Small ruminant production and the small ruminant genetic resource in tropical Africa

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Small ruminant production and the small ruminant genetic resource in tropical Africa

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PREFACE

Goats and sheep ("small ruminants") are an important livestock component in all ecological zones (arid, semi-arid, subhumid, humid, highland) and all types of agricultural systems (smallholder mixed farming, agro-pastoral, pastoral, urban, commercial ranching) in tropical Africa. Small ruminants are complementary to cattle and camels in their production cycles and generally do not compete directly with them for feed. Goats and sheep are owned by more production units in African farming systems than any other species of domestic livestock except poultry. Because of their lower feed requirements, their rapid reproduction cycles and the ease with which they can be handled, they are particularly important for resource-poor households and are often the property of underprivileged groups, such as women and children, within those households.

Small ruminant research and development has been neglected in the past. During the 1980s the advantages of small ruminants have become increasingly recognised by researchers, development workers, policy makers and aid agencies both on the African continent and elsewhere.

In view of the current interest in small ruminants in Africa there is a need to provide a standard text on production systems, the role of goats and sheep in mixed-stocking guilds and mixed livestock/crop systems and on the indigenous genetic resource. Lack of knowledge of the types and production capabilities of African small ruminants encourages the belief that they are poor performers and that development paths should be based on the importation and imposition of supposedly superior "exotic" animals.

It is hoped that this text goes some way to discountenancing this belief and will encourage the use of African indigenous domestic animal types in African development.

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INTRODUCTION AND ACKNOWLEDGEMENTS

Publications with a somewhat similar philosophy to this one were published for the West African region in the 1950s (A classification of West African Livestock. I.L. Mason. Commonwealth Agricultural Bureaux) and for East and South Africa in 1960 (The Indigenous Livestock of Eastern and Southern Africa. I.L. Mason and J.P. Maule. Commonwealth Agricultural Bureaux): although these books are now very much out of date, they are widely quoted in scientific publications. The Institut d'Elevage et de Médecine Védécineterinaire des Pays Tropicaux has published two (1971, 1980) texts on small ruminants in the West African region (Principales races domestiques des zones tropicales d'Afrique francophone et de Madagascar. IEMVT, and Les petits ruminants d'Afrique centrale et d'Afrique de l'Ouest. J. Charray et al. Institut d'Elevage et de Medecine Veterinaire des pays Tropicaux): neither are comprehensive in their treatment of performance (concentrating mainly on pathology) and are largely restricted to countries which were formerly French colonies and, because they are in the French language, are not universally read. One additional book published in 1983, has some country chapters for West Africa and Central/South America but is limited to sheep and lacks depth, particularly in its treatment of Africa (Hair sheep of Wester Africa and the Americas: A genetic resource for the tropics. H.A. Fitzhugh and G.E. Bradford. Winrock International/Westview Press). The massive work of H. Epstein entitled "The Origin of the Domestic Animals of Africa" (1971. Africana Publishing Corporation) is an erudite work which, as its title implies attempts to trace the genology of all domestic livestock but contains no production data at all. All of these sources have been drawn on for general information for many of the types described but are not specifically cited in the lists of references.

Additional general texts include one each on tropical goats and sheep and one on both species combined. The first (Goat Production in the Tropics. C. Devendra and M. Burns. Commonwealth Agricultural Bureaux) went into a second edition in 1983 but still contains relatively little on breeds and on Africa. The second (Sheep Production in the Tropics. R.M. Gatenby. Longmans.) was published early in 1986 and, in relation to breeds, merely provides a list of names: elsewhere it has major chapters on health, nutrition and feeding and a long chapter on wool. The last, published in 1982, (Goat and Sheep Production in the Tropics. C. Devendra and G.B. McLeroy. Longmans) is again not confined to Africa, is rather weak in its treatment of sheep and is aimed primarily at an undergraduate audience.

This current publication does not pretend to catalogue every African indigenous "type", "breed" or "race" of small ruminant that has ever been

identified or described. It does attempt to provide information on the major types or groupings, in particular in respect of their relationship to other types, their areas of distribution, the systems under which they are managed, their major morphological characteristics and their major production parameters. The imbalance in detail under the various entries is evidence, not of the knowledge that has been gained over the last two decades or so, although this is considerable, but of how much remains to be done to characterize and to evaluate the indigenous African small ruminant resource.

The sections on Productivity are best regarded as providing a baseline for future work. Many of the data are, in any case, from traditional systems where animals receive little, other than some management skills, in the way of inputs which might lead to improved performance. Even on stations, however, some inputs have been hard to come by in recent years and it might not be inappropriate to suggest that management skills there, in many cases, are of a lower order than in the traditional systems. Some of the "experimental" results therefore appear to be no better, and are indeed often worse, than those obtained from the field. The total lack of any genetic parameter information is eloquent testimony of what still needs to be done.

I have been singularly fortunate in the last 2 5 years. I have managed large scale ranches, lived and travelled with farmers and pastoralists in their daily lives, worked on development projects, and tried to assist many scientists in the compilation, analysis and interpretation of their research data. In this context I have been able greatly to increase my own knowledge, and have taken advantage of personal communications of the oral kind, of grey literature, and of conventional literature in compiling this document. I could not, even if I would, name everyone who has helped in its construction and its completion. But this book is, indeed, their testament and I am merely their apostle. My fervent hope is that it will encourage all of them to continue in their individual and collective efforts to improve livestock productivity in Africa.

R. TREVOR WILSON

PART ONE
INTRODUCTION

DESCENT AND DOMESTICATION OF GOATS AND SHEEP

Goats and sheep both belong to the tribe Caprini of the family Bovidae in the sub-order Ruminantia of the order Artiodactyla (Zeuner, 1963; Epstein, 1971; Corbet, 1978; Corbet & Hill, 1980; Ryder, 1984). They are typical cloven-hoofed ruminants of relatively small size.

The tribe Caprini is comprised of five genera. Two of these genera, *Capra* and *Hemitragus,* are true goats; one genus, *Ovis,* is the sheep; and there are two genera -- *Ammotragus* and *Pseudois* -- of goat-like sheep or sheep-like goats.

The Barbary sheep or aoudad, *Ammotragus lervia* (Figure 1), is confined to the Sahara and the bharal or blue sheep, *Pseudois nayaur,* to the Himalayas: neither of these have been domesticated and neither will hybridize with true sheep of the genus *Ovis.* Fertile offspring by male Barbary sheep out of female domestic goats are known, however.

According to latest taxonomic opinion the two genera of true goats are divided into three species of *Hemitragus* or tahrs, and six of *Capra.* All the tahrs have the same chromosome number (2n=48). Most of the *Capra* species are interfertile although for some pairs no crosses are recorded: all the species examined (bezoar, ibex and markhor) have the same number of chromosomes (2n=60).

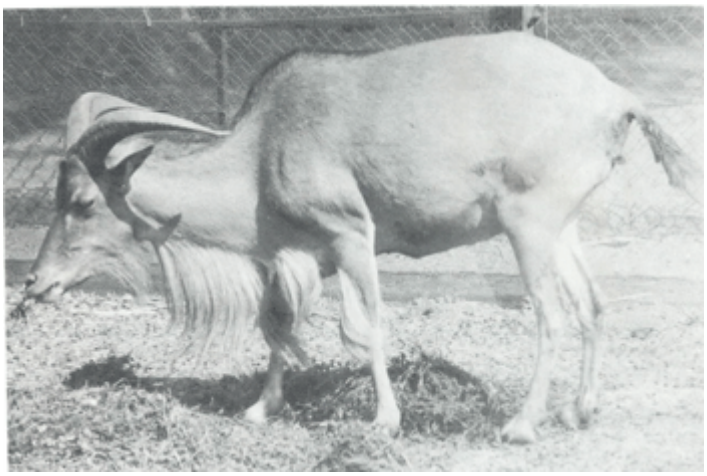

Figure 1 A female Barbary sheep *Ammotragus lervia* at Khartoum zoo

Hemitragus jayakari: Arabian tahr, found now only in Oman and in danger of extinction;
Hemitragus jemlahicus: Himalaya tahr;
Hemitragus hylocrius: Nilgiri tahr of southern India;
Capra aegagrus: Bezoar or wild goat with five sub-species: the domestic variant is classed as *Capra hircus*;
Capra ibex: Ibex, with four sub-species in the Alps; in central Asia; in the Near East, Egypt and Sudan (*C.i.nubian*) (Figure 2); and in the Simen Mountains of Ethiopia, this last being *C.i.walie*;
Capra caucasica: West Causasian tur or kuban which until recently was considered as a sub-species of the ibex named *C.i.severtzovi*;
Capra cylindriocornis: East Caucasian tur which was earlier called *C.caucasica*;
Capra pyrenaica: Spanish ibex or wild goat with two sub-species;
Capra falconeri: Markhonr of Afghanistan and Pakistan with six or seven sub-species.
The nomenclature of the genus *Ovis* is confused bur latest opinion tends to favour six wild species.
Ovis orientalis: Mouflon, with one sub-species in Asia (*O.o.laristanica*) and one in Europe (*O.o.musimon*);
Ovis ammon: Argal, with nine sub- species;
Ovis vignei: Urial, with thirteen sub- species. *Ovis orientalis* is some-times considered synonymous with *O.vignei*;

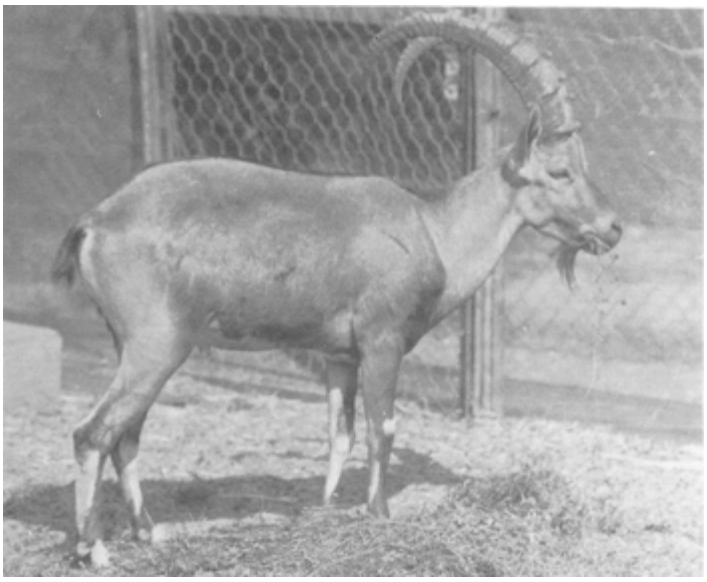

Figure 2 Nubian ibex *Capra ibex nuniana* in captivity at Khartoum zoo

Ovis canadensis: Bighorn, with eight sub-species in Canada and the United States of America;
Ovis nivicola: Snow sheep of Siberia with three sub-species;
Ovis dalli: Thinhorn of Alaska also with three sub-species;
All these "species" of *Ovis* are fully interfertile and might therefore be considered to be monotypic. To distinguish them from the wild types, all domesticated sheep are now classed as *Ovis aries.* The mouflon has the same number of chromosomes as the domestic sheep (2n=54) while the urial (2n=58) and the argal (2n=56) differ.
Of the six species of *Capra,* it is most likely that only *C.aegagrus* blood is present in the modern domestic goat although a slim possibility still remains that the markhor, *C.falconeri,* may have been involved in the ancestry of some Indian breeds.
The bighorn, *0.canadensis,* and the thinhorn, *0.dalli,* are excluded, on geographical considerations alone, from the ancestry of domestic sheep. Some authorities, on the grounds of chromosome number, consider the mouflon to be the sole ancestor of the domestic sheep. Both the argal and the urial, however, freely interbreed with, and produce fully fertile offspring from, the domestic sheep and therefore cannot be excluded from its ancestry.
Domestic goats and sheep, because of the divergence in chromosome numbers, do not usually interbreed (Gray, 1972). Experimental chimaera are known (Fehilly, Willadsen & Tucker, 1984; Meinecke-Tillman & Meinecke, 1984) and one of these, back-crossed to a ram, is reported to have produced twin offspring (Bunch, Foote & Spillet, 1976).
The most simple and effective visual way of separating goats from sheep is the carriage of the tail -- in all domestic forms, goats' tails are erect while those of sheep are pendent. There are, however, a considerable number of additional morphological differences between the two species. Goats have beard and caudal (i.e. at the tail) scent glands in the male. Sheep have suborbital (under the eye) tear glands and lachrymal (tear) pits in the skull and also possess foot glands: goats may, however, have glands in the

forefeet. Both species differ from cattle in normally having only two nipples instead of four.
Goats were almost certainly the first ruminants to be domesticated and were possibly only the second species to be taken into the human fold after the dog. South-west Asia (Iran and Iraq) is the most likely origin of the domestic species, the bezoar, *C.aegagrus,* being present there. Domestication occurred gradually over a period centred about 9000 years Before Present (Mason, 1984). Domestication of sheep possibly followed closely upon that of the goat and took place in the same area. Both goats and sheep appeared in tomb and cave paintings in Egypt by about 7000 years BP. Goats moved into sub-Saharan Africa by at least 5500 years BP and a dwarf type has been recorded from that period near Khartoum in Sudan. Sheep probably entered Africa with cattle, at some time in the period 6000-5000 BP, possibly slightly later than goats.

SMALL RUMINANT PRODUCTION SYSTEMS IN TROPICAL AFRICA

Tropical Africa contains one-third of all the world's goats and one-sixth of its sheep. On average there is one goat or sheep on *every* 10 ha of tropical Africa and there are 1.1 head of goats and sheep per person employed in the agricultural sector. Goats and sheep are equivalent, in weight terms, to about 17 per cent of the total domestic ruminant biomass (DRB) of tropical Africa.

Total meat production from African goats and sheep combined is estimated (FAO, 1985) at 1.15 million tonnes, equivalent to about 16 per cent of total world output from these species. Milk from small ruminants is 1.99 million tonnes, about 14 per cent of world production. Small ruminant skins from Africa, estimated at 258 000 tonnes, represent about 16 per cent of world production, the proportion from goats (25 per cent) being much greater than that from sheep. African wool production, of about 228 000 tonnes, is equivalent to less than 8 per cent of world output and most of this wool is produced in South Africa and Africa north of the Sahara. Goats in tropical Africa are much more important than sheep as milk producers and she-goats (does) are estimated to produce about three times as much milk in total as are ewes.

DISTRIBUTION AND IMPORTANCE OF GOATS AND SHEEP

The major criteria adopted for assessing the distribution and importance of goats and sheep are: the ratios of goats to sheep; the density per unit area of both species combined; the ratio of goats and sheep to the human population involved in agricultural activities; and the contribution of goats and sheep to the total domestic ruminant biomass.

Ratios of goats to sheep

In tropical Africa as a whole, goats outnumber sheep in the ratio 1.16:1.00. There does not appear to be any overall pattern in the relative importance of goats and sheep related to the major ecological zones or to the major production systems, at least at the country level (Figure 3).

Goats are dominant and exceed sheep by a ratio of 4:1 in widely disparate countries. The highest ratios of more than 11:1 are found in the Central African Republic and in Zambia. Both countries have low densities of small ruminants, low ratios to the human population and a low contribution of small ruminants to total ruminant biomass. Swaziland has a ratio of goats to sheep exceeding 8:1. The ratio of goats to sheep in Botswana approaches 5:1, this country in general being much drier than the others where high ratios are found and also having a largely pastoral vocation.

Countries in which goats remain dominant over sheep in ratios varying from 2:1 to 4:1 also appear to have few factors in common, either in terms of agro-ecology or of principal production systems. They include the mainly pastoral Niger (2.1:1.0) and neighbouring Nigeria (2.0:1.0). They also include the largely agricultural countries of Zaire (3.8:1.0) and Mozambique (3.1:1.0) as well as some countries with mixed agricultural-livestock economies such as Angola (3.8:1), Zimbabwe (3.4:1.0) and Madagascar (2.5:1.0). The two small central African highland republics of Rwanda (2.9:1.0) and Burundi (2.2:1.0) also fall within this group.

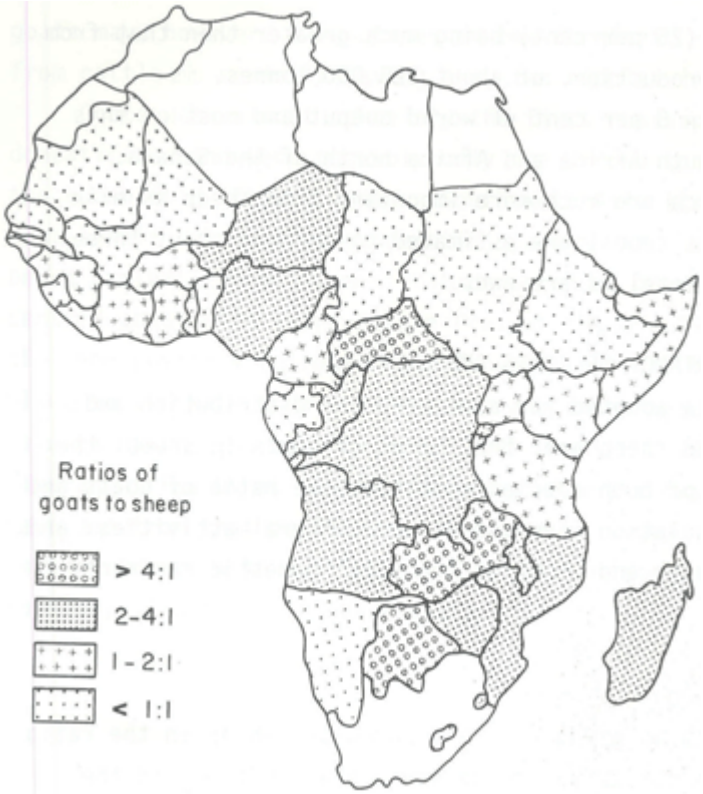

Figure 3 Ratios of goats to sheep in tropical Africa

Sheep assume more importance but are still fewer in number than goats in the major East African countries and in some of the Gulf of Guinea states in West Africa. Somalia has a ratio of goats to sheep of 1.6:1.0, Djibouti of 1.3:1.0, Kenya of 1.2:1.0, Uganda of 1.7:1.0 and Tanzania of 1.6:1.0. In West Africa the ratio varies from 1.3:1.0 in Burkina Faso to about parity in Guinea, Côte d'Ivoire and Ghana.

Goats are less numerous than sheep across much of the Sahel. In Senegal there is only one goat for *every* two sheep and in Mauritania there are two goats for three sheep. In Sudan and Ethiopia (and also in Gabon and Lesotho) the proportion of goats to sheep is about 0.7:1.0 while in Chad it is about 0.9:1.0. Sheep are more important than goats in Namibia, largely because of the pelt industry, and outnumber them in the ratio of 1.0:0.4.

Density

Small ruminants achieve their highest densities in two distinct areas (Figure 4). More than 35 goats and sheep per square kilometre are found in the Horn of Africa in Somalia and Djibouti where people are traditionally pastoralists. Very high densities are also found in Ethiopia where much of the northern, eastern and southern lowlands also have a pastoral vocation. An additional factor in the high densities in Ethiopia is that the highlands have heavy concentrations of people, the case being similar in the small central African highland republics of Burundi and Rwanda. On a finer scale, the eastern Zaire province of Kivu would also show high densities. Large numbers of small ruminants are also found in Nigeria due to the same

combination of a pastoral vocation (in the north) and large numbers of people (in the centre and south) as in Ethiopia.

Figure 4 Densities of small ruminants per unit area in tropical Africa

Medium densities (18-35 head/km^2) of small ruminants are found in countries where there is relatively heavy human population pressure and where they can be integrated with crop farming in mixed smallholder systems. Examples are Togo and Benin in West Africa (countries which are less humid than their immediate neighbours in the Gulf of Guinea) and Uganda and Kenya in East Africa (although Kenya is also largely pastoral in the north and north-east).

Lower densities (7-18 head/km^2) are found in all the West African Sahel countries and in Sudan. On a regional basis, densities would probably be in the highest class in the southern areas of this group of countries but large tracts of desert in the north are sparsely populated. Low to extremely low densities are also found in the coastal Gulf of Guinea states mainly because the people are principally agriculturalists but possibly also because of tsetse fly infestation and other humid-associated disease problems.

Very low densities (< 7 goats and sheep/km^2) are found from Chad (which is very sparsely populated), through central Africa and into the southern states of Botswana and Zimbabwe. With the exception of the two last named, agriculture is the main preoccupation of the human population and trypanosomiasis is also a problem. Zimbabwe has many more cattle than small ruminants, mainly for socio-cultural reasons, and Botswana, like Chad, is very sparsely populated. Madagascar also falls into the lowest density class.

There are three major exceptions to the general rules governing density of small ruminants. Tanzania has a low human population in relation to its resource potential. Namibia is very thinly populated and has developed an important industry based on pelt production from Karakul sheep. Lesotho is in the highest density class for reasons similar to Namibia in that it has

developed specialist production of mohair from Angora goats and fine wool from Merino sheep.

Numbers of goats and sheep per person

Highest ratios of goats and sheep to humans (> 2.5:1.0) are found in the principally pastoral countries (Figure 5). These include, again, Somalia and Djibouti but also Mauritania. Namibia has by far the highest ratio of small ruminants to humans (13.5:1.0), almost twice as great as in Mauritania (7.6) and Somalia (7.4).

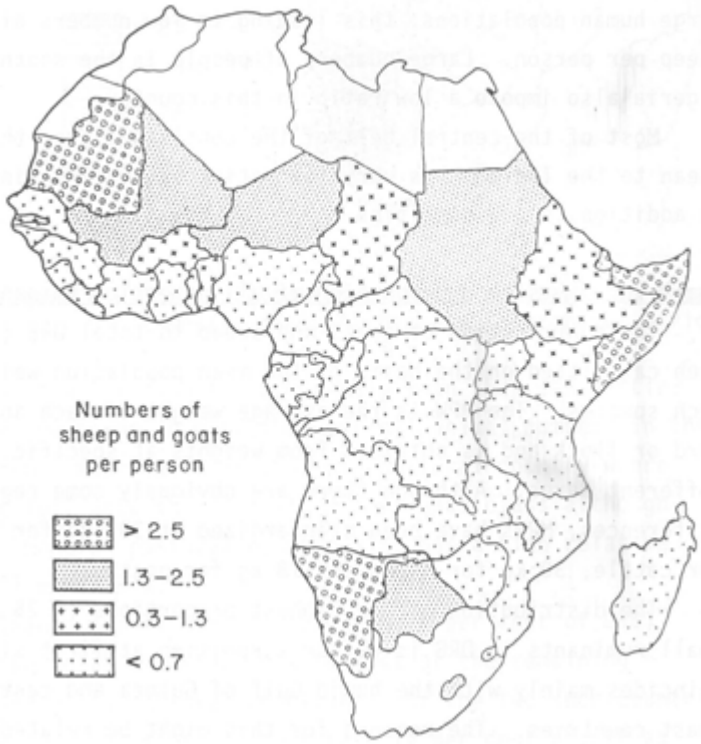

Figure 5 Relationships of total numbers of goats and sheep to the numbers of people in tropical Africa

Intermediate ratios (1.3-2.5 head per person) are found in countries where large segments of the population in the drier areas are pastoralists. These include Mali, Niger and Sudan in the north and Botswana in the south. Small, mountainous Lesotho also appears in this intermediate class because, whilst having the highest density (78.9 head/km^2) of goats and sheep of all African countries, it also has a large human population in relation to its area.

Low (0.7-1.3 head/person) and *very* low (< 0.7 head/person) ratios prevail in the remainder of Africa. In Ethiopia the highland, mainly agricultural, areas have a population of farmers which greatly outnumbers the pastoral peoples of the lowlands and the situation is similar in Kenya. Togo and Benin, as well as Burundi and Rwanda, which are in the high density classes for small ruminants, also have large human populations, this leading to low numbers of goats and sheep per person. Large numbers of people in the south and centre of Nigeria also impose a low ratio in this country.

Most of the central belt of the continent, from the Atlantic Ocean to the Indian, has very low ratios of small ruminants to people in addition to low densities.

Small ruminants as a proportion of all domestic ruminants

The contribution of goats and sheep to total DRB (Figure 6) has been calculated on the basis of the mean population weight (MPW) of each species. The MPW is the average weight of each animal in the herd or flock and is obtained from weights at specific ages and for different sexes. Although there are obviously some regional differences, MPWs have been standardized at 307 kg for camels, 206 kg for cattle, 30 kg for sheep and 18 kg for goats.
The distribution of the highest proportions (> 25 per cent) of small ruminants in DRB is rather surprising at first sight as it coincides mainly with the humid Gulf of Guinea and central Atlantic coast countries. The reasons for this might be related to the better tolerance, compared to cattle, of goats and sheep to trypanosomiasis. It is also possible that the mainly agricultural peoples of these areas can handle small ruminants more easily than they can cattle. It should, however, be borne in mind that overall animal numbers in these countries are few. Mauritania.is the only pastoral country where goats and sheep fall into the highest proportional class although Namibia with a "modern" pastoral economy also has a high relative biomass of small ruminants.

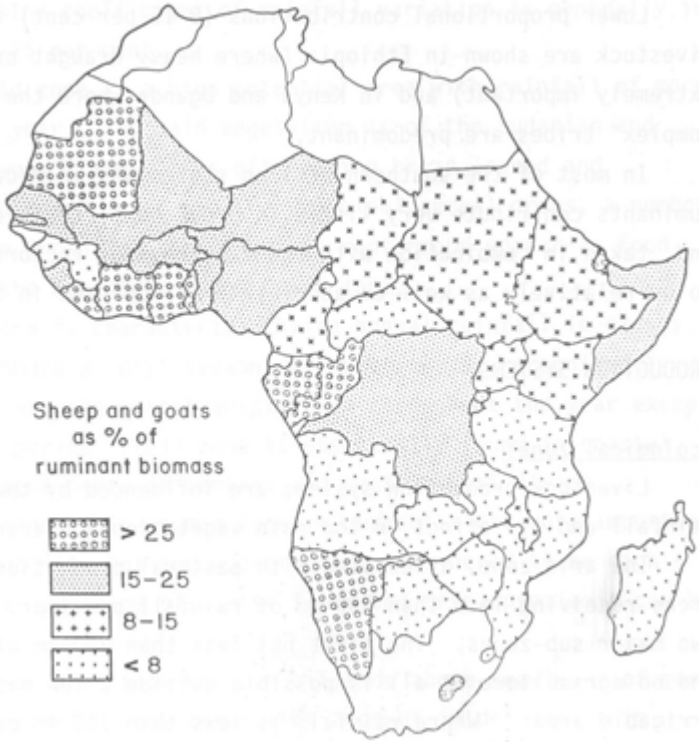

Figure 6 The contribution of small ruminants to total domestic ruminant biomass in tropical Africa

Small ruminants are of considerable (15-25 per cent of DRB) importance in the total livestock mix in most of the remaining pastoral or principally pastoral countries. Of the two such countries that are not in this class,

Sudan does have 14 per cent of DRB as goats and sheep. Small, intensively cultivated countries with high goat and sheep densities also fall into this grouping.

Lower proportional contributions (8-15 per cent) to total livestock are shown in Ethiopia (where heavy draught oxen are extremely important) and in Kenya and Uganda where the "cattle complex" tribes are predominant.

In most of the southern African states and in Madagascar, small ruminants contribute very little (< 8 per cent) to livestock biomass and, taken in combination with the two previous factors, can be seen to be relatively as well as absolutely unimportant in this region.

PRODUCTION SYSTEMS

Ecological zones

Livestock production systems are influenced by the annual rainfall and its effect on the main vegetational characteristics.
The arid zone, associated with pastoral production, includes all areas receiving less than 600 mm of rainfall per year. The zone has two major sub-zones. The first has less than 200 mm of rain per year and no agriculture at all is possible outside a few oases or other irrigable areas. Where rainfall is less than 100 mm per year, the natural vegetation is of the Saharan type. The second sub-zone has rainfall of 200-600 mm per year and is often called the Sahel zone in northern and western Africa. Some agriculture is possible but crop failures are frequent and yields are generally low as the coefficient of variation of rainfall is in the range 25-35 per cent.
In the semi-arid zone, rainfall is between 600 and 1000 mm per year. Livestock raising is usually intimately associated with crop production. Vegetation is of the south-Sahelian or north-Sudanian type in northern and western Africa. In eastern and southern Africa the lightly forested 'miombo' areas are part of this ecological zone. Rainfed millets *{Pennisetum, Eleusine, Digitaria,* etc.) are the principal cereal crops but these are replaced by sorghum and maize where rainfall is better and where year to year variation is less. Some cash crops such as cotton and groundnuts may be grown in the more favoured areas. The coefficient of rainfall variation is generally in the region of 20-25 per cent.
The sub-humid zone is a high potential area with rainfall of more than 1000 mm per year. The main vegetation is of the Sudanian and south-Sudanian types, large trees often being broad-leaved and deciduous. Sorghum and maize are the principal cereal crops, a number of cash crops are grown and some tuberous root crops appear as food staples towards the boundary of the humid zone.
The humid zone is characterized by an annual rainfall in excess of 1500 mm. Although a "dry" season may sometimes be recognised, rainfall usually exceeds evapotranspiration throughout the year except for a very short period. This zone is essentially found in coastal West Africa and some parts of central and central-west Africa. Livestock production in the humid zone is currently not very important as an economic activity but the potential is considered to be high providing that the problems of tsetse flies and trypanosomiasis can be overcome.
Highland areas are those with an altitude above sea-level of more than 1500 m. Rainfall is not taken into account in defining this zone. The major crops are cereals (tef *Eragrostis tef,* barley and wheat in Ethiopia, maize and sorghum elsewhere), pulses, and bananas or plantains. Livestock production is generally an important secondary activity on the small farms that are typical of this zone. In some areas extensive or intensive commercial, purely livestock operations have developed.
Large areas of seasonally flooded land or areas capable of being permanently irrigated can be considered as a quite separate ecological zone. On account of the possibilities of out-of-season conservation of fodder and the quantities of crop and agro-industrial by-products potentially available, these are important livestock producing areas.

