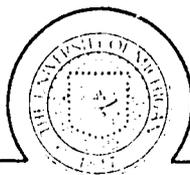


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CENTER FOR RESEARCH ON ECONOMIC DEVELOPMENT
The University of Michigan
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LIVESTOCK AND MEAT MARKETING IN
WEST AFRICA PROJECT

THE STRATIFICATION OF LIVESTOCK PRODUCTION
AND MARKETING IN THE ZINDER
DEPARTMENT OF NIGER

by

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PREFACE

This paper examines the stratification of livestock production and marketing in the Zinder Department of Niger. It is a part of the studies on the livestock and meat marketing system in central West Africa conducted by the Center for Research on Economic Development at the University of Michigan, under the sponsorship of the Regional Economic Development Services Office, West Africa (REDSO/WA) of the United States Agency for International Development (USAID). The original report, which this paper summarizes, contains the actual data, a detailed methodology, and a discussion of policy issues.

Five other volumes have previously appeared under the first phase of this project, covering the livestock trade flows linking Mali and Upper Volta with the coastal states between Liberia and Benin. This study looks farther east to the cattle market in Niger, and addresses several specific issues associated with cattle fattening and growing-out carried out by small farmers in the agricultural belt in southern Niger, in the department of Zinder. The economic feasibility of small-scale fattening is an essential condition for the potential stratification of cattle production in Niger into predominantly breeding and fattening zones. Earlier experiences in large-scale feedlot-type fattening in Nigeria and elsewhere in West Africa have proven financially unviable. Recent developments in southern Niger and northern Nigeria indicate that there is indeed an on-going integration of livestock fattening activities by farmers. This study by Randall Thomas provides factual evidence, accumulated over an 18-month period, of the profitability and potential of small-holder fattening programs in southern Niger, and points out constraints and conditions under which their potential is limited. Livestock development in Niger will be enhanced by encouraging farmers to expand these activities further. Prospects for successful replication of similar schemes elsewhere in the southern Sahelian regions seem promising.

Cooperation from two organizations in carrying out this study requires special acknowledgement: INRAN (Institut National de Recherches Agronomiques du Niger) in Niger, provided the institutional and logistical support for Randall Thomas while in Niger; several USAID officers personally participated in the design and supervision of the fieldwork, in particular Muri Baker in Niamey, and Tridji Mukherjee and Gordon Evans in Abidjan.

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September 1982

Edgar J. Ariza-Niño
Project Director

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ABSTRACT

Southeastern Niger's distinct climatic and geographical zones have the potential for regional specialization in livestock production. An arid northern region which is suitable only for rainy season grazing, a wetter southern area which can support year-round livestock production, and an Intermediate zone which is useful primarily for the growing-out of cattle, comprise the three major production zones. This paper examines the existing degree of specialization of production in the southern and intermediate zones.

Primary data collection was conducted in the Zinder Department of Niger from 1979-1981. Farm management survey techniques were used to collect information on labor, land, capital, budget, and management variables for the analysis. Agricultural production functions, linear programming models of small mixed farms, and social benefit-cost analysis of a government-financed cattle fattening project, comprise the three major analytical tools applied to these data.

The main finding of this paper is that small mixed farms are an economically viable system of livestock and crop production that should serve as the basis for the further development of these activities in the Department of Zinder in Niger. The existing production and marketing system operates efficiently in performing the stratification of livestock production, although the growing-out and breeding operations are currently performed by the same groups. Cattle fattening and breeding/growing-out operations are well integrated at their existing levels of operations, though there are questions remaining about how large these operations could become without causing shifts in the structure of cattle and feedstuff prices.

The other principal results of this work are: (a) that the government-financed cattle fattening project is privately and socially profitable; (b) that small farmers use their resources in an efficient fashion with little additional output possible from a reallocation of these resources; and (c) that cattle breeding/growing-out activities could be expanded through the extension of government credits to farmers for the purchase of additional cattle. These results are used in developing a set of policy recommendations for improving the existing project's structure and implementing new programs for further encouraging the stratification of livestock production and marketing in the Zinder Department of Niger.

INTRODUCTION

Livestock exports are very important foreign exchange earning activities for the inland West African countries of the Sahel: Niger, Mali, Chad, and Upper Volta. These countries send large numbers of cattle, goats and sheep to the coastal consuming countries of Ivory Coast, Nigeria, Togo, Senegal and Benin. The currency earned from this trade helps the inland countries to finance needed imports.

These exports are frequently interrupted by periods of severe drought in the inland countries. Most recently, the prolonged drought of the late 1960's to early 1970's resulted in large losses to these nations' herds and a temporary breakdown in traditional exporting patterns. The economic dislocations related to these rapidly shifting export trends are the cause of tangible concern among officials of the Sahelian countries and international aid agencies.

Attention is focused principally on three crucial economic variables: (1) consumer's taste for red meat, (2) the marketing of livestock, and (3) new production systems for livestock. After the drought period, consumers' spending patterns are thought to have been affected by the relative scarcity and high cost of red meat. Large influxes of cheap South American meat products were observed in the coastal countries, causing much alarm that the market for live-animal exports was drying up. However, as the inland countries' herds have recovered the previous levels of production and the world surplus of beef has been reduced, these imports have receded rapidly. Furthermore, the demand for red meat is predicted to exceed potential supplies in the near future. This trend has caused a shift of concern toward improving the livestock production and marketing systems of the Sahelian countries.

Although there are some regional differences in how livestock are marketed in the Sahel, there are many similarities. Livestock marketing chains run from the northern producing countries down into the southern coastal consuming nations. Primary collection markets, located in and around the major livestock producing regions, are the centers for great numbers of purchases and sales. Large herds are assembled at these markets to begin the long trek to their final destination. This journey can be by any combination of foot, truck, or train.

During the last drought and in the recovery years immediately following it, there was concern that livestock markets were somehow monopolized by the merchants buying animals and that herders were receiving less than a fair price for their animals. Collusive arrangements between market intermediaries, or excessive concentration of buying power, were frequently cited as major obstacles to the development of this

sector. Furthermore, it was thought that the transportation costs involved in getting animals from the Sahelian countries to the coastal nations were excessively high.

Many of these problems were blown out of proportion by the pressures on public officials to find explanations for the disasters arising from the prolonged drought conditions. Later economic research shows that markets are generally competitive, that the profit margins of intermediaries are not excessive, and that transportation systems, while in need of some improvements, function relatively well. With these findings, more effort will be directed toward production issues.

Traditionally, livestock raising in most areas of the Sahel is an extensive grazing system. Most of the national herd are in the hands of transhumant, or mobile, groups who lead their animals over large areas in search of sufficient pasture and water supplies. In good years, when rainfall is plentiful, there is sufficient forage and water for everyone, and the herds expand. Thus, a period of several consecutive, above average rainfall years would lead to large increases in the herds of the inland countries. This pattern has been observed immediately prior to the severe droughts mentioned above.

With herd sizes swollen, even mediocre rainfall levels means shortages of feedstuffs for these increased numbers of animals. Severe drought, however, spells disaster. During the most severe years of the last drought, thousands of animals died. Many families lost their entire herds. Other households were forced to sell their animals at a fraction of their predrought values. Sedentarized farmers with sufficient capital and feedstuffs bought entire cattle herds for next to nothing which lead to a shift in herd ownership away from nomadic groups towards mixed farmers.

In the aftermath of this calamity, a search began for new types of livestock marketing and production systems that could better withstand a periodic recurrence of severe drought. A plethora of livestock projects, country strategies, and long-term plans address these concerns. This paper concentrates its analysis on the evaluation of one country's version of a popular proposal -- the livestock stratification scheme adopted by Niger.

The salient feature of this strategy is that it divides Niger into several geographic regions and devotes each of these areas to a specific type of production. It is most clearly elaborated for cattle. Three zones of production are defined: (1) a Pastoral zone, where herders will concentrate on raising young animals; (2) Intermediate zone, which will encompass all of the cattle growing-out enterprises; and (3) a Fattening zone for the final finishing of cattle before their export. The marketing chain is delegated the task of connecting these zones and insuring that adequate supplies of cattle move from one area to the next in the system.

This paper examines this proposal and its current level of implementation. First, some background information on Niger is presented to familiarize the reader with this region. Then, an overall picture of the livestock stratification scheme is given, followed by discussions of the individual regions involved. These sections look at the hypothetical function of these regions and the degree to which the projects within them have been implemented. The scope of the analysis is restricted to the Zinder Department of Niger because of limitations on the data collection.

Having described the overall strategy, the last section focuses on evaluating its different aspects. In particular, the growing-out and fattening zones are examined. A summary of a larger research project's results are used in this analysis.¹ The paper concludes with some policy recommendations for improving the design of existing and proposed programs.

¹See Randall Thomas-Peterhans. The Stratification of the Production and Marketing of Livestock in Southeastern Niger in the Department of Zinder, Ann Arbor: CRED, University of Michigan, forthcoming 1982. This paper is adapted from the larger CRED document.

SECTION I

NIGER

Niger is a completely landlocked country, bordered on the south by Nigeria, Benin and Upper Volta, on the north by Mali, Algeria, and Libya, and to the east by Chad (see Map 1.1). Most of the northern regions of the country lie within the Saharan Desert, with just thirty million of the nation's one hundred and twenty-six million hectares of land classified as potentially useful.¹ Furthermore, only fifteen of these thirty million hectares are considered arable.²

Eighty-eight percent of the population of Niger lives in the countryside.³ These people are primarily engaged in either agriculture, or livestock herding, to earn their livelihood. The remainder of the population resides in urban areas and engages in trade, government services, manufacturing, or other activities.

Agriculture is concentrated in the southern quarter of the country, where rainfall levels are high enough to support crops during four to five months of the year. These crops include millet, sorghum, cowpeas, and peanuts, as well as many minor products such as sorrel, sugarcane, and vegetables. The rains usually fall during May through September. During the rest of the year, there is no rainfall.

