (low prices/kg)					
		←				→	←					→

because gross revenues are maximized by selling animals at their highest liveweights. Rural butchers are eager to purchase stall-fed cattle during and after the harvest, since the demand for beef is at its high point during the year in rural markets. In contrast, cattle slaughter at rural markets declines markedly toward the end of the dry season (March-April), because rural income flows and purchasing power fall off significantly.

The typical marketing strategy of slaughtering and/or selling during, or shortly after, the harvest does not take seasonal variation in cattle prices into account. As shown in Chapters Six and Seven, cattle prices per kilogram liveweight are seasonally lowest during the harvest period (September-November), and increase steadily during the dry season, attaining seasonal highs in the late dry season and early rainy season (March-June). Under current feeding practices, stall animals are released during the dry season to graze crop residues and standing forage, which rapidly lose their nutritional value as the dry season progresses. Consequently, cattle lose weight steadily throughout the dry season, reaching annual lows by May and June. Even though prices per kilogram are highest during this period, producers are reluctant to sell or slaughter the stall-fed cattle at this time, because animals are in poor condition and traditional social practice dictates that slaughter take place during the harvest festival (November-December) or the Marai (January-February) (see Figure 10-1).

In striking contrast to rural areas, demand for beef remains high in urban areas during the late dry season and throughout the rainy season. During the same period slaughter cattle supply from the extensive herds of the Diamare Plains and the Mandara Mountains contracts

during the March-August period, which causes live cattle prices to rise per unit of liveweight during the dry season and remain seasonally high during most of the rainy season.[1] Retail price ceilings on sales of beef in urban areas are maintained below market-clearing levels, however, which compels urban butchers to procure low quality cattle or small ruminants for slaughter at this time. Urban cattle slaughter therefore declines during this period, and urban demand for beef goes partly unsatisfied. Although urban markets are a potentially promising marketing alternative for stall producers during the March-August period, retail pricing policies presently foreclose this opportunity.

The disposal/marketing strategies of some producers would also have to change before sales to urban areas could be increased. Many producers will have to be convinced that financial returns to stall-feeding could be increased if they purchased feeder calves in relatively good condition around harvest time and sold finished stock during the late dry season, which is the period of greatest nutritional stress under current feeding practices.

As implied in the sensitivity analysis of producers' financial returns to stall-feeding using rice bran, selling finished cattle during the February-June period increases individual producers' returns to labor and management. By acquiring feeder calves during or shortly after the harvest, feeding them for 16-20 months, and selling the finished bulls before the period of peak agricultural labor inputs (June-August),

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[1]As shown in Chapter Six, urban cattle slaughter was seasonally lowest at Mokolo during the May through August period from 1975 to 1980. Judging from the slaughter data shown in Table 6-2, 10 to 40 additional head could be slaughtered in each of these months at Mokolo alone, when slaughter cattle supply at Gazawa contracts and butchers' access to that important cattle market becomes increasingly difficult.

producers minimize labor requirements for stall-feeding and benefit from the seasonal movement in cattle prices. Net financial returns to feeding stall animals rice bran (or cottonseed cake) during the five months of the dry season are positive but only if rates of gain exceed 120 grams per day. Simply holding the cattle during the dry season, incurring the higher costs of supplemental feeding and maintaining cattle liveweights (yet failing to attain expected rates of gain), will lead to dry season financial losses. This finding is important in that it emphasizes the necessity of improving applied research and extension services to ensure successful introduction of supplemental feeding.

D. THE PROJECTED ECONOMIC VIABILITY OF THE STALL-FEEDING PROJECT WITH AND WITHOUT AN INTENSIFIED APPLIED RESEARCH AND EXTENSION COMPONENT

1. Projected Financial Returns to Producers from Using Concentrated Feedstuffs

The financial analysis of returns to producers under different stall-feeding technologies shows that there is potential for using concentrated feedstuffs as dry season supplements during two-year feeding periods. Net returns to producer labor and management from supplemental feeding were estimated to be 147 FCFA per man-day using cottonseed cake and 150 FCFA per man-day using rice bran, assuming an average daily rate of gain of 250 grams. The sensitivity analysis showed that producer returns are especially sensitive to changes in variables such as the rate of weight gain during the feeding period, cattle acquisition and sale prices, and seasonal variations in cattle prices per unit of liveweight.

Under several plausible alternative production and marketing scenarios producer returns could increase 21-58 percent per man-day over

the return estimated in the base rice bran budgeting analysis. These increases are possible only if the average rate of gain is 250 grams per day, which is approximately 25 percent higher than typical rates of gain under current stall-feeding practices. If this improved rate of gain is not achieved, producers' returns could be far below returns from existing practices, since the new technology involves higher costs of production.

The financial analysis has also shown that producer returns to labor and management could improve if finished cattle were sold for a higher price per unit liveweight than that paid by rural butchers. A 5 percent higher sales price would allow producer returns to increase 9 percent, while a 10 percent higher final price would increase returns by 19 percent. Producers could obtain these higher sales prices if they sold finished stall-fed cattle in Nigeria or to traders bound for Nigeria. Removing retail price controls on the sale of beef in urban areas would also put upward pressure on stall-fed cattle prices, as urban butchers could offer higher prices to producers.

If price controls were enforced in rural as well as urban areas of the Mandara Mountains and rural butchers were only able to offer the price per unit of liveweight paid by Mokolo butchers, then producers' returns to stall-feeding would decline 30 percent. Wider enforcement of retail price controls in combination with a stricter ban on cattle exports could conceivably lower stall-fed cattle sales prices by 10 percent, which would cause producers' returns to drop 17 percent.

2. Problems in Implementing the FONADER Loan Scheme

In introducing supplemental feeding of rice bran during the dry season to two-year stall-feeding enterprises, FONADER subsidized the

use of the concentrated feed, but it failed to provide adequate applied research and extension. No analysis of rates of gain using rice bran and other feeds as dry season supplements was conducted prior to the pr ject or during its first two years of implementation. Although loan recipients are unfamiliar with the new technology, little systematic supervision of dry season feeding has been provided. As a result, only two of the thirty loan recipients at Magoumaz and Mavoumai have successfully fed the rice bran to their cattle. And delays in rice bran procurement and distribution have resulted in considerable spoilage of the bran, rendering it unpalatable to many of the stall-fed cattle. Finall little attention has been paid to marketing issues, such as seasonal cattle and beef price trends, alternative sources of demand for stall-fed beef, producers' marketing strategies, and livestock sector policie affecting retailing of beef and cattle export.

Although project designers were constrained in their appraisal of the stall-feeding loan program by a scarcity of time, funds and analyti cal resources, and by inadequate knowledge of the Mandara Mountains region, this should not have deterred implementation of the loan scheme It appears, however , that too many loans were extended too quickly for FONADER to coordinate input distribution and monitor supplemental feeding practices. As a result, the new technology has not been successfully introduced. The absence of an applied research and extension component made it impossible for FONADER to counsel producers regarding the timing of cattle acquisition and sale, or to pressure local authorities to modify retail pricing policies. Although FONADER was instrumental in creating the cattle market at Mokolo, this market

did not provide stall producers in the region around Mokolo with additional sales opportunities. In fact, trying to develop a market there reflects little understanding of the economic incentives and opportunities operating in the stall-fed cattle subsystem. Mokolo butchers are constrained in offering attractive prices to producers by retail price controls. Rural butchers and cattle smugglers are able to offer higher prices, but they do not have incentives to come to the Mokolo market to purchase cattle.

3. Projected Benefits of an Expanded Applied Research and Extension Component

By expanding the applied research and extension program, supplemental feeding practices could be successfully introduced, resulting in higher rates of gain, and producers could be encouraged to benefit from seasonal cattle and beef price trends. Moreover, cattle mortality would decline and manure management could improve, leading to higher cereal production. These benefits could accrue to stall producers who do not receive FONADER loans, as well as to loan recipients, since improved production and marketing practices by loan holders would have positive demonstration effects.

The economic analysis of the viability of the stall-feeding loan scheme conducted in Chapter Nine shows that the internal rate of return would increase from 11.2 percent without an applied research and extension component to 16.5-18.3 percent with the program. It is assumed that loan recipients would benefit from improved timing of acquisition and sales, leading to 5 percent lower purchase prices and 5 percent higher sales revenues. Cattle mortality is assumed to be cut in half.

The greatest increases in returns come from diffusion of applied research and extension findings to stall producers who do not receive loans. In general, the assumptions made in the economic analysis are generally conservative, and as the sensitivity analysis shows, the internal rate of economic return could exceed 25 percent under likely parameter changes.

A well designed applied research and extension program could also have important indirect benefits. The institutional capacity of the Livestock Service and FONADER would be strengthened in the Mandara Mountains region. Livestock-owning agricultural groups who have been neglected by the Livestock Service would receive better veterinary and extension services. Small ruminant production in mountainous zones could also be improved and mortality reduced. Institutional linkages with the Veterinary School in Maroua and the proposed Veterinary Laboratories at Garoua could be developed, as the applied research and extension agents would communicate research findings and transmit blood, tissue and fecal samples for laboratory analysis. The applied research and extension program in the Mandara Mountains could also be linked with ongoing livestock research projects in Cameroon and with international research centers run by ILCA (the International Livestock Centre for Africa) in other African countries.

4. The Consequences of Changing Livestock Sector Policies

Two livestock sector policies that will affect the long-run economic viability of stall-feeding are export restrictions and retail price controls. Stricter enforcement of export limitations would likely increase the risk of cattle smuggling, reduce outflows from the Mandara

Mountains, and put downward pressure on stall-fed cattle prices. Allowing for unrestricted export of cattle would increase competitive bidding for stall-fed cattle in the Mandara Mountains and therefore benefit producers. Yet regional consumers might pay higher prices for beef, as butchers' costs would increase.

Retail price controls in urban areas are the single most limiting factor in development of the current regional market for stall-fed beef. By continuing to enforce price ceilings in urban areas, the Cameroonian authorities will restrict producers' access to promising urban markets. Removing or raising price ceilings would increase competition for stall-fed cattle and prevent producers' returns from declining during implementation of the project and the resulting non-marginal expansion in slaughter cattle supply. While only an estimated 4 percent of all cattle slaughtered in urban areas in 1980 were stall-fed animals, it is likely that at least 20 percent and perhaps as many as 50 percent (or an additional 830-2,420 head) would be stall-fed cattle in the absence of retail price controls. Therefore, the probable effect of the change in retail pricing policy on urban butchers' existing procurement practices would allow loan recipients to sell all or nearly all of the annual non-marginal increase in stall-fed cattle offtake (1,000 head per year) to urban butchers. These stall animals would replace in part the high volume of slaughter cattle imports (3,580 head in 1980) from the Diamare Plains.

Removing or raising price ceilings would also allow stall-fed cattle to be an important supplementary source of supply for urban butchers in the medium- to long-run. As estimated in Chapter Five, the incremental

urban demand for beef will be 1,123-1,642 stall-fed cattle equivalents by 1985 and 2,523-4,174 head by 1990. If price controls were not relaxed, then it is possible that by 1985 only 4 percent of the additional slaughter stock would be stall-fed cattle, reflecting urban butchers' existing procurement patterns. If 30 percent of this additional urban demand were met by stall-fed cattle, urban butchers would slaughter 466-681 additional stall-fed animals by 1985 and 947-1,732 by 1990. Meeting 50 percent of incremental urban slaughter during the coming decade by slaughtering stall-fed animals would create even greater marketing opportunities for producers, allowing for a significant expansion in the scope of the stall-feeding project.

E. SUGGESTIONS FOR FURTHER APPLIED RESEARCH

An important area of applied research with a potentially high payoff is cattle nutrition. The Veterinary School of Maroua began monitoring the feeding practices of a sample of 20 households participating in the FONADER stall-feeding scheme in a village near Mokolo (Mofole) beginning in October 1980. As part of a program of applied studies, several students participated in this exercise, which concluded in October 1982. The students should be well-trained to continue applied research on cattle feeding practices and to provide extension services to loan participants once they have completed the two to three year program of studies at the Veterinary School. They could conduct on-farm feeding trials, using different concentrated feedstuffs provided in varying quantities to stall-fed cattle during the dry season, when the animals typically lose weight. By monitoring rates of gain during the dry season, the most economical ration that is best suited to the range

conditions and feed supply of the Mandara Mountains could be selected for use in an expanded loan scheme.

The sensitivity analysis of producers' returns to stall-feeding shows that the timing of cattle purchases and sales also had an important effect on producers' returns to stall-feeding. The direction of seasonal variation is quite clear from the seven months of survey data on cattle and beef prices (per kilogram), although the magnitude of seasonal variation is not known. Since producers' financial returns to stall-feeding can vary considerably, depending upon the timing of purchases and sales, there is potentially a high payoff to further applied research on seasonal trends in cattle prices and weights.

Project planners' and implementers' knowledge of seasonal price trends would increase by collecting slaughter cattle price and carcass weight data, as well as retail beef price data, over a several year period at Mokolo and also at one representative rural market, such as Soulede. Results of an analysis of this information could be made available to producers through extension agents. In order to ensure that producers benefit from seasonal price movements, proportionally more loans for stall-feeding could be disbursed when the supply of bull calves at Gazawa and other markets is abundant. In addition, repayment of the loans could be scheduled so that a significant proportion would have to be paid back when cattle prices per kilogram are seasonally high. Substantial penalties could be assessed against those who failed to pay their loans back at the pre-determined time.

It is important to collect cattle/beef price and carcass weight data over a several year period. The magnitude of seasonal highs and lows is affected greatly by grazing conditions, which are determined each

year by the quantity and distribution of rainfall. Moreover, differences across space may change over time, reflecting changes in regional supply and demand relationships. As stall-feeding is expanded, it will become important to monitor the dynamic evolution of supply and demand, which will affect producers' financial returns and economic returns to the overall loan scheme.

Another promising area of applied research is retailing of beef by producers. Price and quantity data were not collected for retail sales of beef by producers in rural areas during the survey research. As a result, the magnitude of the retailing margin is unknown. If producers are able to earn returns to retailing that approach rural butchers' margins, then stall-feeding enterprises may be far more economically viable than estimated. Producer slaughter of stall-fed cattle may be so widespread, not only because producers wish to consume and distribute beef from stall animals, but also because the return to retailing is high. By retailing the beef, producers are able to satisfy traditional social objectives and generate income for reinvestment in livestock or the purchase of grain, clothing or other commodities. Extension agents could inspect the quality of the beef and coordinate producer sales of beef to urban butchers.

In conclusion, while there is little understanding of the production and marketing processes in isolated regions of the developing world, such as the Mandara Mountains of Northern Cameroon, governmental and development assistance agencies should not be discouraged from trying to promote agricultural or livestock production. The stall-feeding project, although difficult to implement, would improve the economic viability of the intensive farming systems in the mountainous zones of the Mandara

region. Participating rural households would be able to increase their incomes and enhance the fertility of their soils, which would augment cereals production in a region prone to grain deficits. Implementation of the stall-feeding project needs to be carefully monitored, however. This study has shown that timely applied research can facilitate the adoption of new production and marketing technologies which match the particular set of factor endowments and supply and demand conditions of the Mandara region. Such research and extension efforts are also useful in facilitating the adoption of effective and relevant policy which creates new opportunities for producers and other subsector participants.

ANNEX 1

SUMMARY AND CRITIQUE OF DATA COLLECTION PROCEDURES

A. THE EXTENSIVE SURVEY

Michigan State University team members arrived in the Mandara Mountains in February 1980 to begin preparations for a year of applied research. During the first two months a good deal of informal interviewing with both individual farmers and groups of farmers was conducted. After a short period of time it was concluded that an initial extensive survey was required in order to gather preliminary data about a wide variety of socioeconomic and agricultural variables.

At the time the extensive survey was undertaken, a number of detailed studies by French and Cameroonian geographers, anthropologists and sociologists were available, as were ORSTOM documents detailing the region's soil, water, and rangeland resources. There were, however, little quantitative data of the sort used by agricultural economists in identifying constraints in crop and livestock production and marketing, and inadequacies in government institutions working in the areas of agricultural and livestock production. Moreover, even though the heterogeneity of the region was well-known and descriptions of the different types of farming and livestock systems were available, the relative importance of these individual systems within a regional context was not well understood. The extensive survey enabled the research team to collect detailed information on a number of socioeconomic indicators for which central tendencies could then be identified.

