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Livestock Production in Somalia with Special Emphasis on Camels

Ahmed A. Elmi

The Somali pastoral economy is mainly based on range animal resources. Over 70 percent of the Somali human population subsist in pastoralism. Pastoralists contribute more than 60 percent of the GDP and 80 percent of National export. Camel, cattle and small ruminants are widely distributed in all ecological zones of the country. Sheep and goats are dominant animals, but camel population exceeds cattle in number. A large number of camels and small ruminants are found in the drier northern and central zones. Cattle dominate in the wetter southern and Trans-Juba regions. Small ruminants make up 70 percent of the livestock marketed producing 69 percent of total meat production. Camels and goats provide 75 percent of the total milk supply. In the pastoral subsistence economy camels are primarily raised for milk production and small ruminants for generating cash income for the family.

Background: Somalia and its Livestock

Introduction

Somalia is situated between 11° 30' north and 1° 30' south latitudes and between 41° 00' east and 51° 25' east longitude. It represents a large portion of the Horn of Africa with an area of 638,000 km². About 13 percent of it is suitable for farming and about 45 percent is best suited for livestock raising (Ministry of National Planning, 1990).

The country is located on the equator. Average minimum and maximum temperatures are 18°C and 30°C respectively, with an average day temperature of about 27°C and a high relative humidity on the southern coast (Hutchinson, 1986).

Its climate is characterized by alternating wet and dry seasons with predictable but erratically distributed rainfall during the wet season. Recurrent droughts occur once in every 3 to 10 years (Elmi, 1990; in press). Average rainfall ranges from 50 to 800mm per year and is erratic in annual distribution and amount (UNSO, 1984). The rainfall is mainly confined to two rainy seasons: *Gu* (Spring)—April to June and *Dayr* (Fall)—September to November. Two dry seasons, *Xagaa* (Summer)—July to September and

Jiilaal (Winter)—December to March occur between the two rainy seasons. The southern coast receives showery rains in Xagaa (Ministry of National Planning, 1990).

Somalia is a rangeland country. About 90 percent of it is best suited for foraging by camels, cattle, sheep and goats (FAO, 1968; IBRD, 1975). This includes most of the farmlands and forest areas, and what is considered to be wasteland on which native desert forage plant species grow. The size of the rangeland, the number of animals which browse and graze on it, the number of people dependent on range livestock, and the value of the income from export in the animal industry, all show the economic importance of the livestock sector for the country. This paper deals with the economic importance of Somali livestock in general and camel production and improvement in particular.

Number and Distribution

The livestock sector dominates the economy of Somalia. Estimates of the total number of livestock population from 1978 to 1988 are given in Table 1 (Ministry of National Planning, 1990). Small ruminants are the major domestic animals in the country. Camel population exceeds cattle numbers. In terms of tropical livestock units (TLUs),

Table 1. Estimates of total number of livestock population (in millions) in Somalia from 1978 to 1988

YEAR	CAMELS	CATTLE	SHEEP	GOATS	TOTAL
1978	5.6	4.0	9.8	16.0	35.4
1979	5.8	4.5	10.7	17.2	38.2
1980	5.8	4.5	10.3	16.8	37.4
1981	5.8	4.4	10.3	17.0	37.5
1982	6.0	4.5	10.8	18.0	39.3
1983	6.2	4.6	10.6	19.0	40.4
1984	6.1	4.2	11.2	18.0	39.5
1985	6.2	4.3	11.8	18.3	40.6
1986	6.4	4.5	11.8	19.0	41.7
1987	6.4	4.6	12.3	19.3	42.5
1988	6.6	4.8	13.2	19.7	44.3

(Source: Ministry of National Planning, 1990)

46% of the country's total livestock population in TLUs are camels (Wilson and Bourzat, 1986).

The country can be generally divided into four ecological zones (Figure 1). These are the Northern, Central, Southern and Trans-Jubba ecological zones. The northern ecological zone comprises the seven regions of Awdal, Northwest, Togdheer, Sool, Sanaag, Nugaal and Bari. The central zone consists of Mudug, Galguduud and Hiiraan regions. The southern zone includes Middle Shabeelle, Lower Shabeelle, Banadir, Bakool, and Bay regions. The Trans-Jubba zone contains Gedo, Middle Jubba and Lower Jubba regions.