Livestock is held by farmers and herders alike with many families participating in both activities. The transhumant herders, who depend exclusively upon their animals to support themselves, live primarily between the Sahara desert and the farmlands of the south. This ill-defined region is comprised of seasonally good pastureland, whose quality and quantity varies with annual rainfall levels.

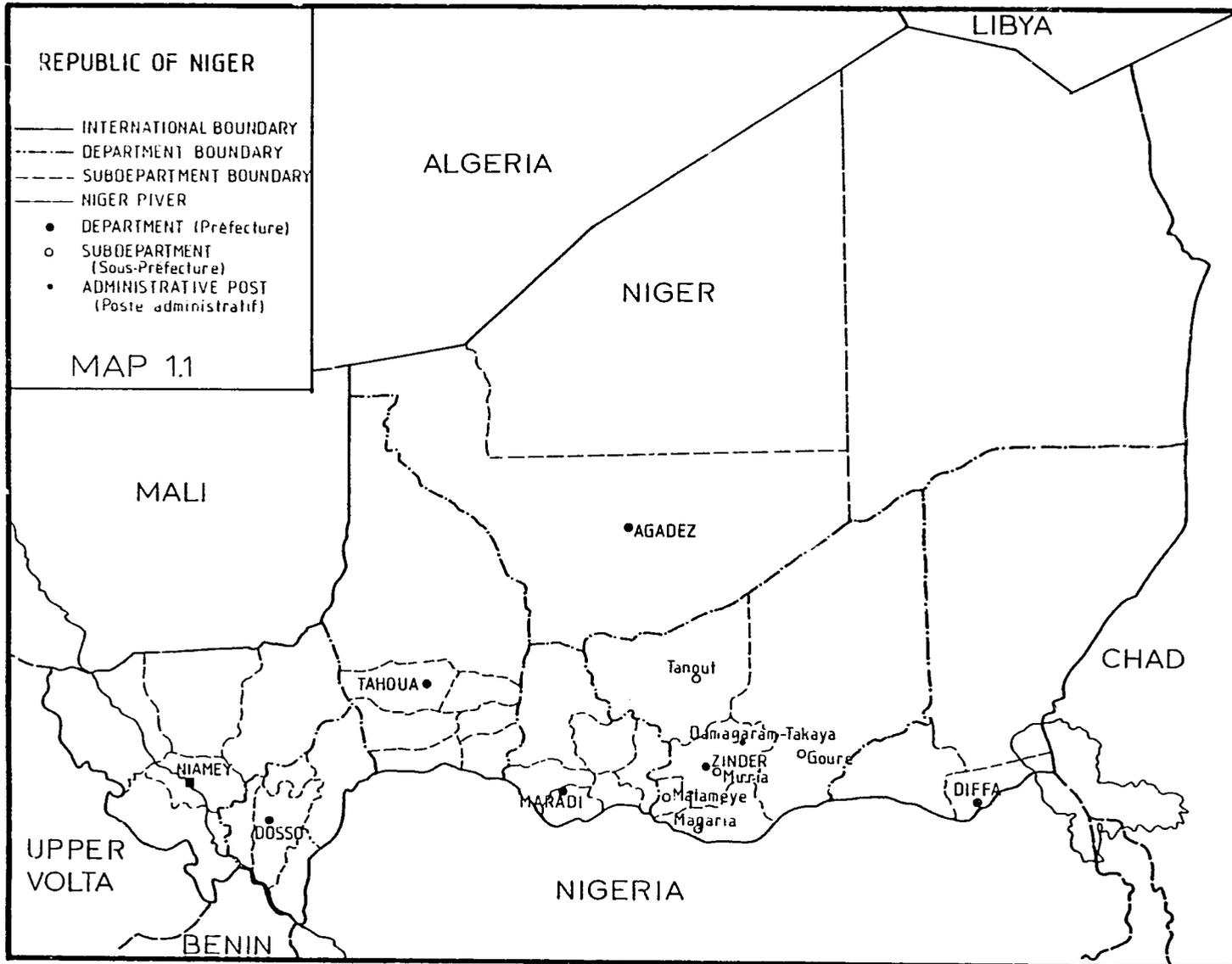
Increasingly, it is apparent that these rangelands are being cultivated by settlers from the southern regions, where population pressure is forcing many families to look for new lands to farm.⁴ While farming in this region is officially forbidden, it is

¹Republic of Niger. Annuaire Statistique, 1978-79, Direction de la Statistique et des Comptes Nationaux, Ministère du Plan, p. 71.

²Ibid, p. 71.

³Ibid, p. 39.

⁴See E.D. Eddy III. Labor and Land Use on Mixed Farms in the Pastoral Zone of Niger, Monograph III, Livestock Production and Marketing in the Entente States of West Africa. Ann Arbor: CRED, University of Michigan, July 1979, for a discussion of this problem.



SOURCE: Annuaire Statistique du Niger, p 10.

difficult to enforce this restriction. As a result, herders and farmers are coming frequently into conflict over animal grazing rights.

These difficulties add to the pressures upon government authorities to devise a system that enables all parties concerned to pursue their enterprises. The government wants a national plan for livestock production and marketing, and their integration with agriculture. The stratification of livestock production and marketing is such a plan.

SECTION 2

THE STRATIFICATION OF LIVESTOCK PRODUCTION AND MARKETING IN NIGER

The underlying hypothesis behind livestock stratification is that, given the variation in the levels of rainfall which fall on the different geographical zones of Niger, the potential for regional specialization in production exists. Each production strata has different amounts of water and forage available within it. Therefore, each region is theoretically better adapted for some types of livestock holding than others. The role of the livestock markets is to connect the three zones and to facilitate the export of the finished animals. Map 2.1. shows the proposed partition of Niger according to the livestock stratification formula.

2.1. The Saharan Zone

The northernmost area, or Saharan zone, is composed almost entirely of arid desert. Its value as pasture is extremely limited. Only during the peak of the rainy season, when some grasses grow in this region and water is available in flooded areas, can this zone support animals. This region has little productive value though, and is not considered as part of the area to be developed in the stratification strategy.

Those animals and people which pass through this region are nomadic. They follow the pastures and water supplies, moving whenever there are too many animals for the existing supplies. The two main nomadic population groups are the Tuareg and the Fulani. However, these nomads spend the majority of their time further south in the Pastoral zone.

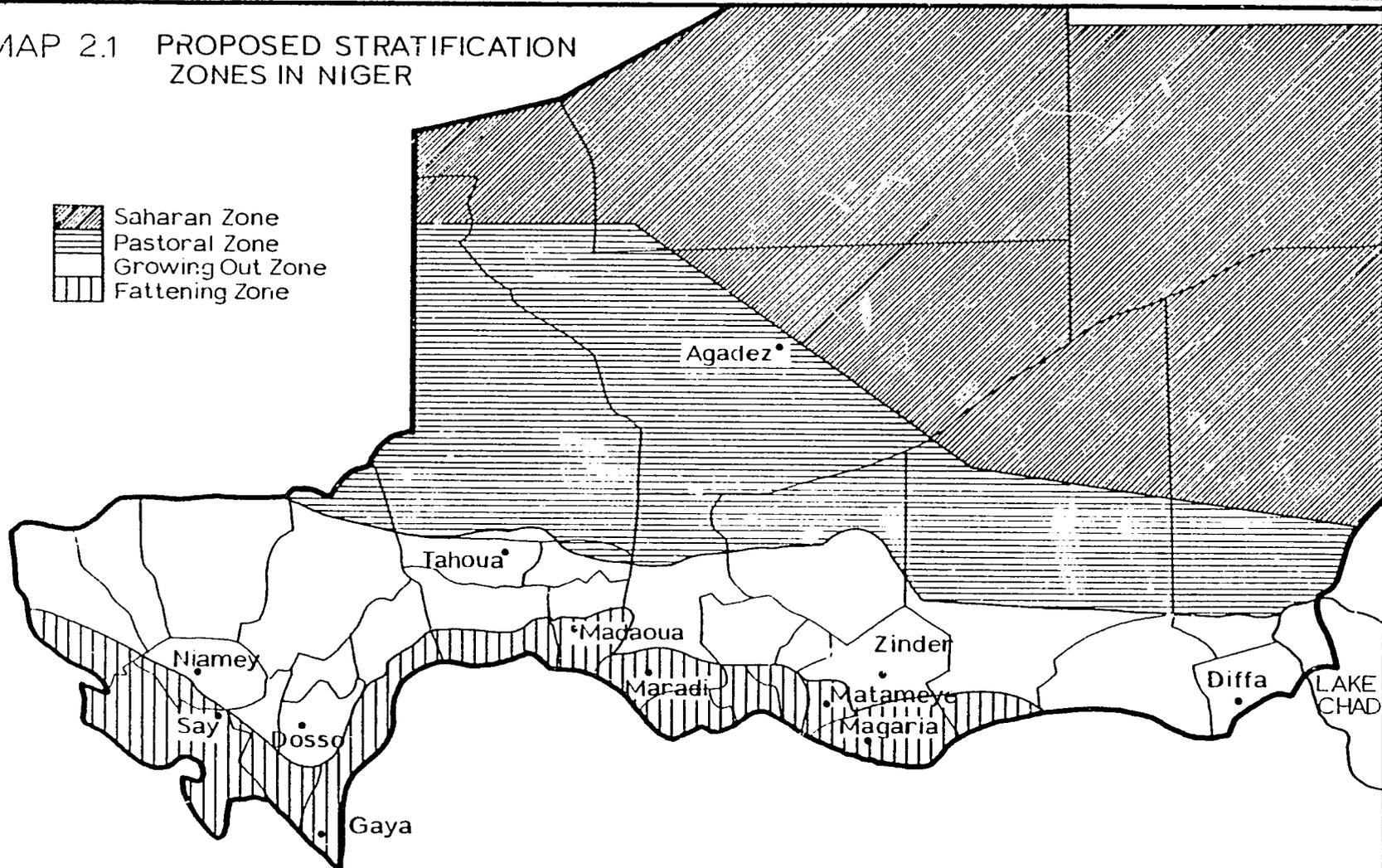
2.2. The Pastoral Zone

The Pastoral, or Birth, zone runs in an east-west band across the middle of Niger. Rainfall levels vary between one hundred and three hundred millimeters (mm) annually. This level of precipitation is sufficient to support certain types of scrubs and trees, as well as seasonal grasses. The higher rainfall regions, with 200-300 mm of annual precipitation, are used for grazing purposes. Some low-lying lands and oases are irrigated and used for the gardening of fruits, vegetables, and grains.

