

Rangelands and Small Ruminant Production in Ceara' State, Northeastern Brazil

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Rangelands are receiving increased attention as a resource for improving world food supplies. Ironically, nowhere does this food production potential need to be exploited more than in developing countries or regions without established principles of range management.

One such region is the tropical semiarid northeast of Brazil. Comprising about 20% (1,600,000 km² or 1,072,000 mi²) of Brazil's land area, 9 states make-up the geopolitical region commonly called the "Northeast."

The area lies in a transitional zone influenced by both northern and southern hemispheric weather patterns. Extreme variation in precipitation from year to year is common. The term "drought polygon" is sometimes used to describe the area because of the frequency and severity of droughts.

The semiarid inland region of the northeast is called the *sertao*, and extends for 1 million km² (670,000 sq. mi²). Climatically the *sertao* is characterized by mean annual temperatures ranging from 22 to 28° C (72 to 82° F), with annual minimum and maximum temperatures ranging from 8 to 40° C (46° to 104° F), respectively. Annual precipitation ranges from 300 to 1,000 mm (12 to 39 in.). A 4- to 6-month rainy season (December through May) is followed by a 6- to 8-month dry period. Periodic droughts may extend the dry season to 11 or 12 months.

The drought phenomenon in the *sertao* exerts a profound influence on man and vegetation. Severe and frequent droughts are responsible for famine, unemployment, and outward migration of the human population (particularly those of the poorest economic stratum) to the major cities.

Livestock are economically important in the agriculturally based society of the northeast. There are about 6 million each of goats and sheep. Ninety-two percent of Brazil's goat population is found in the northeast, compared to 30% for sheep. Generally, the sheep and goats are of mixed breeding and exhibit a variety of coat colors and patterns. Native hair (woolless) sheep are of Crioula ancestry, and have a pelage varying from a slick hair coat to a coarse short-wooled coat. The native SRD (*Sem Raca Definida*, without definite race) goats generally exhibit a short hair coat. There are approximately 20 million cattle in the northeast; these are a large frame-zebu type with vestiges of a hump.

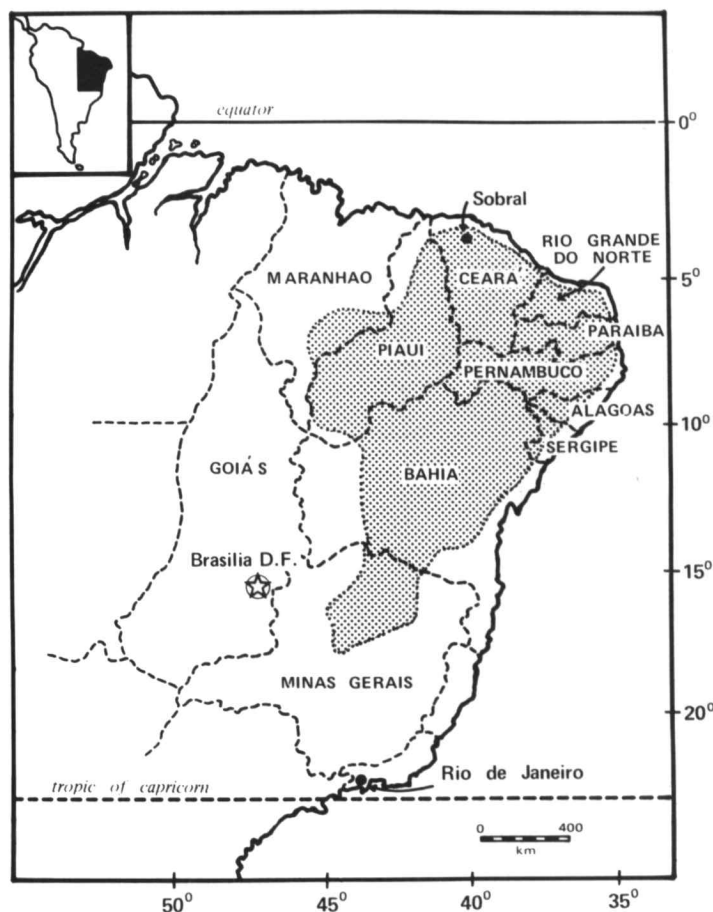
The predominant vegetation of the *sertao* is the *caatinga*, which is an Indian word meaning "white forest." Native *caatinga* rangelands are largely deciduous and during the dry season take on a distinctive "bleached bones" appearance. The vegetation is a complex mix of small trees and

shrubs with an annual herbaceous understory.