Domestic animals such as camel, cattle, sheep and goats are widely distributed throughout all regions of these zones (Table 2). A large number of camels, sheep and goats are found in the drier regions of the Northern and Central zones. Cattle dominates in the wetter Southern and Trans-Jubba zones of the country. Sheep and goat biomasses are greatest in the Northern and Central zones, respectively. Total livestock

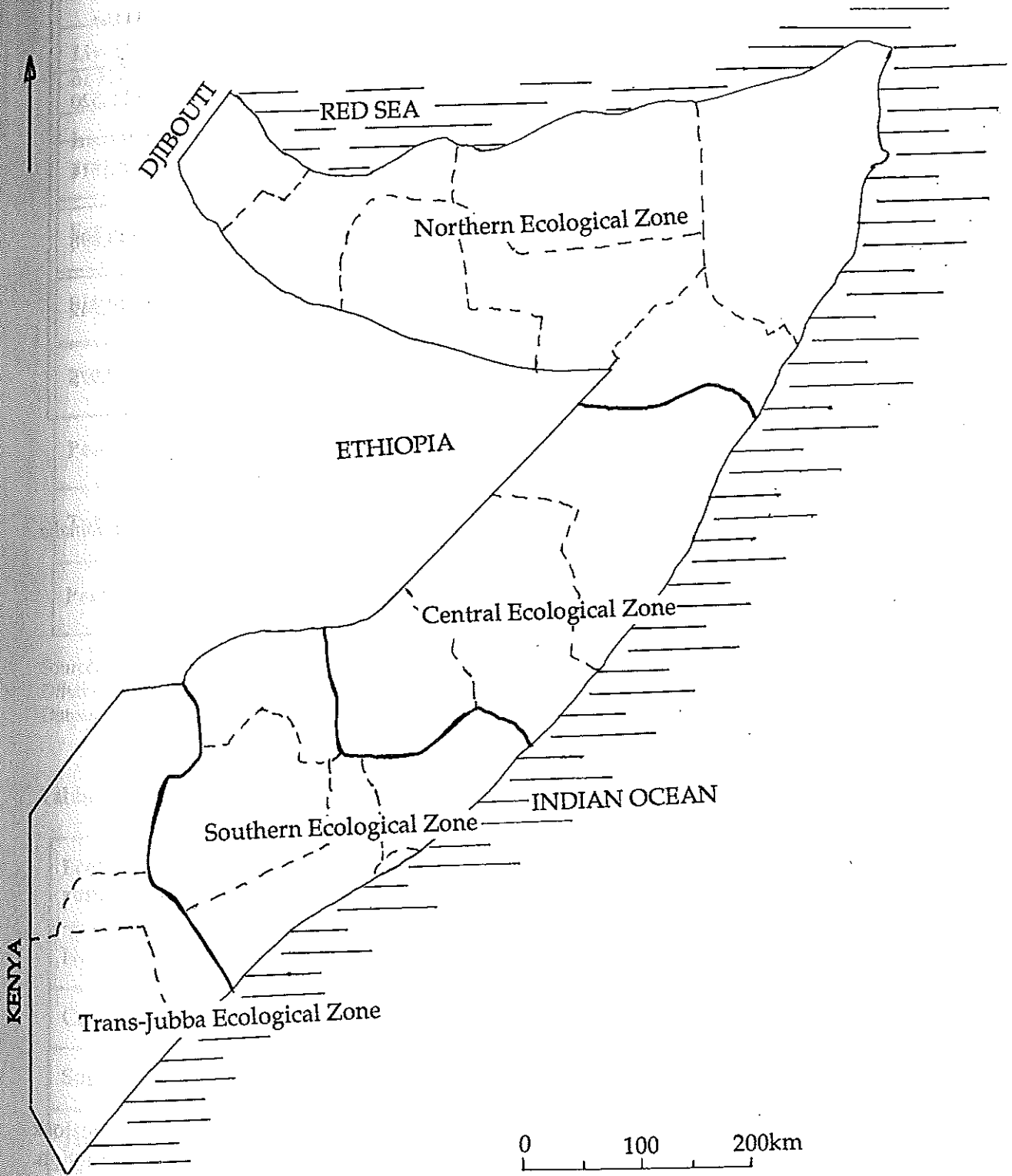
biomass, in terms of TLUs, are almost evenly distributed in the Northern, Central and Trans-Jubba regions. Slightly fewer animals inhabit the more agricultural zones of Southern Somalia.

About 43% of the camels, 2% of cattle, 10% of sheep, and 5% of goats, of the livestock population of Africa are found in Somalia (Table 3).

Performance

Major domestic animal performance is presented in Table 4. Total numbers of camel, cattle, sheep, and goats were recorded at the end of 1989. Different livestock classes, increment, export and slaughter during the year were determined (MNP, 1990). Total offtake of camels, cattle, sheep, and goats was 1.9%, 10.1%, 19.4%, and 22.8%, respectively. Total output of camels, cattle, sheep and goats was 2.7%, 11.2%, 19.5%, and 22.9%, respectively. Percent output of each class of livestock offsets its percent offtake, while the herd growth is almost constant

Figure 1. Ecological zones of Somalia



Source: Puntland Journal of Agriculture Vol.1 No.1, 1979

Table 2. *Distribution of livestock in percent and TLUs in Somalia in different ecological zones, 1989*

ECOLOGICAL ZONES/ PERCENT	CAMELS	CATTLE	SHEEP	GOATS	TLUs*
Northern	28.1	7.3	66.6	42.7	3,656,520
Central	30.1	19.3	21.2	37.4	3,586,814
Southern	19.3	28.9	5.9	9.5	2,543,898
Trans-Jubba	22.5	44.5	6.3	10.5	3,345,742
TOTAL					13,132,975

