Goat Types of Ethiopia and Eritrea

Physical description and management systems

by

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International Livestock Research Institute

October 1996

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ISBN 92–9146–014–1

Correct citation: FARM-Africa. 1996. *Goat Types of Ethiopia and Eritrea. Physical description and management systems.* Published jointly by FARM-Africa, London, UK, and ILRI (International Livestock Research Institute), Nairobi, Kenya. 76 pp.

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Foreword

The results presented in this monograph represent the work of many people and organisations. The British non-governmental organisation (NGO) FARM-Africa initiated and co-ordinated the work as part of its Dairy Goat Development Programme. Initial funding came from Band Aid, but most funding was received from the Overseas Development Administration (ODA) of the British Government. Three graduate students from Alemaya University of Agriculture (AUA), Alemayehu Reda, Workneh Ayalew and Nigatu Alemayehu, carried out the field data collection with assistance from field staff of the Ministry of Agriculture. Data analysis was carried out by the students at the International Livestock Research Institute (ILRI) under the supervision of Dr Bernard Rey. Much of the computer programming was carried out by Mesfin Shibre. Advice on data analysis was received from other ILRI staff, Dr Ed Rege and Mr John Sherrington. The students were jointly supervised by Dr Christie Peacock (FARM-Africa), Dr Bernard Rey (ILRI) and Dr Kano Banjaw (AUA). The photographs were taken by Gezachew Yirgu, Alemayehu Reda and Workneh Ayalew. The report was compiled by Dr Christie Peacock, formerly the Dairy Goat Development Programme Co-ordinator of FARM-Africa.

Those involved in this study would like to acknowledge the contributions made by the following people and organisations:

- The co-operation of the farmers and pastoralists of Ethiopia and Eritrea made this study possible.
- The assistance of countless Ministry of Agriculture field staff allowed the field teams easy access to sites of interest.
- The International Livestock Research Institute (ILRI) showed great interest in the study and has supported it in innumerable ways. Dr Trevor Wilson and the Small Ruminant and Camel Group assisted it in the early stages, and Dr Ed Rege and Mr John Sherrington made valuable contributions in guiding the data analyses. Dr Hank Fitzhugh and Dr Michael Smalley showed great interest and support for the work. Anne Nyamu helped to bring it to its final form.
- FARM-Africa has been the major driving force behind the survey and the support of Dr Asefa Wolde-Giorgis, Country Representative, Teferra Gebre-Meskel, Dairy Goat Programme Co-ordinator, and Samson Hailu, Administrator, is gratefully acknowledged. In the field Arafynie Mitiku, Yosef Demissie and Abebe Shenkutie made immense contributions.

Introduction

There are an estimated 18.1 million goats in Ethiopia and the newly independent state of Eritrea (FAO 1992a). They are kept in a wide range of production systems reflecting the diversity of the Ethiopian and Eritrean environments. Approximately half the goat population is kept by pastoralists in the lowlands of the south, east and west, while the remaining 50% are found in small flocks on mixed highland farms. To their owners goats are a valuable source of milk, meat, cash and security against the vagaries of the environment. Yet despite their economic importance to many of Ethiopia's and Eritrea's most vulnerable groups, little attention has been paid to their development through research and extension.

In 1988 the British non-governmental organisation (NGO) FARM-Africa initiated a Dairy Goat Development Programme in collaboration with the Ministry of Agriculture, Alemaya University of Agriculture, Awassa College of Agriculture and several international and indigenous NGOs. The programme aimed to redress the past neglect of goats through an extension programme in the highlands of south and east Ethiopia, a cross-breeding programme and through supporting research on goats.

It was clear at the start of the programme that a comprehensive description of the diverse goat types found in Ethiopia and Eritrea had never been made. Descriptions of localised goat types had been attempted during the colonial era in Eritrea and Somaliland. Marchi (1929 cited in Mason and Maule 1960) and Gadola (1947 cited in Mason and Maule 1960) described the variety of small goats kept by various Eritrean tribes such as the Beni-Amer, Assorta and Bilena. Salerno (1939 cited in Mason and Maule 1960) described a short-haired goat of the Danakil desert, and the white and variegated coloured goats of the Hararghe highlands and lowlands. Girardon (1939 cited in Mason and Maule 1960) mentions the Bati goat of Wollo valued for its skin, the Arusi goat and the goats of the western lowlands of Ethiopia. Drake-Brockman (1912 cited in Mason and Maule 1960) described the Somali goats he encountered in Somaliland. In all, 17 goat types were described during the period 1920–50.

A systematic description of the goat types and management systems should be considered a prerequisite for planning the rational use of the national goat resources. In addition, breed characterisation is the first step in the urgent task of genetic resource conservation (Baker 1992; FAO 1992b).

In order to make a first attempt at identifying the goat types of Ethiopia FARM-Africa began a National Goat Breed Survey of Ethiopia and Eritrea in 1990. The objectives of the survey were to:

- identify and characterise the indigenous goats types in Ethiopia and Eritrea
- describe the traditional goat husbandry practices in different production systems
- develop and test a method for the rapid survey of indigenous livestock.

Ethiopia has the largest livestock population of any country in Africa. The majority of the cattle population, estimated at 28 million, is found in the highlands (Table 1) where the animals supply draft power for cultivation and milk for home consumption and sale. The bulk of the sheep population, estimated at 23 million, is also found in the highlands. Sheep are readily traded, providing a useful source of cash and store of wealth. It was formerly believed that the majority of the goat population is found

in large flocks in the lowlands where they are kept by pastoralists for milk production, for slaughter and for sale. However, a recent survey of agriculture in the highlands of Ethiopia found that 9.6 million goats are reported to be kept in the highlands (CSA 1995). This represents about 50% of the estimated total goat population. Evidence is accumulating that there has been an underestimate of the importance of goats kept in small flocks on mixed farms in the highlands. The distribution of goats in Ethiopia and Eritrea is presented in Figure 1.

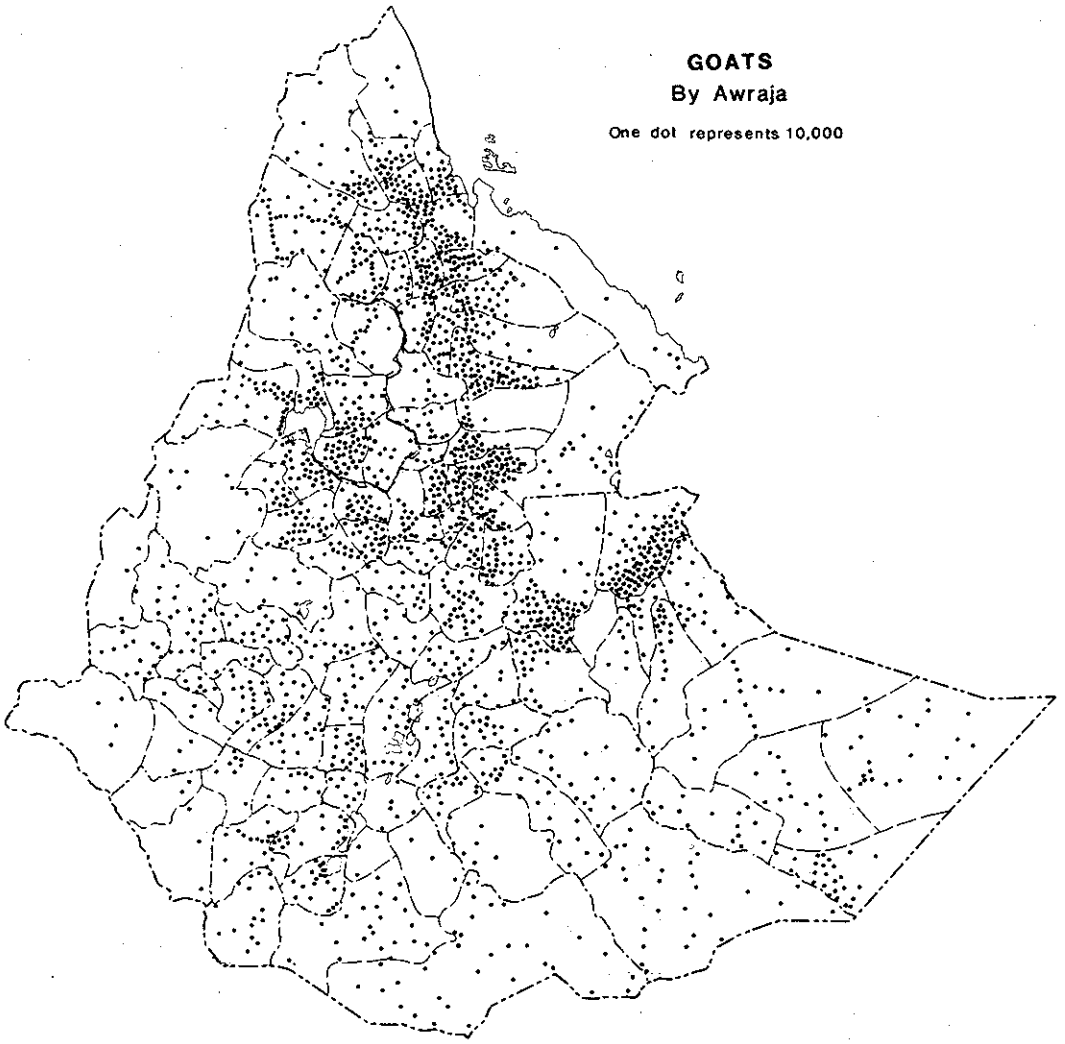

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Figure 1. *Map of goat distribution.*

Source: EMA (1988).

Table 1. *Distribution of Ethiopian and Eritrean livestock by agro-ecological zone.*

Zone	Land area (%)	Cattle (%)	Sheep (%)	Goats (%)	Ruminant TLU (%)	Human population (%)
Arid	44.5	14.0	10.0	38.0	19.0	5.6
Semi-arid	10.1	14.0	16.0	22.0	14.2	43.4
Subhumid	7.7	14.0	8.0	5.0	12.2	4.9
Highland	37.7	58.0	66.0	35.0	54.4	46.1

Source: Jahnke (1982).

The agroclimatic zonation commonly used in Ethiopia is presented in Table 2. Climate is predominantly determined by altitude which in Ethiopia may range from below sea level in the Danakil desert to above 4000 metres in the Simien mountains. This huge altitude range creates a wide variety of environments which may be classified into the 12 zones defined in Table 2.

Table 2. *The agroclimatic zones of Ethiopia.*

Altitude (m)	Annual rainfall (mm)		
	Less than 900	900–1400	More than 1400
Above 3700 m			**High *Wurch*** (Afro-alpine steppe, meadow) A: None, frost limit S: Black soils little disturbed T: Mountain grassland (*Artemisia, Helichrysum, Lobelia*) L: Sheep, cattle
3200–3700 m		**Moist *Wurch*** (Subalpine) A: Only barley, one crop per year S: Black soils degraded T: *Erica, Hypericum* L: Sheep, cattle, goats	**Wet *Wurch*** (Subalpine) A: Only barley, two crops per year S: Black soils highly degraded T: *Erica, Hypericum* L: Sheep, cattle, donkeys

Table 2. *Cont'd*

Altitude (m)	Annual rainfall (mm)		
	Less than 900	900–1400	More than 1400
2300–3200 m		**Moist *Dega*** (Afro-montane forest woodland) A: Barley, wheat and pulses; one crop per year S: Brown clay soils T: *Juniperus, Hagenia, Podocarpus* L: Sheep, cattle, goats, horses, bees, chickens	**Wet *Dega*** (Afro-montane forest-bamboo) A: Barley, wheat, noug, pulses; 2 crops per year S: Dark brown clay soils T: Juniperus, *Hagenia, Podocarpus,* bamboo L: Sheep, goats, cattle, chickens, horses, bees
1500–2300 m	**Dry *Weyna Dega*** (Savanna) A: Wheat, teff, rarely maize S: Light brown to yellow soils T: *Acacia* savanna L: Cattle, goats, sheep, bees, donkeys, chickens	**Moist *Weyna dega*** A: Maize, sorghum, teff, *enset* (rare), wheat, noug, finger millet, barley S: Red-brown soils T: *Acacia, Cordia, Ficus* L: Cattle, goats, sheep, horses, mules, donkeys, bees, chickens	**Wet *Weyna dega*** A: Teff, maize, *enset* (in western parts), noug, barley S: Widespread drainage T: *Acacia, Cordia, Ficus,* bamboo L: Cattle, goats, sheep, horses, mules, donkeys, bees, chickens
500–1500 m	**Dry *Kolla*** A: Sorghum (rare), teff S: Yellow sandy soils T: *Acacia,* bushes and trees L: Goats, cattle, camels, sheep, donkeys, chickens	**Moist *Kolla*** A: Sorghum, rarely teff, noug, finger millet, peanuts S: Yellow silty soils T: *Acacia, Erythrina, Cordia, Ficus* L: Cattle, goats, bees, chickens, donkeys	**Wet *Kolla*** A: Mango, taro, sugar-cane, maize, coffee, oranges S: Red clay soils, oxidised T: *Milicia, Cyathea, Albizia grandibracteata* L: Cattle, goats, donkeys, bees
Below 500 m	***Bereha*** (*Acacia-Commiphora* bushland) A: Crops only with irrigation S: Yellow sandy soils T: *Acacia bussei, Commiphora erythrina* L Camels, goats		

A: main crops; S: soils; T: natural trees; L: main livestock species.

Methods

The National Goat Breed Survey was carried out by three consecutive graduate students from Alemaya University of Agriculture between January 1990 and June 1993. A standard survey method was followed by each student to ensure comparable data. Each student's data set was analysed independently after completion of the field survey. When the final student completed his survey the three data sets were amalgamated and analysed as one.

Field method

Each region surveyed was stratified by altitude and ethnic group. Peasant Associations (PAs), the smallest administrative unit in Ethiopia and Eritrea, were taken as sampling sites. Sites were selected at 500 m intervals along altitude transects spanning the known ethnic range (Figure 2). The survey included only one visit to a sampling site at which whole flocks of goats were sampled until about 500 goats had been physically measured.

A total of 21 variables were selected from the FAO (1986) goat breed descriptor list. These were divided into morphological and other variables. The morphological variables were further divided into qualitative and quantitative:

- Qualitative: sex, dentition, presence of beard, presence of ruff, presence of wattles, head profile, coat pattern, coat type, ear form, horn shape, horn orientation.
- Quantitative: body length, chest girth, height at withers, pelvic width, ear length, horn length, body weight.

The other variables included:

- Parturition history of does as recalled by owner: total number of parturitions, single births, multiple births.
- Source of animal: whether home-bred, purchased, given etc.

Although it is customary to describe breeds in terms of mature females, whole flocks were sampled to obtain information on the size of flock owned and flock structure.

The dentition classes used in the survey were not entirely uniform between students. In order to standardise the classes for the overall analysis, the more refined classes were amalgamated into the broader categories of milk teeth, one, two, three and four pairs of permanent incisors. Goats were measured using a plastic tape measure and weighed using a 100 kg x 500 g spring balance suspended from a metal tripod. Weights were recorded to the nearest half kilogram. Flocks were sampled early in the morning before grazing. To facilitate the survey local Ministry of Agriculture veterinary personnel accompanied the survey team to vaccinate or treat the goats brought to be measured.

Information, reported by goat owners, on the reproductive performance of each doe sampled was recorded. Data on parturition history, number and types of birth enabled the estimation of the average litter size and the average reproductive performance.

A questionnaire was used to collect information on housing, feeding, breeding management, product use and the traditional use of goats at each site.

Figure 2. *Map of sampling sites by ecological zone.*

The main field problems encountered affecting the data were the reluctance of some goat owners to bring their very young kids to be surveyed. This led to slightly distorted flock structures for the Worre, Barka and Nubian goats.

Analytical technique

The analytical goal was to determine the morphological resemblance or dissimilarities within an assemblage of animals. If there are initial classes such as uniform animal populations indicating a breed type, or commonly accepted, but not established, local names of breed types, and if the total sample population can be classified into these categories, discriminant analysis can be used to justify group differences (Klecka 1980). In the absence of distinct initial classes, the animal population may be assumed to be a heterogenous set divisible into more homogenous taxonomic groups which may represent breed types or varieties (Aldenderfer and Blashfield 1984). Multivariate

analysis techniques are usually used to explore the factors of dissimilarity within a population, and eventually reorganise a heterogenous set of observation units into relatively more homogenous groups from the total population.

For this study the unit of analysis was the population of mature female goats at each site characterised by the mean of the continuous variables and the frequency of discrete variables. Mature females were selected because it is customary to describe a breed by a description of the females because they usually exist in larger numbers and it is easier to determine their stage of maturity than for males. The variables selected to describe the mature female goats included continuous variables, such as height at withers or ear length, and discrete variables such as coat colour or ear orientation. Variables were screened for variability and discriminating power. A total of 35 variables were finally selected.

The number of animals measured at each site depended upon the precision required and the variability in the population. Coefficients of variation on growth traits have been observed to be up to 35% (Peters 1985). For significance at the 5% level, 100–300 mature females are required per site (Bruns 1992), implying a target sample size of 500 goats from any site. A total of 103 sites were included in the analysis. Thirteen additional sites were considered as supplementary observations due to the small number of animals recorded, implying high variability for means and frequencies.

Variation trends: Principal components analysis

In order to identify the most important multifactorial variation trends across the populations the 35 variables, naturally correlated, were transformed into as many independent principal components using the procedure ANCOMP of ADADSAS software (ADDAD 1990).

Appendix II presents the correlation of the variables with the first seven principal components. The first three principal components account for 45% of the total variance of the model. They indicate the major contrasts between the goat populations.

The first principal component contrasts goat populations with:

High positive value on Axis 1
- Ear length
- Height at withers
- Straight horn shape
- Brown coat colour
- Patchy coat colour pattern
- Ruff with hair on the thighs

High negative value on Axis 1
- Curved horn shape
- Lateral horn orientation
- Plain coat colour pattern
- Smooth and short hair

The second principal component segregates:

High positive value on Axis 2
- Ear length
- Chest girth
- Body weight
- Weight to height at withers ratio
- Ear to height at withers ratio
- Lateral horn orientation

The third principal component is a contrast of:

High positive value on Axis 3	**High negative value on Axis 3**
- Height at withers ratio	- Horn to height at withers
	- Long hair

The fourth principal component compares goat populations with:

High positive value on Axis 4	**High negative value on Axis 4**
- Height at withers	- Upward horn orientation
- Backward horn orientation	- Beard
	- Black coat colour
	- Grey coat colour

Classification: Cluster analysis

The first 15 principal components, accounting for 94% of the total variance, were considered to develop the classification by cluster analysis. The set of 103 observations against those principal components was clustered by a single-linkage, agglomerative, hierarchical and non-overlapping (SAHN) technique which is the most widely applied method of clustering in biological systematics (Sneath and Sokal 1973; Aldenderfer and Blashfield 1984). The Mahalanobis distance was the similarity coefficient used to develop the classification tree from which the desired number of clusters was obtained. The procedure of ADSAS was used.

The classification tree or dendogram (Figure 3) allows the exploration of the general pattern of relationships between the observation units. Heuristic decisions were taken to determine the number of clusters. The choice was largely subjective but efforts were made to find one with the most meaningful biological interpretation. The initial results of the cluster analysis were mapped for consistency. Population means and frequency were computed for the newly assembled populations. A few (nine) mis-classified sites, forming one cluster, were reclassified into the other 14 clusters. The geographical representation of that reclassification was pertinent.

The dendogram shows four distinct groups (families) of goat populations. Figure 4 represents the projection of the inerty clouds of those four major clusters in the coordinate system defined by Axes 1 and 2 of the Principal Component Analysis.

A 14-cluster solution was found to be meaningful (Table 3).

Naming livestock types can be a contentious issue. In Africa breeds are often named after the main ethnic group keeping them, e.g. the Boran cattle breed, the Boer goat etc. However, some of these names date from the colonial era and can take on a pejorative meaning when used in modern times, e.g. the Galla goat in Kenya. The breeds can also be named after the region in which they are found, which is sometimes synonymous with ethnicity. Types can also be referred to in a more neutral manner by naming them after an important identifying characteristic, e.g. West Africa Dwarf goat, the Long-eared Somali goat. The names given to the clusters (Table 3) reflect geographical location as much as possible rather than ethnic group.

Figure 5 describes the distribution of the goat types in Ethiopia and Eritrea and Table 4 presents estimates of the population of each goat type.