The role of the Pastoral zone in the stratification strategy is to provide ample supplies of young male calves to the more southerly regions for growing-out and

MAP 2.1 PROPOSED STRATIFICATION ZONES IN NIGER

-  Saharan Zone
-  Pastoral Zone
-  Growing Out Zone
-  Fattening Zone



SOURCE: Livestock Service of Niger, *Embouche Bovine Paysanne* 1977-78, p. 35.

fattening. Female calves will continue to be held by herders, in the foreseeable future, to provide replacement for older females and offset mortality losses. This plan will lead to major alterations in existing nomadic production patterns, which currently emphasize long-term herd growth by holding all available animals, selling animals only to meet household financial needs, and a preference for selling male cattle at older ages.

These proposed changes in cattle production patterns are thought necessary because of the relatively low offtake rates, high mortality, and low fertility of the cows of the region. In addition, based on the estimated herd structure shown below, it is hypothesized that the herds of the nomads contain surplus males.

TABLE 2.1.
Estimated Herd Structure for Cattle Held
By Transhumant Herders¹

MALES		FEMALES	
Calves	11.77%	Calves	14.23%
Bulls	8.08%	Heifers	16.85%
Oxen	3.57%	Cows	45.50%

The goal of stratification activities is to alter this herd structure to more heavily favor females and to increase the number of young males marketed. By removing these young males from the Pastoral zone, the pastures in the area should improve for the remaining animals.

The Niger Livestock Service has outlined, and started to implement, a detailed strategy for the Pastoral zone. The Services' modernization program for the Pastoral zone will consist of several parts:

- 1) rationalizing the transhumance routes used by the herders by geographically fixing these routes, establishing itineraries for their use, and opening and closing of water holes to make sure that these schedules are followed;
- 2) establishing responsible nomad families, or parties, at the permanent watering points by giving them dry season usufructuary rights to the water;

¹See Seydou Oumarou. La Stratification en Matière de Production De Viande Bovine Au Niger, Theses #5, Ecole Inter-Etats des Sciences et Médecine Vétérinaires de Dakar. Dakar: Senegal, 1980.

3) installing rescue shops (ateliers de sauvetage) for young animals in distress, with support buildings and backstop equipment, to give medical aid and balanced nutrition to these animals. The objective of these centers is to reduce the calf mortality rate below its current level (estimated at thirty percent in normal years and eighty percent in drought years);

4) encouraging the formation of pastoral units, i.e. cooperatives for transhumant herders, with the intention of bringing them into closer contact with the rest of the economy. These pastoral units would include schools that would teach a special curriculum for the transhumant peoples;

5) establishing livestock research and sanitary facilities to systematically vaccinate animals and help fight malnutrition;

6) various ecological actions including helping herders to preserve forage during the rainy season, increasing the area covered by wells to improve the usage of pasture, and several other proposals.

In terms of actual implementation of these proposals, the progress achieved by 1980 was limited to the establishment of several livestock multiplication centers that had a limited capability to act as rescue centers for young animals. These centers have been established in Ibesseten (Tahoua Department), Belbeji (Zinder Department), Sayam (Diffa Department), and North Dakoro (Maradi Department). These centers raise the young cattle until eight months of age and then sell them to ranches in the Intermediate zone for growing-out. Each of these centers differs as to its capacity, degree of completion, and level of operation. There are also many new projects being developed by two major livestock projects in the Pastoral zone.

For the nomadic herders that currently live within this region, this strategy requires a modification in their lifestyle over the long run. Their role as producers is changed from being relatively independent entities to being a small, specialized unit, incorporated into the national economic system. Nomadic groups would become much more dependent on the state in meeting their personal and animals' needs.

The anticipated increased offtake of young male animals will be accomplished through decreases in the mortality rate of young male calves, as well as encouraging herders to hold fewer males in the herds. A lower calf mortality rate for these cattle is achieved by improving the calves' diet. Supplemental feed rations will be sold to herders on credit. Furthermore, the nomads will be asked to let their calves use all of their mother's milk, instead of consuming it themselves. Getting the nomads to feed their calves with all of the mother's milk would require fundamental changes in their peoples' diets and way of life.

A myriad of other issues exist concerning the feasibility and desirability of the changes to be made in the Pastoral zone. These include questions of (a) land tenure; (b) herder motivations for selling animals; (c) credit schemes needed to encourage sales and provide outside inputs; (d) the desirability of grazing patterns; and many more. These problems, however, extend far beyond the scope of this paper. Fortunately, there are currently two major donor-financed livestock projects which are studying them: the Niger Range and Livestock project (USAID) in Tahoua and the World Bank's Livestock Project in Zinder. These two projects have large on-going research and implementation programs underway which will shed more light on the necessary improvements, if any, that should be made in the Pastoral zone.

2.3. The Intermediate Zone

The Intermediate, or Growing-out, zone (shown in Map 2.1.) is an area which receives from 300 to 450 mm of annual rainfall, has pastures throughout the year, and supports rainy season farming. This region is noted for its mixed farming activities, i.e. agriculture and livestock enterprises that are operated by the same family.

This region of the country has been proposed as an area for holding young male cattle from the age of eight months until they attain 2½ years of age. These animals start at a weight of 100 kilos and are well fed until they reach 250 kilos. At this point, they are sold to southern region cattle fattening projects.

During the growing-out period, the cattle develop into adulthood. Chronologically, this growth pace starts with the formation of nervous tissue and bone structure before birth, and for a short time after, muscle tissue during the growing-out period, and fat layers in the finishing stage. Thus, it is primarily the muscle tissues (meat) that are being developed in the growing-out period.

The strategy which the government had followed until 1980 was to develop livestock production by building large state-owned ranches. Two of these ranches were built near the capital city of Niamey -- Toukounous and Ekrafane -- and two others are proposed in Dakoro and Goure. The ranch in Toukounous, situated two hundred kilometers northeast of Niamey, was established in 1954. It functions not strictly as a ranch, but also as a research and experimental center. Its 4,600 hectares are subdivided into five large parks with a total of thirty-one pieces. Each of these pieces has its own water supply. In 1972, the ranch started disseminating cattle stock to the subdepartments.

Ekrafane is a ranch owned by the para-statal livestock and meat marketing agency, SONERAN (Société Nigérienne d'Exploitation des Ressources Animales). It is

located three hundred kilometers northeast of Niamey, with 110,000 hectares and a capacity of ten thousand head of cattle. SONERAN purchases its animals on the open market from Ayorou (near the Malian border) to Abala. After one to two months of quarantine, in which vaccinations and other treatments are given, the animals are well fed for slaughter purposes. Thus, Ekrafane operates more as a fattening ranch than as a growing-out operation.

The two proposed ranches are to be built in Dakoro and Goure. Both areas exhibit relatively good quality forage, although the latter region has been plagued by fires, erosion, and the multiplication of unwanted plant species. Thus, while construction of the first ranch had begun in 1978, as of 1979 the second had yet to be commenced.

The limited development of the state-run ranching system, and some questions about its overall profitability, raise the issue of whether it is more profitable socially to move growing-out operations into the private sector. In particular, the possibility of involving small mixed farms in the Intermediate zone through the use of government loans of cattle will be tested by the World Bank Livestock Project in Zinder.

This project proposes that cattle loans be extended on medium-term credit to former transhumant herders that engage in mixed farming. There are many advantages to using these groups, instead of big ranches, to improve production. Small-holders have experience in raising cattle, a desire to reconstruct their herds which suffered during the drought, and a commitment to agriculture as a necessary means of supplementing their income from livestock activities. The agricultural by-products which result from their farming activities are useful as forage for their animals, too. Thus far, these loans have not been started because of difficulties in designing the terms of credit and selecting the target group.

2.4. The Fattening Zone

Livestock fattening is an old tradition in Niger with farmers holding sheep, goats, and sometimes cattle, on their farms and feeding them a rich diet. There are similar larger-scale efforts that have been conducted by private traders and government ranches. Small farm fattening activities have recently been given much more importance though, as their value in providing dry season employment and utilizing the agricultural by-products of the farms in southern Niger has been emphasized. Furthermore, they create additional supplies of valuable manure that is used for agricultural purposes.

The Fattening, or Finishing, zone of Niger runs along the southern edge of the country. Its relatively high rainfall, 500-800 mm annually, supports the greatest

amount of agricultural production in the nation. Large quantities of agricultural by-products, that can be used as animal feeds, are produced annually. These include two good forage crop residues -- peanut leaves and cowpea vines.

The large-scale commercial fattening operations usually purchase bulk quantities of feedstuffs for their activities. Merchants buy up to twenty-five head of cattle, fatten them for a few months, and resell them in Nigeria. These merchants have reported large profit margins on these operations.

The government sector has adopted the industrial feedlot concept for its cattle fattening operations. The new ranch (scheduled to be completed in 1980) at Tiaguirire, thirty-five kilometers south of Niamey, has three hundred hectares of irrigated land that will be used to produce forage for fattening purposes. With an estimated annual capacity of 7,500 head of cattle, the ranch hopes to produce an additional 1,200 tons of carcass weight per year. Most of this meat is destined for sale in Niamey.