Besides the climatic stress imposed on the *caatinga* by drought, man's activities over the past 2 centuries have apparently done much to shape the present-day *caatinga*. Over-grazing by livestock in conjunction with slash and burn agricultural practices have caused major problems in range degradation and soil erosion. Low livestock production levels and poor condition ranges are generally found throughout the northeast region. Because of the high degree of variation in climate and physiognomy of the *caatinga* rangelands, we have generally limited our discussion to the rangelands of northern Ceara' state.

Small Ruminant Production

Small ruminants have many desirable characteristics that favor production in less-developed regions. Economically they can be produced with a low investment in land and labor. Holders of small land areas own one or more of these



The *caatinga* zone of northeastern Brazil (shaded area). Its distribution includes all or parts of nine states.

Research was conducted under the auspices of US-AID Title XII, Small Ruminant Collaborative Research Support Program (SR-CRSP) in collaboration with the Brazilian Agricultural Research Agency (EMBRAPA). Authors are affiliated with the Department of Range Science, Utah State University, Logan, Utah, USA. We gratefully acknowledge the contributions of colleagues at the Centro Nacional de Pesquisa de Caprinos (CNPIC)/EMBRAPA in the development of this paper.

animals, which in turn integrate well with cropping or other agricultural enterprises. Because individually each animal is a small animal unit, the risk involved if an animal sickens, dies, or is stolen is greatly reduced. Also, small ruminants have proven to be especially well adapted to the often poor range conditions in semiarid or arid climates.

Small ruminant products are used in a variety of ways in the Brazilian northeast. Perhaps the most important is meat production, which augments the protein level of human diets. Many goats and sheep are consumed on the ranches where they are raised. In hot tropical climates where rural refrigeration is often wanting, the small carcasses can be quickly used before spoilage begins. Goats and sheep are typically slaughtered at about 25 kg (55 lb) liveweight. Native Crioula sheep and SRD goats reach this weight at about 18 months of age under native range conditions. Dressing percentages for native sheep and goats are 40 to 45% of liveweight. In the local marketplace in Ceara', animals sell for about US \$.90/kg (US \$.41/lb) liveweight. In the over-the-counter transactions, undifferentiated cuts of meat sell for about US \$1.80/kg (US \$.82/lb).

Since hair sheep and goats are overwhelmingly predominant in the northeast, wool production is virtually nonexistent. As far as we know, no figures are available on hair production.

Sheep and goat hides are commercially very important to the northeastern region. In 1976, Brazil exported 11.5 million dollars worth of hides of goats and sheep. Europe (especially Spain and W. Germany) is the principal market for Brazilian hides. In the local marketplace after the animals are slaughtered, the dry, green hides are worth from 20 to 30% of the liveweight price of the animal.

Although milk from sheep and goats is of little commercial importance in the region, Gutierrez¹ in a recent (1981) economics survey, found that about 20% of the goat producers surveyed in Ceara' had at least one milk goat, and that about 1% of the respondents milked sheep.

In Ceara' over 90% of the livestock owners have cattle, sheep, and goats in a mixed cropping system. Ranchers generally reserve the best grazing land for cattle. Sheep and cattle graze dry crop residues as supplemental feed during the long dry season. Many producers (approximately 40% in

¹Gutierrez, N., A.J. DeBoer, and J. Ubiraci. 1981. Some resource interactions and economic characteristics of sheep and goat producers in the *sertao* of Ceara' state, northeast, Brazil: Some preliminary survey results. 1st National Symposium on Tropical Sheep and Goats. EMBRAPA/CNPq. Fortaleza, Ceara'. 42 p.



Native crioula (woolless) sheep drinking from a depleted stock-pond near the end of the dry season, Ceara' state.



SRD (*Sem Raca definida, without definite race or breed*) goat typical of the type indigenous to northeast Brazil.