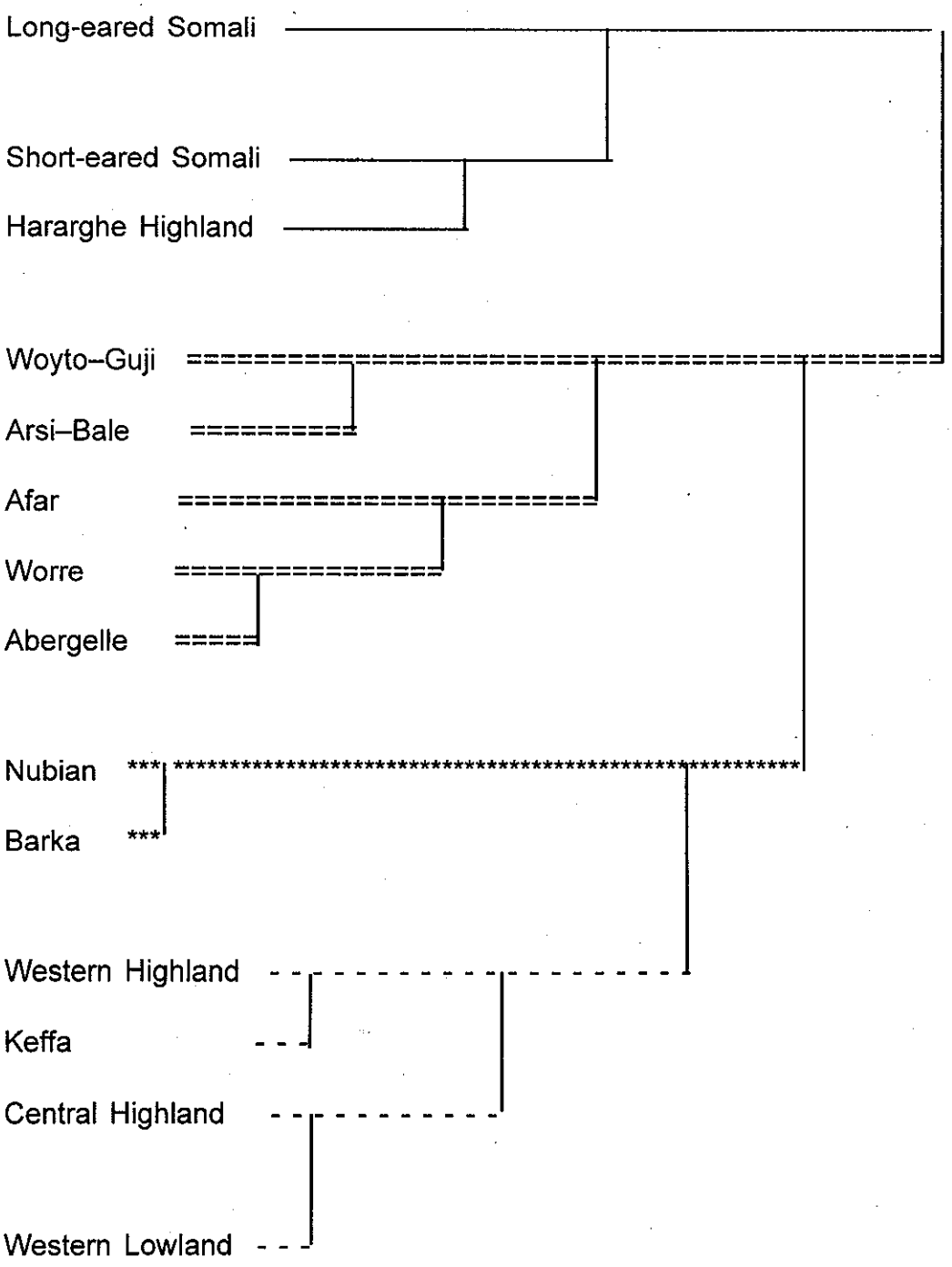


Figure 3. *Hierarchical classification tree.*

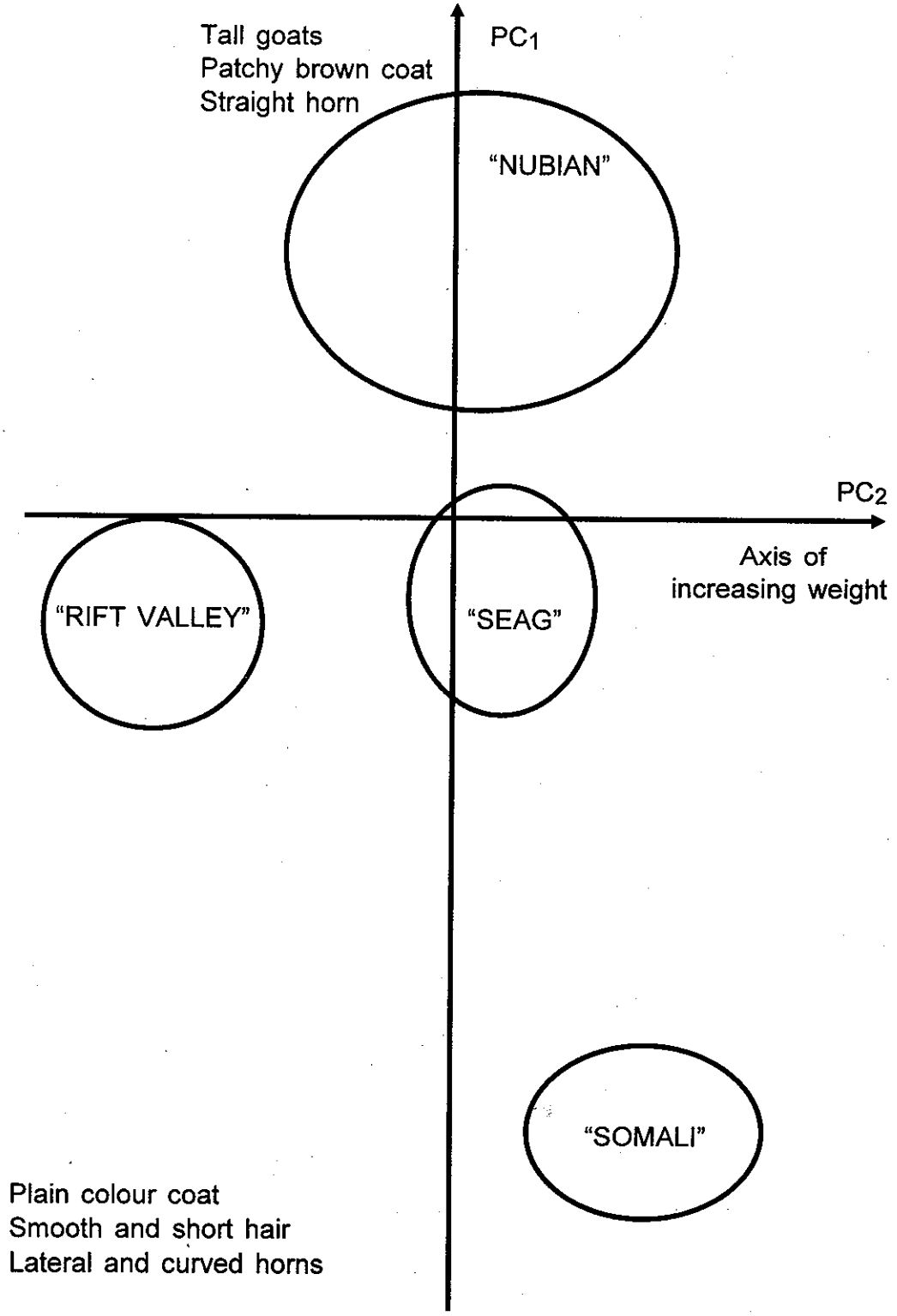


Figure 4. *Inerty clouds of four major clusters in co-ordinate system PC1–PC2.*

Table 3. *The goat types of Ethiopia and Eritrea.*

Cluster number	Name
1	Nubian
2	Woyto–Guji
3	Arsi–Bale
4	Central Highland
5	Afar
6	Western Highland
7	Keffa
8	Barka
9	Worre
10	Abergelle
11	Short-eared Somali
12	Hararghe Highland
13	Long-eared Somali
14	Western Lowland

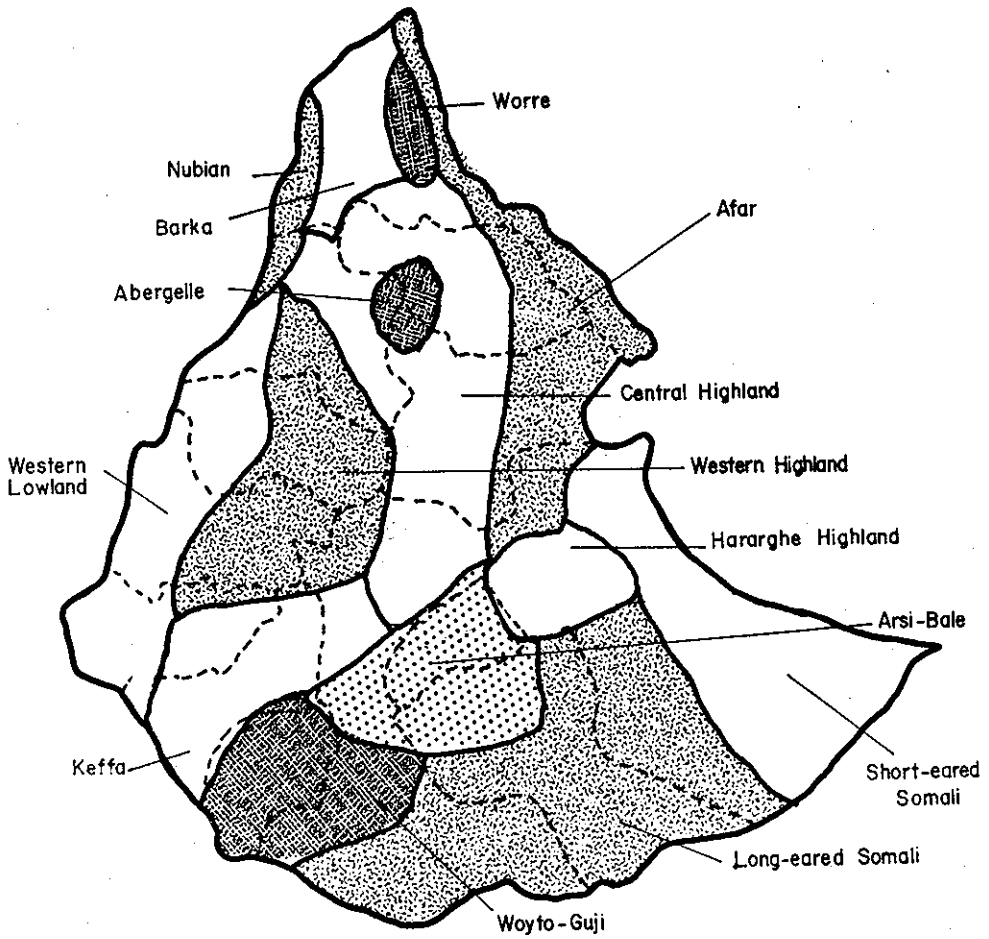


Figure 5. *Geographic distribution of goat types.*

Table 4. *Distribution and estimated population of goat types.*

Goat type	Distribution	Population
Nubian	Lowlands of western Eritrea (Gash and Setit)	200,000
Barka	Lowlands of western Eritrea (Gash, Setit and Akordat)	600,000
Worre	Highlands of northern Eritrea (Keren and Sahil)	500,000
Afar	Rift Valley areas of Eritrea and north-eastern Ethiopia (Afar region)	1,000,000
Abergelle	Mid-altitude of southern Tigray and northern Wollo, along Tekeze valley	300,000
Central Highland	Highlands of southern Eritrea (Akale Guzay and Seraye) and northern Ethiopia (Tigray, Wollo, north Gondar and north Shewa)	6,000,000
Western Highland	Highlands of western Ethiopia (south Gondar, Gojam, eastern Wellega and Illubabor)	3,000,000
Western Lowland	Lowlands of western Ethiopia (Metekel, Asossa and Gambela)	400,000
Keffa	Keffa, part of Illubabor and south Shewa	1,000,000
Arsi–Bale	Highlands of Arsi, Bale and south Shewa	600,000
Woyto–Guji	Gamu-Gofa and eastern Sidamo (Guji)	900,000
Hararghe Highland	Highlands of eastern and western Hararghe	1,000,000
Short-eared Somali	Lowlands of Ogaden	1,500,000
Long-eared Somali	Lowlands of southern Ogaden	1,500,000

Results: Description of goat types

Nubian family

Name: Nubian

Synonyms/local names: Shukria, Langae, Hassen.
Origins: Originated in the Middle East (Iraq, Syria and Israel) and moved through Egypt to Sudan.
Subtypes, races and related types: Bledi goat kept by the Nara ethnic group in the western lowlands of Eritrea.
Distribution: Lowlands of western Eritrea (Gash, Setit and Akordat) and north-west Ethiopia (Wegera) on the border with Sudan.
Agroclimatic zones: *Bereha* and dry *Kolla* (arid and semi-arid).
Management systems: Predominantly pastoral. Kept by the nomadic Hidareb and Nara ethnic groups, mainly for milk production. The goats are also kept for milk production around urban areas.
Flock size: Mean flock size owned is 18 (SD 12).
Flock structure: Flock structure shows a very high proportion of females (94%), reflecting the owners desire for milk (Table 5). Very few breeding males are maintained in the flock possibly leading to reproduction problems.

Table 5. *Flock structure of Nubian goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	21	3.7	–		21	3.7	105	18.4	126	22.1
1 pair*	6	1.0	–		6	1.0	40	7.0	46	8.0
2 pairs*	2	0.3	–		2	0.3	69	12.1	71	12.4
3 pairs*	–		1	0.2	1	0.2	90	15.8	91	16.0
4 pairs*	–		1	0.2	1	0.2	234	41.1	235	41.3
Total	29	5.0	2	0.4	31	5.4	538	94.5	569	100

* of permanent incisors.

Feeding: In pastoral systems, free grazing during the day returning to stone enclosures at night. Around urban areas Nubian goats may be supplemented with crop residues and other feeds. Does may have bags placed over their udders to prevent suckling by kids.
Housing: In pastoral systems, the animals are kept in stone enclosures at night. In urban centres they may be housed during the wet season.
Major problems: Poor quality grazing limits milk production. The main diseases reported were mange, mastitis, pasteurellosis and some tick-borne diseases.

Physical characteristics

Key identifying features: Tall (Table 6), markedly convex facial profile, long ears, hairy.

Table 6. *Physical characteristics of Nubian goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	74.0±4.6	30.0±4.2	75.0±4.8	19.7±3.9	16.8±3.1
Female	70.1±3.4	34.1±5.4	74.3±3.8	20.1±3.6	14.6±2.9

The head of the Nubian is markedly convex (63% convex, 37% straight). Sixty-three per cent of the males have curved horns, while the remaining 37% have straight ones. Horns in males are mainly pointed backwards. There were no polled goats recorded. The main coat colour is black (72%), with occasional white and red patches on a black background. Most (75%) of the males are hairy and 12% have hair on the thighs. A ruff and beard were present in all goats; no wattles were recorded.

Products and productivity

Reproduction: The average number of kids born per breeding female was 2.1. Single births are most common (97.1%), followed by twin births (2.7%); triplets are rare.
Milk: All Nubian goat owners reported milking their goats. The Nubian doe has a large udder of 29 cm mean circumference and 18 cm mean length.
Skins: Skins of Nubian goats are used as water containers, and some are sold.
Research: None.
References: Nigatu Alemayehu (1994).

Name: Barka

Synonyms/local names: Bellenay.
Origins: Derived from the Nubian type.
Subtypes, races and related types: Bellenay goats (kept by Tigrawi and Kunama ethnic groups), Nubian and Bledi goat types.
Distribution: West and south-west Eritrean lowlands.
Agroclimatic zones: *Bereha* and dry *Kolla* (arid and semi-arid).
Management systems: Predominantly pastoral. Kept by nomadic Tigre and Kunama ethnic groups in the western lowlands, and the sedentary Tigrawi ethnic group in south-west lowlands of Eritrea.
Flock size: Mean flock size owned is 21 (SD 19).
Flock structure: There is a high proportion (95%) of females (Table 7), reflecting the owners' desire for milk. The flock structure suggests a shortage of breeding males.

Table 7. *Flock structure of Barka goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	23	2.7			23	2.7	149	17.4	172	20.1
1 pair*	6	0.7			6	0.7	21	2.5	27	3.2
2 pairs*	5	0.6			5	0.6	103	12.0	108	12.6
3 pairs*	5	0.6	1	0.1	6	0.7	141	16.5	147	17.2
4 pairs*	3	0.3			3	0.3	398	46.5	401	46.8
Total	42	4.9	1	0.1	43	5.0	812	95.0	855	100.0

* of permanent incisors.

Feeding: Free grazing during the day, returning home at night.
Housing: Kids are kept in corrals during the day. A special goat house is constructed in the south-west lowlands.
Major problems: Main diseases reported are orf, anthrax, mange and pasteurellosis.

Physical characteristics

Key identifying features: Tall (Table 8), predominantly white coat colour, hairy thighs common, long ears.

Table 8. *Physical characteristics of Barka goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	74.3±7.2	45.3±14.1	83.0±9.5	18.1±5.3	20.0±9.9
Female	67.9±4.3	33.8±5.3	73.9±4.8	18.2±3.1	13.9±3.1

Barka goats have a predominantly straight facial profile (95%). They are mainly white in colour with brown patches (73%). Hairiness (26%), particularly on the thighs is common (42%). Horns are mainly straight (53%) or slightly curving (47%), predominately orientated backwards (90%). A ruff is present on all goats and a beard on 95%. Wattles are absent.

Products and productivity

Reproduction: The average number of kids born per breeding female was 2.7. Of the total births, 93.4% were single births and 6.6% were twin births.
Milk: All Barka goat owners reported milking their goats which have a large udder size, mean circumference 28 cm, and mean length 18 cm.
Skins: Skins are mainly used as water containers. Very few are sold.
Research: None.
References: Nigatu Alemayehu (1994).

Rift Valley family

Name: Worre

Synonyms/local names: Tseada, Arab, Milege.
Origins: Derived from the Rift Valley type. Probably from Yemen and Saudi Arabia.
Subtypes, races and related types: Afar, Abergelle.
Distribution: Mainly in eastern lowlands and mid-altitudes of Eritrea around Keren and Nacfa, also in the Rift Valley strip of northern Eritrea.
Agroclimatic zones: Dry and moist *Kolla* (semi-arid) and dry *Weyna dega*.
Management systems: Mainly pastoral. Kept by nomadic Rashida and Tigre ethnic groups and the transhumant Billen ethnic group.
Flock size: Mean flock size owned is 29 (SD 27).
Flock structure: The high proportion of females maintained in the flock (Table 9) reflects the owners' desire for milk. Very few breeding males are maintained in the flock leading to an adult male to female ratio of 1:34.

Table 9. *Flock structure of Worre goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	5	0.8	–		5	0.8	57	8.7	62	9.5
1 pair*	3	0.5	–		3	0.5	50	7.7	53	8.2
2 pairs*	5	0.8	–		5	0.8	85	13.0	90	13.8
3 pairs*	4	0.6	–		4	0.6	137	21.0	141	21.6
4 pairs*	5	0.8	–		5	0.8	300	46.0	305	46.8
Total	22	3.5	–		22	3.5	629	96.5	651	100.0

* of permanent incisors.

Feeding: Free grazing during the day; during heavy rain the goats may be moved to the highlands.
Housing: Kids are kept separate during the day in corrals. Lactating does may wear udder bags or kids may have a thorn through their nose to prevent suckling during the day. Fires may be lit to keep goats warm during the wet season.
Major problems: The diseases reported were pasteurellosis, and internal and external parasites. Peste des petits ruminants (PPR) was reported in the lowlands of Sahel.

Physical characteristics

Key identifying features: Short (Table 10), concave facial profile, relatively short horns.

Table 10. *Physical characteristics of Worre goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	61.7±4.4	26.9±6.0	68.9±4.7	15.1±2.3	16.1±3.6
Female	61.0±3.1	24.9±4.3	67.8±3.8	13.9±2.8	13.2±2.9

The Worre goat has a predominantly concave facial profile (64.7%); the remainder (35.3%) have a straight facial profile. Horns are either straight (47.1%) or curved (41.2%); the remainder (11.7%) are polled. All horns are pointed backwards. The hair is mainly short and smooth (82.4%), and 17.7% of these goats have hair on their thighs. The coat colour is mainly white (58.8%) with 23.5% brown, and 17.7% black. Colours are mainly in patches (88.2%) with only a few in plain colours (11.8%). Beards are present on 88.2% of males and 18.4% of females, ruffs on 94.1% males and 31.8% females, and wattles on 5.9% males and 6.6% females.

Products and productivity

Reproduction: The average number of kids born per breeding female is 1.74. Virtually all births are single (99.8%).
Milk: All Worre goat owners reported milking their goats which have a relatively small udder of 22 cm mean circumference and mean length of 15 cm.
Skins: Most Worre goat skins are sold.
Research: None.
References: Nigatu Alemayehu (1994).

