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Small Ruminant Production in the  
Sertao of Ceara, Brazil:  
A Sociological Analysis

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A Producao de Pequenos Ruminantes no sertao do Ceara, Brasil:  
Uma Analise Sociologica

Abstrato

Este trabalho enfatiza a importancia de uma compreensao das condicoes socio-economicas nas quais pequenos ruminants sao criados no nordeste. Ele complementa o projeto de Economia do SR-CRSP, e grande parte dos dados aqui usados sao os mesmos da sub-amostragem de 32 fazendeiros do projeto supra-citado. Alem destes 32 fazendeiros, 20 outros pequenos fazendeiros tambem foram entrevistados (pequenos fazendeiros sao definidos como aqueles que possuem 75 ha de terra ou menos), para que uma melhor representacao da populacao local fosse obtida.

Os principais objetivos da pesquisa foram identificar o tamanho das propriedades para as quais pequenos ruminantes sao mais importantes e as razoes para tal, assim como averiguar como as estacoes chuvosa e seca influenciam a producao desses animais na regio. Embora a producao de pequenos ruminants nao seja uma atividade rural primordial no sertao do nordeste, ela e um elemento essencial do conjunto de estrategias utilizadas para a sobrevivencia da populacao local.

O numero de animais na propriedade aumenta a medida que aumenta o tamanho da fazenda. Somente 37% dos produtores muito pequenos (com fazendas de 10 ha ou menos) tinham animais, ao passo que a maioria dos pequenos produtores (com fazendas ate 75 ha) tinham ovinos, seguidos em importancia por bovinos e finalmente por caprinos. As principais razoes pelas quais pequenos produtores nao preferiam caprinos eram: caprinos requerem supervisao intensa, e pastagem e cerca extensa. Tais fatores sao incompativeis com a escassez de terra, trabalho e capital comuns aos

pequenos produtores da regio. Escassez de agua tambem foi considerada um dos mais importantes problemas para qualquer tipo de atividade agropecuaria.

Ovinos sao considerados fontes de subsistencia e de renda, ao passo que bovinos sao principalmente considerados fontes de renda, e caprinos fontes de subsistencia. Aqueles produtores que tinham caprinos indicaram as vantagens principais de tal atividade: (a) caprinos produzem leite e carne; (b) sobrevivem facilmente durante as estacoes secas; (c) estao em grande demanda no mercado durante todo o ano. Os caprinos nao sao vendidos na epoca em que sao mais rentaveis (estacao chuvosa), mas em qualquer epoca do ano, de acordo com a necessidade monetaria da familia do produtor. Provavelmente poder-se-ia aumentar a renda dos produtores se tornar-se possivel manter o peso dos animais durante a estacao seca.

Grandes fazendeiros tem uma percentagem maior de caprinos do que pequenos fazendeiros, possivelmente porque eles podem dispor de mais terra para pastagem e de mais capital para cercar partes da propriedade destinadas a criacao de tais animais. No entanto, eles preferem criar gado. Bovinos e ovinos sao considerados complementares entre si, mas caprinos nao. Existe uma relacao entre o tamanho da fazenda e a criacao de animais. Grandes fazendeiros preferem criar bovinos para fins de comercializacao e lucro. Pequenos fazendeiros, estando mais interessados em melhorar suas condicoes de sobrevivencia, preferem criar pequenos ruminantes, muito embora demonstrem grande interesse em criar bovinos como fontes de renda.

Tanto pequenos como grande produtores se dedicam a criacao extensiva de animais e ao cultivo intensivo de produtos agricolas, ambos com baixa produtividade. Em geral, grandes fazendeiros sao mais

interessados na producao de algodao e na criacao de gado, enquanto que pequenos fazendeiros estao primeiramente interessados no cultivo de produtos para subsistencia e secundariamente interessados no criacao de animais.

Os principais problemas relacionados a criacao de animais no sertao de Ceara foram identificados: falta de agua e de alimentacao durante a estacao seca, e saude dos animais. Sugere-se que se faca esforcos para fornecer condicoes apropriadas ao pequeno produtor para que aumente a producao (numero) de pequenos ruminantes. Nao se deveria dirigir esforcos para a especializacao de produtos por parte do pequeno produtor. Em longo prazo, um aumento no nivel de comercializacao de pequenos ruminantes poderia ser prejudicial ao produtor. Esforcos para melhorar a producao e distribuicao de forragem e alimentacao suplementar entre os pequenos produtores podem, na verdade, ser empregados em melhorar a producao bovina em vez da caprina ou ovina, pois bovinos sao mais lucrativos que pequenos ruminantes no sertao do Ceara. Neste trabalho tambem da-se sugestoes para melhoramentos tecnologicos e para as possibilidades de que estes melhoramentos sejam aceitos pelos produtores.

## Small Ruminant Production in the Sertao of Ceara, Brazil: A Sociological Analysis<sup>1</sup>

### Introduction

This report consists of three parts. The first part offers a social description of the general region in Brazil where the Small Ruminant CRSP program is situated. The second part reports the results of the sociology baseline study. The last part presents some conclusions.

To fully understand small ruminant production in a cultural region like Northeast Brazil, one must first understand the social context in which the production takes place. Otherwise, there is a strong likelihood of misinterpreting why the animals are being produced in the first place. Ignorance of the producer's motives results in a diminished ability to make meaningful recommendations on how to improve production.

Too often in the past, research has focused exclusively on the animals themselves with little or no attention paid to the people that produced them. As a result, the recommendations of researchers were often ignored or resisted by the producers. The suggestions were rejected not because the producers were lazy, stupid or ignorant but rather because they made no sense to them. In many cases, the rejections were very rational decisions. If we are to offer improvements to producers, we must first know what constitutes an improvement to them.

The second part of the report describes our research and its findings. These findings present a partial picture of the socioeconomic

<sup>1</sup>This research was carried out as a part of the United States Agency for International Development Title XII Small Ruminant Collaborative Research Support Program under Grant No. AID/DSAN/XII-G-0049, in collaboration with Empresa Brasileira de Pesquisa Agropecuaria, Centro Nacional de Pesquisa de Caprinos e Ovinos Tropicais (Brazil).

factors which influence the production of sheep and goats in the sertao of Ceara. Our description is complementary to the information that has been obtained by the Economics component of the Small Ruminant CRSP program in Brazil. A comprehensive understanding of the social and economic factors of production requires consulting both sources.

If there is an overall finding from the initial Sociology research project it is that the production of small ruminants in the sertao is heavily influenced by a number of complex tasks which constantly confront the producer and which he must resolve successfully if he is to survive. The role of sheep and goats can only be properly understood within the context of the total production strategy of the producers. In Northeast Brazil, there are marked differences in the relative importance of small ruminants between different-sized producers as well as between wet and dry seasons or years.

We have learned that the proper response to the question of how important are small ruminants in the sertao of Northeast Brazil is the question: For what size of producer and in what type of season or year?

#### Small Ruminant Production in Northeast Brazil

Northeast Brazil, a region covering 1,542,271 km<sup>2</sup> and supporting a population of over 35 million people, is perhaps one of the most researched areas in Latin America. The social science literature concerning this land is extensive and diverse. Yet, the results have never been woven together into a lucid account of the Northeast and of its people. This is perhaps so because the region encompasses a great variety of ecological and social formations. The term "the Northeast" is a term of convenience rather than an accurate descriptor.

Most of the social and economic analyses of the Northeast have correctly focused on the region's traditional role as an exploited and underdeveloped periphery which has been used to provide cheap raw materials and labor to wealthier and more powerful economic regions, both in Brazil and overseas. Although the active exploitation of the region may have diminished, the Northeast remains economically marginal with a large impoverished rural population literally scratching a living out of the soil. The economic development of this area has been complex spawning very different interpretations about its problematics and suggestions for their resolution. A good and useful review of this literature is provided by Cavalcanti et al (1981).

The physical heterogeneity of the region has forced social geographers to subdivide the Northeast into macroecological zones, each with a typical range of socioeconomic structures. Although the division of the region into more homogeneous areas is based on several criteria, rainfall is the paramount factor. Ultimately, it is the consistent variation in rainfall which has created the different macroecological zones which characterize the region. The best introduction to the geography of the Northeast and its consequences for human habitation is Andrade's (1980).

The Northeast is conventionally divided into three macroecological zones: the zona de mata, the agreste and the sertao. The first is a very thin strip which parallels the coast; it is characterized by high rainfall. Paralleling the zona de mata is the agreste, a broader band which represents a transitional zone between the humid coast and the arid interior. The sertao is the arid interior. It is a vast region of about 755,700 km<sup>2</sup>, constituting about half of the total surface of the

Northeast. It is a relatively flat region. The low rainfall rates have induced a vegetation cover composed of a substantial variety of xerophytic plants known locally as caatinga.

It is the limited quantity of rain and its irregular periodicity which stamp on the region its most typical characteristics. Average annual precipitation in the sertao is less than 300 mm in some areas. Rainfall can vary considerably between regions and between years. Sometimes, of even greater importance than the total rainfall is its distribution. The entire annual precipitation may fall in a matter of days or weeks; as in 1981.

The distribution of the population, the characteristics and range of its economic institutions and its social welfare, are all ultimately conditioned by the rains. The frequent social dislocations in the modern history of the sertao have all been linked to the extended droughts which develop almost every decade.

The sertao is often viewed as a barren region characterized by the unending monotony of the caatinga. There is, in fact, considerable variety. Rivers and mountains are the features which alter most often the surface of the sertao, and its human landscape. The water available in some of the river valleys turns the surrounding land into semi-tropical oases which attract and support dense human populations. Such areas tend to be intensively cultivated. A very similar process occurs in many of the isolated mountain chains. Rainfall is more abundant at these higher elevations and thus these regions also are densely populated and intensively farmed. River valleys and highlands are economically important not only because they support more intense agricultural

exploitation but also because they produce crops that cannot be cultivated in the lowlands. There, the land supports a much sparser human population and is used principally for limited intensive agriculture and extensive animal husbandry.

The modern economic history of the sertao is linked to the economic development of the zona de mata. The growth of a sugar cane economy on the coast, especially in the state of Pernambuco, created a demand for food and draft animals; the less fertile lands of the arid hinterland were relegated to meet these needs. As the scope and area of sugar cane production increased, it became necessary to go even further inland to grow the food and animals necessary to sustain sugar production. Eventually, the sertao was explored, conquered and settled by sugar interests. The region was converted into a producer of cattle for meat for draft purposes.