The data obtained in the course of the extensive survey that were particularly relevant for the study of cattle stall-feeding and livestock production in the Mandara Mountains region were those on livestock holdings and flows during the previous year, stall-feeding production and marketing practices, and general characteristics of the different farming systems in the region. Livestock holdings at the compound and elsewhere were recorded, as were livestock births, deaths, purchases, sales, slaughter and gifts. The data on household livestock holdings correspond closely to estimates that can be derived using Livestock Service regional livestock population figures and census estimates of population and household size in the Mandara Mountains.[1] In contrast, the recall data on births, deaths, purchases and other flows during the previous year proved to be less reliable. Without doubt the recall period was far too long (one year), leading to both recall error and telescoping of events, particularly in the case of livestock mortality. Our initial estimates of mortality were far higher than generally accepted figures for other parts of Africa.

The extensive survey was conducted over a three-week period beginning in late April 1980 and ending in mid-May 1980. Thirty-six first stage sampling units were selected using village lists furnished by the national census bureau. A few of these units were discarded and replaced by more accessible villages. Within each of the 36 villages an initial, incomplete listing of households was made, followed by the random selection of eight households for interviewing. Three enumeration teams, consisting of one researcher, one supervisor and four enumerators,

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[1]See Chapter Three.

worked in different parts of the region, each covering four villages per week. Two hundred and eighty-eight households were interviewed, and the data were manually tabulated for preliminary analysis during the month following the survey. The data were first aggregated by village and then by geographic region, which proved to be an appropriate level of aggregation given the geographic heterogeneity of the Mandara Mountains. A preliminary summary of the research findings was released in early July 1980.

The extensive survey was an invaluable means of gaining a rapid understanding of both a qualitative and quantitative nature of the diversity of agricultural and livestock production practices, and of a number of socioeconomic indicators in an exceptionally heterogeneous region. The survey took each enumeration team over a wide-ranging area, across different ecological zones in a short period of time just as the cropping season was about to begin. Embarking upon an extensive survey did, however, delay the start of the intensive survey. The analysis of the extensive survey data and write-up of a preliminary report of the survey findings absorbed a large part of the team's energies during a six-week period (mid-May through early July). Little field research was conducted during this period. Moreover, enumerators were not fully trained, settled in their villages and interviewing households on a biweekly basis until the end of June, over a month ofter the cropping season had begun.

B. THE INTENSIVE SURVEY

Beginning in late June 1980 intensive field research was begun in six villages in the Mandara Mountains region. These villages were

purposively selected to gain a more detailed understanding of returns to different cropping and livestock enterprises in representative farming systems. Samples of 24 households were randomly chosen in each village to take part in the longitudinal survey. Biweekly interviews were conducted with household heads where the standard type of input-output flow data was collected for three enterprises (two cropping enterprises and one livestock enterprise). Data were also obtained on household expenditures, gifts, revenue, consumption, crop production, livestock holdings, land holdings, and household size and composition.

The methodology employed in the data collection was a modified cost-route approach, which relied upon longer but less frequent interviews than the usual cost-route method. Labor data were collected on a post-activity basis, rather than in the usual semiweekly and highly disaggregated manner. The researchers realized that some loss of accuracy was likely, particularly in obtaining a precise age-sex profile for different activities, but that this would be outweighed by the advantages of having partly aggregated data at the analysis stage.

Although one livestock enterprise was selected for each household in the sample, it was discovered that the data proved to be of little interest. In three of the villages located on or adjacent to the plateau south of Mokolo (Ldama, Roumzou and Ouda) most livestock is extensively grazed during the rainy season on the abundant pasture near the villages. Children usually herd the livestock, although it is not uncommon for the settled farmers to entrust their cattle and sheep to Fulani graziers. Stall-feeding of cattle was initially thought to be widely practiced in the three mountain villages of Ldama, Madakonay and Manguirda. Early

interviews on livestock holdings revealed, however, that only four of the forty-eight households in Madakonay and Manguirda stall-fed cattle. Six stall-feeding households were discovered in the sample at Ldama but only two of them kept their cattle enclosed during the entire growing season. The other cattle were entrusted to herders or accompanied by children to nearby pastures.

Livestock inventory data were obtained three times during the study: at the beginning (June 1980), after the harvest (November 1980), and at the conclusion (February 1981). Flows of livestock in the form of slaughter, sales, purchases, gifts, mortality, reproduction, loss and theft were recorded biweekly over the course of the survey. The researchers felt that such a method would succeed in accurately capturing inventory changes and livestock movement, areas in which the extensive survey was found to be grossly lacking.

C. THE SURVEY OF STALL-FED CATTLE ENTERPRISES IN TWO MAFA VILLAGES

As pointed out above, few stall-feeding households were chosen in the random sampling that initiated the intensive survey. Consequently, the research team decided to undertake an additional survey of stall-feeding enterprises in two Mafa villages in the mountains close to Mokolo. One of the villages, Mavoumai, was chosen because it closely ressembles Ldama, one of the intensive sites where a mix of intensive and extensive cropping and livestock production practices are found. The second village, Magoumaz, was selected because it represented the type of mountain village where terraced agriculture is practiced on steeply sloped hillsides. This type of intensive agriculture is not practiced in the five other villages in the intensive survey, except by

a few households in Ldama and Manguirda. Furthermore, a noted French cultural geographer, Jean Boulet, had carried out research in Magoumaz 15 years earlier and published a monograph on agricultural practices in the village. He collected detailed labor, rainfall, crop production, revenue and expenditure data for a sample of 12 households, relying heavily upon the participant observation methodology. Having this study as a benchmark was judged to be a rare opportunity to observe and document how the village had changed over time and to compare the findings of two scholars with quite different disciplinary perspectives and training.

Magoumaz and Mavoumai were also selected because the Cameroonian parastatal, FONADER (Fonds National de Développement Rural), had extended loans for stall-feeding to farmers in both villages in 1979 as part of a World Bank financed pilot project in the Mandara Mountains. Over half of the households in the sample had received these loans and most recipients were obligated to repay FONADER in February and March of 1981. By monitoring the stall-feeding practices, input purchases, and cattle slaughter and sales of loan recipients in the two villages, it was hoped that the potential for expanding the scheme could be evaluated and policy recommendations for improving or discontinuing the project could be made. Furthermore, collecting similar data for both loan recipients and nonrecipients could allow the researcher to analyze differences between these two types of stall-feeding households which might enable policy-makers to identify more easily any promising prospective recipients.

The stall-feeding survey began in late September 1980 and was concluded in early March 1981. Fifty-two households (30 in Magoumaz and

22 in Mavoumai) were selected purposively for interviewing. Thirty of these households had received FONADER loans for purchasing bulls and rice bran. Nearly all (27) of the households had raised stall-fed cattle before acquiring the bulls they were actually stall-feeding as of September 1980.

In the course of the stall-feeding survey biweekly interviews were used to obtain input-output data for stall-feeding enterprises. Labor inputs were recorded on a post-activity basis, as in the intensive survey, except during the immediate pre-harvest and post-harvest periods.

It is important to note that labor data were obtained for a seven month period (March-September 1980) in one interview conducted in late September and early October. The cost-route enthusiast would argue that these data must be subject to gross recall error, but this researcher would argue otherwise. Most of the activities required for stall-feeding of cattle are repeated each day over easily recognizable, several month periods or only once or twice during the year. Labor allocated to stall-feeding tends to be repetitive, because stall-fed cattle have certain minimum maintenance requirements that must be met each day if the animals are not to become seriously weakened and vulnerable to disease.

The farm manager has somewhat more flexibility in carrying out cropping activities. For example, a farmer can decide to allocate relatively more labor to the weeding of one field as opposed to another on a given day. Or he may defer weeding for several days, choosing to mourn the death of a relative in a neighboring village or to attend a weekly market to buy food, clothing, livestock or inputs into crop or livestock

production. The weeding does have to be accomplished within a specified time frame if the farmer wants to avoid undue damage to his crops. However, the farm manager has considerably more flexibility in deciding what activities need to be performed on which fields at what time than he does in feeding and providing water for his livestock.

At the other extreme, the stall-feeding household performs other activities, such as construction and repair of the stall, removal of the cattle manure from the stall for application on fields near the compound, removal of ticks, and visits to vaccination centers or to markets where minerals are sold, only once or infrequently in the course of the year. The respondent is usually able to recall accurately labor allocated to these activities, because they are exceptional and therefore notable. He may have some difficulty, however, telling the enumerator exactly when these activities were performed. This problem can be overcome, to a large extent, by developing an agricultural calendar for each village in which research is being conducted. By referring to the agricultural period (i.e., set of agricultural activities for the principal cropping enterprises) during which the livestock production activity was carried out, the enumerator can determine with reasonable accuracy when the activity was performed.

The danger in relying heavily on recall over as a long period as was used in the stall-feeding survey is that the age-sex composition of these labor flows might not be accurately obtained. The labor of wives in the household may have substituted for the labor of the household head in, say, cutting and carrying grasses to the stall-fed bull on local market days. In responding to questions about labor flows, the household head may be tempted to report that he cut and carried grasses

twice a day for two hours a day over a three month period, neglecting to mention that he went to the local market on certain days and that his wife (wives) performed this daily task in his place. The greater the extent to which his visits to the market were regular and predictable, however, the easier it is to obtain accurate data on labor flows over a long recall period. If his visits to the market (or whatever other exceptional pattern of behavior) took place infrequently, then it probably makes little difference whether he is able to recall how often and when these occurred.

The above arguments are not advocacy for full-scale adoption of one-visit or infrequent interviewing strategies for the collection of detailed information such as labor data. Rather, they are an indirect plea for careful consideration of the types of data that are required in conducting research, analysis of the characteristics of such data, and judgement as to a suitable methodology for obtaining them. In the case of labor flow data, the researcher must judge what interview frequency, recall period, and interviewing techniques are appropriate for eliciting reasonably accurate data on different labor activities. What constitutes reasonably accurate data will be determined by the (time, financial, staff) resources the researcher has at hand, as well as an often subjective assessment of the probability and potential cost of obtaining erroneous information for policy-making. It is usually only after a good number of informal interviews that the applied researcher is able to judge what data collection methodology is suitable for his needs.

The most serious difficulty likely to be encountered in using a post-activity methodology for collecting labor flow data is the boundary

problem. This refers to the inability of a respondent to put (time) boundaries on the performance of particular activities that began in the not-so-recent past and are no longer being done. The exact date when an activity was begun is especially prone to recall error. This may lead to exaggeration of the time span over which an activity was performed, imparting a serious upward bias to estimates of labor inputs.

The boundary problem did in fact bias some of the labor flow data collected in the first interview in the survey of cattle stall-feeding. The raw data show that the bulls were enclosed as early as March in some cases and by April in most households. There are a whole series of late dry season/early rainy season activities involved in maintaining enclosed cattle. These activities include hand-feeding of stored grasses and hauling of water over substantial distances (since this is the driest time of the year), the latter of which consumes a good deal of time (two hours per day). The researcher did not leave the Mandara Mountains region until late March of the following year (1981), at which point few of the stall-fed cattle had been enclosed. By late April virtually all of the bulls are enclosed for the growing season, but few of them are put back in their stalls by early April. It is possible that a good number of them are still grazing on meager range resources that remain in and around the villages during the month of April. Since the researcher never observed livestock production practices in the field during the month of April, he cannot answer this question with any degree of certainty. Boulet's labor data suggest,

however, that few of the cattle were actually enclosed during the month of April 1965.[2]

We can probably safely conclude, then, that a boundary problem does exist in the raw labor flow data for stall-feeding enterprises in the two Mafa villages. Consequently, it is very likely that adult labor inputs are exaggerated for the month of April 1980. Most of the cattle in the sample were probably grazing extensively until mid- or late April 1980, since the onset of the rains was relatively late in 1980. Although children herd the cattle during the dry season, adult inputs into raising stall-fed cattle are minimal during the months that the cattle are grazing.

In addition to collecting labor data, we obtained biweekly data on both purchased and non-purchased inputs into stall-feeding. Most inputs, such as freshly cut grasses and water, are not purchased and do not have a market value. These inputs can be best valued by imputing the value of the labor that goes into their acquisition.

The input-output data collected during the survey were supplemented by livestock inventory and flow data. We decided to ask households about their livestock holdings only after the stall-feeding survey was several months in progress. The enumerators recommended this approach, and they argued that the data (obtained during the dry season) were more reliable than they would have been if collected during the opening interview. They pointed out that livestock inventories taken during the dry season are easier to verify, since livestock are not enclosed at that

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[2]Jean Boulet, Magoumaz; pays Mafa (Nord Cameroun): étude d'un terroir de montagne, Cahier ORSTOM, No. 11, Paris, 1975.

time. Data concerning livestock slaughter, sales, purchases, gifts and mortality were also obtained in biweekly interviews from September 1980 through the end of February 1981. We attempted to capture livestock flows over a year long recall period at the time the livestock inventory data were collected, and for most categories the data appear to be reliable. As in the other surveys, the mortality figures are probably exaggerated.

Livestock holdings were not the only measures of wealth that were obtained. We also collected data on household size and age-sex composition, grain production as estimated by farmers for the 1979 and 1980 crop years, purchases of meat and fish, and each household's history of stall-fed cattle production. The enterprise histories were also useful in learning whether any changes had taken place during the last decade in the survey households' slaughter/sales behavior and strategies. Questions about earlier acquisition prices for bulls, place of purchase, means of acquisition (cash payment vs payment in kind), length of feeding, and final disposition were posed regarding farmers' present and previous bulls. Information was collected for as many bulls, going back in time, for which it was judged that the data were reasonably accurate. In most instances the household head could recall many of the details for his last three or four animals, which were generally raised during the last five to seven years. This recall capacity may seem implausible, but it must be remembered that stall-fed bulls are one of a mountain household's most valuable assets. As such, transactions and slaughter/sale decisions concerning these bulls are noteworthy events and apt to be recalled quite accurately.

An important joint product of stall-fed cattle production is manure. In the course of the stall-feeding survey, farmers were asked to value cattle manure in terms of the additional grain production it was estimated to yield. Three-by-four meter sorghum yield plots were also staked out in well-manured sorghum fields lying near the compounds of the better farming households at Magoumaz. The harvested and threshed grain was then weighed to obtain estimates of the productive potential of well-fertilized indigenous varieties of grain. Farmers were also asked about how they used small ruminant manure, ashes from burning firewood and sorghum stalks, and other household wastes.

In the process of monitoring the FONADER loan scheme, we asked loan recipients about problems with the program and their recommendations for improving it. Specific questions about the use of a feed supplement, rice bran, were also posed. In addition, we inquired about the veterinary and extension services provided by the Livestock Service in the two villages. This information was designed to aid us in evaluating the success of the loan program from both the recipients' perspective and our perspective as agricultural economists.

Finally, a subsample of five to six households was chosen from the sample in each village for periodic informal interviewing. Each of these households was visited a minimum of two times; several of the more articulate and cooperative farmers were visited three to four times. The researcher concluded early in the survey that these informal interviews were necessary to obtain a better understanding of the problems and constraints facing stall-feeding households and of their perceptions of how stall-feeding could be improved. The informal interviews proved to be very useful for learning about farmers' management goals, skills

and requirements for stall-feeding as well as small ruminant enterprises. Moreover, the unstructured interviews enabled the researcher to begin to understand how mixed farmers perceive stall-feeding of cattle and small ruminant production in the broader context of their farming system and how these enterprises have changed over time. Last, the in-depth informal interviews increased the researcher's knowledge of mixed farmers' cropping and off-farm enterprises.

D. SURVEY OF EXTENSIVE CATTLE PRODUCTION BY TRADITIONAL FULANI HERDERS ON THE PLATEAU NEAR MOKOLO

Most of the cattle in the Mandara Mountains region are grazed extensively on the abundant pasture found on the plateau and in the plains. Moreover, many of the mixed farmers who cultivate intensively in densely populated zones raise cattle extensively. Their cattle are entrusted to Fulani herders or guarded by young children. In intensively cropped areas bordering on plateau and plains rangeland there are other important interactions between herders and settled farmers. Cattle herds graze on the crop stubble and manure farmers' fields, and exchanges of dairy products for grain take place commonly.