Name: Afar

Synonyms/local names: Adal, Danakil.
Origins: Descendent of the Rift Valley goat thought to have entered Ethiopia from Yemen and Saudi Arabia.
Subtypes, races and related types: Worre and Abergelle types.
Distribution: Kept almost exclusively by the Afar ethnic group in the Ethiopian and Eritrean rift valley strip, Danakil depression, Gewane, northern and western Hararghe.
Agroclimatic zones: *Bereha* and dry *Kolla* (arid and semi-arid).
Management systems: Pastoral.
Flock size: Mean flock size owned is 41 (SD 24).
Flock structure: The Afar maintain a high proportion (94%) of breeding females (Table 11) in their flock because of their need for milk. Males not kept for breeding may be sold or slaughtered at a very young age (less than 7 days old) leaving very few breeding males. Adult male:female ratio is 1:42.

Table 11. *Flock structure of Afar goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	108	4.2	3	0.1	111	4.3	370	14.4	481	18.7
1 pair*	15	0.6	1	0.0	16	0.6	276	10.8	292	11.4
2 pairs*	13	0.5			13	0.5	265	10.3	278	10.8
3 pairs*	13	0.5			13	0.5	379	14.8	392	15.3
4 pairs*	7	0.3	3	0.1	10	0.4	110	43.3	1120	43.7
Total	156	6.1	7	0.2	163	6.3	2400	93.6	2563	100.0

* of permanent incisors.

Feeding: Free grazing on arid to semi-arid rangeland areas. These goats are well adapted to arid environments, infrequent watering (every 3–4 days) and travelling long distances. Where it is possible flocks may move to highland areas during the dry season (Afoot, Timugu, Kalu and Ambasel). The animals are usually herded by children and occasionally by women.

Housing: Kids are kept in small houses. Adults return to thorn enclosures for protection during the night.

Major problems: The main diseases are pasteurellosis, goat pox, gastro-intestinal parasites, ticks and occasional epidemics of contagious caprine pleuropneumonia (CCPP).

Physical characteristics

Key identifying features: Concave facial profile, narrow face, prick-eared, leggy, long thin upward-pointing horns, patchy coat colour (Table 12).

Table 12. *Physical characteristics of Afar goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	64.5±2.9	31.3±3.7	74.6±3.8	12.4±0.7	29.8±6.8
Female	60.9±3.3	23.7±3.4	67.4±3.8	12.3±1.8	17.4±3.9

The coat is very fine and short with variable colours and colour patterns — white 48%, light brown 25%, black 27%, and flecks and patches are also common. A ruff is present in 67% of the goats. A beard is present in 79% of males; wattles are relatively common (19%). Afar pastoralists commonly identify their goats by branding their ears or hindquarters, or by notching the ears.

Products and productivity

Reproduction: The average number of kids born per breeding female is 2.9. Of all births reported 98.6% were single births and 1.4% were twins.

Milk: Afar goats are extensively milked (*hadore hana*) for food, medicine and sale. Udder size is relatively small with a circumference of 21 cm and length of 17 cm. Occasionally the milk is made into butter for home use and sale. Sour milk, mixed with fenugreek and garlic, is used to treat measles. Skimmed milk may be mixed with sorghum and maize porridge. Melted goat milk butter is used to treat sick eyes and ears and as a treatment for headaches. It is also used to massage damaged limbs.

Meat: Meat may be consumed fresh or air-dried (*teru*). Fresh meat may be cooked with rice or roasted and eaten on its own (*alayseni*). Kids, less than 1 month old, may be sold as a delicacy known as *bekel* (male) and *bekelo* (female). Fresh blood is consumed to treat malaria and bullet wounds.

Skins: Skins are used for beds and made into prayer mats (*akess*). Skins are extensively used as water containers (*sar*) and as butter churns (*koda*).

Social functions: Goats are commonly used to pay bride price, and at weddings the groom gives a goat to the woman who performed the circumcision of his bride. Goat milk is also served at funerals. Religious healers (*shekas*) use white or black goats for sacrificial slaughter.

Research: None.

References: Wilson (1975); Galal and Getachew Feleke (1977); Galal et al (1977); Galal and Kassahun Awgichew (1981); Kassahun Awgichew et al (1989); Nigatu Alemayehu (1994).

Name: Abergelle

Synonyms/local names: None.

Origins: Descendent of the Rift Valley goat type from south-west Asia.

Subtypes, races and related types: Afar and Worre types.

Distribution: Localised distribution along the Tekeze river in southern Tigray (Tembien and Inderta), northern Wollo (Wag and Raya Azebo) and eastern Gonder (Simien). The goats are kept by the Agew and Tigray ethnic groups.

Agroclimatic zones: Moist *Kolla* and *Weyna dega* (highland areas above 1000 m, and along the subhumid Tekeze river valley).

Management systems: Mixed farming and agropastoral systems.

Flock size: Mean flock size owned is 20 (SD 16).

Flock structure: The flock structure (Table 13) reflects the multiple reasons for ownership. A relatively high proportion of males are kept for breeding and sale, and sufficient mature females retained for breeding and milk production.

Feeding: Free grazing during all seasons, supplemented with crop residues in the dry season. Some localised transhumance is practised moving flocks down to graze along the banks of the Tekeze during the dry season.

Housing: Goats are mostly housed in a separate building.

Major problems: The main diseases are respiratory problems, anthrax and some bone deformities, possibly due to selenium deficiencies. Shortage of labour for herding was reported.

Table 13. *Flock structure of Abergelle goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	45	9.8	–		45	9.8	105	23.0	150	32.8
1 pair*	3	0.6	–		3	0.6	11	2.4	14	3.0
2 pairs*	2	0.4	2	0.4	4	0.8	48	10.5	52	11.3
3 pairs*	12	2.6	2	0.4	14	3.0	47	10.3	61	13.3
4 pairs*	1	0.2	7	1.5	8	1.7	172	37.6	180	39.3
Total	63	13.6	11	2.3	74	15.9	383	83.8	457	100.0

* of permanent incisors.

Physical characteristics

Key identifying features: Stocky build, mostly reddish brown colour, males have magnificent spiral horns.

Abergelle goats are stocky, compact and well-built (Table 14). They have a straight (44%) to concave (56%) facial profile. Horns are found on all males, and 89% are spiral while 11% are straight. Horns are directed backwards. The majority of the goats have a plain coat colour (56%), with 33% patchy and 11% spotted. The hair is short and smooth. Ruffs are present on all males and beards on 94% of males. Wattles are almost entirely absent (94%).

Table 14. *Physical characteristics of Abergelle goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	71.4±3.5	33.6±5.9	79.5±2.9	13.0±0.8	37.0±9.1
Female	65.0±2.8	28.4±3.5	71.2±3.8	12.7±0.8	19.6±5.7

Products and productivity

Reproduction: The average number of kids born per breeding female is 2.8. Single births make up 98.7% of all births and twin births only 1.3%.

Milk: All Abergelle goat owners reported milking their goats, and milk is made into butter for home consumption and sale. Milk is thought to have medicinal qualities and is used to treat the sick. Goats are extensively milked in Tigray. Goat milk (*tseba)* butter (*t'esmi)* is made and used for cooking and as a cosmetic (*likai*); it commands a high price. Milk is also made into yoghurt (*rugeo*) and cottage cheese (*ajebo*).

Skins: Goat skins in Tigray are used for a multitude of purposes. The skin (*korbet)* is softened by rubbing with animal fat, rapeseed oil or other oils. After processing the skin may be used as an apron (*shirara*); a grain, water, butter or honey container (*lekota*); sling (*wanchef*); a small mat or shoulder cape (*agoza*); pages of religious books (*brana*); sandals (*sa'ani*); edges of baskets (*makumbeti*) and belts (*kulfi*). Goat skins are widely traded.
Manure: Goat manure (*duheri*) is widely used as a soil fertiliser in Tigray.
Research: None.
References: Nigatu Alemayehu (1994).

Name: Arsi–Bale

Synonyms/local names: Gishe, Sidama.
Origins: Part of the Rift Valley family.
Subtypes, races and related types: The Woyto–Guji goat is the closest relative. Previously known as Galla–Sidamo in the literature.
Distribution: Throughout the Arsi and Bale regions, up to an altitude of 4000 m. They are also found in the higher altitudes of Sidamo and western Hararge. It occupies all the agropastoral lowlands within the Rift Valley from Lake Abaya in the south to south Shoa in the north.
Agroclimatic zones: *Weyna dega* and *Dega* (humid and subhumid highlands with long rainy seasons. Some are kept by agropastoral societies in the semi-arid areas of Arsi, Bale and Sidamo).
Management systems: Arsi–Bale goats are kept in small flocks in mixed farming systems in the highlands, as well as in agropastoral systems at lower altitudes. Perennial crops (*enset* and coffee) are common in areas with a high population density (Sidamo).
Flock size: The mean flock size owned is 7 (SD 9).
Flock structure: (Table 15).

Table 15. *Flock structure of Arsi–Bale goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	808	17.3	5	0.1	813	17.4	1140	24.5	1953	41.9
1 pair*	121	2.6	9	0.2	130	2.8	384	8.2	514	11.0
2 pairs*	55	1.2	31	0.7	86	1.9	245	5.3	331	7.4
3 pairs*	32	0.7	50	1.1	82	1.8	421	9.0	503	10.8
4 pairs*	13	0.3	64	1.4	77	1.7	1274	27.3	1351	29.0
Total	1029	22.1	159	3.5	1188	25.6	3464	74.4	4652	100.0

* of permanent incisors.

Feeding: Predominantly free grazing. Tethered feeding is practised around perennial crop growing areas in Sidamo. Some arable farmers provide crop residues, thinnings of maize or sorghum, kitchen waste and chopped browse. Provision of mineral supplements in the form of natural licks and table salt is common among the Sidama people. Kids are sometimes provided with supplements.

Goats are herded mostly by family members with their other livestock during the day. It was reported that 20% of households hired labour to herd their goats. Labour is paid for in cash or kind (milk, butter and/or offspring). The main grazing areas are waterlogged valley bottoms and hillsides. Grazing is supplemented with crop residues, mainly wheat and barley straw. Goats in Bale can graze up to an altitude of 4000 m. In the dry season most owners are able to water their goats every day, 25% water every other day, while 21% water every third day.

Housing: The Sidama ethnic group usually keeps goats in sheds; they use either a separate part of the family home or a shed on its own to house goats (with calves and sheep). Goats are housed during the night and early hours of the morning. Particularly during the rainy season goats remain within the shed for part of the day to avoid cold and diseases (foot rot and orf).

Most goats (56%) are housed at night in the family house, while 24% are housed in specially constructed houses. The remainder (20%) are housed in communal barns, shared with neighbours.

Breeding: Mating is allowed to take place all year round. Kids are kept at home for the first 2–4 weeks until they are strong enough to go out grazing. A small number of males are castrated at two years and above. The main reason given for castration was to receive a better price at sale.

Major problems: The most frequently reported constraints in the highlands are shortage of grazing, problems due to the mobility of goats in densely populated villages and diseases. The major goat diseases reported are anthrax, liver fluke and other internal parasites, orf and pneumonia. Early kid mortality is considered a serious problem.

Physical characteristics

Key identifying features: Medium-large size (Table 16), often hairy. Coat colours are most common in a combined patchy pattern.

Table 16. *Physical characteristics of Arsi–Bale goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	73.2±6.9	42.1±9.6	85.0±7.0	14.1±1.3	23.7±7.2
Female	66.1±3.5	30.4±4.5	74.9±4.0	14.0±1.3	12.5±3.3

The Arsi–Bale goat is a relatively tall goat with a predominantly straight facial profile (98%). Hairiness was observed on 25% of goats recorded. Males have curved (47%) and straight (41%) horns mainly pointing backwards (58%) with some pointed straight upwards (28%). Polled goats were 6% in both sexes. Ruffs occurred in 33%

of males with beards on 92% males and 52% of females. Wattles are present in 14% of males and 11% of females.

The coat colour varies between any of the seven types (white, black, brown, fawn, grey, roan and red), with the first three being most dominant. Colours appear more in patchy combined patterns than in plain or spotted ones. The most frequent colours are mainly white in males (35%), and brown in females (40%). Black is found in 20% and grey in 22% of goats. In parts of Sidamo and Arsi the long legs, ears and body suggest a lowland-type conformation, but at high altitudes in Bale, Arsi and Sidamo goats have a hairy coat. The goats in Sidamo are horned with only 1.7% of females and 1.8% of males being polled. The ears are fairly long. About 10% have a semi-pendulous ear form, the rest being erect or horizontal. About half of the females and 75.5% of the males in Sidamo are bearded, but in the agropastoral areas beards on females are less frequent (38.7%).

Products and productivity

Reproduction: The average number of kids born per breeding female is 3.6. Of all the births recorded 82% were single and 18% were twin births. For the goats in Sidamo an average litter size of 1.3 was estimated for the 2463 total births recorded. Two quadruplets (0.08%), 48 triplets (1.95%) and 755 twins (20.15%) were recorded for home-bred and purchased does, implying a multiple birth frequency of 32.68%. The goats in Sidamo appear to attain a greater number of average kiddings for a given dentition class than other goat types in the region.

Growth: The average body weight for each dentition class shows that kids reach 23% of maximum average weights by the time the fourth deciduous incisor teeth erupt. This relatively high value compared to goat types in adjacent areas may be indicative of good milk productivity and kid growth rate, particularly when compared with the Woyto–Guji goats. However, the subsequent growth rate up to eruption of the first incisor pair appears to be less than that of the Woyto–Guji goats.

Milk: Arsi–Bale goats are extensively milked. Among the Sidama people goat milk is a highly valued source of nourishment for children. The demand for goat milk is so high that even the smallest amount of milk available is diluted with some water to make sure that as many children as possible drink some. Daily milk offtakes of 250 to 500 ml were recorded in the agricultural highlands of Sidamo for 10 lactating does on their third or above parity. Does with desirable dairy type body conformation are common, especially in the highlands. The goats are milked usually once a day for two to four months throughout the year. Butter is occasionally extracted for medicinal purposes.

Meat: Goat meat is widely eaten, mostly during social and festive occasions. This goat type is more prolific than other goat types in the region and is potentially a desirable meat producer in the highlands.

Meat is eaten raw, fried or boiled as a soup (*kikil*). The intestines are cooked as *dulet*, or cooked with blood as *wadi diga*.

Skins: The skins of the hairy Arsi–Bale goats are highly valued as saddle covers. The white haired skins are particularly prized and, if well-decorated, can fetch Birr 50–80.

People living at very high altitudes around Dinsho and Batu value hairy skins as a warm garment (*gishe kora*) often worn when herding goats.
Manure: Manure is highly valued in the perennial crop growing areas of Sidamo.
Social functions: In some communities of the Sidama people there are cultural taboos against domestic use of different goat products, especially the viscera. Use of goats to fulfil ritual customs is not common. Goats are highly regarded for traditional healing, and are slaughtered during the elaborate *Fiche* festival by the Sidama people.
Research: None.
References: Mason and Maule (1960); Epstein (1971); Workneh Ayalew (1992); Alemayehu Reda (1993).

Name: Woyto–Guji

Synonyms/local names: Woyto, Guji, Konso.
Origins: Part of the Rift Valley family of goats.
Subtypes, races and related types: Related to the Arsi–Bale goat.
Distribution: In North and South Omo, southern Sidamo and parts of Wolayta. These goats are mainly kept by pastoral ethnic groups (Tsemay, Malie, Hamer, Benna, Dasenatch, Bumie and Guji) and by a few agricultural groups (Konso and Gardula). Less distinct types of this goat are also kept by the Wolayta, Gofa and Gamo people in North Omo. More notably this goat type inhabits those areas in Sidamo known to be endemic with trypanosomiasis, especially the Gelo valley to the south of Lake Abaya and the western Ghenale catchment area.
Agroclimatic zones: *Kolla* and *Weyna dega* (semi-arid and arid).
Management systems: Predominantly pastoral, some in mixed farming systems.
Flock size: The mean flock size owned is 11 (SD 17).
Flock structure: (Table 17).

Table 17. *Flock structure of the Woyto–Guji goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	1557	17.5	11	0.1	1568	17.6	1885	21.2	3453	38.8
1 pair*	251	2.8	44	0.5	295	3.3	692	7.8	987	11.1
2 pairs*	103	1.1	41	0.4	144	1.5	539	6.0	683	7.7
3 pairs*	81	0.9	82	0.9	163	1.8	804	9.0	967	10.
4 pairs*	50	0.6	110	1.2	160	1.8	2630	29.6	2790	31.4
Total	2042	22.9	288	3.1	2330	26.0	6550	74.0	8880	100.0

* of permanent incisors.

Feeding: Flocks are mostly herded on rangelands. Crop residues are supplied in the agricultural highlands. The provision of mineral supplements is less common than for the Arsi–Bale and Long-eared Somali goat types.

Housing: Various types of housing for goats were observed. The pastoral Guji ethnic group by tradition have a separate hut for goats with a raised wooden floor 30 cm above the ground. Kids and adults are housed separately and are together only during the morning and evening hours during or soon after milking. Diseased goats are also isolated. Because of their prevalence mange mite infestation and diseases such as pasteurellosis are treated very carefully. Goats are often housed in overcrowded conditions causing the rapid spread of mange mite infestation in those areas. The goats do not come in contact with manure as it collects under the wooden slatted floor. The manure is not put to any agricultural use.

Other pastoralists use open kraals around their homesteads. Goats are kept with sheep, and the young stock is, in all cases, kept in a small protected shed within or beside the kraal. Those of the Tsemay people are very clean and are usually built on a slope to ensure good drainage. Isolation of diseased goats was observed among the Hamer and Dasenetch pastoralists.

Highland farmers in North Omo use part of the family home to keep the small flocks during the night and early hours of the morning.

Major problems: Goat owners reported that the major constraints to goat husbandry were disease, shortage of labour and grazing. The most frequently reported diseases are mange mite infestation, CCPP and internal parasites. Mange mite infestation was also observed in epidemic proportions causing heavy flock losses (probably complicated by other diseases) in South Omo (Hamer and Woyto) and Sidamo (Odo Shakiso). The Hamer, Benna and Guji pastoralists are well acquainted with the use of acaricides. A shortage of acaricides at the time of the survey resulted in mange spreading rapidly. CCPP was also causing very high mortality rates (85%) among goats kept by the Hamer.

Physical characteristics

Key identifying features: Brown, black or red colour with a shiny, smooth coat and small head with a straight or concave facial profile. Coat colours are often marked with black or brown stripes along the back, on the underside or on the front of the legs.

Table 18. *Physical characteristics of Woyto–Guji goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	72.9±5.0	39.0±6.3	80.8±6.6	12.5±1.3	17.6±7.2
Female	66.4±3.5	28.8±5.0	72.5±4.2	12.5±1.0	10.8±3.7

The Woyto–Guji goat is a medium-sized goat (Table 18) with a mainly straight (89%) to concave (11%) facial profile. Straight horns, occur on 71% of the males, curved on 26%, with polled goats forming 3% of the population. Horns mainly point backwards (75%) or upward (21%) and in a few cases laterally (2%). The coat is

mainly short, smooth and shiny (76%), with a few goats with coarse hair (6%) or hair on the thighs (6%) and 11% being hairy. The predominant colours are reddish-brown (49%) and black (12%) in a patchy pattern (50%). Black or brown stripes on a dark background are common. A beard is present on 96% of all males, a ruff on 91% and wattles are present on 10%.

Products and productivity

Reproduction: The average number of kids born per breeding female is 4.3. Of all births reported 83% were single, 16% were twin and 1% were triplet births. Kidding records of seven and above were frequently reported in Woyto. This needs to be examined more closely.

Milk: In pastoral (South Omo) and agropastoral (Sidamo) areas the goat is an important milk producer. For the poorest families in Wolayta and Konso the goat provides the only milk to feed to children. By tradition the Gardula, Zaisie, Gamo and Gofa ethnic groups in North Omo do not milk goats. The Gedeo in Sidamo do not use goat milk, but they do not seem to like cow milk either. In Wolayta men do not like to admit that they use goat milk because culturally it is associated with poverty. However, mothers from the poorest families do appreciate the crucial role of goats as the only source of milk for their children.

Goats may be milked once or twice a day for one to four months irrespective of the season. Milk is sometimes made into butter and used in traditional healing treatment.

Meat: The Woyto–Guji goats are known to be good for meat. Most of the viscera are edible but marketing is very limited. Except among some of the Guji and Gardula blood is an edible product and it is sold among the Konso. Members of pastoralist societies in South Omo (Hamer and Dasenetch) sometimes collect blood from live goats by piercing the jugular vein, as practised on cattle. Fresh blood mixed with milk is a delicacy. Various goat products, including rumen contents and intestines, are often used in traditional medicine.