Source: Adopted from the Ministry of Livestock, Forestry and Range, 1990

*TLUs = Tropical livestock units = 250kg liveweight or equivalent

Table 3. *Percentage of African human population, livestock number and land surface in Somalia*

	PERCENT
LAND SURFACE	2.10
HUMAN POPULATION	0.83
LIVESTOCK NUMBERS	
Camels	43.00
Cattle	2.00
Sheep	10.00
Goats	5.00

Source: Ministry of Livestock, Forestry and Range 1990

for the past eleven years. Percent output of camels (2.7%) is, however, more than its offtake (1.9%). Thus, camel population steadily increased from 1900 TLUs in 1975 to 57000 TLUs in 1984 (Wilson and Bourzat, 1986) or from 5.6 million in 1978 to 6.6 million head in 1988 (MNP, 1990).

Production

Pastoralists raise various types of livestock primarily for milk and meat production. Meat and milk production in different ecological zones of the country in 1989 is shown in Tables 5 and 6, respectively. A total of 149,313 metric tons of meat was produced throughout the country. Goats and cattle produced 68.6% of total meat production.

Table 4. Major domestic animals performance in Somalia (in 000 heads), 1990

	CAMEL	CATTLE	SHEEP	GOATS
Livestock population end of 1989	6,294	4,636	11,825	19,472
Increment during the year	50	55	12	20
Export	3	13	312	313
Slaughter	115	456	1,981	4,134
Total offtake	118	469	2,293	4,447
Percent offtake	1.9	10.1	19.4	22.8
Total output	168	524	2,305	4,467
Percent output	2.7	11.3	19.5	22.9

Source: Ministry of Livestock, Forestry and Range 1990

Offtake = export + slaughter

Output = increment + export + slaughter (i.e. increment + offtake)

Table 5. Somali livestock meat production (in metric tons) in different ecological zones in 1989

Ecological zones	Camel	Cattle	Sheep	Goats	TOTAL
Northern	5,296.3	3,406.9	18,691.2	23,907.3	51,301.6
Central	5,681.7	8,930.3	5,953.5	20,924.9	41,490.5
Southern	3,652.4	13,408.7	1,679.2	5,262.2	24,002.4
Trans-Jubba	4,252.4	20,616.5	1,761.5	5,887.7	32,518.1
TOTAL	18,882.8	46,362.4	28,085.4	55,982.2	149,312.6
PERCENT	12.6	31.3	18.8	37.5	

Source: Ministry of Livestock, Forestry and Range 1990

Table 6. Somali livestock milk production (in millions of litres) in different ecological zones in 1989

Ecological zones	Camels	Cattle	Goats	TOTAL	%
Northern	247.2	35.4	259.5	542.7	27.5
Central	265.1	92.9	227.1	585.1	29.7
Southern	170.5	139.5	57.1	367.8	18.6
Trans-Jubba	198.4	214.4	63.9	476.8	24.2
Total	881.2	482.2	607.5	1970.9	
Percent	44.7	24.5	30.8		

Source: Ministry of Livestock, Forestry and Range 1990

Camel meat production was only 12.6% (Table 5). Overall, the Northern zone had the largest meat production (34.4%) while the Southern zone produced the least amount of meat (16.1%) compared to the other zones.

Camels and goats generally herded together by the pastoralists produced over 75% of total milk production. The role of the camel in the pastoral subsistence economy is not primarily for the supply of meat, but for the provision of milk. Goat milk production is more than that of cattle. Goats and sheep (no milk data recorded even though milked in some regions) are kept largely as a means of generating cash incomes. Like meat production, milk production in the Southern, primarily agricultural, zone was the lowest (18.6%) of all the zones. One can easily understand from this information that camels are primarily raised for milk production by the Somali pastoral societies.

Marketing

Animals are regularly sold in local markets every day throughout the country. No data on livestock marketing is available for the Northern zones. The location of market cities of Central and Southern zones of the country is shown in Figure 2. The average