Alongside the development of livestock production, there also developed a subsistence economy which allowed settlers to survive without having to transport food from the agricultural regions of the agreste. This subsistence production complex consisted of the cultivation of beans, corn, squash and manioc, and the production of sheep and goats.

The economic role of the sertao as the supplier of livestock for the coastal plantations lasted until the end of the 18th century, when the international demand for Brazilian sugar declined sharply. The ensuing collapse of the coastal sugar economy lessened the demand for livestock from the sertao. This, plus the growth of an international demand for cotton, led producers to cease their exclusive reliance on cattle production and to devote increasing portions of their lands to the

cultivation of cotton.

Fazendas in the sertao adopted a more complex and flexible production strategy. They continued to produce cattle but also produced cotton for the world market. The adoption of cotton cultivation did not impair the subsistence production of the fazendas. Staple crops were interplanted with the cotton. The development of cotton production did not require a significant expansion of cultivated lands, nor did it compete significantly with the land needs of livestock production. Since land was abundant, production could always be increased by incorporating new lands. In this manner there developed a mixed economy which produced cattle and cotton as commodity items and beans, rice, sheep and goats as subsistence items. This basic pattern persists today.

Present-day small ruminant production in the sertao must be understood within this historical context. The contemporary sertanejo is not primarily a small ruminant producer although the production of these animals on a small scale is an essential part of his strategy for survival. Indeed, no single product produced by the fazenderio is essential to his survival. It is critical to remember that the production of sheep and goats is not an exclusive concern for these producers. It is true, however, that the relative importance of these animals varies in different areas of the sertao. In northeastern Bahia or central Paraiba, for example, the production of sheep and goats is much more important to the fazendeiro than it is in Ceara.

The producer of the sertao practices mixed farming in a triple sense: He relies both on agricultural and animal production, he produces both large and small animals and he participates both in a subsistence and

a cash economy. Any attempt to alter any one of these facets must consider the complex relationships between these three spheres of action.

Even though small ruminants are not the most important activity of northeastern fazendas, the Northeast is the most important producer of small ruminants in Brazil. About 40 percent of the Brazilian sheep and 75 percent of the goats are found in this region. In 1979, the Northeast had a sheep herd of 6.1 million animals and a goat herd of 7.4 million animals (Fundacao Instituto Brasileiro de Geografia e Estatistica, 1980).

Attempts at improving small ruminant production in the Northeast date back at least to 1910 when males were imported from Europe (Freitas, 1951). As early as 1944, Freitas studied the possibilities of improving goat production in the Northeast. Most of what he proposed has been left undone and his suggestions are remarkably similar to those being offered today. It might be fruitful to ponder why these early proposals bore no results despite the apparent active interest of the Ministry of Agriculture and whether similar suggestions today will receive serious consideration.

The distribution of small ruminants in the Northeast is rather uneven. Roughly a third of the region's goats and sheep are found in the state of Bahia. This state is by far the most important producer of small ruminants in the Northeast. About fifty percent of the region's goats are evenly divided between the states of Piaui, Ceara and Pernambuco. In addition to Bahia, sheep are concentrated in Ceara, Piaui and Paraiba (Banco do Nordeste, 1974). In absolute terms, the largest concentration of small ruminants in the Northeast, and in Brazil for that matter, is found in an area which extends from western Pernambuco to northeast

Bahia. The National Center for Research on Goats is located in northern Ceara, on the fringes of the most important production zone.

Small ruminant production in the Northeast is associated almost exclusively with meat production and the sale of pelts. Since virtually all of the sheep in the region are hair sheep, there is no significant wool production. Goat's milk is seldom marketed or processed into cheese. The sources of demand for small ruminant meat are the rural population, the small urban centers in the sertao and the migrant population in the coastal cities. The trade in pelts was originally directed at international markets but is now linked to industrial sources of demand within the Northeast (Banco do Nordeste, 1974; Ministerio da Agricultura-Paraiba, 1979).

The commercial importance of sheep and goats in the Northeast seems to vary significantly in different areas of the region. In Bahia there seems to be an extensive and complex marketing system which channels small ruminant meat through various intermediaries from producers to urban consumers. In Ceara the links between producer and consumer are much more direct. This difference is most probably attributable to the much higher production levels in Bahia. In Ceara, not only are the production levels much lower, but it also seems that marketed offtake is lower, leaving a larger share of the offtake for consumption by the producer's household. Such differences between regions must be considered when trying to generalize the lessons learned in Ceara to the entire Northeast.

Despite differences in the numbers and relative importance of their small ruminant herds, most Northeastern states have expressed interest in

increasing the production of sheep and goats in their areas (Comissao Estadual de Planejamento Agricola-Pernambuco, 1976; Ministerio da Agricultura-Paraiba, 1979; Secretaria da Agricultura-Bahia, 1974). Federal agencies have also issued reports seeking to promote small ruminant production either in specific Northeastern states or in larger areas (Comissao Estadual de Planejamento Agricola-Ceara, 1978; Comissao de Planejamento Agricola-Pernambuco, 1978; Fundacao Joao Pinheiro, 1979; Ministerio da Agricultura-Ceara, 1979).

#### The Sertao of Ceara

The state of Ceara covers 146,817 km<sup>2</sup> according to the Fundacao Instituto Brasileiro de Geografia e Estadistica (1981) and 148,016 km<sup>2</sup> according to the Comissao Estadual de Planejamento Agricola-Ceara (1979). The 1980 census gives the state a population of 5,294,876 inhabitants. About 46.8 percent of the population is classified as rural (Fundacao Instituto Brasileiro de Geografia e Estadistica, 1981). Most of Ceara's urban population is concentrated in the Fortaleza metropolitan region. This area has a population of about 1.5 million people. Approximately 30 percent of the state's population lives in its metropolitan region, another 20 percent lives in the small urban centers in the interior of the state and the other half lives in the rural areas.

The demographic pattern alters when we look at the sertao region of the state. This region occupies about 57 percent of the state's surface area. In the present study we will adopt the demarcations adopted by the Comissao Estadual de Planejamento Agricola-Ceara to locate the sertao. Other studies have used slightly different boundaries. The population of the region numbers about 1,720,306 inhabitants, about 32 percent of the

state's population. Of the total population of the sertao, 68 percent, or 1,162,588 people are classified as rural. This population is grouped in 208,729 rural households, yielding an average rural household size in the sertao of 5.7 persons. These households reside in 77,026 fazendas, resulting in a proportion of 2.7 households per fazenda (Fundacao Instituto Brasileiro de Geografia e Estadística, 1981).

Table 1 shows the land tenure pattern which prevailed in the sertao of Ceara in 1972. We can see that whereas the great majority of fazendas, about 79 percent, are less than 100 ha in size, they control only one-fourth of the farmland. At the other end of the land tenure structure, about 40 percent of the land is controlled by fazendas of 500 ha or more, which represent only 3.2 percent of the rural units. Despite the skewed distribution, the size of production units in the sertao is probably larger, on the average, than in the rest of the state. Smallholders are least concentrated in the sertao.

This description of the land tenure structure fails to give an accurate picture of the degree of land ownership concentration in the region. Land ownership is restricted to approximately 30 percent of the rural population; the rest of the rural households own no land. Of the average 2.7 households which reside in each fazenda, one household may be that of the owner, while the other 1.7 represent the families of landless rural workers who are sharecroppers, tenants or hired workers.

Table 1. Land Tenure Structure in the sertao of Ceara, 1972

Size	Number	Percentage	Area in ha	Percentage
Less than 10 ha	13,562	19.3	71,189	1.0
10 to less than 25	15,779	22.5	262,068	3.7
25 to less than 50	13,830	19.7	492,821	7.0
50 to less than 100	12,046	17.2	847,787	12.0
100 to less than 200	7,839	11.2	1,090,604	15.5
200 to less than 500	4,850	6.9	1,472,050	20.9
500 to less than 1000	1,386	2.0	949,359	13.5
More than 1000	834	1.2	1,849,896	26.4
Total	70,126		7,035,774	

Comissao Estadual de Planejamento Agricola-Ceara (1979)

Furthermore, there is a high degree of multiple land ownership. In many cases, a single owner may possess two or more fazendas. When we look at Table 2, we see this clearly. The table shows that in 1978 there were 77,026 fazendas in the sertao but only 63,568 owners. In other words, 13,548 fazendas, about 17 percent of the total, are owned by persons who own at least one other fazenda. On the average, each owner in the sertao owns 1.2 fazendas.

The data show a clear relationship between the prevalence of multiple ownership and the size of fazendas. At the smallest level, we find more owners than properties! This means that the smallest fazendas are in many cases owned by more than one owner, rendering them even

Table 2. Multiple Land Ownership in the sertao of Ceara, 1978

Size	Number of owners	Number of fazendas	Fazendas per owner
Less than 10 ha	11,097	10,961	0.9
10 to less than 25	13,664	14,700	1.1
25 to less than 50	12,335	14,044	1.1
50 to less than 100	11,095	13,465	1.2
100 to less than 200	7,676	10,241	1.3
200 to less than 500	5,064	7,808	1.5
500 to less than 1000	1,583	3,088	2.0
More than 1000	1,054	2,719	2.6
Total	63,568	77,026	

Comissao Estadual de Planejamento Agricola-Ceara (1979)

more marginal as units for subsistence. On the other hand, we notice that at the largest size category, there are many more fazendas than owners. This implies that the degree of concentration of land in large fazendas is quite high. More than half of the largest fazendas are owned by people who own at least one other property.

The problem of land concentration in the sertao is thus not only caused by a minifundio-latifundio structure but is also aggravated by problems of multiple ownership of the more extensive properties. The net result is the exclusion of more than two-thirds of the rural populations from ownership of land. This landless population is transformed into a cheap source of labor which is utilized to operate the larger fazendas.

It is difficult to gauge the degree of stability in this land tenure structure. We have some longitudinal data for the entire state which documents some changes. We cannot disaggregate the data for the sertao. The statewide data shows that between 1940 and 1975 the number of fazendas in Ceara increased by 170 percent, while the total farmland increased by only 28 percent. The number of fazendas increased six times faster than the total farm area. This suggests that a process of land fragmentation was taking place. Table 3 shows the changes in the various size categories.