In recognition of the need to obtain useful information about herder-farmer interactions, 37 single-visit interviews were conducted from September 1980 through January 1981 with 26 semi-sedentary and 11 sedentary herders in the villages of Biskavai, Gorai, Mayo-Sanganare, Kossehone, Mavoumai and Wandai. The interviews began with general questions about the herder's experience, transhumance patterns, herding practices and interactions with settled farmers, and concluded with questions about input purchases and livestock sales, herd size and composition, livestock

flows, and reproductive histories for selected individual cows. Although it is generally not a good idea to ask about herd characteristics in a single-visit interview, we think that the information obtained was reasonably accurate and reliable. The enumerator who conducted the interviews was a skillful communicator and excellent Fulfulde speaker, and his task was rendered easier by the Livestock Service's encouragement of herder participation in the interviews.

Individual herder histories were obtained to get some idea of the magnitude and direction of change in extensive livestock production over the past 20 years. Change in herders' grazing and farming practices, which occurs with population increases and the opening of new tracts of land for cultivation, are important to note in understanding how the cattle subsector is evolving in the Mandara Mountains region. Finally, herders were asked to discuss problems in raising cattle, to evaluate the work of the Livestock Service, and to offer suggestions as to how improvements in cattle production might be made.

E. CATTLE MARKETING SURVEY

Beginning in August 1980 and ending in March 1981 two cattle markets at Gazawa and Tourou were surveyed weekly, while a third market at Mokolo was added when it opened in September 1980. Cattle marketing data were collected primarily to monitor the seasonality of the number, types and prices of cattle offered for sale at three representative markets in or near the Mandara Mountains region. Gazawa is a large foodstuff and cattle market in the Diamare Plains, located 55 kilometers east of Mokolo. It was chosen because it is an assembly market for, 1) young bulls that are bought by mixed farmers from the mountains for

stall-feeding, 2) old cows purchased by butchers from Mokolo and other towns in the Mandara Mountains region, and 3) large bulls and castrated males destined for resale in one of the Nigerian border markets. The Mokolo market was selected because it is situated at the southern edge of a densely populated area where stall-feeding of cattle is widely practiced. The third market surveyed was at Tourou, located on the Nigerian border.

By selecting three markets in different parts of Northern Cameroon the researcher intended to document differences in cattle prices across space, having hypothesized that they increase with greater proximity to Nigeria. The cattle marketing survey was also carried out to learn something about cattle flows within Northern Cameroon, and between Northern Cameroon and Northeastern Nigeria. Data were collected on offer and sale prices for cattle of different ages, sex, race and condition. The types of seller and buyer, their residences and the origin of the cattle offered for sale were also obtained.

The sampling of cattle for enumeration at Gazawa was purposive, aimed at obtaining price data and other information about three different sets of cattle: immature males (bought for stall-feeding), mature males (trade cattle destined for Nigeria) and old or sterile cows (the principal type of cattle acquired for slaughter at Mokolo, Koza and Mora). Since a lot of discretion was left to the enumerator, there was greater potential for error. The fact that only 5-10 percent of the cattle offered for sale could be sampled increased the probability that the sampling was unrepresentative. It probably would have been a good idea to assign two enumerators to the Gazawa market in order to obtain

a larger sample during each visit and to check for enumerator bias. The problems that arose at the Gazawa market were not encountered at Mokolo and Tourou, because the entire population of cattle offered for sale could be enumerated (with the exception of several weeks in September and October 1980 at Mokolo, when larger numbers of cattle at the market prevented complete enumeration).

The cattle marketing survey at Gazawa was far more difficult to carry out than the surveys at the other two markets. Generally, it is harder to work quickly and effectively in a larger and congested market such as Gazawa. The far greater number of buyers and sellers more than proportionally increase the bargaining and transactions that take place. As a result, it is much more difficult for an enumerator to capture and keep the attention of the market participants. In a sensitive research setting, such as a large cattle market, the enumerator is more likely to encounter uncooperative respondents who cut off interviews, refuse to answer certain questions or misinform deliberately.

The cattle marketing survey can be criticized in that data were obtained only over an eight month period. Although eight months of data are better than none whatsoever, seasonal trends in cattle prices cannot be discerned for the entire annual cycle. The seasonal pattern of prices for the missing months can be tentatively noted, however, based on what butchers and traders reported in informal interviews. This is an imperfect substitute, however, for a complete twelve month data set.

Although cattle price data were collected weekly during the survey, biweekly collection of data would probably have yielded precise enough estimates of monthly prices for the principal age-sex categories of

cattle. In examining price seasonality in Northern Cameroon, the relevant unit is the month.

Biweekly data collection would have also permitted monitoring of two markets that met on the same day. Gazawa and Meme cattle markets are held on Friday and both are important consumption/redistribution markets for the Mandara Mountains region. Since Gazawa is the more important market for the Mafa population of the region, it was monitored weekly. Biweekly data collection would have enabled us to monitor Meme, thereby improving our understanding of cattle price variation over space, the influence of Nigerian demand for slaughter and trade cattle, and seasonal variation in the supply of cattle for slaughter, trade and stall-feeding.

F. SURVEY AND CASE STUDIES OF BUTCHERING AND RETAILING

The survey of butchering and retailing had three principal components. Cattle and small ruminant carcasses were weighed on market day each week at one urban (Mokolo) and one rural (Soulede) market to learn about the seasonality of slaugher weights, livestock procurement, the number and types of livestock slaughtered, and livestock prices. In addition, retail meat prices were collected weekly in four representative markets (Mokolo, Tourou, Gazawa and Soulede) to increase our knowledge of spatial and temporal price differences. Finally, two rural and three urban butchers were periodically interviewed by the researcher to learn about their procurement practices and the costs and returns of carrying out marketing functions at different times of the year. Through these in-depth case studies we were also able to gain an understanding of butchers' perceptions, problems and recommendations for change and improvement.

The slaughter retail price and detailed cost data obtained through these three exercises are used to reconstruct enterprise budgets for rural and urban butchers. Their gross returns are estimated using slaughter weights, retail meat prices and typical prices for parts of the carcass that are sold by the piece and not by the kilogram (the head, tail, hide, hooves, tongue and liver). With knowledge of butchers' gross returns and principal costs, such as slaughter cattle acquisition, transport and trekking costs, and veterinary, slaughter and retailing taxes, it is possible to infer butchers' net returns.

In collecting slaughter data, the following information was obtained: type, age, sex and condition of animal slaughtered, carcass weight, weight of the fifth quarter, place of acquisition and seller type. All of the above data, except for the weights and measures, were obtained for slaughter at another rural market (Ziver) and for slaughter on days other than market day in the town of Mokolo. The weighing was accomplished using several two to three hundred pound hanging scales for cattle quarters and the fifth quarter. The fifth quarter was weighed only after the offals had been cleaned and the rumen contents discharged. The offals were then placed in a large pail that was suspended from the hanging scale. All of the weights in pounds were converted to kilograms and rounded to the nearest whole number. A 25 kilogram hanging scale, calibrated in 100 gram units, was used to weigh small ruminants and their carcasses. Small stock weighing more than 25 kilograms had to be weighed using the larger hanging scales calibrated in pounds.

Weighing carcasses at a slaughter slab is a very resource intensive process, requiring at least two enumerators and careful supervision by

the researcher. Consequently, it is best to concentrate scarce research resources on weighing carcasses at slabs where a fairly large sample of animals are slaughtered in order to obtain slaughter data for as many animals as possible at any one weighing. Although we decided to weigh carcasses at one rural market, so as to be able to compare slaughter data collected at a rural and an urban market, the resource costs per animal were far higher at the rural market, where fewer animals were slaughtered, than at the urban slab.

Collection of retail meat price data is relatively straightforward and far less resource intensive than collecting slaughter data. Purchased beef, goat meat and mutton were weighed weekly at two urban (Mokolo, Gazawa) and two rural (Soulede, Tourou) markets, using a table scale calibrated in ten gram units.[3] The markets were selected to show differences in meat prices between rural and urban areas, as well as differences across space. As with cattle prices, it was hypothesized that retail meat prices (beef prices in particular) would be higher closer to the Nigerian border. Although only six to seven months of data were obtained for retail prices at the four markets, it was hoped that the data would provide some evidence of the seasonal pattern of prices over at least half of the year. Information regarding retail price trends over the other months of the year was obtained through informal interviews with butchers, consumers and livestock service personnel. Available secondary data were also analyzed for seasonal trends.

Retail meat price data could probably have been obtained every other week with little loss of precision. It is important, however, to

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[3]This scale had the capacity to weigh up to 2 kilograms of meat. Heavier purchases, although relatively uncommon, were weighed on a larger, less accurate scale.

have at least three observations for each relevant meat category per week. This was easy to accomplish for the three categories of beef: beef without bones, beef with bones, and offals. It proved to be difficult, however, for goat meat and mutton. Part of this difficulty was due to the seasonality of small ruminant slaughter at rural and urban markets. Small stock is only occasionally slaughtered at the end of the rainy season and during the first couple months of the dry season (September-December). A second reason for the difficulty encountered in collecting retail prices for goat meat and mutton resulted from butchers' retailing practices. Butchers prefer grilling small ruminant meat for sale to consumers who consume the meat at the marketplace, probably because it is more profitable than selling uncooked meat. This practice does not lend itself well to weighing, since the buyers of the grilled meat are not infrequently primed with sorghum beer and hence less disposed to cooperate than the more sober and less impulsive buyers of uncooked meat.

The slaughter and retail price data were useful in constructing enterprise budgets for butchers. These data were supplemented with detailed cost data obtained in informal interviews with a small sample of reliable informants. Butchers were not asked about their gross returns for individual slaughter cattle, because they did not, as a group, offer reliable information about returns. The local administration in Mokolo enforces retail price controls on the sale of beef, which is the source of a good deal of butcher dissatisfaction. Consequently, it is in butchers' interest to underreport gross returns from slaughtering individual animals. In this way it would look as if the price control would shortly drive them out of business. Butchers in Mokolo remain in

business despite the price controls by selling parts of the fifth quarter, the tongue and the filet for a premium.

G. CASE STUDIES OF CATTLE SMUGGLING

Although the government of Cameroon prohibits export of cattle without written permission from the Ministry of Livestock, cattle smuggling is practiced widely in Northern Cameroon. The large and growing Nigerian population and increasing demand for beef in urban areas of Nigeria provide strong incentives for export. The demand for bulls that are stall-fed in the Mandara Mountains is strong, and there are a handful of local traders based in Mokolo and Mora who buy cattle from farmers in rural villages for assembly and export. In fact some stall-fed cattle are already being trekked to Nigerian cattle markets for sale. Hence it was judged essential to assess in at least a rough and preliminary way potential demand for well-fleshed, higher quality stall-fed cattle in Nigeria. Getting an idea of traders' costs and returns and hence cattle acquisition prices in Cameroon and resale prices in Nigeria was thought to be one means of evaluating demand. Moreover, knowledge of the actual value of the premium cattle command in Nigeria would help the researcher in conducting a sensitivity analysis of producer returns to stall-feeding.

Since cattle smuggling is such a sensitive issue in Northern Cameroon, little other than general information was obtained in interviews with butchers and butcher-traders during the first six months of research. As the researcher was able to cultivate confidential relationships with several reliable and knowledgeable informants in the cattle and beef subsector, he was put in touch with a few individuals who

were carrying out the illicit trade. Although most of these traders were reluctant to divulge detailed cost and return data, one did offer some price and cost information. In addition, one of the supervisors in the intensive survey, who was raised in the southernmost region of the Mandara Mountains, which is adjacent to one of the largest assembly markets for Cameroonian and Chadian cattle (Mubi), was able to exploit several of his personal contacts in obtaining cost and return data for cattle trading. This supervisor, who had spent a lot of time in Nigeria, was sent to Nigeria to conduct informal interviews at cattle markets near the border at the close of the intensive survey (March 1981).

H. SURVEY OF CATTLE-OWNING MIXED FARMERS IN VILLAGES AROUND MOKOLO

In order to supplement the data collected on stall-feeding histories from the 52 households in the stall-feeding survey at Magoumaz and Mavoumai, brief single-visit interviews were conducted from January to March 1981 with additional households in the villages of Magoumaz, Mavoumai, Mandaka, Ziling and Ldamtsai. Household heads were questioned about prices they paid for stall-fed cattle, oxen and range-fed cattle in the Diamare Plains and area around Mokolo, as well as prices they received for cattle and beef sold in the Mandara Mountains region. Each household was asked to report only those transactions occurring during the previous five years. Farmers estimated the value of small ruminants in cases where cattle purchase was made partially or fully in kind. They also valued unsold livestock or meat from slaughtered animals where some of the meat was sold and the other part consumed or given away.

These data were collected to compare cattle prices paid and received from a large sample in several villages near Mokolo with those from the

smaller sample of the stall-feeding survey. Moreover, the additional data provided a larger total sample from which cattle price trends over the past four to five years could be inferred.

I. INFORMAL INTERVIEWS WITH GOVERNMENT AND PARASTATAL OFFICIALS AND OTHER RESEARCHERS IN CAMEROON

In conducting subsector research it is important to interview knowledgeable officials and researchers working on livestock-related research issues in the subsector. Government and parastatal officials are able to provide useful information about government policies and programs, factors constraining the implementation of these policies and programs, and their perceptions of means of improving these policies and programs. Interviews with other researchers are useful for learning about past and ongoing research on the subsector, as well as these researchers' views of constraints, problems, potentials and prescriptions for improving subsector performance.

This researcher was especially fortunate to have a community of well-informed government and parastatal officials and researchers to draw upon in Northern Cameroon. Livestock Service and FONADER officials in Mokolo, Mora, Maroua and Garoua provided detailed information about government policies, veterinary services, the FONADER loan program, and the livestock subsector in Northern Cameroon. A French animal scientist conducting applied research on intensive cattle fattening using rice-milling by-products at Yagoua, the headquarters of SEMRY (Société d'Expansion et de Modernisation de la Riziculture de Yagoua), the parastatal promoting rice production in Northeastern Cameroon, was a valuable source of information. Officials of SODECOTON (Société pour le

Développement de la Production Cotonnière) in Maroua and Garoua were also helpful in explaining that parastatal's policies and program, particularly SODECOTON's role in implementing the World Bank funded Center-North Project, its animal traction program, and its production and marketing of cottonseed cake, a by-product of cotton oil production which is used as a feed supplement. In addition, several of the members of the team implementing the USAID funded North Cameroon Livestock Project provided useful information about livestock production and marketing and water resources development in the Diamare Plains of Northern Cameroon. A complete list of the officials and researchers contacted during the course of the study appears after the bibliography.

ANNEX 2

MACROECONOMIC INDICATORS FOR CAMEROON AND NIGERIA

Table A1-1: Basic Development Indicators for Cameroon and Nigeria

	Cameroon	Nigeria
1. Population	8.2 mill.	82.6 mill.
2. Land Area	475,000 sq. km.	924,000 sq. km.
3. GNP/per capita	$560	$670
4. Average annual growth rate in GNP, 1960-79	2.5%	3.7%
5. Average annual inflation rate		
a) 1960-70	4.2%	2.6%
b) 1970-79	10.3%	19.0%
6. Average annual growth rate in GDP	5.4%	7.5%
7. Average annual growth rate in GDP, agricultural sector, 1970-79	3.5%	-0.3%
8. Agricultural product as a percentage of GDP		
a) 1960	n.a.	63%
b) 1979	32%	22%
9. Average index of food production per capita, 1977-79, where 1969-71=100	110	87
10. Percentage of labor force in agriculture		
a) 1960	87%	71%
b) 1979	83%	55%
11. Average annual rate of population growth		
a) 1960-70	1.8%	2.5%
b) 1970-79	2.2%	2.5%
12. Average annual rate of urban population growth		
a) 1960-70	5.6%	4.7%
b) 1970-80	7.5%	4.7%
13. Urban population as a percentage of total population		
a) 1960	14%	13%
b) 1980	35%	20%

Source: World Bank, World Development Report 1981, Oxford University Press, New York, 1981.