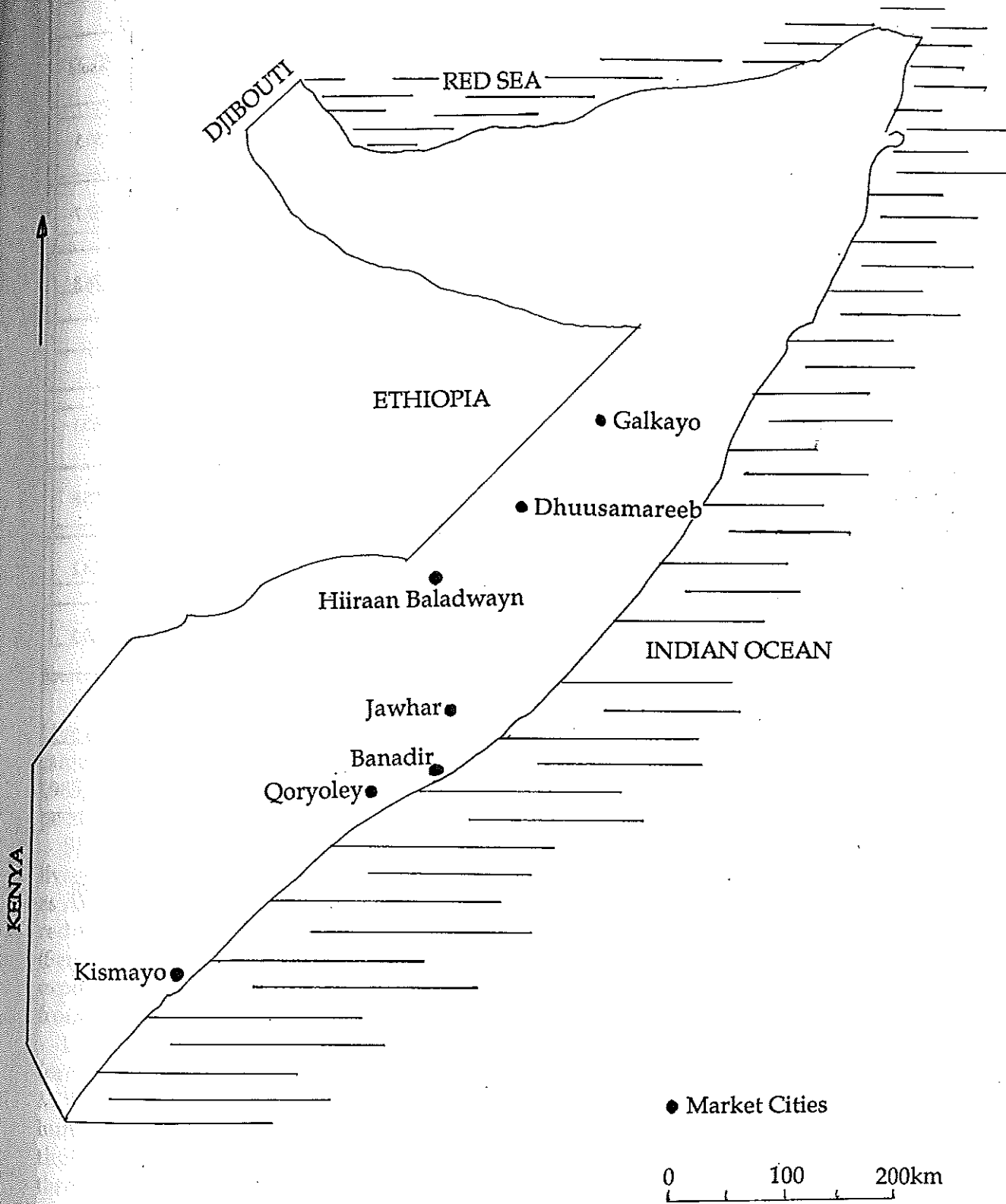
number of camels, cattle, sheep, and goats marketed and percent sold in Central and Southern Somalia, in the major market cities, in 1989 is presented in Table 7. High percentage of animals were sold in big cities such as Mogadisho, Kismayo and Jawhar. Cities located in the pastoral areas, including Dhuusamareeb, and Galkayo, also consumed large numbers of animals. Low percentage of animal consumption was calculated for Baladweyn, and Qoryoley, where more people are involved in cultivation than in livestock rearing.

Overall, small ruminants make up about 70% of the number of livestock marketed in the Central and Southern market cities (Table 7). Based on the data obtained from the municipal slaughter houses in 1987 and 1988, sheep and goats were 74% and 72%, respectively (Table 8), of the total number slaughtered.

Export

Amongst the countries in the Horn of Africa, Somalia is the principal exporter of livestock and livestock products to the Gulf States (Reusse, 1982). Millions of live animals (camel, cattle, sheep, goats) were sold in the international markets of the Middle East (Table 9).

Figure 2. Market cities in Central and Southern Somalia



Source: MLFR 1990

Table 7. Average number of livestock marketed and percent sold in the Central and Southern market cities in 1989

Market area	No of months	Camels		Cattle		Sheep		Goats	
		No	%sold	No	%sold	No	%sold	No	%sold
Central B/weyn	11	450.5	44.0	271.9	28.4	1029.9	44.7	2476.0	50.3
Dh/ mareeb	11	26.2	56.1	10.8	49.1	200.2	67.7	363.3	67.7
Galkayo	9	179.5	72.5	0.3		352.8	62.6	1148.2	76.8
Subtotal		656.2		283.0		1582.8		3987.5	
Southern Mogadisho	7	2155.0	71.9	2692.0	82.2	2516.0	62.5	6020.0	65.1
Jawhar	8	218.7	61.9	409.2	33.0	273.1	67.1	898.2	75.8
Qoryoley	9	196.3	48.1	533.5	36.7	234.9	44.4	920.7	23.2
Kismayo	10	204.4	60.4	120.5	70.0	60.0	65.2	344.4	69.3
Subtotal		2774.4		3755.2		3084.6		8183.3	
Grandtotal		3430.6		4038.2		4667.4		12170.8	