Livestock production systems

In Africa, it is possible to distinguish two major types of production systems. These are the traditional systems and the modern ones. Some major characteristics of each group of systems are provided in Table 1. The two groups differ essentially in their use of the main factors of production, with traditional systems using mainly land and labour while modern systems also have large capital requirements and generally a lesser requirement for one or other of the remaining factors.

Two principal criteria serve to define traditional systems. The first is the degree of dependence of the household or the production unit on livestock or livestock products either for household income or for food supply. The second is the type of agriculture practised in association with livestock production. The distance and duration of movement (transhumance, migration) might also be used to define systems and it is recognised that this is an important aspect of management within a system. It is considered to be a secondary one, however, subordinate to the two major ones just discussed.

Rather arbitrary limits have been set to define the systems. A system in which more than 50 per cent of gross household revenue or more than 20 per cent of total household food energy derives directly from livestock is considered to be a pastoral one (Wilson, de Leeuw & de Haan, 1983). The term "derived from livestock" in relation to revenue would also include the value of any transport (donkeys carrying firewood, camels carrying salt, etc.) plus sales or exchange of manure plus income from any other minor functions.

An agro-pastoral system is one in which between 10 and 50 per cent of household revenue derives from livestock or livestock products. A third, agricultural, system be one in which revenue from livestock amounts to less than 10 per cent of the total. In the modern African context, one must not omit the urban or peri-urban systems. These last are assuming increasing importance in many countries and one may cite the cases of Nouakchott and Djibouti for camel dairies, Khartoum and Mogadishu for goat production, and Ethiopia and many west African regional centres where donkeys provide transport of domestic fuel and building materials.

Table 1 A classification of small ruminant production types and systems in tropical Africa

Type	System	Macro-management	Main production factors	Nutrient source
Traditional	Pastoral	Nomadic/Semi-sedentary	Land	Range
	Agro-pastoral	Transhumant/Sedentary	Land/Labour	Range/Crop by-products
	Agricultural	Sedentary	Labour/Land	Crop by-products/Household waste/Forage
	Urban	Sedentary	Labour	Household waste/Feed
Modern	Ranching	Sedentary	Land/Capital	Range/Forage
	Feedlot	Sedentary	Capital/Labour	Feed/Forage
	Dairy farm	Sedentary	Capital/Labour/Land	Feed/Forage
	Station	Sedentary	Land/Labour/Capital	Range/Forage/Feed

Within the pastoral system, three major sub-systems can be identified. The first is a pure system in which little or no agriculture is practised. Examples are the camel cultures of the northern Sahel and (at least until the 1960s) the Masai system in eastern Africa. In the pure system, mobility is often high, and long distances might be covered in search of grazing and water. The second pastoral sub-system is found in the semi-arid regions and is one in which livestock production is associated with dryland or rainfed agriculture. Examples of this system are many of the Fulani groups of West Africa, most Baqqara in Sudan, and the Wagogo in Tanzania. In the livestock-rainfed agriculture system, cattle, sheep and goats are often of equal importance and donkeys provide many of the needs of transport. Draught animal power (oxen, donkeys and occasionally horses) and the use of, or exchange of, manure are important elements of this major sub-system. The third pastoral sub-system is associated with oases or with large irrigated areas. Some Touareg groups, the Macina Fulani of the Niger inundation zone in Mali, a number of Nilotic tribes in southern Sudan and areas in Zambia and Mozambique provide examples of this sub-system.

In the agro-pastoral system, livestock are usually sedentary or, if movement is part of the management practice, it is generally restricted to short distances. The three major sub-systems here are those associated with rainfed subsistence agriculture, rainfed cash cropping, and large-scale permanent irrigation of cash crops.

Some examples from West Africa of these different production systems are provided in Table 2 (Wilson, de Leeuw & de Haan, 1983) and a more detailed analysis of Systems in the sub-humid zone of Côte d'Ivoire is shown in Table 3 (adapted from von Bassewitz, 1983).

Table 2 Characteristics of small ruminant production Systems in West Africa

Characteristic	Pastoral System			Agro-pastoral Systems		
	Pure	Associated with rainfed agriculture	Associated with irrigation	Associated with subsistence rainfed agriculture	Associated with irrigation	Associated with cash crop rainfed agriculture
Contribution of livestock to revenue (%)	95	90	60	25	15	10
Rainfall (mm/year)	<400	300-600	Variable	400-800	Variable	700-1400
Relations with agriculture	weak	some cultivation, exhange of manure	own fields cultivated	own fields cultivated, animal traction important, crop residues important		
Number of TLU/100 hal)	0.0 - 3.9	4.0 - 17.9	10.0 - 27.9	4.0 - 9.9	10.0 - 17.9	4.0 - 17.9
Carrying capacity						
people	very low	low/medium	high/very high	medium	high	medium
animals	low	low/medium	medium/high	low/medium	medium/high	medium/high
Ratio TLU:person	0.0 - 1.6	0.4 - 1.6	1.2 - 1.6	0.4.- 1.2	0.4 - 1.2	0.4 - 0.8
Mobility	high, no fixed base	medium/fixed base	high in wet season	Low and for short distances at main cultivation season		
Importance						
Mali	high	medium	medium/high	high	high	high
Mauritania	high	low	1ow/medium	medium	low	low
Niger	high	high	low/medium	medium	low	medium
Senegal	low	low	low/medium	high	low/medium	high
Burkina Faso	low	medium	low	high	low	medium/high

Note: 1) TLU is a Tropical Livestock Unit of 250 kg live weight equivalent.
Without being able to provide precise figures, it is probable that in the arid zone 70 per cent of small ruminants are found in pure pastoral Systems and 30 per cent in agro-pastoral Systems. In the semi-arid zones the figures are reversed with 70 per cent of small ruminants in the agro-pastoral Systems. In the more humid areas, virtually ail small ruminants are in the agro-pastoral System with a small percentage being found in the agricultural and urban Systems.
The relative importance of the main domestic species varies across Systems. Camels are important only in the driest pastoral areas. Cattle are probably the main species in ail Systems when these are considered as a whole. In agro-pastoral Systems, goats are generaily more numerous than sheep although only recently is this fact being recognised by the official statistical services.

Table 3 Small ruminant production systems in Cote d'Ivoire

Criteria	System					
	Urban	Vi1lage				Pastoral
		Paid shepherd	Family shepherd	Not herded	Opportunistic	
Day management	Free ranging	Herded	Herded (except dry season)	Free ranging	Free ranging	Herded (except dry season)
Night management	Housed	Housed/penned			Free ranging	Penned
Supplementary feed	Regular (household waste, cut browse, bought by-products)	Regular by means of crop by-products			Occasional by-products	Rare
Mineral feed	Household salt	Household salt, mineral licks			Rare	Salt and licks
Selection and culling	Regular	Often practised			Not practised	Regular
Traditional health care	Regular	Occasionally practised			Not practised	Regular

Flocks are constituted by a great variety of processes. Major methods of acquiring animals include inheritance, gifts, dowry, exchange, leasing and natural increase. In the pure pastoral system, additional animals are bought with money obtained from caravan operations and from salaried employment. In agriculture-associated systems, the money from sales of crops surplus to subsistence is often invested in livestock. Where women may own livestock, they often obtain them by dowry or by income from sales of milk.

As an investment vehicle, small ruminants are often considered as the small change or credit account of a savings plan while cattle constitute the capital account. Many new entrants to the business of livestock production start with small ruminants. In addition, because of their greater resistance to drought conditions and their faster breeding cycle, small ruminants are the first type of animal to become available and be bought by people with a livestock tradition who, for some reason, have lost their stock.

MANAGEMENT

General practices

Until recently, it was widely considered that no management was practised in traditional herds and flocks. This attitude still prevails in some quarters but even a little thought will show its absurdity. Pastoralists are generally better managers than agro-pastoralists or crop farmers who depend only in small part on animals for their livelihood. Nomadism and transhumance are sophisticated responses to a resource which is always in short supply and often totally deficient. Smallholder fattening is equally a reaction to a long or short term excess of resources and often to a spatially and temporarily restricted demand for meat. These two examples are at the outer limits of a whole range of management practices found across the spectrum of ecological zones from extreme arid to very humid.

Table 4 provides some indications of the strategies ("macro-management") and tactics ("micro-management") of management of traditional owners in Africa. With few exceptions, the tendencies follow a logical pattern from dry to wet zones. These tendencies are: nomadism to fattening; free range grazing to totally confined animals; larger flocks in less favourable to smaller flocks in more favourable areas; and sheep in pastoral to goats in agro-pastoral systems. One of the exceptions is the example of highland central Africa (Table 5; Bizimungu, 1986) where goats are more important in the drier and less intensively cultivated areas. Large-scale modern management systems are generally found in the highland areas of Kenya and Zimbabwe but intensive modern feed lots are increasing in numbers in all areas.

Table 4 Ecology and management of goats and sheep in semi-arid Africa

Climatic regime (rainfall) mm		Country/ Ethnic group	"Macro" management	"Micro" management				Size of flock/ herding group	
				Sheep		Goats		Sheep	Goats
				Day	Night	Day	Night		
Arid	(200)	Mauritania/Moor	Nomadic	↑↑	Open camp	↑↑	Open camp	100-500	30- 80
		Ethiopia/Afar			Penned		Penned		
		Sudan/Kababish			Open camp		Open camp		
		Mali/Touareg		Loose flock	Open camp	Loose flock	Open camp		
	(300)	Niger/Touareg	Transhumant	↓↓	↓↓	↓↓	↓↓		
		Chad/Zhagawa			Penned			200-250	40
		Kenya/Turkana					Penned		
Semi-arid	(400)	Ethiopia/Afar			Penned		Penned	50-150	30-100
		Sudan/Baqqara	Semi-sedentary	Tight flock	Penned		Penned/tied	20-60	20- 80
	(500)	Mali/Fulani		Loose flock	Open camp		Penned/tied	200-500	
		Kenya/Masai		Tight flock	Penned	Tight flock	Penned	20-80	40-120
	(600)	Sudan/Daju etc.	Sedentary	Tight flock	Penned	Dry season not herded	Tied	5- 10	5- 40
		Mali/Bambara		Tight flock	Penned/tied	Crop season tight flock	Tied	0- 10	2- 20
		West Africa/"Mouton de Case"	Stall-feeding	Tied	Tied			1- 5	
		Kenya/"Thenges"				Tied	Tied		1- 5

Highlands		Kenya/Large scale farms	Extensive paddocks	Padcfock			500-1000	

Ownership patterns

Patterns of ownership in traditional systems differ widely and are often difficult to understand, especially for someone not a member of the owning group. The ramifications of the numerous African extended family systems, the practices involving "stock friends", loans and flock splitting, and sub-letting the flock to a professional herder usually of a different tribe, all lead to a rather vague idea of who owns which animal. Under these conditions, "ownership" changes many times during the life of an animal. Nonetheless, it is generally true that individual or family ownership is greatest in the dry areas. In West Africa and in Sudan, this essentially means that flock sizes and numbers owned decrease from north to south. In Ethiopia and Kenya, flock sizes decrease with altitude. These trends reflect the systems' differences which change from pastoral in the dry areas to agro-pastoral or agricultural in the better endowed zones.

Table 5 Biophysical characteristics and livestock ownership patterns in highland central Africa

Region and Country	Altitude (m)	Rainfall (mm)	Temperature (°c)	Number of			
				Families	Cattle	Sheep	Goats
Bugorhe, Zaire	2000	1500	<20	483	222	814	940
Giheta, Burundi	1700	1200	20	552	146	821	1232
Gashora, Rwanda	1300	1000	21	445	97	177	1682

Perhaps of more importance, even though the change has been less well recorded, are the increasing numbers of goats and the increasing numbers of people who keep goats as management systems become sedentary. Goats are generally more prolific than sheep and are possibly easier to manage for people with little experience of animals because they are capable of foraging more widely and on more vegetation types. Table 7 (Mosi et al, 1982) are shown ownership patterns in the humid zone of south-west Nigeria while Table 8 provides additional data for Chad and Kenya.

Table 6 Ownership patterns of sheep and goats in the agro-pastoral area in central Mali

Parameter	Irrigated rice sub-system		Rainfed millet sub-system	
	Goats	Sheep	Goats	Sheep
Number of owners studied	27		16	
Number owning sheep or goats	26	15	16	9
Number owning	12		7	

goats but not sheep				
Number owning sheep but not goats	1		0	
Mean flock size[1)]	9.0	6.4	38.2	7.1
+ s.d.	6.03	13.51	27.75	14.81
Mean flock size[2)]	9.3	11.5	38.2	12.6
+ s.d.	5.87	17.0	27.75	18.27
Range in flock size	0-23	0-64	2-91	0-58

Notes: 1) of all owners i.e. irrespective of whether the holding of one species of stock is nil
2) of only those flocks in which animals are held, i.e. nil holdings excluded
During the last few years (although again official statistics do not yet show this), it is probable that the goat population has increased absolutely and relatively more quickly than the sheep one. This is probably due to the generally higher reproductive rate of goats and their less demanding dietary requirements.

Table 7 Patterns of small ruminant ownership in the humid zone of south-west Nigeria

Item	Forest	Derived Savanna
Percentage of farmers owning small ruminants	73.0	20.0
Mean flock sizes		
Goats only	2.8	3.7
Sheep only	2.0	0.0
Mixed flocks	5.1	5.3

When calculated on the same basis of unit weight or unit metabolic weight, goats are usually less productive than sheep in terms of meat but their better milk yield makes them a more attractive proposition to livestock owners who keep only a few animals. In traditional systems, it is probable that goats will continue to expand in relation to sheep for the foreseeable future. In modern systems there is still some resistance to goats, especially in Kenya, but even here the attitude is changing and meat goats and Angoras for mohair production are beginning to make their appearance.

Table 8 Livestock ownership (numbers per household) in agro-pastoral and pastoral societies in Kenya and Chad

Species	Kenya		Chad		
	Masai pastoral	Karapokot agro-pastoral	Zioud pastoral	Salamat agro-pastoral	Gondeye-Tchein agro-pastoral
Cattle	157.3	11.8	36.4	133.3	2.1
Sheep	44.0	5.4	43.5	2.0	1.3
Goats	83.1	13.6	45.0	46.3	4.7

Flock structures

In earlier times, "prestige" and "perverse supply" were terms often used, usually in a derogatory manner, to describe the behaviour of traditional owners in relation to their animals. African livestock owners are undoubtedly conservative but it is doubtful if they are more so than their counterparts in Europe, the Americas and Australia. Their reasons for keeping stock are rarely irrational and are related to their particular needs either in the long or in the short term. This hypothesis can be supported in regard to the age and sex structure of flocks. Whatever the major objective of the keeping of sheep and goats, there is always a preponderance of females in the flocks while minor differences in sex and age structure are maintained. It needs to be emphasized that almost all animals in the flocks are "productive" whether that production consists of giving birth to young, providing wool or hair, producing milk, or simply undergoing the process of growth to a size at which another product becomes the principal one.

Table 9 provides some examples of flock structure related to production objectives. With the exception of the Afar of Ethiopia (the Afar in Djibouti have a similar strategy) and the case of pelt production in Botswana, all flocks have 70 to 75 per cent of the total as females and about 55 per cent of the flock is comprised of females of breeding age. In five ethnic groups in Mali covering the whole range of systems, females ($x \pm s.d.$) accounted for 74.7 + 3.07 per cent of the flock and breeding females 54.3 ± 2.43 per cent. Contrary to another article of conventional wisdom, there are very few old females in the flocks: in large pastoral flocks, this class of animal is rarely in excess of 5 per cent and in small agro-pastoral flocks it is never more than 10 per cent.

Table 9 Flock structures in relation to management objectives (as per cent of animals)

Region/ Ethnic group	Sheep					Goats				
	Use	Males		Females		Use	Males		Females	
		Total	Castrated	Total	Breeding		Total	Castrated	Total	Breeding
Mauritania/Moor	Meat/Hair	22.9	6.2	78.1	58.6	Milk/Meat	20.2	1.2	79.8	55.1
Mali/Fulani	Meat/Wool	25.5	11.3	74.5	55.9	-	-	-	-	-
Chad/"Arab"	Meat/Milk	26.7	"few"	73.3	53.7	Milk/Meat	28.3	"few"	71.7	48.1
Sudan/Baqqara	Meat	22.2	0.0	77.8	57.7	Milk/Meat	23.6	0.0	76.4	51.2
Kenya/Masai	Meat/Fat	31.4	15.4	68.6	54.2	Meat/Fat/Milk	33.8	10.3	66.2	48.3
Botswana/Tswana	Pelt	13.2	0.6	86.8	64.5	-	-	-	-	-
Ethiopia/Afar	Milk	7.8	0.0	92.2	61.4	Milk	3.3	0.0	96.7	65.5

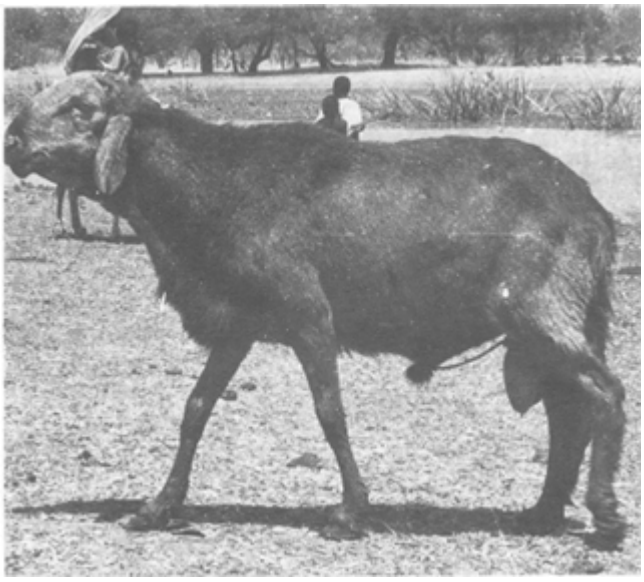

Figure 7 A Sudan Desert ram in Southern Darfur with a 'Kunan' to prevent breeding

Figure 8 Leather apron to restrict breeding on a Masai buck in a Kenya flock

The major management practice used to obtain this stability of structure is the early culling of males not required for other productive functions. Such young males are sold or slaughtered for home consumption. The numbers of males of breeding age and whose function is reported as "reproduction" are usually, and strictly speaking, in excess of those required: numbers are not excessively high, however, in view of the insurance required against sterile and temporarily infertile males. Other mature males fulfil a productive function whether this is the provision of wool for Macina Fulani, hair for Moors, or fat for Masai. In the humid zones, proportions of females may exceed 80 per cent in the derived savanna areas and 85 per cent in true forest areas. insurance required against sterile and temporarily infertile males. Other mature males fulfil a productive function whether this is the provision of wool for Macina Fulani, hair for Moors, or fat for Masai. In the

humid zones, proportions of females may ex- ceed 80 per cent in the derived savanna areas and 85 per cent in true forest areas.
Stratification of flocks is not common in traditional societies. Where breeding control is required it is achieved by a variety of means including the 'kunan' (Figure 7) in northern and western Africa and an apron (Figure 8) in eastern Africa. In some ethnic groups where small ruminants are the principal animal wealth, there exist sophisticated Stratification patterns, one example for the Macina Fulani being provided in Table 10.

Table 10 Stratification of Macina flocks in Mali, with demographic characteristics of each

Name of unit	Group size	Use	Composition			Notes
			General	Males	Females	
Beydi	Generally small	Nurse flock	Newly lambed females, advanced pregnancy, weak and aged animals	26	74	Kept in village. Herded by infants. Regular movements of animals into and out of group
Tarancaradji	Medium	Sale/slaughter	Largely male, generally young, with some older females	60	40	Kept in village, generally not herded
Njarniri	Small	Slaughter	Overwhelmingly male	95	5	Individually tied and zero grazed. Responsibility of women
Bucal	Medium	Milk	Predominantly female	25	75	Individual ownership, commonly grazed on reserved pastures by family labour in rotation. Household milk supply. Most of village goats are in this group.
Bendi						Similar to Bucal. Term used mainly by hair sheep owners
Horey	Large	Wool/meat	Predominantly female	24	76	Main flocks which transhume. Reserve for constitution of other groups as required. Milked by herders for own use.

ADAPTATION AND INTEGRATION OF SMALL RUMINANTS IN AFRICAN SYSTEMS OF PRODUCTION

UTILIZATON OF RESOURCES

Any degree of utilization of the natural vegetation involves modifications to its composition. Such modifications are often referred to as degradation. Where such degradation occurs there is often a gradual change in the combination of domestic ruminant species in favour of small ruminants and in particular the goat. This is one of the. main reasons why goats are blamed for desertification. Small ruminants compete with other domestic species for the resources available. They are however complementary to other species with regard to forage resources consumed and the height at which the forage is found. For this reason higher total biomasses of domestic livestock can be maintained, resulting in higher incomes from livestock production for owners. The production of more than one species of domestic animal enables maximum utilization to be made of grass and browse cover across and within years. An illustration of the complementarity of the two major feed strata in the Sahel zone is given in Figure 9. The browse layer, such as *Boscia Senegalensis,* is consumed by goats (87 per cent of feeding time being spent on the browse layer) and camels, whilst sheep (59 per cent of grazing time) and cattle graze on the annual grass *Schoenefeldia gracilis.* In this system in the southern Sahel, crop residues supplement the total forage resources and cattle spend 43 per cent of their annual grazing time on stubbles, with goats and sheep spending1 per cent and 2 per cent of their time respectively. Crop residues are available from January onwards, during the dry season, when the quantity and quality of natural feed resources are mediocre.

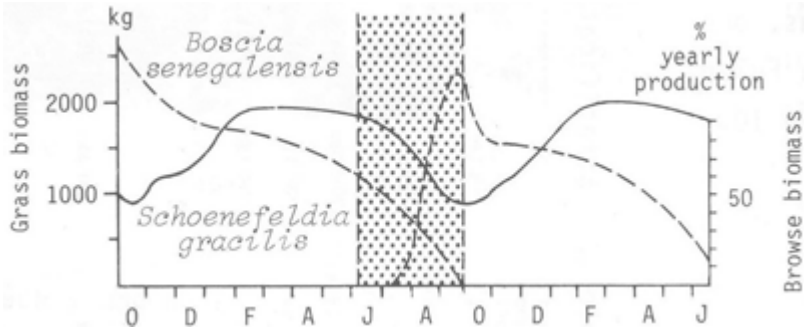

Figure 9 Complementarity of biomass production curves in fodder species in the browse and field layers

Table 11 Contribution of different fodder sourees (per cent) to the diet of domestic herbivores in Kenya

Species	Field layer	Dwarf shrubs	Browse layer
Camels	3	56	34
Cattle	96	4	0
Goats	38	21	18
Sheep	58	25	2
Donkeys	71	22	0

Recent surveys carried out in kenya further demonstrate the complementarity of domestic species with regard to the utilization of forage resources. The time spent by each of five categories of livestock on three elements of the rangeland resource are given in Table 11 (Schwartz & Said, 1986). Data provided by a related survey (Figure 10) indicate the feeding height of camels, goats and sheep.

A mixture of species on semi-arid rangelands, for example, makes it possible to reduce the stocking rate of 26 hectares per tropical livestock unit (a TLU is equivalent to 250 kilograms live weight) for cattle alone to 13 hectares per TLU when cattle and goats are reared together and to 10 hectares per TLU when camels are included (Schwartz, 1983). In order to maintain these stocking rates, the ratio of one species to the other in terms of TLU should be 1.0:1.0:0.3.

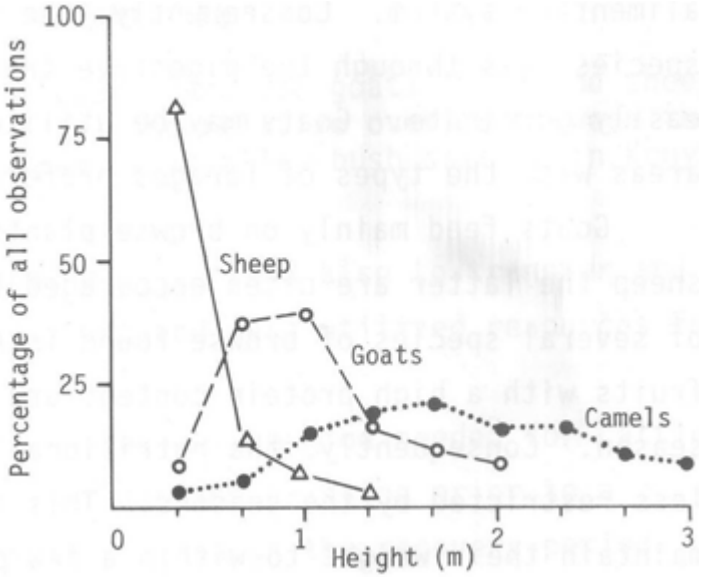

Figure 10 Feeding times at different heights above ground level by three domestic ruminant species

Goats walk long distances in search of food and feed on a wider range of vegetation types than do other domestic animals living in the same environment (Table 11). Even when they graze at the same height as sheep and cattle, the overlap of species eaten is not very great (Figure 11 and Figure 12). When feeding, goats nibble rather than bite due to the anatomy of their muzzles and jaws. They are selective feeders, eating mainly leaves, flowers and fruits as opposed to stems and other permanent parts of plants. For this reason they cause little damage to the plant structure unless the vegetative biomass is already greatly reduced. Goats ruminate less effectively than sheep or cattle and food passes faster through their alimentary system. Consequently, the seeds of their preferred plant species pass through the digestive tract more or less intact and can easily germinate. Goats may be utilized in this way to seed denuded areas with the types of forages preferred.

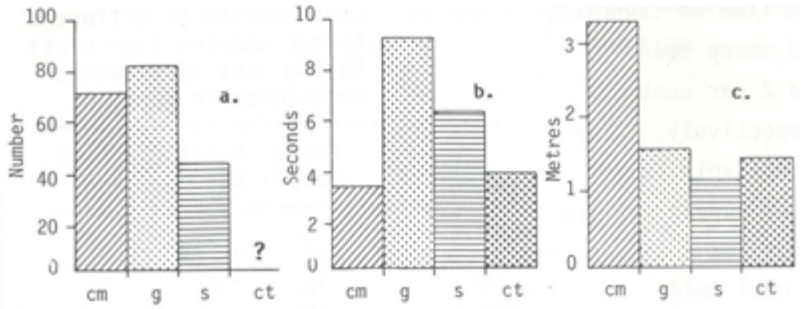

Figure 11 Feeding behaviour of four domestic animal species in Kenya in relation to: a. number of species in diet; b. time spent at each feeding station; and c. feeding height

Goats feed mainly on browse plants and when herded together with sheep the latter are often encouraged to do likewise. The phenology of several species of browse found in Africa is such that leaves and fruits with a high protein content are available during the dry season. Consequently, the nutritional needs of small ruminants are less restricted by the seasons. This is reflected in their ability to maintain their weight to within a few per cent of their annual average as compared to cattle (Figure 13). Seasonality of breeding is also less marked than for cattle, this probably also being related to nutritional status.

In zones in which agriculture is an important part of the system, the feeding habits of goats are an additional advantage. They spend less than 30 per cent of the time spent by sheep and only 5 per cent of the time spent by cattle feeding off crop residues (Table 12; Wilson, de Leeuw & de Haan, 1983). This therefore enables cattle to benefit directly from the farming system and also to transfer and convert, through their manure, distant and less utilized resources for the benefit of man.

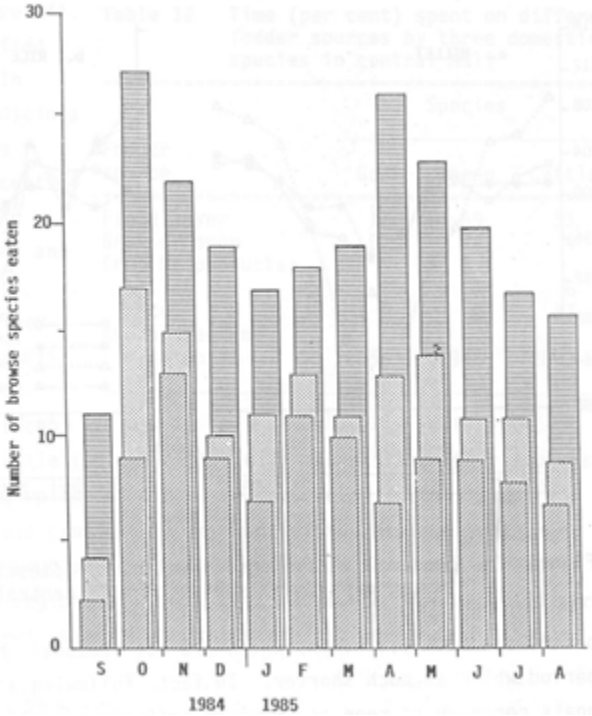

Figure 12 Dietary range of goats (?) and sheep (?) and relative overlap between the species in a low-bush savanna in Kenya

It has been estimated that the recovery period needed for cattle to attain the number and level of production existing prior to a drought could be as long as 40 years (although the recovery period following the notorious 1968-1973 drought in the Sahel was less than 10 years in most cases). Small ruminants, due to their lower mortality rate, their shorter gestation period, reduced generation period and multiple births which are not seasonal, have a recovery period which is much shorter. In fact, following a severe drought, goats conceive as soon as there is sufficient humidity for the growth of leaves on browse plants, kid five months later, and consequently produce milk for human consumption at a very early phase of the recovery cycle. In numerous instances, they are a source of food before cereals are ripe for harvesting.