Gutierrez's survey) prefer to run sheep but not goats. There are two principal reasons for this: first, there is the need for tighter, more expensive fencing for goats, especially in areas adjacent to cropland. He further reported that the producers considered fences the limiting aspect to expanding goat production. Secondly, there is a greater acceptance by sheep of crop residues and cultivated grass as supplemental feed in the dry months. This preference for running sheep persists in spite of the need to supplement, or at least save, an ungrazed forage reserve for sheep use in the dry season, while goats are often forced to survive the dry season with few special management provisions. Goats are looked upon as a form of drought insurance because of their survivability. However, on heavily stocked ranges, even hardy native goats will at times die of starvation before the end of the dry season.

Sheep and goat management practices vary greatly in Ceara'. Small producers with few animals generally practice little management. Such basic practices as castration and worming are often neglected. High mortality rates (20-35% up to 1 year of age) and low animal offtake (10-25%) are common on ranches of less than 250 hectares (600 acres).

On ranches of greater than 250 ha, such as characterized by Gutierrez's (1981) survey, improved management practices are followed. Penning of the animals at night to avoid predators (human or animal) is common. Even though the type of structure is variable, some form of housing is available to animals on these better managed ranches. Most of the ranchers castrate and deworm animals at least yearly. A majority of ranchers have cultivated pastures as supplemental feed. Some ranches even raise spineless cactus (*Opuntia ficus-indica*) as supplemental feed. Two undesirable management characteristics are prevalent in the *sertao* region regardless of ranch size. First is a year-long breeding season, and second is a lack of culling from ranch herds.

Water plays an important role in the production systems in this region. Most ranches depend heavily on small, earthen-dam reservoirs, called *acudes*, to provide stockwater throughout the year. These *acudes* fill during the rainy season, then are slowly depleted during the dry season. Usually before the rains begin anew, the water in most *acudes* resembles a large, dirty mud puddle, and is highly contaminated, yet livestock, and even humans, often have no other alternative drinking water. The potential for transmitting diseases is

probably staggering, but is undocumented.

Land Distribution

Two striking characteristics of the agricultural sector in the northeast are the distribution of land and the ownership of livestock by a landless group of people. Seventy percent of the landholders in the northeast have individual holdings of 10 hectares (22 acres) or less, while 1.1% of the landholders have 500 ha or more. However, those holders of more than 500 ha occupy over 40% of the agricultural land in the region, while those landholders with less than 10 ha occupy about 5% of the land (Reboucas 1979).²

Reboucas also indicated that the percent of landholders with less than 10 ha has increased from 62% in 1960 to the 1975 level of 70%. One partial explanation is that existing landholdings are divided among surviving children when the "dono da terra" dies, thus family holdings tend to shrink with each passing generation. In a range management context, one might speculate that holders of small parcels of land are not very important because they probably own few animals and even collectively control only a small part of the range. However, the skewed distribution of land resources undoubtedly affects decision making about animal and range management, especially at the small-holder level. The size of landholding would certainly influence many basic ranch characteristics such as numbers of livestock, proportions of cattle, sheep and goats, availability of capital for range improvements, economic capacity to withstand extended drought, and ability to respond to new research and technology.

A second important characteristic of the agricultural sector is the ownership of livestock by a landless group of sharecroppers termed *moradores*. Preliminary research results by Gutierrez indicate that about 19% of the sheep and goats in Ceara' are owned by *moradores*. These sharecroppers are an important labor source on many ranches and share in crop production, while using the owner's rangeland for pasture. In some cases a yearly contract is signed; in other instances the sole security of the *morador* rests with the word of the landowner.

Range management may be of little, if any, consequence to those people who own animals but hold no deeded land because most of these herds appear to be very small (i.e. 5 to 10 animals), and are scattered amongst larger flocks. Because of their dispersed nature, it seems unlikely that these flocks will have much impact in future range management schemes.

Vegetation

Caatinga vegetation has been subjected to manipulations by man since the 17th century. Extensive clearing of native *caatinga* rangeland is widely practiced in Ceara'. The primary purpose of clearing is for cultivation of subsistence crops and perennial (5-year) cotton. On larger holdings, clearing of the woody canopy is also practiced for range improvement purposes. Normally clearing is accompanied by burning of the woody slash piled around stumps. Selective wood removal for fence posts and construction timber is also widely practiced. All land treatments are superimposed upon by the grazing of cattle, sheep, goats and ubiquitous grey burros. Of all land treatments in the *caatinga*, small-scale subsistence farming using hand tools has probably contrib-

Table 1. Herbaceous genera occurring in the surveyed area.