A small farm cattle fattening project, called Embouche Bovine Paysanne, is funded by government loans and is a relatively new phenomenon. The first studies for the project were made in 1967 but funding was made available only in 1976. The European Development Fund (FED) gave Niger a loan of six hundred million francs (FCFA), or about three million dollars (U.S. \$), at that time. By late 1977, the personnel for the project had been assembled and the first group of animals purchased.

The initial pilot projects for the cattle fattening program were conducted by other agencies in villages along the Niger river. Two efforts were started: one by OXFAM in Libore, the other by SONERAN in Boubon. In both cases, the cattle were fattened using grasses found only in areas near the river. This type of diet has led to these operations being named Embouche Fluviales, or river fattening. This method of fattening accounts for thirty percent of the Embouche Bovine project cattle. Its profitability and form of operation have been evaluated in other reports.²

The remaining seventy percent of the cattle are fattened using the Embouche Sahélienne, or Sahelian fattening system. This technique is practiced in the regions of the country which are too far away from the Niger River to depend upon its forage. Instead, these areas feed their cattle with other agricultural by-products, such as millet stalks and peanut leaves.

²For instance, see Christopher Wardle. "Promoting Cattle Fattening Amongst Peasants in Niger," Working Paper #2, Livestock Production and Marketing in the Entente States of West Africa. Ann Arbor: CRED, University of Michigan, February 1979.

A jointly-directed program under the Union Nigérienne de Crédit et de Coopération (UNCC), Caisse Nationale de Crédit Agricole (CNCA), and the Service d'Elevage, called Embouche Bovine loans cattle to farmers for fattening. The three services involved supervise the purchase of these animals, assist farmers with technical advice on fattening methods, provide medical care for any sick animals, and recuperate loans at the end of the program. Specifically, the CNCA and the UNCC oversee the financial operations, and the Livestock Service oversees the technical ones.

The program takes place on a nationwide basis in the southern Fattening zone of the proposed stratification strategy. The actual areas within which the program operated in the 1977-78 campaign are shown in Map 2.2. In this first year, a massive effort was made to start the program in as many areas as possible with the greatest number of cattle possible. With the project's infrastructure barely in place, the initial results were discouraging. Many farmers defaulted on their loans because of uncertainties about the terms of credit; insufficient feedstocks were available; there was very poor coordination among the three government services in their efforts to assist farmers with fattening, and a myriad of other difficulties.

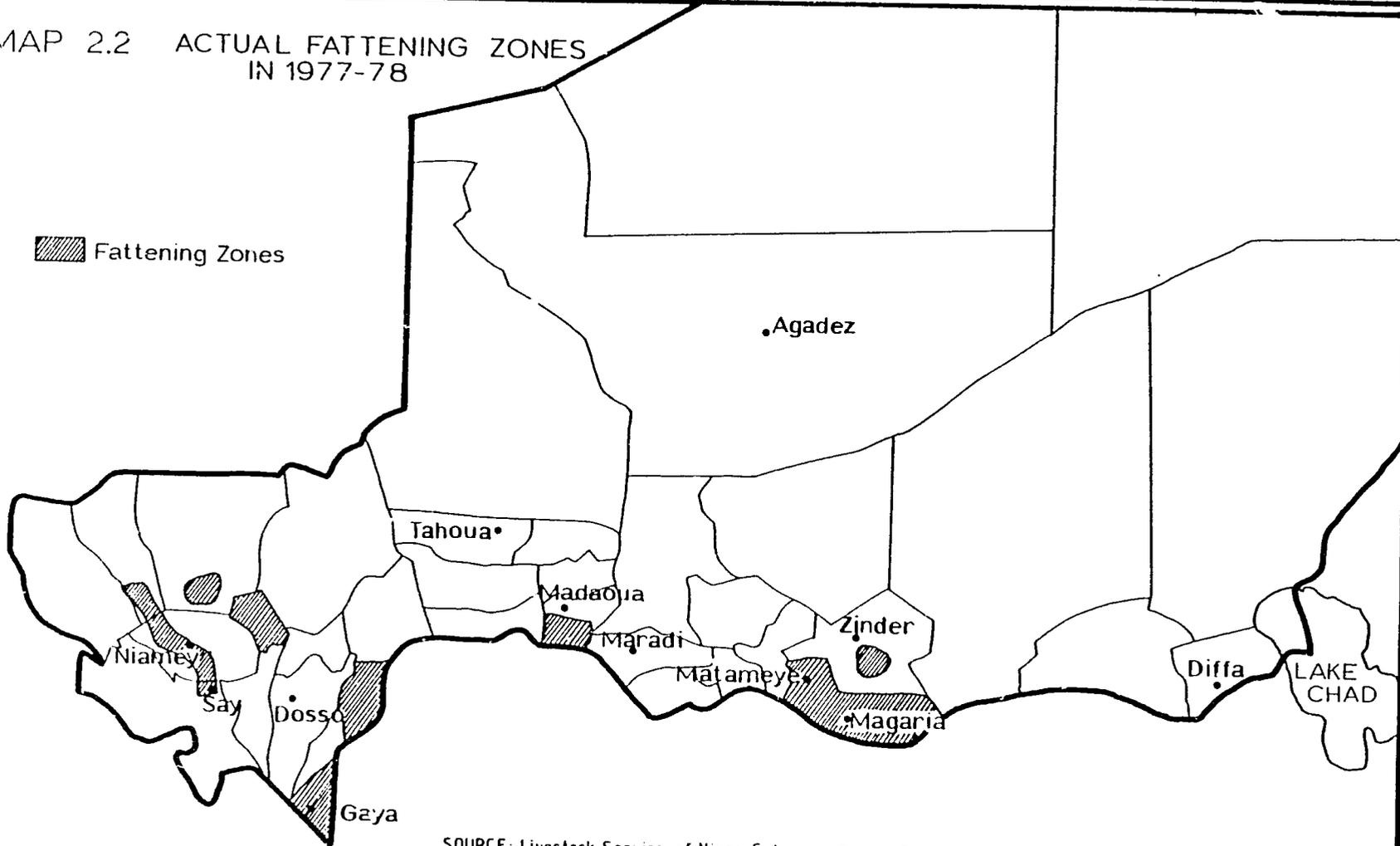
In the aftermath of these problems, the project's efforts were severely curtailed. By the 1979-80 season, the level of operations in the Department of Zinder had been reduced from 1,978 head to 309 head. In the 1979-80 campaign, most of these animals were concentrated in the subdepartment of Matameye. The analysis here focuses exclusively upon this subdepartment.

Initially, Matameye farmers indicate their interest in participating in the program verbally and later with a cash deposit of 4500 FCFA (in the 1980-81 season, \$1 US = 250 FCFA). This deposit represents about 10% of the purchase price of the animals involved. Based on the number of deposits collected, the approximate number of animals to be purchased is determined. Then project buying teams composed of Livestock and UNCC, or CNCA, representatives accompany selected farmers to the larger animal markets to purchase these animals. Major livestock markets visited include Birnin Kazoe, Koundoumawa, Zinder, and Dakoro.

Government buying teams form a conspicuous group and purchase fifteen to twenty cattle at one time. While purchases this large are made by many private buyers, these private traders spend all day bargaining for their animals and are very secretive about their dealings. The government buyers are in the market for only a few hours and do not hide their operations. For these reasons, the government faces price discrimination when buying cattle. The price difference between government and private participant's purchase prices for equivalent cattle, was approximately 7,000 FCFA per animal for the 1980-81 season.

MAP 2.2 ACTUAL FATTENING ZONES
IN 1977-78

 Fattening Zones



SOURCE: Livestock Service of Niger, *Embouche Bovine Paysanne* 1977-78, p 40.

After their purchase, the cattle are trekked down to UNCC cooperative distribution centers. Here they are weighed, where cattle scales are available, vaccinated (if sufficient quantities of serum are available), and then distributed to farmers for the four-month dry season period of fattening. Animals are allocated using a lottery system in order to insure impartiality in their distribution.

During the 120-day fattening period, animals are installed in the farmer's compound, usually under a straw awning to protect them from the sun. Most participants feed their animals using home-produced agricultural by-products, such as peanut leaves, cowpea vines, sorghum stalks, and dry straw. Additionally, farmer's make cash outlays to purchase cereal bran, salt and water for their animals.

The Livestock Service makes regular visits to farmers to see how their animals are progressing. During these visits, they vaccinate those animals which were not previously inoculated and care for any sick animals. They look at the fattening diets which the farmers have adopted and offer technical advice, if needed. In some past years, they have sold salt, bran and other feedstuffs on a cash-and-carry basis.

Near the end of the program, the Livestock Service tells farmers the date on which they can begin selling their animals. This date is determined according to the Livestock agent's assessment of the level of available feedstuff stocks and cattle market prices. Upon doing so, project participants reimburse the UNCC the amount of their loans. The cost of the loan includes the purchase price of the animal, the transport costs incurred in trekking the animal from the market, a nominal 5.25% interest charge on the loan, and a nominal 0.75% charge for insurance on the animal's life. The loans are extended for a six-month period and since the farmer has already held the animal for four months, he has two month's grace period before the end of the time. Any loans outstanding at the end of this time are charged one percent additional interest per month as a penalty payment.

2.5. Marketing of Livestock

The role of markets in the livestock stratification scheme is to insure that sufficient numbers of young male calves move from the Pastoral to the Intermediate zone and after growing-out occurs, down into the Fattening zone. The government wants these transfers to be made as efficiently as possible, i.e., without excessive profit and distribution costs.