We can see that increases in farm units and in area were strongly and negatively related to the sizes of the fazendas. If these changes are representative of what has been happening in the sertao, then we must conclude that there is a process of restructuration occurring in its land tenure. The emergence of new small fazendas would appear to be occurring at the expense of the largest fazendas. These large fazendas probably have become subdivided into smaller units of varying sizes. The overall trend is one of the multiplication of the very small fazendas, the stability of the middle-sized ones, and a reduction in the largest units.

Differences in the sizes of the production units seem to have little effect on the production strategies pursued by them. The pattern of farmland utilization appears to be rather similar in fazendas of different size, only the scale of production varies. This similarity appears to hold true not only in different regions of the sertao but also appears remarkably stable through time.

Farmland use in the sertao of Ceara is devoted almost exclusively to crop and livestock production. Agricultural crops are grown on an

Table 3. Percentage Changes in Land Tenure Structure in Ceara from 1940 to 1975

Size	Percentage Increase in Number of Fazendas	Percentage Increase in Aggregate Area
Less than 10 ha	404.8	382.7
10 to less than 50	128.1	103.2
50 to less than 100	43.6	42.1
100 to less than 200	28.1	24.9
200 to less than 500	11.6	7.9
More than 500	13.3	7.0
Total	170.5	28.5

Comissao Estadual de Planejamento Agricola-Ceara (1979)

intensive basis while livestock production is based on extensive practices. This holds true regardless of the size of the production unit. In the small fazendas, crops are intensively grown in the limited areas suitable for agriculture and the livestock is pastured on the rest of the land, the number of animals being largely limited by the carrying capacity of the caatinga. In the large fazendas, most of the land is devoted to livestock and there is no extensive agriculture. Instead, small plots of land are either rented or sharecropped by landless households and are cultivated in the same intensive manner as are small units. As a result, agricultural production tends to be the same in large and small farms. Livestock production, on the other hand, does differ between small and large units and productivity tends to be higher in the smaller fazendas. On a

statewide basis, fazendas of 200 ha or more are generally unable to meet the minimum livestock production levels set by the Instituto Nacional de Colonizacao e Reforma Agraria (Comissao Estadual de Planejamento Agricola-Ceara, 1979).

Of the total farmland being utilized in the sertao in 1972, 5,108,456 ha or 66 percent, was devoted to livestock production, 29 percent to agriculture, and the rest to extractive activities. However, these areas are not mutually exclusive as animals are often pastured on the stubble from various crops. In general, the smaller the fazenda, the larger the area devoted to crops.

Agricultural activity in the sertao is devoted primarily to the production of perennial cotton, beans and corn. The last two crops are interplanted annually with the cotton, which is usually harvested for about five years. Crops of secondary importance are rice, sweet manioc and sugar cane. The larger fazendas also have some cultivated pastures, mostly napier grass. Most of the crops, but especially beans and corn, can serve both as subsistence and as cash crops. The produce is sold only if the harvest exceeds the internal subsistence demands of the household. In practical terms, this means that these items are sold rather infrequently.

Animal production in Ceara is concentrated in cattle, sheep, goats and pigs. In 1978 the state had a cattle herd of 2,183,615 animals, a herd of 1,219,365 sheep, 808,477 goats and 1,341,640 pigs (Fundacao Instituto Brasileiro de Geografia e Estadistica, 1980). The cattle and sheep are produced by various types of extensive grazing production systems, while the goats and pigs are produced mainly by scavenger production.

In 1979 the sertao of Ceara had 1,294,817 head of cattle, 859,325

sheep and 450,816 goats. These herds represented about 59 percent of the state's cattle, 70 percent of its sheep and 56 percent of its goats. With the exception of sheep, the sertao does not produce more than its proportional share of livestock. This is an important point. Although the region specializes in livestock production, it only manages to equal the productivity of the other regions in the state.

The distribution of livestock by species in the Sertao is not uniform. Cattle are most numerous in the microregions of Sertoões de Crateus and Baixo Jaguaribe. Sheep are concentrated in the microregions of Sertoões de Crateus, Sertão dos Inhamuns and Baixo Jaguaribe. Goats are found principally in the microregions of Sertão de Inhamuns, Litoral de Camocim e Acarau and Baixo Jaguaribe. The Sertoões de Crateus and the Sertão dos Inhamuns are contiguous regions and are located within the sertao. The microregion of Baixo Jaguaribe straddles the sertao and a more humid area, this microregion is included sometimes as part of the sertao. The most important producer, by far, of livestock in this microregion is the município of Morada Nova. This município is located entirely within the sertao.

Livestock production in the sertao appears to be concentrated in a few well defined areas. The microregions of Sertoões de Crateus and Sertão dos Inhamuns contain about 24 percent of the region's cattle, 33 percent of its sheep and 44 percent of its goats. A look at the distribution of the livestock shows that the three species tend to be produced together, especially cattle and sheep.

However, even in the sertao not all fazendas produce animals. Production of livestock tends to be associated with the size of the

production unit. According to the census, only 37 percent of the fazendas of 10 ha or less produce animals; this percentage increases drastically in the larger units. About 60 percent of the fazendas between 10 and 50 ha produce animals, 73 percent of those between 50 and 100 ha, 79 percent of those between 100 and 200, 83 percent of those between 200 and 500, and 89 percent of those larger than 500 ha. It is very likely that these figures underestimate the actual production rates, especially for small ruminants in the smallest fazendas.

As might be expected, livestock production tends to be more intensive in the smaller units. Table 4 shows the percentage distribution of pastures, cattle, sheep and goats in the sertao in 1972 according to the size of the units. We see that there is little relationship between the distribution of pastures and the animals produced on them. In fact, the distribution of livestock tends to be remarkably uniform between the various sized units. The only exception is the smallest stratum of producers, where the percentage of animals tends to be lower. However, when we look at the share of the pastures controlled by this stratum, we see that animal production in these fazendas is the most intensive.

#### The Sample

In 1980 the Economics component of the Small Ruminant-CRSP program in Brazil chose a sample of 127 fazendas, for an initial survey of fazendas in Ceara which produced sheep and/or goats. The criteria for the selection of this sample as well as some of the results of the survey are reported by Gutierrez et al (1981)

Table 4. Percentage Distribution of Pasture and Cattle, Sheep and Goats in the sertao of Ceara, 1972

Size	Pasture	Cattle	Sheep	Goats
Less than 10 ha	0.2	1.9	2.0	7.7
10 to less than 50	5.6	13.8	15.8	17.7
50 to less than 100	8.6	13.4	15.0	14.5
100 to less than 200	13.2	16.1	17.0	16.5
200 to less than 500	20.9	21.2	18.4	19.1
More than 500	51.5	33.6	31.8	24.5

Comissao Estadual de Planejamento Agricola-Ceara (1979)

After the initial survey, a subsample was drawn from the original sample. The new sample consisted of 32 fazendas located in eight different municipios. This sample is being used by the Economics project for a detailed study through periodic surveys. The principal criterion for the selection of this sample was that there be different sized sheep and goat herds in the fazendas of each of the municipios. This subsample provided the foundation for the sociology study presented here.

One of the original aims in the selection of this sample was that it be used by the other projects in the Small Ruminant-CRSP program so that it be subjected to multidisciplinary investigation. It was hoped that in this manner the research would generate a global and comprehensive picture of small ruminant production which was based on the same sample. The present study represents the second utilization of this sample.

The sample consisted of four fazendas in each of eight municípios. However, due to some changes in ownership and some problems in the field, the actual sample differed a bit from the original. We do not believe that the alterations impaired the validity of the sample. There were, however, other aspects of the sample that must be noted when making generalizations from the data. In essence this is a stratified sample of different sized livestock herds identified in the original survey. It is not a sample of fazendeiros or fazendas nor was it intended to be such. This means that the fazendeiros interviewed do not constitute a representative sample of fazendeiros in the sertao of Ceara. A sample of that group would require: 1) selecting both small ruminant producers and non-producers, 2) interviewing persons living too far from roads to permit periodic sampling, and 3) small producers not known to extension agents. In addition, because the sample is stratified by herd size, it contains a disproportionate number of large producers who are not the target audience of the SR-CRSP. The sample was designed to identify production parameters and is well suited for this purpose but the findings of the sample must be used cautiously when making generalizations about the population of producers in Ceara.

The fazendas in the sample are located in the municípios of Crateus, Granja, Independencia, Morada Nova, Parambu, Quixada, Sobral and Taua. All these municípios, with the exception of Granja and Morada Nova, are located in microregions situated within the sertao, according to the definition of the sertao noted in the previous section. Granja belongs to the microregion of Litoral do Carnocin e Acarau, which, it will be recalled, is one of the leading producers of goats in Ceara. This município

borders on the fringes of the sertao. Morada Nova, as we suggested previously, is within the ecology of the sertao.

These municipios are among the major producers of small ruminants in the state of Ceara. Together they account for 25 percent of all sheep and goats produced in the state. They also produce about 14 percent of its cattle. These figures may lead to the erroneous conclusion that these municipios specialize in the production of sheep and goats and that cattle production is less important. If we look at Table 5, however, we see that they produce many more cattle than small ruminants. These last figures suggest that the proportion of pastures devoted to cattle must be considerably larger than that given to sheep and goats.

When we look at the relationships between the production of the three species within each municipio, we see a clear relationship between sheep and cattle and a very mixed relationship between these two species and goats. Sheep and cattle production appear to be complementary, whereas the production of goats seems to be unrelated to other livestock production. The municipios of Independencia and Taua, which are contiguous, have the highest production levels for all three species.

The differences in Table 5 cannot be explained either in terms of differences in the total farmland in each municipio or in relation to differences in the average size of the fazendas of the various municipios. The average fazenda size in 1978 varied from a low of 40.8 ha in Sobral to a high of 117.7 ha in Taua, the mean size for all eight municipios was 69.9 ha (Superintendencia do Desenvolvimento de Estado do Ceara, 1980).

Table 5. Cattle, Sheep and Goat Herd sizes in the Eight Municipios of the Sample, 1979

Municipio	Cattle	Sheep	Goats
Crateus	49,100	39,690	17,200
Granja	20,749	17,944	33,245
Independencia	63,780	67,700	40,100
Morada Nova	52,581	40,854	20,200
Parambu	20,900	19,100	28,700
Quixada	50,000	37,500	12,600
Sobral	56,000	27,000	7,000
Taua	57,100	52,580	39,480

Fundacao Instituto Brasileiro de Geografia e Estadistica (1980)

Table 6. Cattle, Sheep and Goat densities per Hectare in Municipios of Sample based on Total Farmland Area

Municipio	Cattle	Sheep	Goats
Crateus	.19	.15	.07
Granja	.16	.14	.25
Independencia	.21	.22	.13
Morada Nova	.22	.17	.09
Parambu	.11	.11	.17
Quixada	.13	.10	.03
Sobral	.34	.16	.04
Taua	.18	.17	.13

Superintendencia do Desenvolvimento do Estado do Ceara (1980)

When we standardize the animal populations into densities per hectare of farmland, we see some variation between the municipios. Table 6 presents the animal densities for the municipios. Sobral, for instance, is a very intensive producer of cattle but it has one of the lowest goat densities.