Skins: Almost all pastoral groups in South Omo use goat skins to make traditional leather garments for women. Well-processed skins decorated with beads and shells are made into skirts, robes and other clothing in distinct patterns characteristic of the ethnic groups. Goat skins are also used to make sacks and for wrapping produce to take to market. To a lesser extent goat skins are needed for various home uses among the Guji people in Borena and Sidamo (carrying rugs, reinforcements to utensils etc). Because of these extensive domestic uses 19.5% of the respondents in the pastoral areas said they never sell goat skins and many others said they seldom sell. As a result the official figures of goat skin sales are gross underestimates of skins produced in South Omo and Borena. As this goat is a lowland type adapted to the arid tropical environment the skin is of a high quality.

Manure: Manure is used as a fertiliser in all the agricultural and agropastoral areas. Manure was reported to be sold in Konso. Otherwise it is dumped as waste in pastoral areas piled up in heaps that mark settlements.

Social functions: Some members of the Wolayta, Amaro, Ari, Benna and Bodi ethnic groups have certain cultural taboos against goat products. But most societies that keep

the Woyto–Guji goat prefer goat meat for certain social occasions, or for fulfilment of ritual customs. In some cases goats are used for payment of bride price, burial or other cultural ceremonies. The Hamer, Guji, Tsemay and others slaughter a goat to honour important visitors.

Research: On-farm productivity monitoring currently in progress in North Omo as part of the FARM-Africa Dairy Goat Development Programme.

References: Workneh Ayalew (1992); Workneh Ayalew and Peacock (1993).

Somali family

Name: Hararghe Highland

Synonyms/local names: None.
Origins: Most likely derived from the Somali goat type.
Subtypes, races and related types: Related to both the Short- and Long-eared Somali goat types.
Distribution: In the highlands of East and West Hararghe.
Ecological zones: Moist *Weyna dega* and moist *Kolla*.
Management systems: Small flocks kept in mixed farming systems.
Flock size: Mean flock size owned is 4 (SD 4).
Flock structure: (Table 19).

Table 19. *Flock structure of Hararghe Highland goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	321	19.5	7	0.4	328	19.9	366	22.2	694	42.1
1 pair*	44	2.7	4	0.2	48	2.9	172	10.4	220	13.3
2 pairs*	23	1.4	24	1.5	47	2.9	124	7.5	171	10.4
3 pairs*	11	0.7	22	1.3	33	2.0	201	12.2	234	14.2
4 pairs*	5	0.3	15	0.9	20	1.2	310	18.8	330	20.0
Total	404	24.6	72	4.3	476	28.9	1173	71.1	1649	100.0

* of permanent incisors.

Feeding: Free grazing during the dry season but usually tethered during the growing season. The goats are mainly herded by family labour, but 12% of owners reported hiring labour, and 16% reported sharing herding with neighbours. There is a widespread use of maize and sorghum thinnings and crop residues. Sweet potato vines are fed as dry season supplement and leftover chat (*Catha edulis*) known as *geraba* is widely fed to semi-urban goats. Many Hararghe farmers (46%) are only able to water their goats every other day during the dry season, and some (15%) water every third day. The remainder water their animals daily.
Housing: Goats are housed at night, mainly in the owner's house (65%). In some cases (15%) the animals are housed in a specially constructed building.
Major problems: The main disease problems are gastro-intestinal parasites, liver fluke and mange.

Physical characteristics

Key identifying features: Small, white, brown or black, commonly polled.

The Hararghe Highland goat is relatively small (Table 20), with a straight (60%) or concave (40%) facial profile. There is a very high incidence of polledness (37%).

Horned goats have straight (32%) or curved horns (29%). Hararghe Highland goats have short hair. Colours are mainly in a plain pattern (90%); 10% are spotted. The main colour is white (41%), with equal proportions of black (23%) and brown (23%). A beard is present on 72% of males but there are no ruffs. Wattles are present on 14% of goats.

Table 20. *Physical characteristics of Hararghe Highland goats.*

Sex	Height at withers (cm)	Weight (cm)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	71.5±7.2	41.9±7.2	80.6±7.9	14.4±1.4	21.4±6.7
Female	62.5±3.5	29.1±4.5	72.8±4.5	13.0±1.1	13.1±3.4

Products and productivity

Reproduction: The average number of kids born per breeding female is 2.2. Single births are 85% of all births and twin births are 15% of all births.
Milk: Hararghe Highland goats are commonly milked (*anan rae*) for home consumption and sale in some markets. The milk is widely used to make *hoja*, milk boiled with dried ground coffee leaves, drunk when chewing *chat* (*jima*).
Meat: Goat meat is widely eaten and preferred to sheep meat. It commands a higher price than mutton or beef, particularly during Moslem holidays. Male goats are commonly castrated and fattened for sale during holidays. The meat is mainly eaten fresh but sometimes is air-dried (*jeji*), cooked as a kind of *wat* known as *hulbet merek*, or as *dulet*, a dish made from liver, rumen, kidney and lean meat. Blood is also cooked with intestines (*wadi diga*); sometimes salt and/or lemon is added to it and it is drunk.
Skins: Skins are used for beds and prayer mats (*sijaja*). They are also made into blacksmith's bellows (*bufa*).
Other products: In the Afden area goat manure is placed around hot pepper seedlings to protect them from hares (*Lepus habessinicus*).
Social functions: Goats are widely used by traditional healers for sacrifices during personal or community problems. If the shadow of the bird *alachua* passes over a pregnant woman this is considered bad luck. A cream-coloured goat should be slaughtered and the mother made to drink the rumen contents while the child is wrapped in the skin.
Research: On-farm productivity monitoring currently in progress in East Hararghe as part of the FARM-Africa Dairy Goat Development Programme.
References: Alemayehu Reda (1993); Workneh Ayalew et al (1994).

Name: Short-eared Somali

Synonyms/local names: *Denghier* or *Deghiyer*.
Origins: Probably related to the Arab goats in Somalia which were introduced directly from Arabia.
Subtypes, races and related types: Long-eared Somali.

Distribution: Northern and eastern parts of Ogaden (Jijiga, Degeh Bur and Werder) where they are kept by the Isaaq and Mijertein Somali clans, and Dire Dawa, Issa and Gurgura.
Agroclimatic zones: Dry *Kolla* (arid and semi-arid).
Management systems: Pastoral.
Flock size: The mean size of flock owned is 23 (SD 21).
Flock structure: The relatively high proportion of females (Table 21) reflects the owners' desire for milk. There appears to be an adequate number of breeding males and some fattening of excess males as castrates.

Table 21. *Flock structure of Short-eared Somali goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	328	9.6	16	0.5	348	10.1	481	14.0	825	24.1
1 pairs*	118	3.4	10	0.3	128	3.7	367	10.7	495	14.4
2 pairs*	83	2.4	48	1.4	131	3.8	334	9.7	465	13.5
3 pairs*	43	1.2	46	1.3	89	2.5	481	14.0	570	16.5
4 pairs*	17	0.5	20	0.6	37	1.1	1040	30.4	1077	31.5
Total	589	17.1	140	4.1	729	21.2	2703	78.8	3432	100.0

* of permanent incisors.

Feeding: The animals are herded during the day by family members, usually with sheep. During the dry season goats are watered infrequently, every 5–8 days.
Housing: The goats return to thorn enclosures at night.
Major problems: Gastro-intestinal parasites and respiratory problems including occasional outbreaks of contagious caprine pleuropneumonia (CCPP).

Physical characteristics

Key identifying features: Medium sized (Table 22), mainly white, short hair.

Table 22. *Physical characteristics of Short-eared Somali goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	64.9±5.5	32.8±6.5	72.8±4.7	12.1±2.2	19.6±6.9
Female	61.8±4.1	27.8±6.0	70.4±4.7	12.8±1.8	12.2±4.2

The Short-eared Somali goat is smaller than the Long-eared Somali type. It has a straight facial profile and most males bear straight (46%) upward pointing (64%) horns. Females appear to bear more curved horns (50%), most of which point upwards (55%),

but 27% are orientated backwards and 12% are lateral-pointing. Polled goats are found in 5% of males and 7% of females. There is a low incidence (6%) of spiral horns in both sexes. The Short-eared Somali goat has a short smooth coat which is mainly white (76%) with brown (9%), black (7%) and grey (7%) occasionally in spotted patterns (12%). No ruffs were observed in either sex, but beards are present in 79% of males and 14% of females. Wattles were found in 5% of all goats.

Products and productivity

Reproduction: The average number of kids born per breeding female was 2.4. Short-eared Somali goats mainly give birth to single kids (97.5%) with very few (2.5%) twins. Somali goat owners reported a tradition of selecting against twinning and past selection appears to have been very effective.
Milk: Somali goats are widely milked (*hanna ear*) and milk is consumed fresh and also made into butter. The Somalis use butter for both food and medicinal purposes. Milk may also be sold.
Meat: Meat may be eaten fresh or preserved by cutting into slices, frying it in butter or animal fat and keeping it in a container (*odka*). Preserved in this way the meat can keep for up to five years. *Odka* may be given to the groom by the parents of the bride. Meat may also be preserved by air-drying strips (*solei*). Fresh meat may be roasted and eaten with rice (*wesla*).
Skins: Goat skins are widely used as sitting or sleeping mats and prayer mats (*harek* or *okedi*). The Somali make water containers (*karbit*) and use goat skins to churn butter. The Somali also use strips of goat skin for tying firewood and constructing their houses (*aqal*).
Social functions: A Somali man wishing to marry will take a goat in good condition to the father of the girl he wishes to marry. If the father accepts the goat and slaughters it, it is understood that he has agreed to the marriage. At Somali funerals it is customary to serve goat milk. Traditional healers slaughter goats of particular colours — Somalis will never slaughter a black goat. The Rare Bare Somali clan associates particular parts of the goat's body with specific parts of the human body and uses.
Research: The Short-eared Somali goat is used as the dam line in the cross-breeding programme of the FARM-Africa Dairy Goat Development Programme at Alemaya University of Agriculture.
References: Neugebauer et al (1993); Alemayehu Reda (1994).

Name: Long-eared Somali

Synonyms/local names: Large white Somali, *Degheir*, Galla, Digodi, Melebo.
Origins: Probably related to the descent of the Arab goats in Somalia introduced directly from Arabia.
Subtypes, races and related types: Short-eared Somali.
Distribution: Distributed throughout the Ogaden, lowlands of Bale, Borana and southern Sidamo. Kept by the Hawia, Ogaden, Rare Bare, Digodi clans of the Somali ethnic group and the Boran, Gabra and Geri ethnic groups.
Agroclimatic zones: *Bereha* and dry *Kolla* (arid and semi-arid).

Management systems: Pastoral.
Flock size: Mean flock size owned is 37 (SD 36).
Flock structure: The high proportion of females (Table 23) reflects the owners' desire for milk. There appears to be an adequate number of breeding males, and some fattening of excess males as castrates.

Table 23. *Flock structure of Long-eared Somali goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	350	8.7	18	0.4	368	9.1	705	17.5	1073	26.6
1 pair*	93	2.3	2	0.05	95	2.3	371	9.2	466	11.5
2 pairs*	40	1.0	4	0.1	44	1.1	291	7.2	335	8.3
3 pairs*	39	1.0	11	0.3	50	1.3	441	10.9	491	12.2
4 pairs*	27	0.6	24	0.6	51	1.2	1623	40.2	1674	41.4
Total	549	13.6	59	1.4	608	15.0	3431	85.0	4039	100.0

* of permanent incisors.

Feeding: Free grazing on rangeland areas.
Housing: The goats return to thorn enclosures at night. The Boran and Somali pastoralists keep enclosures clean, especially those for the kids.
Major problems: Gastro-intestinal parasites and respiratory problems including occasional outbreaks of contagious caprine pleuropneumonia (CCPP). Ticks are also considered a serious problem.

Physical characteristics

Key identifying features: Large (Table 24), white, short hair.

Table 24. *Physical characteristics of Long-eared Somali goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	75.8±4.2	42.3±7.4	82.3±4.9	14.8±1.7	13.5±6.2
Female	69.4±3.3	31.8±5.4	74.4±4.0	14.6±1.7	9.0±3.8

The Long-eared Somali is a large white goat with a predominantly straight facial profile. Horns are mainly curved (41% in males, 46% in females), and pointed backwards in 38% of males and upwards in 48% females. Some 13% of horns in both sexes have a lateral orientation. A high incidence of polledness was recorded in males (19%) and females (8%). The Long-eared Somali has a short smooth coat which is mainly white (92%), with occasional brown (4%), black (3%) and grey (1%) coat colours. A spotted coat pattern was observed in 21% of males, but rarely occurs in

females. Ruffs occur in 21% of males but never in females. Beards were observed in 66% of males and 7% of the females. Wattles were observed in 6% of males and 3% of females.

The ear is horizontal (64% in females, 66.8% in males) and semi-pendulous (22% in females, 16% in males). Vestigial ears, which are not found in other goat types, occurred concentrated in one site, Dollo, in Borana.

Products and productivity

Reproduction: The average number of kids per breeding female is 3.2. Single births account for 97% of all births and twins for 3%. An average litter size of 1.04 was estimated for the 4530 total births recorded. The Somali and Boran pastoralists reported deliberately culling does giving birth to twins. This obviously successful selection for single births enables good kid survival and milk offtake for human consumption.

Milk: Somali goats are extensively milked (*hanna ear*) by the Somali and Boran pastoralists. Milk is consumed fresh and also made into butter for both food and medicinal purposes. Milk may also be sold. Goats are usually milked before and after grazing; herdsboys may milk the animals while out grazing. Lactation extends for three to four months.

Meat: Goat meat is preferred to mutton in most areas where the Long-eared Somali goat is kept. Meat may be consumed fresh or preserved by cutting into slices and frying it in butter or animal fat and keeping in a container (*odka*). Preserved in this way the meat can keep for up to five years. *Odka* may be given to the groom by the parents of the bride. Meat may also be preserved by air-drying strips (*solei*). Fresh meat may be roasted and eaten with rice (*wesla*). The Boran slaughter a goat when a woman gives birth. The new mother drinks the coagulated blood mixed with some of the rumen contents to replace the blood lost during childbirth.

Early kid growth rates appear to be faster than in the other goat types from average weights for dentition classes.

Skins: Goat skin is widely used as a sitting or sleeping mat and prayer mat (*harek* or okedi (Somali)). The Somali make water containers (*karbit*) and use goat skins to churn butter. The Somali also use strips of goat skin for tying firewood and constructing their houses (*aqal*).

Social functions: Young Boran boys of the same age group may slaughter a goat to celebrate their birthdays. A Somali man wishing to marry will take a goat in good condition to the father of the girl he wishes to marry. If the father accepts the goat and slaughters it, it is understood that he has agreed to the marriage. At Somali funerals it is customary to serve goat milk. Traditional healers will slaughter goats of particular colours — not black goats among the Somali. The Rare Bare Somali clan associate particular parts of the goat's body with specific parts of the human body.

Research: Used as the dam line in the cross-breeding programme of the FARM-Africa Dairy Goat Development Programme. Widely used as an improver breed in Kenya.

References: Wahome et al (1986); Kimenye and Karimi (1989); Skea et al (1990); Workneh Ayalew (1992); Workneh Ayalew and Peacock (1993); FARM-Africa (1992; 1993; 1994).

Small East African family

Name: Central Highland

Synonyms/local names: Brown goat.
Origins: Highland type derived from mixing of types in the past.
Subtypes, races and related types: Western Highland and Keffa goat types.
Distribution: Central highlands west of the Rift Valley escarpment in central Tigray, Wollo, Gondar and Shoa. Owned by settled farmers of the Tigray and Amhara ethnic groups.
Agroclimatic zones: *Dega* and *Weyna dega* zones.
Management systems: Kept in small flocks in mixed farming systems. Free grazing on hillsides with seasonal confinement.
Flock size: Mean flock size owned is 10 (SD 9).
Flock structure: The relatively high proportion of males (29%), both intact and castrated (Table 25), reflects their owners' interest in keeping goats for fattening, and for sale in times of need.

Table 25. *The flock structure of Central Highland goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	1032	17.1	1	0.01	1033	17.1	1380	22.9	2413	40.0
1 pair	156	2.6	35	0.6	191	3.2	429	7.1	620	10.3
2 pairs*	76	1.2	77	1.3	153	2.5	375	6.2	528	8.7
3 pairs*	59	1.0	143	2.4	202	3.4	657	10.9	859	14.3
4 pairs*	18	0.3	131	2.2	149	2.5	1467	24.3	1616	26.8
Total	1341	22.2	387	6.5	1728	28.7	4308	71.3	6036	100.0

* of permanent incisors.

Feeding: The goats are seasonally tethered during the growing season and graze freely on hillsides and communal grazing areas during the dry season. Crop residues are used as supplement.
Housing: Adults and kids are housed at night in the owner's house.
Major problems: The major disease problems reported were gastro-intestinal parasites, lungworm, liver fluke, respiratory problems, mange, goat pox, nasal bot fly (*Oestrous ovis*) and anthrax.

Physical characteristics

Key identifying features: Medium-sized (Table 26), broad-faced, thick horns, reddish-brown colour.

Table 26. *Physical characteristics of Central Highland goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	76.3±5.0	43.0±7.7	84.6±5.8	13.5±0.9	23.4±5.1
Female	67.9±3.2	30.1±5.4	74.1±4.4	13.1±1.1	13.7±3.5

The Central Highland goat has a predominantly straight (71%) facial profile; 29% of the goats have a concave profile. Virtually all males have horns, 82% being straight and pointed backwards, 13% curved and 5% spiral. The coat type is short and smooth with 51% plain colour, 42% patchy and 7% spotted. The predominant colour is red-brown (41%), the remaining goats being split between black, white and grey. Most males (82%) have a beard and ruff (99%). Wattles are present on 6% of males.

Products and productivity

Reproduction: The average number of kids born per breeding female is 2.9. Single births account for 83% of all births while twins account for 17%.
Milk: Goats are extensively milked in Tigray. Goat milk *(tseba)* butter *(t'esmi)* is made and used for cooking and as a cosmetic (*likai*) and it commands a high price. Milk is also made into yoghurt (*rugeo*) and cottage cheese (*ajebo*). Goat milk is believed to have medicinal value.
Skins: The skins from Central Highland goats are an important export product. The best quality skin 'Bati Genuine' is made from skins of brown/fawn coloured goats in the Bati area of Wollo. The lower grade 'Bati type' skins are from black coloured goats. Skins are locally used to make sacks for grain and may be sold.

Goat skins in Tigray are used for a multitude of purposes. The skin, *korbet*, is softened by rubbing with animal fat, rapeseed or other oils. After processing the skin may be used as aprons (*shirara*); grain, water, butter or honey containers (*lekota*); slings (*wanchef*); small mats or shoulder capes (*agoza*); pages of religious books (*brana*); sandals (*sa'ani*); edges of baskets (*makumbeti*) or belts (*kulfi*).
Manure: Goat manure (*duheri*) is widely used as a soil fertiliser in Tigray.
Research: None.
References: Nigatu Alemayehu (1994).

Name: Western Highland

Synonyms/local names: Agew.
Origins: Highland type derived from past mixing of types.
Subtypes, races and related types: Central Highland and Keffa types.
Distribution: Highlands of South Gonder, Gojam, Wellega and western Shoa.
Agroclimatic zones: *Weyna dega* and *Dega* (highlands).
Management systems: Mixed farming.
Flock size: The mean flock size owned is 8 (SD 6).
Flock structure: The relatively high proportion of males (27%) (Table 27) reflects their owners' desire for males for sale for cash. These males appear to be sold young—before 14 months old.

Table 27. *Flock structure of Western Highland goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	688	21.0	3	0.1	691	21.1	994	30.3	1685	51.4
1 pair*	43	1.3	6	0.2	49	1.5	275	8.4	324	9.9
2 pairs*	14	0.4	25	0.8	39	1.2	229	7.0	268	8.2
3 pairs*	4	0.1	41	1.3	45	1.4	256	7.8	301	9.2
4 pairs*	6	0.2	42	1.3	48	1.5	652	19.9	700	21.4
Total	755	23.0	117	3.7	872	26.7	2406	73.3	3278	100.0

* of permanent incisors.

Feeding: Free grazing during the day. Castrates are occasionally supplemented with roasted beans.
Housing: The animals are housed at night separate from the owner's house.
Major problems: The main health problems reported were gastro-intestinal parasites, respiratory problems, orf, foot rot and mange.

Physical characteristics

Key identifying features: Tall (Table 28), coarse hair, white and/or fawn colour.