Table A2-2: Selected Agricultural and Livestock Development Indicators for the Mandara Mountains Region, Northern Cameroon, the Republic of Cameroon and Nigeria

	Mandara Mountains Region	Northern Cameroon (Excluding the Adamaoua Plateau)	Cameroon	Nigeria
1. Population (1000 inhab.)				
a) Total population	547.7	1723.5	8444	77,082
b) Agricultural population		1494.0	6815	41,049
c) Agricultural population/ total population		86.6%	80.7%	53.3%
d) Economically active population in Agriculture			3162	15,475
e) Economically active population/agric. pop.			46.4%	37.7%
2. Land Area (sq. km.)				
a) Total land area	7659	98,800	475,440	923,770
b) Arable land area	1553	5,911	69,120	277,300
c) Arable land area/total land area	20.3%	6.0%	14.5%	30.1%
d) Permanent pasture	4084	75,696	83,000	208,800
e) Permanent pasture/total land area	53.3%	76.6%	17.5%	22.6%
3. Ruminant Livestock Population (1000 head)				
a) Cattle	185.2	1312.5	3200	12,300
b) No. of cattle/sq. km. (no. of head)	23.5	13.1	6.7	13.3
c) Small ruminants	566.8	1988.9	4500	35,700
1. goats	316.8	1075.0	2340	24,000
2. sheep	250.0	913.9	2160	11,700
d) Total tropical livestock units (TLU)[1]	197.5	1156.6	2778	12,887
e) TLU per sq. km. (no. of head)	25.0	11.5	6.7	14.0
4. Livestock Trade (no. of head)				
a) Cattle exports	6110	68,285	>80,000	nil.
b) Cattle imports	14,560	39,750	>50,000	360,000
c) Small ruminant imports	n.a.	>10,000	>10,000	235,000
5. Meat Consumption (kg./capita)	(1980)	(1974)	(1974)	(1966)
a) Beef consumption				
1. all areas	8.6	13.5	8.6	4.4
2. urban areas	11.4	17.9		9.8
3. rural areas	8.3			1.6
b) Small Ruminant Meat				
1. all areas	5.6	4.8	2.2	2.7
2. urban areas	5.8			1.7
3. rural areas	5.6			3.3
c) Total Meat Consumption				
1. all areas	14.2	18.3	13.8	8.9
2. urban areas	17.2		20.0	12.3
3. rural areas	13.9		11.5	5.5
6. Cereals Production (1000 MT)[1]	(1979)	(1975)	(1980)	(1980)
a) Total cereals production	109.5	316.5	936	9356
b) Cereals production/capita (kg./capita)	199.9	213.8	110.8	121.4
c) Millet and sorghum production	87.2	296.0	400	7000
d) Sorghum and millet production/total cereals production	99%	94%	43%	75%

[1]A Tropical Livestock Unit (TLU) equals 1.0 camels, 1.43 head of cattle and 8.33 small ruminants.

[2]Cereal crops include sorghum, millet, maize and rice.

Sources:

Food and Agriculture Organization, United Nations,
1) FAO Production Yearbook, 1980, FAO Statistics Series No. 34, Rome, 1981.
2) FAO Trade Yearbook, 1980, FAO Statistics Series No. 35, Rome, 1981.

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S.E.D.E.S., Recueil Statistique de la Production Animale, République Francaise, Ministère de la Coopération, Paris, 1975.

S.E.D.E.S., Etudes préliminaires a la création d'une communauté économique du bétail et de la viande dans les pays de l'Union Douanière et Economique de l'Afrique Centrale, Paris, 1976.

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*Information and estimates also obtained from one year of survey research.

ANNEX 3

SUPPLEMENTARY CATTLE SLAUGHTER, PRICE AND FLOW DATA

A. SUPPLEMENTARY CATTLE SLAUGHTER DATA

1. Carcass Weights for Cattle Slaughtered at Mokolo, 1976-81

The Mokolo secondary school regularly buys beef for its boarding students, and the accountant has systematically weighed the cattle carcasses over the last five years. Monthly carcass weights for four academic years are shown in Table A3-1. Since the numbers of cattle slaughtered during any one month are quite small, it is best to look at the pooled samples (1976-1981) for each month. It should be emphasized that the data are not necessarily taken from a random sample and that the sampling frame is small particularly for the months of March, April and June. The reader should also be forewarned that different numbers of observations for each month across years may significantly bias our estimates of the monthly means for the pooled sample.

For the most part the school data illustrate the same seasonal pattern in carcass weights as do the Mokolo slaughterhouse data analyzed in Chapter Six, even though the February mean appears to be exceptionally high and seasonally off trend. The carcass weights are highest in November and lowest in June. They are especially low in May and June, when little pasture and water are available in Northern Cameroon. Additional data for the months of July and August would probably show that carcass weights trend upward beginning in July.

TABLE A3-1

CARCASS WEIGHTS OF CATTLE SLAUGHTERED AT THE MOKOLO SECONDARY SCHOOL, 1976-1981

Month	1976-77		1978-79		1979-80		1980-81		1976-81	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
October	15	101.0	8	136.8	7	149.0	10	143.5	40	127.2
November	14	140.7	8	160.9	7	139.2	6	135.9	35	144.2
December	11	121.5	6	169.1	2	142.0	4	102.7	23	132.4
January	15	128.6	9	138.7	6	147.3	8	113.0	38	130.7
February	14	140.0	11	137.4	6	130.0	6	119.6	37	134.3
March		n.a.	4	150.2	3	140.3	4	119.5	11	125.5
April		n.a.	5	150.0	5	110.4	5	98.0	15	119.5
May		n.a.	15	104.6	7	118.0	5	83.5	27	104.2
June		n.a.	8	100.8	2	95.5	4	103.8	14	100.9

SOURCE: Lycée de Mokolo.

[1]The accountant at the secondary school has weighed cattle carcasses using a 200 kilogram groundnut scale over the last five years. For our purposes the cattle carcass includes the four quarters, the offals and the tail. Unfortunately, slaughter data for the 1977-78 academic year were not available.

2. Carcass Weights for Cattle Slaughtered at Maroua

A year before the Mandara Mountains study of stall-feeding was carried out, the Veterinary School of Maroua weighed approximately 300 head of cattle slaughtered at the Maroua abattoir. According to Dr. Eric Thys, a Belgian veterinarian who teaches at the school and who supervised the weighing, 80-90 percent of the sample was female. Table A3-2 summarizes the results, which show a similar seasonal pattern to the one occuring in Mokolo a year later. The main difference between the two sets of data is that carcass weight is highest in December in Maroua, whereas it peaks in November in Mokolo.

TABLE A3-2

MONTHLY CARCASS WEIGHTS OF CATTLE SLAUGHTERED AT MAROUA, OCTOBER 1979-MARCH 1980

Month and Year	Approximate Carcass Weight
October 1979	±125 kg.
November 1979	±125 kg.
December 1979	±130 kg.
January 1980	±110 kg.
February 1980	±110 kg.
March 1980	± 95 kg.

It is also important to note that the Maroua carcass weights are 15-20 percent higher than those recorded at Mokolo the following year. This may be due to measurement errors on our part; the tail was not systematically weighed at Mokolo, even though carcass weight by definition includes the four quarters plus the tail. It is more likely, however, that economic factors are responsible for much of the difference.

First, Maroua is a far larger town than Mokolo, and it has a larger and more well established cattle market. The strong demand for beef in a town the size of Maroua attracts larger and better fleshed cattle than does a smaller town such as Mokolo. Second, the butchers of Maroua have not been subject to the same kind of rigorous price controls and enforcement practices as have been their Mokolo counterparts. There are retail price controls on the sale of beef in Maroua, but they are presently 100 FCFA per kilogram higher than those prevailing in Mokolo. Moreover, enforcement has been haphazard and irregular in Maroua, whereas Mokolo butchers are required to sell beef at the control prices. Since Maroua butchers are able to sell at a higher price per kilogram, they can afford to buy and slaughter cattle which are in better condition and which tend to cost more per kilogram. The cattle slaughtered at Mokolo may also have been lighter due to tissue losses incurred by trekking cattle acquired at Gazawa (55 kilometers from Mokolo) or Bogo (111 kilometers from Mokolo). Even though these treks take place during the night, they can exhaust the cattle, a good number of which are not in top health and condition at the outset. A final economic factor that may explain why cattle weights are highest as late as December at Maroua and a month earlier at Mokolo is that the butchers of Maroua are able to buy and slaughter at a profit some of the well-fleshed bulls and steers coming from Chad during the middle of the dry season. The demand for beef in Maroua, the largest town in Northern Cameroon (circa 80,000), is strong around Christmas, due to the sizeable expatriate and Southern (Christian) Cameroonian population.

3. Recorded Cattle and Small Ruminant Slaughter at Maroua and Gazawa

Recorded monthly slaughter of cattle and small ruminants at Maroua and Gazawa is shown in Tables A3-3 and A3-4. Although the time series are too short for using the ratio to moving average procedure, the data can be smoothed somewhat by calculating three month moving averages. Plots of the cattle and small ruminant slaughter data for Maroua and for Gazawa appear in Figures A3-1 and A3-2. The data for Maroua show that small ruminant slaughter peaks in the months of April, May and June, which corresponds to what was observed in Mokolo. Cattle slaughter tends to be lower during this period than during other months of the year. Cattle slaughter generally appears to be highest during the months of October, November and December.

The data for Gazawa do not present as clear a seasonal pattern. The only conclusion that can be drawn from the cattle slaughter data is that it has trended upward over time. Small ruminant slaughter tends to peak during the months of May, June and July, which is somewhat later than at Maroua. This may be due to the poor condition of the cattle trekking routes during the rainy season. Since Gazawa butchers depend more heavily on larger and better fleshed trade cattle for their supply of slaughter cattle, substitution of small ruminants for cattle may take place longer into the rainy season than at other markets.

4. Cattle and Small Ruminant Slaughter at Tourou

Cattle and small ruminant slaughter at Tourou market, which is reported in Table A3-5, illustrate the seasonal pattern of slaughter in rural markets in the Mandara Mountains. Since Tourou is located on the

TABLE A3-3

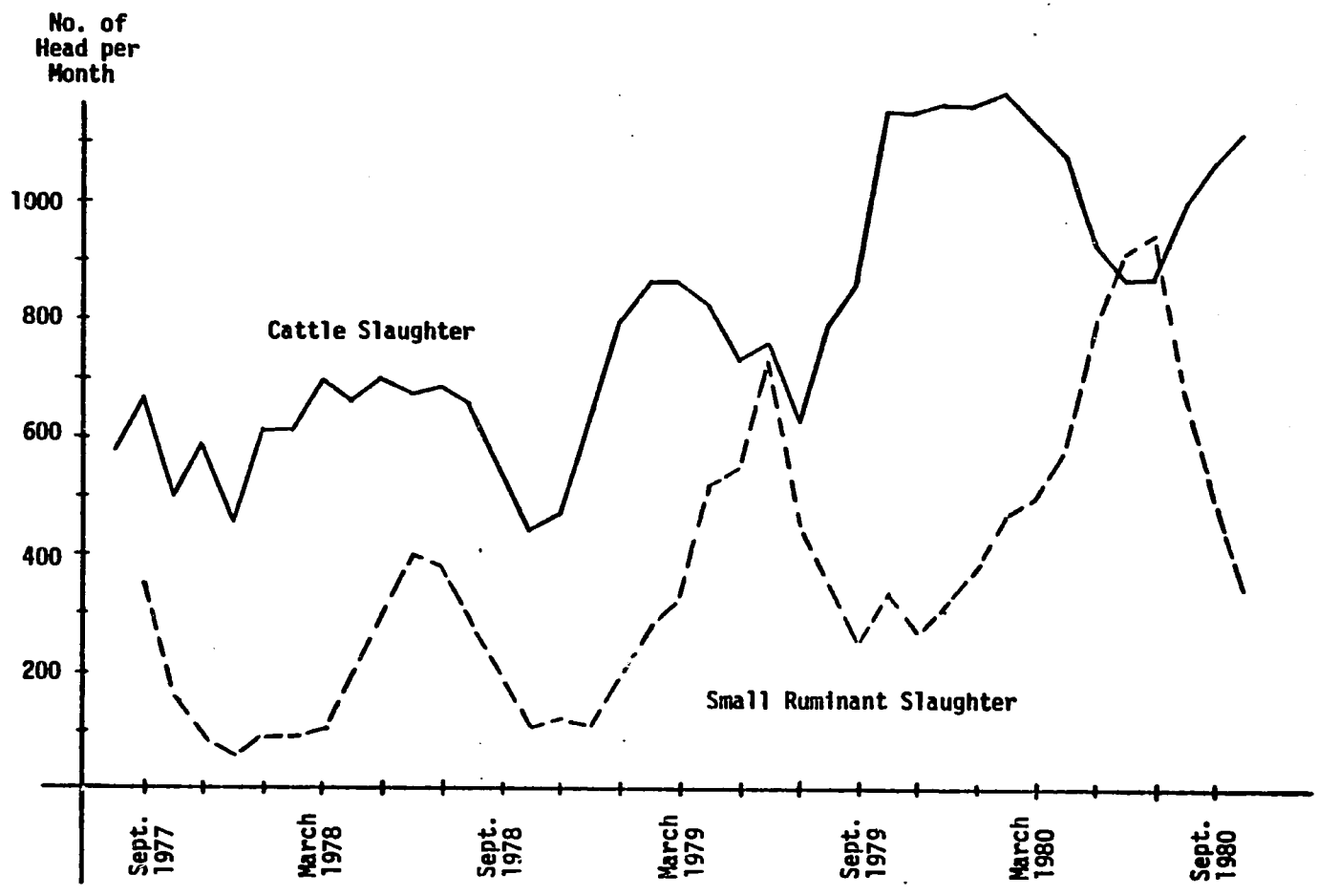
RECORDED SLAUGHTER OF CATTLE AND SMALL RUMINANTS AT MAROUA, JULY 1977-DECEMBER 1980

	1977			1978			1979			1980		
	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats
January				497	20	38	850	40	96	1195	149	260
February				662	58	75	771	54	214	1146	129	327
March				682	62	19	958	158	267	1206	195	346
April				751	25	69	845	107	166	1025	210	288
May				550	150	236	676	252	605	1011	219	481
June				782	177	241	679	173	345	734	471	720
July	570	358	431	688	181	212	935	301	279	870	359	477
August	739	274	384	589	189	123	285	27	2	995	440	347
September	392	127	147	689	70	58	1157	184	276	1096	181	219
October	888	79	75	358	92	68	1151	113	160	n.a.	n.a.	n.a.
November	208	19	25	285	27	2	1151	113	160	1096	107	172
December	678	24	54	774	56	113	1147	93	176	1133	116	197
Total	3,475	881	1,116	7,307	1,107	1,260	10,605	1,615	2,746	11,507	2,576	3,834

Source: Veterinary Center, Maroua.

FIGURE A3-1

MONTHLY SLAUGHTER OF CATTLE AND SMALL RUMINANTS AT MAROUA, AUGUST 1977-NOVEMBER 1980



Note: The graph is a plot of three-month moving averages.