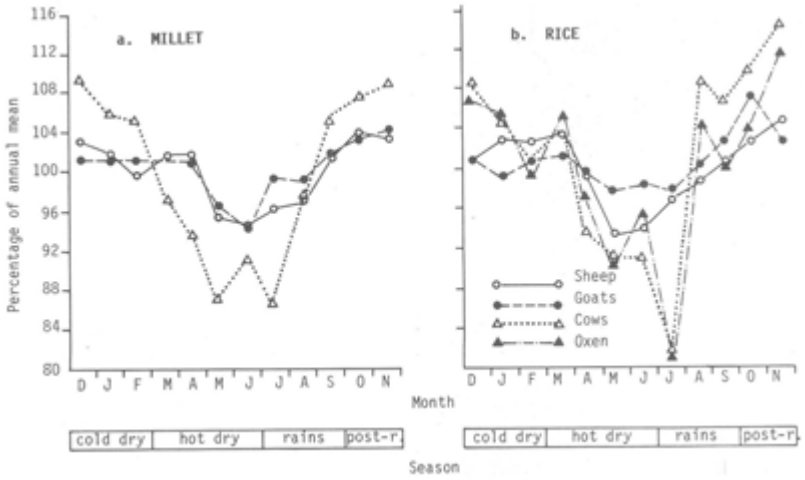

Figure 13 Seasonal variations in weight of domestic ruminants in two agro-pastoral sub-systems in central Mali

CONTRIBUTION TO MAN'S WELL BEING

Small ruminants are not only advantageous to man during periods of cyclical and unpredictable food shortages. They are also adapted to balancing the energy and protein supply during normal variations occurring over the years as well as between different seasons.
In Mali, goats provide about half the total quantity of meat sold to consumers living in the towns, the greater part of this being available towards the end of the dry season when there is little beef on the market (Figure 14). In Kenya in a modified traditional system in which veterinary medicines were provided, goats contributed 18 per cent of the minimum calorific requirements (in meat and milk combined) of the human population. They were surpassed by camels (27 per cent) but contributed more than sheep(12 per cent) and cattle (16 per cent), with cereals and other sources (27 per cent) making up the remainder of the diet. In this same Rendille system, goats provided 33 per cent of the minimum protein requirements even though protein availability was in excess of that required. In other regions of Kenya, goats accounted for about 75 per cent of the total meat consumption in pastoralist households (Figure 15 ; Schwartz, 1985).

Table 12 Time (per cent) spent on different fodder sources by three domestic species in central Mali

Fodder source	Species		
	Goat	Sheep	Cattle
Field layer	11	59	53
Browse cover	87	34	4
Crop by-products:			
millet	2	7	6
rice	0	0	37
Annual feeding time (hr)	2051	1948	2883

Small ruminants produce lower absolute quantities of milk than do cattle. Taking into account body weight or metabolic weight, however, their milk yield is higher than other species, with perhaps the exception of the camel. These minor supplies are, when all else fail, available during the most difficult periods of the year as is shown in Figure 16 for the Sudan and Table 13 (Coppock et al, 1982) for Kenya.

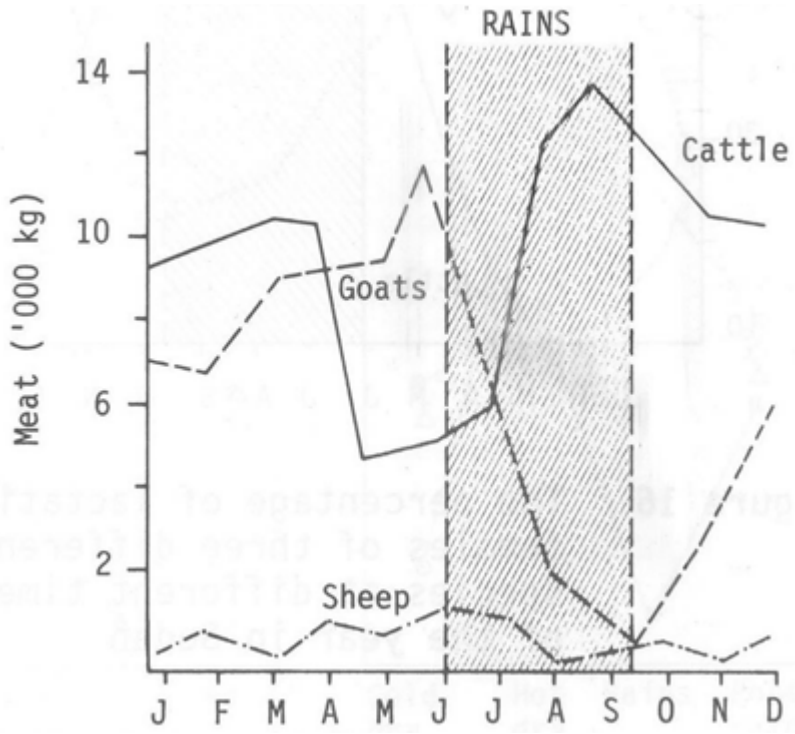

Figure 14 Contribution of domestic ruminant species to the meat supply of a central Mali town

At the beginning of the 1970s, the publicity given to the drought in the Sahel focused international attention on the fragility of the food supply system in Africa. The droughts of the early 1980s, which mainly affected Ethiopia but which also affected the Sahel as well as Sudan, have again resulted in famine situations. During both periods, 80 per cent or more of cattle were lost, according to reports, while small ruminant losses did not exceed 50 per cent.

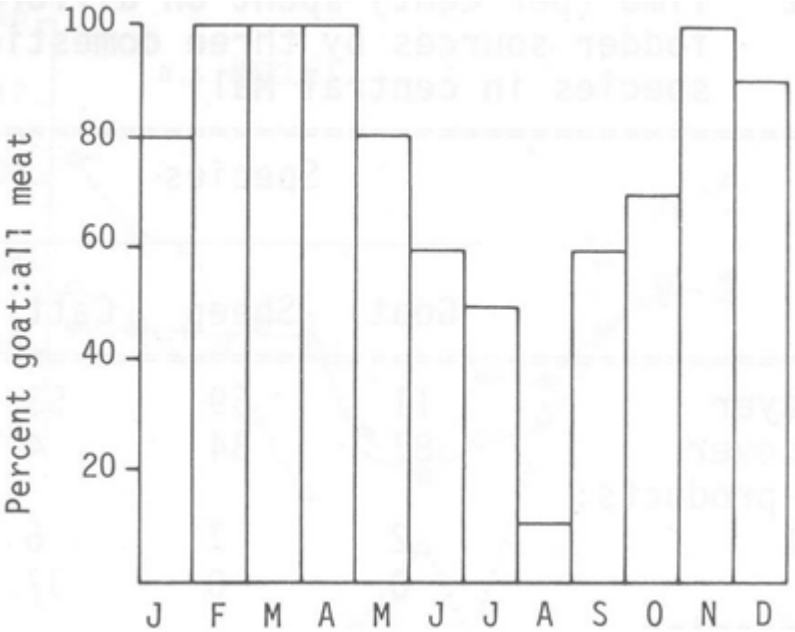

Figure 15 Proportion of goat meat to all meat eaten in 60 Kenya pastoral households

The products obtained from an animal may be expressed as a productivity index. Some generally accepted indices are the live weight of young produced by a breeding female per year, per kg of breeding female per year and per kg metabolic weight of breeding female per year. Some calculated productivity indices are given in Table 14 for Mali for four species of domestic ruminants. These figures, collected over a six year period between 1978 and 1983, clearly demonstrate the relative effectiveness of the short term utilization of each of these species in this environment. The annual and seasonal responses are different for each species, however, and in general seem to complement each other (Figure 17, Table 15). It is evident that fluctuation in productivity is considerably reduced when the livestock holding consists of several rather than of a single species.

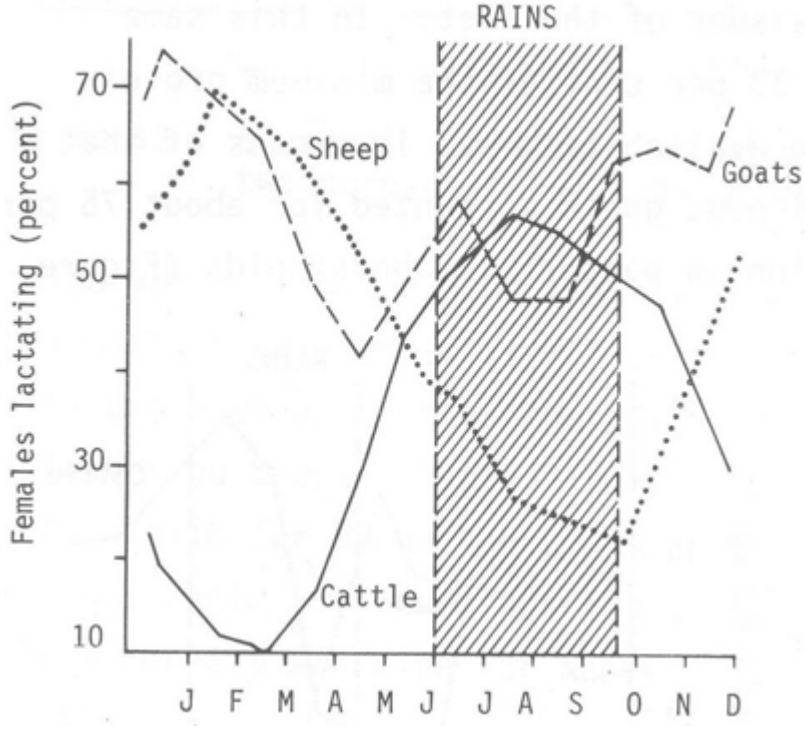

Figure 16 The percentage of lactating females of three different species at different times of the year in Sudan

Table 13 Seasonal contribution to human milk supply (per cent) by different livestock species in Turkana, northern Kenya

Species	Wet season	Dry season
Camels	45	70
Cattle	12	10
Goats + Sheep	43	20

The major advantages of including small ruminants in mixed species guilds are evident during a prolonged period of drought. The two species of small ruminants appear to withstand drought better than cattle although there exist regional and breed variations with regard to the ability of sheep and goats to do so. Table 16 (Campbell, 1978) provides the figures for cattle, sheep and goats in the region inhabited by the Masai in Kenya following the drought of the mid 1970s. Although the Masai are generally considered to

be cattle breeders, the importance of goats and sheep is clearly emphasized by the number of people who keep them. The resumption of breeding by these two species following a drought guarantees food in the form of milk even before cereals can be harvested. In more general terms, the role of goats and sheep as a continuous source of protein during and immediately following a period of drought is demonstrated in Table 17. The overall demand for meat in four West African countries remained constant throughout the drought period but the relative and overall contribution of goats and sheep increased.

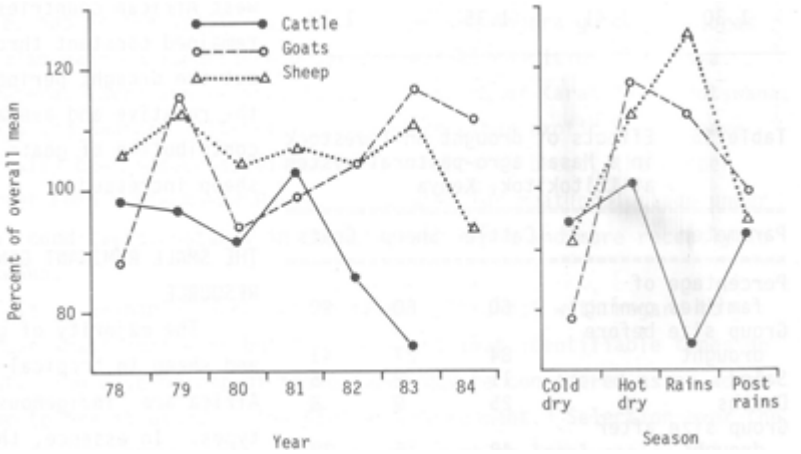

Figure 17 Comparative annual and seasonal productivity indices for cattle, goats and sheep in central Mali

Table 14 Productivity indices for different livestock species in Mali

Species	Annual index		
	per breeding female	per kg of breeding female	per $kg^{0.73}$ of breeding female
Goats	18.7	565	1.47
Sheep	29.5	888	2.31
Cattle	41.2	173	0.76
Camels	43.6	125	0.61

Table 15 Ratios of variation (maximum: minimum) of productivity indices for three domestic species in Mali

Cattle	Goats	Sheep	Overall
Year (1978-1983)			
1.29	1.54	1.14	1.16
Season			
1.30	1.41	1.35	1.13

Table 16 Effects of drought on livestock in a Masai agro-pastoral system at Loitokitok, Kenya

Parameter	Cattle	Sheep	Goats
Percentage of families owning	60	80	90
Group size before drought	84	27	41
sales	11	2	5
Deaths	25	9	8
Group size after drought	48	16	28
Per cent of animals after drought	57	59	68

The majority of goats and sheep in tropical Africa are "indigenous" types. In essence, this means that they have been naturalized for several thousands of years, although both species were originally domesticated in Asia (Epstein, 1971).

Table 17 Contribution of sheep and goats ('000 head) to recorded slaughter in four Sahel countries before and after a drought (per cent of total TLUs)

Country	1973			1976		
	Sheep	Goats	Sheep and Goats	Sheep	Goats	Sheep and Goats
Mauritania	21	4	16	10	3	23
Mali	80	23	22	90	38	30
Niger	62	79	56	33	89	73
Chad	56	10	15	55	13	19
Total	219	116	35	188	143	43

Recent importations -- in the last 150 years -- of specialized types of small ruminants have been mainly for modern commercial operations. The Republic of South Africa has been foremost in this movement but there are large populations of Merino sheep in Kenya and Zimbabwe and of Karakul sheep in Namibia. Merinos are also important in Lesotho in the small-scale sector, as are Angora goats. Angoras are also gaining importance under commercial conditions in Kenya. Elsewhere, there are relatively small numbers of Karakuls in Botswana, Angola and Rwanda. Attempts to introduce other exotic breeds have generally been unsuccessful but a new composite breed, the Dorper (Dorset Horn x Blackhead Persian), is used for meat production under local conditions, notably in Zimbabwe and Kenya and more recently in Botswana.

It is probably incorrect to talk of "breeds" with regard to African small ruminants but it is evident that identifiable types do exist. The development of these types may be considered as an adaptation to the stresses of the African environment. Selection over the centuries has been on their ability to adapt to local ecological conditions and to meet the production requirements of their owners.

Until recently, blood grouping and chromosome mapping have been little studied but increased interest is currently being shown in this field and it is certain that in the near future some light will be thrown on the relationships between one type of sheep and another.

Figure 18 A castrated West African Long-legged goat in Burkina Faso

Goats

Indigenous goats have been classified into two main groups, the long-eared and short-eared (Mason & Maule, 1960). This is not a particularly useful system and a more appropriate one ascribes goats to large, small and dwarf types (Devendra & Burns, 1983). Large types, which may also have disproportionately long legs (Figure 18) are found along the southern fringe of the Sahara and also in southern Africa; the small types are mainly distributed in eastern Africa; and the dwarf types, which are also to some extent tolerant of trypanosomiasis, are found mainly in humid West Africa (Figure 19). Dwarf types are usually more prolific than the small and large types.

The normal regional distribution and major production aptitudes of some goat types are shown in Table 18. Variation in the productive efficiency of goats is due not only to animal type but also to the environment and management.

Other than meat, skins and milk are the two major products of goat production. Constant attempts have been made to improve indigenous goats by outcrossing to non-African breeds for the production of milk, meat or fibre. These have in general failed except in cases where artificial conditions have been created for the purely exotic types and the progeny of the crossbreeding. Possibilities for improving milk or meat production exist by the utilization of some indigenous breeds such as the Boran or Galla of northern Kenya or the Boer of southern Africa.

Figure 19 Distribution of major goat types in tropical Africa

Table 18 Areas of distribution and production aptitudes of some African goat types

Type	Country:Zone	Production
Sudan Desert/Sahel	Senegal-Sudan: arid, semi-arid	Meat, milk
Maradi/Red Sokoto	Niger/Nigeria: southern semi-arid	Skins, milk and meat
Nubian	Sudan: riverain, urban	Milk
Afar	Ethiopia: arid, semi-arid	Milk
Small East African	Kenya: highlands	Milk, meat
Mubende	Uganda: highlands	Skins, meat
Boer, Boran	Kenya: highlands	Meat, crossing
Angora	Lesotho, Kenya: mountains, highlands	Mohair

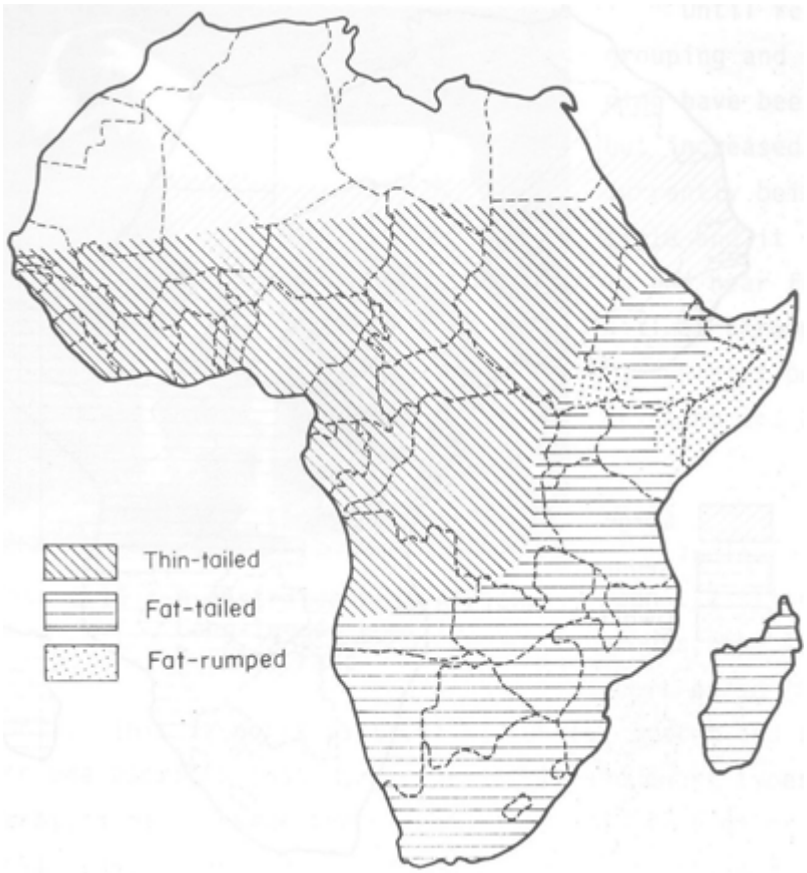

Figure 20 Distribution of major sheep types in tropical Africa

Table 19 Areas of distribution and production aptitudes of some African sheep types

Type	Country:Zone	Production
Black Maure/Zhagawa	Mauritania-Sudan: arid	Meat, hair
Sudan Desert	Sudan: desert fringe	Meat, milk
Sahel	Senegal-Chad: semi-arid	Meat, (skins)
Macina	Mali: inundation zone	Wool, meat
Afar	Ethiopia: semi-arid	Milk, (meat)
Masai	Kenya: semi-arid highlands	Fat meat (skins)
Djalionké	West Africa: sub-humid, humid (trypanotolerant)	Meat
Sahel x Forest/Nilotic	Mali/West Africa:	Meat-supplemented
	semi-arid, sub-humid	
Blackhead Persian	Kenya: semi-arid	Meat, crossing
Karakul	Botswana: arid	Pelts

Sheep

African sheep are usually described as thin-tailed, fat-tailed or fat-rumped (Mason & Maule, 1960) and thin-tailed are sometimes further segregated into hairy or woolled types (Epstein, 1971). Thin-tailed sheep are

commonest in the northern dry tropics where they are usually of large size or in the western humid areas where they are smaller and often referred to as dwarf or forest sheep. Fat-tailed types predominate in eastern Africa as far south as Mozambique. Fat-rumped types are commonest in traditional systems in north-east Africa, but have spread in commercial systems to Zimbabwe and other countries of the southern region (Figure 20).

The major production aptitudes of African sheep and the general type of environment in which they are found are given in Table 19.

There appears to be little reason at present in Africa to attempt an improvement of sheep by utilizing non-African breeds. In areas of favourable climate, however, as in the East African highlands and Zimbabwe, such an improvement may be justified. An example is the crossing of the Dorset Horn with the fat-rumped Blackhead Persian in order to increase the prolificacy and the growth rate of the latter. Under ideal climatic or management conditions, a direct introduction of exotic sheep could be considered.

PART TWO
SMALL RUMINANT TYPES/GOATS

LARGE GOATS

BOER

Synonyms. Africander; Afrikaner [both now uncommon].
Origins. Conformation and colour suggest a crossing of Dutch and Indian goats with local Bantu stock as the parents of this goat. The "improved" type dates from the 1920s although the name Boer was first used in the mid-19th century to distinguish short-haired goats from the recently imported Angoras. The modern Boer was developed in the Eastern Cape Province of the Republic of South Africa. A breed society was established in 1959.
Sub-types and races. Ordinary; Long-haired; Polled; Native; Improved ("Ennobled"). The Pafuri goat of western Mozambique results from crossing of a small number of Boer males on the Landim.
Distribution. Southern Africa. The Republic of South Africa has exported animals to Lesotho, Swaziland (Figure 21), Botswana (Figure 22), Mozambique, Zimbabwe and Namibia. Also in Kenya and in very small numbers in Burundi. Imported to Tanzania (Tanganyika) in the 1950s and subsequently used, with the Kamorai in the development of a "blended" goat.

Figure 21 A Boer buck imported from South Africa to a private flock in Swaziland

A "few dozen" in West Germany (from where exported to South-east Asia and to Rwanda). Total population might be 5.0 mil1ion of which about 2.2 million of "improved" type.

Figure 22 Boer females imported from South Africa to the Sunnyside Ranch of the Animal Production Research Unit in Botswana (note horn shape in doe on right)

Ecological zones. The Boer does best in arid areas although the improved type, at least, does not do well in really hard conditions outside the Republic of South Africa.

Management systems. Agro-pastoral, pastoral and ranching. Flock sizes large to very large under ranching conditions.

Physical characteristics. Large size 75-80 cm. Weight: male 120-140 kg; female 70-90 kg.

Head strong, forehead prominent (Figure 23), soft eyes, profile markedly convex particularly at lower end, wide nostrils.

Horns present or absent in both sexes: strong in males (black colour preferred) and of medium length with open homonymous twist with straight axis projecting backwards and outwards; lighter, scimiter shaped and backward curving in female. Ears medium-long and broad, lopped; shorter

or vestigial ears encountered in common stock. Toggles absent. Beards in males but not usually maned; females not bearded.

Figure 23 Profile, horns and earns of a male Boer goat

Neck of moderate length. Chest broad and deep. Withers higher than or level with sacrum. Back long, usually slightly dipped. Croup broad and long, not sloping. Strong rather short legs. Udder well developed. Testicles in unsplit scrotum.

Colour of improved type is white except for red head and part of neck: broad white blaze on face preferred. Common goats have more variable colours including spots on body and legs. Coat of short, stiff hair except long-haired type.

Products. Meat; (milk); (skins).

Productivity.

REPRODUCTION. *First kidding:* 12 months. *Kidding interval:* 12 months. *Multiple births:* common; single 43 per cent, twin 50 per cent, triplet 7 per cent. *Litter size:* 1.64. *Annual reproductive rate:* 1.64. *Oestrus cycle:* 22.0 ± 0.03 days with heat lasting 26.7 hours; seasonally polyoestrus with heats longer in autumn than spring and early summer. *Ovulation rate:* 6.0 ± 2.6 after treatment with PMS/HCG.

Spermatogenesis commences in males at 84 days, sperm in epididymis at 140 days and spermatozoa in ejaculate at 157 days: first successful mating at 168 days. Artificial insemination successful in getting 71 per cent of does pregnant with average of 1.9 kids per birth (200 x 10^6 sperm per dose).

GROWTH. *Birth weight:* 3.0-5.0 kg; singles 4.5, twins 3.9, triplets 3.5 kg. *Weight for age:* male; 100 days-30 to 33, 6 months-40 to 50, 8-64, 12-92, 18-117 kg.

Weight at 100 days in improved flocks in South Africa increased from 24 to 32 kg for males and 22 to 28 kg for females between 1970 and 1982.

MILK. *Lactation length:* 120 days (Figure 24). *Yield:* when supplemented with 2.7 kg of 4:1 mixture of lucerne:maize meal does suckling singles gave 1272 g/d (160.3 kg total yield) and suckling twins 1811 g/d (228.1 kg). *Composition:* DM 15.7 per cent; fat 5.7 per cent; protein 3.1 per cent;

lactose 6.1 per cent; ash 0.9 per cent. Hand-milked does yielded one-third (476 v 1551 g) of suckled does
MEAT. *Dressing percentage:* 48 at 8-10 months, 56-60 at mature ages. Carcass of 23 kg preferred from goats 6-15 months old.
SKINS. Three types are recognised: fine-fibred from short-haired goats in hot areas; medium-fibred used primarily for shoes; and coarse-fibred from long-haired goats in cold areas and used for handbags, suitcases and furniture.

> NOTE: The few data available from outside the Republic of South Africa for the Boer goat usually indicate performances considerably inferior to those recorded here.

Research. Secretary, Boer Goat Breeders' Association, P.O.Box 282, Somerset East, 5850 Republic of South Africa. Other research in Germany, Botswana, Burundi, Zimbabwe and Kenya.

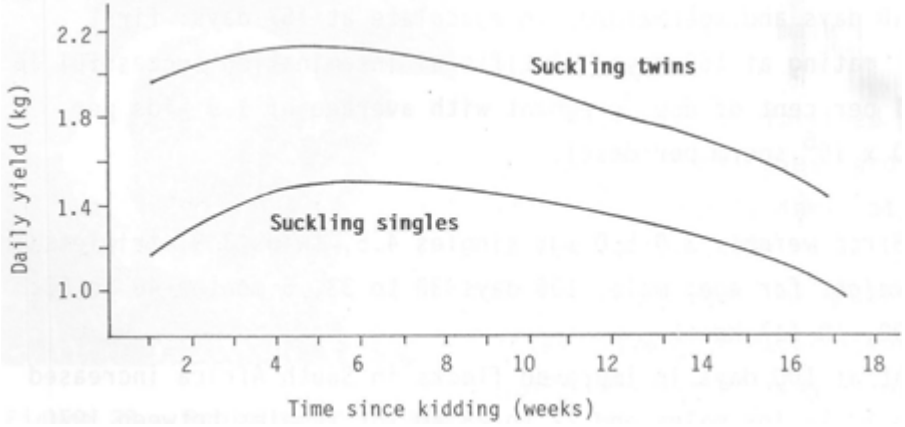

Figure 24 Lactation curves of Boer goats with different litter sizes.

References. van Rensburg, 1938; Hofmeyr, 1965; Hofmeyr et al, 1965; 1966; Skinner, 1972; Ueckermann, Joubert & Steyn, 1974; BGBA, 1984; Das, 1989; R. Lawrenz, pers.comm.

PAFURI

Origins. Results from crossing Boer males on Landim females. The Boers were introduced from the northern Transvaal in 1928. An attributed origin to the Nubian is probably erroneous.
Distribution. Restricted to a small area known as Pafuri (hence the type name) in south-west Mozambique near the border with South Africa and Zimbabwe. Total population is not known but numbers are probably very few.
Ecological zones. Semi-arid to arid sub-tropical with annual precipitation of less than 400 mm falling in one short season.
Management systems. Agro-pastoral to pastoral transhumant. The area of occurrence is thinly populated and there is limited cultivation of millet and some sorghum.
Physical characteristics. Large size. Weight: male 60 kg; female 43 kg. Head with convex profile.
Horns in both sexes: well developed in males and diverging; smaller and scimitar shaped in females. Ears medium-long and lopped or semi-lopped with rounded tips. Beards in males and females.
Neck strong and well set on both top and bottom lines. Back straight. Legs strong and well developed. Udder well rounded with large teats.
Colour very variable. Coat short or long.
Products. Meat; milk.
Productivity.
REPRODUCTION. *First kidding:* 1053 days on station. *Litter size:* 1.09; first cross Landim x Pafuri females 1.43.
GROWTH. *Birth weight: 2.4* kg. w*eight for age:* 30 days-4.2, 90-8.0, 150-10.1, 365-16.7, 550-25.8, 730-30.8 kg.
MILK. *Yield:* 398 ml/d during third month of lactation in foundation does (n=47) on station; station born primiparous does (n=16) averaged 305 ml/d in third month.
Research. Formerly at Instituto de Reproduçao e Melhoramento Animal, CP 1410, Maputo, Mozambique.
References. de Pinho Morgado, 1954; 1959; Rocha, McKinnon & Wilson, 1990a.