Table 28. *Physical characteristics of Western Highland goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	80.7±6.5	48.4±9.9	87.2±7.9	14.6±6.0	20.7±4.8
Female	70.8±4.7	33.0±6.0	75.8±4.5	14.7±1.6	12.8±3.6

The Western Highland goat is relatively tall with a concave facial profile (100%). It has a relatively coarse long coat (82%); 12% of the animals have hair on their thighs. The coat colour is mainly plain (51%), 42% have a patchy colour pattern, and 7% are spotted. The main colours are white (42%) and fawn (42%), and combinations of these colours. There is a relatively high proportion of polled goats in the Western Highland population (14%). The horned goats have straight (76%) horns directed backwards (73%). A ruff is present on 99% of males, and a beard on 84%. Wattles are present on 12% of the goats.

An unusually high proportion of polled and hermaphrodite goats were found around Lake Tana. The goats showed hermaphroditism based on examination of external genitalia. There is an established relationship between hermaphroditism and polledness in goats (Gall 1981).

Products and productivity

Reproduction: The average number of kids born per breeding female is 3.6. Single births were 62% of all births while twins were 36% and triplets 2%.
Milk: There is a cultural taboo against goat milk in parts of Gojam.
Meat: There is a cultural taboo against goat meat in parts of Gojam.
Skins: Skins are widely used as grain containers.
Research: None.
References: Nigatu Alemayehu (1994).

Name: Western Lowland

Synonyms/local names: Shankela, Gumez.
Origins: Highland type derived from past mixing of types.
Subtypes, races and related types: Most closely related to the Central and Western Highland goats.
Distribution: Western lowlands bordering Sudan in Gojam (Metekel), Wellega (Assosa) and Illubabor (Gambela).
Agroclimatic zones: Wet *Kolla* (subhumid savannah).
Management systems: Agropastoral.
Flock size: Mean flock size owned is 11 (SD 12).
Flock structure: (Table 29).

Table 29. *Flock structure of Western Lowland goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	189	18.8			189	18.8	315	31.3	504	50.1
1 pair	18	1.8	1	0.1	19	1.9	87	8.7	106	10.6
2 pairs	1	0.1	1	0.1	2	0.2	81	8.1	83	8.3
3 pairs	3	0.3			3	0.3	80	8.0	83	8.3
4 pairs	4	0.4	5	0.5	9	0.9	230	22.9	429	23.8
Total	215	21.4	7	0.7	222	22.1	783	79.9	1005	100.0

* of permanent incisors.

Feeding: The goats graze freely with no supplementary feeding.
Housing: The animals are housed at night in thorn enclosures in Gambella and Assosa, and in specially constructed wooden-floored houses in Metekel.
Major problems: Occasional epidemics of contagious caprine pleuropneumonia (CCPP), gastro-intestinal parasites, trypanosomiasis, mange and insect bites. Smoke is used to repel biting flies at night in Gambella.

Physical characteristics

Key identifying features: Short, straight face, fawn or white patchy colour.

Table 30. *Physical characteristics of Western Lowland goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	67.2±5.0	35.5±10.2	77.0±9.2	14.1±1.6	18.5±7.2
Female	63.5±3.8	33.9±6.9	75.9±5.2	13.8±1.5	12.8±3.6

The Western Lowland goat is a relatively short goat (Table 30) with a straight facial profile (100%). It has a predominantly short smooth coat (81%), with 16% having a relatively coarser coat. The main colours are white (42%) and fawn (38%), with some black (9%) and grey (11%), occurring mainly in patches (73%). Most male goats have straight horns (85%) orientated backwards (77%). There are 12% polled males in the population. A ruff is present in 96% of all males and a beard in 70% of males. Wattles are present in 12% of all male goats.

Products and productivity

Reproduction: The average number of kids born per breeding female was 3.5. Western Lowland goats are remarkably prolific with 56% single births, 41% twin births and 3% triplets. Quadruplets were also reported to occur.
Milk: Goat milk is used extensively by pastoral and agropastoral groups in the area of distribution.
Meat: Goat meat is widely eaten.
Skins and other products: The horn is used as a musical instrument (*zoombara*) in Assosa.
Research: None.
References: Nigatu Alemayehu (1994).

Name: Keffa

Synonyms/local names: None.
Origins: Derived from mixing of types in the past.
Subtypes, races and related types: Related to the Western Highland goat.
Distribution: In the highlands and lowlands of Keffa, and parts of south Shoa, Kembata and Hadiya.
Agroclimatic zones: Wet *Kolla, Weyna Dega* and *Dega* (subhumid highlands and semi-arid lowlands).
Management systems: Kept in small flocks in mixed farming systems.
Flock size: The mean flock size owned is 6 (SD 5).
Flock structure: (Table 31).

Table 31. *Flock structure of Keffa goats.*

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	738	21.9	10	0.3	748	22.2	840	24.9	1588	47.1
1 pair*	68	2.0	25	0.7	93	2.7	264	7.8	357	10.5
2 pairs*	28	0.8	32	0.9	60	1.7	209	6.2	269	7.9
3 pairs*	13	0.4	34	1.0	47	1.4	324	9.6	371	11.0
4 pairs*	8	0.2	49	1.5	57	1.7	728	21.6	785	23.3
Total	855	25.3	150	4.4	1005	29.7	2365	70.1	3370	100.0

of permanent incisors.

Feeding: Goats often roam unherded, particularly around Mocha, with a lead goat guiding the flock.
Housing: No housing is provided despite the high rainfall (1800–2000 mm per annum). Goats may shelter under large trees.
Major problems: Attacks from wild animals are reported as a major problem. The main disease problems are gastro-intestinal parasites, liver fluke, mange, ticks and respiratory problems. Epidemic outbreaks of contagious caprine pleuropneumonia (CCPP) are common in the Keffa lowlands.

Physical characteristics

Key identifying features: Small, red or black, short neck, prick ears.

Table 32. *Physical characteristics of Keffa goats.*

Sex	Height at withers (cm)	Weight (kg)	Chest girth (cm)	Ear length (cm)	Horn length (cm)
Male	75.6±6.8	40.5±8.4	82.7±5.9	13.3±1.1	20.1±5.5
Female	66.7±4.0	28.2±5.2	72.2±4.5	13.0±1.0	11.6±3.6

The Keffa goat is relatively short (Table 32) with a predominantly straight facial profile 92%. Most males (83%) have straight horns pointing backwards (80%). A small proportion, 14%, have curved horns. The incidence of polledness is low at 3%. Keffa goats have short pricked ears. Most Keffa goats have a coarse (38%) to hairy (27%) coat type; some 16% have hair on the thighs. Plain colours predominate (52%), with some patchy colour patterns (45%). The main colours are black (30%) or brown (31%). Among males, 88% have beards, 97% have ruffs. Wattles are present on 12% of all goats.

Products and productivity

Reproduction: The average number of kids born per breeding female is 3.1. Of all births reported 78% were single births, 21% were twins and 1% were born as triplets.
Milk: The pastoral ethnic group, the Surmas, drink the milk and blood of goats.

Meat: Goat meat is widely eaten.
Skins: The skin is used to cover seats, as a wig or headress. It is also placed underneath saddles. The horn is used as a container for igniting a mixture of explosive minerals.
Social functions: Goats have important social functions in the Mocha area. They are used in divine healing and as gifts for spiritual leaders.
Research: None.
Reference: Nigatu Alemayehu (1994).

Discussion and conclusions

The domestic goat, *Capra hircus*, is believed to be the first ruminant ever domesticated. Evidence suggests that this took place before 7000 BC in south-west Asia, on the borders of present-day Iran and Iraq, where agriculture was already advanced (Mason 1984). It is believed that *Capra hircus* is derived from the wild goat, *Capra aegagrus*, whose horn shape closely resembles the horns of the domestic goats we know today.

Ethiopia has long been recognised as a source of genetic diversity in plants and animals. It appears that Ethiopia has served as a gateway of genetic material from Asia to Africa, and that its diverse ecology served to further diversify and develop the genotypes it received. It is believed that the first goats reached Egypt by 5000 BC and spread south and west thereafter. Remains of a small goat have been found in a site in Sudan thought to date from before 3300 BC and the lop-eared Nubian type has been found in sites dating from 2500 BC (Mason 1984). It is therefore likely that the first wave of goats entered Ethiopia from the north sometime between 2000 and 3000 BC.

Immediately after domestication physical differentiation of goats into types must have begun. Early physical changes affected the ears, horns, colour and hair type. These changes must have arisen from natural mutation and selection by their keepers within the environment in which they were reared. Most type development must have taken place in relative geographical isolation. New blood may have entered populations when man moved during trade, wars and ethnic movements. Looking at the breeds that now exist we can see that there are locations containing populations of goats of relative uniformity and these might be termed 'breeds'. However, the mixing of stock around the boundaries of these areas, through trade or movement, has led to many intermediate, less distinguishable goats which might be referred to as 'types' or 'subtypes'.

In the past the influence of man on livestock populations has, perhaps, been underestimated. However, it is quite clear from the results of this study that man has, in many cases, exerted considerable influence on the populations studied. The Somali goat has clearly been selected for milk production, against twinning (to the point where it is virtually eliminated), and for production and survival in harsh environments. Its uniformly white coat appears also to have been selected for. The prolificacy of the Western Lowland, Western Highland, Keffa and Woyto–Guji goats has clearly been selected for by societies for whom milk is not so important. In addition, the multiple social and economic functions reported during the study demonstrate the social value placed on their flocks by the societies keeping them.

Although Ethiopia's and Eritrea's rugged highland terrains have served to keep their peoples in relative isolation there is a long history of trade with Arab countries across the Red Sea, with Sudan in the west and through pastoral groups on the southern borders. It could be imagined that waves of trading, together with physical movements of people, e.g. the Oromo migrations, must have influenced the genetic make-up of domestic livestock, including goats (Hultin 1987; Mohammed Hassen 1990).

The identification, description, classification and naming of livestock types is the first step in the assessment of a country's livestock resources. The physical description

of types can only dimly reveal the genetic relationships between individuals, but is a first step in classifying a diverse population into relatively homogeneous sub-populations. New techniques of genotyping are now better able to reveal the genetic distance between populations and this allows a better understanding of how these populations evolved. However, for the practical exploitation of livestock resources the productive and adaptive performance of identified populations in specified environments is required. It is only in this way that variations in their performance due to genetic effects (additive and non-additive) and non-genetic effects can be elucidated (Fitzhugh 1987). The performance assessment of domestic livestock species must be considered a prerequisite for the sound planning of livestock development in any country.

In addition, the classification and characterisation of livestock types is necessary before homogenous genetic material can be preserved for future generations. Much genetic variability, the raw material of breed improvement, has been lost in developed countries. There is no doubt that preserving genetic diversity, for either immediate or future use, is important.

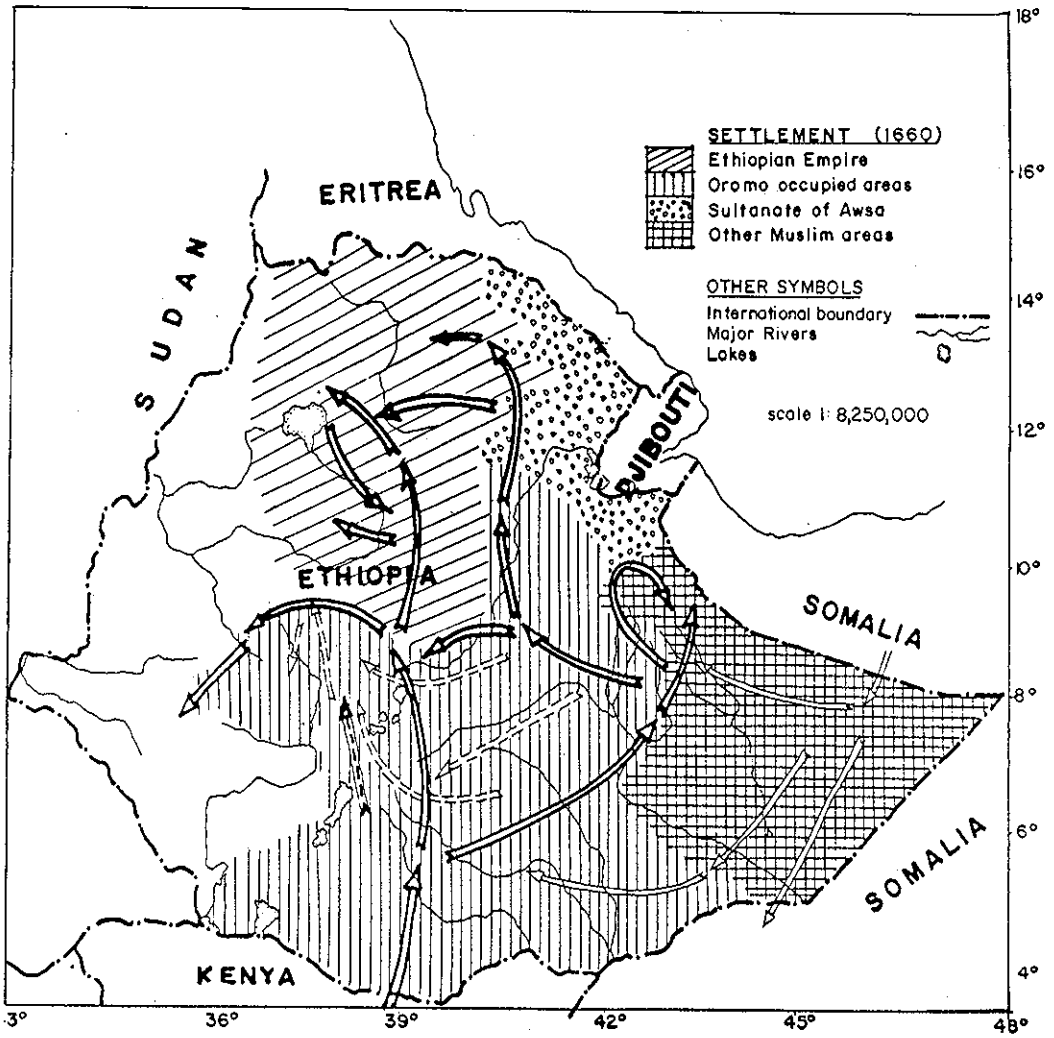
Goats in Africa have traditionally been divided into three main families – the Dwarf goats of West and central Africa, the savannah goats of sub-Saharan Africa and the Nubian type goat of northern Africa (Epstein 1971; Wilson 1991). However, the principal components analysis clearly differentiated four major families of goats in Ethiopia — the Somali family (Short-eared Somali, Long-eared Somali and Hararghe Highland), the Nubian family (Nubian and Barka), the smaller Rift Valley family (Abergelle, Worre, Afar, Arsi–Bale and Woyto–Guji) and finally the more heterogeneous Small East African family (West Highland, Keffa, Central Highland and West Lowland).

Lauvergne et al (1993) have developed the concept of an 'index of primarity' in goat populations, reflecting the distance between a population and that originally domesticated. After domestication, mutations arise which are no longer necessarily removed by natural selection. Measuring the incidence of these mutations can indicate the degree of primarity of the population. An index of 0 describes a standardised breed with little variability, while an index of 1 describes an original population close to the original domesticated. In the goat populations they examined in Chad and northern Cameroon, indices of 0.75–0.88 were recorded, indicating that the populations were close to those originally domesticated.

However, the heterogeneity of a population does not just reflect its degree of primitiveness. It must also, to some extent, be a result of mixing and interbreeding of populations combined, possibly, with a relatively low level of selection by owners.

It is hard to definitively identify the order in which the four 'families' entered Ethiopia. The Nubian family is clearly closely related to the goats found in Egypt, Sudan, Syria, Iraq and Iran today. The Rift Valley type is believed to have entered Ethiopia from across the Red Sea and has extended its range along the Rift Valley. The Somali family has been subject to strong selection pressure for some clearly defined characteristics, while the Small East African has been kept by diverse ethnic groups for diverse reasons.

It is evident from the data that goats maintained by pastoralists in relative isolation have more homogenous, clearly defined characteristics than the more heterogenous



Legend

Map Symbol	Migratory Directions of	Calendar
	OROMO	1520 - 1620
	SOMALI	1530
	SIDAMA	1531 - 1570
	ADAL	1600
	DERASA	1550 - 1570

Figure 6. *The great ethnic migrations C 1520–1660.*
Sources: Adapted from Fage and Verity (1978); Ajayi and Crowder (1985); EMA (1988).

goat populations kept in the highlands. This heterogeneity may be as a result of human movements mixing previously more homogenous types, combined with the weaker selection pressure that can be exerted in small flocks. The degree of movement thought to have taken place in the 16th and 17th centuries alone is indicated in Figure 6. Ethnic groups must have moved with their livestock which subsequently interbred with stock in the new location. Much of this movement involved the settlement of relatively more hospitable highland areas by groups used to a more pastoral way of life. This inevitably led to a mixing and interbreeding of goats creating the heterogenous highland goat types we observe today.

The survey carried out should be the very first step in breed characterisation through differentiating a heterogenous population into relatively homogenous sub-populations which may then be named as breeds, types or subtypes. However, it would be ideal if the relationships of the types identified phenotypically could be confirmed through analysis of their DNA. Kemp (1992) has described the range of techniques currently available to determine the genotype of individual animals. The polymerase chain reaction (PCR) allows the amplification of specific DNA sequences. This can be generated from small amounts of DNA extracted from hair or blood samples. From this the genetic distance between individuals can be determined, or potentially, specific areas of the DNA can be used to identify DNA sequences containing specific traits. If the DNA analysis validates the effectiveness of the field and data analysis method used in this study to identify relatively more homogenous populations, the field method could have much wider applications.

The survey has also clearly shown how widely goats are milked in Ethiopia and Eritrea. Goats are milked in both the lowlands and highlands of both countries with the exception of parts of Gojam, Wellega and Keffa. In all other parts of the country goats are milked as much as the limited milk yields allow. In some parts of the country, most notably Wolayta, milking goats is considered to be a sign of poverty.

Suggestions for future research and development

The limited quantitative and qualitative measurements made during this survey have allowed the preliminary description of the phenotypic characteristics of the goat types of Ethiopia. Once more homogenous populations have been defined what is the next step?

Baker (1992) suggests that once breeds are known there are three levels of research studies required for genetic characterisation of these known breeds:

- Macro-level studies: on-farm surveys to describe the population structure and make a physical description of the breed.
- Meta-level studies: for phenotypic characterisation of breeds a more detailed on-farm monitoring is needed. This should be designed to allow comparisons of the breed's mean and variance for physical traits, performance traits and health traits.
- Micro-level studies: more detailed on-station characterisation studies with sufficient dams and sires to allow the estimation of genetic parameters, e.g. heritabilities, and between breed comparisons under the same environment. Genetic characterisation

at the molecular level is the surest way to define 'breed' boundaries and to quantify available genetic diversity. Investigation of protein polymorphisms may be used as a step before this.

These studies can assist in developing rational, between-breed, and within-breed, improvement strategies. The most promising goat types could be evaluated 'on station' to try to establish their production potential. On the basis of information obtained from such studies selection programmes could be designed to exploit valuable traits.

In terms of the assessment of these types for the purposes of practical improvement the next step should be the performance testing of the most promising types. The major goat types and their main traits of interest are listed in Table 33.

Table 33. *Goat types and some of their promising traits.*

Goat type	Trait
Nubian	Milk
Barka	Milk
Somali (Short- and Long-eared)	Milk and survival
Abergelle	Growth
Western Lowland	Prolificacy
Keffa	Prolificacy
Central Highland	Skin quality

Suggestions for modifications to field and data analysis methods

The main modifications to the field method suggested are:

- If on-farm phenotypic characterisation is the main purpose of the field survey measurements from adult females only need to be taken. At the same time hair or blood samples can be taken for DNA analysis.
- It is hard to make meaningful conclusions from one milk measurement because of the confounding effects of stage of lactation, season, management etc. If possible, enumerators should be employed to record the milk yields of as large a number of lactating females as possible for 3–4 days at each site. Information on parity or age, together with stage of lactation should also be collected wherever possible.
- General management information can most quickly be obtained from a group discussion.

For further data analysis of the existing data set discriminant analysis can be used to create a field identification key. Each cluster should be assumed to group sites where the goat population is considered homogeneous. The interpretation of the knots of the hierarchical tree is indicative of the discriminating factors between clusters. These can be used to produce an aid to the field identification of breed types. For each knot in the hierarchical tree, a stepwise discriminant function (proc MAHAL2 of ADSAS) can be computed (ADDAD 1990). The most discriminating variables at each knot provide indications of the logical path if the intention is to relate an unknown Ethiopian goat population to one of the types described.

The phenotypic characterisation of the goats of Ethiopia and Eritrea described in this report is the first attempt at a systematic description of the goat resources of a nation. It has clearly shown that there are distinct and diverse goat types maintained by their owners in a wide range of environments. It is clear that the more homogenous types are found in the lowlands of the two countries while highland goats show more heterogenous characteristics. There are clearly traits of economic importance the development of which should be considered. There are no populations under threat of extinction but some genetic erosion occurs at the edges of some lowland populations. However, as yet this poses no threat to the continued existence of the types of concern. This unique study has laid the foundation for the future exploitation of the goat breeds described for the benefit of some of the world's most needy livestock keepers.