As in the data in Table 5, the figures for animal densities do not present any clear patterns except for the same general association between sheep and cattle. Overall, the municipios of Independencia, Granja and Sobral seem to be the most intensive producers of livestock in the sample. Granja shows a relatively high goat density compared to the other municipios. In relation to small ruminant production, the most intensive producers are Granja and Independencia, while Quixada is the least productive. When we rank the municipios by species, Independencia has the highest sheep density and Quixada the lowest. For goats, Granja has the highest density and Quixada, again, the lowest.

These figures give some idea of the differences which exist between the municipios in our sample. However, since the sizes of our sample within each municipios are so small, we made no attempt to compare municipios in the analysis of our data.

The sample of fazendeiros was interviewed using an open-ended questionnaire consisting of 128 questions. These questions sought information on several topics, including the social background of the fazendeiros, the social organization of the fazenda and various aspects of livestock production and marketing. None of the fazendeiros refused to be interviewed although some were clearly distrustful at the beginning and may have systematically biased some answers. There was a definite

tendency for most owners to underestimate the size of their property or their herds. In a very few cases we terminated the interview early because we suspected the veracity of the information that we were receiving. We conducted a total of 29 interviews from the main sample.

Since we knew beforehand that this sample underrepresented the smaller strata of landholders, we sought to gain information from this group by interviewing some of them whenever possible. Such interviews ranged from a few casual questions to a full interview in one case. We tried to interview small owners whose properties were located in the vicinity of one of the fazendas in our main sample. We conducted perhaps twenty such interviews.

Our field work commenced on 26 October 1981 and ended on 4 January 1982; however, we did not conduct field work continuously throughout this period.

### Results

The initial portion of the interviews sought information about the fazendeiros. We obtained biographic data which might have bearing on their performance as producers and on their receptivity to innovation.

The sample of fazendeiros proved to be more heterogeneous than we expected. As a group, they are relatively old. They ranged in age from 35 to 74 years and had a mean age of 53. Twenty-one were males and five were females. Of the latter, four were widows who became titular heads of their fazendas at the deaths of their husbands.

The group was poorly educated, most had only 2 to 3 years of formal education. One, however, had a degree in law. There was a tendency for the wives of the male owners to be slightly better educated than their

husbands. This is probably attributable to the fact that the rural households have less need for the labor of their girls and they are allowed to go to school longer than the boys.

The children of these fazendeiros appear to be better educated than their parents. Many had at least five years of schooling and some had finished the full 8 years of primary education. There were wide differences in the educational levels of these children, however. It may be that the brighter children are kept in school longer while their siblings drop out and help in the fazenda. If this is occurring, then there may be a process of negative selection in the transference of the fazendas from one generation to the next.

The low educational levels of these rural households makes them both easy and difficult to work with. On the one hand, they are much more ready to accept the advice from experts and much more impressed with the magic of science. On the other hand, they understand little of the evidence or reasoning behind the advice and thus cannot be expected to implement it without close guidance. We would suspect that the educational level of small fazendeiros is perhaps even lower and their capability for absorbing new techniques more limited.

About half of the owners were born in the municipio where they presently have their fazendas, the other half was born in other municipios in the state of Ceara. The fact that half the owners migrated to the municipios where they now own land is suggestive for two reasons. First, it is evidence of a sizeable migratory current within the state. Secondly, it indicates that fazendas or parts of them are placed on the market in significant numbers. These two indications suggest a rather active trade

in land and a degree of economic entrepreneurship that are somewhat incompatible with subsistence-oriented rural sectors.

This interpretation is strengthened when we look at how the owners came into possession of their properties. Contrary to our expectations, only 32 percent of the fazendas in the sample were inherited, the rest were purchased. In some of the former cases, the inheritance was subsequently supplemented by the heir with the purchase of additional land. This means that non-commercial forms of land ownership transfer may be less important than market mechanisms. This, in turn, places some constraints on the scope of subsistence production within the fazendas. Purchased fazendas must be regarded as investments which are expected to return profits, and thus cannot be dedicated exclusively to subsistence production.

Eleven of the thirty fazendeiros are absentee owners. Two or three of them live in Fortaleza and the others reside in urban centers close to their fazendas. Some commute to their properties daily while others visit them weekly or less often. These fazendas are managed by relatives or by paid foreman. In one of the latter cases, the foreman had been managing the fazenda for over twenty years.

Nearly all the absentee owners are economically active in the towns where they reside; they do not simply live off the income from their fazendas. A few have small stores, one works as an administrator of a cotton cooperative, another as a truant officer. One of the owners who lives in Fortaleza is an agronomist and works for a public agency. Two of the absentee owners are retired. None of these people appear to depend on their fazendas for their subsistence.

Nine of the owners reported owning at least one other piece of land in addition to the fazenda in our sample, a few owned two or three more parcels. These properties tend to be relatively close to each other. It appears that in some cases they are utilized in complementary ways, suggesting a strategy whereby the owners separate the production functions normally found within the same fazenda between their different properties. Thus, owners might report having all their goats in only one of their properties. This means that their total production strategy cannot be gauged from understanding the operation of any one unit but must be understood by examining the division of production which exists between the various units.

The second section of the interview concerned some of the characteristics of the fazendas themselves. We found a bewildering variety of ways in which the present fazendas came into being. Some were inherited or bought in their present form. Others were aggregated through purchases and/or inheritances. In some cases the present fazendas were portions of an older larger fazenda, while in other cases they were put together from smaller pieces of land. We could not detect a net process of land fragmentation or consolidation.

We obtained information on the size of 26 of the fazendas in the sample. The smallest measured 20 ha while the largest was reported to be 700 ha. Table 7 shows the size distribution of the fazendas. It can be seen that about half of the units are larger than 200 ha and that there are no fazendas smaller than 10 ha. When we compare this distribution with that in Table 1, where we show the land tenure structure in the sertao, we have some idea of the biases in our sample.

It would be misleading, however, to use the size of the production unit as the only criterion in classifying and stratifying the fazendas. As in many other non-temperate regions, soil quality and water availability are also crucial elements, sometimes surpassing land area as the most important factor of production. In the sertao, the availability of water tends to be a crucial factor when comparing or assessing the production potential of the fazendas.

Table 7. Sizes of Fazendas in CRSP Sample

Size	Frequency
Less than 10 ha	0
10 to less than 50	3
50 to less than 100	3
100 to less than 200	6
200 to less than 500	8
More than 500	6
Total	26

There is another characteristic of the land tenure pattern in the sertao which, we discovered is of crucial importance when evaluating production strategies and potentials of the fazendas. That characteristic is the configuration of the property. Because of the critical shortage of water, the land has been divided in a manner which seeks to provide equitable access to water. In many regions, this practice has led to a land division pattern which resembles a piano keyboard. Each lot has a

very limited water access front and a long narrow area stretching away from the water. In one region where we found a concentration of smallholders, we found lots measuring 88 by 3000 m, 120 by 6000 m, 99 by 6000 m, and so on.

The configuration of these fazendas creates important problems for their production. First, it is very difficult to produce both crops and livestock within such a spatial arrangement. Since the crops must be planted as closely as possible to the water, they constitute a barrier between the water and the animals. The narrow width of the land makes it difficult to herd the animals around the crops. The only solutions are either to expend much labor and herd the animals daily through the cultivated areas or to build internal fencing to keep the animals away from the crops.

The second problem is that the narrowness of the land makes it imperative to have perimeter fencing if the animals are to be contained within the property. However, since such land configurations maximize the length of their perimeters, they are much more expensive to fence. The result is that such fazendas require proportionally much more infrastructural investment. The problem is compounded by the fact that it is often the smallest fazendas, and the poorest, that have such unfortunate configurations.

One of the central concerns of our research was to determine what constitutes a small fazenda in the sertao. We wanted to answer the question: Who are the small fazendeiros? Bearing in mind the limitations of using size as the key indicator of economic status, we can nonetheless establish an upper limit. We recognize that such a task is arbitrary in

nature. We base our recommendation on our contact with smallholders in the eight municipios in the sample. Our recommendation is that the category of small fazendas should include units up to 75 ha. We view this as a flexible upper limit, recognizing that in some cases households with more than 75 ha might be poorer than some with considerably less land. However, we do feel that this represents a realistic cut off point. We would therefore recommend that in the sertao, fazendas under 75 ha be considered by the CRSP projects as the target population of their research.

Labor availability is one of the crucial elements in determining the production strategies within fazendas. The organization of labor is different in the large and the small fazendas. In the smaller units, the labor is supplied either exclusively or primarily by the owner's household. In the larger farms the organization of labor is more complex. In the case of absentee owners, the labor is provided either by relatives of the owner, such as a son and his family, by outside sources, or both.

Although most of the households on the fazenda seem to have relatives living near their properties, there do not appear to be any institutionalized means whereby households mobilize labor along kinship lines. Similarly, there are no traditional practices of collective labor or of reciprocal labor exchanges. For each landowning household only the labor of its members is "free"; any additional labor must be compensated. There exists, therefore, a significant difference in cost between production activities whose labor requirements do not exceed the household's labor supply and those which require additional labor.

There is a relatively sharp sexual division of labor within these

households. Women are largely restricted to reproductive and maintenance functions. Young children of both sexes help with maintenance functions, but the boys are shifted to production tasks earlier and more permanently. Livestock production is almost entirely a male occupation. Milking the animals is also primarily a male task. However, cheese-making is regarded as a female occupation. Young girls sometimes help in the daily care of the animals. We never observed an adult woman working with the livestock herds. It is our impression that women routinely perform certain agricultural tasks in the peak labor demand periods of the agricultural cycle, especially weeding plots and harvesting. However, since the period of this research did not overlap with the active phase of the agricultural calendar, we did not have a chance to observe such participation.