Source: Adopted from Ministry of Livestock, Forestry and Range 1990

Table 8. Number of animals slaughtered in the municipal slaughter houses in 1987 and 1988

ANIMAL/YEAR AND AMOUNT	1987		1988	
	No	%	No	%
Camel	84,994	11.3	78,957	12.8
Cattle	106,206	14.1	92,290	15.0
Sheep & Goats	563,094	74.7	444,518	72.2
TOTAL	754,294		616,765	

Source: Ministry of National Planning 1988

Table 9. Total number of livestock exported from Somalia, 1978 through 1988

YEAR	CAMEL	CATTLE	SHEEP	GOATS
1978	21,000	74,000	739,000	715,000
1979	17,000	79,000	717,000	705,000
1980	17,000	94,000	745,000	736,000
1981	15,000	116,000	685,000	680,000
1982	15,000	157,000	730,000	719,000
1983	8,000	54,000	559,000	557,000
1984	4,000	8,000	339,000	337,000
1985	6,622	42,417	718,698	718,698
1986	8,770	55,768	567,364	566,849
1987	19,674	52,401	579,342	579,341
1988	10,513	26,551	200,858	203,128

Source: Ministry of Livestock, Forestry and Range 1990

Live animal export, especially of cattle and camels, decreased drastically from 1982 to 1985, due to the Saudi import ban on suspected diseased cattle from Somalia.

Shipping problems, and increases of livestock export from other countries such as Australia and Turkey to Saudi markets, reduced livestock export from Somalia (Samantar and Awale, 1987). However, the export business of the country did recover from 1985, onwards.

Live animal export is the major earner of foreign trade exchange for the country. Millions of dollars were obtained exporting hundreds of thousands of live animals and their products, specifically from 1985 through 1988 (Table 10).

Dairy products, hides of livestock, and meat preparations are also important in obtaining hard currency for the development of the country.

Importance in the National Economy

Over 70% of the Somali population subsist in pure pastoralism. They contribute more than 60% to the gross domestic product (GDP) and 80% to the value of the national exports (Reusse, 1982). The pastoral livestock production system is, therefore, the backbone of the national economy. Its contribution is a net value added to the GDP since it comes from rangeland resources produced and marketed with little input from outside the system. Livestock is the most important sector in the economy of Somalia (Table 11). The livestock sector amounts to more than 40% of the gross domestic products in 1988 and over 66% of the national export in 1987 (Table 12). Livestock export and slaughter increased by 4.4% between 1985 and 1986, and by 2.7% between 1986 and 1987 (MNP 1988).

Table 10. *Livestock exports (in metric tons) from 1985 to 1988*

	1985	1986	1987	1988
Live animals	43,241	45,195	55,775	23,106
Camels	3,216	5,851	11,979	—
Cattle	10,393	15,292	19,654	7,755
Sheep	29,632	24,049	24,117	8,828
Goats	—	—	—	6,521
Meat and meat preparations	—	2	269	100
Dairy products	2	6	9	69,447
Hides & skins	1,945	5,165	1,683	1,744
Camels	—	—	—	—
Cattle	91	382	367	343
Sheep	951	508	457	2,106
Goats	903	4,274	859	1,168
TOTAL	90,374	100,724	115,169	121,118

Source: MNP 1988

Table 11. *Gross domestic production by different sectors of agriculture activities at current prices (in millions of Somali Shillings) from 1978 to 1987*

Economic activity/Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Livestock production	3,491	3,129	7,591	9,365	12,775	14,812	21,180	30,908	41,159	64,937
Crop production	812	1,185	3,150	3,761	4,308	4,791	16,112	19,065	10,338	28,838
Forestry production	184	250	369	664	1,173	1,672	2,903	5,060	8,346	11,215
Fishery production	9	24	52	65	90	132	366	509	570	989

Source: Ministry of National Planning 1988

Table 12. Importance of livestock sector in Somalia

SECTOR	1989 National budget %	1988 Gross domestic products (GDP) %	1987 Export %
Livestock production	4.1	41.5	66.1
Crop production	4.1	24.8	16.1
Fishery production	1.8	0.7	1.8
Others	90.1	33.0	15.9

Source: Ministry of Livestock, Forestry and Range 1990
GDP at constant price, 1985

Camels

Importance

Total Number

Somalia has the largest number of one-humped camels (*Camelus dromedarius*) in the world. The camel population of the country is 7.5 million tropical livestock units (TLUs). The latest population estimate in 1988 was 6.6 million head (MNP, 1990). This is approximately 30% of the world, and 43% (MLFR, 1990) to 50% of the total African camel population (FAO, 1978; Wilson, 1984). The average camel population in Somalia from 1978 to 1988 comprises 42.4% TLUs, and 54.4% of the domestic herbivore biomass (DHB) of the country (Table 13). The TLU values obtained in this analysis are lower, and those of DHB higher, than the values reported by Wilson and Bourzat (1986). According to their analysis, the camel population in Somalia amount to 53.8% and 46.6% of the country's total DHB and TLU, respectively. This variability of values could be attributed to the difference of the data sources used. The importance is, however, that these values should be regarded as indicative figures only. Both values clearly

reflect the importance of camels in the Somali economy.