Livestock markets are stratified geographically in a fashion similar to that of the proposed production zones. The small Pastoral zone markets serve as collection points for diverse groups of animals. These animals are funnelled south toward the larger

markets in the Intermediate zone. The geographical location of these larger markets has shifted farther north over time as transport routes have improved, allowing traders and goods to move more quickly and easily. From these larger markets, the animals are trekked south, passing through and stopping at any other major markets along the way. The smaller Fattening zone markets are less important, although some of the finished animals of the government fattening projects are sold there.

The existing chain of markets has been subject to much criticism. For example, during 1980-81, government livestock buyers faced discrimination in the form of artificially high prices whenever they attempted to buy animals for projects. This practice has led many projects to purchase animals by weight, paying a fixed price per kilogram.

However, a recent study³ of the livestock marketing system finds that the system exhibits a remarkable degree of competitiveness. Animals appear to move from northern Niger down into Nigeria quickly and cheaply. At the current level of demand for stratification operations, the system functions effectively.

A question remains, though, as to how well the system will work if the demands from growing-out and fattening projects increase dramatically. Will herders raise the numbers of young male cattle that they market in response to price incentives? If so, will these animals be sold for growing-out, or fattening, within Niger, or will they be directly exported? These are issues that have less to do with the markets themselves than with the motives and means of the participants in the markets.

Concerned that the answer to the second question might be negative, planners have proposed a variety of methods of eliminating the market's role altogether. Government projects in the Pastoral zone will purchase young animals directly from the herders for resale to growing-out operations. Those ranches and families that participate in growing-out operations will resell their animals to fattening projects. Thus, the problem of marketing animals reduces to getting enough young males from the herders. This would be the responsibility of the pastoral units described in Section 2.2.

³See Marty Makinen and Edgar Ariza-Nino. The Market for Livestock from the Central Niger Zone. Ann Arbor: CRED, University of Michigan, April 1982.

SECTION 3

SCOPE OF ANALYSIS

This paper looks at the existing structure of livestock production and marketing and how it fits into the livestock stratification strategy in the Intermediate and Southern zones in the Department of Zinder. In particular, small farms' mixed livestock and agricultural activities are examined with attention being paid to their existing levels of participation in cattle raising/growing-out, or cattle fattening, enterprises. Livestock marketing data from markets that tie together these two regions are also analysed, but are a secondary focus of the study.

Pastoral zone activities are neglected here because of data limitations. Several highly detailed anthropological works are in the process of being prepared by the Niger Range and Livestock project's staff.¹ These research reports discuss the various proposals and policies that have been proposed and implemented in the Pastoral zone.

For the Intermediate zone, this paper examines the existing degree, and potential for expansion of cattle breeding/growing-out enterprises. The two activities are lumped together because that is how they are currently practiced. No information exists about how to separate out the costs and benefits of the two activities in order to compare them with the proposed government system. Therefore, the cattle growing-out activities in this paper refer to the current practice on these farms of breeding and growing-out young cattle.

The analysis is based upon data collected using farm management survey techniques from a sample group composed of Fulani and Tuareg sedentarized herders. These former herders now engage in mixed farming in the subdepartment of Mirriah. Current production techniques and available resources are then examined in order to establish the existing constraints on crop and livestock production. The returns to holding livestock are determined using data on existing livestock, prices, demographics, and offtake rates. The impact of several policies that would change these constraints are then illustrated, and their benefits and costs weighed.

Cattle fattening programs in the Southern zone are analysed in-depth. Their integration into the Southern zone's farming system, level of private and social

¹The interested reader should contact the Niger USAID Mission, or the team anthropologists -- Cynthia White (Fulani), Bill Fitzgerald (Tuareg), John Curry (Hausa), and Jeremy Swift (Team Leader) -- for copies of their reports which to the best of this author's knowledge, had not been published at the time this paper was written.

profitability, effect on agricultural by-product usage, and many other economic facets are discussed. In the course of this analysis, crop production levels are examined, and the quantitative effect of different types of inputs upon output made precise. Furthermore, the impact of additional supplies of livestock manure upon crop production is evaluated and manure's social value estimated.

These analyses are based upon a sample group of Hausa farmers drawn from two villages in the subdepartment of Matameye. Farm management survey techniques were used to collect these data from March 1980 to May 1981. The analytical methodology applied to them is described below.

This paper contains a summary of the results of a larger document soon to be published.² The empirical work underlying this paper has been presented in the larger document. In that work, three sets of analyses were conducted: (1) agricultural production function analysis; (2) linear programming models of small mixed farms; and (3) social benefit-cost analysis of government-financed cattle fattening programs. These economic models were applied to the household survey data gathered in the course of farm management studies. Readers interested in econometric and data methodology questions are referred to the larger paper.

3.1. A Comparison of the Three Villages in the Zinder Department

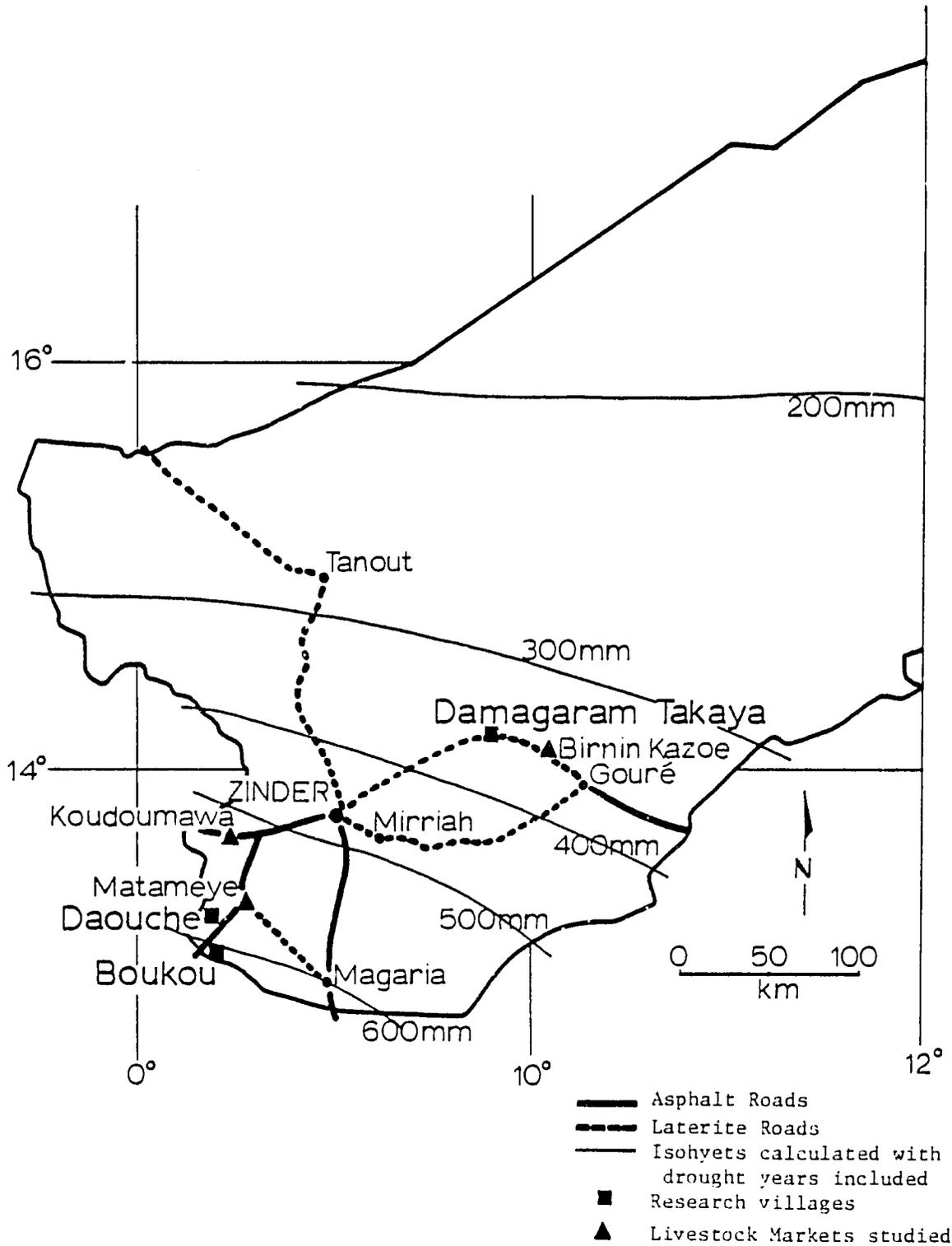
With the broad agricultural and developmental circumstances of Niger in mind, the salient characteristics of the three villages in the Zinder Department covered by this study are examined. First, some general characteristics of villages studied are outlined. This is followed by a brief description of each of the three villages.

The three village research sites and three livestock markets visited are shown in Map 3.1. Rainfall levels differ substantially between the two southern villages, where 500-550 mm of rain falls annually, and the northern village, which receives only 400 mm of yearly precipitation. This level of rainfall is enough to support crops during the four-month rainy season, but allows only irrigated gardening during the eight-month dry season.

During the rainy, agricultural season (May to September), the main crops are millet, sorghum, cowpeas, and peanuts. Millet and sorghum are the principal foodgrains in the region. Usually, they are grown in intercropped stands with cowpeas and sometimes, peanuts. However, there are many different cropping combinations of

²See Randall Thomas-Peterhans. The Stratification of the Production and Marketing of Livestock in Southeastern Niger in the Department of Zinder. Ann Arbor: CRED, University of Michigan, forthcoming 1982.

MAP 3.1 LOCATION OF THREE VILLAGES STUDIED WITHIN THE ZINDER DEPARTMENT *



*Adapted from John Sutter, Peasants, Merchant Capital and Rural Differentiation: A Nigerien Hausa Case Study, Ph.D. Dissertation, Cornell University, 1982, p. 61.

the four crops ranging from pure stands to any possible permutation. Two minor crops which are frequently seen in the area are sorrel and bambara nuts. The former is used as a seasoning, while the latter is often roasted and cracked to eat as snacks.