TABLE A3-4

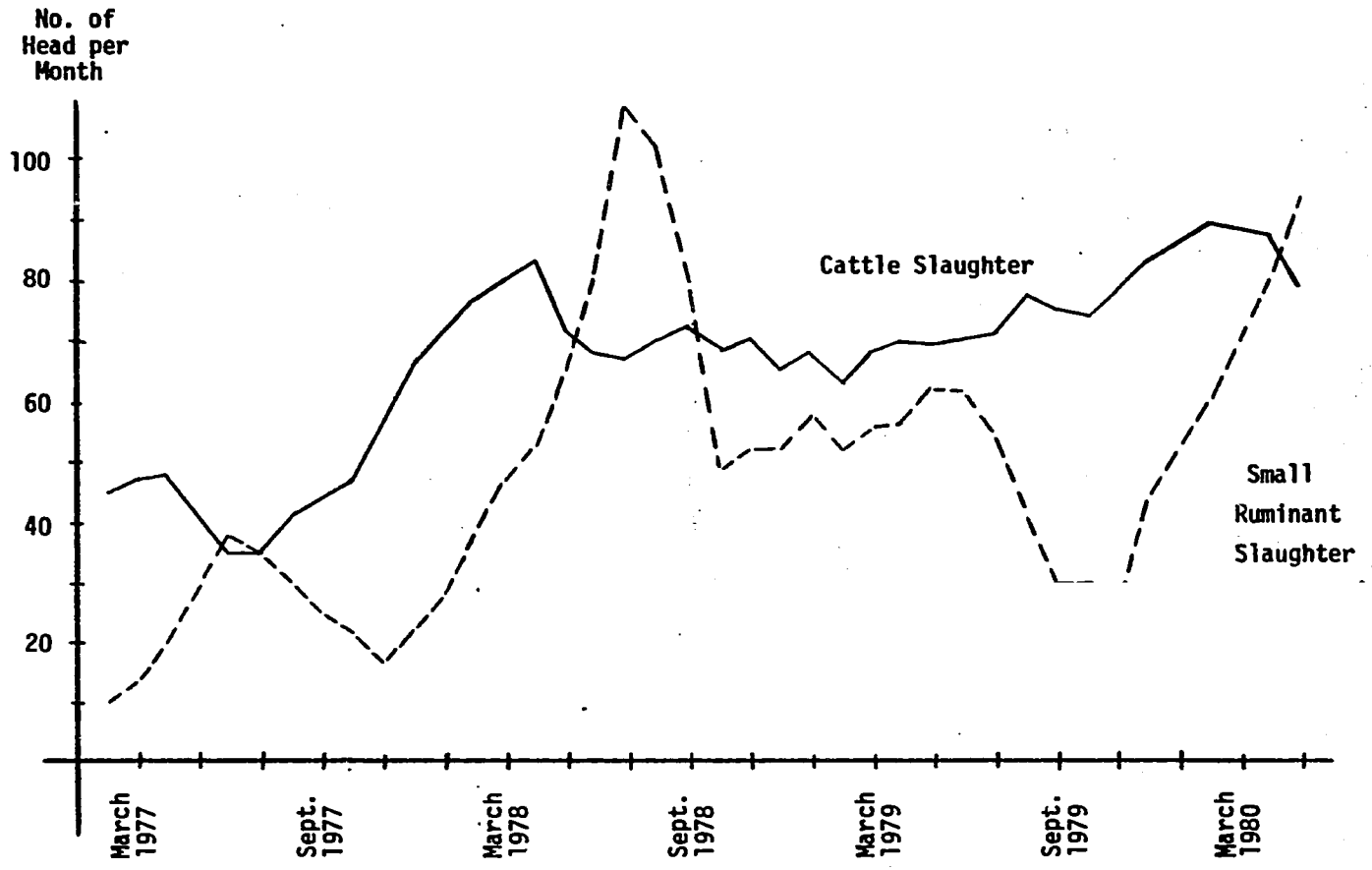
RECORDED SLAUGHER OF CATTLE AND SMALL RUMINANTS AT GAZAWA, JANUARY 1977-JUNE 1980

	1977			1978			1979			1980		
	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats
January	44	3	4	73	1	39	60	3	43	n.a.	n.a.	n.a.
February	37	2	6	64	6	28	67	4	49	n.a.	n.a.	n.a.
March	53	0	15	94	0	47	61	2	54	88	4	74
April	51	3	12	82	19	46	77	1	59	85	4	73
May	40	11	20	73	10	34	69	2	52	88	3	81
June	31	7	35	62	11	71	62	1	71	64	17	101
July	33	7	33	70	18	95	78	5	55			
August	40	9	15	70	20	110	72	2	31			
September	49	2	27	71	1	63	80	3	29			
October	44	0	23	76	6	40	73	3	23			
November	48	0	13	58	3	33	69	1	30			
December	76	4	10	72	5	69	93	2	23			
Total	546	48	213	870	94	675	861	29	519			

Source: Veterinary Center, Gazawa.

FIGURE A3-2

MONTHLY SLAUGHTER OF CATTLE AND SMALL RUMINANTS AT GAZAWA, FEBRUARY 1977-MAY 1980



Note: The graph is a plot of three-month moving averages.

TABLE A3-5

CATTLE AND SMALL RUMINANT SLAUGHTER AT TOUROU ON SELECTED MARKET DAYS, NOVEMBER 1980-MARCH 1981

Date	Cattle	Sheep	Goats
13-11-80	12	3	0
11-12-80	7	8	2
13/12/80	8	4	6
November-December Subtotal	27	15	8
08-01-81	2	15	4
15-01-81	7	5	6
22-01-81	3	0	6
29-01-81	5	4	3
January Subtotal	16	24	19
05-02-81	5	4	5
12-02-81	2	6	4
19-02-81	2	0	8
26-02-81	3	0	13
February Subtotal	12	10	30
05-03-81	2	3	10
12-03-81	4	3	13
19-03-81	1	0	2
March Subtotal	7	6	25

Nigerian border and roughly half of the people who attend the market are Nigerians, one would expect demand to be subject to less seasonal fluctuation.[1] The downward trend in cattle slaughter shows that supply constraints are, at best, only partially offset by the constancy of a strong

[1]The Tourou market chief claims that about half of the people attending the weekly market come from Nigeria. More than half of the transactions that take place involve the exchange of Nigerian currency. All retail meat purchases are made with Naira.

demand on the part of Nigerian consumers for beef. Small ruminant slaughter remained at the level of roughly ten animals per week from January through March. Less than eight small ruminants were slaughtered weekly for those weeks in November and December for which there are observations. Unfortunately, slaughter numbers for earlier months are not available. Judging from retail price data for different types of meat for October and November and from observations made during several earlier visits to the market by the author and his enumerators, small stock were not slaughtered in as great numbers during the rainy season as during the dry season.

5. Unrecorded Cattle Slaughter at Secondary Town Markets in the Mandara Mountains Region

As estimated in Chapter Six, 5,300 head of cattle were slaughtered in urban areas of the Mandara Mountains in 1980. Eighty-three percent of this slaughter was recorded, while the remaining 17 percent (920 head) was unrecorded. The breakdown of unrecorded slaughter by town is shown in Table A3-6. The individual town estimates were obtained through structured interviews with butchers and observations at rural markets. The estimated numbers of head procured in the Diamare Plains are also shown in the table.

B. SUPPLEMENTARY CATTLE PRICE AND FLOW DATA

1. Acquisition and Offer Prices for Different Age-Sex Categories of Cattle at Gazawa, Mokolo and Tourou Markets, July 1980-March 1981

Three cattle markets were monitored in the course of the field research in Northern Cameroon. Cattle price data were collected weekly

TABLE A3-6

ESTIMATES OF UNRECORDED CATTLE SLAUGHTER AT SECONDARY TOWN MARKETS IN THE MANDARA MOUNTAINS REGION

Market	Total Estimated Slaughter	Estimated No. of Head Bought in the Plains
Mogode	105	50
Roumzou	130	50
Zamai	50	25
Mokong	100	80
Meri	75	50
Dogba	100	90
Tokonbere	100	60
Meme	260	220
Total	920	625

at Gazawa, Mokolo and Tourou for different age-sex categories of cattle, and they are aggregated by month in Tables A3-7 to A3-10. The first two tables show monthly acquisition prices paid by cattle buyers. In the few instances where the purchase price reported by the buyer differed from the sales price reported by the seller, the buyer's reported acquisition price was used in the analysis. There are rarely intermediaries at the Mokolo and Tourou markets, although there are intermediaries who facilitate transactions between some buyers and sellers in the larger cattle markets, such as Gazawa. Most transactions at Gazawa take place, however, without the intervention of intermediaries. The second two tables show monthly offer prices, which were reported by sellers at the marketplaces. Either these sellers were unable to sell their cattle or the sales price was not obtained.

TABLE A3-7

MEAN MONTHLY ACQUISITION PRICES FOR AGGREGATED CATEGORIES OF CATTLE AT GAZAWA, MOKOLO AND TOUROU MARKETS, JULY 1980-MARCH 1981 (in FCFA)

	All Cattle								All Male Cattle							
	Gazawa		Mokolo		Tourou		Total		Gazawa		Mokolo		Tourou		Total	
Month	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N
July	37,536	(14)			50,818	(11)	43,380	(25)	33,000	(11)			47,667	(9)	39,600	(20)
August	38,381	(109)			51,250	(8)	39,261	(117)	36,223	(74)			47,143	(7)	37,167	(81)
September	33,433	(119)	22,000	(3)	65,000	(1)	33,411	(123)	31,110	(91)	22,000	(3)	65,000	(1)	31,179	(95)
October	29,413	(149)	26,300	(20)	46,000	(1)	29,144	(170)	28,126	(101)	26,625	(16)	46,000	(1)	28,074	(118)
November	34,867	(30)					34,867	(30)	32,413	(23)					32,413	(23)
December	41,006	(77)	25,850	(12)	63,889	(9)	41,252	(98)	41,149	(37)	25,850	(12)	63,889	(9)	41,512	(58)
January	40,283	(100)	29,600	(5)	70,875	(12)	42,964	(117)	40,914	(70)	29,600	(5)	75,045	(11)	44,622	(86)
February	42,553	(91)			59,292	(6)	43,589	(97)	43,135	(46)			73,250	(4)	45,544	(50)
March	42,238	(37)	24,575	(4)			40,515	(41)	42,186	(29)	18,400	(1)			41,393	(30)
Overall Mean	36,828	(726)	26,102	(44)	59,609	(48)	37,588	(818)	35,383	(482)	26,178	(37)	61,036	(42)	36,697	(561)

	All Female Cattle							
	Gazawa		Mokolo		Tourou		Total	
Month	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N
July	54,167	(3)			65,000	(2)	58,500	(5)
August	42,943	(35)			80,000	(1)	43,972	(36)
September	40,982	(28)					40,982	(28)
October	32,120	(48)	25,000	(4)			31,572	(52)
November	42,929	(7)					42,929	(7)
December	40,875	(40)					40,875	(40)
January	38,808	(30)			25,000	(1)	38,363	(31)
February	41,959	(45)			31,375	(2)	41,509	(47)
March	42,425	(8)	26,333	(3)			38,036	(11)
Overall Mean	39,681	(244)	25,700	(7)	49,625	(6)	39,532	(257)

SOURCE: Survey of cattle markets, July 1980 through March 1981.

TABLE A3-8

MEAN MONTHLY PRICES FOR SELECTED CATEGORIES OF CATTLE AT GAZAWA, MOKOLO AND TOUROU CATTLE MARKETS, JULY 1980-MARCH 1981 (in FCFA)

	Male Cattle < Three Years								Male Cattle ≥ Three Years				Cows ≥ Six Years		Cows ≥ Three Years and < Six Years		Heifers < Three Years	
	Gazawa		Mokolo		Tourou		Total		Gazawa		Tourou		Gazawa		Gazawa		Gazawa	
Month	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N
July	23,500	(6)			29,500	(2)	25,000	(8)	44,400	(5)	52,857	(7)	52,500	(2)			57,000	(1)
August	33,717	(53)			38,200	(5)	34,103	(58)	42,548	(21)	69,500	(2)	44,867	(15)	54,571	(7)	34,462	(13)
September	26,837	(49)	22,000	(3)			26,558	(52)	36,095	(42)	65,000	(1)	39,548	(21)	47,500	(6)	32,000	(1)
October	24,520	(60)	24,692	(13)			24,551	(73)	33,402	(41)	46,000	(1)	30,699	(34)	39,714	(7)	31,429	(7)
November	23,950	(10)					23,950	(10)	38,923	(13)			35,375	(4)	53,000	(3)		
December	28,000	(5)	26,473	(11)	30,000	(1)	27,129	(17)	43,203	(32)	68,125	(8)	44,021	(24)	40,000	(11)	27,700	(5)
January	24,167	(21)	27,750	(4)	33,000	(1)	25,057	(26)	48,092	(49)	79,250	(10)	40,875	(22)	42,250	(4)	24,000	(4)
February	28,962	(13)					28,962	(13)	48,718	(33)	73,250	(2)	37,629	(29)	56,031	(13)	22,833	(3)
March	26,333	(6)	18,400	(1)			25,200	(7)	46,322	(23)			37,000	(1)	43,629	(7)		
Overall Mean	27,514	(223)	25,238	(32)	34,770	(9)	27,486	(264)	42,159	(259)	68,197	(33)	38,653	(152)	47,359	(58)	31,176	(34)

SOURCE: Survey of cattle markets, July 1980 through March 1981.

TABLE A3-9

MEAN MONTHLY OFFER PRICES FOR AGGREGATED CATEGORIES OF CATTLE AT GAZAWA, MOKOLO AND TOUROU CATTLE MARKETS, JULY 1980-MARCH 1981 (in FCFA)

	All Cattle								All Male Cattle							
	Gazawa		Mokolo		Tourou		Total		Gazawa		Mokolo		Tourou		Total	
Month	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N
July					46,667	(21)	46,567	(21)					46,600	(20)	46,600	(20)
August	62,442	(43)			59,096	(52)	60,611	(95)	63,522	(23)			58,224	(49)	59,917	(72)
September	42,500	(2)	38,148	(54)	56,351	(32)	44,932	(88)	42,500	(2)	37,700	(40)	55,900	(30)	45,417	(72)
October			29,810	(79)	52,581	(40)	37,464	(119)			29,194	(62)	52,390	(34)	37,409	(96)
November	36,982	(57)	28,517	(59)	46,148	(27)	35,220	(143)	38,447	(47)	28,412	(57)	45,840	(25)	35,446	(129)
December	41,593	(27)	27,581	(31)	45,462	(26)	37,619	(84)	42,333	(21)	27,500	(30)	46,696	(23)	37,676	(74)
January	40,300	(30)	28,167	(15)	58,176	(17)	42,266	(62)	39,472	(18)	28,167	(15)	62,133	(15)	43,021	(48)
February	29,100	(25)	29,452	(21)	44,130	(27)	34,760	(73)	27,881	(21)	29,559	(17)	44,079	(19)	33,781	(57)
March	35,696	(23)	32,087	(23)	44,929	(14)	36,467	(60)	35,095	(21)	32,600	(20)	41,167	(12)	35,849	(53)
Overall Mean	42,312	(207)	30,963	(282)	51,573	(256)	41,198	(745)	41,103	(153)	30,454	(241)	51,660	(227)	40,807	(621)

	All Female Cattle							
	Gazawa		Mokolo		Tourou		Total	
Month	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N
July					48,000	(1)	48,000	(1)
August	61,200	(20)			73,333	(3)	62,783	(23)
September			39,429	(14)	66,000	(2)	42,750	(16)
October			32,059	(17)	53,667	(6)	37,696	(23)
November	30,100	(10)	31,500	(2)	50,000	(2)	33,143	(14)
December	39,000	(6)	30,000	(1)	36,000	(3)	37,200	(10)
January	41,542	(12)			28,500	(2)	39,679	(14)
February	35,500	(4)	29,000	(4)	44,250	(8)	38,250	(16)
March	42,000	(2)	28,667	(3)	67,500	(2)	43,571	(7)
Overall Mean	45,991	(54)	33,951	(41)	50,897	(29)	43,157	(124)

SOURCE: Survey of cattle markets, July 1980 through March 1981.