TSWANA

Synonyms. Bechuanaland [obsolete].
Origins. The Batswana have owned goats for a very long time, unlike most other southern Bantu peoples.
Sub-types and races. A similar goat to the Ndebele of south-west Zimbabwe with which it intergrades along the Botswana/Zimbabwe border.
Distribution. Botswana, mainly along eastern and southern boundaries. Also in Zimbabwe and Bophuthatswana close to common borders. Total goat numbers in Botswana were estimated at 1.2 million in 1986, mostly of this type, and 97 per cent of these were in the traditional sector. Numbers were 783 000 in 1983, down from 1.0 million in late 1960s.
Ecological zones. Semi-arid to arid areas with one short, unreliable rainy season in summer and as many as 50 nights per year with temperatures below 0°C. Within these zones mainly distributed in scrub acacia areas with relatively little ground cover.
Management systems. Pastoral, agro-pastoral and a few flocks on commercial and larger modernised traditional holdings. Less than 3 per cent of goats are subject to modern management but 70 cooperative groups comprising 1648 small farmers (42 693 goats and sheep combined) receive extension assistance in the form of dipping, vaccination, castration and other veterinary services. Flock sizes average 20.9 in the traditional sector, 108.2 in the modern or commercial sector (Table 20). In Botswana 53 000 of 80 500 traditional farms own goats. Flock structures, related mainly to meat production: females 70.1 per cent (51.9 per cent breeding > 1 year), males29.9 per cent (14.7 percent > 1 year).
The ram subsidy programme of the Animal Production Division of the Ministry of Agriculture supplied 2 Tswana and 18 Boer x Tswana bucks to producers in 1985 (compared to 90 pure Boers).

Table 20 Goat flock size distribution in Botswana

System and Flock size	Percentage of farms	Percentage of goats
Traditional (n = 53 000)		
1- 5	18.1	2.9
6- 10	20.8	8.0
11- 20	28.7	20.3
21- 30	14.0	16.5
31- 40	7.5	12.4
41- 50	4.0	8.4
>50	6.9	31.5
Commercial (n = 270)		
1- 50	37.1	9.2
51-100	29.6	20.6
101-200	18.5	26.0
> 200	14.8	44.2

Physical characteristics. Large size 60-75 cm (male castrate 73.2 ± 0.76 cm; female 60.9 ± 3.54 cm). Weight: male 43.9 ± 6.6 kg; female 40.0 ± 4.9 kg.
Head not very strong, forehead flat to prominent, profile straight and relatively short (Figure 25).

Figure 25 Male Tswana goat owned by the Animal Production Research Institute

Horns: 69 per cent of males have horns of medium length, projecting backwards and then outwards; 76 per cent of females have lighter, narrower horns. Ears medium-long and broad, lopped.
Neck rather long. Chest fairly broad but shallow. Withers level with sacrum. Back straight. Croup has moderate slope. Legs relatively long.
Colour highly variable with mixed colours predominating (40 per cent), whites next most common (29 per cent), followed by blacks (17 per cent), browns (8 per cent), and greys (6 per cent). Coat short and fine (39 per cent), intermediate and wavy (47 per cent) or long (14 per cent).
Products. Meat; milk.
Productivity.
REPRODUCTION. *Kidding interval:* usually once a year; considered to be related to availability of food as a function of rainfall but conception is very delayed in this context in comparison to goats in similar ecoclimatic zones and it is possible that there are some photoperiod effects in this type of goat (Figure 26). *Litter size:* 1.50 (n=426) on research station, 1.37 (n=285) in traditional system. *Fertility:* 82 per cent of does exposed (n=521) to bucks kidded over 8 year period (1976-1983) on research station, in traditional system 95 per cent of 298 breeding age females kidded in 1986. Ministry of Agriculture estimated 70.3 to 86.4 "kidding percentage" nationwide from 1980 to 1985.

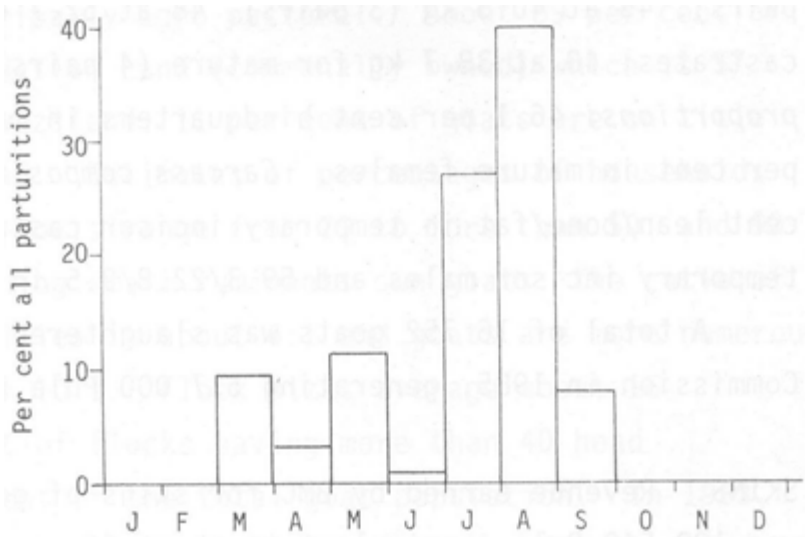

Figure 26 Birth distribution in a Tswana traditional flock with continuous buck presence from 1981 to 983.

GROWTH. *Birth weight:* 2.8 kg (n=426) on research station; in traditional system male single 4.3 ± 1.5, twin 4.3 ± 1.0 and female single 3.6 ± 0.9, twin 3.7 ± 1.0 kg. *Weight for age:* 4 months-13.4 (n=297, research station), 5-16.1 (single male 17.8, twin male 15.4, single female 16.2, twin female 14.9 in traditional system), 10-22.5 (single male 24.4, twin male 24.5, single female 22.6, twin female 21.5 in traditional system), 12-29.6 (n=251, research station), 18-34.5 kg (n=184, research station). *Average daily gain:* birth-150 days - single males 93.3, twin males 84.2, single females 83.7, twin females 74.4 g in traditional system; birth-300 days - 67.1, 67.4, 63.3, 59.2 g for respective sex and birth type classes in traditional system.

MILK. *Lactation length:* up to and in excess of 180 days in traditional system. *Yield:* 284 g/d in addition to that taken by kids in traditional system; highest yielding goat averaged 960 g/d for 1 month.

MEAT. *Dressing percentage:* 43 for live weight of 23.9 kg (milk teeth), 43 at 28.4 kg (1 pair permanent incisors), 44 at 34.0 kg (2 pairs**),** 45 at 40.5 kg (3 pairs), 48 at 52.7 kg (4 pairs) for male castrates; 40 at 38.7 kg for mature (4 pairs) females. *Carcass proportions:* 46.1 per cent hindquarters in mature male castrates; 49.9 per cent in mature females. *Carcass composition:* 58.3/21.2/14.3 per cent lean/bone/fat in temporary incisor castrates, 59.0/22.2/12.5 in temporary incisor males and 59.3/22.8/9.5 in full mouth females.

A total of 16 752 goats was slaughtered by the Botswana Meat Commission in 1985, generating 537 000 Pula for farmers.

SKINS. Revenue earned by BMC for skins of goats slaughtered in 1985 was 108 540 Pula, equivalent to about 20 per cent of their revenue from the meat of the same animals.

Research. Animal Production Research Institute, Private Bag, Gaborone, Botswana.

References. Owen et al, 1977; 1978; Owen & Norman, 1977; APRU, 1984; Gray, 1987.

SWAZI

Sub-types and races. The Swazi is part of the Nguni group of which other varieties occur in the Zulu areas of the Republic of South Africa.
Distribution. Swaziland and adjoining areas. The 1985 census showed a population of 268 422 goats, down from 333 895 in 1983 and similar to the 1970 number of 259 047.
Ecological zones. Sub-tropical sub-humid areas.
Management systems. Principally agro-pastoral. About 89 per cent of goats are found on Swazi Nation Land (communally owned) which is 57 per cent of the area of Swaziland: 11 per cent of goats are on title deed (privately owned) land. Estimates of percentages of households on communal land that own goats range from 29 to more than 50, and 90 per cent of households owning small ruminants own goats: the ratio of goat- to sheep-owning families is about 6:1 and goats are more numerous than sheep in the ratio of 10:1. Flock sizes average about 16 animals, with 6.3 per cent of flocks having more than 40 head accounting for 20.6 per cent of the total goat population. In 1983, flocks comprised 32.3 per cent of animals younger than 6 months and, of animals older than this, 48.0 per cent were females, 13.8 per cent entire males and 5.9 per cent castrated males. Flock structure for a sample of 160 flocks is given in Table 21.
Physical characteristics. Large size. Weight: 30-40 kg; castrates to 70 kg.

Table 21 Goat flock structure and breeding status from 160 multiple owner flocks in Swaziland

Variable	Male		Female		Total	
	n	Per cent	n	Per cent	n	Per cent
Age (years)						
<1	289	11.0	376	14.3	665	25.2
1-2	203	7.7	687	26.1	890	33.8
2-6	53	5.8	782	29.7	935	35.5
>6	24	0.9	120	4.6	164	6.2
Breeding status						
immature	269	10.2	376	14.3	645	24.5
breeding	237	9.0	1589	60.3	1826	69.3
castrate	163	6.2	0	0.0	163	6.2
Total population	669	25.4	1965	74.6	2639	100.0

Horns present in both sexes: strong, moderately heavy and long in males with homonymous twist projecting sideways or backwards and outwards (Figure 27); lighter, scimitar shaped and backward curving in females. Ears medium-long (16 cm) and broad, lopped.

Figure 27 Swazi bucks in the traditional agropastoral system on Swazi Nation Land

Colour variable but whole colours (grey, black, white) predominate. Hair short and coarse or long and fine; longer breeches on both fore and hind legs of males and females not uncommon.

Products. Meat.

Productivity.

REPRODUCTION. *First kidding:* 344 days in range 263-428 days. *Kidding interval:* 268 days (range 192-348 days, n=204); first to second parity 273 (203-348) days, subsequent parities 253 (192-320) days. *Multiple births:* common; 69.0 per cent (52.3 per cent of young) single, 30.4 per cent (46.2 per cent of young) twin, 0.6 per cent (1.4 per cent of young) triplet. *Litter size:* 1.32, being 1.13 in primiparous does and 1.39 in multiparous ones. *Annual reproductive rate:* 1.80, increasing from 1.54 at first parity to 2.01 at higher parities. *Fertility* (=does kidding/does in flock): 63 per cent, 54 per cent in maiden does and 70 per cent in females already having kidded at least once.

Kidding occurs all the year but with a peak in the winter months of May-Jul, associated with conception during the rains.

GROWTH. *Birth weight:* 1.9 ± 0.14 (s.d.) kg (n=482); males 2.0 ± 0.09, females 1.8 ± 0.10. w*eight for age:* 6 months-8.0, 12-14.5, 24-24.0, 36-35.2 kg. *Average daily gain:* birth-3 months - 68, birth-6 months -60, birth-12 months - 50 g.

MEAT. Carcass of 10-12 kg at 18-24 months.

Research. Animal Production and Health Department, University of Swaziland, P.O. Luyengo, Swaziland.

References. Lebbie & Mastapha, 1985; Lebbie, 1987; Lebbie & Manzini, 1989.

NDEBELE

Synonyms. This goat appears to have been inadequately described in the past and has been remarked to occur in the "Gwanda-Tuli area of Rhodesia" and in "Matabeleland". The term Ndebele is here proposed for the first time.
Sub-types and races. This is similar to the Tswana.
Distribution. South-west Zimbabwe. Small goats with shorter ears, similar to the Small East African group, are found in the remaining areas of Zimbabwe.
Ecological zones. Semi-arid.
Management systems. Principally agro-pastoral. There were only 6200 goats on large scale commercial farms in Matabeleland in 1982 and 3100 on small scale commercial farms.
Physical characteristics.
Large size. Weight: males 50-55 kg; females 39 kg.
Head rather fine, forehead flat, profile straight or dished (Figure 28).

Figure 28 Ndebele male goat at Matopos research station, Zimbabwe

Horns present or absent in both sexes: males flattened in cross-section, directed backwards with little lateral tendency; females finer and scimitar-shaped, some females have only scurs. Ears medium-long and broad, lopped with tip occasionally turned up. Beards in both sexes. Males have top knot.
Neck short. Chest shallow. Withers lower than sacrum. Back short and dipped. Croup short and sharply sloping. Legs long and lightly boned.
Colour variable with whites and creams predominant but many others and mixed colours common. Coat short or long, males may have "cape" over shoulders, chest and fore legs.
Products. Meat.
Productivity.
REPRODUCTION. *Multiple births:* 67.0 per cent of does mated gave birth to more than one young at Matopos; of does kidding, single 36.4 per cent, twin

62.0 per cent, triplet 1.6 per cent. *Litter size:* 1.54 (n=549). *Fertility* (=percentage of dams giving birth): 87.5 per cent. *Birth rate* (=progeny born/does mated): 159.9.
GROWTH. *Birth weight:* 2.53 kg (n=905). *Weight for age:* 3 months-13.9, 5(weaning)-15.9 (twins 13.5), 18-31.3 (twins 28.6), 30-35.0, 42-38.7, 54-39.1 kg, data from weaning relate to females only; 140 days(weaning)-15.2 kg (n=759). *Average daily gain:* birth-12 weeks -109, birth-20 - 97, post-weaning - 39g.
Phenotypic correlations among growth traits at Matopos were 0.45, 0.46 and 0.21 for birth and weights at 12 weeks, weaning (150 days) and 18 months and 0.29 and 0.31 for birth weight and daily gains from birth to 12 weeks and birth to weaning.
MEAT. *Dressing percentage:* 43.7 at live weight of 30.9 kg in castrated males at about 24 months; 43.5 at live weight of 31.4 kg (n=292) in castrated males at about 23 months.
Research. Matopos Research Station, Private Bag K5137, Bulawayo, Zimbabwe.
References. Arrowsmith & Ward, 1981; Tawonezvi & Ward, 1986.

LANDIM

Synonyms. Mozambique ("Landim" = Portuguese "Landrace").
Origins. Possibly has some early incorporation of European blood.
Sub-types and races. The Pafuri in Gaza Province of western Mozambique is a Boer x Landim derivative.
Distribution. Mozambique, south of the Limpopo and in Tete Province.
Ecological zones. Semi-arid to sub-humid monomodal rainfall area in sub-tropical southern Mozambique.
Management systems. Sedentary agro-pastoral with cultivation of annual subsistence crops being the dominant farm enterprise. An urban system is developing rapidly. Total population of this type of goat is probably less than 400 000.
Physical characteristics. Fairly large size 65 cm. Weight: male 50 kg; female 35-40 kg.
Head fairly heavy, concave profile in females, slighty convex in males. Horns in both sexes: 96 per cent of all animals but 31 per cent have only rudimentary horns or scurs; heavier in males than females but grow upwards and backwards in both sexes; length 11.3 cm, males 2.3 cm longer than females. Ears medium-long, carried erect or horizontal, 13.3 cm (Figure 29). Toggles present in 7 per cent of both sexes. All males have beard but only 12 per cent of females. Male has short stiff mane extending down back line.
Neck short and thick. Chest well developed, girth measurement exceeding withers height considerably at all ages (Table 22). Back short. Croup fairly long but sloping. Legs medium length.

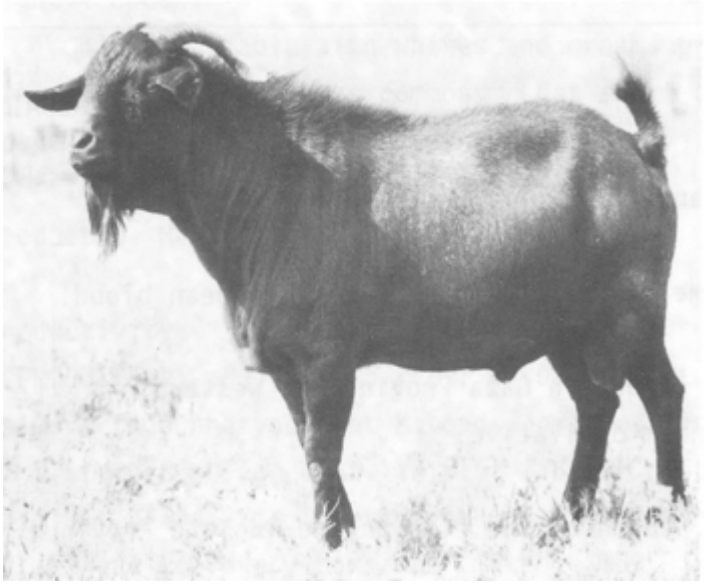

Figure 29 A male Landim goat at Chobela Research Station, Mozambique

Colour variable, commonly dark brown (36.3 per cent), black (23.6 per cent), pied (23.6 per cent), white (4.5 per cent), yellow (4.5 per cent) and several combinations of colours. Coat usually short and fine.
Products. Meat.

Table 22 Body measurements and body mass of female Landim goats

Age		n	Shoulder height (cm)		Ches girth (cm)		Weight (kg)	
Pairs permanent incisors	Months		x	s.d.	x	s.d.	x	s.d.
0	<14.3	9	49.7	4.3	63.1	5.2	19.4	3.4
1	14.3-19.8	7	52.4	4.8	69.3	8.0	26.6	7.3
2	19.8-24.5	21	55.7	3.6	72.5	4.5	30.7	4.9
3	24.5-32.0	32	53.5	4.0	73.5	3.7	31.8	4.0
4	32.0-42.0	22	57.7	3.1	78.6	3.7	37.2	5.1
Aged	>42	10	57.5	4.8	80.1	4.5	38.5	6.1

Productivity.

REPRODUCTION. *First kidding:* 781 ± 319.3 (s.d.) days (n=175). *Kidding interval:* 373 ± 167.1 (s.d.) days (n=255). *Multiple births:* common. *Litter size:* 1.57 ± 0.53 (s.d.) (n=350). *Annual reproductive rate:* 1.75 kids per doe. Age at first kidding and kidding interval controlled by station management.
GROWTH. *Birth weight:* 2.34 ± 0.441 (s.d.) kg (n=464); males 2.5 kg, females 2.3 kg; singles 2.5 kg, multiples 2.3 kg; kids born in rains and the early part of the dry season are heavier than those born in the late dry season. *Weight for age:* 90 days-9.6, 180-14.3, 365-22.0 kg. *Average daily gain:* birth-90 days - 76, 90-180 - 53, 180-365 -52, birth-365 - 54 g.
Research. Institute of Animal Production, CP 1410, Maputo, Mozambique.
References. Wilson, Murayi & Rocha, 1989; Rocha, McKinnon & Wilson, 1990a.

NUBIAN

Synonyms. Shukria (Eritrea).
Origins. The Nubian is one of a group of similar goats common throughout the Middle East and extending as far eastwards as India. The centre of

origin of this type was most likely in Iran during Assyrian times. It is not likely that it is descended from the Himalayan tahr as, although the tahr male will mate with goat females, foetuses are aborted. Similarly, there is no evidence that the Nubian has at some time crossed with the Walia Ibex in Ethiopia.

Sub-types and races. Classed as a breed group and includes Mzabite (Algeria) and Zaraibi (Egypt) as well as the Nubian proper (Figure 30) and the Shukria. V*ery* similar to the Damascus goat of the Near East and said also to be closely similar to the Syrian Mountain.

Common ancestor, with several other breeds, of Anglo-Nubian.

Distribution. Riverain and urban areas of the northern part of the Republic of Sudan, north of 12°N and westwards to E1 Obeid. Also in Eritrea. Similar types throughout North Africa, Near and Middle East. Population of Nubian proper estimated at 2.5 million during 1950s.

Figure 30 Female and young Nubian goats on the Nile bank at Shendi, Sudan

Ecological zones. Arid and extreme arid areas but, as noted, essentially along rivers and in urban or peri-urban areas.

Management systems. Urban. Owned primarily by urban dwellers in small numbers with flock sizes ranging from 2 to 10 animals. Usually free roaming during the day, scavenging in towns and confined and fed household wastes and occasionally concentrates at night. Also owned by settled agriculturalists on irrigation schemes along both White and Blue Niles south of Khartoum and along main Nile north of Khartoum.

Physical characteristics. Large size 70-75 cm; Shukria up to 85 cm. Weight: male 50-70 kg; female 40-60 kg.

Head small to medium, forehead prominent, profile markedly convex in males and usually so in females, depression just behind nostrils, prognathous to some degree (Figure 31).

Horns when present rather light and of medium length: simple or partially twisted backwards or divergent sweep in males; usually backward sweeping in females but some diverge. Ears long (25 cm), broad, pendulous with bottom one-third turning upwards; trail on ground when head down for feeding. Toggles, short in length, occur occasionally in both sexes. Beard usually absent. Knot of hair on forehead common.

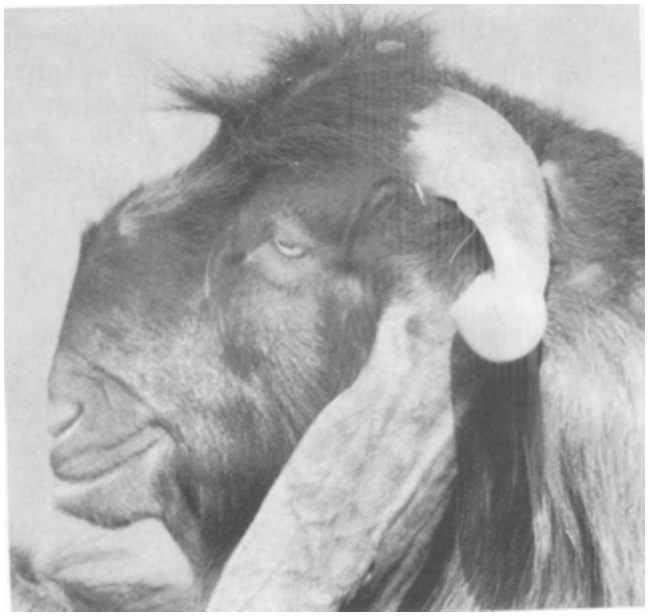

Figure 31 Topknot, profile and prognathous jaw of male Damascus goat in Tunisia

Neck moderately long and rather heavy. Chest fairly deep. High withers. Back long and straight. Croup well developed with tail set high. Long but well proportioned legs. Udder well developed.

Colour generally black except for ears which are grey or speckled grey; other colours from light fawn through to dark chocolate brown also occur. Coat variable in length, generally long, longer hair on front legs and especially on hindquarters and hind legs give appearance of breeches.

Products. Milk.

Productivity.

REPRODUCTION. *Age at first oestrus:* 213.2 days in Egypt. *Kidding interval:* 228 ± 17 days in Sudan; 6-8 months in Egypt. *Multiple births:* fairly prolific with high proportion of twin births; 66.1 per cent single, 30.4 per cent twin, 3.5 per cent triplet; in Egypt about 90 per cent of does lambing had multiple births. *Litter size:* 1.40 in Sudan; 1.38 in Egypt. *Oestrus cycle:* 4-30 (10) days with heat lasting 12-48 hours; oestrus throughout year with peaks in January, June and September and least activity in August and November in Sudan; least activity in March and April in Egypt. *Ovulation rate:* 2.67 and 2.53 in 2 years in Egypt, more than half of does having more than 3 corpora lutea. *Gestation period:* 146.0 $\pm$ 1.1(s.e.)days in of male and female Nubian kids weaned at 10 weeks and Sudan; 156.5 ± 0.66 (s.e.) days in egypt. post-partum anoestrus: 123.5 days following 84 days suckling in Egypt.

Table 23 Monthly average body weights of male and female Nubian kids weaned at 10 weeks and fed a 29.8 per cent crude protein concentrate ad lib from 4 weeks

Age	Sex			
	Male		Female	
	kg ± s.d.		kg ± s.d.	
Birth	2.5	0.5	2.1	0.3
4 weeks	4.1	1.2	3.7	0.6

8 weeks	6.0	2.5	5.1	1.3
12 weeks	9.3	1.9	7.1	1.7
16 weeks	9.0	2.0	8.3	1.7
20 weeks	11.0	2.2	9.1	2.8
29 weeks	13.1	3.2	11.7	1.2
28 weeks	15.9	2.8	13.	1 2.9

GROWTH. *Birth weight:* 2.96 + 0.07 (s.e.) kg; males 2.5 ± 0.5, females 2.1 ± 0.3 at Khartoum University.*Weight for age:* males heavier than females at birth and to 7 months at Khartoum University (Table 23); males 22.2 kg at 12 months, females 18.0 kg. *Average daily gain:* 1-4 weeks - males 60 females 70, 5-10 weeks - males 60 females 50, 11-20 weeks - males 30 females 50, 21-28 weeks - males 90 females 60 g; birth-1 year - males 56 females 50 g.

MILK. *Lactation length:* 147 days in Sudan; 90-120 days in Egypt. *Yield:* 73.5 kg in Sudan; 1.5-2.0 kg per day, 150-200 kg per lactation in addition to that taken by kids in Egypt. *Composition:* total solids 10.5-13.0 per cent, fat 2.9-3.5 per cent, solids-not-fat 7.7 per cent, protein 3.1-3.9 per cent, lactose 4.7 per cent, ash 0.85-0.88 per cent; mineral content generally high Ca 30.2, P 13.4, Mg 3.1, Na 2.4, K 14.0 mg/g DM, Cu 6.3, Zn 55.3, Fe 6.1 ug/g DM.

Kids are prevented from suckling by means of a bag over the udder (Figure 32) or by tying the teats with cord.

MEAT. *Dressing percentage:* 43.2 at 14.1 kg live weight with cotton seed cake as nitrogen source and 38.4 at 12.1 kg live weight with blood as nitrogen source. *Carcass composition:* gut fill 23.6 and 26.7 per cent in the 2 samples cited above, head 9.9 and 11.0, hide 8.9 and 9.2, feet 4.5 and 4.4. Lean/ bone/fat present at 52.2/28.1/19.7 per cent in cotton seed cake supplemented animals and 45.4/ 28.8/ 25.8 in blood supplemented ones.

Figure 32 Nubian female goat in Batn elHaggar, Sudan, with udder bag to prevent suckling by kids

Research. Animal Production Research Administration, Ministry of Animal Resources, P.O.Box 293, Khartoum, Sudan. Faculty of Veterinary Science, University of Khartoum, P.O.Box 32, Khartoum North, Sudan.

References. Gray, 1953; El-Nairn, 1979; Abdelaziz, Musa & Ali, 1982; Sulieman & El-Shafei, 1984; El-Tayeb et al, 1987; Abdel Rahim, 1987; Maglad & Kudouda, 1987; Aboul-Ela et al, 1988.

SUDAN DESERT

Synonyms. Sudanese Desert.
Origins. Savanna type, similar to West African Long-Legged.
Sub-types and races. Possibly allied to the Shukria goat of western Eritrea, although the latter is probably a much better milk producer, more closely related to the Nubian. It is probable that the so-called Zaghawa goat is a black colour variant of the Sudan Desert type.
Distribution. Dry areas of the Republic of Sudan, generally to the north of 12°N but north of 10°N in Darfur and western Kordofan. Also in parts of Eritrea and westwards into Chad. At its southern limit in Sudan, intermediate types with small forest goats are seen. Numbers ere estimated at 1.0 million in early 1950s but certainly much more numerous than this in 1970s and 1980s. Population figures based on tax returns were 571 000 in Southern Darfur Province alone in 1972.
Ecological zones. Semi-arid, arid and, during transhumance and nomadic migration, extending into hyper-arid.
Management systems. Traditional agro-pastoral and pastoral. Probably originally owned only by nomadic pastoralists but now owned in large numbers by agro-pastoralists. Common and shared use makes it difficult to define ownership patterns and flock sizes: about 20 goats per household in Southern Kordofan. Most goats in agro-pastoral system are "owned" by women. Flock structures related to milk and meat production are dominated by females, especially in age groups over 6 months. In Southern Darfur 46.5 per cent of flock < 6 months (25.7 per cent females, 20.7 per cent males); 12.4 per cent 6-15 months (9.4 per cent females, 3.0 per cent males); 41.1 per cent > 15 months (40.8 per cent females, 0.3 per cent males); total females 75.9 per cent (49.8 breeding > 10 months). In Southern Kordofan agro-pastoral sedentary system 38.0 per cent < 6 months; 15.7 per cent 6-12 months (females 11.6 per cent, males 4.1 per cent); 32.7 per cent 13-24 months (females 30.6 per cent, males 2.5 per cent); 13.2 per cent > 24 months (no males); 55.4 per cent breeding females.
Physical characteristics. Large size 65-85 cm. Weight: male 40-60 kg; female 32.7 ± 5.22 kg.
Head fine, forehead flat, profile straight or slightly dished.
Horns in 95 per cent of both sexes: large and flattened in cross-section in males, homonymously twisted, up to 35 cm long, projecting outwards or backwards; females finer and curving upwards and backwards, up to 30 cm in length. Ears medium to *very* long (12-20 cm), lopped. Toggles in 15 per cent of both sexes. Beards in both sexes, *very* bushy in males. Males may have a mane to the shoulders or extending the whole length of the back, mane occasionally present in females.
Neck rather short. Chest shallow and often pinched. Withers prominent (male 69-83 cm; female 65.5 ± 3.73 (s.d.) cm (n=397)). Back short and straight. Croup very weak and sharply sloping with tail set low. Legs long and poorly boned.
Colour variable from white to black, greys common (Figure 33) but many mixed colours: black back stripe in dark colours and grey in light colours. Coat usually short and fine except for mane: some animals (particularly

Zaghawa) have longer hair which may be general over the whole body or confined to hindquarters and legs.