Cultivation is done almost exclusively using hand tools. Five major operations are involved in the agricultural cycle:

- (1) ground preparation,
- (2) seeding,
- (3) first weeding,
- (4) second weeding,
- (5) harvesting.

Some of these tasks may not be performed for all fields, e.g. a second weeding may be forgone on a field which is growing poorly. Generally speaking, they are all done for the major fields of the household.

Livestock are raised in all three of the villages studied. These animals may belong partly or entirely, to the household which herds them, with the remainder of the herd owned by other families.

Roughly speaking, livestock ownership takes two different forms. Families whose principal concern is livestock herding live outside of established villages. In the northern area studied (Damagaram Takaya), practically all of these households engage in agriculture but at least one adult male member of the household is occupied with livestock on a permanent basis. Herd sizes vary greatly between these families, as does the herd composition. To a first approximation, their herds are primarily composed of female animals in their fertile age period. Cattle, sheep, goats, camels, donkeys, and horses are kept by these families, although the latter two types are generally kept for work and transport, respectively.

Herders usually pasture their animals on open bushland during the rainy season and on fields with crop residues in the dry season. For southern village herders with large numbers of animals, this can involve long-distance, rainy season transhumance to find suitable areas of pasture. Dry season pasture, while less of a problem in the southern zone, is becoming more difficult to find as many villagers have recently begun harvesting crop residues for use, or resale. Water is a problem too, since it must be drawn from wells which can be as deep as thirty meters.

Many of the herders in the northernmost village, Damagaram Takaya, migrated there within the last ten years because of the excellent pasture and water which is freely available in the region. Two large, rainy season lakes provide ample water throughout the year (although shallow wells are dug during the dry season). Uncultivated bushlands are available throughout the year and crop residues can be found on most fields since forage is not widely harvested in the region.

The second class of livestock owners are those households that live inside the established villages and whose main occupation is farming. Some of these families own cattle but entrust them to herders outside of the village. Others have work cattle, or cattle they are fattening, which they keep inside of their compound walls and tend themselves. This type of production system is common in the two southern villages, Boukou and Daouche.

Among these households, goat and sheep ownership is widespread. Most frequently, women have a large number of these animals, which are females in their fertile age period. Many households own donkeys and use them as work animals. Horse ownership is a sign of wealth, as horses are used only for transportation purposes.

Animals held outside of the compound are only examined in the village of Damagaram Takaya because of problems in enumeration and verification in the southern villages. Only in Damagaram Takaya could the cattle outside of the compound area be visited and directly counted. In the southern villages, verification of sample members responses was impossible, and given the likelihood of underestimation, it was decided to concentrate on the cattle inside of the village. Thus, it is important to remember when interpreting the results of this paper that the investment in cattle held outside of the southern villages was not evaluated.

SECTION 4

REVIEW OF THE MAJOR RESULTS

Small farms' agriculture and livestock enterprises are the center of attention for this paper's analysis. Beyond looking at these activities in isolation, the work done looks at the integration of the two areas. In this section, the major results for these three topics -- agriculture, livestock, and their interactions -- are each discussed separately.

4.1. Agriculture

The agricultural production functions and linear programming models look at the levels of agricultural production on small farms in the three villages studied. The production functions quantify the level of returns to scale exhibited by agriculture in the survey region and attribute output received to the levels of inputs used in the productive process. The question addressed is whether farmers are allocatively efficient -- do they equate the marginal products of the inputs used with the marginal costs of employing them?

Linear programming models look at the resource allocation problems involved in producing the profit maximizing level of household output. The implicit costs of devoting scarce land, labor, and capital resources to different agricultural activities are calculated. After finding an optimal production plan, the effects of introducing higher government purchasing prices for grains, or new technical packages, are examined.

The principal conclusions that can be drawn about agriculture in the Department of Zinder are outlined below. First, in all of the villages studied, agricultural production exhibits constant returns to scale. Thus, proportional increases in all inputs used will lead to a proportional augmentation in output produced. The implication of this result is that increasing farm sizes, e.g. through communal management schemes, will not result in any additional output greater than what could be produced by a similar amount of land farmed in smaller parcels by individual households.

A second important result is that no significant difference was found between the marginal product of male and female household labor inputs. Combined with the finding that a unitary elasticity of substitution exists between male labor, female labor, and land inputs, this result points out the potential for increased agricultural output by raising the level of female labor inputs into agricultural production. This

conclusion is modified through recognition that some heavier tasks require male laborers and that women have many other demands on their time during the rainy season.

Of all the agricultural inputs examined, including (1) land, (2) household labor, (3) animal traction labor, (4) wage labor, (5) agricultural equipment stocks, and (6) management inputs, the first three of these inputs are the most important determinants of the level of agricultural output. Their contributions are all positive and significantly different from zero in the estimating equations. In particular, manured land and garden plots are found to have high marginal products.

The marginal product of wage labor is significantly higher than that of household labor inputs. This reflects the very high marginal product of wage labor during peak labor bottleneck periods during the first weeding in late June and early July. The much lower value of household labor shows the duality that exists in the labor markets of these villages during the short agricultural season.

The results of the agricultural production function analysis state that the higher implicit value of wage labor is not significantly different from that of the agricultural hourly wage rate. The linear programming models show that the dual price of labor is two to three times as high as the going wage rate. These seemingly contradictory results can be reconciled by observing that the fixed coefficient production function of the linear programming models is probably unduly restrictive on the possibilities of substituting labor between time periods. This would have the effect of raising the shadow price of wage labor to abnormally high levels in bottleneck periods.

Overall, farmers appear to allocate their inputs efficiently. The measured gains from a constrained (i.e. total input usage is fixed at existing levels) reallocation of resources within each village are very small compared to the costs associated with such transfers. Therefore, it appears there is little scope for important increases in agricultural production in these villages without the introduction of a new, more productive technology, or an increase in the availability of existing resources.

This point is dramatized by examining the impact that doubling official government purchasing prices for millet has had upon millet production. In all villages, and for all income groups, the effect is negligible. Only when this policy is coupled with the introduction of new laborsaving technologies does it have any effect on grain output. Even in this case, its effect on production is secondary to that of the new technology.

The laborsaving technology introduced in the linear programming models is a simulated program that would reduce labor requirements in peak demand periods by

twenty percent. In the two villages where land is not fully utilized, this technology has a significant, positive impact on grain production. However, in the village where all land is already under cultivation, laborsaving technology has no effect on agricultural output, although some increases in livestock holdings are noted. In this village, it is the lack of adequate manure supplies that constrains output.

The optimal solutions of the basic linear programming models show that wealthier households all produce quantities of cereals that are greater than their internal consumption requirements. This is also true for two of the three low income groups. The third group is a deficit cereal producer but harvests and sells sufficient quantities of cash crops to finance purchases of cereals. These conclusions would be modified if initial stocks, or debts, of cereals were included in the models.

Year-round gardening is a very lucrative sideline for farmers who live in regions with land suitable for these activities. In the one village where extensive gardening was observed, the optimal solution to the linear programming models has sugarcane plots being cultivated by all farmers. The size of these plots was quite small but their marginal product very high. The cash incomes gained from these enterprises provide farmers with needed incomes to finance feedstuff purchases for cattle fattening programs.

4.2. Livestock

Cattle and small ruminant holdings are examined in the linear programming models and the social benefit-cost analysis of cattle fattening activities. The profitability of cattle fattening, cattle breeding/growing-out, and cattle traction/transport undertakings, as well as the returns to holding small ruminants, are analysed. The trade-offs in resource allocation are quantified and optimal choices, based on these patterns, are calculated.

The social benefit-cost calculus focuses more narrowly upon the Niger government's Embouche Bovine cattle fattening program in the subdepartment of Matameye. It examines the feasibility of cattle fattening for the private sector and its social profitability for the nation. Some alterations of, and alternative plans to, the existing project are examined.

Several conclusions can be drawn from these analyses. Cattle breeding/growing-out activities are profitable for farmers in the Intermediate zone and could be expanded if proper attention is paid to several factors. First, the farmers studied lacked sufficient capital to finance cattle purchases, implying that government assistance is needed in this area. Next, the price structure for cattle which prevailed

during the 1980-81 survey period was in favor of owners selling their cattle at one year of age, instead of holding them for a longer period. Slight increases in the price of older animals, or decreases in mortality rates, would make farmers sell cattle at the older age. Finally, substantial increases in current levels of cattle breeding/growing-out enterprises will result in reduced grain production by households in the sample group. If no alternative supplies of grain are available for purchase, then many families would be unwilling to participate in the program for fear of not having enough grain to feed themselves.

Animal plowing/transport enterprises are only regionally feasible, and though they appear exceptionally lucrative where practiced, they have such high opportunity costs (e.g. rainy season labor needs) that they remain only marginally profitable at best. Wealthier families, who are the only ones that find animal traction activities feasible, prefer to rent these services when possible. If there is no rental market available, then these households have a marginal preference for owning the traction team rather than doing without traction altogether. In areas where only transport services are rendered, the optimal solution to the linear programming model indicates that farmers would rather not have the teams. This result is very sensitive, however, to changes in the value of transportation services, indicating that farmers willing to assume these risks may want to hold transport cattle. Poorer groups find animal plowing/transport to be either infeasible, or economically disastrous. Smaller investments in donkey carts and traction equipment might be a way to involve these groups in livestock plowing/transport programs.

The existing cattle fattening project in the subdepartment of Matameye is socially and privately profitable. The cattle involved in the project make significant weight gains eating agricultural by-products that might otherwise go to waste, or be exported. Thus, the project has achieved one of its stated goals, the utilization of agricultural by-products in the project zone.