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Appendix I
Sample size of each goat type

Goat type	Number of goats sampled
Nubian	569
Barka	855
Worre	651
Afar	2,563
Abergelle	457
Central Highland	6,036
Western Highland	3,278
Western Lowland	1,005
Keffa	3,370
Arsi–Bale	4,663
Woyto–Guji	8,880
Hararghe Highland	1,649
Short-eared Somali	3,432
Long-eared Somali	4,039
Total	41,447

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Appendix II
Correlation coefficients of the 35 active variables with the first seven principal components

	J1		1#F	2#F	3#F	4#F	5#F	6#F	7#F
1	EARL	Ear length	545	707	–141	239	–116	61	–71
2	HORN	Horn length	265	–249	497	536	330	–248	–26
3	GIRT	Chest girth	343	570	373	56	20	–580	–36
4	WGHT	Body weight	280	685	330	118	–35	–520	–22
5	HGHT	Height at withers	509	370	548	29	–179	–195	–218
6	HOP	(Horn/Ht) x 100	108	–330	–602	497	359	174	28
7	GIP	(Chest/Ht) x 100	–384	112	–414	–109	325	–381	282
8	WTP	(Weight/Ht) x 100	53	673	107	121	69	–573	96
9	EP	(Ear/Ht) x 100	357	620	–439	261	–40	173	36
10	HP1	Straight head __	–30	128	375	–313	569	96	508
11	HP3	Concave head __	–128	–311	–217	298	–438	–138	–494
12	HP5	Concave head __	332	354	–392	85	–371	71	–119
13	HS1	Polled horn shape	–387	289	–135	–238	540	–2	–497
14	HS2	Scurs horn shape	–247	306	259	129	34	275	116
15	HS3	Straight horn shape	673	–421	425	25	131	–14	152
16	HS4	Curved horn shape	–543	467	–323	–107	–397	98	81
17	HS5	Spiral horn shape	–212	–268	–355	401	147	–260	–235
18	HO1	Lateral horn orientation	–696	517	83	83	–57	176	83
19	HO2	Upward horn orientation	–440	–361	185	–501	–328	–229	–112
20	HO3	Backward horn orientation	645	159	–160	513	174	172	219
21	HO4	Polled horn orientation	–388	294	–139	–243	537	–5	–494
22	CP1	Plain coat pattern	–59	382	28	–53	221	–72	71
23	CP2	Patchy coat pattern	686	–334	12	–2	–280	115	–30
24	CP3	Spotted coat pattern	–359	–71	–106	144	200	–130	–100
25	HT1	Short smooth hair	–648	–234	76	390	–121	–268	308
26	HT2	Coarse hair	460	40	325	–220	274	269	–468
27	HT3	Hair on thighs	518	196	–435	–249	–97	197	143
28	HT4	Hairy	317	371	–547	–359	–187	–20	75
29	RP	Ruff presence	789	151	2	122	222	80	–17
30	WP	Wattle presence	456	–142	–56	–234	476	210	22
31	BP	Beard presence	401	272	–415	–592	38	–34	2
32	CLT1	White coat	–466	465	132	389	11	448	–36
33	CLT2	Black coat	88	–302	–457	–503	51	–127	131
34	CLT3	Brown coat	526	–431	203	–76	4	–423	–45
35	CLT4	Grey coat	5	82	–457	–507	–173	–233	71

Appendix III
Flock structure of goats in all clusters

	Males									
	Intact		Castrate		Total		Females		Total	
Age (teeth)	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock	No.	As % of total flock
Milk teeth	6,732	15.1	77	0.2	6,809	15.3	9,768	22.0	16,595	37.3
1 pair*	981	2.2	150	0.3	1,131	2.5	3,672	8.3	4,803	10.8
2 irs*	464	1.0	301	0.7	765	1.7	3,221	7.2	3,986	8.9
3 pairs*	330	0.7	457	1.0	787	1.8	4,769	10.7	5,556	12.5
4 pairs*	171	0.4	517	1.2	688	1.5	12,817	28.8	13,505	30.3
Total	8,678	19.4	1,502	3.4	10,180	22.8	34,265	77.2	44,445	100.0

* of permanent incisors.

Appendix IV
Photographs of typical adult buck and/or typical adult doe, emphasising key characteristics for identification in the field

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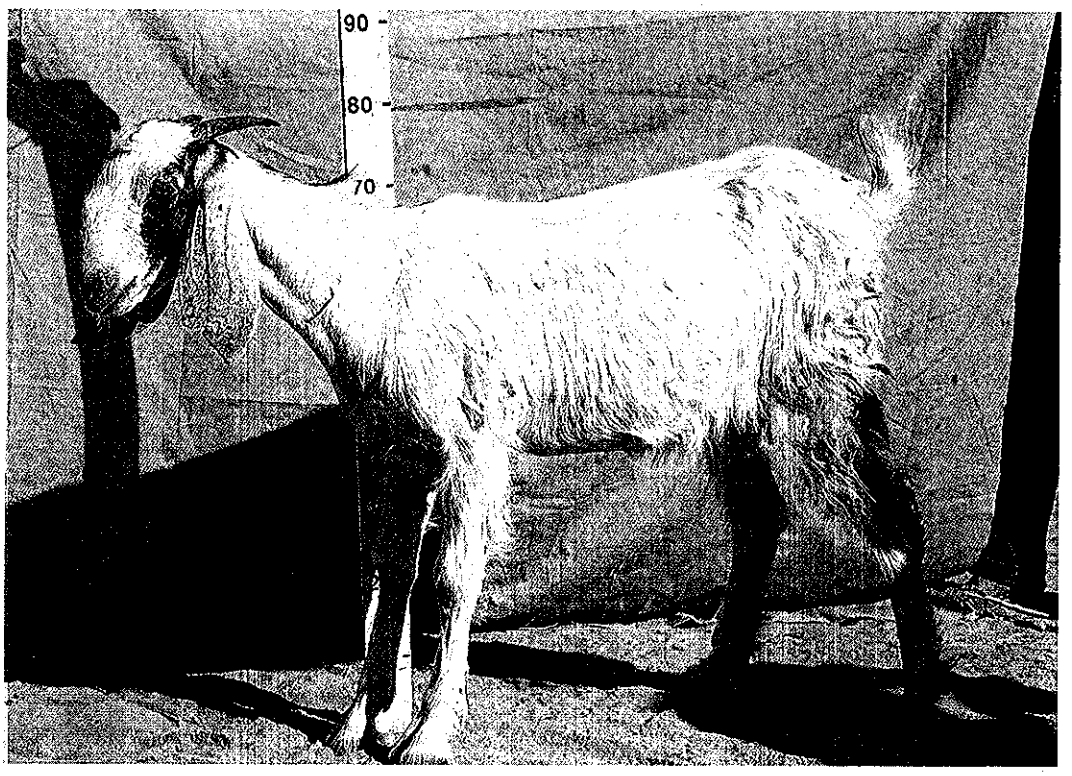
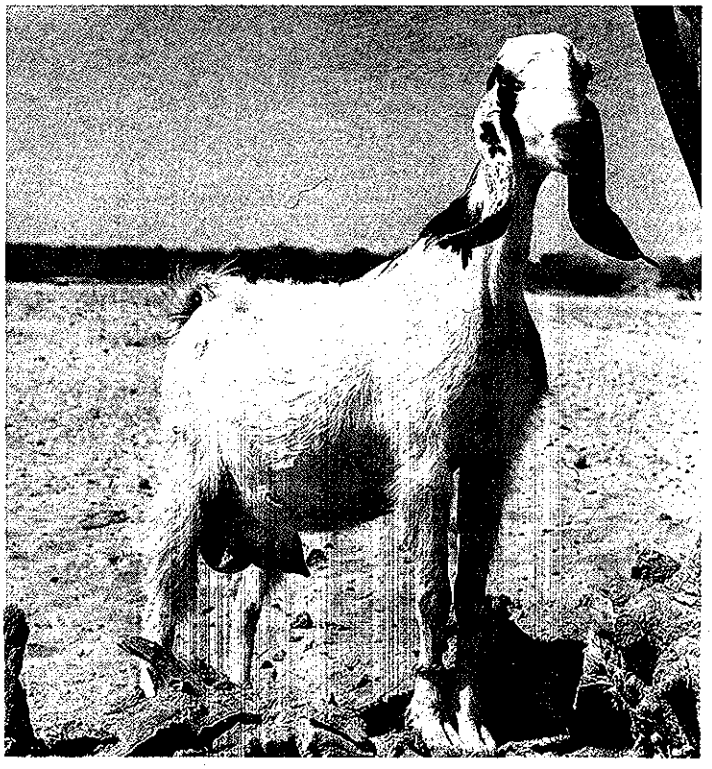
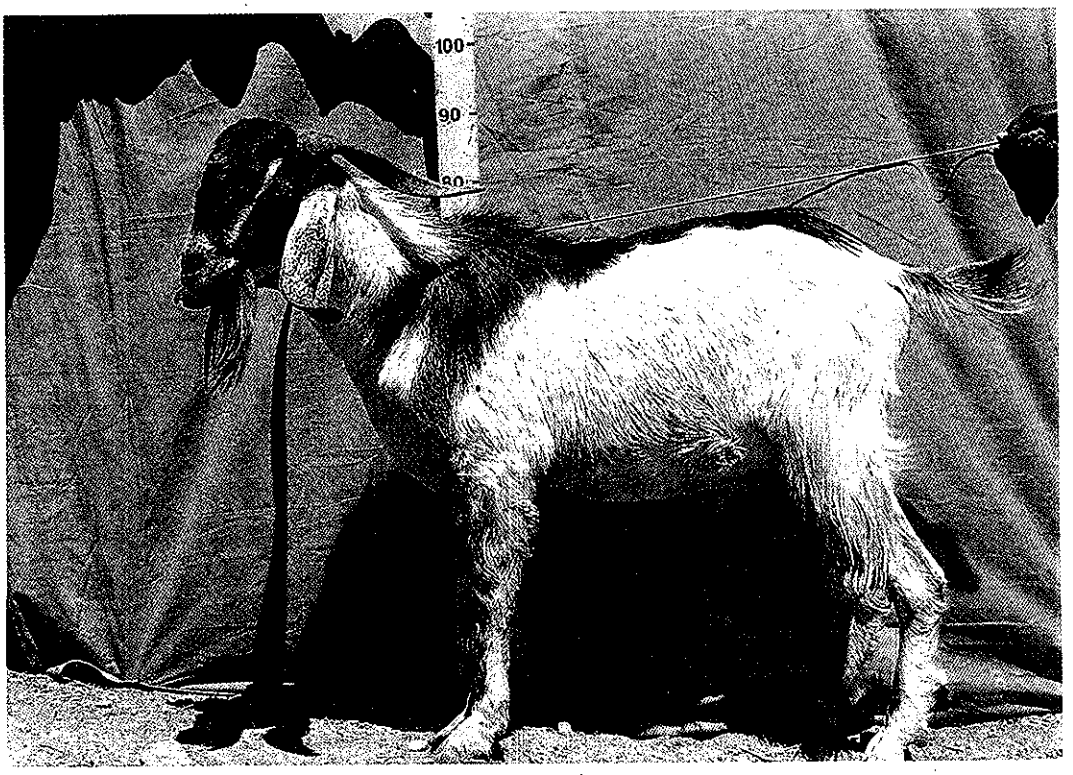