As is often the case, the rigidity of the sexual division of labor is related to the level of labor availability within the household. We suspect that when a household is temporarily or chronically short of labor, that women will engage in male production tasks. By and large, however, the very large size of most of the rural households assures the preservation of the relatively rigid gender separation in the economic life of the household.

The expansion of small ruminant production in the small fazendas would not appear to alter significantly the sexual division of labor within the households. The only possible exception might be the introduction of an active dairy goat sector. It is possible that if this activity is adopted as an additional task by the household, that it may be allocated to the women because it would be intrinsically linked to cheese-making. We

would not expect that such a development would in any significant way alter the existing sexual division of labor or improve materially the position of women within or outside the household. We would expect the household to appropriate the returns from such an activity.

The sizes of the owner's households in our sample ranged from 2 to 16 people, most of the households had between 5 and 8 members and they were predominantly nuclear families. The children who were living on the fazendas were expected to help with its operation. Child labor is most often used outside of the household, in the daily care of the small animals and possibly during peak labor demand phases in agriculture. The father and the older sons performed the majority of the tasks done by the family in the fields. In most of the cases, the household's supply of labor did not exceed the fazenda's labor demands. In almost every case household members worked exclusively on their own properties and did not seek work in other fazendas. In fact, most of the owners utilized additional labor on their properties.

We found three different types of non-household workers in the fazendas: tenant farmers, wage laborers and drought-relief workers. The first type is by far the most important and can be regarded as an integral part in the economic structure of most large fazendas. In our sample, most of the fazendas had remarkably similar numbers of tenant farmers, regardless of farm size. These numbers ranged from one to four tenant farmers. The limited variability in the number of tenant farmers probably reflects administrative constraints. It may be that having a greater number of tenant farmers might be unmanageable for the owner, and ultimately unprofitable. We did interview one owner, however, who

stated that he had 14 tenant farmers in his 559 ha fazenda.

The arrangements between the owners and the tenant farmers tend to be flexible and diverse. In some cases the tenant farmers are allowed to live on the fazenda and utilize some of the land without any compensation to the owner. In such cases, the owner simply wants to insure that he will have available wage labor when he needs it. The labor of tenant farmers must be remunerated by the owner when the former provide labor to the fazendeiro. During the period of our interviews, tenant farmers were being used to make or repair fencing on the fazendas.

Other tenant farmers are really sharecroppers. Sharecropping arrangements varied considerably. In some cases the owners provided financial help, usually without interest, as well as other inputs such as seed. In other cases, their only contribution was land. Repayment took various forms. Sometimes the sharecroppers were expected to furnish a percentage of all their crops, although this was an infrequent arrangement. Other sharecroppers had to share only one crop, usually cotton. In still other cases, the sharecroppers retained all their production but were expected to take care of the fazenda's livestock. In such cases, they were compensated by the owners by being given one of every five animals born during the preceding year. However, since most tenant farmers are not allowed to keep livestock, they either sell back the animals to the owner or sell them elsewhere, unless they have access to land somewhere.

The owners' general attitude towards tenant farmers is that they are necessary because they can be utilized to provide labor in the fazenda,

even though that labor has to be remunerated. The share of the crops received by the owners did not seem to be an important source of revenue to them. The main reason for having tenant farmers is to be able to employ them when needed. This attitude points to the fact that labor is not as abundant in the sertao as might be expected. Most of the owners agreed that it was not easy to find labor, especially during the rainy season when labor demands in agriculture are at their peak level.

Most tenant farmers seem to stay in a fazenda for at least 2 years, many stay longer and a few settle permanently. In most of the fazendas in the sample, there was invariably a tenant farmer who had arrived very recently or one who was getting ready to leave. It appears that most of this movement is initiated by the tenant farmers rather than by the owners. Tenant farmers who change fazendas usually remain in the same region; in our sample, most of them were born in the municipio where they were now located.

The second type of workers, wage laborers, were found in only a few fazendas of the sample. They are paid on a daily basis. It is our impression that they represent a less satisfactory source of labor for the fazendeiro because he has no means to assure that he will be able to retain the workers during the wet season. The main benefit of this type of labor acquisition is that the fazendeiro retains control of his land and other productive resources.

The third type of worker, the drought-relief worker, is not a permanent source of labor in the sertao but rather a temporary category which is activated by federal funds in times of extended droughts. The drought-relief program makes available to landowners in drought-stricken

areas funds for materials and labor for water-related construction projects. During the period of our research, such funds were available for the construction or repair of dams and water wells. Most of the workers were tenant farmers from the area, usually from neighboring fazendas. Although these relief programs are temporary, they do have lasting importance because they represent a free source of labor for infrastructural improvements on the fazendas. Furthermore, they can alter significantly the production potential of the fazendas since they affect water availability, perhaps the singlemost important factor of production in the sertao.

The next part of our questionnaire was directed towards production activities in the fazenda. We found little variation in crop production strategies and more variability in the production of livestock. The size of the fazenda appeared to have little influence on crop production but a considerable effect on animal production, although this influence was not very systematic (Gutierrez et al, 1981; Gutierrez et al, 1982).

Almost every fazenda that we looked at, both in the sample and outside it, grew corn, beans and cotton. These three species are usually intercropped. The beans and corn are planted annually between the perennial cotton shrubs. The intensity of the intercropping is determined in part by the production levels of the cotton. Good cotton crops result in less intense intercropping. In addition to these three basic and everpresent crops, there are some other secondary food crops which are planted wherever local conditions allow it. The most important of these crops are rice, sugar cane and sweet manioc. These are usually produced on a smaller scale.

Besides food crops, many of the larger fazendas also cultivate forage. Two principal forages are grown, napier grass and a thornless cactus locally known as palma forrageira. Most often, this forage is grown almost exclusively for the cattle. We observed widespread mismanagement in the production of the napier grass. The grass is allowed to grow considerably beyond its maximum nutritional stage, thus losing much of its nutritional value. This is a very serious problem considering the generally low levels of food resources that are available to the livestock most of the year.

Cotton is cultivated strictly as a cash crop. It is sold immediately after it is harvested. Since this production is one of the few sources of cash for the fazendeiro, it is seldom withheld from the market even when prices are low. The fazendeiros are simply unable to hold on to their crop until prices improve. Despite the inelasticity in the supply, most fazendeiros feel that it is very profitable to grow cotton. In fact, most believed that during good years, cotton is the most profitable product, more profitable than other crops or than livestock.

Beans are regarded as a dual crop. They are first and foremost a subsistence crop, but surpluses, if they occur, are sold. Apparently beans are profitable and producers have a high incentive to sell their production; however, since they are the main staple in the local diet, the bulk of the production is retained for household use. Most fazendeiros in the sample had not sold any part of their bean harvest for the last two or three years, in fact, some had been forced to supplement their harvest with store-bought beans in order to meet their household needs. Bean surplus production seems to occur only in years with good rainfall, thus they

represent an uncertain and sporadic source of income.

Corn is produced mainly for internal consumption; most of it is fed to the cattle. Apparently it is very seldom sold. It is our impression that corn production rarely meets the needs of the fazendas and thus there is no surplus to be sold.

The napier grass is cut and fed immediately to the cattle. It is seldom baled or stored for dry season use. This crop is grown in the high moisture soils surrounding water holes and reservoirs. The plama forrageira is planted on drier soils and is also cut for immediate use. The leaves are machine-chopped and the chips are mixed with other feed for cattle.

An important aspect about crop production in these fazendas is that it is largely oriented towards subsistence. Cotton is the only exclusive cash crop. In practice, cotton appears to be the only source of income from crop activities. It is our impression that cotton is more important in the smaller fazendas. In general, the larger the fazenda, the less important the role of agriculture as a source of income. In good years, meaning abundant rainfall that is evenly spaced, cotton production is perhaps the most profitable activity. In such years the returns from the cotton crop probably meet a substantial portion of the fazenda's cash needs. In bad years, the agricultural sector seems to produce very little income and then the burden for the acquisition of cash falls on the livestock. However, since poor agricultural years are also bad years for the production of cattle, the responsibility for generating income falls mainly on the goat and sheep herds. The crucial role of cotton in the economics of the fazenda is partly conditioned by the size of the fazenda

(for more information on incomes by enterprise see Gutierrez et al, 1982).

Although it is possible to discuss farming and livestock activities separately, it is very important to stress that these two sectors represent interrelated spheres to the fazendeiro. When asked to choose which is the most important, most owners refused to do so, explaining that they were both essential and could not be separated. These two activities represent integral parts of a single and unitary scheme which at times may stress one or the other activity but can dispense with neither in the long term. It is for these reasons that the fazendeiro of the sertao cannot be considered or treated as part-rancher, part-farmer; or, as both a farmer and a rancher. He is neither of these, he is a mixed producer and therein lies a subtle but important difference. He cannot be meaningfully understood when viewed separately in his roles of crop producer or animal producer. To understand the calculus which guides his strategy for the production of small ruminants, it is crucial to understand the relationships between these animals and the crops, as well as the other livestock.

Most fazendas in the sertao produce animals. We did find some very small fazendeiros who did not have animals, though most of them had raised livestock in the past. There were two basic reasons given for not breeding animals. The first was lack of enough land or water to produce livestock. For some, this had only become a problem during the current three year drought, when they had been forced to sell or to eat all of their animals. The other reason given for not having animals was the lack of money to buy the animals or the necessary fencing. Most of these informants volunteered that they would like very much to have animals. We found no informant who did not want animals, even if he currently had

none. As one of them said, to have animals is to always have money.

Among small fazendeiros we noticed a rather consistent practice of having two or three dozen sheep and a very small number of cattle, usually less than six. Very few of the small fazendeiros raised goats. This combination of sheep and cattle may be more variable during the wet season. Many fazendeiros stated that they had been forced to sell many of their sheep recently because of the drought. It is our impression that the number of sheep in the small fazendas may vary considerably, both seasonally and annually, depending on the available pasture and water. The number of cattle seems to be more stable.

In the sample, we found a large variability in the size and composition of the herds and very little relationship between them and the size of the fazendas. Twenty-seven of 29 fazendas produced cattle. The herds ranged from 9 head in a 74 ha fazenda, to 200 head in fazendas of 164 ha and 500 ha. The cattle herds in the sample were considerably larger than those we found among small fazendeiros.