TABLE A3-10

MEAN MONTLHY OFFER PRICES FOR SELECTED CATEGORIES OF CATTLE AT GAZAWA, MOKOLO AND TOUROU CATTLE MARKETS, JULY 1980-MARCH 1981 (in FCFA)

	Male Cattle < Three Years Old								Male Cattle ≥ Three Years Old							
	Gazawa		Mokolo		Tourou		Total		Gazawa		Mokolo		Tourou		Total	
Month	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N	Mean Price	N
July					43,429	(7)	43,429	(7)					48,308	(13)	48,308	(13)
August	55,667	(9)			53,385	(26)	53,971	(35)	68,571	(14)			63,696	(23)	65,568	(57)
September	42,500	(2)	28,652	(23)	38,889	(9)	32,176	(34)			49,941	(17)	63,190	(21)	57,263	(38)
October			27,170	(47)	44,625	(10)	30,232	(57)			35,533	(15)	55,625	(24)	47,894	(39)
November	24,500	(14)	26,444	(36)	21,000	(2)	25,712	(52)	44,364	(33)	31,786	(21)	48,000	(23)	42,019	(42)
December	27,600	(5)	26,708	(24)	29,111	(9)	27,395	(38)	46,938	(16)	30,667	(6)	58,000	(14)	48,528	(36)
January	28,111	(9)	27,607	(14)	36,750	(4)	29,130	(27)	50,833	(9)	36,000	(1)	71,364	(11)	60,881	(21)
February	26,639	(18)	28,767	(15)	28,786	(7)	27,813	(40)	35,333	(3)	35,500	(2)	53,000	(12)	47,824	(17)
March	27,769	(13)	30,417	(12)	30,333	(6)	29,290	(31)	47,000	(8)	35,875	(8)	52,000	(6)	44,318	(44)
Overall Mean	30,864	(70)	27,556	(171)	41,534	(80)	31,761	(321)	49,572	(83)	37,536	(70)	57,170	(147)	50,487	(300)

	Cows ≥ 6 Years Old		Cows < 6 Years Old and ≥ 3 Years Old		Cows < 3 Years Old	
	Gazawa		Gazawa		Gazawa	
Month	Mean Price	N	Mean Price	N	Mean Price	N
July						
August	72,500	(6)	57,364	(11)	52,667	(3)
September						
October						
November	33,333	(3)	32,200	(5)	20,000	(2)
December	40,800	(5)			30,000	(1)
January	48,500	(7)	48,000	(2)	21,000	(3)
February			43,000	(1)	33,000	(3)
March			54,000	(1)	30,000	(1)
Overall Mean	51,357	(21)	49,250	(20)	32,308	(13)

SOURCE: Survey of cattle markets, July 1980 through March 1981.

For the most part, the acquisition price data are better than the offer price data. Offer prices tend to be somewhat inflated, as sellers may quote the price they would like to receive rather than the price for which they are willing to settle. Yet the enumerator who carried out the cattle marketing research was instructed to ask sellers for their "last price", which often required some prodding on his part, as well as tact and the maintenance of the strictest confidentiality.

2. Annual Livestock Sales in Margui-Wandala, 1973-1980

Recorded livestock sales during the period 1973-1980, which are shown in Table A3-11, follow the same pattern as recorded slaughter figures for the same period in Margui-Wandala. Recorded sales were far higher in 1973-74 than in the following years, declining steadily from 1973 to 1977 but then rising somewhat from 1977 to 1980. These trends may be due to poor and unsystematic data collection. It is quite possible, however, that livestock sales, particularly cattle sales, were far above trend in 1973-74 at the close of the Sahelian drought. Herders were probably forced to sell large numbers of cattle that had been severely weakened by poor nutrition during the drought. Small ruminant sales may also have been affected by the drought, as goat and sheep sales were nearly double the 1977 level in 1973.

Since small ruminants, particularly goats, are highly robust, one would expect fewer distress sales following a drought than in the case of cattle. This appears to have been true in Margui-Wandala, where the high level of small ruminant sales in 1973-74 was not as far off trend as the level of cattle sales in 1973-74, which were five to six times the 1977 level. It is also possible that fewer cattle were sold in

TABLE A3-11

ANNUAL LIVESTOCK SALES AT MARKETS IN MARGUI-WANDALA, 1973 THROUGH 1980

Year	Cattle	Goats	Sheep	Donkeys
1973	10,067	28,647	26,051	7,674
1974	7,989	26,003	20,346	8,135
1975	4,535	24,045	21,995	3,891
1976	1,784	21,892	19,870	1,607
1977	1,632	17,343	14,532	1,170
1978-79	2,899	22,067	18,332	1,176
1979-80	3,015	21,097	20,845	948

SOURCE: Annual Reports of the Livestock Service Subsector Offices at Mokolo (1973-1980) and Mora (1979-80 only).

regional markets in 1976-77, because farmers and herders may have preferred to sell their animals at Nigerian border markets such as Kerawa and Banki, where cattle prices are usually higher, or to local smugglers who assemble herds for export by buying directly from producers in villages and in the bush.

3. Monthly Livestock Sales at Gazawa and Maroua, 1977-1980

Cattle sales recorded at the Gazawa and Maroua cattle markets by Livestock Service officials from 1977 through 1980, which are shown in Table A3-12, provide some evidence of the strength of international trade flows during the dry season, when many of the cattle offered for sale are trekked from Chad. As shown in Figure A3-3, the number of cattle

TABLE A3-12

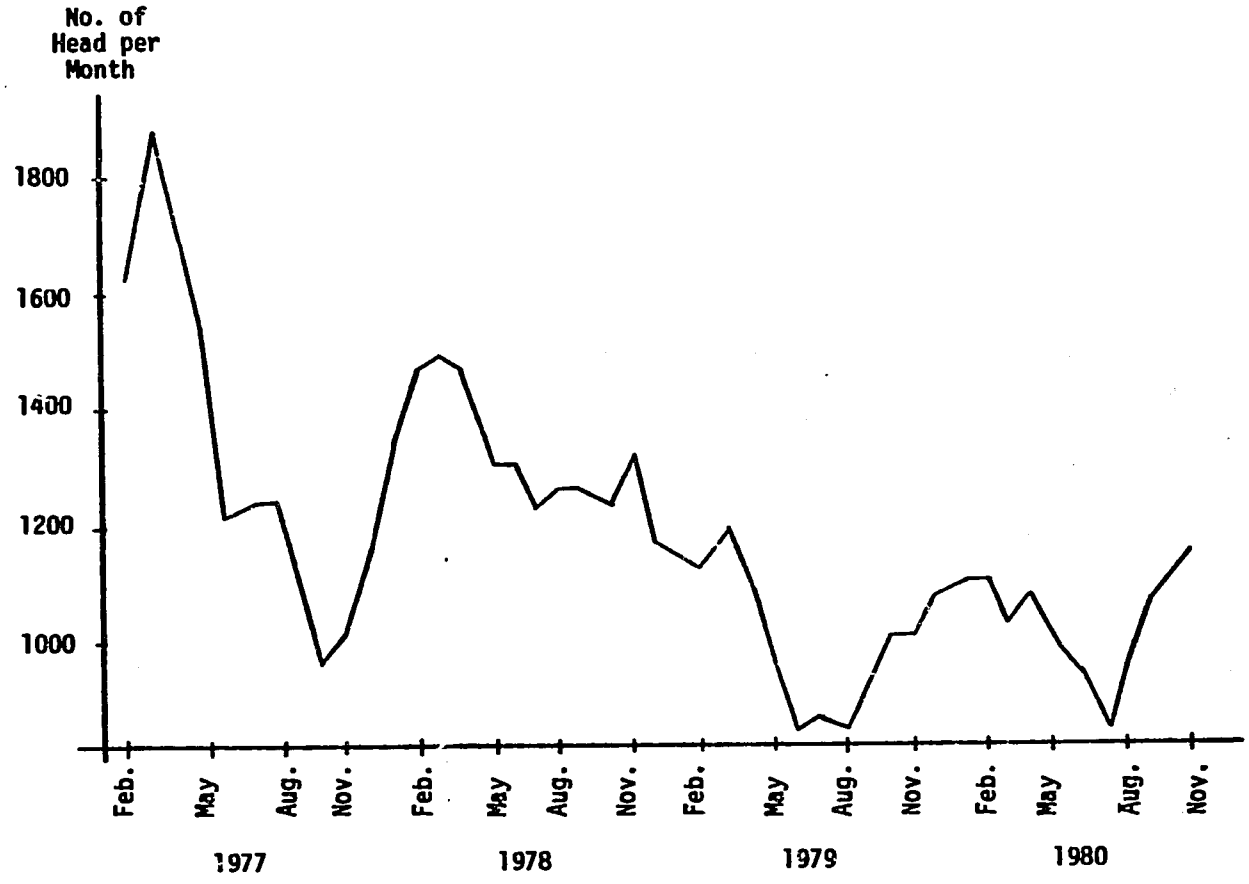
NUMBERS OF LIVESTOCK SOLD AT GAZAWA, JANUARY 1977-DECEMBER 1980

	1977			1978			1979			1980		
	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats
January	1457	186	545	1310	145	468	1034	217	442	1257	457	635
February	1692	156	870	1408	260	484	987	187	543	1129	417	492
March	1720	456	536	1685	370	615	1397	186	553	920	395	577
April	2210	580	735	1430	298	519	1190	330	450	1050	314	535
May	1170	320	430	1338	156	646	758	319	480	1283	468	729
June	1270	300	480	1188	219	490	956	498	715	724	300	516
July	1220	360	760	1440	124	243	826	380	509	857	590	663
August	1269	544	665	1091	102	431	879	420	628	1010	250	415
September	1236	615	824	1270	123	268	898	222	523	1072	403	625
October	795	478	574	1475	490	460	1043	550	849	n.a.	n.a.	n.a.
November	910	747	860	1000	642	783	1105	396	719	n.a.	n.a.	n.a.
December	1330	263	542	1470	260	610	911	418	548	1199	697	859
Total	16,279	5,005	7,821	16,105	3,189	6,017	11,984	4,123	6,959	10,501	4,291	6,046

Source: Veterinary Center, Gazawa

FIGURE A3-3

MONTHLY CATTLE SALES AT GAZAWA CATTLE MARKET, FEBRUARY 1977-NOVEMBER 1980



Note: The graph is a plot of three-month moving averages.

sold per month at Gazawa swung upward in 1977, 1979 and 1980 at the end of the rainy season, then fell off beginning in April, remaining relatively low during the rainy seasons of 1977-1980. The early dry season (October-December) of 1978 is the only period that does not follow the expected seasonal pattern.

In contrast to Gazawa, monthly cattle sales at Maroua trended upward from 1977 to 1980, as shown in Table A3-13 and Figure A3-4. Cattle sales here follow a seasonal pattern of low sales during the late dry season and early rainy season (April-June), followed by higher sales from the late rainy season through the middle of the dry season (August-February).

As in the case of Gazawa, cattle sales at Maroua did not correspond to the expected seasonal pattern during the early dry season of 1978. Although sales rose at the end of the rainy season of 1978 as expected, they fell off sharply after October 1978, which is a premature decline. This same drop in cattle sales took place beginning in December 1977 at Maroua, which also is earlier than expected. Generally, cattle sales begin to drop in January, continuing to decline throughout the mid- to late dry season, following the annual peak during the late rainy season and early dry season. This downward trend in cattle sales during the dry season contrasts with the Gazawa market, where cattle sales remain at high levels during the entire dry season. The strong demand for slaughter cattle and young bulls for stall-feeding throughout the dry season at Gazawa, due to the reliance of town butchers and farmers of the Mandara Mountains region on Gazawa cattle market as a source of supply, is probably the reason for this difference. The

TABLE A3-13

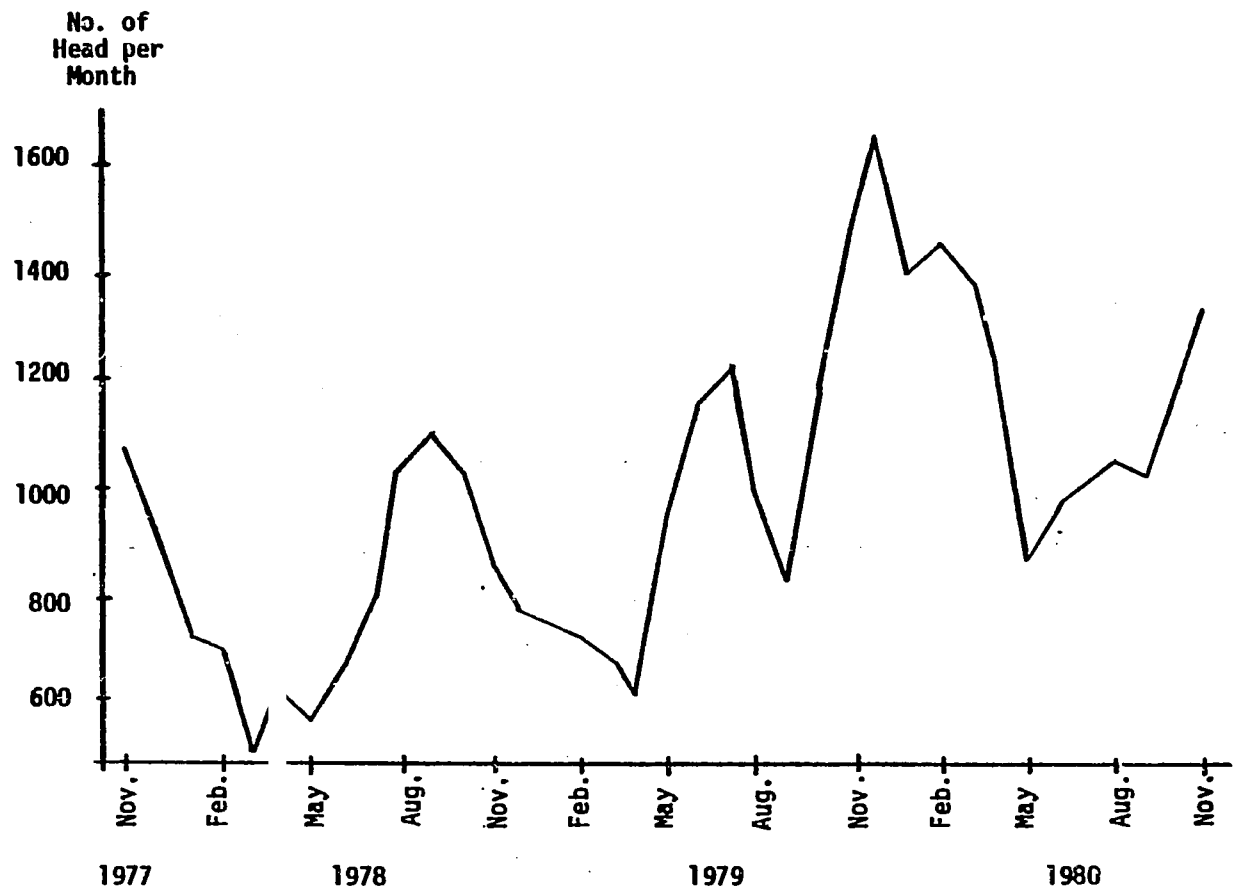
NUMBERS OF CATTLE AND SMALL RUMINANTS SOLD AT MAROUA, JULY 1977-DECEMBER 1980

	1977			1978			1979			1980		
	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats	Cattle	Sheep	Goats
January				1056	1276	707	855	1332	1466	1204	1862	1139
February				295	611	666	728	995	1139	1141	1745	1584
March				713	1854	2205	573	1635	1264	2041	1324	1550
April				514	659	680	707	1426	1426	993	2108	1638
May				658	896	1548	594	1389	1648	671	1436	1348
June				527	983	93	1592	1379	1648	954	1700	1648
July	7042	1565	966	807	1457	1641	1268	1033	2080	1292	1285	1170
August	6705	1139	993	1036	895	976	828	953	801	851	218	233
September	8876	2461	1119	1238	1646	1599	923	943	895	1015	1318	994
October	1444	2049	2780	1030	1291	985	733	2230	1048	n.a.	n.a.	n.a.
November	919	7633	2873	823	795	901	1885	4467	2345	1396	862	743
December	848	1344	1789	681	863	1770	1887	2377	1588	1427	1930	1249
Total	25,834	16,191	10,519	7,638	13,226	13,681	12,573	20,159	17,348	12,984	15,788	13,296

Source: Veterinary Center, Maroua.

FIGURE A3-4

MONTHLY CATTLE SALES AT MAROUA CATTLE MARKET, NOVEMBER 1977-NOVEMBER 1980



Note: The graph is a plot of three-month moving averages.

Maroua cattle market, which is rarely attended by butchers and farmers from the Mandara Mountains region, is affected principally by other factors, especially the relatively constant demand for beef in Maroua and the highly seasonal supply of Chadian trade cattle.