More than half of the Somali population live directly on livestock production. Camels, primarily by providing milk, have exceptional importance and a major role in the subsistence economy of the pastoralists. Camels are also symbols of wealth and prestige and are cornerstones for the social organizations of the pastoral societies (Abokor, 1987).

Production

The family unit of husband, wife, children, unmarried brothers and sisters, or married brothers, cousins, in-laws, and their dependents, collectively own the camel herd (Elmi, 1989a, b). The family needs of milk determines the herd structure and composition in the Somali pastoral societies. Family and camel herd, therefore, develop together for subsistence.

In herd management, pastoralists selectively breed their camels for milk production (Wilson, *ibid*; Elmi, *ibid.*). Even though camel production and herd growth are low, the year long milk production makes the animal the most valuable of all livestock in Somali pastoral societies.

Table 13. Trends of total number of livestock and camels in TLUs (millions of heads) and the total DHB of livestock and camels (in millions of metric tons) from 1978 to 1988

YEAR	TOTAL TLUs*	CAMEL TLUs*	TOTAL DHB**	CAMEL DHB
1978	16.1	6.9	3.13	1.72
1979	17.1	7.1	3.34	1.78
1980	17.1	7.1	3.32	1.78
1981	17.7	7.1	3.30	1.78
1982	17.5	7.2	3.42	1.84
1983	18.1	7.6	3.51	1.90
1984	17.5	7.5	3.40	1.87
1985	18.0	7.6	3.47	1.90
1986	18.6	7.9	3.58	1.96
1987	18.1	7.9	3.62	1.96
1988	19.4	8.1	3.77	2.03
AVERAGE	17.7	7.5	3.44	1.87

*TLUs = Tropical livestock units = 250kg liveweight or equivalent = 1 adult cow.

It is used for stocking rate determination expressed in numbers using ratio based on actual weight: camels = 1.228, cattle = 1, sheep and goat = 0.2.

**DHB = Domestic herbivore biomass expressed in liveweight (metric tons)

Both TLUs and DHB are calculated based on mean weight of each animal type of livestock:

camel = 307kg, cattle = 206Kg, sheep = 30Kg and goats = 18kg (Wilson 1984).

Total number of livestock is given in Table 1.

Detailed discussion of TLU and DHB is beyond the scope of this paper.

Data of the actual amount of milk produced by individual camels is difficult to obtain under pastoral conditions. Calves and herders compete for milk. How much milk goes to each is difficult to measure. In northern Kenya, camel milk production during the first 10 weeks after calving was as high as 13 liters a day (Field, 1979). Spencer (1973) found that 20 Rendille camels gave as much milk as 80 zebu cows. Stiles (1983; 1987) estimated that an average female camel produces 5 to 10 times as much milk per lactation as a cow and continues producing milk throughout the dry season.

In Somalia, average milk yield of camels was estimated to about 4-5kg per day (Rossetti and Congui, 1955; Cozzi, 1965; Taneja, 1980). More recently, Hussein (1987) reported 5-6 liters of average milk production per day, with the best milk producers averaging about 12 liters a day.

The life span and lactation period of camels are much longer than that of cattle (Dahl and Hjort, 1976). Annual reliability of camel milk production is much higher than cows (Coughenour et al., 1985). These are extremely important points if food requirements are to be maintained while keeping reasonable herd size.

Marketing

In Somalia camels are marketed and sold every day in different local markets of the country. Camel meat is eaten more often than cow or beef meat. It is generally available in most major towns and villages throughout the year. About 20,000 metric tons (12.6%) of total meat production recorded for local consumption in the country in 1989 came from camels (Table 5). Local consumption of camel meat is increasing in Somalia.

Camel export declined in the 1980s (Table 9). The Saudi ban of imported Somali cattle affected camel exports. Reduced camel export to Middle East markets was influenced by both an increase in camel prices due to high taxation, and other export expenses, along with soaring inflation, fluctuation of exchange rates, and other logistical shipping problems. (Samantar and Awale, *ibid.*).

In short, camels are recognized for producing more milk than cows, and having more energy than donkeys or bulls. This economic importance of camels, as in both producers of protein, and a source of energy, has created a growing interest in their ability to exploit range resources unavailable to other domestic animals. Camel development and improvement is necessary to alleviate human starvation in the arid lands of developing countries in Africa and Asia.