Figure 33 Sudan desert goats on migration in Southern Darfur

Products. Meat; milk.

Productivity.

REPRODUCTION. *First kidding:* 290 days (n=4) in Southern Darfur; most females kid before eruption of first pair of permanent incisors. *Kidding interval:* 238 ± 41 days (n=44) in Southern Darfur traditional system; 9 months in Kordofan. *Multiple births:* common; 69.8 per cent single, 30.2 per cent twin (n=63) in first kidders and 39.0 per cent single, 54.5 per cent twin, 6.5 per cent triplet in multiparous females (n=154) in Southern Darfur sedentary agro-pastoral system. *Litter size:* 1.57; 1.30 in primiparous does and 1.68 in multiparous ones. *Annual reproductive rate:* 2.41. *Lifetime production:* 9-10 kids in Southern Darfur; 4-7 in Kordofan.

GROWTH. *Birth weight:* 2.13 kg; single 2.27 (male 2.30, female 2.25); twin 2.05 (male 2.03, female 2.07); triplet 1.82 (male 1.88, female 1.73). W*eight for age:* 4 weeks-4.8, 8-7.1, 13-9.9, 20-12.6, 26-14.7 kg. *Average daily gain:* birth-13 weeks - 86.9, birth-26 - 67.0 g; on high roughage/sorghum bran diet with 30 mg Monensin per day ADG was 89 g from 26.5 to 33.2 kg at a conversion rate of 10.7 feed/gain and on high concentrate/sorghum grain diet with 30 mg Monensin was 93 g at a conversion rate of 9.0 from 29.9 to 34.0 kg.

MEAT. *Dressing percentage:* entire males 48.2 (44.2-52.8) at live weight of 34.7 kg and castrates 51.2 (46.6-33.1) at live weight of 35.8 kg in Southern Darfur traditional system; 46.0 in central Sudan. *Carcass composition:* 72.7/28.3 per cent meat/bone at 30 kg empty body weight in fattened animals; tail 0.2 kg, head and skin 3.2 kg, abdominal fat 0.2 kg in 20 kg live weight animals.

Research. Field studies in Darfur in early 1970s and in Kordofan in early 1980s. Faculty of Veterinary Science, University of Khartoum, P.O.Box 32, Khartoum North, Sudan.

References. Wilson, 1976b; Bunderson, Cook & Fadlalla, 1984; El-Hag, El-Haj & Gaali, 1984; El-Hag, Kurdi & Maghoub, 1985.

WEST AFRICAN LONG-LEGGED

Synonyms. Arab (Chad); Maure (Mauritania and northern Mali); Sahel; Touareg.
Origins. These goats are part of the Savanna group which includes many Saharan types from Egypt, Libya, Tunisia, Algeria and Morocco.
Sub-types and races. Many local names are given to the West African Long-legged type: Gorane, Peul (Chad); Voltaïque (Burkina); Sahel (Figure 34), Nioro, Niafounké (Mali). Crosses with dwarf goats are also often given names, e.g. Vogan in Togo.

Figure 34 West African Long-legged goats of the Sahel type at Bamako market, Mali

Distribution. North of the 12°N parallel from central Chad in the east to the Atlantic coast in the west, and well into the southern Sahara. In recent years have penetrated farther south, consequent on drought.
Ecological zones. Mainly in the semi-arid but also in the arid zone. A few goats of this type are found in higher rainfall areas but, not being trypanotolerant, they do not survive for long in forest or dense savanna. Many goats of this type are sold in the coastal towns of humid West Africa either having walked or been trucked from the north.
Management systems. Agro-pastoral, pastoral and urban. In the agro-pastoral systems there is very little seasonal movement of stock, when it does take place it is usually of short distance and duration.
CHAD. Sedentary "Arab" flocks in central Chad usually contain 50-70 head of goats and sheep combined (ratio 2:1); in Batha and Chari, Baguirmi goat flocks average 45.0 (+ 43.3 sheep) and 46.3 (no sheep) respectively with an average of 3.8 goats per "taxed person" in the second area. In the Chad long-distance migration pastoral system 85 to 90 per cent of all flocks are mixed goats and sheep, 50 per cent are mixed in short distance migration flocks, and 57 per cent are mixed in agro-pastoral sedentary flocks; flocks of goats only are more common than sheep only. Almost all goats (87.1 per cent of females, 95.3 per cent of males in sedentary flocks; 66.1 per cent of females, 96.0 per cent of males in trans-humant flocks) are born in the flock in which they spend the rest of their lives. Flock structures (Figure 35) are related to meat and milk and comprise about 73 per cent females (51 per cent > 1 year), 27 per cent males (10 per cent > 1 year). Offtake is about 27

per cent per year of which about 30 per cent is for home consumption, 63 per cent is sold (majority males) and 7 per cent is gifts (mainly females).

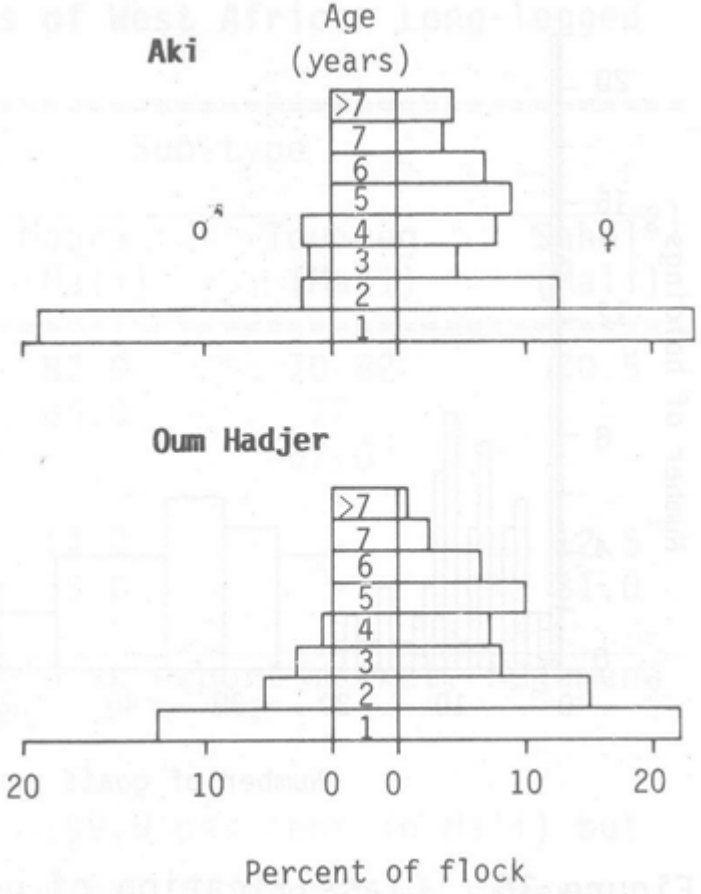

Figure 35 Goat flock structures in different trans-humant ethnic groups in Chad

MALI. In the agro-pastoral system goat flocks in the irrigated rice sub-system average 9.0 ± 6.03 head and in the rainfed millet sub-system 38.2 ± 27.75 head. Flock sizes range from 0-23 in the rice and from 2-91 in the millet areas with more families owning goats in both systems than owning sheep: flock sizes in the transhumant Fulani system in the Gourma average 41. Flock structures are 77.8 per cent females (55.4 per cent > 1 year, 4.0 per cent "broken-mouthed"), 22.2 per cent males (4.2 per > 1 year, 3.9 per cent castrates) in the sedentary systems; in the Gourma transhumant system females are 70 per cent of the flock with a high proportion (67 per cent) of breeding age, males 21 per cent with 6.5 per cent > 14 months of which 3.3 per cent are castrates. Offtake: 26.6 per cent (14.8 per cent females, 53.1 per cent males) in the rice sub-system; about 13.8 per cent (9.0 per cent females, 38.7 per cent males) in the millet sub-system.

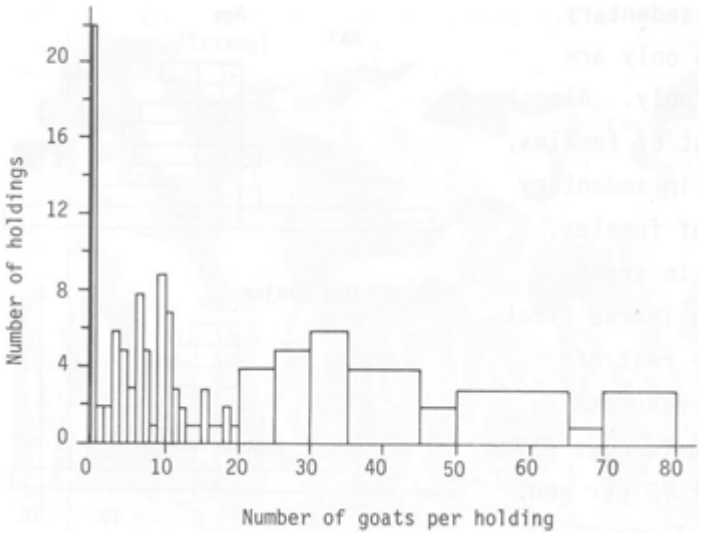

Figure 36 Classification of goat holding sizes in a Mossi agro-pastoral system in northern Burkina Faso

BURKINA FASO. Sedentary flocks in the Mossi agro-pastoral system in Yatenga average 17.1 goats and 16.8 sheep (Figure 36). In the Fulani pastoral system, flocks aver-age 53.7 goats and 23.0 sheep: flocks with only goats are more common than flocks of sheep only and these average 61.9 head (compared with 28.7 head). Fulani flock structures are mainly related to milk and meat production: females 76.3 per cent (approximately 60 per cent > 1 year), males 23.7 per cent (10 per cent > 1 year, 3.1 per cent castrates).

NIGER. In the Touareg system in the Aïr goats are not usually herded but feed in the vicinity of the camp in a loose flock, returning to their kids and to be milked at night. Milking is done by women and children. Flock sizes average about 60 head. Flock structure related mainly to milk production: females 86 per cent (67 per cent breeding); males 14 per cent (1.2 per cent > 14 months)

Physical characteristics. Large size 70-85 cm (male 80-85 cm; female 70-75 cm). Weight: male 40 kg; female 27 kg (Table 24).

Head small, fine and triangular in shape, forehead flat and narrow (Chad), slightly concave (Maure) or convex and narrow (Touareg), profile straight or slightly dished (Voltaïque), narrow nostrils, fine lips, large or less large supraorbital processes.

Table 24 Morphological characteristics of West African Long-legged goats

Character	Sub-type			
	Arab [1](Chad)	Maure (Mali)	Touareg (Mali)	Sahel [2](Mali)
Withers height (cm)	80.5	82.0	70-82	70.5
Girth (cm)	82.0	85.0	72	-
Scapulo-ischial length (cm)	69.6	-	67.0	-
Horn length (cm)	21.0	-	-	-
Ear length (cm)	21.6	14.0	-	12.5

Weight (kg)	37.3	3.0	-	31.0

Notes: 1) 8 male sheep about 3 years old at export market, Ndjamena
2) Mean of 20 full-mouth females

Horns usually present in both sexes (99.9 per cent in Mali) but absent more often in Touareg: strong in males, flattened in crosssection, markedly ribbed, directed straight upwards and backwards diverging more or less then turning inwards at the tips, homonymously twisted with slow spiral, up to 40 cm in length, sometimes horizontal (Figure 37); female horns are finer and scimitar shaped, or curving out and then in, up to 13 cm long. Ears long (21 cm) and wide or shorter (11 cm), usually pendent or semi-pendulous; vestigial ears occur; in Chad can be longer than face. Toggles common: 45 per cent in Mali. Beards common: present in almost all males from 4 months; about 40 per cent of females in Mali over 3 years carry beards. Manes are common in males, occasionally along the whole length of the back.

Figure 37 Maure goats near Niafounké in northern Mali (note male and female horn types)

Neck long and thin. Chest generally narrow and shallow, with girth circumference about or slightly exceeding withers height. Withers prominent but less so in Arab variety in Chad. Back usually straight with prominent backbone. Croup short and very sharply sloping. Legs long and spindly, lightly boned and with sickle hocks Udder usually elongated, more or less distinctly divided into two halves with large teats. Scrotum longish and usually split.

Colour is very variable and depends on sub-type: in eastern Chad 45 per cent are white or predominantly white, 28 per cent red or red pied, 22 per cent black or black pied; in western Chad 39 per cent white, 27 per cent black or pied, 25 per cent red or pied; Touareg type normally red pied or black pied; Maure are red pied or fawn pied; Volta&ium,;que 49 per cent white or principally so, 7 per cent cream to red, 3 per cent dark brown pied, 26 per cent red pied, 7 per cent black pied and 8 per cent solid black; in Mali, Sahel type colour is predominantly red or red-pied but whites, greys and blacks also common. Coat is usually of short stiff hair, except for mane (which may be 15 cm long) and occasional animals with long breeches or more general long hair.

Products. Meat; milk; skins.

REPRODUCTION. *First kidding:* 485 ± 128.9 (s.d.) days (n=307) in central Mali in range 275-1104 days; 455 ± 86 (s.d.) days (n=10) in transhumant system and 13.1 + 1.3 (s.d.) months to 16.5 ± 1.5 months in sedentary system depending on year in Burkina Faso; 407 + 30 (s.d.) days for

nomadic Touareg and 387 ± 32 days for Fulani in Niger; 13.7 ± 16.5 months in Chad. *Kidding interval:* 291 ± 105.2 (s.d.) days (n=1111) in central Mali; 291 ± 73.4 (s.d.) days (n=51) in Burkina agro-pastoral system and 328 ± 85.8 days (n=88) in the pastoral system; 234 ± 9 (s.e.) days (n=177) in Chad; 258 ± 10 (s.e.) days in Niger; births occur all the year round but in all studies there are more parturitions during cold dry season (conceptions in late hot dry season) than at other times of year. *Multiple births:* fairly common (Table 25); of 1955 parturitions in Mali agro-pastoral system, 1593 (81.5 per cent of parturitions, 68.5 per cent of young) are single, 350 (17.9 and 30.1 per cent) are twin, and 12 (0.6 and 1.5 per cent) are triplet; in Burkina in Fulani flocks 72.1, 27.8 and 0.1 per cent of parturitions are single, twin or triplet; in Niger in Touareg flocks the figures are 74.5, 24.8 and 0.7 per cent and in Fulani flocks are 54.6, 44.1 and 1.3 per cent; in Chad 53.8 per cent of parturitions are of only a single young, 43.7 per cent are twin and 2.5 per cent are triplet. *Litter size:* 1.24 in single round retro-spective survey in central Mali in 1978 (Table 25); 1.19 ± 0.41 (s.d.) (n=1955) in long term study in Mali agro-pastoral system where there were differences due to season of parturition (1.08 in rains related to conception in dry season and 1.25 in cold dry season related to conception in rains) and parity of dam (1.03 in primiparous does and 1.34 in does of fourth and higher parities); 1.21 + 0.41 (s.d.) , (n=126) in Burkina agro-pastoral and 1.05 ± 0.24 (n=461) in the pastoral system where season again had significant effects on number of young born at each parturition; 1.01 to 1.50 in Chad, ranging from 1.12 for primiparous females to 1.74 for multiparous females on station; 1.26 in Niger Touareg flocks and 1.47 in Niger Fulani flocks. *Annual reproductive rate:* 1.49 in Mali, increasing with parity; 1.51 in Burkina agro-pastoral and 1.17 in pastoral system. *Lifetime production:* most goats do not exceed 5 parturitions (Table 26). *Oestrus cycle:* first return to heat 68 days after parturition on station in Chad; heat lasts 24-48 hours. *Gestation period:* 148 days on station in Niger.

Table 25 Owners' recall data of litter sizes of Sahel goats in central Mali

Parameter	Physiological age of goat					Overall
	Pairs permanent incisors				Temporary incisors	
	4	3	2	1		
Number in sample	180	77	61	111	444	873
Type of birth						
single	457	139	81	77	5	759
twin	203	11	4	1	0	219
triplet	8	0	0	0	0	8
Total births	668	150	85	78	5	986
Total young born	887	161	89	79	5	1221
Litter size	1.33	1.07	1.05	1.01	1.00	1.24

Table 26 Age (months) and reproductive history of Fulani (Voltaïque) goats in Burkina Faso

Age class	Number of parturitions												Number of females	Mean births at age
	0	1	2	3	4	5	6	7	8	9	10	11		
10-14	14												14	0.00
15-19	29	45											74	0.60
20-24	8	21	9	2									40	1.12
25-30	2	40	26	12	0	1							81	1.64
>30	2	22	42	88	49	32	11	7	1	0	2	1	257	3.42

GROWTH. *Birth weight:* 2.2 ± 0.64 (s.d.) kg (n=581) in Mali agropastoral system, male 2.3, female 2.1, single 2.4, twin 2.0, young of primiparous does 2.0 and of fourth parity and above 2.3; 2.7-3.2 kg on station in Niger. *Weight for age:* 10 days-3.0, 30-4.3, 90-7.7, 150-10.9, 240-15.2, 365-20.2, 550-25.2, 730-29.8, 1095-33.6 kg in Mali agro-pastoral system, main environmental influences being system, sex, parity, type of birth, season (Table 27) and year; 10 days-4.4, 30-5.5, 90-9.9, 150-12.8, 240-15.5, 365-19.9 kg in Burkina pastoral system, affected by sex, parity, season and year; similar weights in Chad. *Average daily gain:* in Mali, birth-150 days - 58.0, birth-365 -49.3, birth-1095 - 28.7 g; in Burkina pastoral system, birth-150 -70.6, 150-365 - 39.7, birth-365 - 49.0 g; in Chad pastoral system, 1 week-weaning - males 80.4 females 67.9, weaning-18 months - males 32.8 females 27.9, 18 months-5 years - males 14.5 females 8.1 g. *Post-partum weights:* 26.0 ± 5.16 (s.d.) kg (n=1729) in Mali, varying by system, parity, birth type, season, year and flock; primiparous does weigh 21.2 kg and those of fourth parity and upwards 29.4 kg.

Table 27 Weight changes (maximum and minimum averaged for 6 years) by sex and age in central Mali goats expressed as percentages of mean annual weight

Sex and age[1)]		Millet sub-system				Rice sub-system			
		n[2)]	[x3)]	Weight (per changes cent)		**n**[2)]	[x3)]	Weight (per changes cent)	
				min	max			min	max
Males:	1	642	25.1	93.0	106.5	167	24.7	91.1	107.9
	2	380	30.3	95.6	104.6	51	30.4	93.5	108.3
	3	309	34.7	87.6	110.5	49	29.8	84.1	104.9
	4	385	40.9	96.8	104.9	14	30.8	90.9	107.1
Females:	1	1342	20.4	91.8	105.0	218	20.9	94.1	109.3
	2	1026	22.5	91.9	106.3	145	23.3	5.4	109.2
	3	1300	24.9	96.2	103.1	179	26.0	96.7	105.4
	4	4257	28.0	94.9	104.3	789	28.8	97.5	107.8

Notes: 1) Age given as pairs of permanent incisors
2) Number of observations in each class of stock
3)Mean annual weight in kg

Weight changes within years in Mali, although significant, are slight and, in contrast to cattle, long term weight changes are not very marked. In Burkina within year variation is considerable, being 88.2-115.8 per cent of the annual mean in the Mossi agro-pastoral system and 87.5-113.4 per cent in

the Fulani pastoral system, in both cases for does with 3 pairs of permanent incisors.

MILK. *Lactation length:* 5-6 months; 134.7 ± 5.6 (s.e.) days (n=173) in range 54 to 155 days on station in Niger, maximum daily yield at 34 days. *Yield:* 1500 g/d for Maure in Mali, 900 g/d on station in Niger, Touareg 600-800 g/d, Voltaïque 900-1000 g/d; total lactation yield of 77.1 litres on station in Niger. *Composition:* density 1.030; DM 12.7 per cent; fat 3.9 per cent; lactose 4.6 per cent.

MEAT. *Dressing percentage:* castrates 49.4 at 26.7 kg live weight, entire males 48.0 at 27.4 kg and females 48.1 at 27.8 kg at central Mali abattoir; 41.9 at 26.8 kg, females 43.3 at 23.3 kg at Farcha (Chad); 45-48 for Voltaique type in Burkina. *Carcass composition:* "carcass" 47.9 per cent in central Mali, stomachs and intestines 5.0, kidneys 0.5, liver 1.9, lungs and heart 2.6, mesenteric fat 4.4, spleen 0.5, head 6.9, feet 3.2, wet skin 6.7, udder 0.8, gut fill 12.7, blood and body fluids 6.8.

Average carcass weights in Mali were 14.2 kg for all ages and *sexes* combined and goat dressing percentages were significantly better than sheep, mainly attributable to lighter gut fill. In 1979 and 1980 at Niono in central Mali, goats contributed 36.3 per cent of all meat produced at the municipal abattoir.

SKINS. Chad exported, through official channels, 1 106 000 skins in 1973 and it was estimated that 176 500 were used locally but this was an exceptional year due to the Sahel drought: in 1976, 820 000 skins were exported of which just over half were goatskins each of about 500 g dry weight.

HAIR. Attempts to produce mohair from Sahel goats in Mali by crossing with Angoras during the 1920s to 1940s achieved only limited success on station and the results were not extended to the traditional producer level.

Research. Mainly systems studies carried out by ILCA, EEC and national organizations, the last particularly in Niger and Chad.

References. Dumas & Raymond, 1975; Dumas, 1977; Gerbaldi, 1978; Dumas, 1980; Bourzat, 1980; Wilson, 1981; Alaku & Moruppa, 1983; Wilson & Durkin, 1983; Wilson & Wagenaar, 1983; Wilson, 1984a; Ouedraogo, 1984; Wilson, 1986; Wilson & Light, 1986; Wilson, 1987; Wilson & Sayers, 1987; Wilson, 1988; Wilson & Durkin, 1988; Bourzat & Wilson, 1989.

SMALL GOATS

RED SOKOTO

Synonyms. Chèvre rousse de Maradi.
Origins. One of the Savanna goat group but its relatively small size in relation to these indicates possible crossing with forest or dwarf goats before selection in its present area of distribution. The relatively high prolificity of the Sokoto goat would tend to support a hypothesis that such a fusion has occurred.
Sub-types and races. Outside the main centres of its distribution, the colour varies somewhat and various types are recognised such as Kano Brown, Bornu White, etc. The Buduma goat of Chad appears to be the same variety as the Bornu White.
Haemoglobin variants (3 variants and 5 phenotypes) have been reported to differ from the expected proportions and it has been postulated that these differences are due to differential susceptibilities to helminth infestation.
Distribution. Southern Niger and northern Nigeria between latitudes 12°N and 14°N and longitudes 4°N and 10°E. In Nigeria its main strongholds are in Sokoto and Kano States and in Niger it is commonest in Maradi and Tessoua Departments but its sub-types extend to the west and east. The purebred population is probably about 1 million with a further 2.5 million of similar type.
Ecological zones. Semi-arid areas with a single rainfall season of 4-6 months duration. These areas are cultivated to millet, sorghum and groundnuts. Several species of economic trees (Baobab, *Adansonia digitata;* Shea-butter Nut, *Butyrospermum parkii*; Locust Bean, *Parkia biglobosa)* form an integral part of the agro-sylvo-pastoral system. In Maradi Department most goats are found in the cultivated valleys of seasonal rivers (rainfall 600 mm) which provide a favourable micro-zone with out-of-season crop residues and browse shrubs.
Management systems. Agro-pastoral. Owned mainly by sedentary cultivators of the Hausa tribe or of related Hausa-speaking groups. Often confined within house compounds, either loose or tied to stakes, especially during the crop growing season when they may be zero-grazed. Flock sizes are usually small (< 10 head) but as skins are the main product, the imbalance in the sex ratio between females and males is less marked than in many other systems. In a traditional system in the Zaria area in northern Nigeria 64.6 per cent of families own goats, average flock size being 19.2 in the range of 2 to 70. In the Zaria area flock structures are 79.3 per cent females (45.8 per cent with 1 or more pairs permanent incisors) and 20.6 per cent males (2.2 per cent with 1 or more pairs permanent incisors) with a ratio of breeding males to females of 1.0:19.7,
Physical characteristics. Relatively small size 60 cm (male 60-65 cm; female 54-65 cm). Weight: male 27 kg; female 25 kg. Bornu White is larger, up to 80 cm.
Head fine, forehead prominent, profile rather short and straight or slightly dished, mucous membranes black.

Figure 38 Red Sokoto buck or Chèvre ,rousse de Maradi at Zugu Sokoto State, Nigeria

Horns in both sexes: short to medium in length, slightly heavier in males but set close together on the skull; rather flattened dorso-ventrally and growing backwards close to the head and neck (Figure 38). Ears short, medium width and usually carried horizontally; rather longer and semi-pendulous in Niger; longer also in Bornu White. Toggles rare. Beard of profuse hair in males but usually often covered with hair which is absent in females. Forehead longer, bushier and darker in males than in females. Males carry a light mane extending to the shoulders.

Neck short, thin and very mobile. Chest rounded and well pro portioned. Withers not prominent. Back of medium length and Croup short.Legs rather short and strong but well muscled both fore and hind. Udder of good conformation, well rounded and with well spaced teats (Figure 39).

Figure 39 Female Chèvre rousse de Maradi straight. at Maradi station, Niger

Colour usually deep red in the Sokoto but lighter and occasionally almost chestnut in the Maradi. A government order promulgated in Niger in 1945 made the culling of spotted females obligatory in parts of Maradi and by

1950 this order had been extended to other Departments including Zinder, Tahoua and Goure: undesirable males were to be castrated before 6 months but animals of the correct type of both sexes could not be slaughtered at less than 18 months. Males are invariably darker than females and may have a black back stripe. Tail hairs usually black. Coat of fine and short hair but males may have longer and wavier hair. Bornu White is white, occasionally with black or brown spots on ears, nose and around eyes.

Products. Skins; milk (especially in Niger); meat.

Productivity.

REPRODUCTION. *Age at first oestrus:* 157 ± 5.92 (s.d.) days (n=8), youngest at 120 days in Kano Brown. *Weight at first oestrus:* 10.5-18.0 kg. *First kidding:* 435 ± 135.0 (s.d.) days (range 243-882) (n=51) at Shika experimental farm in Nigeria; apparently rather late in Nigeria traditional system near Zaria where only 2.4 per cent of does with milk teeth and 75.6 per cent with 1 pair of permanent incisors had kidded; 7.1 per cent at 10 months on station in Niger, 21.4 at 12, 14.2 at 13, 35.7 at 14, 14.3 at 16, 7.1 at 17; 426.7 + 204.40 (s.d.) days (n=227) in a traditional Hausa village in Niger in a study of 3 years duration; 416 ± 86 (s.d.) days for Kano Brown and also 9-16 months; in traditional systems in Niger it has been recorded that 31 per cent of first births take place when the dam is 7-10 months old, 25 at 10-11, 27 at 11-12 and 7 at > 12 months. *Kidding interval:* 240 + 57.8 (s.d.) days at Shika; 332 ± 109.3 (s.d.) days (n=665) in Niger traditional system with 11.3 per cent of intervals < 240 days, 43.5 at 240-340 and 45.2 at > 340; under research station management in Niger 20.0 per cent of intervals were < 180 days, 25.0 at 180-210, 17.5 at 210-240, 17 at 240-275, 12.5 at 275-305, 2.5 at 305-335 and 5.0 at > 335; intervals following an abortion (220 ± 16 (n=59)) and those following kid deaths in the first 15 days of life (269 ± 22 (n=32)) were significantly shorter than all intervals (332 ± 109 (n=665)) in the Niger traditional system; intervals were also influenced by season of previous birth and when this took place in the rainy season of Jul-Aug, interval was 266 + 97.3 (n=56) days, in the dry season of Sep-Apr was 343 ± 164.5 (n=552) days and in the pre-rains season of May-Jun was 302 ± 105.7 (n=57) days; breeding occurs all year round but there are markedly more births in early hot dry season in Niger than at other times of year. *Multiple births:* extremely common; 32.6 per cent single, 58.8 twin, 7.2 triplet, 1.8 quadruplet (n=123) at Shika; 32 per cent multiple births in Zaria traditional system; 56.1 per cent single, 40.9 twin, 2.8 triplet, 0.1 quadruplet (n=1668) in Niger traditional system; 48.6 per cent single, 47.5 twin, 3.9 triplet on station in Niger. *Litter size:* about 1.8; 1.45 at first parity (n=51) at Shika increasing from 1.17 for dams of 8-9 months to 1.70 for dams > 24 months, 1.86 at second parity (n=37) and 2.00 at third (n=8); 1.35 (n=1938) in northern Nigeria traditional system near Zaria (Table 28); 1.47 ± 0.83 (n=761) in Niger traditional system rising from first to third and older parities being 1.08 ± 0.60 (n=227), 1.20 ± 0.79 (n=51) and 1.72 ± 1.10 (n=483) respectively; considerable variation in litter size in relation to month of birth and maximum litter size not occurring at period of maximum number of births (Figure 40) as seen also in West African Long-legged goats in Mali and Burkina Faso. *Annual reproductive rate:* 1.50-2.00; 1.67 in Niger. *Oestrus cycle:* 15-30 days but up to 66 days on station in Niger; heat lasts

24-120 hours in Kano Brown. *Gestation period:* 153 days (range 142-165) in Niger.