Annual forbs (non-leguminous)	Legumes (mostly annual)	Grasses
<i>Hyptis</i>	<i>Centrosema</i>	<i>Brachiaria</i>
<i>Bainvillea</i>	<i>Macroptilium</i>	<i>Digitaria</i>
<i>Melanthera</i>	<i>Canavalia</i>	<i>Sporobolus</i>
<i>Ipomoea</i>	<i>Arachis</i>	<i>Paspalum</i>
<i>Bidens</i>	<i>Cassia</i>	<i>Panicum</i>
<i>Wissadula</i>	<i>Phaseolus</i>	<i>Eragrostis</i>
		<i>Antephora</i>
		<i>Chloris</i>
		<i>Echinochloa</i>
		<i>Setaria</i>
		<i>Aristida</i>
		<i>Dactyloctenium</i>

uted the most to the heterogeneity of the local landscape. Despite the great variability in physiognomy, the term "caatinga," as used in the international literature, erroneously conveys the idea of homogeneity. In fact, the *caatinga* embraces a wide spectrum of different vegetation sub-types which occur in the northeast. Annual forbs and grasses are the dominant vegetation of the herbaceous layer in the area surveyed (Table 1). The ephemeral nature of the herbaceous strata and a lack of botanical information preclude a more detailed discussion of the herbaceous vegetation. The dominant woody species of the surveyed area are listed in Table 2.

Forage Production and Use

Wet-season forage is apparently not a limiting factor to animal production during the wet season. Preliminary studies indicate that herbage yields of 2500 kg/ha (2225 lb/acre) are typical during the wet season. This abundance of forage usually lasts for 1 or 2 months after the rains cease, then forage as we typically think of it (i.e., herbaceous material) begins to decline during May and June. By June most herbage is dry and adds little to the total biomass of available forage, yet dry, standing-dead herbage contributes substantially to animals' diets in June and July.

Although not usually considered as forage in traditional range forage inventories, leaf litter from the deciduous forest is a very important dietary component of grazing sheep and goats in the dry season. Our preliminary results show that the green foliage of the tree species, measured up to the browsing limit for goats of 1.6 m (5.25 ft.), contributes about 300 kg/ha (270 lb/acre) of forage in May and June. The amount of green foliage available to animals on the trees begins to decline in July as the deciduous trees shed their leaves. An important forage species, *sabia*, begins to lose

Table 2. Important woody plants of the surveyed area (in approximate order of prevalence).

Scientific names	Common names
<i>Auxemma oncocalyx</i> Taub.	pau branco
<i>Croton hemiargyreus</i> Muell. Clog.	marmeleiro
<i>Mimosa acutistipula</i> Hub.	jurema preta
<i>Combretum leprosum</i> Mart.	mofumbo
<i>Mimosa caesalpiniaefolia</i> Benth.	sabia
<i>Caesalpinia pyramidalis</i> Benth.	catingueira
<i>Copernicia cerifera</i> Mart.	carnauba
<i>Torresea cearensis</i> Fr. All.	imburana
<i>Zizyphus joazeiro</i> Mart.	juazeiro
<i>Caesalpinia ferrea</i> Mart.	juazeiro
<i>Pithecolobium multiflora</i> Benth.	canafistula
<i>Astronium urundeuva</i> Engl.	aroeira
<i>Licania rigida</i> Benth.	oitica

²Reboucas, O.E. 1979. Desenvolvimento do Nordeste: Diagnostico e Sugestoes de Politicas. Revista Economica do Nordeste, n. 2, abr/jun., v. 10. p. 189-430.

leaves quickly as the dry season commences, usually in June, while other deciduous trees extend their leaf drop into July and August.

In June, leaf litter makes up less than 25% of the forage available. However, from July on through the remainder of the dry season (usually until January), the leaf litter component of available forage is predominant. We found that in July and August, over 1000 kg/ha (890 lb/acre) of forage available is leaf litter. The palatable leaf litter is gradually consumed as a natural hay by grazing animals. Under heavy stocking with goats and sheep, grazing pressure (and some decomposition, weathering and trampling) reduces the leaf litter in November to about 500 kg/ha (445 lb/acre). By December and January, relatively small quantities of poor quality forage remain.