Its two other objectives are to value more of Niger's underemployed dry season labor and to stop the out-migration of young male workers. In terms of the first of these goals, it appears that the project has provided up to 120 hours of additional dry season employment to project participants. It does not seem to have slowed dry season out-migration though. This was shown in the linear programming analysis. Furthermore, the level of cash expenditures which project participants must make is too great for most of the poorest households. In order to reach these families, small ruminant fattening projects should be initiated.

An unexpected result is that the intensity of cultivation of land emerges as an important determinant in the level of social profitability of cattle fattening within

participating villages. Areas where land intensification efforts are more advanced, due to land scarcity for instance, will place a higher value on the manure output of the cattle fattening project. This increase in the value of manure largely explains the observed difference in the social evaluation of the project in two sample villages.

A shift toward purchasing project cattle by weight, instead of by sight, will increase the social profitability of the cattle fattening project, since it will eliminate price discrimination problems. However, a move away from fattening toward using maintenance rations will reduce the project's social profitability. The reduced feed costs do not offset the lower sale price of the cattle, given the 1980-81 price structure.

Small ruminant ownership is found to be profitable in all three villages studied. In the Intermediate zone, where the milk from the goats and sheep held is consumed, small ruminants are most profitable. The villages in the Southern zone do not use this milk, instead letting the young consume all of it. This results in lower mortality in the Southern zone herds but its value is not sufficiently great to offset the lost milk revenue. Thus, the net return on small ruminants is lower in the Southern zone than in the Intermediate zone villages.

4.3. Integration of Livestock and Agriculture

There are two main areas where livestock and agricultural activities interface in the sample villages: manure resources and agricultural by-product usage. Livestock projects which increase the availability of manure for farmers will have a positive effect on agricultural production, especially in regions where manure is intensively applied to the fields. This is seen in the high shadow price which is placed on manure in the Southern zone villages. Further calculations made about the social value of manure inputs show them to be socially valuable. Finally, the production function analysis finds that the productivity of all inputs is higher on manured than on nonmanured fields. The implication of this result is that overall farm productivity increases with increases in manure applications.

There is a disturbing corollary to these results though. Participation in the livestock projects described here has overwhelmingly benefited the wealthier households in the villages studied. Increased manure supplies will naturally fall primarily into their hands. This is coupled with the tendency, observed in the linear programming models, of the poorest families to sell their additional manure production to the better-off households. To the extent that better manuring of fields leads to greater crop production, this concentration of manure supplies will lead to greater

inequalities in the agricultural capabilities of poorer and wealthier families. Economic theory states that such transactions on the free market will improve social welfare and should be allowed to continue without government interference. What the government can do to improve the well-being of the poorer groups is to implement development projects that combine low investment demands and widespread participation, e.g. small ruminant fattening.

Agricultural by-products can be effectively used by new livestock projects. This will result in valuing them inside of Niger, instead of exporting them, or letting them rot. Higher agricultural revenues will be the end result of this process.

There are some questions, however, about how far this process can be carried. On an individual basis, farmers that cannot purchase any feedstuffs can produce sufficient quantities of by-products to fatten two cattle, at the production levels of the 1980-81 season. If the market is assumed to be perfectly adjusted, so that all feedstuffs can be bought and sold in any quantity, then it is the level of cash available to finance purchases which determines the number of cattle that can be held. Up to four cattle can be held, in most cases, without violating the existing cash constraints.

On the societal level, the issue of how many cattle can be supported by existing agricultural by-product supplies is more complex. Estimates in the larger paper suggest that the subdepartment of Matameye has some room for expanding livestock projects before it runs into these barriers. This is an area which should be thoroughly researched before any major new projects are initiated.

For cattle breeding/growing-out projects in the Intermediate zone, the interactions of livestock and agriculture are restricted by soil acidity problems in applying manure to fields in low rainfall areas. More efforts must be devoted to finding methods of reducing the dangers of manure doing harm to seedlings during brief drought periods during the rainy season.

The use of stocked agricultural by-products for livestock would be a new activity for the sample group studied here. As the number of cattle in the area increases, farmers will have to be taught to store these by-products. The potential of the region for these type of enterprises is great but should be developed slowly to avoid scaring off possible program participants when the inevitable shakedown problems occur.

SECTION 5

POLICY RECOMMENDATIONS

Five main subjects were analyzed in this study: (a) cattle fattening; (b) cattle plowing/transport; (c) cattle breeding/growing-out; (d) livestock marketing; and (e) agricultural production. Having reviewed the major findings in these areas, it remains to discuss the implications of these results for future project development and implementation.

5.1. Cattle Fattening

The existing cattle fattening program, Embouche Bovine, has been found to be socially profitable in its current form. The project should be extended into new areas if these regions satisfy three conditions. First, they must produce a crop of high nutritive value, such as peanut leaf, and in large enough quantity to support the intensive cattle feeding proposed. Second, they must be close enough to a market where fattened cattle can be sold at premium prices (e.g. Niamey, or Nigeria). Finally, either farms should be intensively cultivated, or a scarcity of arable fields exist, for the project to be most socially profitable.

There are, however, several changes which could be made in the project's structure which would increase its profitability. Shifting purchasing of cattle from sight-buying to using a fixed per kilogram price has already been discussed. Other potential changes are mentioned below.

The project should purchase larger, older animals to realize the maximum benefit from its operations. These bigger cattle have a greater weight gain capacity. They have already reached the point of maximum growth of their frame but can gain much more weight. Furthermore, these older animals are more disease resistant and have greater marketability. Their manure output would be greater, too. Thus, the age at which cattle are purchased for the project should be increased from 1½ - 2 years of age up to 3 - 4 years of age.

Second, the possibility of increasing the number of animals held by each farmer should be explored. The results of this paper suggest that, even without making purchases of feedstuffs, most farmers could hold two cattle on their farms and have sufficient feedstuffs to meet their dietary requirements. When the market is assumed to function perfectly, then up to four animals can be held on-farm without violating the existing constraints on the amount of money which farmers can spend on feedstuffs.

This possibility is especially important for extended households, or gandu. The many sons of these families, and their greater control of village resources, point out the desirability of allowing them to take more than one animal for fattening. By allowing the sons to hold cattle separately from their fathers, out-migration of these young men could be better controlled.

More attention must be paid to checking that farmers are stocking sufficient quantities of feedstuffs for the program. In particular, the nutritive value of cowpea leaf should be made clear and farmers encouraged to harvest these plants earlier in years of poor rainfall. Some improvements could be made in the minimization of food wastage too, by designing inexpensive containers and including them in the loan package.

Farmers appear to do fairly well in balancing their cattle's diet with the feeds which they give them. This observation is borne out by comparing the value of the diet which the average farmer gave to his animal with the nutritive requirements proposed by the Livestock Service. These values are quite close together.

The purchasing of animals by the government remains a problem. In both the 1979-80 and 1980-81 seasons, the unblocking of credit by the CNCA for purchasing project cattle was accomplished very late in the year. Coupled with ineffective department level coordination of the services, this led to an important delay in the soliciting of participants' names and deposits.

On top of these problems, the number and structure of the buying commissions of the project are inadequate. The buying teams are cumbersome since they require that a member from two of the three services involved to accompany the farmers to the marketplace. This problem would not be so severe except that very few members of the services involved are competent to supervise the purchases. With few officials available, and enormous time pressures to buy animals in large quantities as quickly as possible so as to prevent further delays in the project, it is inevitable that the prices paid are too high and the cattle purchased are of poor quality for fattening.

The insufficiency of project personnel extends to the subdepartment level, too. Each technical agent of the Livestock Service is restricted to supervising three hundred head of cattle in his geographical area. This is a prudent measure that is designed to avoid spreading agents too thinly over the project zone. Unfortunately, it has the undesirable side effect of unduly limiting the number of cattle which are involved in the project. In 1980-81, this meant that many would-be participants were not given loans since each village was allocated an inadequate number of cattle.

There was an insufficient amount of project material at the level of each cooperative. For instance, no cattle scales were available in several of the

cooperatives. This made weighing the cattle impossible and impeded evaluations of the project.

Finally, the method by which the date of sale of the cattle is fixed, is very unclear. In the two campaigns observed by this study, it appeared that farmers were told that they could sell their animals when the livestock agents thought they had gained a sufficient amount of weight, or when feedstocks appeared to be low. There was little effort to set this date by reference to the most crucial variable in determining the project's profitability -- cattle prices in the area.

A detailed, on-going study of cattle prices should be included in the project for the months of March, April and May. Information from these surveys could be used to determine the optimal time for selling cattle by computing the trade-offs between the cost of continued feeding of the animal versus the increase in value that would result from this feeding. Additionally, farmers could be informed of the price differences between selling their animals in the market and selling them at their home.

The national direction of the Embouche Bovine project appears to be aware of these difficulties and has proposed remedies to most of them. Yet, it is interesting to note that a report that evaluated the 1977-78 season of the project noted many of these same problems.¹ Also, independent studies² by a French volunteer serving as a project technical assistant have mentioned these problems repeatedly. It remains to be seen whether the awareness generated by these criticisms will be translated into actions to correct them.

For the private farmer, cattle fattening with government loans is a highly profitable activity. The level of cash expenditures which he must make varies with the amount of feedstuffs which he has stocked, but in all cases observed was greater than 14,000 FCFA. Even though the period in which he must make these expenditures coincides with his period of maximum liquidity (postharvest), this sum is still much greater than the poorer families can afford.

What is needed to reach these households is a lower investment small ruminant fattening program. If farmers were allowed to participate in either one program or

¹See Seydou Oumarou. La Stratification en Matière de Production De Viande Bovine Au Niger. Theses #5, Ecole Inter-Etats Des Sciences et Médecine Vétérinaires de Dakar. Dakar: Senegal 1980.

²See Luc Mathys. "Embouche Bovine Paysanne, Campagne 1979-80, Bilan de l'Arrondissement de Matameye." Niamey: Livestock Service of Niger, 1980.

the other, this would allow the poorest families to choose the project with lower capital requirements. Women should also be allowed to participate in small ruminant programs.