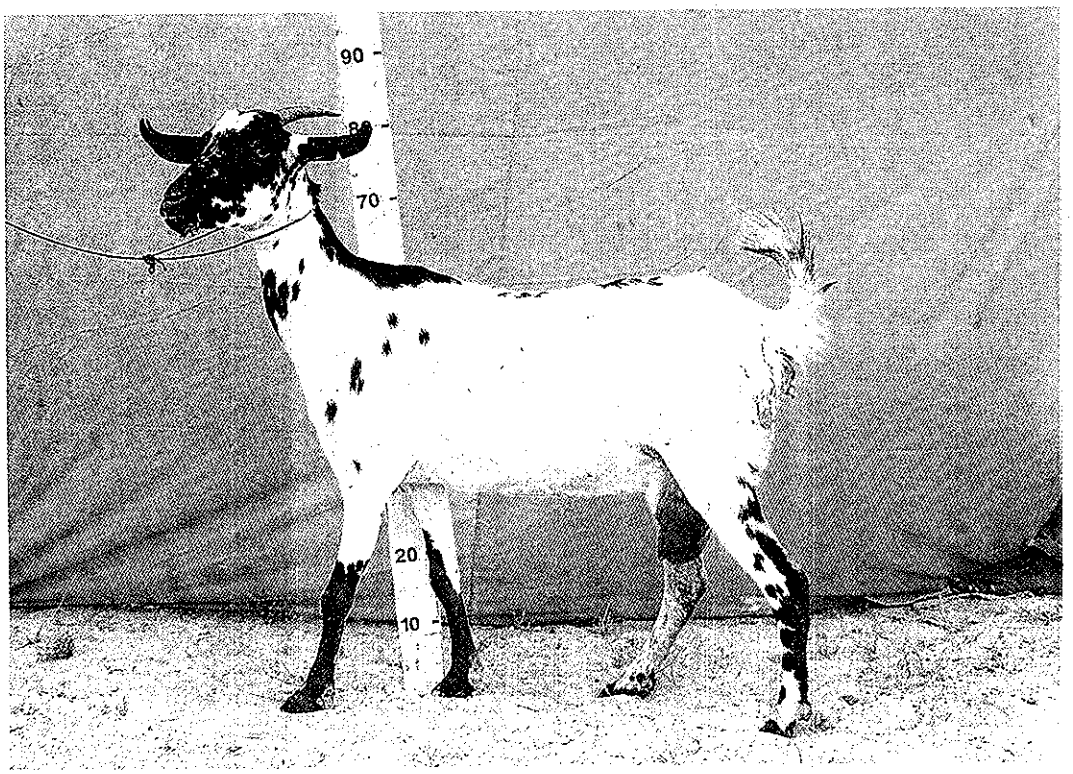
Nubian female



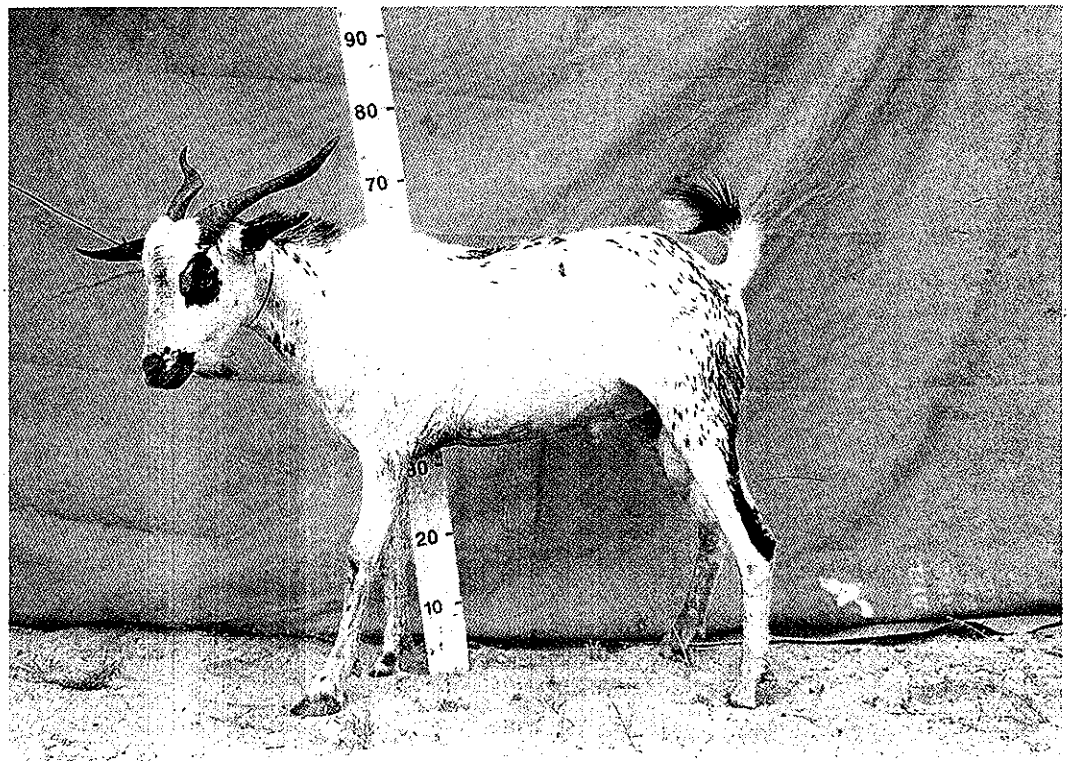
Barka female



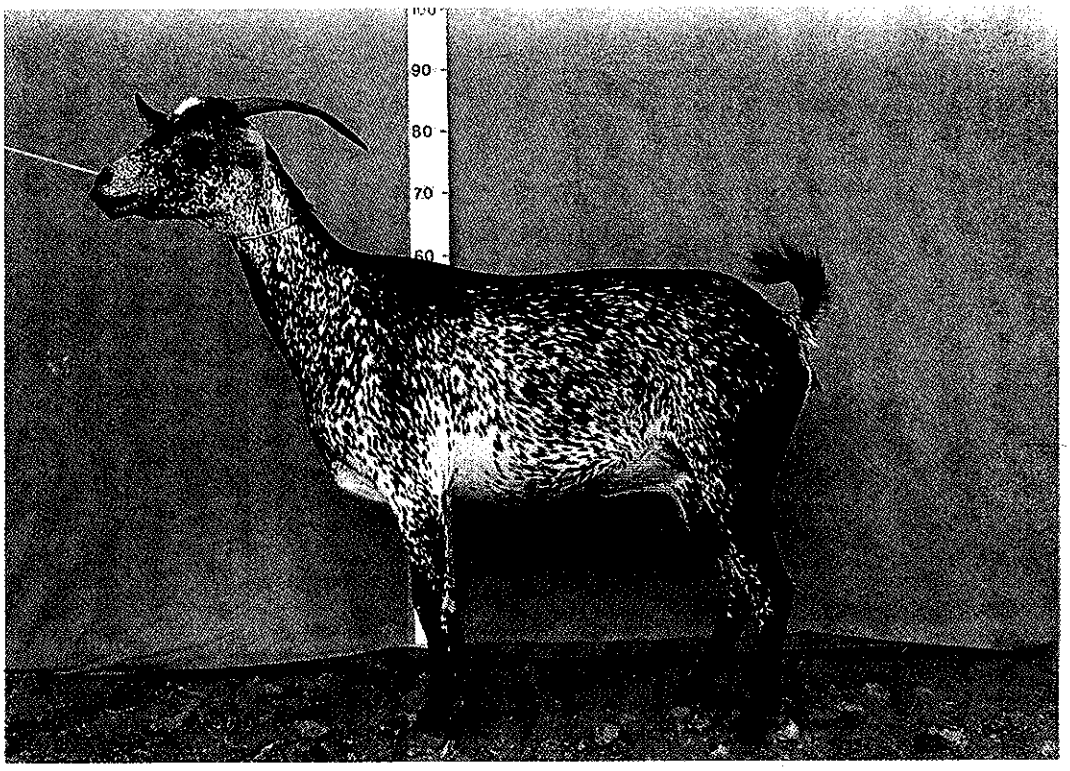
Barka male



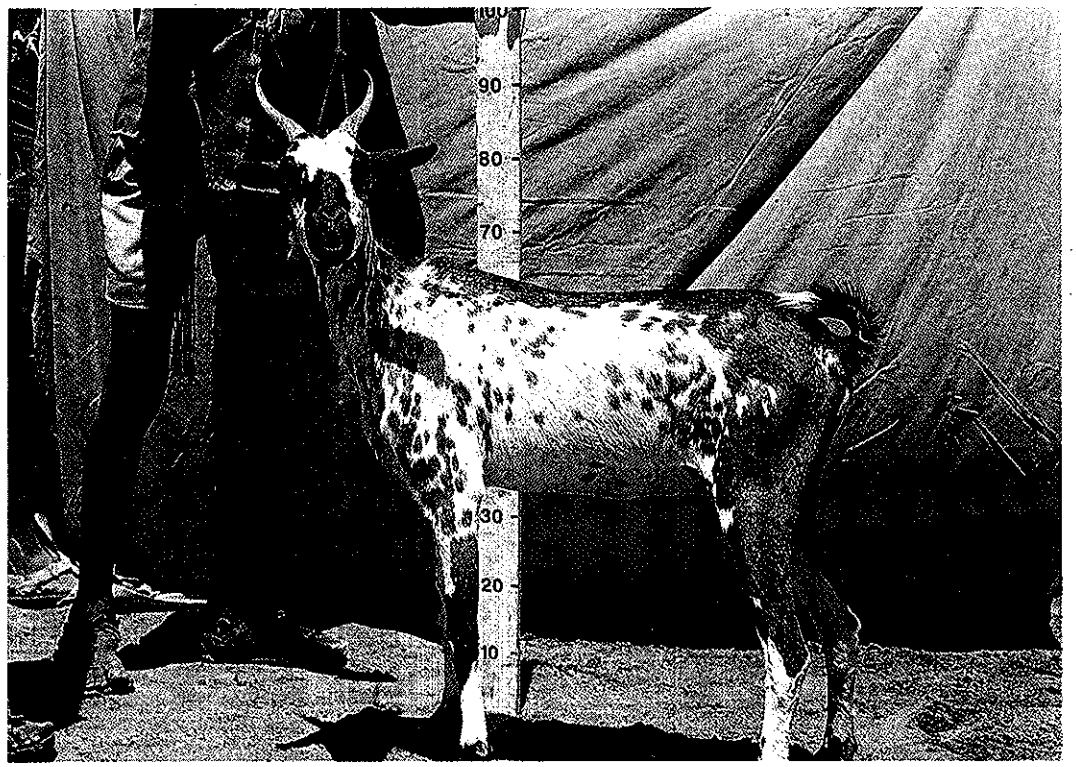
Worre female



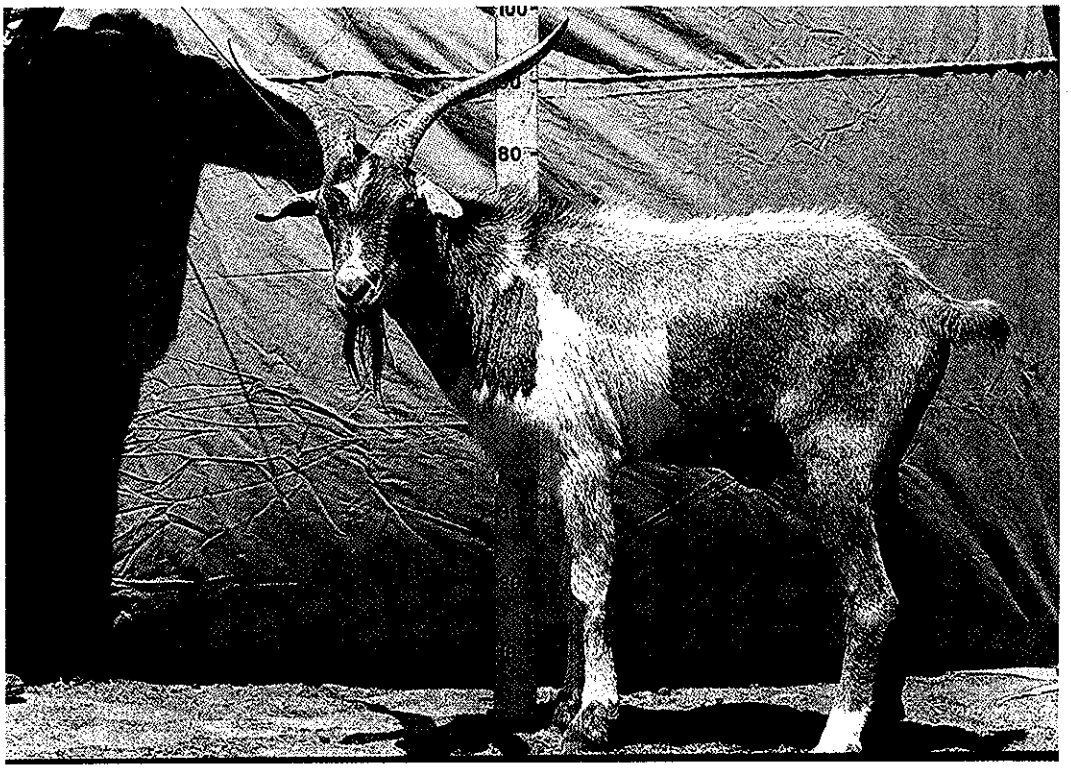
Worre male



Afar female

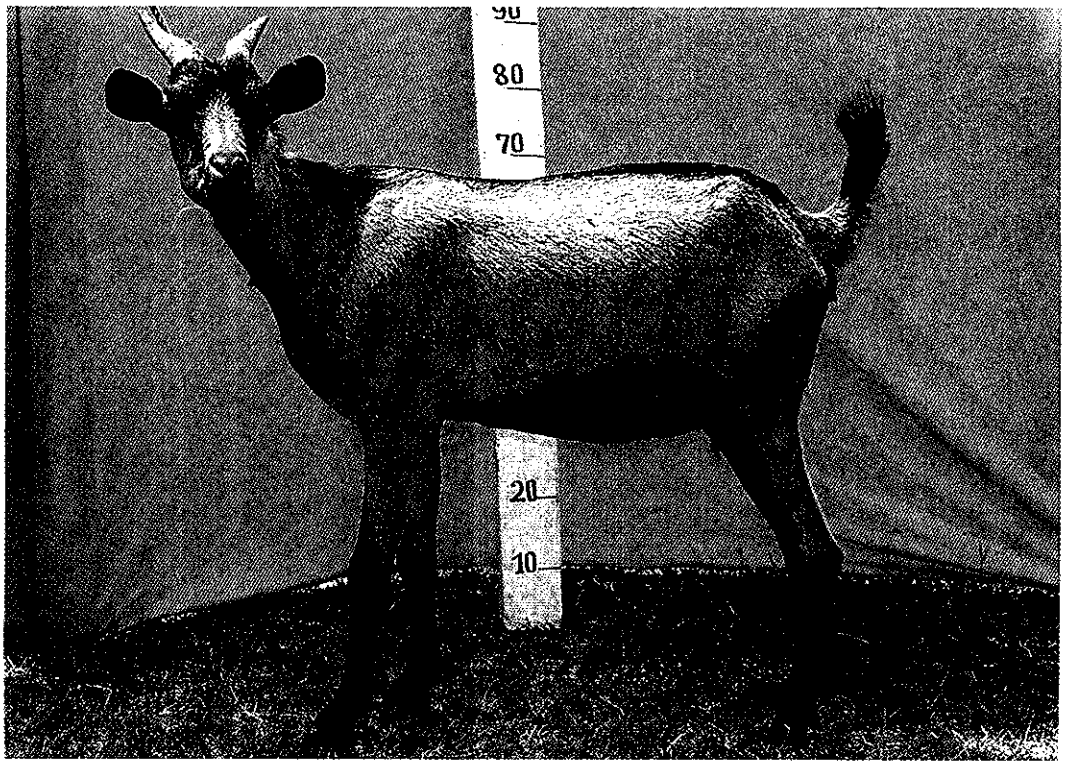


Abergelle female

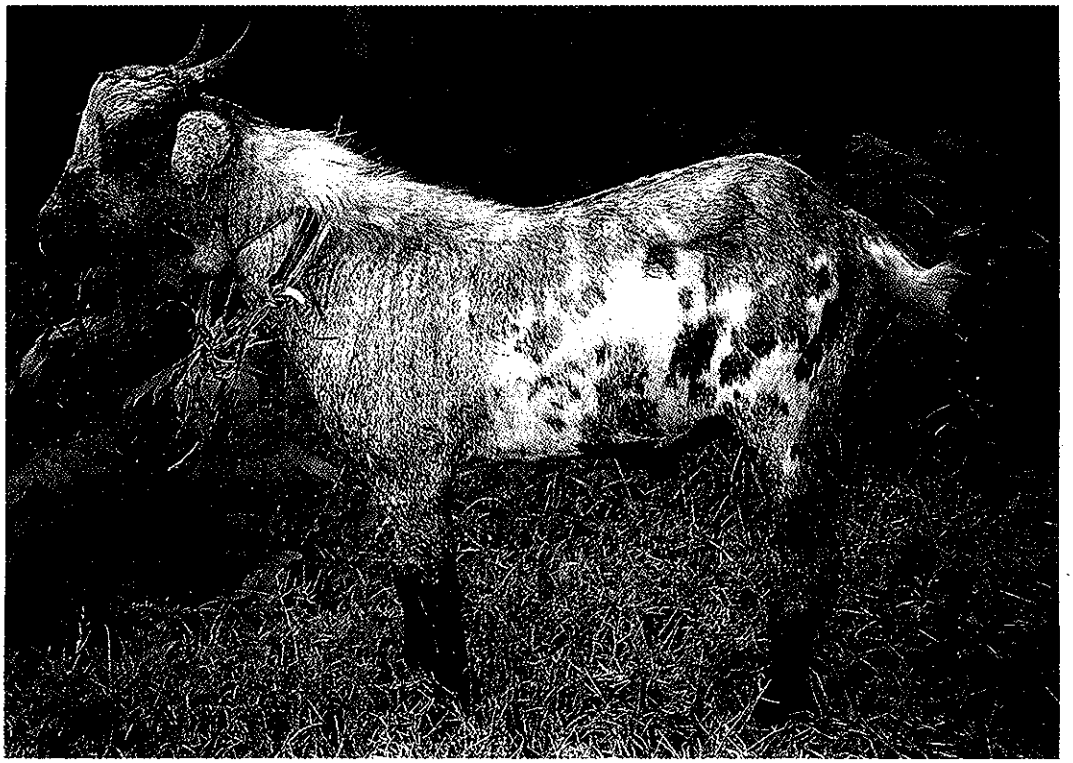


Abergelle male

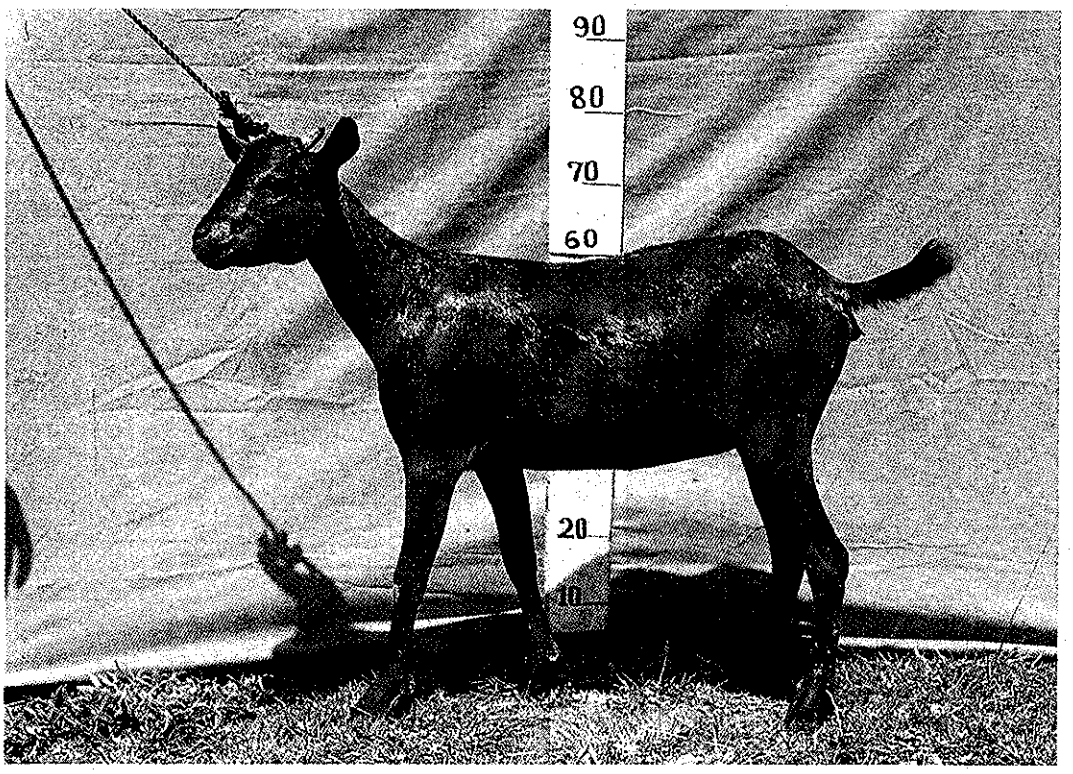
Arsi–Bale male



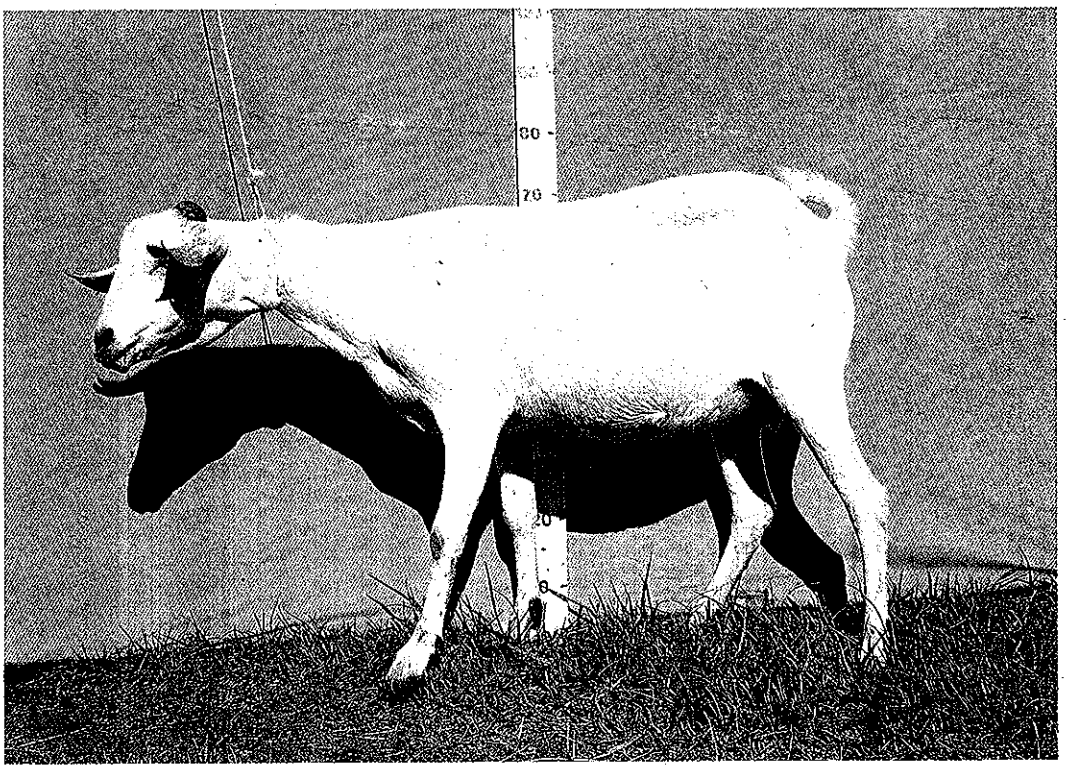
Woyto–Guji female



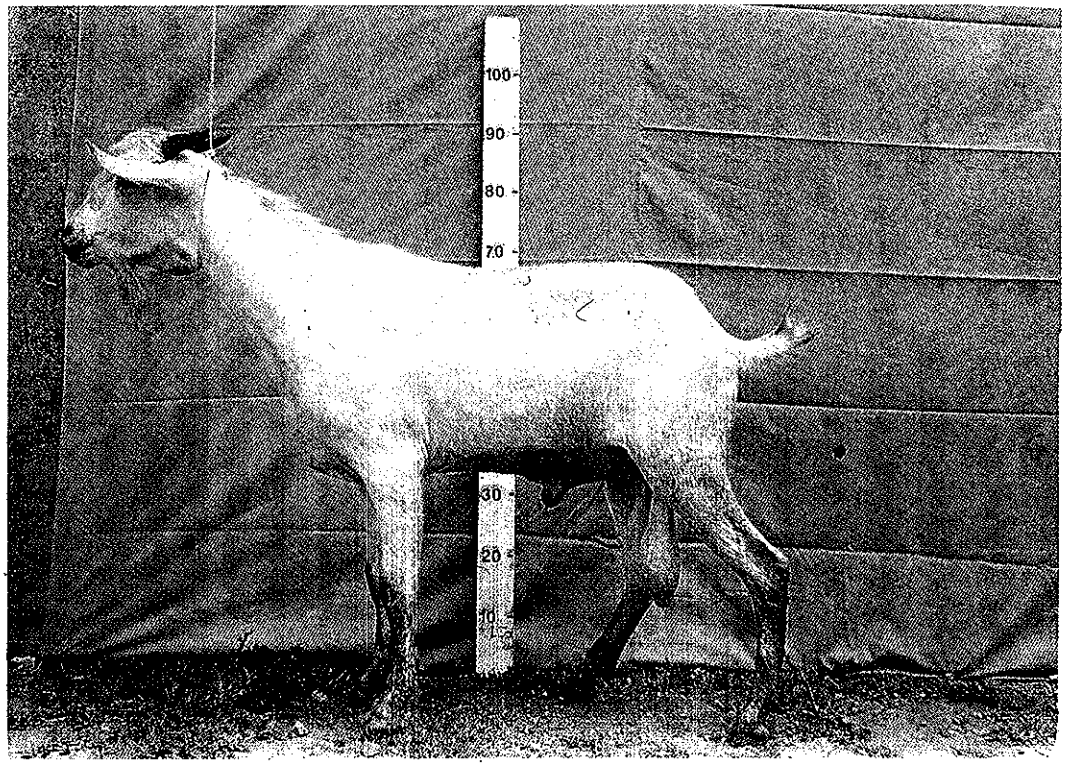
Woyto–Guji male



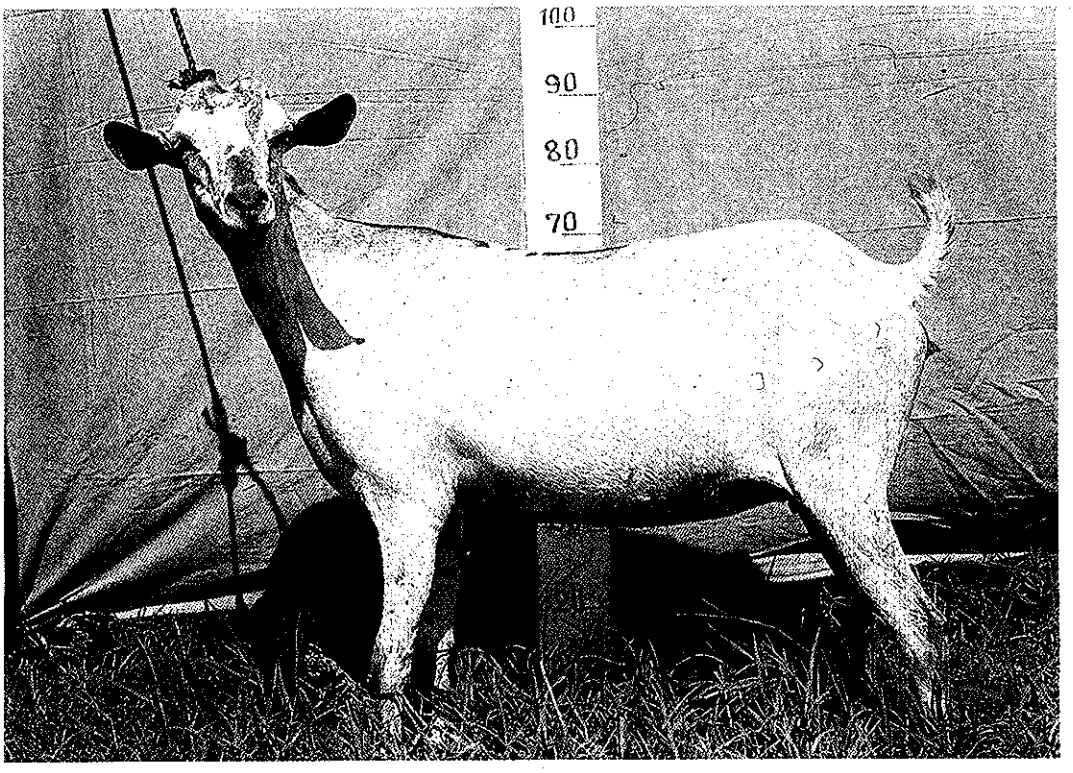