Table 28 Reproductive data established from owner recall in 116 flocks of sedentary Red Sokoto goats in Kaduna state, northern Nigeria

Parameter	Physiological age of goat					Overall
	Pairs permanent incisors				Temporary incisors	
	4	3	2	1		
Number in sample	280	205	173	254	665	1577
Type of birth						
single	605	334	204	174	14	1331
twin	402	103	52	18	2	577
triplet	43	4	1	0	0	2
quadruplet	2	0	0	0	0	2
Total births	1052	441	257	192	16	1958
Total young born	1546	552	311	210	18	2637
Litter size	1.47	1.25	1.21	1.09	1.13	1.35
Births per doe	3.76	2.15	1.49	0.76	0.02	1.24

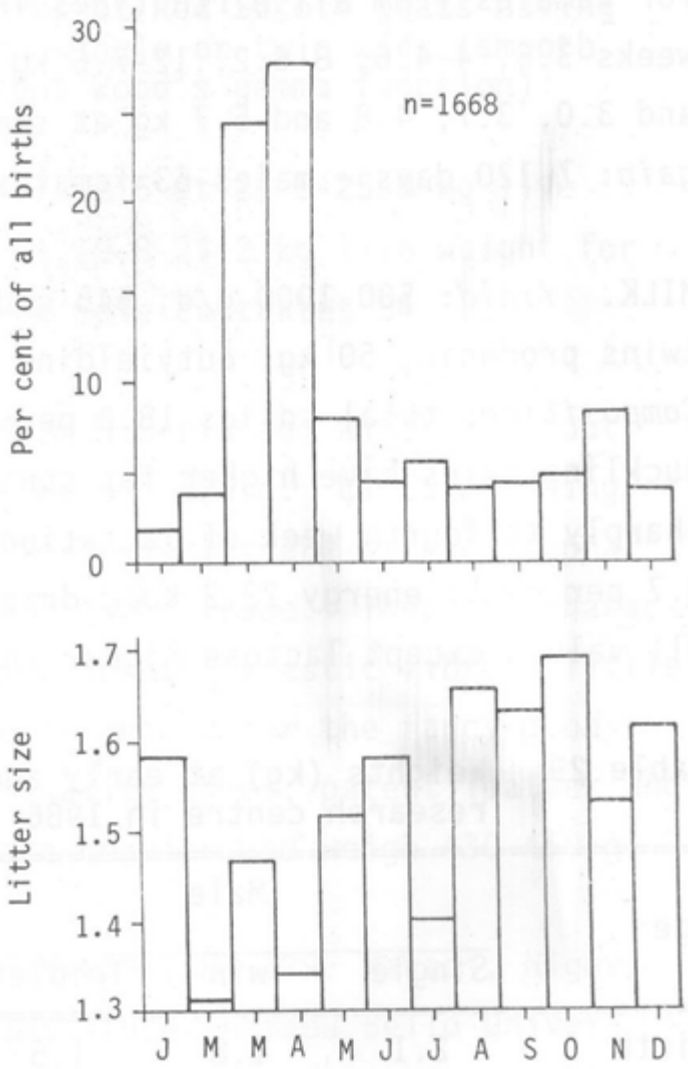

Figure 40 Distribution of parturition and variations in litter size in Maradi goats in Niger

Repeatability of litter size 0.28 ± 0.07 for 37 first to second kiddings and heritability at first kidding 0.08 ± 0.02 for 50 dam-daughter pairs, both estimates from Shika.

GROWTH. *Birth weight:* 1.7-2.0 kg; 1.8 + 0.021 (s.e.) kg (n=1301) and 1.9 ± 0.022 kg (n=624) in Niger. *Height for age:* 3 weeks-2.7, 1 month-3.9, 2-8.1, 4-9.9, 5-12.1 kg for twins, both sexes combined, on station in Niger (Table 29); 2 months-8.0, 4-8.9, 6-10.5, 12-18.5, 18-26.3 kg for females from all birth types in traditional system in Niger; 2 weeks-3.6, 4-4.6, 8-6.2, 12-7.6 kg for singles on station in Nigeria and 3.0, 3.7, 4.8 and 5.7 kg at same ages for twins. *Average daily gain:* 7-120 days - males 63 females 55 g, 4-18 months - females 41 g.

MILK. *Yield:* 500-1000 g/d; 545 g/d in 12 week lactation, does with twins producing 50 kg, outyielding singles by 20 per cent (Figure 41). *Composition:* total solids 18.2 per cent; fat 4.7-7.8 per cent, does suckling twins have higher fat content and fat content diminishes sharply to fourth week of lactation; protein 3.8-4.7 per cent; lactose 4.7 per cent; energy 22.2

KJ/g dried milk, 381 KJ/100 g whole milk; all values except lactose higher in colostrum than in milk.

Table 29 Weights (kg) at early ages of Sokoto goats at Maradi research centre in 1986

Age	Male			Female		
	Single	Twin	Triplet	Single	Twin	Triplet
Birth	2.1	1.8	1.5	2.1	2.1	1.4
1 month	3.0	3.9	3.0	3.7	4.4	3.0
2 months	6.1	5.8	5.4	5.0	5.0	4.2
3 months	7.7	7.0	6.8	7.5	7.5	4.4
6 months	10.3	10.1	10.9	10.4	11.1	6.5

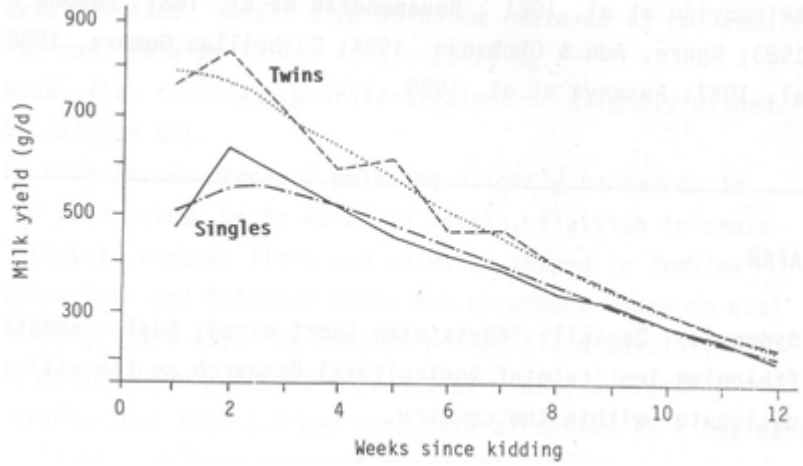

Figure 41 Lactation curves of Red Sokoto goats having given birth to single or twin kids (smooth curves represent Wood's gamma function)

MEAT. *Dressing percentage:* 45-50; 44.7-48.6 at 20.5-25.0 kg live weight for Bornu White and 43.7-48.1 at 19.8-24.2 kg live weight for Red Sokoto at Maiduguri abattoir; young male castrates 54-55.

SKINS. Average dry weight of skins from Nigeria and Niger is about 420 g, "extra light" being 250 g and "heavy" 625 g. Useful tanning area is 3-7 ft^2 (0.28-0.65 m^2). Red Sokoto skins are of exceptional quality and known as "Morocco" in the tannery trade. They are characterized by deep pronounced grain, dense compact elastic fibres, little grease, and ease of tanning; they are in demand for the fancy goods trade, particularly for gloves, high quality shoes, patent leather and suede clothes. Skins of Kano goats are heavier and weigh 430-460 g.

Research. Centre d'élevage caprin du Maradi, BP 379, Maradi, Niger. National Animal Production Research Institute, Ahmadu Bello University, Shika, P.M.B. 1096, Zaria, Nigeria.

References. Beaton, 1939; Robinet, 1967; Haumesser, 1975; Mba, Boyo & Oyenuga, 1975; Molokwu & Igono, 1978; Adu, Buvanendran & Lakpini, 1979; Akinsoyinu et al, 1981 ; Buvanendran et al, 1981; Ehoche & Buvanendran, 1983; Ngere, Adu & Okubanjo, 1984; Djibri1lou Oumara, 1986; Otchere et al, 1987; Fasanya et al, 1988.

AFAR

Synonyms. Danakil; ?Abyssinian Short-eared; Adal - adopted by the Ethiopian Institute of Agricultural Research as the official designator within the country.
Origins. Probably from south-west Asia (North Yemen and Saudi Arabia) where similar goats are common.
Sub-types and races. There are possibly some morphological and performance differences throughout this type's range from Eritrea in the north to Djibouti in the south.
Distribution. Coastal strip and Rift Valley in Ethiopia from 12°N to 6°N in the area where the Afar (Danakil) tribe is found. Northern two-thirds of Republic of Djibouti.
Ecological zones. Desert and coastal desert.
Management systems. Pastoral. Free-ranging transhumant and/or nomadic Afar. Kids are separated from adults and housed in small stone houses. Male kids, except those required for breeding, are usually killed (especially in drier than usual periods) a few days after birth. Flock sizes generally large (> 100 head). Flock structures, related to requirement for milk, overwhelmingly female: females 98.0 per cent (breeding 84.5); males 2.0 per cent (no castrates).
Physical characteristics. Small size 55-65 cm (male 60-65 cm; female 55-60 cm). Weight: male 26-39 kg; female 22-28 kg.
Small head, flat forehead, profile straight or slightly dished, narrow muzzle (Figure 42).
Horns in both sexes: erect or pointing slightly backwards in males, half to full twist, up to 45 cm in length, flattish in cross-section and slightly ribbed; light and scimitar shaped in females although assymetrical and deformed horns not uncommon, round to oval in cross-section (Figure 43); few females polled (?and possibly males). Ears medium length (10-12 cm), medium width, noticeably pricked and erect; less than 1.5 per cent have atrophied (3-4 cm) ears (Figure 43). Toggles in both sexes (6 per cent). Males usually bearded and lightly maned; females unbearded except for a few with very wispy beard.
Neck medium long. Chest very narrow and shallow. Croup sharply sloping. Legs tend to be short in relation to height, a character more noticeable in some flocks than others. Scrotum usually split for at least half its length.
Colour very variable, whole whites common, reds and blacks less so, multicoloured and spotted and blotched animals commonest. Coat of very fine, short hair.

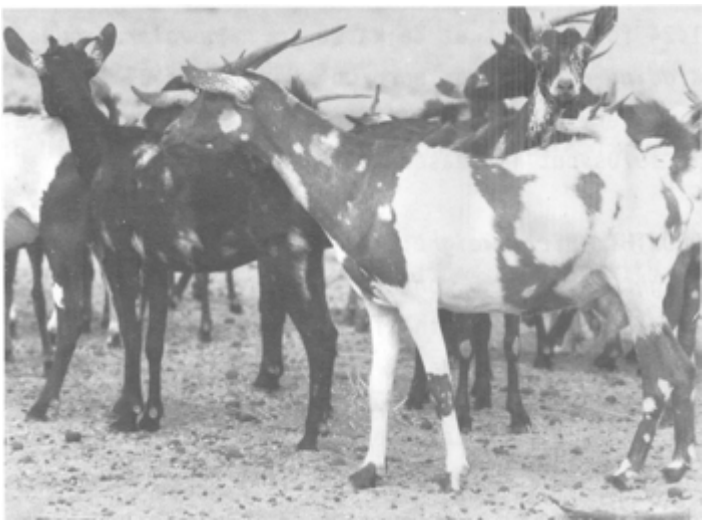

Figure 42 Afar goats at a desert well in Djibouti

Products. Milk; (meat); skins for water carriers.

Figure 43 Afar goats showing (left) horns of female, immature and male; and (right) vestigial ears on a female

Productivity.

REPRODUCTION. *First kidding:* 24 months. *Kidding interval:* once a year although some only every 2 years; related to short rainy period, not otherwise controlled. *Multiple births:* very uncommon (or uncommonly admitted) in traditional systems; 65 per cent single, 35 per cent twin at Melka Werer. *Litter size:* ?1.02 in traditional systems; 1.24 for 21 does at Melka Werer. *Annual reproductive rate:* ?0.9. *Kidding rate* (=kids born/does mated): 1.07 (n=352 does mated).

Very low conception rates of 45 per cent obtained at Melka Werer in 1970s but increased to 79 per cent in 1980s.

GROWTH. *Birth weight:* 2.0 kg in traditional system; 2.1 kg on station. *Weight for age:* 6 months-11, 9-13, 12-16, 18-21, 24-23, 36-27 kg in traditional system in Tigray; 90 days-7.6, 180-15.3, 365-22.1 kg on station. *Average daily gain:* birth-26 weeks - 45 g in Tigray; 90-180 days - 48 g at Melka Werer. *Mature weights:* males 34.1 kg (n=4) in Tigray traditional system, 33.0 kg on station at Melka Werer; females 26.8 ± 3.71 (s.d.) kg (n=431) in Tigray, 24.0 kg at Melka Werer.

MILK. *Lactation length:* 90-120 days; 84 days on irrigated pasture and with 200-300 g concentrate at Melka Werer. *Yield:* 20-25 kg; 491 g/d (range 230-1080) at Melka Werer.

MEAT. *Carcass yield:* males 12 kg; females 10 kg.

Research. Melka Werer Research Station, Institute of Agricultural Research, P.O.Box 2003, Addis Ababa, Ethiopia. Some minor and incomplete field studies.
References. Wilson, 1975; Galal & Getachew, 1977; Galal, Sebhatu & Getachew, 1977; Galal & Kassahun, 1981; Kassahun, Yibrah & Fletcher, 1989.

MUBENDE

Origins. Part of the Small East African group but said to be specifically selected for its skins.
Distribution. Mainly in the former Kingdom of Buganda in the Mubende district of west-central Uganda and in Masaka district to the south but also elsewhere in higher rainfall areas of Uganda north and west of Lake Victoria.
Ecological zones. Sub-humid highland areas of Uganda, usually with bimodal or a prolonged unimodal rainfall pattern.
Management systems. Agro-pastoral. Animals are tethered or allowed to roam freely, particularly in the non-cropping season. In addition to being reputed producers of skins and meat, goats have important cultural and social functions in the Baganda area and are used in divine healing.
Physical characteristics. Small size. Weight: male 35 kg (up to 51 kg); female 31 kg.
Horns in both sexes although polled animals not uncommon: generally short and carried close to nape of neck. Ears short to medium length, pricked forward and upward. Males and some females bearded. Males have a mane along the length of the back (Figure 44).
Colour, selected, generally black: other colours also occur. Coat short and fine.
Products. Meat; skins.
Productivity.
REPRODUCTION. *First kidding:* 13.5 months on station at Makerere; 567 ± 11.6 (s.e.) days (n=80) on station at Mbarara. *Kidding interval:* 9.6 months at Makerere, 10.6 months at first and 8.5 months at second and third intervals; 297 ± 8.5 (s.e.) days at Mbarara. *Multiple births:* common; 69.0 per cent single, 31.0 per cent twin at Makerere, 86.4 per cent single at first, 50.0 per cent single at second and third parturitions; 68.3 per cent single, 30.0 per cent twin, 1.7 per cent triplet at Mbarara. *Litter size:* 1.4 (n=42) at Makerere. *Lifetime production:* 6 parturitions at Mbarara.

Figure 44 Male Mubende goat at Lweza station, Uganda (photograph by K.L. Okello)

GROWTH. *Birth weight:* 1.22 kg on station at Makerere, single 1.39, twin 1.04, male 1.26, female 1.19; male singles 2.14 ± 0.045 (s.e.) kg (n=538) at Mbarara. *Weight for age:* 4 months-10.3, 12-21.3 kg at Makerere; 2 months-7.4, 5(weaning)-11.9, 12-20.3 kg for male singles at Mbarara. *Average daily gain:* birth-120 days - 75.7, post-weaning-12 months - 44.9 g at Makerere; birth-2 months - singles 86 twins 68, 2-5 - singles 45 twins 40, 5-12 - singles and twins 36 g at Mbarara.
MEAT. *Dressing percentage:* 56.4 for males at live weight of 35.7 kg, 50.7 at 36.0 kg and 44.1 at 28.4 kg for castrates, 54.4 for females at 31.5 kg.
Research. Department of Veterinary Physiological Sciences, Makerere University, P.O.Box 7062, Kampala, Uganda.
References. Trail & Sacker, 1966; Okello, 1985; K.L. Okello, pers.comm.

KIGEZI

Origins. Part of the Small East African group.
Sub-types and races. Sebei and Karamoja types are also recognized in Uganda.
Distribution. South-west Uganda and neighbouring Zaire and Rwanda.
Ecological zones. Warm or hot semi-arid lowlands to sub-humid uplands and cool mountains.
Management systems. Agro-pastoral and agricultural of the Bakiga tribe.
Physical characteristics. Small size 50-60 cm. Weight: 30 kg.
Horns in both sexes. Ears shortto medium length, pricked.
Colour black or grey in Kigezi. Hair long, especially on hindquarters, in Kigezi.
Products. Hair; meat.
Productivity.
MEAT. *Dressing percentage:* males 49.4 at live weight of 30 kg, castrates 52.0 at 28.8 kg, females 51.6 at 30.3 kg.
HAIR. Used for clothing by Bakiga tribe.
References. Okello, 1985.

BORAN

Synonyms. Galla; Somali.
Origins. Part of the Small East African group.
Sub-types and races. In the Somali systems the 'yeygirr' is smaller than the 'deguen' and has short prick ears in contrast to the forward-inclined pendent ears of the latter which is bred by the Muruli clan. Several Somali clan types have names, including Mudugh, Abgal, Benadir and Ogaden.
Distribution. Northern Kenya, southern Somalia and parts of southern and south-eastern Ethiopia.
Ecological zones. Semi-arid bimodal rainfall areas, bordering on arid.
Management systems. Pastoral, agro-pastoral and agricultural.
KENYA COAST. Three agro-ecological zones are recognised, these being the coconut-cassava (1000-1230 mm annual rainfall), the cashewnut-cassava (800-1100 mm) and the livestock-millet (700-880 mm) areas. About 20 per cent of farms keep cattle but about 60 per cent have small ruminants, mostly goats. Of farms with small ruminants, 59 per cent have goats only, 37 per cent goats and sheep and 3 per cent sheep only. Flock sizes are medium averaging 22.8 on farms owning small ruminants, 80 per cent being goats: the ratio of goats to sheep is 8.6:1.0 in the coconut zone and 3.0:1.0 in the millet zone. Goat and sheep numbers (on farms owning) increase from the coconut zone to the millet zone (Table 30). Flock structures are related mainly to meat production: females 73 per cent (51 per cent "mature"); males 27 per cent (11 per cent mature, 1 per cent castrates) (n=18 330); the proportion of males decreases from wetter to drier zones. About 5 per cent of goats are not owned by farmers in whose flocks they are found.
CENTRAL SOMALIA. Rainfall averages 100-250 mm per year and the vegetation is predominently low open thornbush. Animals are herded during the day and penned in thorn enclosures at night, kids separate from adults. Kids are allowed to suckle twice a day after milk for human consumption has been taken off. Bucks run continuously with does to ensure kidding (and a human milk supply) all year round.

Table 30 Small ruminant flock sizes in various agro-ecological zones on the Kenya coast

Agro-ecological zone	Flock size					
	Goat flocks		Sheep flocks		Mixed flocks	
	n	± s.d	n	± s.d	n	± s.d
Coconut-cassava	11.2	8.4	5.3	4.5	18.2	9.6
Cashewnut-cassava	16.6	13.6	8.6	7.9	28.3	18.2
Livestock-millet	32.5	33.5	17.5	18.8	54.4	49.9
Overall	18.8	21.1	11.2	13.6	22.7	27.1

Flock sizes usually *very* large, 9000 flocks averaging 154 head in 11 'degaan' in Bulo Burti district in 1983, in range 52-241 head. About 8 per cent of goats are in multiple-owner flocks. Flock structures, with some very early offtake of males, are related to milk production: females 78.7 per cent

(57.8 per cent breeding); males 21.3 per cent (6.6 per cent breeding bucks, 7.4 per cent mature castrates).

Physical characteristics. Small size 60 cm. Weight: male 30-40 kg; female 25-30 kg. Benadir is slightly larger.

Head fine, muzzle narrow, facial profile convex.

Horns small, usually slender with no marked twist, in about 97 per cent of animals. Ears short to medium, pricked sideways and slightly forwards and upwards (Figure 45). Toggles in about 5 per cent of both *sexes.*

Neck medium length. Chest narrow, girth exceeding withers height by about 10 per cent. Withers (58.1 ± 5.52 (s.d.) cm (n=293) in central Somalia) about same height as sacrum. Back fairly long and slightly dipped. Croup sloping. Legs rather long.

Colour usually brilliant white (> 70 per cent in central Somalia). Some Ethiopian goats from the Ogaden have black spotting or solid black on the head and fore part of the neck: some varieties have a black dorsal stripe. Hair short,shiny, smooth. Skin thin.

Figure 45 Boran or Galla goats at Kiboko National Range Research Station, Kenya

Products. Meat; milk; (skins).

Productivity.

REPRODUCTION. *First kidding:* very late, about 30 months in central Somalia. *Kidding interval:* about 14 months in central Somalia. *Multiple births:* fairly common. *Litter size:* 1.29 (n=108) at Kiboko in Kenya. *Annual reproductive rate:* 1.03 with 8 month mating at Kiboko; in Somalia national statistics indicate range of 0.65 to 0.90 kids per doe per year from 1970 to 1984. *Fertility* (=does kidded/does mated): about 75 per cent at Kiboko. *Fecundity* (=kids born/does present per year): 65 per cent in central Somalia.

GROWTH. *Birth weight:* 3.38 kg (n=139) at Kiboko. *Height for age:* 6 months-13.7, 18-19.2, 30-23.5, 42-25.6, 54-27.7 kg in central Somalia *Average daily gain:* birth-120 days - 82 g at Naivasha.

MILK. *Yield:* almost 1 million tonnes of which 360 000 tonnes used for human consumption from Somali national flock in 1984; in central Somalia does kidding during the rains yield 85 litres in 6 months, those during the

rains 49 litres, of which about 40 and 20 per cent is used for human consumption.
MEAT. Exports of live goats from Somalia varied from 273 000 to 828 000 from 1970 to 1984; internal slaughter in the same period was 1.8 to 3.6 million head.
SKINS. Total production in Somalia of goats and sheep combined varied from 1.54 to 3.84 million pieces in 1970-1984.
Research. National Range Research Station, Kiboko, Kenya.
References. Rakoczi, 1974a; Dahir Mumin, 1986; Bourzat et al, 1988; W. Thorpe, pers.comm.

MASAI

Origins. Part of the Small East African group
Sub-types and races. Goats of very similar type occur throughout much of East Africa and are given tribal or regional names. Gogo in central Tanzania, Arusha and Chagga in northern Tanzania.
Distribution. Kenya and northern Tanzania.
Ecological zones. Semi-arid bimodal rainfall areas, bordering on sub-humid to the west of their range in both Kenya and Tanzania.
Management systems. Pastoral, agro-pastoral and agricultural where they are owned by mainly cultivating tribes, for example on the slopes of Mounts Kilimanjaro and Meru. Often kept in mixed flocks about equally composed of goats and sheep. Both goats and sheep are herded by children by day and penned in thorn enclosures at night with unweaned kids being separated from adults. Flock sizes fairly large to large and average about 190 head on Elangata Wuas group ranch in south-central Kenya. Flock structure is related to meat, fat and milk production: females 66.2 per cent (48.3 per cent breeding); males 33.8 per cent (4.1 per cent entire > 14 months, 6.1 per cent castrates > 14 months).
Physical characteristics. Small size 64 cm. Weight: male 40 kg; female 31 kg.
Head fine, muzzle narrow, facial profile dished or straight (Figure 46). Horns usually present in both sexes: short (10 cm) and fine and sweeping directly backwards, often curved upwards at the tip. In some flocks only about 65 per cent of animals are horned, possibly indicating some out-crossing to exotic breeds. Ears medium length (12-16 cm), slightly pendent, rarely pricked. Males and about 10 per cent of older females have a small beard of rather fine hair: 40 per cent of males under 14 months have beards. Toggles in both sexes in less than 5 per cent of animals. Males have a light or heavier mane extending to the withers or just beyond.

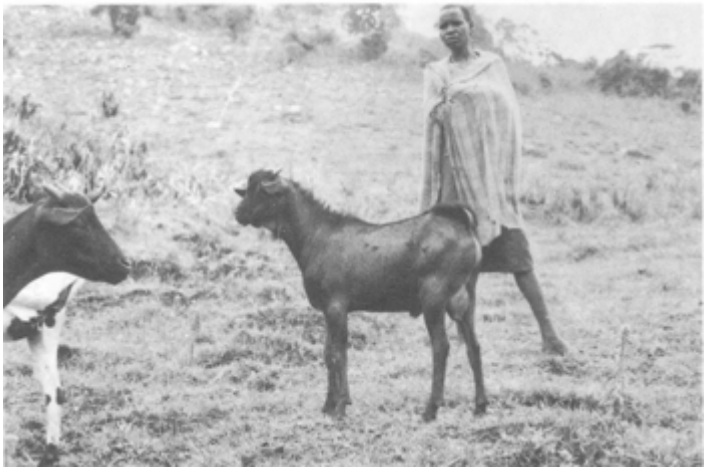

Figure 46 Masai goat of Small East African type in west Mara region, Kenya

Neck fine and medium long. Chest fairly well rounded, girth measuring 10-15 per cent more than withers height (64 ± 3.2 (s.d.) cm (n=239) in females, 73 ± 4.4 cm (n=22) in mature castrates). Withers not prominent and lower than sacrum. Back short and dipped. Croup short and sharply sloping. Legs well proportioned and fleshed.

Colour extremely variable. Coat short and fine in both males and females but with occasional longer hair on the hindquarters.

Products. Meat; milk; fat.

Productivity.

REPRODUCTION. *First kidding:* 556 ± 119.0 (s.d.) days (n=28) on group ranch in south-central Kenya which is very late for a traditional system and due to use of an apron to control breeding (Figure 8); of 211 first kidding dams 12.3, 37.9, 34.1, 13.7 and 1.9 per cent had milk teeth and 1 to 4 pairs respectively of permanent incisors. *Kidding interval:* 306 days at Elangata Wuas group ranch, decreasing with increasing parity, differing in different flocks and also varying with season, intervals being longer following parturitions in long and short rains seasons. *Multiple births:* fairly common. *Litter size:* 1.23, varying with parity and season, litters larger for parturitions in short and long dry seasons. *Annual reproductive rate:* 1.46.

GROWTH. *Birth weight:* about 2.9 kg at Elangata Wuas. *Weight for age:* 10 days-3.3, 550 days-21.8 kg, a growth equation $y=ax^b$ having values of 0.95 and 0.48 for variables a and b respectively. *Average daily gain:* birth-150 days - 49.3, birth-365 - 38.3 g. *Post-partum weights:* 28.0 kg; 23.4 kg at first and 27.5 at fourth and subsequent parities. *Mature weights:* females 30.9 ± 3.99 (s.d.) kg (n=239), range 18-44 kg; castrates 42.2 ± 6.12 (s.d.) kg (n=22) in range 33-53 kg.

Research. Field studies in 1978-1983 by ILCA now discontinued.

References. Wilson, 1978; Wilson, Peacock & Sayers, 1983; 1984; 1985; Wilson & Ole Maki, 1989.

Synonyms. Chèvre commune rwandaise; chèvre commune burundaise.
Origins. Part of the Small East African group.
Sub-types and races. The "types" from Rwanda, Burundi and eastern Zaire are, for all practical purposes, indistinguishable.
Distribution. Rwanda, Burundi and Kivu province of Zaire and extending into southern Uganda and the extreme west of Tanzania.
Ecological zones. Sub-humid east-central African highlands from 1200 m to 2500 m altitude in 800 mm to 1500 mm rainfall zone. Rain falls in two more or less distinct seasons.
Management systems. Agro-pastoral and agricultural. Verging on pastoral in Ankole/ /Bahima areas of eastern and lower areas of Rwanda. Often attached individually to pickets (Figure 47). Some data on the importance of goats in 3 different areas of highland central Africa have been provided in Table 5. Approximately 76 per cent of families own goats, average flock size being 2.95 goats for those owning (2.88 in Burundi, 3.42 in Rwanda and 2.67 in eastern Zaire). Generalized flock structure is related mainly to meat production: females 82.6 per cent (65.7 per cent weaned); males 17.4 per cent (3.7 per cent weaned); 51.3 per cent of all goats in the traditional system have milk teeth only. The estimated total number of goats and sheep (of which probably 75 per cent were goats) in Burundi was 1 313 000 in 1984; total goats in Rwanda were 940 000 in 1983, according to an administrative census (for tax purposes), but a sample agricultural survey at the same time estimated 2.2 million goats. Goats are important sacrificial animals in Rwanda ('guterekera'), killed and eaten following the death of a family member: they are also used as dowry among the Twa of north-west Rwanda, 1 male and 1 female goat being offered by the man to his prospective in-laws.