Breeds

Distribution

Camel breeds in Somalia are not yet properly identified. Two types of camels exist in the country and are distributed according to their habitat (Mason, 1979). The first one is called a hill or mountain type. Camels of this type are small, compact, muscular, hairy with hard foot soles suited to the rocky environment of Gollis Range in the north of the country. The second is the plain type of camel. They live in flat areas and usually are large with less hair and softer foot soles than the hill type of camels. The plain camels are subdivided into two groups, 1) the "riverine", and 2) the *haud*. In the northwest region both hill and plain types exist. In the northeast

and central regions camels close to the plain type are found. Big riverine camels inhabit the southern part of the country.

With current available information, it is not easy to classify these camel types or subtypes into breeds. Differences in camels in different zones of the country could be due either to ecological factors unique to each zone, or to inherent camel variations (milk production, for instance) that may lead to different breeds of camels.

Research on camel types was initiated by the Somali Camel Research Project (SCRCP). A pilot study was conducted in the southern and central zones of the country. Size, weight, colour, milk production, maturity, resistance, habitat and distribution was used by Hussein (1987) to classify the camel types as to possible camel breeds. Based on this investigation three camel types were differentiated: 1) *Hoor*—ashywhite, small, compact, distributed in Mudug, Hiiraan and Bakool regions, 2) *Siifdaar*—brownish, medium in size, found in Lower Shabeelle and 3) *Eyddimo*—tall heavy, distributed in Bay, Gedo, and Jubba regions.

Production

Hoor, the small camel type, has higher milk yields than *siifdaar* or *eyddimo*. Average daily milk production was estimated to about 8 liters for *hoor*, 6 liters for *siifdaar* and 4 litres for *eyddimo* (Hussein, 1987). Lactation period ranged from 8 to 16 months. Maturity age is between 4 and 6 years. Weight gain after dry seasons and weight loss during the dry periods is fast for *hoor*, average for *siifdaar* and slow for *eyddimo* (Hussein, *ibid.*). This preliminary research finding is far from complete for use in camel breed classification. More studies are necessary to properly and accurately classify the Somali camels.

Forage

Range Forage Species

Somali camels are exclusively dependent on forage produced naturally in the rangelands of the country. No feed supplements are

provided except minerals. Common salts (NaCl) or a particular type of soil dug from specific locations under surface or top soil is given to the camels when advised by an experienced camel herder. Camels are also foraged on salty plants or watered from salty wells where available.

Camels consume a diversity of forage plant species in the range (Elmi, 1989a). Woody shrubs, and trees which include deciduous and evergreen species, are the dominant component of the available forage on a seasonal basis (Table 14). They contribute 69.2%, 92.5% and 80.9%, in dry, wet, and over the year, respectively. In the dry seasons, more low growing shrubs, grasses and vines are used than for the wet seasons, apparently to compensate declining browse forage species available.

Acacia species are the favorite deciduous forage in all seasons. Most acacia plants either stay green longer in the dry seasons or turned green long before the on-set of the rainy seasons. Dichrostachys sp., Terminalia sp., Balanites sp., Indigofera sp., Crotalaria sp., Pentatropis sp., Rhyncosia sp., together with some grass species are among the most important forage species in the diets of camels.

Relatively small number of plants comprise the bulk of the camel diets in one season or another. Indigofera intricata (45.5%) in summer of 1986; Acacia nilotica (20.3%), A. reficiens (15.4%), Balanites sp. (16.2%) in winter of 1987; Dichrostachys sp. (54%), Crotalaria sp. (19%) in summer of 1987; Terminalia spinosa (20.7%), Acacia horrida (11.7) in fall of 1987; Grewia Pennisilata (14%) in Spring of 1987; and Albizia sp. (23.8%) in fall of 1987, were the major camel diet components in Central Somalia (Elmi, *ibid.*).

Forage plant species consumption by camels was not affected by physical defense structures or by leaf size in relation to bite dimensions of the animal at any given time. Structures such as spinescence, thorniness, awns, pubescence, etc. did not prevent the camels feeding on the plant species. Small-leaved deciduous spiny (thorny) plants were

utilized along with the large-leaved deciduous or evergreen plants. Bite size was, however, influenced by growth stage of plants, which was in turn affected by season.

Forage Quality

One of the criteria used to assess the value of plant species consumed by foraging animals is its nutritive content (i.e chemical composition and digestibility). Nutritional fluctuations with regard to quantity and quality exist in different seasons of the year in the semiarid climate of Somalia. Nutritional fractions (crude protein, fibers, etc.) influence acceptability of forage plants to herbivorous animals.

Crude protein content of individual plant species consumed by camels varied from about 10 to 31 percent in the dry seasons and from about 11 to 48 percent in the wet seasons (Elmi, 1989a). Overall, crude protein contents of major forage species in camel diets were 16.3% in the dry seasons and 24.1% in the wet seasons (Table 15). High crude protein levels have been reported for several acacia species (Pellew, 1980). Acacia species are important forage plants for camels in both dry and wet seasons due to their relatively high protein content and their abundance in the camel habitat of Somalia.