All fazendas in the sample produced sheep. However, since the sample was drawn to only include sheep or goat producers, this datum is not meaningful. The largest sheep herd had 200 animals and was located in a 700 ha fazenda. Sheep herds tended to be either between 30 and 60 animals or between 100 and 150 animals. The goat herds varied significantly in size, the largest one numbering 200 animals. Most of the goats were found in the larger fazendas of the sample.

We could detect no systematic relationships between the production of these three species beyond the general association between sheep and cattle. Even within this relationship, we could find no systematic trends

in the ratio between the two species. From our data it appears that the number of each type of animal that is produced in a fazenda is determined much more by idiosyncratic factors on the fazenda than by general production factors. The only exception to this is the general absence of goats in the small fazendas.

As we shall see later, producer preferences may account partly for some of the variability. Nevertheless, we think that these variations are also caused by differences in the availability of labor. We suspect that the composition of the owner's household plays an important role in limiting the production options available to the producer. This should be particularly true in the larger fazendas.

A clear finding from our interviews with smallholders is that they do not raise goats. When asked why, the answers were very consistent. Goats require either intense supervision or extensive fencing, or both. In essence, goat production is incompatible with the production conditions found in the small fazendas. The animals escape easily from areas where the producers wish to contain them unless they are effectively fenced. Most small fazendeiros cannot afford the type of fencing, both perimeter and internal, that is required to enclose the goats, neither do they have the available labor to supervise the goats continuously in the absence of effective fencing.

Goats located in small fazendas commonly invade lands belonging to neighbors, often grazing on cultivated plots. This causes much friction, especially if the animals are killed by the neighbors. Rather than having to deal continuously with this problem, most smallholders reluctantly opt not to have goats on their property. Many of these informants stated that

they wished that they could keep goats because they are much hardier and more resistant to drought conditions and require less handling or care.

There is a clear lesson here. If goat production is to be fostered among small producers in the sertao, then it is imperative that the fazendas be equipped with effective fencing (Gutierrez *et al*, 1981). Without it, any goat production project is unlikely to succeed. Even with the fencing, the goats require supervision. It would seem that a comprehensive program of goat production in small fazendas should at the very least provide or facilitate this infrastructural facility and also provide the animals.

The relative importance of livestock production in the sertao is largely determined by the weather. During periods when the rains are both abundant and evenly spaced, crop production becomes the central economic activity of the region. Under good rainfall conditions production levels are relatively high and crops become very profitable for producers, especially cotton. At the same time, good crop production assures ample forage for the livestock, particularly for cattle. Good harvests represent the single most important source of income for most fazendeiros, especially the smallholders. During such periods the producers have less need to sell their animals, yet it is at these times that the animals are at their highest weight levels, and therefore most profitable. The net result seems to be that at such times the herds tend to expand because of the increased availability of pasture and the diminished economic need of the animals as sources of income.

During dry periods, the picture is reversed. Crop production is minimal or even nonexistent and the fazenda relies heavily on its

livestock. This reliance takes the form both of subsistence consumption and market sales. The animals are at their lowest weights and are least profitable, but are most essential. At such times, the herds tend to decrease as the animals are consumed or sold.

Although this alternating pattern tends to coincide with seasonal changes and characterizes the annual production cycle, it also corresponds with longer and irregular fluctuations in rainfall. Thus, in addition to regular dry and wet annual seasons, there also exist periods of dry or wet years. The most notable expression of this long term fluctuation are the periodic droughts which assault the sertao almost every decade and which may last for several years. Under such conditions, production strategies tend to follow the dry season pattern throughout most of the annual cycle for the duration of the drought. Our research was conducted precisely at such a period and therefore in a time when the importance of livestock, especially small ruminants, was maximized.

The existence of alternative production strategies, which will be discussed more fully, demands a great deal of flexibility from producers and places strong constraints on the changes and innovations which can be usefully adopted by them. The most important feature of the present system is its ability to adapt to different rainfall conditions by allowing the producers to maximize the advantages of adequate rainfall and minimize the dangers of droughts. Therefore, producers cannot risk specializing in either crops or livestock. Agriculture is profitable when harvests are good, but harvests are good infrequently. Livestock is not as profitable but it is the main source of survival when there are droughts. To rely exclusively on either sector is to jeopardize survival in the long

run.

As we have stressed, cotton is perhaps the most profitable activity on most fazendas. Its production does not require large economic inputs and its labor requirements can be met internally by many households. The price received by producers is generally regarded as satisfactory by them. However, good harvests are infrequent.

After cotton, most producers regard cattle as the most desirable activity (Gutierrez *et al*, 1982). Cattle is sought both for milk and for meat; in the small fazendas milk production is the more important activity. The combined value of milk and meat makes cattle potentially very profitable. Most of the fazendeiros regard cattle as more profitable than either sheep or goats. However, they simultaneously complain that it is very expensive to raise cattle and that it requires much land and large amounts of forage. A minority of our sample expressed a preference for sheep because they are cheaper to produce, since they eat much less, and because they reproduce at much higher rates. One of the advantages most frequently mentioned in regard to sheep is that they can lamb twice yearly and thus flock sizes can be easily increased and the offtake easily replaced. Very few producers regard goats as the preferable production animal. Many mentioned that goats are the easiest livestock to take care of, provided there is adequate fencing or ample land.

We noticed an interesting anomaly in the attitudes of producers towards the livestock. Although most preferred cattle as the most important and profitable animal, many of the same producers felt that they could most easily improve their sheep production. It may be that

with their low levels of capitalization, the fazendeiros are unable to initiate breed improvement programs with their cattle, given the high price per animal, but can afford to do so with their sheep flocks.

Goats are regarded as animals which are raised principally to meet subsistence needs and as ready sources of cash in times of financial need. Households consume a much higher proportion of their goats than of their other livestock. By doing so, they consume the meat which has had the least production cost, while reserving for the market the meat which has required more inputs.

There is a basic difference between cattle and sheep production, on the one hand, and goat production, on the other. The former are produced and disposed more in accordance with a market oriented economic calculus. Goats are more of a self-renewing resource, periodically harvested for the maintenance of the household. Goats are usually sold only when the producer has an immediate need for money. Frequently these needs for cash stem from activities in the other spheres of production. Thus, goats may be sold in order to obtain money to buy cotton seeds or forage for the cattle.

It is easy to overemphasize the differences between the reasons given for producing cattle and sheep and those given for producing goats and to paint too rigid a picture of the livestock production process. In fact, each type of animal can sequentially or simultaneously be produced for different purposes. Cows may be kept only for milk and never be sold; sheep are often used to provide cash for the cattle operation, and so on. Furthermore, there may be long term shifts in strategy. During wet years sheep may be produced for the market but be utilized for household

consumption during the dry years. These necessary shifts in strategy lead producers to avoid any overspecialization in their livestock. This explains in part their reluctance to adopt some recommendations by outside experts.

On the whole, producers express a preference for small animals, but this is by no means consensual. The rationale favoring smaller animals centers on the lower input levels required for their production while that favoring the larger livestock is based on the higher market price of these animals. This is a very important difference in outlook and it perhaps underlies a systematic difference in the production calculus of small and large fazendas. The smallholder may base his livestock production strategy on his very limited ability to meet the required inputs for the various types of livestock. His strategy would then be to minimize production costs, or only to pursue production lines for which he can provide the necessary inputs. Thus, he may prefer to raise sheep or goats simply because he cannot afford to produce cattle, while perhaps thinking that the latter might be more profitable. Largeholders, on the other hand, may base their strategy on a profit rationale and pursue a production program of maximizing profits; they would then most likely choose to raise cattle.

These alternatives suggest that attempts to introduce improved techniques or animals in the sertao will have to take into account that producers are engaged in different strategies and therefore have different needs. Potentially profitable innovations are unlikely to be adopted by smallholders if they exceed their capacity to provide the necessary inputs, both in terms of capital or labor. This is especially true with production

that is traditionally destined for household subsistence needs.

Despite the differences in livestock production strategies, there is strong agreement among producers on the key constraints on animal production in the sertao. Most of them mentioned lack of water and food as the most important problems in raising animals. A second problem area, but mentioned less frequently, is animal health. There were very few comments identifying other constraints. By and large, the producers do not perceive the animals themselves as problematic but do see problems with the conditions under which they are being produced. From their perspective, improvements in livestock production should be directed toward nutrition and health rather than toward improving the characteristics of the animals themselves.

Lack of water is a pervasive problem throughout the region. Except during the relatively brief rainy season, when water is abundant and sometimes is disastrously over-abundant, the procurement of water, both for household consumption and for animals and crops, is a continuous hardship for many small producers. The problem is met in several different ways. In the larger fazendas, there are often one or more earthen dams which are used to collect the surface run-off during the rainy season; the reservoirs are then used to provide water throughout the rest of the year. Typically, these reservoirs contain water during the entire dry season, drying up only in periods of extended droughts.

Medium-sized and small fazendas may have one such reservoir. Some may have one or more wells as an alternative or additional source. Water levels in wells tend to vary considerably, in some areas the water line is only 5 meters below the surface, while in other places it is below

10 meters. Wells infrequently dry up during long droughts. Well water is often so saline it can only be used to water livestock.

Small fazendas frequently lack a permanent source of water within their property and must resort to obtaining it from neighbors or from public sources. Commonly, there are two such sources, one is a system of water delivery by cistern trucks and the other is an extensive series of small ponds. The water delivery system is operated by a government agency (SUDENE) and it only provides sufficient water to meet household subsistence needs. This service is available only in the more arid areas of the sertao. The ponds have been machine excavated along the major highways and are used to collect rainwater, the roadbed in essence functioning as a water retention barrier. Although not very deep, these ponds retain water for a very long time into the dry season and represent a very important source of water both for human and animal consumption.

Different sources of water have varying consequences for livestock production. The two most important characteristics are their accessibility and reliability. It is much easier to water animals by herding them to a pond than by extracting the water from a well. There are great differences in labor input between these two sources. Thus, the form of water access and its attendant labor needs strongly influence the size and characteristics of livestock herds. Whereas it may be easier to water animals from reservoirs or ponds, these sources are more apt to dry up during droughts. Wells, on the other hand, tend to be more reliable. Most producers try, whenever possible, to have access to both types of water sources. Again, this is an example of their quest for flexibility in coping with varied and demanding rainfall conditions.