Figure 47 A Rwanda goat at a picket in the agricultural system near Kigali

Physical characteristics. Small size 64 cm (60-67). Weight: male 35 kg; female 27 kg.

Horns in both sexes: curving outwards and backwards in males, up to 20 cm in length; female horns lighter and scimitar shaped; polled animals very rare. Ears short to medium length, pricked forward and upward. Toggles present in both sexes (- 14 per cent). Most males and some females are bearded. Some males have a top-knot and a mane along the whole length of the spine is almost universal in this sex.
Neck fine and medium length. Chest reasonably well rounded, girth measurement 20-25 per cent greater than withers height. Withers level with sacrum. Back short and straight. Legs normally proportioned in relation to body, front cannon bone circumference about 7-8 cm. Udder rounded and small with short teats.
Colour very variable, whole blacks common but many parti- and multi-coloured animals. Coat is fine and short but a very few males have long hair on the hind legs.
Products. Meat.
Productivity.
REPRODUCTION. *First kidding:* 640 ± 27.8 (s.e.) days (n=205) on station in Rwanda where does born as twins kidded more than 3 months later than those born as singles and females out of older dams kidded younger than those out of junior dams. *Kidding interval:* 343 ± 13.8 (s.e.) days (n=498) on station but this largely due to an imposed breeding season. *Multiple births:* very common; 61.1 per cent single, 37.1 per cent twin, 1.8 per cent triplet (n=221) in traditional system in north of Burundi; 54.6, 42.5, 2.8 and 0.2 per cent single, twin, triplet and quadruplet (n=1340) in large scale traditional study in 3 countries combined; 41.4 per cent single, 58.6 per cent multiple (n=256) under station management in south-east Rwanda. *Litter size:* 1.44 (n=1378 parturitions) in traditional system; 1.75 (n=726) on station, not differing significantly with season but larger litters at older parities were noted. *Annual reproductive rate:* 1.86 on station. *Lifetime production:* most females do not exceed 5 parturitions but up to 12 recorded (Figure 48); average of 2.39 parturitions for 1340 does in large scale traditional system survey.
GROWTH. *Birth weight:* 2.0 kg in north Burundi traditional system; 2.3 kg (n=156) on station in Rwanda. *Height for age:* 3 months-8.5, 6-12.1, 12-19.1 kg in traditional system; 30 days-3.9, 90-8.7, 150-11.1, 240-14.4, 365-19.9 kg on station in Rwanda. *Average daily gain*: birth-3 months - 68, 3-6 - 40, 6-12 - 39 g. *Mature weights:* 2 years-27.7, 3-31.2, 4-33.5, 5-36.4 kg on station in Rwanda.

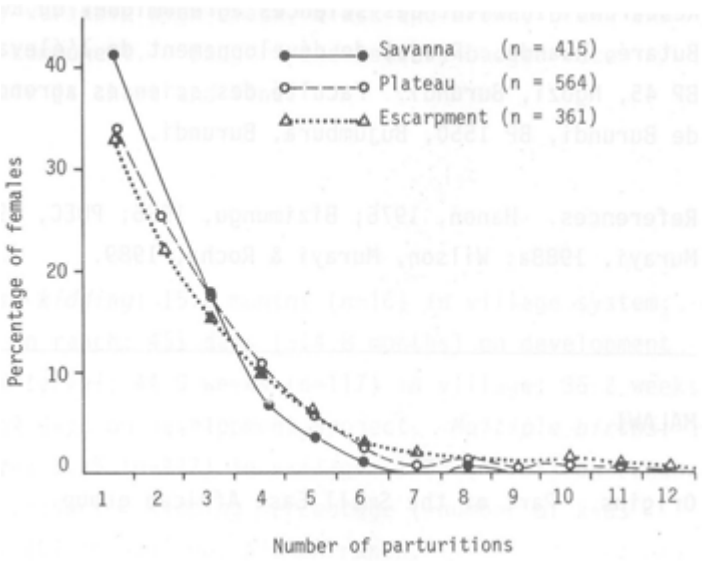

Figure 48 Frequency distribution of reproductive careers of Rwanda/Burundi goats in traditional systems in highland east-central Africa.

MILK. *Yield:* 33-86 kg in 108 days; average production of 380 ml/d for 12 goats on station, best female yielding 780 ml when fed concentrate.
MEAT. Dressing percentage: 52.2 at 18.2 kg live weight. Carcass *composition:* fifth quarter 16.6 and wet hide 7.9 per cent of live weight.
In 1983 a total of 37 800 goats was slaughtered at official abattoirs in Rwanda.
SKINS. Skin exports from Rwanda varied from 203 000 to 435 000 pieces from 1971 to 1975 inclusive, average dry weight being 470 g.
Research. Institut des sciences agronomiques du Rwanda, BP 138, Butaré, Rwanda. Projet de développement de l'élevage caprin de Ngozi, BP 45, Ngozi, Burundi. Faculte des sciences agronomiques, Universite de Burundi, BP 1550, Bujumbura, Burundi.
References. Hanon, 1976; Bizimungu, 1986; PDEC, 1986; Wilson & Murayi, 1988a; Wilson, Murayi & Rocha, 1989.

MALAWI

Origins. Part of the Small East African group.
Distribution. Malawi, but more common in the south than in the north. Estimated population 950 000 in 1988.
Ecological zones. Semi-arid to sub-humid uplands.
Management systems. Agricultural. About 43 per cent of households keep goats around Lilongwe with an average flock size of 9; 60 per cent of flocks are less than 10 animals. Tethering during the day to prevent crop damage is common (93 per cent). Night housing practices vary, some being in the owner's house, some in purpose built sheds, but whatever system is adopted goats are tied individually. Flock structure is related to meat production: females 72.4 per cent (57.1 per cent > 12 months); males 27.6 per cent (7.0 per cent > 12 months).
Physical characteristics. Small size 62 cm. Weight: female 29.1 kg. Head fine. Profile straight or dished.

Horns in both sexes: light and short. Ears pricked.
Neck fine and fairly long. Chest fairly well developed, girth measurement greater than withers height by about 20 per cent. Rump higher than withers. Colour is very variable with black, black and brown, brown and red, and white the commonest. "Badger" and reverse badger face markings occur. Hair is short and fine.

Products. Meat.

Productivity.

REPRODUCTION. *First kidding:* 15.6 months (n=16) in village system; 17.5 months (n=21) on ranch; 451 days (=14.8 months) on development project. *Kidding interval:* 44.9 weeks (n=l17) in village; 35.2 weeks (n=80) on ranch; 254 days on development project. *Multiple births:* common. *Litter size:* 1.35 (n=422) in village; 1.38 (n=152) on ranch; 1.46 on develoment project. *Kidding percentage* (=number of kids born/does exposed): 107 in village; 175 on ranch.

GROWTH. *Birth weight:* 1.76 kg (Table 31). *Height for age:* 280 days-12.2 ± 2.4 (s.d.) kg (n=49) on development project. *Average daily gain:* birth-280 days - 36 ± 8 g on development project. *Post-partum weights:* 29.5 kg (n=421) in traditional system; 28.5 kg (n=151) on ranch.

Table 31 Birth weights (kg) of Malawi kids under various management systems

Type of birth and Sex		System							
		Traditional village			Ranch			Development project	
		n	x	s.d.	n	x	s.d.	n	x
Single									
	male	139	2.0	0.5	45	2.0	0.6	143	2.1
	female	133	1.8	0.5	49	1.9	0.5	137	1.9
Twin									
	male	92	1.7	0.5	57	1.6	0.6	51	1.6
	female	146	1.6	0.5	55	1.6	0.6	47	1.6
Triplet									
	male	2	1.2	0.2	3	1.5	0.0	-	-
	female	4	1.0	0.0	-	-	-	-	-

MILK. *Yield:* 290 g/d over 16 weeks (n=8) fed solely on natural pasture. *Composition:* fat 6.7 per cent; solids-not-fat 9.6 per cent; protein 2.2 per cent; lactose 6.3 per cent.

MEAT. *Dressing percentage:* 52.3 at 25.7 kg live weight for females, 52.7 at 19.6 kg for males, 53.6 at 21.7 kg for castrates. *Carcass proportions:* hindquarter percentage increases with age to 48.4 at 2 years. *Carcass composition:* head 7.2 per cent, liver 2.9 per cent, skin 6.9 per cent, lungs 2.0 per cent, heart 1.5 per cent, testes 2.1 per cent; 66.3/15.9/11.3 per cent lean/bone/fat in 15-24 months males weighing 29.1 kg.

Research. Department of Animal Science, Bunda College of Agriculture, P.O.Box 219, Lilongwe, Malawi.

References. Owen, 1975; Phoya, 1982; Kamwanja, Ayoade & Makhambera, 1985; Kasowanjete, Stotz & Zerfas, 1987; Karua, 1989.

DWARF GOATS

WEST AFRICAN DWARF

Synonyms. Chèvre de Fouta Djallon; chèvre guinéenne; chèvre naine.
Origins. An achondroplastic dwarf (Figure 50) with lack of ossification at the cartilage joints. Probably evolved specifically in response to the conditions of the humid forest zone by selection of recessive genes for dwarfism. More or less trypanotolerant.
Sub-types and races. Many are recognised, usually by the name of the country of their location and the type of habitat: Cameroon grassland (Figure 51); Ghana forest (Figure 51); Cote d'Ivoire dwarf (Figure 51); Congo Dwarf. Slightly larger goats than the typical West African Dwarf such as the Mossi of Burkina Faso, goats of southern Mali and the Kirdi of southern Chad and northern Cameroon are also sometimes included in this main type.

Figure 50 West African Dwarf goat scavenging in Abomey market in Benin

Distribution. The true West African Dwarf is considered to be confined to 15 countries in West and Central Africa (Table 32), all of these except the Central African Republic having an Atlantic coastline. An experimental flock is maintained at Wageningen University in the Netherlands. There are many kept as pets and in zoos in the USA where it is known as the African Pygmy and for which there is a breed society. The total population in West Africa is probably about 16 million.
Ecological zones. Essentially confined to humid forest zones with more than 270 growing days per year and rainfall in excess of 1500 mm per year. Most of this zone is infested with the tsetse fly and trypanosome infections are prevalent.
Management systems. Agricultural, urban and (to a lesser extent) agro-pastoral. Owned by many ethnic groups. These goats are often not herded but left to wander in the vicinity of the household or village. Household waste is an important but unquantified source of food in many areas. Flock sizes are usually very small.
NIGERIA. Flock structure, related primarily to meat production, results from very early offtake of males: females 77.0 per cent (55.5 per cent breeding);

males 23.0 per cent (3.0 per cent > 12 months). In south-west Nigeria (Ogun and Oyo states) 80 per cent of house-holds own 1.7 to 3.7 goats and far fewer households own lesser numbers of sheep. In south-east Nigeria (Bendel, Anambra, Imo and Rivers states) 92 per cent of households own goats, flock sizes being 7.5 head in those households owning, 6.9 head in all households. The range in flock size for house-holds owning is 1-183, the modal number owned being 3. There is a strong correlation between goat and sheep ownership. Three types of management are evident in south-east Nigeria: free roaming (59 per cent); confined for part of the year (5 per cent); confined the whole year (36 per cent); free range flocks are larger than confined ones. Percentages of households with different flock sizes are: 0=8; 1-4=54; 5-9=11; 10-19=2; >20=5.

Figure 51 West African Dwarf goats of (top) the Cameroon Grassland sub-type at Mankon station, Bamenda, of (centre) the Ghana Forest sub-type in a house compound at Kumasi, and of (bottom) the Cote d'Ivoire type near Abidjan

Table 32 Distribution and importance of the West African Dwarf goat

Country	Sheep and Goats ('000)	Goats ('000)	WAD goats (per cent of all goats)
Guinea Bissau	200	140	80
Guinea	870	425	80
Liberia	440	220	100
Sierra Leone	433	158	100
Cote d'Ivoire	2640	1320	75
Ghana	3900	2150	33

Togo	1585	750	47
Benin	1910	940	47
Nigeria	40000	26600	29
Cameroon	4715	2535	50
Congo	211	139	100
Equatorial Guinea	41	7	100
Gabon	116	59	100
Zaire	3664	2900	50
Central African Republic	1075	988	80
Total	59820	38331	38

SENEGAL. West African Dwarf goats are mostly found in Casamance, in the southern part of the country. Almost all families own small ruminants, with more owning goats than sheep. Within families, 60 per cent of adult women and 40 per cent of adult men own either or both species, women owning 60 per cent of both species combined but owning 75 per cent of goats. Individual owners with more than 5 animals are rare, the average holding for each human adult being 2.5 goats and sheep combined. About 68 per cent of households own less than 10 head, these families owning only 32 per cent of the total small ruminants. In Fulani villages, increasing flock sizes are usually a prelude to barter of goats and sheep for cattle. Integration of goats with agriculture is evident from the seasonal feeding patterns. Crop residues are the main source of feed in the dry season from Oct-Mar/Apr, when animals may not be herded but provided with some supplement in the compound to entice them home at night: during the crop growing season animals are individually attached to pickets or herded. Flock structure is related to meat production: females 71.9 per cent (35.2 per cent breeding > 1 year, this low percentage indicating a very high reproductive rate), about 30 per cent not being born in the flock but bought in; males 28.1 per cent (1.4 per cent > 1 year showing very early offtake).

TOGO. Total population about 750 000 head. Approximately 45 per cent of households (- 118 000) own goats. Unlike sheep, goats are evenly distributed throughout the country except for Central Province where there are few. Average flock size is 7: more than 90 per cent of flocks are smaller than 10 head. Most animals are confined or tied individually to stakes and fed on household waste and crop by-products. Flock structure also related to meat production but from males at older ages: females 67 per cent (50 per cent breeding > 1 year); males 33 per cent (15 per cent > 1 year).

Physical characteristics. Markedly dwarfed 30-50 cm. Weight: male 20-25 kg; female 18-22 kg.

Strong head, bulging forehead, profile straight or slightly dished, narrow muzzle, lower jaw slightly longer than upper.

Horns in both sexes: curl outwards and backwards in males and fairly strong; light, sharp and pointing upwards and backwards in females. Ears short to medium length, narrow, carried horizontally. Toggles present occasionally in both sexes. Males normally bearded and with a weak mane; females occasionally have beards; degree of bearding varies greatly according to sub-type.

Neck strong and fairly long. Chest broad and deep, girth much greater than height (60-70 cm). Back straight and long. Croup well developed. Legs extremely short. Udder small but usually well shaped.
Colour very variable according to region, dark brown with black points possibly commonest but blacks, whites, reds, pied and mixed colours also occur. Coat usually of stiff short hair, longer hair with a varying degree of waviness in some sub-types.
Products. Meat (skin is eaten with meat).
Productivity.

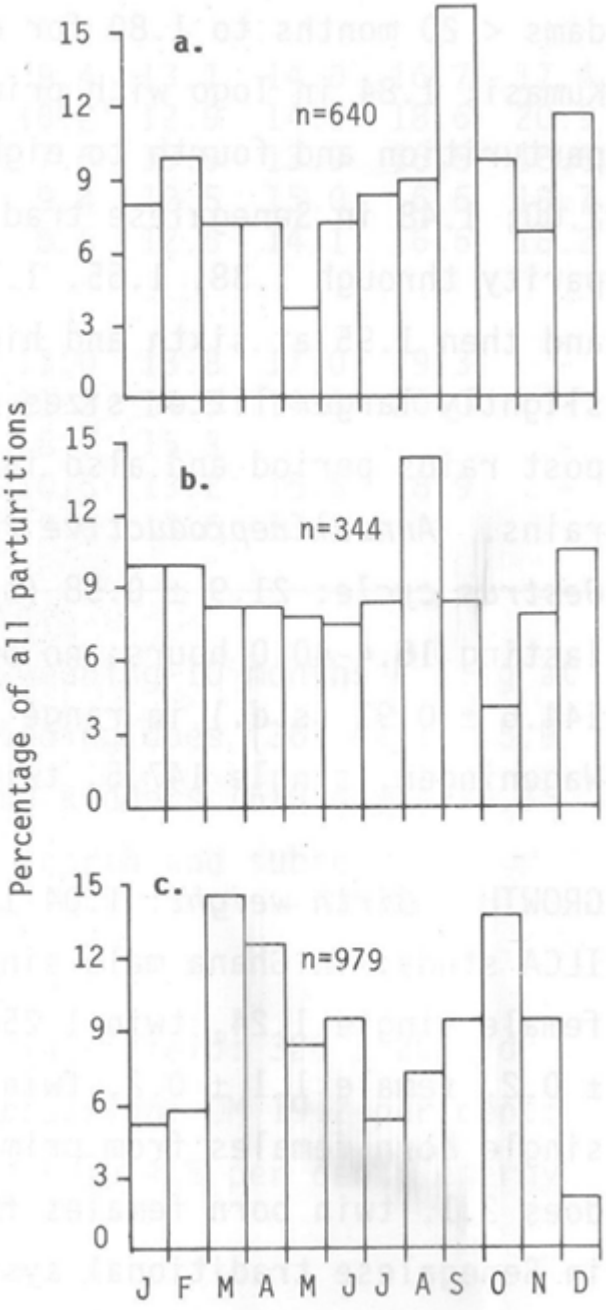

Figure 52 Distribution of parturitions in 3 traditionally man-aged populations of West African Dwarf goats in: a. Nigeria, b. Togo and c. Senegal

REPRODUCTION. *First kidding:* 12-18 months; 19.8 months at Ibadan University research farm; 17.0 + 4.56 (s.d.) months (n=206) in ILCA study of traditional system in south-western Nigeria; 361 ± 93 days (n=166) in Senegal; 450 ± 83 days (n=47) in Togo. *Kidding interval:* means of several studies vary between 228 and *283 days in overall range of 210-290;* first interval 267 ± 49 (s.d.) days and subsequent intervals 219 + 27 at Ibadan; 283 ± 88.4 (n=350) in ILCA study; 206 ± 43.6 (s.d.) days (n=9) at Kumasi in traditional system; first interval 258 days (n=127) and subsequent intervals 231 days (n=293.) in Senegal; 208 + 38 (s.d.) days (n=201) in Togo where births occur, as they do almost throughout the type's range, all the year (Figure 52). *Multiple births:* very numerous; twins extremely common, triplets common, occasional quadruplets; 19.1 per cent single, 53.6 twin, 27.4 triplet at Ibadan; 32.7 per cent single, 54.0 twin, 12.8 triplet, 0.6 quadruplet in Togo; 55.1 per cent single, 40.0 per cent twin, 4.9 per cent triplet overall in Senegal traditional system changing from 80.7 per cent single and 0.3 per cent triplet at first parturition to 26.2 per cent single and 21.3 per cent triplet at sixth and subsequent parturitions. *Litter size:* 1.40-1.85; 1.56 ± 0.60 (s.d.) (n=890) in ILCA study where increased from 1.2 for dams < 20 months to 1.80 for dams > 40 months; 1.50 ± 0.575 (n=54) at Kumasi; 1.84 in Togo with primiparous does producing 1.18 kids per parturition and fourth to eighth parities all producing more than 2.00; 1.48 in Senegalese traditional system rising from 1.17 at first parity through 1.38, 1.55, 1.74 and 1.86 at second to fifth parities and then 1.95 at sixth and higher parities and with some evidence of slightly larger litter sizes in Mar-May related to conception in the post rains period and also in Oct related to conception in the early rains. *Annual reproductive rate:* 1.86-2.96; 2.01 in ILCA study. *Oestrus cycle:* 21.9 ± 0.58 (s.d.) in range 16-25 days with heat lasting 16.4-40.0 hours; no observed seasonality. *Gestation period:* 144.6 ± 0.93 (s.d.) in range 142-149 days; 146 ± 3.3 days (n=124) at Wageningen, single 147.5, twin 146.4, triplet 149.1 (s.d.) days.

GROWTH. *Birth weight:* 1.04-1.62 kg; 1.57 ± 0.513 (s.d.) kg (n=657) in ILCA study; in Ghana male single 1.45, twin 1.22, triplet 1.04 and female single 1.24, twin 1.25, triplet 1.06; in Togo 1.1 kg, male 1.2 ± 0.2, female 1.1 ± 0.2, twin (not distinguished by sex) 1.0 ± 0.2; single born females from primiparous does 1.5 kg, from multiparous does 2.1, twin born females from primiparous and multiparous does 1.1 in Senegalese traditional system. *Weight for age:* 3 months-4.6 ± 1.28 (s.d.) (n=657), 9-6.0 ± 1.58 (n=127), 12-9.5 ± 3.16 kg (n=127) in ILCA study; females with 1 pair permanent incisors in Togo-8.5, 2 pairs-11.7, 3 pairs-13.8, full mouth-17.4 kg; heavier weights at comparable ages recorded in traditional system in southern Senegal (Table 33). *Average daily gain:* birth-90 days - 35, 90-150 - 20, 150-365 - 16 g in ILCA study; birth-weaning - males 88.1 females 83.4, singles 95.0 twins 87.0 triplets 74.0 g at Wageningen under intensive feeding of 60 g concentrate per day per $kg^{0.75}$; post-weaning-10 months - 52 g at Wageningen. *Post-partum weights:* first kidding does (361 days) 15.9 kg (=58 per cent of maximum weight), second kidders (619 days) 19.3 kg, third kidders (856 days) 21.8 kg, and fourth and subsequent kidders 25.2 kg.

Table 33 Weights (kg) at specific ages of West African Dwarf goats in a southern Senegal traditional system as affected by different variables (n=933 animals at 1 month)

Sex and Birth type		Age (months)							
		1	2	3	5	8	12	18	24
Overall average		3.6	5.5	7.2	9.9	12.9	14.8	17.1	18.8
Female									
	single primiparous	3.5	5.1	6.5	9.4	13.1	14.0	16.7	17.4
	single multiparous	4.0	5.9	7.8	10.2	12.9	14.6	18.6	20.9
	twin primiparous	2.8	3.9	5.2	7.6	10.9	13.9	16.5	18.6
	twin multiparous	3.4	5.2	6.8	9.4	12.5	15.0	16.6	18.7
	triplet multiparous	2.9	4.5	6.1	8.6	12.6	14.1	16.6	18.2
Male									
	single primiparous	3.8	5.7	7.7	11.0	13.8	17.0	19.3	-
	single multiparous	4.7	6.8	8.5	11.2	14.5	14.3	20.0	-
	twin primiparous	2.9	4.4	5.6	8.7	15.3	-	-	-
	twin multiparous	3.8	5.8	7.7	10.5	13.2	15.5	18.9	-
	triplet multiparous	3.2	5.2	7.0	9.6	13.6	13.2	-	-

MILK. *Lactation length:* 126 days in Nigeria. *Yield:* 320 ± 20 g/d with peak of 710 g at about 40 days. *Composition:* DM 19.2 per cent; fat 8.3 per cent; protein 5.1 per cent; lactose 4.5 per cent; energy 123 Kcal/100 g.
MEAT. *Dressing percentage:* 63 at live weight of 23.5 kg. *Carcass composition:* meat/bone ratio 0.41.
Carcass has more fat than dwarf sheep in the same environment.
Research. Department of Animal Production, University of Ife, Ile-Ife, Nigeria. Humid Zones Programme, International Livestock Centre for Africa, P.M.B. 5320, Ibadan, Nigeria. Laboratoire national de l'élevage et de recherches vétérinaires, Institut sénégalais des recherches agricoles, BP 2057, Dakar-Hann, Senegal. Institut de recherches zootechniques, BP 1457, Yaoundé, Cameroun. Societé pour le Développement de la Production Animale, BP 1249, Abidjan 01, Côte d'Ivoire. Department of Tropical Animal Production, Agricultural University of Wageningen, The Netherlands.
References. Epstein, 1953; Akinsoyinu, Mba & Olubajo, 1975; Mba, Boyo & Oyenuga, 1975; Akinsoyinu, Mba & Olubajo, 1977; Matthewman, 1980; Ademosun & Adebowale, 1981; Oppong & Yebuah, 1981; Mack, 1983; Togo, 1983; Akusu & Egbunike, 1984; Ngere, Adu & Okubanjo, 1984; Bourzat, 1985 (includes extensive bibliography); Ademosun, Bosman & Roessen, 1985; Asare & Wilson, 1986; Amégee, 1988; Francis, 1988; Hadzi, 1988a; ISRA, 1988.

EXOTIC GOATS

ANGORA

Origins. Probably from the Himalaya region. Modern development dates from the middle of the 16th century in the Angora region of Turkey. Mohair production was a Turkish monopoly until the early 19th century.
Distribution. Southern Africa including the Republic of South Africa (which is now the world's main mohair producing area) and Lesotho. Also in Kenya. World distribution includes Turkey and southern Texas.
The first importation into South Africa was of 12 bucks (rendered sterile by the Turks) and one female in 1838. The female gave birth to a male kid and this became the foundation of the South African national flock. Other Turkish importations were made until 1896. By 1900 the breed was widespread over much of what is now the Republic of South Africa. Angoras were already present in 1900 in Lesotho. It is probable that Lesotho Angoras arrived by two main routes -- thefts from Republic farms by returning labourers and purchases from these farms by the same labourers. Labourers probably also received goats in lieu of cash wages and imported them to Lesotho. In 1908 the Lesotho administration imported 35 bucks and a further 140 were imported in 1910. No stud is established in Lesotho and 275 bucks were imported from South Africa in 1986. The Angora goat population was estimated at 1.0 million in Lesotho in 1986 and it is so important to the economy that it is depicted on a coin (Figure 53).
Commercial keeping of Angoras started on the Laikipia plateau in Kenya in 1920 when a Mrs Carnegie bought two South African bucks from the Naivasha Experimental Station. These were bred to local white or other light-coloured goats and the current flock, following continued importation of South African bucks, is considered among the best in the world outside the major stud flocks in South Africa. Two other Kenya breeders started flocks in the Laikipia area later in the 1920s but these flocks were later amalgamated, the joint flock now numbering about 3000 animals. Total pure and high-grade Angoras in Kenya is less than 4000.
Ecological zones. Semi-arid in South Africa. Highland sub-humid and mountainous areas in Lesotho. Upland semi-arid in Kenya.
Management systems. Ranching, pastoral and agro-pastoral. Producer cooperatives in Lesotho had 1877 members in 1982 and 4234 in 1986. Two large scale commercial flocks in Kenya.

Figure 53 A Lesotho coin attesting to the importance of the Angora goat to the country

About 23 per cent of Lesotho households own goats, those owning goats only having a flock of 25.2 animals, those combining goats with sheep owning a flock of 55.0 animals. Older household heads are more likely to own, and own larger, flocks than younger ones. Only 12 per cent of flocks are owned or managed by women whose flocks are small.

Physical characteristics. Small size.

The South African Angora Goat Stud Breeders' Society has standards of which the following is an abridged version. The flock-book was closed to non-registered does in 1969, since when new members must buy animals from registered breeders.

Head bold in males, forehead wide, muzzle strong, mouth small. Hair should grow on forehead and down sides of face.

Horns present in both *sexes:* thick in males, set at least 2.5 cm apart at the base and spreading upwards, backwards and outwards; less heavy in females but also set apart and sloping backwards and out-wards; colour should not be wholly black. Ears long and lopped. "Beard" of mohair in males and females.

Neck long, well covered with hair. Chest deep with well sprung ribs. Back and underline straight. Croup full, not falling away. Legs straight and well set, well covered with hair. Tail straight and also covered with hair. Colour should be white as colour-ed hair reduces commercial value. Traces of colour persist in grade goats for many generations. Hair not excessively curly or straight, fine, dense and long (Figure 54).

Figure 54 An Angora buck, imported from South Africa, at a Lesotho government stud

Products. Mohair ("Angora" wool).

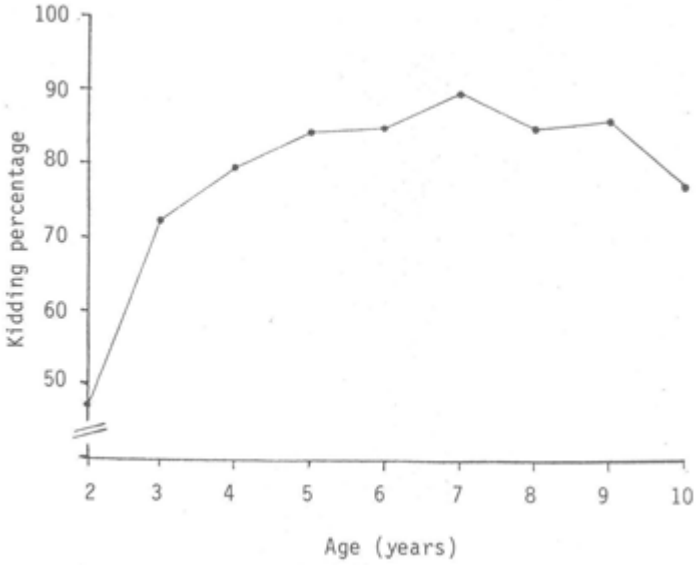

Figure 55 Angora goat fertility in different age groups in South Africa

Productivity.