Although some *caatinga* species such as juazeiro and juazeiro are evergreen, much evergreen foliage is rendered unavailable to animals during the dry season because it is out of reach even to browsing goats. During droughts, farmers sometimes lop off branches to feed to animals. Green foliage on several tree species is at times partially renewed during the dry season by ephemeral rains. Marmeleiro and catingueira appear to be especially opportunistic in using this moisture; both species displayed a sudden production of new leaves within a week of a 25-mm (1 in.) rain in August, 1981. In fact, catingueira reputedly can leaf out in response to sudden increases in relative humidity.

Browsing goats are very adept at using this green foliage while it lasts. One such shower can have a residual effect for several months as the animals benefit from the green foliage, and then from the new available leaf litter when the leaves are dropped.

Late dry season (November to January) is a tense period for livestock producers as they anxiously await the preliminary, often erratic rains which signal the approaching wet season. Without supplementation, moderate weight losses (15 to 25% of bodyweight) are normal on native *caatinga* range during these months. If ephemeral rains do not occur in November or December, severe late season weight losses of 30 to 35% can occur.

Local ranchers have traditionally viewed land clearing, with or without burning, as a means to increase livestock carrying capacity of the *caatinga*. They reason that clearing the tree overstory promotes the growth of the herbaceous understory in the wet season, and therefore provides more animal feed per hectare during the dry season. It is also believed that clearing will result in increased forage quality. These assumptions have yet to be proven.

Presently, clearing native *caatinga* and planting buffelgrass (*Cenchrus ciliaris*) is a promoted range improvement practice in Ceara'. Although high yields of plant biomass are produced, the nutritional value or acceptability of buffelgrass to goats is unknown. Our experience leads us to believe that such monocultures will not capitalize upon the highly selective feeding habits of goats. Such pastures are probably better suited for sheep and cattle grazing.

As range scientists we see several problems with the current axe-wielding philosophy. Clearing native *caatinga* may well result in increased short-term forage production. However, the annual and herbaceous perennials contributing to these high yields may fail entirely during consecutive drought years, or those plants with less drought-tolerance may disappear, resulting in a forage decline.

On cleared areas, nutritional benefits to undernourished



Local workers clearing a stand of native *caatinga* vegetation. Wood is stacked and sold by volume for firewood, construction purposes, or fence posts.

goats from ephemeral rains would be greatly reduced. We have noted that on uncleared native range after a sudden shower, goats elected to browse heavily on fresh, green tree leaves even though several species in the herbaceous understory had germinated and were available within 24 to 36 hours after such a rain. Sheep, on the other hand, selected mainly from amongst the herbaceous plants, but also browsed some tree leaves. Although the quantity of arboreal forage that becomes available after such ephemeral rains may be relatively low, such forage often becomes available at critical times in the dry season. In addition, highly nutritious fruits and flowers would not be available at key periods on cleared areas. Our observations indicate that the flowers of many woody species are avidly sought after by goats and sheep during different periods in the dry season. The fruits of juazeiro are also highly palatable to animals in the late dry season (and are sold for human consumption in the local marketplace).

Although native trees and shrubs may offer less total year-round forage than many herbaceous species, complete clearing and burning may favor increased short-term site productivity at the expense of long-term stability. The importance of leaf and wood decomposition in nutrient recycling in *caatinga* forests, though not documented, must be of primary importance to ecosystem stability. Since the woody plant material is a major nutrient sink, continual removal of the trees may produce a decline in long-term productivity as these nutrients are drained off without replacement.

Another interrelated and serious problem we see is soil erosion on cleared and burned *caatinga*. When such pastures are grazed (and even when deferred from grazing), the ground cover during the dry season is sparse. We suspect that on cleared lands, the reduced ground cover will increase soil losses due to water erosion. Extremely intense rainstorms are very common at the beginning of the rainy season when cleared *caatinga* has very little protective ground cover. The uncleared *caatinga* forest canopy appears to offer protection and soil-building potential due to accumulated leaf litter, and subsequent nutrient redistribution after leaf decomposition.