In the case of the small fazendas, lack of water looms as a crucial constraint on livestock production. These units often must depend on deep wells and/or small ponds for all their water needs. Under such circumstances, the producers opt for raising smaller animals in small herds as the safest strategy, or alternatively, to concentrate on a very few head of cattle. In either case, their access to water varies enormously during the year and it is labor intensive throughout the drier parts of the year. Large producers, on the other hand, generally have more water, have it more regularly, and from sources that are less labor demanding. As a consequence, they tend to be less constrained by water shortages and more affected by nutritional problems.

In the sertao, food scarcity goes hand in hand with water scarcity. Food shortages take the form both of insufficient pasture lands as well as inadequate supplies of forage. Shortage of food during the dry season is generally regarded as the most limiting factor in livestock production. It is perhaps the problem which producers wish to resolve above all others. As in the case of water, the nutritional problems of the smallholders are different than those of the larger producers; they are also more severe.

Smallholders devote less land to animal production, both in absolute and relative terms. Most of their usable land is utilized for crop production. These units tend to have limited cleared pastures and almost no cultivated pastures. The animals, especially sheep and goats, graze and browse in the native caatinga. In large part, these animals are completely dependent for their survival on the natural vegetation. While the caatinga provides more than sufficient food during the rainy season, its carrying capacity decreases sharply with the onset of the dry season.

Crop stubble and forage, when available, are fed primarily to the cattle and sometimes to selected sheep, such as pregnant or lactating ewes. Goats are almost never given forage. As the availability of food decreases in the smaller fazendas, the producers are forced to reduce their herds. Goats are most expendable in such situations and so they are consumed or sold in higher numbers while the pastures are reserved for the cattle and sheep. When it becomes necessary to buy forage for these animals, then the producer may sell additional goats to obtain money to buy the forage. Sometimes, sheep may also be sold to buy forage for the cattle, but this is less common. Some smallholders opt for an alternative strategy. They get rid of their cattle and attempt to preserve as much as possible their small ruminant herds. The rationale for this choice is that these animals reproduce much faster and therefore the producer can recuperate his animal capital in a shorter time.

In the larger fazendas forage is more abundant and its availability represents an important reason why cattle can be kept. As in the smaller farms, sheep are sometimes given food supplements and goats are not. However, the larger production units have much more extensive land and the sheep and goats are less stressed during the dry season than in the small fazendas. Furthermore, they have proportionately more improved pastures; pastures consisting of caatinga which has been cleared of its woody cover. Cattle, and sometimes sheep, are grazed in these pastures.

Forage is obtained both by cultivation or by buying it. The most common forages that are cultivated are napier grass and palma. Forage is very seldom stored. More frequently, the cultivated forage is harvested daily as needed. This practice can be detrimental. Napier grass, for

instance, is very often harvested long after it has passed its highest nutritional levels. Large fazenderos often buy forage from their neighbors and balanced rations from commercial sources. Purchased forage usually consists of corn stover and crop residues. Additionally, some of the larger fazenderos sometimes are able to graze their animals on the stubble of neighboring farms. In such cases, the livestock owner pays a daily fee per head of cattle.

Based on the present system of allocation of forage, it is our feeling that increases in the production or general availability of forage in fazendas of all sizes would be channeled almost exclusively to cattle production. In other words, it is very likely that increase in forage production capabilities would serve to increase cattle production rather than that of sheep or goats. Sheep, and especially goats, are regarded as being capable of surviving without the benefit of supplemental feeding. Furthermore, since many producers regard cattle production as more profitable, they are more likely to concentrate their efforts on these animals.

Solving the nutritional problems of small ruminants in the sertao may be a tricky task. It may be that this can be best accomplished in the small fazendas which have no cattle and therefore would be willing to utilize cultivated forages and crop residues in their sheep production. However, there is always a possibility that the availability of feed would encourage even the smaller producers to raise cattle. Another problem is that the small fazendas lack available land for the cultivation of forages. We suspect that most of these producers would be resistant to turning crop land over for forage production. Forage crops would have to be

grown in the more marginal lands and the chances for their successful adoption would be diminished.

Animal health seems to be a much less serious constraint to production. The most common complaint is about various types of endoparasites, especially worms in the sheep. De-wormers are generally available (Gutierrez et al, 1981). Still many small producers cannot afford them. Worm infestation seems to be most common during the rainy season. Some producers complained about rabies, however others reported that they vaccinated their animals against it regularly. The diagnosis of rabies appears to be utilized for a wide range of symptoms. Producers use this term to refer to a variety of types of ailments, so it is not always clear what the actual disease is.

By and large, producers seem satisfied with the health of their animals. They recognize that their animals could be healthier but in many cases feel that it is not worth the expense to buy medication especially for the sheep and goats. They seem more concerned with the health of their cattle. There is a clear consensus that sheep are the most delicate of the livestock and that they require close attention. Goats are regarded as requiring almost no health management. In general terms, producers view their small ruminants as undernourished and seasonally parasitized and are interested in solving these problems only if they can do so at a reasonable cost. For the smaller producers reasonable cost would exclude any significant cash expenditures.

To understand these attitudes one must understand the reasons why these producers raise animals in the first place. First of all, most are not commodity market producers. Their production strategy does not respond

in a significant manner to market demand levels. Neither are they peasant producers oriented exclusively towards meeting subsistence needs by direct production, since a significant portion of their needs is met by purchases.

Their basic priority is the long run survival of the household and their basic production calculus is designed to assure this goal. They first want to ensure the production of enough beans, corn and meat to cover the needs of the household. They want to produce these staples with a minimum of risk and therefore they rely on production strategies which minimize their reliance inputs which are susceptible to fluctuations in cost or supply. By pursuing such a strategy the small producer can continue to subsist successfully even when the cost of fertilizer goes up or the supply of wage labor dwindles, because his production is essentially disconnected and unaffected by such factors. His major source of risk is the weather and he therefore prefers to concentrate his investments of capital and labor in infrastructural improvements which mitigate the dangers of droughts. The small producer prefers to invest in wells rather than in improved stock. Within this strategy, he relies for his subsistence on the livestock which requires the least investment. In most cases he would prefer to rely on goats because he regards them as requiring least care. Not being able to have goats because he cannot manage them on his small farm, he depends on his sheep. It should be noted that building fences to contain the goats does not make much sense within this calculus.

Small ruminants produced under such a strategy serve two basic purposes, they represent both a source of food and of ready cash. Under

such circumstances, the critical factor in their production is not their health or genetic makeup but their number and capability of surviving at no expense to the producer. Improvements in the animals which can be brought about by even moderate expenditures are not apt to attract these small producers. However, they are willing to spend their money readily if the survival of the animals is threatened. This explains the general willingness of most producers to vaccinate their animals against rabies if they can afford it. Otherwise, they have more pressing uses for their cash. As long as the sheep or goat herds maintain their desired sizes, producers are unlikely to be concerned whether they could do better with a few more inputs. In many cases, the small producers do not have the necessary land or facilities to handle increased animal numbers should they wish to do so.

We could define this type of production calculus as a minimizing strategy. It seeks to ensure the production of at least the minimum household requirements with a minimum of exogenous inputs. These requirements are the minimum subsistence level of production below which the household ceases to be self sufficient. Such an orientation is more of a conceptual norm or guiding principle rather than an actual production goal. We suspect that it is very seldom that any producer sets out consciously on a pure minimizing production strategy. Instead, producers, even small producers, engage in a mixed calculus which also involves what we can label a maximizing strategy.

The maximizing strategy is intrinsically oriented towards markets, or more properly, towards profits. Within this orientation, the producer is willing to invest capital and labor in order to maximize profits. Under

this strategy, it makes sense to expend time, labor or money on livestock production because the cost of these inputs will be recuperated through the increased profitability of the animals. It should be noted that this maximization of the value of the animals precludes their utilization by the household for subsistence needs. The animals represent investments that can only be recuperated by selling them. The producer's household simply cannot afford to eat them.

In general terms, goats are raised within a minimizing production calculus and cattle within a maximizing strategy; sheep seem to be produced within both schemes but perhaps are more important in the former strategy. These animals then, are grown differently and for different reasons. Some must be grown with a minimum of expenses for food while others are raised to attain maximum returns. As we stated before, the actual production strategy of any fazendeiro represents a careful combination of these two orientations. Two factors appear to exert strong influence on how a given producer combines the two orientations: they are size of the production unit and the prevailing long term climatic conditions.

The smaller the size of the fazenda, the more precarious the economic base of its owner and the more likely that he will be primarily oriented towards a minimizing strategy. He will be less in a position to take risks and to invest his limited capital on the expectation of increasing it through profits. For these reasons, he will devote a large proportion of his land to grow the necessary staples and the rest to produce a few animals for home consumption. He will not expect to realize much profit but he will have optimized his chances for survival

and will have done it at a minimum cash cost.

On larger fazendas, the producers can overlay, as it were, maximizing strategies over a basic subsistence strategy. Having assured their subsistence production, and having additional land available, they can engage in more speculative types of production. As the land base of the fazenda increases, the land that can be devoted to maximizing production strategies also increases. This type of production increasingly overshadows, in scope and importance, subsistence production. In many of the large fazendas, the owner does not even engage in subsistence production. Rather he relies solely on a maximizing strategy. In other words, he is a rancher or farmer, an exclusively commodity producer.

The size of the production unit, then, influences the possible combinations of production strategies. The effect of increasing size is not simply one of increasing the levels of production but also one of changing the nature of that production. This type of influence is relatively static. It does not change unless the producer changes the size of his production unit. Assuming that the size of production units tends to be relatively constant through successive years, we can assume fairly constant production strategies within each production unit.

However, other factors do change and can alter strategies within an individual unit. Changes in the annual rainfall can have such an effect. In general, periods of extensive drought impel producers towards a minimizing strategy, while wet years favor maximizing types of production. This means that within the same fazenda, the producer may alternate production strategies in different years.

Since the maximizing strategy is based primarily on the production

of cotton and cattle and since their production is strongly affected by rainfall, changes in production strategy also imply shifts in production emphasis. Thus, when producers expect sufficient rainfall, they concentrate on cattle and cotton as much as possible, while in dry years they tend to revert to a minimum strategy and emphasize bean, corn and small ruminant production. The need to be prepared for such changes in production strategy, forces them to maintain small ruminant herds during wet years when they have limited need for them. Maximizing types of production may diminish the importance of subsistence production but rarely eliminates it. In summary, most producers never know when they will have to depend on their sheep or goats in order to survive; so, they always save some for a dry year.

The last part of our interviews concerned the marketing strategies of these producers. As we have already indicated several times, these producers are not oriented exclusively towards cash markets. The smaller producers are oriented only narrowly and sporadically. In general terms, market orientation seems to increase with expansion of the production unit.