Future research on cattle fattening projects should attempt to better evaluate the potential of small ruminant fattening, perhaps through conducting pilot projects in selected regions of the country and monitoring them on an on-going basis. This was done for the cattle fattening project and served as a basis for securing funds from international donors to finance later efforts. The existing interest in small ruminant fattening in the private sector is highly developed and it appears to be very profitable, particularly during periods immediately preceding the Moslem feast days. Questions of how best to tap this potential remain.

A third alternative, which some private farmers pursue, is to buy cattle and to fatten them without the assistance of the government. The profitability of these projects is high but so are the capital requirements.³ Only the wealthiest farmers can afford to undertake this type of project.

5.2. Breeding/Growing-Out of Cattle

Farmers in Damagram Takaya raise some cattle and farm their own lands concurrently. From their herds, they make some sales of young male cattle. In spite of a slight bias in the price structure in favor of selling animals at an early age, most of these sales are of animals aged two to four years old, which is approximately the correct age for further fattening. These farmers are, therefore, already engaging in the growing-out of cattle, though the number of animals involved is not very large.

Farmers do not currently participate in the kind of growing-out of cattle which has been envisioned by the Livestock Service. This type of growing-out of cattle has been defined as purchasing male animals at eight months to one year of age and then holding them for a period of two years before reselling them. During this holding period, the cattle are semiconfined, fed using stocked by-products during the dry season, and range grazed in the rainy season. There is no intensive feeding period because the emphasis is on letting the cattle obtain their maximum growth before fattening. This paper's analysis has focused on the economics of the existing system of breeding/growing-out since there is little data about the costs and benefits of the proposed system.

³See Randall Thomas. "The Stratification of the Production and Marketing of Livestock in Southeastern Niger in the Department of Zinder: Preliminary Report of Results." Ann Arbor: CRED, University of Michigan, May 1981, for an analysis of private sector cattle fattening efforts.

A simple measure of potential profitability for new projects is the existing differential between the price of male calves at one year and their value at three years of age. At existing prices, this value was about 14,000 FCFA. A gross return of 14,000 FCFA over a period of two years on a loan of an animal worth roughly 28,000 FCFA at existing market prices appears to be quite adequate. If the cash costs of holding the animals are kept to purchases of salts, with feedstuffs being harvested from the household's fields, or animals being freely grazed on open rangeland, the farmer should retain a reasonable net profit margin. With these monies, he could repay the government loan.

For this scenario to occur, there remain a number of steps to be taken. First, pilot projects for pure cattle growing-out operations must be started. These projects should extend medium-term credit on loans sufficiently large to buy several cattle. If it is desired to make breeding activities a part of the project, this could include female animals.

The crucial stages of the project are the purchasing and sale of the cattle. Provision should be made for the participants to take part in the selection of animals and the cattle should be purchased using a fixed per kilogram price. Sales could be made on an organized basis, perhaps to cattle fattening agencies, or a free basis, so long as it was made clear when cattle could be sold and that the loan must be repaid at that time.

Small pilot projects could be run using the multiservice format of Embouche Bovine, if that system can be better organized. If not, then it would be preferable to place the pilot efforts in one of the Livestock Service's projects, giving it a chance to get through their start-up period.

Two serious problems face these pilot projects. They will have the effect of increasing the number of animals in the Intermediate zone. This greater amount of cattle, and the increased demand for agricultural by-products, will exacerbate some tensions that already exist within this region. First, the level of conflict between livestock and crops for control of the region's fields will undoubtedly increase. Population in this region has been, and will be, increasing steadily for both humans and cattle. Areas which were once free pasture have been increasingly transformed into cropped fields. As consumption of agricultural by-products grows in the region, this will lead to questions of ownership of forage and further conflicts over land tenure. The need for a clarification of tenurial rights is pressing.

The second question which arises is the extent to which this new program will lead to a conflict between labor needed for stocking agricultural by-products and that

needed for tending crops. Farmers in this region currently expend little effort to create stocks of forage for dry season usage. Since this new program demands that these stocks be created, additional labor will be required during the harvest period.

From the results of this study, it does not appear that this new demand for labor will cause any real conflict with crop production. Farmers appear to have sufficient slack time to stock more by-products, if they desire to do so. There is a danger, however, that the rainy season labor required for guarding the additional livestock will cause a decrease in crop production.

This problem lead to a twenty-five percent drop in agricultural output when cattle holdings were doubled in the linear programming models. This predicted fall is mitigated by the knowledge that the labor required to herd twice as many cattle is somewhat overestimated by the coefficients in the model. However, some provision must be made for these farmers' potential need to purchase more grains than they currently buy. Otherwise, farmers may be tempted to neglect their animals, or not to participate in the program.

5.3. Cattle Plowing/Transport

The subdepartment of Matameye, where this study was conducted, is thought to be one of the better areas in Niger for animal plowing and transport packages. It has relatively high rainfall, good soils, a high population density, and relatively intensely cultivated farms. The Zinder Department's productivity project has been giving out animal traction units for many years.

The evidence of this study suggests that these efforts are misplaced. In areas where traction is applied to crops, the plowing/transport package currently offered is marginally profitable for well-to-do farmers. They would, however, prefer to rent the equipment rather than owning it.

Custom carting provides the bulk of the revenues which farmers taking out credit for this equipment will make as a return on their investment. Yet, in areas where only carts are used and no plowing is applied, the plowing/transport package exhibits negative returns. Therefore, it is the additional revenues gained from the plowing enterprise which make the package privately profitable.

There are several implications of these results. First, before continuing to promote plowing/transport packages indiscriminately, a social benefit-cost analysis which considers the returns to the alternative available projects should be conducted. Of particular importance are the returns to using donkey carts and plowing equipment to fill the need for plowing/transport enterprises. Further research needs to be

conducted. Of particular importance are the returns to using donkey carts and plowing equipment to fill the need for plowing/transport enterprises. Further research needs to be conducted on the private profitability of donkey carts and traction before any major efforts are made to expand the existing projects.

Second, families who take out loans to buy cattle for transport purposes; tend to be those households who are rich enough to pay off these loans without worrying whether the revenues of carting are sufficient to cover the costs of the loan. These families can afford to view these loans with a long-term profit outlook. In this case, the economics of these loans improve since the cost of repaying the loan are covered by revenues from all future periods, i.e. a present value calculation is needed instead of looking at annual costs and revenues.

In villages where plowing is applied, the wealthier households will prefer to own plowing/transport units rather than not be able to use them. Plowing activities, however, have been limited to a very few operations. Their effects upon labor utilization may be to shift labor demands away from ground preparation and seeding into weeding and harvesting. To the extent that this is true, new weed control technologies are needed to help relieve this already binding labor constraint.

The principal implication of these results for cattle plowing/transport projects is that they should only be implemented in regions where plowing inputs are actually applied to the fields. Where plowing is infeasible or not used, it would be better to look at alternative means of providing transportation services, such as donkey carts.

5.4. Livestock Marketing

The role of livestock markets is to move cattle from one production zone to another. The government wants them to do so efficiently and without excessive cost. The markets studied appear to fill this function adequately. The profit and distribution margins of market participants are, on the average, not excessively high.

The only exceptions to these conclusions concerns the government sector's involvement in purchasing cattle for the Embouche Bovine program. In these instances, the traders in the private sector form collusive arrangements against government buyers and raised prices. This problem can be avoided by installing and maintaining cattle scales in the markets to be visited.

Concerning the price structure for the male cattle needed for growing-out activities, the existing price structure of Intermediate zone markets favors the sale of young males at one year instead of at an older age. If this result is extended to the markets where pastoralists sell their animals, then it contradicts the argument that

transhumant producers have economic incentives to hold animals until they reach an older age. However, this conclusion is highly sensitive to changes in mortality rates, prices of the different aged animals, the type of alternative activities available to herders, and the discount rates of the herders involved.

With the existing price structure of 1980-81, there were sufficient price differentials at each stage of the stratification system to make stratification economically viable. The issues remaining are whether large numbers of young male cattle are available in the Pastoral zone herds and, even if the price incentives exist, whether nomadic pastoralists will respond to them and sell cattle.

Much will depend upon whether these price differentials are permanent. The future effects of stratification operations upon market prices are difficult to predict. With the threat of meat imports from South America holding down final consumer prices for meat in the coastal countries, there is limited scope for increases in the prices paid for exported cattle. However, based on consumer surveys, there is sound evidence⁴ that the price of fattened cattle will remain high.

Future research should concentrate on establishing the cattle herd structures of the nomadic groups in the Pastoral zones and on testing the hypothesis that these herds respond positively to price incentives by selling male animals at a young age. The question of whether the price structure will continue to favor stratification is less tractable since it depends upon projections of the price differentials between fattened and unfattened cattle.

5.5. Agriculture

The principal implication of this study for agriculture is that small farmers are economically efficient producers. Development projects must respect their capabilities and try to design their technological packages with farm level conditions in mind. These resources should be channeled through the small farmer and not funnelled into untested capital intensive, regional development schemes. In this fashion, the proven ability of veteran farmers can be utilized.

A corollary to this statement is that there is little room for increasing crop production through a reallocation of existing resources. New resources must be made

⁴See Bernard Kouassi. Determinants of New Food Product Adoption Decisions in a Developing Nation, Ph.D. Dissertation, School of Business Administration, University of Michigan. Ann Arbor: 1982.

available to obtain additional output. Livestock projects which turn unused agricultural by-products into manure are one way of increasing agriculturally useful resources.

Meanwhile, research must continue to attempt to develop new technologies and inputs that are adapted to the milieu of the small farmer. Drought resistant seeds, crop specific weed control techniques, and other means of reducing yield variability among the crops traditionally grown in the survey region, are good examples of needed research. Only by lowering the risk associated with new technologies will these innovations become widely accepted.