Crude protein content of camel diets was high in all seasons. This is apparently due to the ability of camels to select green leaves and relatively young tender twigs with high crude protein contents in the dry seasons. Crude protein contents in camel diets is more than the protein requirement of other livestock. Whether this crude protein value is completely and effectively digestible needs further investigations.

Camel diets were high in fiber and lignin contents and low in invitro dry matter digestibility tests (Table 15). Low digestibility of camel diets could be due to the high lignin component in the diets. Camels selected new shoots already lignified in the semiarid tropical climate. Use of enzymes only without rumen fluid of the camels may have also

Table 14. Dietary selection (%) by camels and foliage cover (%) of all species comprising each forage class in different seasons and locations, Central Somalia, 1986 and 1987

YEAR	Season	Animal/ vegetation cover	Woody shrubs trees %	Low growing shrubs %	Grasses %	Vines %	Forbs %
1986	XAGAA (dry) (Summer)	camel	41.3	45.6	10.7	2.3	0.0
		cover	5.6	10.4	14.4	1.0	0.0
	DAYR (wet) (Fall)	camel	90.7	6.0	1.8	1.3	0.0
		cover	42.4	10.3	24.6	5.6	0.0
	JILAL (dry) (Winter)	camel	75.3	5.8	17.7	1.2	0.0
		cover	43.7	9.5	17.8	0.7	0.0
1987	GU (wet) (Spring)	camel	96.7	1.4	0.0	1.9	0.0
		cover	31.0	0.3	2.2	4.2	0.0
	XAGAA (dry) (Summer)	camel	90.9	1.1	2.0	5.2	0.8
		cover	38.8	5.4	10.0	2.7	3.4
	DAYR (wet) (Fall)	camel	90.1	4.2	2.6	1.3	1.9
		cover	24.6	2.8	17.1	2.4	4.8
Mean dry seasons		camel	69.2	17.5	10.1	2.9	0.3
Mean wet seasons		camel	92.5	3.9	1.5	1.5	0.6
Mean all seasons		camel	80.9	10.7	5.8	2.2	0.5

Source: Elmi, 1989a

contributed to the invitro digestibility values.

Major mineral elements such as calcium, potassium and sodium were adequate in regard to most species. Phosphorous was, however, low. It is extremely low in its ratio with calcium (Elmi, *ibid.*). In summary, the different forage plant species which camels consume in the Central zones of Somalia appear to be rich in crude protein and major mineral elements, but not in phosphorous.

Cell wall constituents (i.e neutral detergent fiber) and lignin are high.

Management

Forage, water, and labour availability determines the efficiency of camel management in Somalia. The family's need for milk is one of the major factors influencing camel herd composition. Intensive breeding management is used by the Somali pastoralists to control breeding males, and thereby increase

Table 15. Seasonal nutritive contents of major forage species in camel diets, Central Somalia, 1986 and 1987

Nutrient contents		Dry season %	Wet season %
Crude protein		16.3	24.1
Invitro dry matter digestibility		35.5	39.2
Neutral detergent fiber		66.9	65.3
Acid detergent fiber		50.3	49.8
Acid detergent lignin		13.4	14.7
MINERALS	Calcium	1.9	1.8
	Phosphorous	0.1	0.1
	Potassium	1.3	1.7
	Sodium	0.3	0.2

Source: Elmi, 1989a

the female component of the herd in order to secure a continuous milk supply for the family (Wilson, *ibid.*; Elmi, 1989a, b).

Camels eat a wider array of forage plants as the dry season progresses and forage availability declines (Elmi, 1989a). They include a modest portion of grasses in their diets. Camel herders move the animals frequently from one foraging area to another within or between seasons. Camels are herded where evergreen shrubs and trees comprise the major component of the diet in order to obtain green forage even in the dry periods on the natural range.

In the Somali pastoral management system, camels are herded throughout the year. Camel men are experts in recognizing the preferred forage species of the camels. This knowledge is essential and fundamental in optimizing camel management and production.

From the amount of milk produced and its taste, a camel boy can tell whether camels are well fed or not in the course of the daily foraging activities. Thus, regardless

of season or time, camels are frequently moved where better forage is available. These movements are not accidental but planned. The animals are herded into new locations where evergreen browse species are present or where vegetation stays green in the dry seasons so as to select plant species with better nutritional value.

Summary

Camels are and will remain the basic resource for the survival of particularly pastoralists in arid lands of Africa. For livestock herding societies of Somalia, camels are the mainstay of their subsistence economy. Camel herding is the most efficient way of exploiting Somali rangelands where other means of production (cultivation, other livestock rearing) are difficult. Camels serve primarily as dairy animals for the pastoral societies and secondarily as a source of meat and skin production for local consumption as well as for export.

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