The agricultural segment, principally because of cotton, is more closely linked with market structures than is the livestock. Cotton is grown exclusively as a cash crop and thus its production is directed entirely towards the market. In a very important sense, the marketing activities of the other crops and of the livestock are influenced by the outcome of the cotton crop and of its sale. In the smaller fazendas, the marketing of other products essentially serves to cover the shortfall, very large at times, between the income from the cotton crop and the needs of

the fazenda. Small producers will seldom sell more of their other crops or animals than is required to cover this negative balance. As a rule of thumb, they seem to prefer to sell as little as possible. By maximizing as much as possible the share of production reserved for subsistence they reduce their needs of cash and thus are able to lessen their dependency on cash-producing products. In short, they strive to avoid the cash economy both as buyers and sellers.

There is a tendency, but not a uniform one, to sell the cotton at harvest time regardless of price levels. Many of the producers prefer to sell their crop as soon as it is harvested even if cotton prices are low. The alternative, probably chosen more often by the larger producers, is to store the cotton until prices are more favorable and to meet expenses either from available cash reserves or by selling livestock. Because of their more precarious economic position, the small producers have less flexibility in this matter and are more constrained to selling their cotton as soon as possible, often receiving unfavorable prices. However, it is clear that the livestock is much more valuable to the small producer than the cotton, and if faced with a choice, he would prefer to sell his cotton.

Since they are rather adverse to selling their animals, producers sell relatively small numbers of their livestock. It is difficult to determine the average proportion of animals that are annually culled for sale. On the basis of very limited data, we guess that very seldom does more than thirty percent of a sheep or goat herd get sold in a year; this figure may be exceeded in very small herds. Sheep are much more likely to be sold than goats. The sale of cattle appears to occur on a much lower scale. Quite a few producers reported not having sold any small ruminants during

the preceding year. Most of those who do sell, do so in lots of ten animals or less.

Livestock is normally sold live at the farm gate. Very few producers extend their livestock activities beyond production on the fazenda. As a rule, they neither transport their animals to off-farm marketing sites nor do they slaughter their animals and commercialize the various products separately. They can limit their marketing activities to farm gate sales because current levels of demand greatly exceed supply and thus the buyers are willing to go to the production sites to buy the animals and then transport them to the centers of consumption. Cattle are normally sold on credit while sheep and goats are sold for cash. This constitutes another strong reason for producers to prefer selling their small ruminants when they need cash.

Every producer that we talked with agreed that if he had more sheep or goats he would be able to sell them without any difficulty. This is a very important point. Producers clearly feel that marketing increased small ruminant production is not a problem. A low demand for goat products is not frequently cited as a barrier to production. However, the relatively low prices received for small ruminant meat compared to other fed meats may inhibit production (Gutierrez and DeBoer, 1982).

The animals are sold almost exclusively to traders and other producers from the surrounding regions. There appears to be little long distance trade in small ruminants. Both the marketing structure and the personnel involved are local. Most of the animals sold are transported to the municipio capital where they are slaughtered and consumed. This results in a marketing structure in which each municipio contains a

relatively closed system within which the animals are produced, marketed and consumed; with few linkages between municipios. We are not sure how representative this model might be of other municipios in the sertao.

Although most of the production of small ruminants is consumed regionally, a small percentage does leave the region of production. In some cases animals are exported to other states, usually as breeding stock. It is also likely that some animals are transported to Fortaleza to meet urban demands for meat. It may be that even if the percentage of such animals is very small in each municipio, the aggregate number is rather significant and constitutes an important source of supply to the urban population of Fortaleza. From the perspective of the individual producers, however, this urban market is not significant.

Small producers do not sell their livestock, especially their sheep and goats, in response to market demands. Instead, they respond to household demands. They sell when they need money, usually for a specific purpose. This is a crucial factor. It is the internal economy of the fazenda that dictates the levels and timing of livestock sales. The animals are not sold to maximize income but to meet specific needs. It is when such needs develop that the producer regards his sheep or goats in terms of their market value or as a commodity. Otherwise, he tends to perceive his animals in terms of their use value.

However, animals are not only culled and sold according to the economic fortunes of the household. Other factors also intervene. As we would expect, when herds are too large or contain undesirable animals, the producer is motivated to sell. Actual decisions represent a mix of several factors; yet only pressing household needs prompt the selling of

healthy desirable animals.

Just as the internal household needs principally determine when to sell animals, they also determine how many are sold. The size of the sale is calculated on the basis of how much money is needed. Small emergencies might require the sale of only a single animal. Producers will seldom sell more animals than is required by their financial situation. Most producers resort to selling their sheep first. If the cash requirement is large, then it is more likely that the producer will sell some of his cattle, rather than selling his entire sheep herd.

Since the volume of sales is generally fixed by specific cash needs, the actual number of animals sold is also a function of prevailing price levels. The same cash need may result in different numbers of animals sold if prices fluctuate. For instance, lower summer prices may necessitate selling more animals. It is at this junction that market mechanisms influence marketing decisions by producers. Producers know that they will receive less for their animals in the summer and will therefore have to sell more of them to meet specified needs; yet, we found no evidence that they attempted to anticipate monetary needs by selling their livestock at more profitable opportunities.

As we have stated, the price of animals varies seasonally. As a rule, livestock bring better prices in the winter when the animals are at their highest weight levels. Thus, on an animal unit basis, winter prices are highest. However, increased supplies in winter tend to depress meat prices. Unfortunately, it is in the summer that the animals are at their lowest weights and thus producers are unable to take advantage of the increase in meat prices. Since household expenses tend to be highest in

the summer, most small producers sell their animals at that time and are therefore forced to sell thinner animals. The capability of maintaining winter weight levels in the summer, or at least preventing drastic weight losses during the summer, appears to represent a significant potential improvement for these producers. The higher weight unit prices would thus coincide more closely with the peak cash demand levels of the producers.

We cannot account for the seasonal changes in meat supply, and thus the changes in prices. It is our guess that these fluctuations are caused by the marketing behavior of the very large producers. The marketing strategies that we have described for small producers would not cause such seasonal fluctuations.

### Prospects

What can be done to improve small ruminant production in the sertao? In the short term, perhaps very little. If we were to rank order the general problems which constrain livestock production in the sertao we would list them in the following order: ecological, political, economic and technical. Clearly, we do not think that technical measures by themselves are a solution.

There is little that can be done to solve the ecological problems. Recurring droughts will continue to afflict the area. However, the government's current programs for the development of new reservoirs and ponds do appear to ameliorate in part the problem of water shortages. These programs have helped producers by increasing their access to water during critical periods. In essence, the problem has been recognized by the authorities and is being tackled in a reasonable manner.

The same cannot be said of the political constraints. Here we refer specifically to the rationalization of the land tenure pattern. Very clearly, and with the admission of the government's own agencies, the low productivity and the low quality of life which characterize much of the Northeast are directly attributable to its highly skewed land tenure structure. The very large fazendas are in large part highly inefficient and the very small ones cannot achieve efficient levels of production. This problem has been repeatedly diagnosed and the recommendations for its solution have fallen on deaf ears. There is no reason to expect that this will change in the future. The present land tenure structure represents a strong constraint on the improvement of both rural production and the quality of rural life in the region; until it is solved, other types of solutions will be either ineffective or in some cases will actually worsen the present situation. We do recognize, however, that the rationalization of the land tenure structure will not by itself solve all the problems.

The third type of constraints are economic in nature. Small producers just do not have the capital to invest in their fazendas to make the improvements they desire. Although there are programs for the extension of rural credit in the region, most small producers do not qualify for it. Two important reasons why they do not qualify are that in many cases small producers do not have legal title to their land and/or their land is below the minimum size requirement needed to secure a loan. In effect, rural credit guidelines and eligibility requirements often discriminate against small producers.

At the same time, large and often inefficient producers use the various forms of financial credit as subsidies for their operations.

Without such subsidies, it is very likely that many large producers could not survive. Another problem is that the great majority of rural credit programs is targeted towards crop production. It is apparently rather difficult to secure loans aimed at livestock production, especially for small ruminants.

The last general constraints are technical in nature. These are the kind of constraints which the CRSP project seeks to surmount. Obviously, technical solutions cannot solve the severe problems that we have outlined above. They cannot be used to substitute for political and economic measures. However, even within the constraints imposed by the other factors, some types of technical assistance may have some measurable effect.

As we have stated before, these types of solutions must be framed within the actual production systems and their potentialities and cannot be developed within assumed models of production, as is often the case. By now we have a pretty good idea why producers in the sertao produce or do not produce sheep and goats. We also know what types of technical assistance they desire in order to improve their operations. The technical assistance that we offer must be addressed to the producer's expressed needs. This is a dictum that is accepted in theory but is generally ignored in practice, even by sociologists.

Clearly, the producers' technical priorities are better nutrition and improved health. They will be very prone to accept and adopt any improvements offered in these areas, as long as adoption does not prejudice their total production strategy or is prohibitively expensive.

We must remember the complex value which small ruminants have

for these producers. While their value to the household is critical, their value as commodities is marginal. The disparity between the subsistence and commercial values of sheep and goats explains why small producers are eager to have better fed and healthier animals but only if these improvements can be attained at minimum cost. Improvements which enhance the commercial value of small ruminants and are not prohibitively costly might be adopted if they can be used to improve cattle production. In fact, we would expect cattle production to benefit directly from any nutrition improvement systems designed to improve small ruminant production.

Our final observations refer to the problems of increasing the aggregate level of small ruminant production in the sertao. An explicit goal of the Small Ruminant CRSP project is to increase the productivity and production of the small producers. By and large, we do not see this as an attainable goal, especially in reference to increasing production. Given the production calculus of the small producers, there are few incentives to increase production substantially. There is undoubtedly more interest in increasing productivity. If indeed we manage to introduce better technical procedures among these producers, we may help to create fatter and healthier sheep and goats, but not necessarily increase their numbers.

Even with increases in the price of meat, we suspect that the producers will resist converting to a commercial production system and significant expansion of their herds. If we take into consideration all their problems and the socioeconomic context in which they operate, their reaction is quite rational. Given their present situation, their desire to

avoid the vicissitudes of market production and consumption is logical. It is rather likely that many small producers would be worse off in the long run if they became commercial producers of small ruminants. In short, it is unlikely that these small producers would be willing to alter significantly their present systems of production.