C. SUPPLEMENTARY RETAIL BEEF PRICE DATA

1. Retail Beef Prices at Mokolo, Soulede, Tourou and Gazawa, September 1980-March 1981

Consumer purchases of beef retailed at three markets in the Mandara Mountains region (Mokolo, Soulede and Tourou) and one market in the Diamare Plains (Gazawa) were weighed weekly over the course of seven months. Since most beef is sold bone-in, there were many more observations per week for beef with bones. In contrast, sales of beef without bones are rare, so there were few observations per week and several weeks where no observations were recorded. As a result, the data for beef with bones are more reliable, as the greater number of observations generally reduced the variance for each weekly set of data. Moreover, the data for beef without bones tend to show greater variance from week to week than do the data for beef with bones. Sales of offals are common at all the markets except for Soulede, where offals are mixed with beef with bones (forming a separate category). Usually a sufficient number of observations were obtained to generate reliable estimates of retail prices for offals.

Average weekly retail prices for the three different categories of beef were used to generate three-week moving averages. The analysis of the data showed that beef prices trended upward from September 1980 through March 1981 at Mokolo and Soulede. This trend was constrained by

price controls on retail beef sales at Mokolo. In contrast, the prices of beef with and without bones reached their highest levels in late November and early December at Tourou and Gazawa. Demand for beef was strongest during this post-harvest period, because farmers in the regions surrounding the markets had their highest disposable incomes of the year following crop sales (cotton around Gazawa and cowpeas, peanuts and sweet potatoes near Tourou).

Retail prices for offals did not follow quite the same pattern as did prices for beef with and without bones at Mokolo and Gazawa, whereas they clearly did at Tourou. Since retail sales of offals at Mokolo are not subject to price control, they varied little, ranging between 300 and 400 FCFA per kilogram. Offals' sales usually command a premium at Mokolo, as butchers try to compensate for the dampening effect of price controls.

2. Retail Meat Prices in Bamenda and Yaounde During the 1970s

Tables A3-14 and A3-15 illustrate retail meat price increases at Yaounde (the federal capital in Center South Province) and at Bamenda (the provincial capital of Northwest Province). Over the period 1977-1980, the price of beef with bones rose at an average annual rate of 11 percent in Bamenda and 15 percent in Yaounde. Both towns are far from Northern Province and thus the price data should be compared cautiously. However, the cattle and beef subsector in Northwest Province, which borders on Southeastern Nigeria, has been influenced by demand conditions in Nigeria in much the same way as the North. In the final analysis, retail beef price increases in the late 1970s in two major cities appear to have been quite moderate.

FIGURE A3-14

RETAIL PRICE INDICES AND RETAIL MEAT PRICES FOR AVERAGE AFRICAN FAMILIES AT YAOUNDE

Year	General Index[1] (1000)	Foodstuffs Index (336)	Meat and Fish Index (128)	Price of Beef With Bones in (FCFA per kg.)	% Change From Year to Year	Price Index (1971=100)	Deflated Price of Beef Without Bones (FCFA)[3]	Price of Beef Tripe (FCFA per kg.)	Price of Pork (FCFA per kg.)	Price of Live Chicken (FCFA)
1968	100.0	100.0	100.0	150	0	75	150	150	300	350
1969	101.0	100.1	101.4	150	28.0	75	149	150	300	350
1970	106.9	104.6	113.3	192	4.2	96	180	150	350	345
1971	111.3	116.3	115.7	200	2.0	100	180	150	350	350
1972	120.2	130.3	122.9	204	22.5	102	170	150	354	352
1973	132.7	142.1	146.4	250	6.8	125	188	150	508	380
1974	155.5	163.1	154.5	267	13.9	134	172	219	575	400
1975	176.6	188.3	190.0	304	19.4	157	172	250	600	500
1976	194.2	209.5	223.0	363	21.8	182	187	250	600	517
1977	222.4	258.5	259.1	442	10.4	221	199	333	600	625
1978	250.6	288.4	298.7	488	5.7	244	195	425	740	600
1979	267.1	302.3	327.2	516	30.8	258	193	483	775	600
1980	293.3	329.2	404.6	675		338	230	533	950	625
1981[2]				700				500	1000	750

[1]The weighting used in calculating the general price index is as follows: General Index = 1000; Foodstuffs = 336 (of which meat and fish = 128); Lodging = 163; Household Expenses = 146; Transportation = 105; Tobacco and Drinks = 103; Recreation = 51; Health and Hygiene = 50; Education Services and Miscellaneous = 46.

[2]The prices noted are for the months of January and February alone.

[3]The deflator is the general price index (Column 1)

Source: Direction de la Statistique et de la Comptabilité Nationale, Ministère de l'Economie et du Plan.

FIGURE A3-15

RETAIL BEEF AND PORK PRICES AT BAMENDA, 1971-1980 (FCFA PER KG.)

	Beef (Bone-in)				Beef (Boneless)				Intestines		Pork	
Year	Retail Price	Index[1]	% Change From Year to Year	Deflated Price	Retail Price	Index[1]	% Change From Year to Year	Deflated[2] Price	Retail Price	Index[3]	Retail Price	Index[1]
1971	162	100		162	191	100		191	---	---	192	100
			-3.8				1.0					
1972	156	96		144	193	101		179	---	---	199	104
			-3.2				4.1					
1973	151	93		127	201	105		169	138	100	201	105
			19.9				3.5					
1974	181	112		129	208	109		149	169	122	213	111
			37.6				35.6					
1975[4]	249	154		157	282	148		177	---	---	---	---
			20.5				24.1					
1976[5]	300	185		171	350	183		200	---	---	---	---
			19.0				25.1					
1977	357	220		168	438	229		219	284	206	475	247
			8.7				3.0					
1978	388	240		172	451	236		200	361	262	510	266
			15.2				8.2					
1979	447	276		186	488	255		203	385	279	525	273
			8.5				17.8					
1980	485	299		184	575	301		218	478	346	525	273

Source: Ministry of Economics and Planning, Provincial Office of Statistics, Northwest Province, Bamenda; Ministère de l'Economie et du Plan, Direction de la Statistique et de la Comptabilité Nationale, Yaounde

Retail prices are simple (unweighted) averages of bimonthly observations.

[1]The 1971 retail price equals 100. Retail prices for all other years is expressed as a percentage of the retail price.

[2]The index of consumer prices in Yaounde (Moderate-Income Cameroonian Families) is used as the deflator.

[3]The 1973 retail price equals 100.

[4]The 1975 prices are based on figures collected during the first five months of the year.

[5]No prices were collected by the Provincial Office of Statistics in Bamenda during 1976, as all available staff were collecting and analyzing census data. The beef prices were drawn from the Annual Report for Northwest Province, Ministry of Animal Breeding and Industries (p. 30).

The most rapid beef price increases took place during the years 1974-1977 in Bamenda and Yaounde. The retail price of beef with bones nearly doubled in this period, increasing at an average annual rate of 25 percent at Bamenda and 18.5 percent at Yaounde. The deflated price of beef with bones rose from 129 FCFA to 171 FCFA per kilogram at Bamenda (using 1971 as the base year) and from 172 FCFA to 199 FCFA per kilogram at Yaounde (using 1968 as the base year).

ANNEX 4

COMPARISON OF HOUSEHOLDS OWNING CATTLE AND HOUSEHOLDS WITHOUT CATTLE

The differences between cattle owning households and households not owning cattle are more marked at Magoumaz than at Mavoumai. Cattle owning households own significantly more small ruminants (11.5) than non-cattle owning households (6.1) at Magoumaz, whereas the difference is less significant at Mavoumai (8.7 vs 5.7). In addition, cattle owners at Magoumaz are more apt to entrust their small ruminants to members of the extended family or friends than households that own no cattle. While nearly 10 percent of the small ruminants owned by cattle-owning households are entrusted, only 3 percent of the goats and sheep owned by households without cattle are entrusted. At Mavoumai an average of 7 percent of the small ruminants are entrusted for both cattle owning and non-cattle owning households. Cattle owners at Magoumaz tend to entrust a larger proportion of their small stock then non-cattle owners, because they have greater livestock holdings and hence greater rainy season labor requirements for cutting and carrying grasses and hauling water. Open range for grazing livestock is not available around Magoumaz, unlike Mavoumai, where additional livestock can be herded by children near the village. Finally, the calculation of total ruminant numbers shows that cattle-owning households at Magoumaz and Mavoumai own three times as much ruminant livestock as households without cattle.

TABLE A4-1

LIVESTOCK HOLDINGS FOR HOUSEHOLDS OWNING CATTLE AND HOUSEHOLDS NOT OWNING CATTLE AT MAGOUMAZ AND MAVOUMAI

Village / Village Subcategory	Number of Households	Stall-Fed Cattle		Range-Fed Cattle		Entrusted Cattle		Goats		Sheep		Entrusted Small Ruminants		Chickens		Total Ruminant Units[1]	
		Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Magoumaz																	
Stall-Fed Cattle Owners	33	1.4	.1	0.2	0.1	0.2	0.1	8.7	1.3	2.1	0.5	0.9	0.3	21.9	2.8	2.4	0.2
Non-Stall Fed Cattle Owners	77	0	-	0.1	.04	.03	.03	6.1	0.7	0.6	0.2	0.3	0.1	20.0	2.0	0.9	0.1
Cattle Owners	40	1.1	0.1	0.4	0.1	0.2	0.1	9.7	1.3	1.8	0.5	1.0	0.4	22.7	2.8	2.4	0.2
Non-Cattle Owners	70	0	-	0	-	0	-	5.3	0.6	0.8	0.2	0.2	0.1	19.3	2.0	0.7	.07
Mavoumai																	
Stall-Fed Cattle Owners	36	1.1	.05	.06	.06	0.1	0.1	5.1	0.8	2.0	0.5	0.3	0.2	18.1	2.1	1.7	0.1
Non-Stall Fed Cattle Owners	276	0	-	0.1	.02	.03	.01	4.1	0.3	1.6	0.2	0.4	0.1	16.8	0.8	0.7	.04
Cattle Owners	58	0.7	.08	0.5	.08	0.2	0.1	4.5	0.6	2.3	0.4	0.3	0.1	17.9	1.5	1.6	0.1
Non-Cattle Owners	254	0	-	0	-	0	-	4.1	0.3	1.5	0.2	0.4	0.1	16.4	0.8	0.7	.04
Both Villages																	
Stall-Fed Cattle Owners	69	1.1	.06	0.1	.05	0.2	0.1	6.8	0.8	2.1	0.4	0.6	0.2	19.9	1.7	2.0	0.1
Non-Stall Fed Cattle Owners	353	0	-	0.1	.02	.03	.01	4.5	0.3	1.4	0.1	0.4	0.1	17.5	0.7	0.8	.04
Cattle Owners	98	0.8	.07	0.4	.06	0.2	0.1	6.6	0.7	2.1	0.3	0.6	0.2	20.7	1.5	2.0	0.1
Non-Cattle Owners	324	0	-	0	-	0	-	4.4	0.3	1.3	0.1	0.4	0.1	17.0	0.7	0.7	.04

Source: Census of Households at Magoumaz and Mavoumai.

Note: S.E. is the standard error.

[1]Total Ruminant Units = (No. of Cattle/1.43) + (No. of Small Ruminants/8.33).

ANNEX 5

THE SEMRY PROGRAM FOR INTENSIVE CATTLE PRODUCTION

A. FEEDLOT TRIALS

The Livestock Division of SEMRY has conducted feeding trials for several years at a well-equipped livestock farm at Yagoua. Cattle are enclosed in a feedlot and fattened over a 90 to 100 day period on a ration consisting of rice bran, flour and straw, cottonseed cake, calcium, salt and cut forage. The director of the Livestock Division reports that the best and most economical ration for intensive cattle production is one comprised of 66 percent rice bran, 28 percent rice flour, 4 percent cottonseed cake, 1.5 percent calcium and 0.5 percent salt. This is supplemented with 1.5 kilograms of rice straw per day. The cattle consume an average of 10 kilograms of feed per day, resulting in a daily rate of gain of 800 to 1,200 grams. Over the course of 90 to 100 days, then, cattle gain 80 to 120 kilograms, entering the embouche at an average weight of 250 kilograms and leaving it at an average weight of 350 kilograms.

The fattened cattle, which were acquired at an average price of 47,500 FCFA in December 1980, were selling at 190 FCFA per kilogram liveweight in March 1981, fetching an average of 66,500 FCFA per head.[1] Therefore, the cattle increased in value by an average of 19,000 FCFA

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[1]At the end of February 1981, SEMRY sold 20 head of cattle to a local merchant who trucked the fed-out animals to Bogo for resale. The cattle weighed an average of 396 kilograms and sold for an average of 74,879 FCFA per head. Hence, the merchant paid 188 FCFA/kg. for the live cattle.

during the three month period. The cost of the feed was 8,960 FCFA per head in early 1981, and the opportunity cost of the capital invested and the working capital was 3,074 FCFA over the three month period (assuming a 10 percent annual discount rate). Veterinary services and livestock housing are not included in the calculation of costs, nor is the value of manure produced by cattle included in the calculation of benefits. Assuming that these costs and benefits are offsetting, the return to the feedlot's labor and management was 6,966 FCFA.[2]

B. EXTENSION OF INTENSIVE CATTLE FEEDING TO SMALL FARMERS

Although SEMRY has kept detailed records of cattle weights, average daily rates of weight gain, and acquisition and sale prices for cattle fattened at the SEMRY livestock farm, the economic viability of smallholder production has not yet been assessed. Attaining feedlot rates of gain is difficult for small farmers, who have only been recently introduced to intensive feeding of enclosed cattle using agro-industrial by-products. The SEMRY Livestock Division was monitoring the progress of the 20 head of cattle that were being fed rice by-products by 18 farmers near Yagoua during the dry season of 1981. During this first round of extension trials, SEMRY was charging the 18 farmers only 660 FCFA per 70 kilogram sack of rice bran, which covered production but not transport costs. An extension agent from the livestock farm was visiting each farmer weekly to observe the cattle, treat animal health problems, record the quantities of rice flour fed to the animals, and report

[2]This assumption is perhaps not realistic. It may be that the manure has a sufficiently high value to more than offset veterinary and housing costs. We retain the above assumption for simplicity, however, and because the cost of transporting the rice bran was not included in the cost of the purchased input.

participants' complaints and problems. The Director maintains that this type of close supervision is essential to the success of any intensive cattle production scheme, where a new feeding technology is being introduced. The SEMRY example should be highly instructive to FONADER in trying to implement the stall-feeding credit scheme of the Mandara Mountains region.

Inspection of some of the cattle that were being fattened by small farmers showed that the SEMRY extension program was quite successful. This success can be attributed primarily to excellent veterinary services, careful supervision of farmers' feeding regimes, and improved husbandry practices for the enclosed cattle. In the absence of similar levels of supervision and veterinary care, it is unlikely that feedlot rates of gain and returns could be obtained.

C. POTENTIAL MARKETS FOR CATTLE RAISED INTENSIVELY IN NORTHEASTERN CAMEROON

Demand for cattle fattened on rice milling by-products is presently constrained by the low urban population of the rice-producing region. According to the 1976 census, the principal town, Yagoua, has a population of 14,034. Furthermore, Yagoua butchers obtain a large proportion of their slaughter cattle from Chad, which is less then ten kilometers away. During the first four months of the dry season these range-fed Chadian cattle are in good condition, and they are usually cheaper than the cattle fed on rice by-products around Yagoua. The returns to intensive production of cattle are usually highest if the cattle are bought at low prices prevailing in the well-supplied cattle markets at the beginning of the dry season, fattened for three to four months and then

sold at the end of the dry season or early in the rainy season when butchers have difficulty procuring cattle for slaughter.

Other potential markets for cattle fattened on rice by-products around Yagoua are large towns such as Maroua and Garoua. The distance from Yagoua to Maroua (109 km) is too great to permit trekking of fattened cattle during the period of greatest nutritional stress (April-June) without considerable weight loss. Presently the roads between Yagoua and Maroua are close to impassable during the rainy season and barely adequate during the dry season. In the absence of road improvements, trucking is not considered feasible by most traders. One Yagoua rice merchant who owns several trucks did, however, truck 20 head of fattened cattle from Yagoua to the Bogo cattle market during the dry season of 1981. Although no return data are available, the director of the feeding trials at SEMRY claimed that the merchant wanted to buy another 20 head for a second trip to Bogo.

The Livestock Division director of SEMRY said that intensive cattle feeding using rice milling by-products will be cautiously promoted as more area is put under rice cultivation in Northeastern Cameroon during the next few years. He considers Maroua, Garoua and Nigeria to be the best potential markets, provided transportation difficulties can be overcome. Without any assurance of a market for fattened cattle, he is reluctant to expand SEMRY's livestock feeding and extension operations to any great extent.