Research Towards Solutions

Small ruminants such as sheep and goats play an especially critical role in the food production in developing areas such as northeast Brazil. The value of goats and sheep as a renewable food resource is generally recognized; however, research efforts aimed at maximizing productivity among low-income producers have been limited (Devendra 1974, 1981)^{3,4}. While the broad constraints on sheep and goat production systems in many developing areas are known, specific solutions will come only from years of research. Recognizing this research need, the U.S. Congress in 1975 created the Small Ruminant Collaborative Research Support Program (SR-CRSP), under the auspices of Title XII of the International Development and Food Assistance Act. The SR-CRSP has a general mandate to conduct research and training overseas. The SR-CRSP program in Brazil is a multi-disciplinary effort directed towards production of sheep and goats by small landholders.

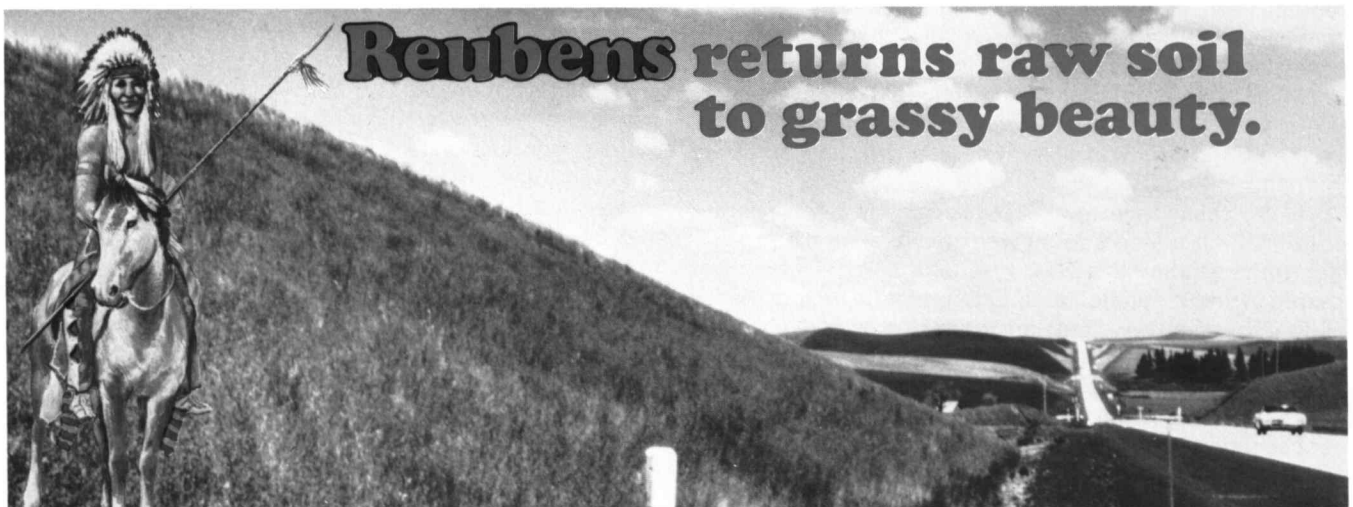
³Devendra, C. 1974. Exploiting goats for maximum productivity. *Z. Tierzucht. Zuchtigsbiol.* 91:246-255.

⁴Devendra, C. 1981. Potential of sheep and goats in less developed countries. *J. Animal Science.* 51:461-473.

Objectives of the range research presently being conducted in Brazil are fourfold: (1) on a seasonal basis determine the botanical and chemical composition, and intake, of grazing animals diets, (2) determine the annual forage supply and decomposition cycle, (3) relate plant-soil factors that define different range sites, and (4) determine effective brush control and manipulation strategies.

Range research in the northeast is coordinated with EMBRAPA, the Brazilian federal agricultural research agency. SR-CRSP activities are centered at the National Sheep and Goat Research Center, located in Sobral, Ceara'. Range researchers realize that a number of years will be required to fulfill the program objectives. It is expected that Brazilian institutions and extension organizations will follow through in the transfer of research results to the producer level. In the long-run, acceptance and use of future range management recommendations by livestock producers and other users of rangelands will be the major measure of the success of present range research efforts in northeast Brazil.

Editor's Note: Upon request the authors will supply references. Range management enthusiasts all over the world will be able to relate to the management problems and situations written about in this article from Brazil, South America.



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