Hararghe Highland female



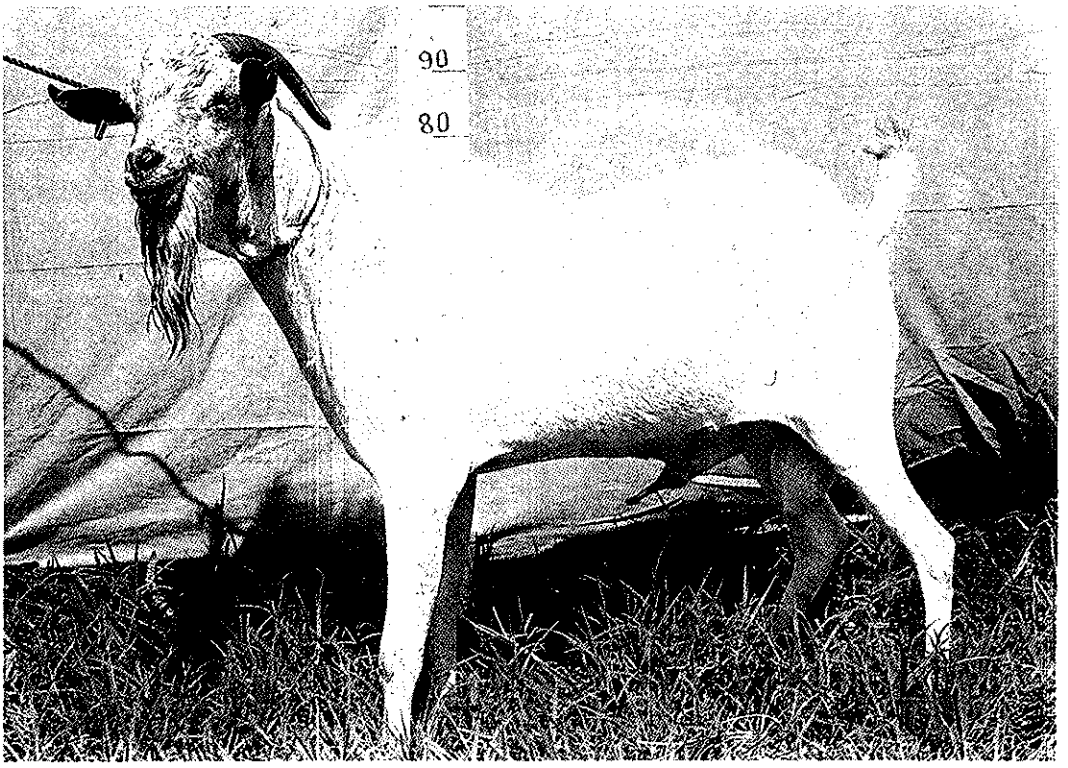
Short-eared Somali female



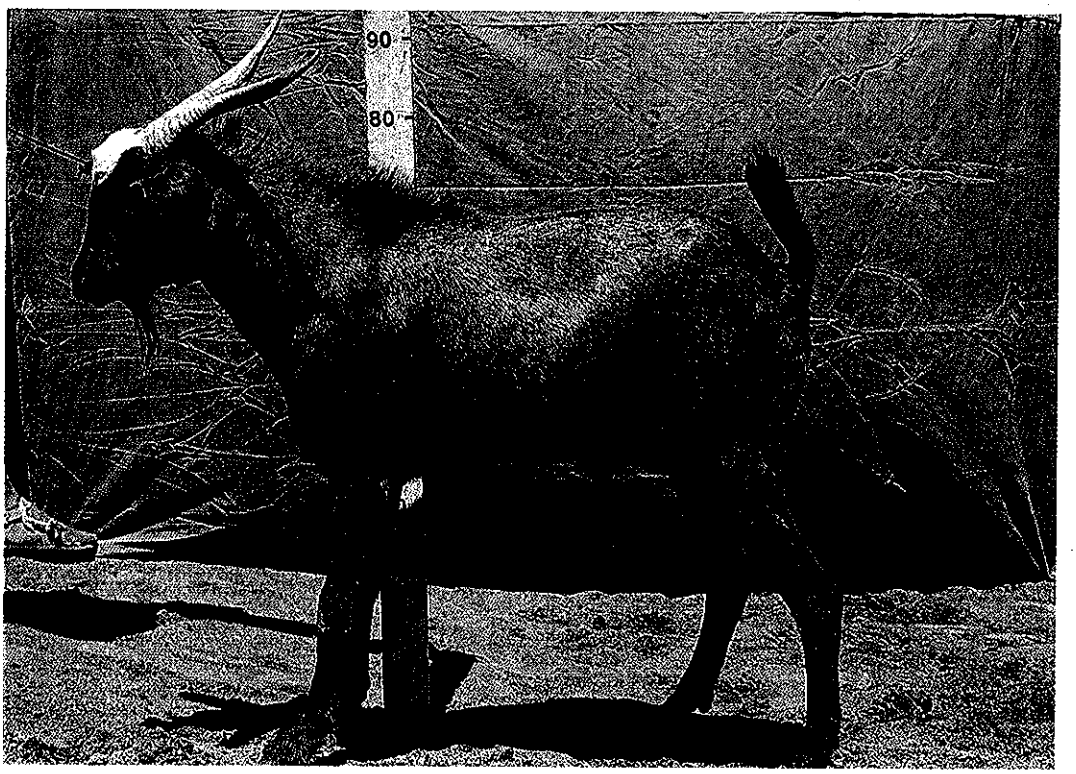
Short-eared Somali male



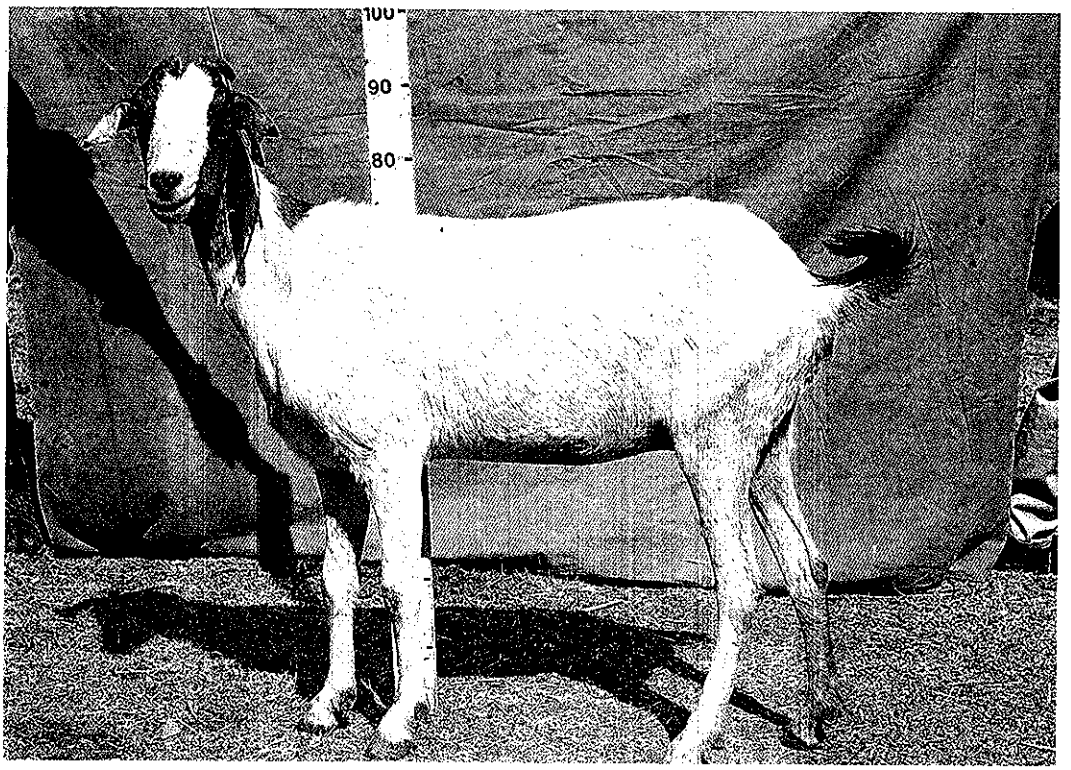
Long-eared Somali female



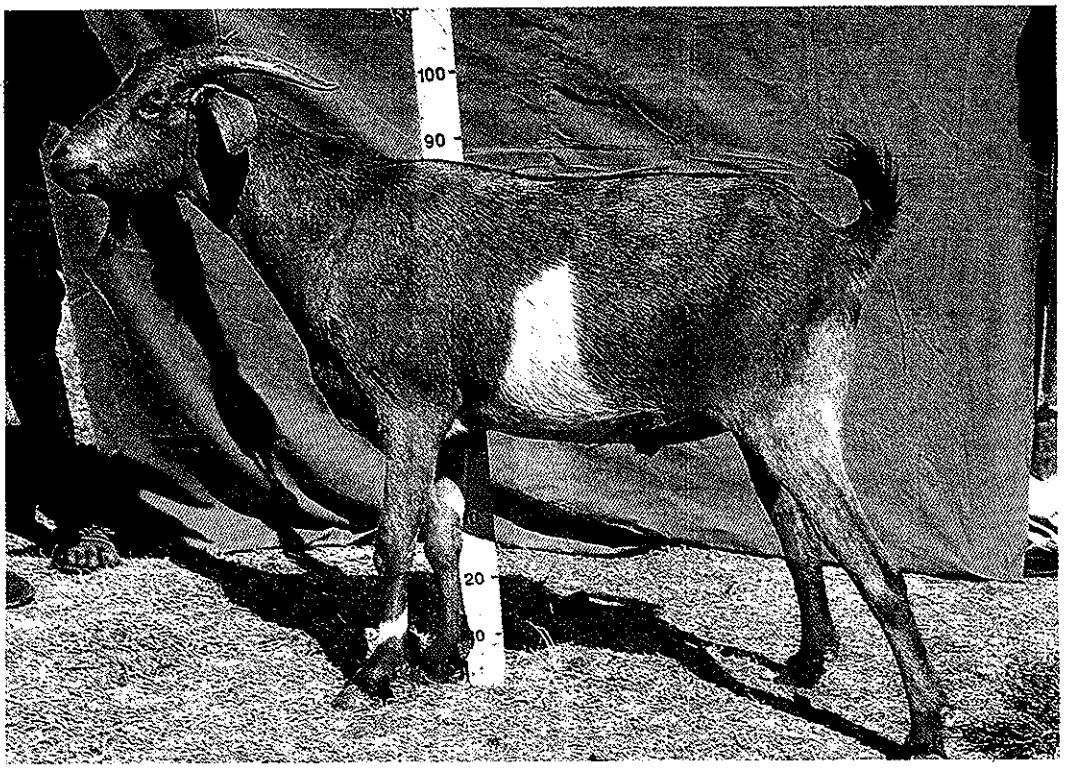
Long-eared Somali male



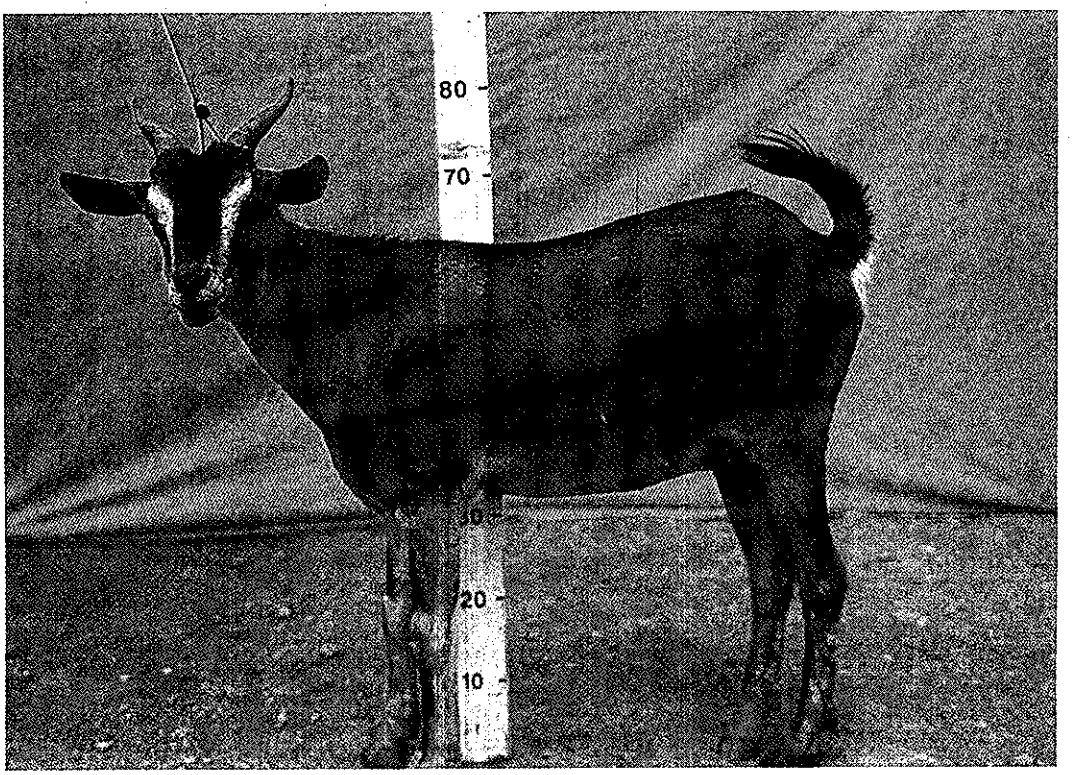
Central Highland male



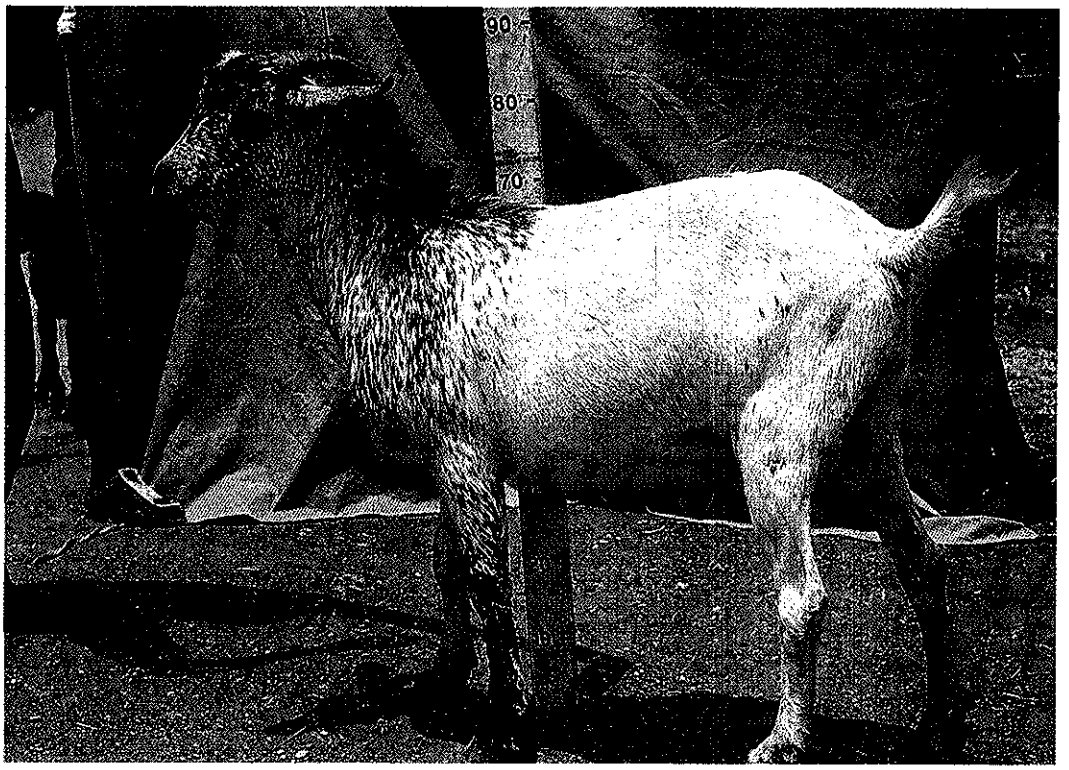
Western Highland female



Western Highland male



Western Lowland female



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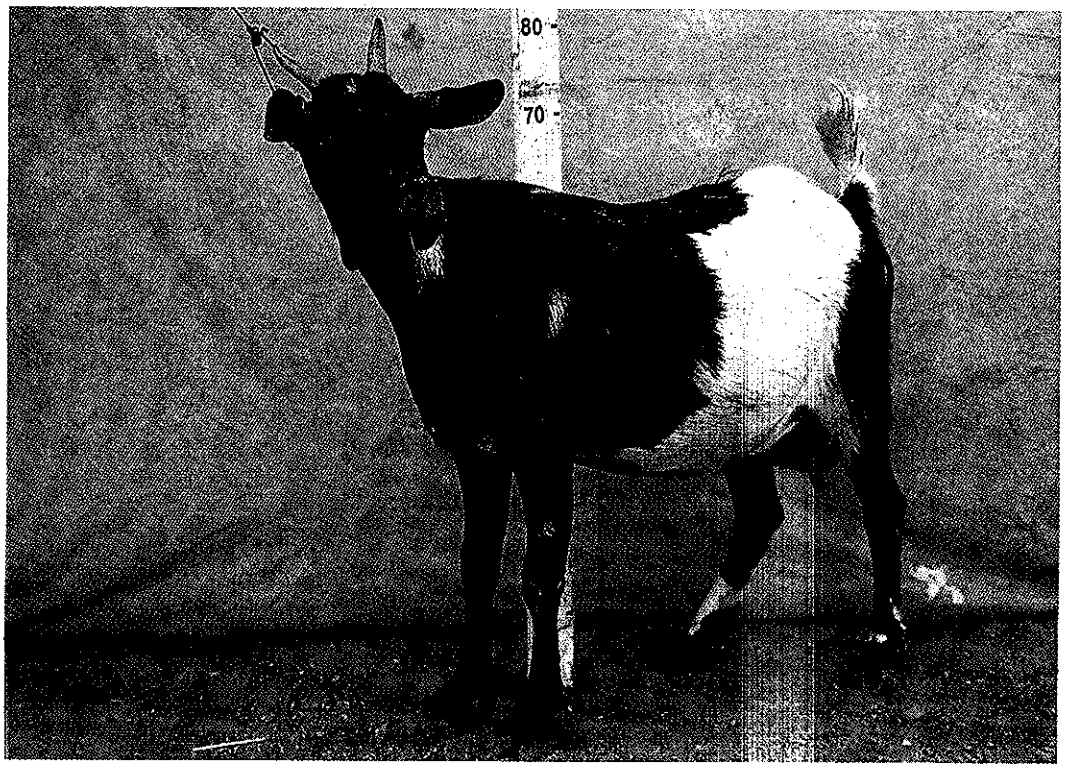
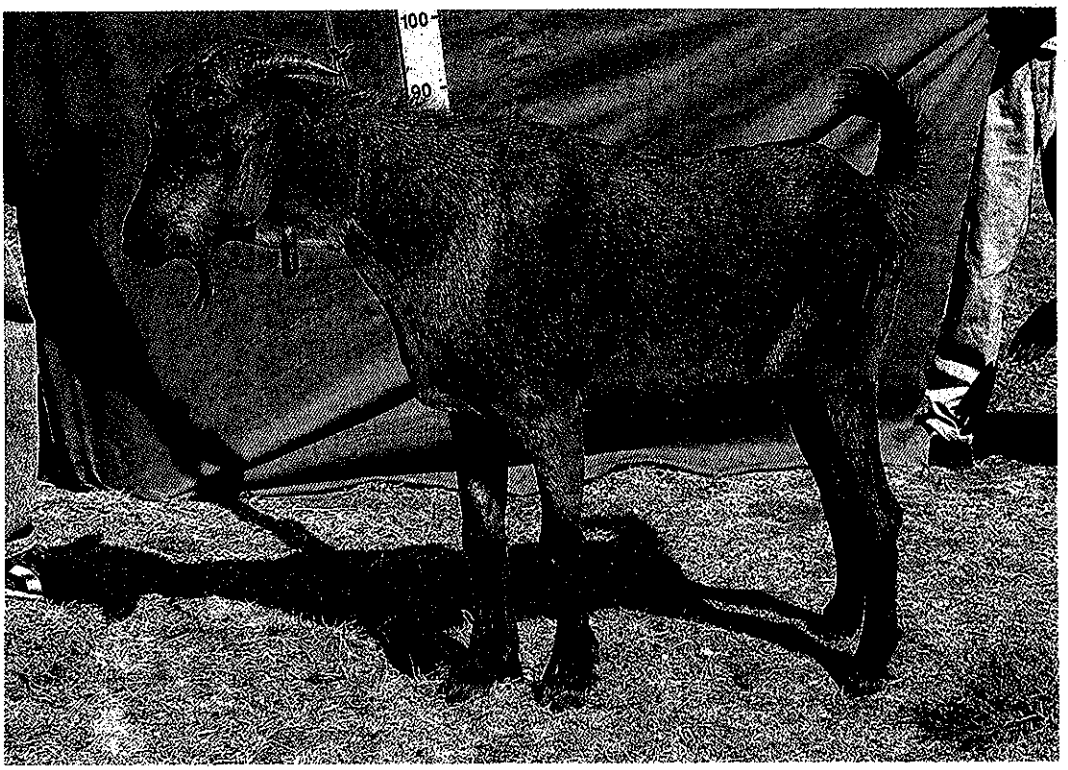


Keffa female



Keffa male