ANNEX 6

EXTENSIVE CATTLE PRODUCTION IN THE MANDARA MOUNTAINS REGION

A. FULANI LIVESTOCK PRODUCTION

The predominant mode of livestock production in many areas in Northern Cameroon is extensive cattle production practiced by traditional Fulani herders. In the Mandara Mountains region the Fulani are concentrated on the plateau to the east, west and south of Mokolo during the rainy season. There are also herders in the plains north of Koza and east of Meri. Once the rains cease and rainy season water supplies dry up, most of the Fulani transhume to the plains north of Koza that extend toward Mora and Nigeria or to grazing areas in the Diamare Plains between Mokong and Gazawa and to the east of Meri.

Fulani herders who take their herds on transhumance during either the rainy season or the dry season but who maintain a permanent base are said to be semi-sedentary. Herders who keep their cattle near their permanent base during the entire year are classified as sedentary. There are very few nomadic Fulani in the Mandara Mountains, although nomads occasionally pass through grazing areas in the Mandara region when they are migrating north with the onset of the rains or south in search of dry season pasture.[1]

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[1]See Derrick Stenning, Savannah Nomads: A Study of the WoDaaBe Pastoral Fulani of Western Bornu Province, Northern Region, Nigeria, Oxford University Press, London, 1959; and J. G. T. van Raay, Rural Planning in a Savanna Region, Universitaire Pers Rotterdam, 1974, for useful taxonomies of Fulani pastoralists.

In contrast to mixed farmers who stall-feed cattle for beef and manure production, the Fulani cattle herders raise cattle essentially for dairy production. Dairy products are the basis of the Fulani diet and household economy. Fulani women exchange sour milk and butter for grain, cowpeas and condiments, or they sell these dairy products to acquire cash in order to buy foodstuffs. Cattle are rarely sold, and usually old, no longer reproducing cows or inferior young bulls are culled for sale. Severely weakened and diseased stock is also sold to avoid financial loss.

From September 1980 to January 1981, 37 single interviews were conducted with traditional herders located on the plateau to the west, south and east of Mokolo. Twenty-four of the herders interviewed go on transhumance during the dry season when the water supply is inadequate on the plateau. These semi-sedentary herders head for the pastures and more abundant water resources of the Koza, Mora, Mokong and Meri plains beginning in November. They then return to the plateau near Mokolo in June with the first rains and subsequent pasture regrowth.

Nearly two-thirds (24 to 37) of the herders interviewed cultivate some crops. They usually employ day-laborers from neighboring agricultural groups (such as the Mafa) to plant, weed and harvest sorghum and maize. These seasonal laborers receive a daily wage of approximately 300 FCFA, which is similar to the rate reported in interviews with farmers in the intensive survey. The grain harvest is rarely adequate to satisfy herders' needs for an entire year; herders reported that the crops harvested fed the households for two to six months. During the rainy season the Fulani obtain grain through sales of dairy products. At other times they must cull cattle in order to acquire grain.

Although the Fulani raise cattle primarily for dairy production, they are well aware of the value of cattle manure as a fertilizer. At the end of a day's grazing, the cattle are enclosed in kraals at night. As a result, cattle droppings are concentrated in a circumscribed area. The thorn enclosures are periodically moved for animal health as well as soil fertilization purposes. Consequently, a sizeable land area is heavily manured. This land is usually cultivated during the following rainy season.

Settled agriculturalists are, of course, well aware of the value of well-manured soils, which can lead to problems when they cultivate areas where herders have camped in previous years. The Fulani usually regard such practices as farmer encroachment, and they tend not to be as careful in controlling their cattle near fields in areas formerly reserved for grazing. What the Fulani view as encroachment may be necessary resettlement in the minds of Mafa farmers, who are compelled to leave heavily populated, overly cultivated hillsides for available farmland on the plateau or in the plains. These sorts of pressures have led to acrimony and litigation in several instances, most notably and recently in areas formerly reserved for grazing near Ziling, Biskavai and Mouhour.[2]

In areas where herders and farmers live side by side, it is not uncommon for farmers to invite herders to graze cattle on the crop stubble after the harvest. The Fulani often receive meals and gifts of grain in exchange for manuring farmers' fields. In addition, farmers

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[2]See James C. Riddell, Land Tenure and Access to Land in the Marqui-Wandala Project Area, Mandara Mountain Research Report No. 3, June 1980; and David J. Campbell, Soils, Water and Land Use in the Mandara Mountains of North Cameroon, Mandara Mountain Research Report No. 15, March 1981.

in these villages often entrust cattle to the Fulani, who receive grain or cash payment at the end of the growing season for their services. When wealthier farmers who own one or more cows entrust their cattle to the Fulani, the herders usually have the right to use the cow's milk. In these instances payment in kind occurs over the long run. The herders usually are able to keep every second or third calf produced by the cow(s), or they have the right to retain a young bull for every six months of service. These types of entrusting arrangements and means of payment are common to most of West Africa.[3]

Although settled farmers such as the Mafa occasionally buy sour milk and butter from the Fulani or give them grain or cowpeas in exchange for dairy products, they rarely buy cattle from the Fulani. In Mavoumai five of the twenty-two farmers in the sample of stall-feeding households bought their most recently owned bulls from local herders. In contrast, none of the farmers in the sample of thirty households at Magoumaz acquired their bulls for stall-feeding from Fulani herders in the Mandara Mountains. In the latter village geographic isolation is responsible for no transactions between farmers and herders. Magoumaz is at least ten kilometers from the nearest Fulani grazing areas. Few of the farmers have any opportunity to interact with herders, and Fulfulde is spoken mainly by local small-scale butchers and traders and rarely by farmers.

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[3]The anthropological literature on the Fulani and their relations with settled farmers in the savannah and sahelian regions of West Africa is vast. See Stenning, Hopen, La Croix, Dupire, Gallais, Swift, and others for detailed descriptions of reciprocal rights and obligations under livestock entrusting arrangements.

In addition to buying young bulls for stall-feeding, mixed farmers occasionally buy heifers or cows from the Fulani. The herders are usually reluctant, however, to sell good breeding stock. Instead, they sell old cows, cows whose calves die, or diseased heifers and cows to local butchers. Bulls and steers are sometimes sold to traders.

B. NON-FULANI EXTENSIVE LIVESTOCK PRODUCTION

Cattle are also extensively raised by the Kapsiki, the Bana, the Mandara, the Guiziga and other ethnic groups on the plateau and in the plains of the Mandara Mountains region. Mixed farmers regard cattle as an inflation-proof store of wealth. Unlike poultry and, to some extent, small ruminants, relatives and friends cannot make demands upon cattle, which are highly illiquid. Cattle are often used in acquiring wives, who represent additional farm labor power, social status, and a long-run insurance policy in that women are able to produce children who will care for their parents when the latter become old.

The extensive survey data in Table 3-10 shows that cattle holdings are on the average far greater for households on the plateau (5.2 head per household) and in the plains (2.6 head per household) than for those in the mountains (.2 head per household) and in the piedmont (.5 head per household). Data on livestock holdings for households randomly selected for the intensive survey, shown in Table A6-1 also support this finding. Range-fed cattle are more commonly owned in the villages on the plateau (Roumzou, Ouda) or in areas adjacent to the plateau (Ldama), where land holdings are greater and adequate pasture is available. The total value of crop production is also higher in villages where more land is available. In order to acquire assets such as cattle, farm

TABLE A6-1

CATTLE HOLDINGS,[1] LAND HOLDINGS AND TOTAL VALUE OF CROP PRODUCTION IN THE FIVE VILLAGES IN THE INTENSIVE SURVEY

Village[2]	Geographic Region	Ethnic Group	June 1980		February 1981		Average[3] Land Holdings (ha.)	Number of Households for which Fields Measured	Average[4] Value of Total Crop Production (FCFA)	Average[5] Household Income Plus Home Animal Consumption
			Number of Cattle Owning Households	Average Number of Cattle per Owner	Number of Cattle Owning Households	Average Number of Cattle per Owner				
Roumzou	Plateau	Kapsiki	14	3.3	12	2.8	2.7 (.6)	8	180,307	91,122
Ouda	Plateau	Bana	16	9.3	11	8.8	2.8 (.5)	8	109,863	93,313
Ldama	Mountains-Plateau	Mafa	15	2.9	12	3.6	2.8 (.3)	23	103,864	82,883
Madakonay	Mountains	Mafa	5	1.4	3	2.3	1.3 (.2)	10	55,728	18,323
Manguirda	Mountains	Mofou	5	1.2	5	1.8	1.4 (.3)[7] 0.8 (.2)[7]	8 6	74,363	51,516
Magoumaz[6]	Mountains	Mafa	5	1.0	30	1.6	1.2 (.2)	6	66,375[8]	101,273[9]
Mavoumaï[6]	Mountains-Plateau	Mafa	n.a.	n.a.	22	1.4	n.a.	0	42,079[8]	78,792[9]

[1]This includes all types of cattle: range-fed cattle, oxen and stall-fed cattle.

[2]There are 24 randomly sampled households in each village, except for Magoumaz (8,30) and Mavoumaï (22).

[3]The figures in parentheses are standard errors.

[4]The value of crops produced by each household was calculated using average wholesale prices over a six-month pre-harvest and post-harvest period (September 1980-February 1981).

[5]This represents household income from July 1980 through February 1981 from sales of crops, livestock, sorghum beer, prepared food and labor services. Income from commercial activities is also included. In addition, livestock slaughtered for household consumption was valued and included in the total.

[6]The June 1980 cattle estimates for Magoumaz are actually the extensive survey figures for early May 1980. The February 1981 estimates of cattle holdings were obtained from the survey of stall-feeding households at Magoumaz and Mavoumaï.

[7]The first figure for land holdings in Manguirda is for cotton-growing households with land in the plains, while the second figure is for non-cotton growing households.

[8]This is the average value of sorghum production for the households in the survey at Magoumaz and Mavoumaï for the 1980 cropping season.

[9]This is the average value of livestock sales and consumption, including consumption of meat from dead animals for the households in the survey at Magoumaz and Mavoumaï. The data were obtained for the period July 1980 through February 1981. Farmers estimated the market value of beef and small ruminants consumed by the household.

households have to produce agricultural surpluses that can be sold and converted into livestock. Finally, cattle holdings, land areas, the value of crop production and household income are highly correlated, as suggested by Table A6-1. The average household income plus home animal consumption for Manguirda is higher than expected, given the average land holdings and value of crop production. This is because cotton is an important cash crop (that is not grown in the other villages), from which earnings averaged 14,565 FCFA across cotton-growing as well as non-cotton growing households. In addition, average wage-labor income is exceptionally high in Manguirda (17,575 FCFA per household). There are opportunities for seasonal agricultural wage labor (in the plains to the east) and dry season wage labor (in Maroua) that are not as readily available to households in more isolated areas of the Mandara Mountains, such as Madakonay.

C. TECHNICAL ASPECTS OF FULANI CATTLE PRODUCTION ON THE PLATEAU NEAR MOKOLO

Single visit interviews were conducted with 37 Fulani herders on the plateau areas to west, south and east of Mokolo from September 1980 through January 1981. In addition to posing general questions about transhumance, relations with agriculturalist groups, dairy herding and problems facing herders, we inquired about herd composition, cattle flows, and the reproductive performance of selected cows in the herd.

Data on herd composition, based upon what herders reported, were collected at the close of each interview. These data are shown in Table A6-2. Calves are defined as cattle under one year of age. Young bulls are immature bulls that are not yet capable of reproducing, while

TABLE A6-2

HERD SIZE AND COMPOSITION FOR 38 CATTLE HERDS AROUND MOKOLO[1]

Category	Total Number (all herds)	Average Number by Herd	Percentage of Total Number of Cattle	Composition[2] of Regional Cattle Herd
Male calves	262	6.9	11.7%	8.1%
Female calves	283	7.4	12.6%	8.1%
Young bulls	206	5.4	9.2%	15.1%
Heifers	300	7.9	13.4%	22.5%
Bulls	111	2.9	4.9%	1.2%
Cows	1,082	28.5	48.2%	45.0%
Total	2,244	59.1	100.0%	100.0%

Sources: Survey of cattle herders around Mokolo, August 1980-January, 1981. Recueil Statistique de la Production Animale, S.E.D.E.S., République Française, Ministère de la Coopération, Paris, 1975, p. 837. The estimates of the cattle herd composition in Northern Cameroon were first reported in Lacrouts, M. and Sarniguet, J., Le cheptel bovin du Cameroun, exploitation, commercialisation, perspectives d'avenir, Ministère de la Coopération, Paris, 1965.

[1]One of the cattle owners surveyed had two cattle herds. He reported herd size and composition for each herd.

[2]This column of percentages shows the composition of the regional cattle herd of Northern Cameroon during the early 1960s.

heifers are young cows that have not yet calved. Bulls and cows are fully mature cattle.

The data on herd composition clearly illustrate the importance of dairy production in traditional cattle husbandry. Sixty-four percent of all the cattle are female, while 81 percent of the cattle over one year of age are female. The proportion of cows (48 percent) in cattle herds around Mokolo appears to be somewhat high, while the proportion of heifers (13 percent) is clearly too low. This is probably due to the

fact that herders may have classified some pregnant heifers as cows. There are very few bulls on average per herd, as herders tend to keep only the best animals for reproduction. Inferior stock is culled at a young age.

We were unable to follow the 38 cattle herds over an extended period, so we lack precise flow data on cattle mortality, fecundity, sales, purchases, gifts, and slaughter. We did ask herders questions about cattle flows during the previous year, however. Recall data over a long reference period are subject to recall errors and telescoping of events, so they have to be interpreted cautiously. Some tentative conclusions can be drawn, however, from these data.

After making adjustments for cattle flows during the preceding year, it was found that an annual average of 1,134 cows were owned.[4] These 1,134 cows gave birth to 617 calves, yielding a calving rate of 54 percent over the course of the year. This is a low calving rate, but is is not implausibly low, given the poor nutrition prevailing during the dry season.[5] During the preceding year, 70 of the 617 calves (11 percent) died or were slaughtered as a precaution as they were on the verge of dying. The Fulani are Moslems and therefore not permitted to eat meat from dead livestock. By carrying out precautionary slaughter,

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[4]Annual Average = (No. of cows at time of interview + No. of cows one year before the interview)/2. No. of cows one year before the interview = No. of cows at time of interview + Total outflows of cows during the preceding year - Total inflows of cows during the preceding year.

[5]See G. Williamson and W. J. A. Payne, An Introduction to Animal Husbandry in the Tropics, Longman Group, Ltd., London, Third edition, 1978, pp. 331-333.

they can carry out the traditional Moslem last rites and either consume or sell the meat. The mortality rate for cattle over one year of age was far lower (6 percent) than the rate for calves, since the older animals have more strength and resistance and are hence less vulnerable to disease.

During the interviews, herders were asked to select several of the cows in their herds and give their reproductive histories. Data regarding age at first calving, calf mortality, calf feeding practices and the age of calves at weaning, were thereby obtained. The average age at first calving was greater than five years, which is higher than usual, even for semi-arid regions.[6] This is probably due to recall error, although the long periods of nutritional stress during the late dry season and early rainy season (March-June) may be responsible in part for such a high reported age at first calving. Among the 310 calves for which there are data 47 or 15 percent died, which is a mortality rate for calves as well as cattle more than a year old. Since a good number of the calves in the samples were less than a year old at the time of the interviews, the mortality figure of 15 percent should be viewed as a conservative estimate. It is likely that some others may have died after the interviews. The average age of the calves at weaning was nine months. Most herders do not feed concentrated feedstuffs to their calves, but it is interesting to note that 36 of the calves did receive cottonseed cake during periods of nutritional stress. Some of the semi-sedentary herders transhume to cotton-growing plains areas

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[6]See F. M. El Amin, "Age at First Calving: A Short Review of Published Studies in European and Zebu Cattle," World Review of Animal Production, Vol. 12, No. 4, 1976; and G. Williamson and W. J. A. Payne, op. cit., pp. 214-215.

during the dry season, where it is possible to buy cottonseed cake in limited quantities from SODECOTON posts.

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