REPRODUCTION. *First kidding:* first bred after eruption of first pair of permanent incisors in Kenya, first birth therefore at about 20 months; earlier in Lesotho traditional system. *Kidding interval:* once a year in Kenya (5 months gestation + 5 months suckling + l?-2 months rest). *Multiple births:* uncommon; twinning rate about 5 per cent. *Kidding percentage:* about 70 in Kenya, less in primiparous does as they are shy and poor mothers; up to 90 in mature does in South Africa (Figure 55).

Male Angoras show a "rut" in part of the year only when beard and caudal glands exude a dark, smelly, fluid.

GROWTH. *Birth weight:* 2.0-3.5 kg.

HAIR. *Yield:* 0.82 kg per head in Lesotho (507 t) in 1976, 0.80 kg (788 t) in 1986 (Figure 56); first-clip kids yield about 1.0 kg at 6 months in Kenya and mature females about 3.0 kg per year in 2 clips; in South Africa total production of Mohair in 1984 was 8.1 million kg from 1.9 million goats

equivalent to an average yield of 4.26 kg. *Fibre length:* 15 cm at 6 months. *Fibre diameter:* 27-32 um.
Kemp should only be present at base of horns: kemp constitutes about 44 per cent of fibres at birth but this is reduced to 7 per cent at 3 months. Breaking strength of single fibres about 0.42 g/um (wool 0.31) and tensile strength about 2154 kg/cm^2 (wool 1510 kg/cm^2). The fleece can be washed on the goat but this should be at least 14 days before shearing to allow grease to redevelop. In Kenya kid mohair is baled separately from adult hair and carried a premium of about US$ 4 per kg in 1984 (US$ 18 compared to US$ 14). Urine-stained mohair is also baled separately but no other sorting is done in Kenya. Kenya hair (about 4 tonnes) is exported to Switzerland and used mainly for fine suitings and knitting yarns but also in space suits as it is radiation resistant.

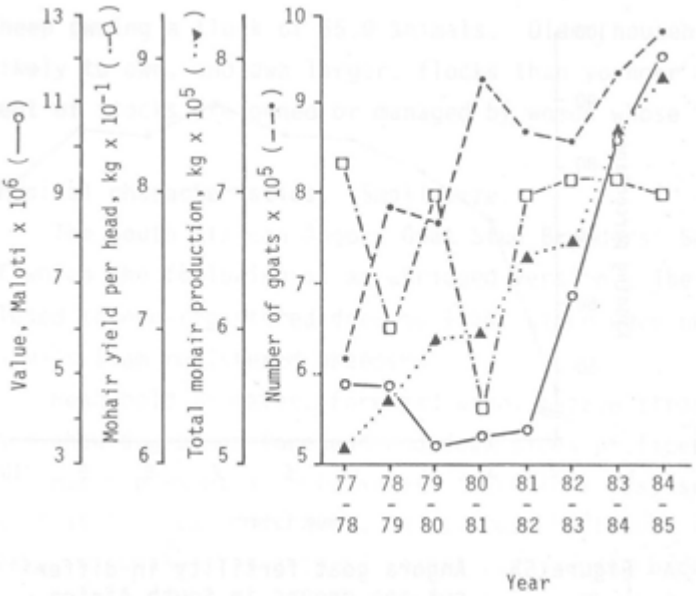

Figure 56 Technical and financial productivity of Angora goats in Lesotho

Research. South African Mohair Growers' Association.
References. van der Westhuysen, Wentzel & Grobler, 1985; Makhooane, 1987; Hunter, 1989; L. Carnegie, pers.comm.

PART THREE
SMALL RUMINANT TYPES/SHEEP

THIN-TAILED SHEEP

SUDAN DESERT

Synonyms. Northern Sudanese; Desert Sudanese; Sudanese Desert; (Hamdé, Drasciani, Gasc [Italian]).
Origins. Probably descended from ancient Egyptian stock.
Sub-types and races. Many "tribal" types have become recognized in recent years including Shugor, Dubasi, Watish, Kababish and Baqqara. Other classifications include Gezira and possibly Barka and Wollega in Ethiopia. A "fused ecotype" of Sudan Desert x Southern Sudan has been recognized in a central belt of Sudan.
Distribution. Sudan, north of 10°N, extending eastwards into Eritrea and westwards into Chad.
Ecological zones. Arid and semi-arid, also riverain.
Management systems. Mainly pastoral but grading into agro-pastoral and urban and similar to those described for Sudan Desert goat (p.66). Flock sizes are large. Flock structure is related to meat and/or milk production: females 77.8 per cent (breeding 55.8 per cent); males 22.2 per cent (4.2 per cent > 15 months).
Physical characteristics. Usually large size up to 80 cm (or bigger according to some sources) but varying with tribal type (as do all characters). Weight: male 60 kg; female 50 kg.
Head strong, forehead broad and flat, profile convex and some-times very markedly so, especially in Dubasi. Eyes set high on sides of head.
Horns usually absent in sheep from eastern Sudan but males from the west are usually horned: length up to 60 cm and of classic "ram's horn" spiral type; about 5 per cent of females in west are also horned. Ears usually medium-long, 12-18 cm, and pendulous. Toggles in both sexes in about 10 per cent of animals.

Neck long but fairly heavy. Chest fairly well developed. Withers prominent but broad in most types. Back long, with distinct dip. Sacrum usually higher than withers. Croup fairly well developed. Legs long, sometimes very long, and lightly fleshed. Tail long, thin but with varying amounts of fat at base or farther down depending on tribal type: length from 60 per cent of withers height to greater than withers height when it trails on ground.
Colour variable depending, also, on tribal type. Coat fine to coarse, short to long.
Shugor. Shugor are moderately large sheep ranging in colour from light to dark brown (Figure 57). They have occasional patches of wool under the hair. Their distribution area is mainly along the White Nile and the regions to the west of it. Flocks of Shugor sheep are commonest in the western part of the Gezira, grazing on cotton and other agricultural by-products. Their migratory movements are longer than the Dubasi.

Figure 57:Ram of shugor tribal type in a traditional flock in the Sudan Gezira (note 'kunan' and charm tied to testicles)

Dubasi. Dubasi are the prototype sheep of the Gezira area, especially the northern part, and are concentrated in the villages of the Dubaseen tribes (hence 'Dubasi') in El-Fawar, Umbusha, Selaim and Kab El - Gidad, but they are also found north of Khartoum, where they are known as the Butana. These sheep are similar to or greater in size than the Shugor but their coat, occasionally hairy, is usually particoloured white and black Figure 58. The distribution of the black patches on the skin varies among regions and breeders.

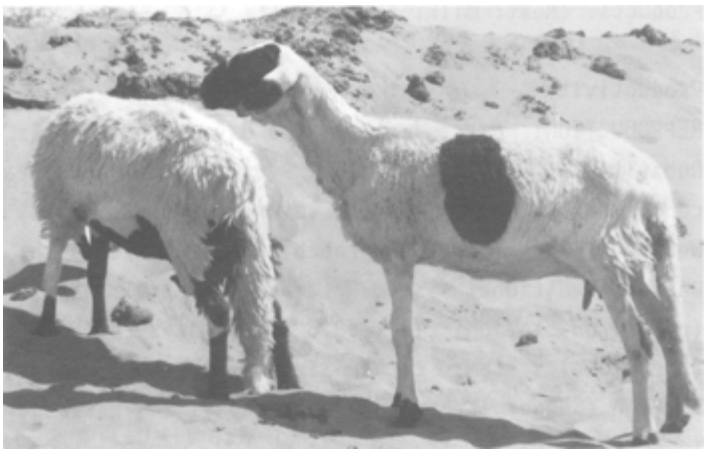

Figure 58: Dubasi ewes on the Nile bank near Khartoum, Sudan Gezira (note plastic bag on treat to prevent suckling and compare Figure 32)

Watish. In comparison with the Shugor and the Dubasi, the Watish is somewhat smaller and stockier Figure 59. It is a hardy sheep and lives under relatively high rainfall conditions between latitudes 10°N and 11°N and mainly along the Blue Nile, south of Wad Medani into the Fung area. The principal tribes owning this sheep are nomadic and semi-nomadic, including the Kenana, the Rufaa El Hoy and the Beni Meharib. Haemoglobin Type B in the Sudan Desert sheep should potentially lead to high productivity, particularly in reproductive performance.

Figure 59: A Watish ram in the southern Gezira, Sudan

Products. Meat; milk; (skins).

Productivity

REPRODUCTION. *First lambing:* 433 days (Shugor 428 ± 3.0 (s.e.), Dubasi 429 ± 5.6, Watish 406 ± 9.0) on station when allowed to run continuously with rams, much later (689 ± 42.5 days) when conception weight of 35 kg imposed; probably about 13-15 months in Southern Darfur traditional system. *Lambing interval*: 426 ± 20.0 (s.e.) days (n=452) on station; 275 ± 58.6 (s.d.) days (n=46) in Southern Darfur traditional system. *Litter size*: 1.22 ± 0.022 (s.e.) (n=1090) on station (Shugor larger than both Dubasi and Watish Table 34 1.14 in southern Darfur traditional system. *Annual reproductive rate:* 1.11 lambs per ewe on station; 1.50 in Southern Darfur. *Oestrus cycle:* 21 ± 5 days; 17 days at El Huda; duration of heat 25 hours.

Gestation period: 154 ± 4 (147-166) days; Shugor 151.3 ± 2.25 (s.d.) days (n-60), Dubasi 152.8 ± 0.36 (s.d.) days (n=96).
GROWTH. *Birth weight*: males 4.1 ± 0.63 (s.e.) kg (n=182), females 3.9 ± 0.66 (s.e.) kg (n=165), Shugor and Dubasi heavier than Watish. *Weight for age:* 30 days-7.4, 90-14, 120-16.7, 150-18.4, 240-25.3, 365- 31.7, 730-35.6, 1095-38.9 kg on station, Watish always lighter than

Table 34 Components of productivity of Sudan Desert sheep at El Huda, Sudan

Component and unit	n	Overall	Sheep sub-type			
			Shugor	Dubasi	Watish	s.e.
Litter size (n)	1090	1.22	1.30a	1.18b	1.17b	0.028
Parturition interval (d)	452	426	449a	425ab	403b	22.7
Lamb weight at 150 d (kg)	361	18.4	18.6a	17.3b	17.0b	0.54
Mortality at 150 d (per cent)	708	43.2	48.5a	46.3a	34.7b	3.60
Ewe post-partum weight (kg)	432	40.5	42.3a	42.2a	37.0b	0.64

Along rows, values without a common suffix letter differ ($P < 0.05$)
Shugor and Dubasi. *Average daily gain:* 0-30 days - 136, 30-120 - 110, 120-365 - 61 g on station. *Post-partum weights:* 40.5 ± 0.51 (s.e.) kg (n=432) on station, first parity ewes 37.5 kg.
MILK. *Lactation length:* 188 days on station. *Yield:* 137 kg. *Composition:* total solids 12.4 per cent; fat 4.28 per cent.
MEAT. *Dressing percentage:* 49.1 and 46.0 at 32.3 kg and 34.9 kg live weight on low- and high-fibre diets: 52.7 at empty body weight of 30 kg. *Carcass composition:* 72.2/28.8 per cent meat/bone at 30 kg empty body weight in fattened animals; butcher's carcass 15.8 kg, head 1.9, skin 2.7, pluck 0.9, tail 0.1, omentum, 0.5, feet 1.3, intestines 1.4, stomach 1.5; muscle/bone/fat present at 54/18/24 per cent in animals fed low fibre and 56/20/22 in high fibre diet animals at 15.9 kg and 16.1 kg carcasses.
Research. Animal Production Research Administration, Ministry of Animal Resources, P.O.Box 293, Khartoum, Sudan.
References. McLeroy, 1961; Khattab, 1968; Wilson & Clarke, 1975; Wilson, 1976a; El-Amin, 1983; El-Hag, El-Hag & Gaali, 1984; Sulieman & Eissawi, 1984; Sulieman & El-Tahir, 1984; El-Hag, Kurdi & Maghoub, 1985; Sulieman, Ali & El-Jack, 1985; El-Tayeb, Nour el-Din & Tibin, 1987; Sulieman & Wilson, 1989; 1990.

Synonyms. Massina [not recommended].
Origins. Probably descended from the woolled thin-tailed sheep of north Africa and introduced to the present area of distribution by Moors and Moroccans during the conquest of Timbuctoo in the 15th and 16th centuries. Also considered, probably erroneously, to be descended from Karakul or from various crosses of Merino with Syrian or Barbary sheep in ancient times. Macina is the Fulani word for the Niger river inundation zone.
Sub-types and races. Goundoun (Doundoun, Koundoum).
Three other types of "wool" sheep are described from West Africa. The Hadina is a large black sheep, kept by the Toubou in the extreme east of Niger. The Dané Zaïla is a very small white sheep from the same area, kept by Arabs. The wool sheep of West Kanem is considered not to exceed 1000 head in total, being found to the north and west of Mao in Chad.
Distribution. Confined essentially to the flood plain of the river Niger in central Mali (± 50 000 km²) and downstream in a narrow band each side of the river as far as Niamey Figure 60. Macina in Mali, Goundoun in Niger particularly around Tillabery. Total population 600 000 plus 30 000 Goundoun.

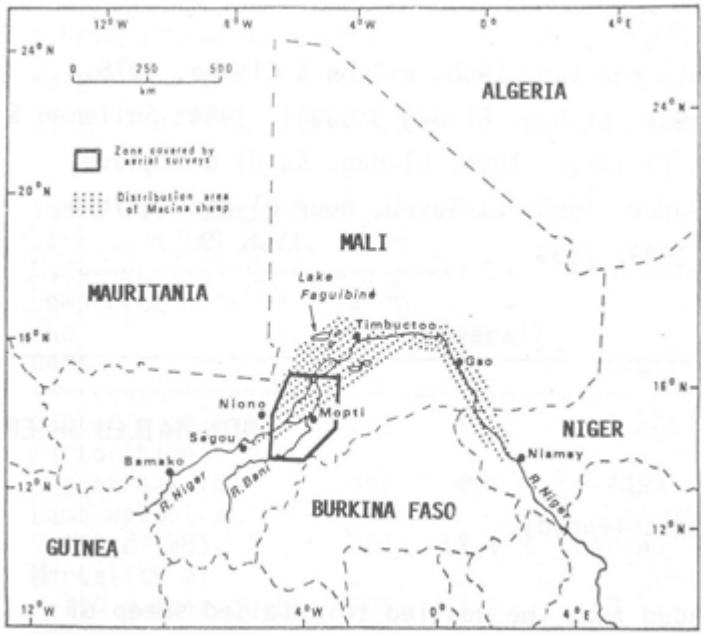

Figure 60 The distribution area of Macina sheep in Mali and Niger
Ecological zones. Does not thrive outside the humid area associated with the annual flood of the Niger river in the area of its distribution.
Management systems. Pastoral and agropastoral . Owned primarily by the Fulani of the Niger flood plain area. Transhumant management involves short treks outside the inundation zone during the period of maximum flood (Jul-Oct). A sophisticated system of flock stratification is used involving milking, breeding, slaughter and wool producing sub- units (Table 10). Flock sizes are generally large (69 per cent of flocks > 100 head). Flock structure, related to production of wool, includes a number of mature castrates: females 74.5 per cent (breeding 54.9 per cent); males 25.5 per cent (castrates 11.2 per cent).

Physical characteristics. Medium size 60-80 cm. Weight: male 40 kg; female 30 kg.
Forehead broad and straight, profile straight or slightly convex in males, no interorbital depression, supraorbital processes pronounced, narrow nose, upper jaw longer than lower Figure 61.

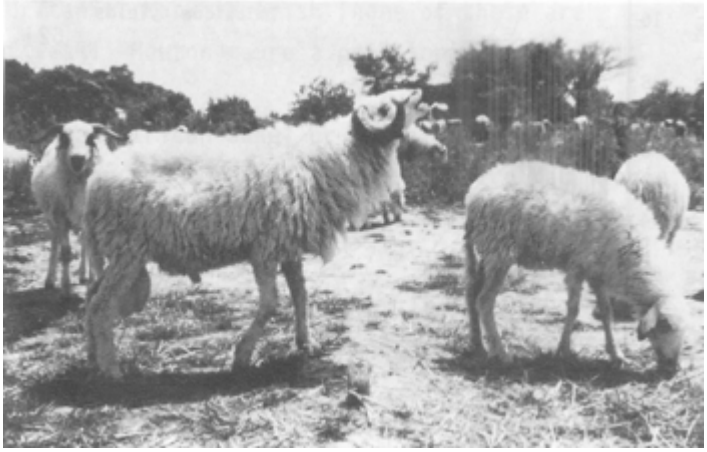

Figure 61 A Macina flock in the Niger river inundation zone in Central Mali

Horns: well developed with deep grooves in males (65 per cent), classic spiral "ram's horn" in shape, 0.5 per cent have multiple horns (4.0 per cent reported to have multiple horns in early 20th century); 8 per cent females carry weak horns or scurs. Ears medium length (12 cm), wide, pendulous. Toggles (apparently absent in original stock) in 15 per cent of animals. Neck short. Chest narrow and shallow. Prominent withers. Back straight. Croup tucked and thinly fleshed. Legs long and lightly fleshed. Tail thin, descends to below hocks.
Colour generally white, variously spotted with black and red particularly around eyes and ears. Coat of coarse wool mixed with hair, to forehead and knees and hocks but underside bare.
Goundoun is similar in most respects.
Products. Wool; milk; meat.

Productivity.

REPRODUCTION. *First lambing:* 500 ± 108 (s.d.) days, range 371-766 (n=7). *Lambing interval:* said to lamb twice a year; observed data 251 ± 73.4 days, range 170-485 (n=84); aseasonal, probably related to conditions in inundation zone. *Multiple births:* twin 3.1 per cent, triplet very rare. *Litter size:* 1.03. *Annual reproductive rate:* 1.5.
GROWTH. *Birth weight:* 2.7 ± 0.62 kg (n=48). *Height for age:* 10 days-3.9, 30-5.9, 90-10.3, 150-14.4, 240-19.0, 365-24.4, 550-29.4, 730-32.7 kg. *Mature weights:* males attain 60 kg.
MILK. *Lactation length:*135 days (range 85-165). *Yield:* 50 kg Figure 62.

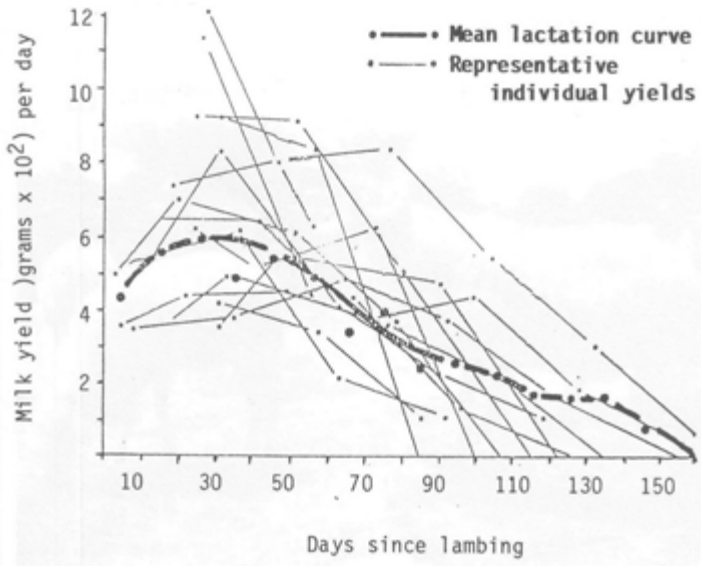

Figure 62 Lactation curves of Macina sheep under simulated traditional management

WOOL. *Yield*: 2 clips per year total 685 ± 42.8 g (males 836 ± 52.5 g, females 534 ± 65.0 g); females produce significantly more wool in wet season (1.92 g/d) than in dry (1.21 g/d); males similar (2.53 g/d, 2.20 g/d). *Fibre length:* 4.6 cm (reported to be up to to 30 cm). *Fibre diameter:* 39 um with CV 41 per cent in lambs but 55 per cent in adults indicating fine and coarse components; about 10 crimps per 100 mm. Resistance 14 g. Very little grease. Used mainly for blankets and coarse cloaks.

MEAT. *Dressing percentage*: 40. Meat has very little fat.

Research. None current. Formerly crossed (1905-1940) with Merino to improve wool production (quantity and quality) but products not accepted by traditional owners due to lack of hardiness and low breaking strain of wool. Some detailed field studies and rapid surveys.

References. Henry, 1918; Curasson, 1930; Doutressoulle, 1947; Ibrahim, 1975; Dumas, Lefèvre & Deslandes, 1977; Wilson, 1981; 1983a.

BLACK MAURE

Synonyms. Arab; Mauritania; Moor; Moorish [none of these are recommended alternatives]. Mouton maure à poil long.
Origins. Part of the West African Sahel or long-legged group. Possibly descended from the Rio de Oro sheep of northern Mauritania, which is in turn descended from the Maghreb type of Morocco.
Sub-types and races. The Zaghawa (or Arid Upland) of north-western Darfur and of eastern Chad appears to be the same sheep as the Black Maure.
Distribution. Owned by a number of Moor tribes in southern Mauritania (Hodh region), in northern Mali in the Nara, Nioro and Niono areas and eastwards to the western border of the Niger inundation zone, and in northern Senegal. Zaghawa are distributed in eastern Chad and north-western Darfur.
Ecological zones. Arid areas with low and highly seasonal rainfall. Northern Sahel and Saharo-Sahelian zones mainly of annual *[Aristida, Cenchrus)* grasses with some perennials and scattered acacia scrub.
Management systems. Principally pastoral. Many owners are "black" Moors (i.e. low cast former slave or 'haratin' groups) who practice some opportunistic agriculture. Owners transhume southwards in the dry season after sedentary farmers' crops are harvested (Dec-Jan) and set up temporary camps on stubbles: herds and flocks manure these fields in exchange for access to water from shallow hand-dug wells. The return north is during the early rains (Jun-Jul). The Zaghawa system is similar. Flock sizes are medium to large. Flock structure is related to production of hair and includes mature male castrates: females 77.2 per cent (breeding 66.0 per cent); males 22.9 per cent (castrates 6.2 per cent).
Physical characteristics. Large size 75-90 cm (male 80 cm; female 74 cm). Weight: male 45 kg; female 32 kg.
Strong head with flat forehead, profile convex in males but less so in females, narrow between eyes, narrow muzzle, well developed tear glands. Horns: well developed in males, triangular shaped, flat spiral directly outwards from head Figure 63, up to 30 cm in length, said to have multiple horns occasionally; females usually hornless. In the Zhagawa the horns have less pronounced ribs. Ears long (20 cm) in Maure, medium (12 cm) in Zhagawa, rather broad, pendulous. Toggles in a small percentage of both sexes, usually long.

Figure 63 A Black Maure ram on stubble grazing in central Mali

Neck long and thin. Chest narrow and shallow. Withers lower than tail head. Back long and dipped. Croup short. Legs long and lightly fleshed. Tail long (36 cm) and thin, falling below hocks.

Colour generally black with white tip to tail. In Chad about 68 per cent of animals black with another 15 per cent being predominantly black. Coat of long, coarse stiff black hair in loose ripples over a softer undercoat.

Products. Hair; meat; milk; (skins and pelts).

Productivity.

REPRODUCTION. *First lambing:* 12-18 months. *Lambing interval:* 8-10 months, generally aseasonal but some control of breeding practised by use of 'kunan'. *Multiple births:* 2-4 per cent. *Litter size:* 1.03. *Annual reproductive rate:* 1.4. *Gestation period:* 153 days in Sudanese Zaghawa.

GROWTH. *Birth weight:* 3 kg. *Weight for age:* 5 months-16.0, 12-24.0, 18-28.2, 24-31.5, 36-32.4 kg.

MILK. No firm information but based on lamb growth rates the lactation yield is probably 40 to 45 kg.

HAIR. *Yield*: multiple clips yield about 200 g per year. *Fibre length:* 3.3 cm (reported to be up to 10.0 cm). *Fibre diameter:* 26.6 um with CV 67.4 per cent. Very little grease. Used mainly in tent manufacture Figure 64 and for blankets.

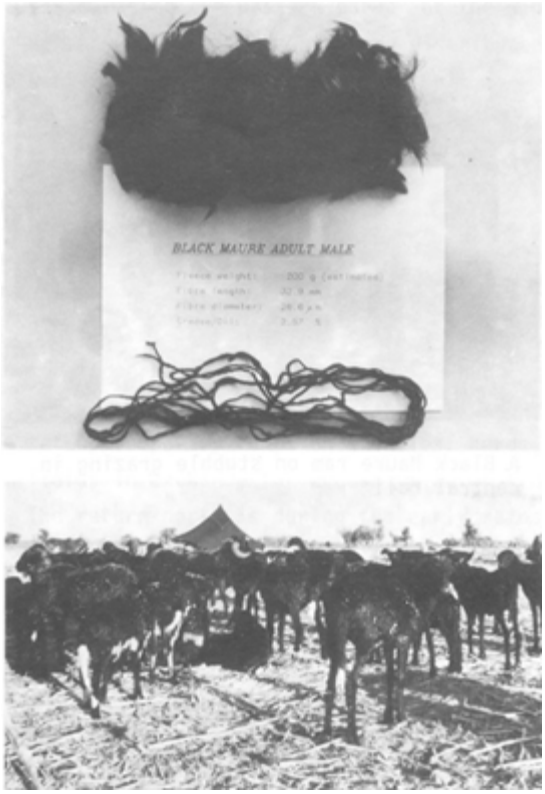

Figure 64 Raw and spun hair (top) and hair tent with Black Maure flock (bottom) on dry season pasture in an agro-pastoral system in central mail

MEAT. *Dressing percentage:* 35-40 in West Africa, 39-42 in Chad. Very little fat.

Research. None current. Used in 1930-1950 in cross-breeding programme with Karakul to produce Astrakhan-type pelts but acceptable pelts could only be obtained from animals with 87.5 per cent Karakul blood and practice was not taken up by traditional owners. Half-bred females from these experiments produced 1.2 kg coarse wool per year. Incomplete rapid surveys in Mali.

References. Curasson, 1934; Vallée, 1938; Chatel, 1939; McLeroy, 1961; Dumas, 1980; Wilson, 1981.

TOUABIRE

Synonyms. White Maure; White Arab.
Origins. Part of the West African Sahel or long-legged group. Sub-types and races. Warale is a Touabire/Peul-Peul crossbred.
Distribution. Owned by the same tribes as the Black Maure, in southern Mauritania, in northern Mali and in northern Senegal, generally north of 15°N.
Ecological zones. Arid areas with low and seasonal monomodal rainfall.
Management systems. As for Black Maure but also in smallholder fattening ("Mouton de Case"). Flock sizes medium to large, up to 130 head. Flock structures are related to meat production: females 74 per cent (breeding 60 per cent); males 26 per cent (breeding 4 per cent). Daily herding and management is done by women and children.
Physical characteristics. Large size 65-90 cm (male 75-90 cm; female 65-80 cm). Weight: 45-50 kg.
Strong head with flat forehead. Profile markedly convex in males and usually so in females (Figure 65). Lower face thin with narrow muzzle. Large eye with prominent supraorbital process.

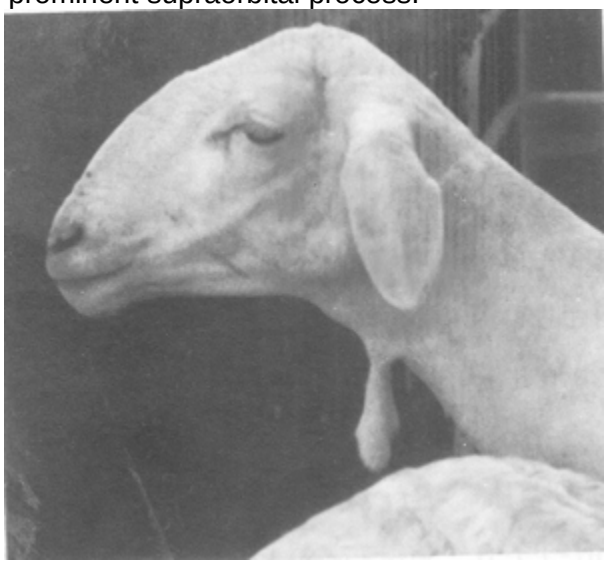

Figure 65 Profile of a female Touabire sheep in a village flock in northern Senegal

Horns: usually present in males, triangular in cross-section, often only as scurs, otherwise typically curved backwards and then forwards;
usually absent in females. Ears long to medium, rather broad and pendulous. Toggles in a small percentage of both sexes, usually long and thin.
Neck long and thin but with a fold of fat at nape on animals in v*ery* good condition. Chest narrow and shallow. Withers prominent.
Back long and dipped. Croup short and sloping. Legs long, very lightly fleshed. Tail long, very thin and falling to or below hocks (Figure 66).

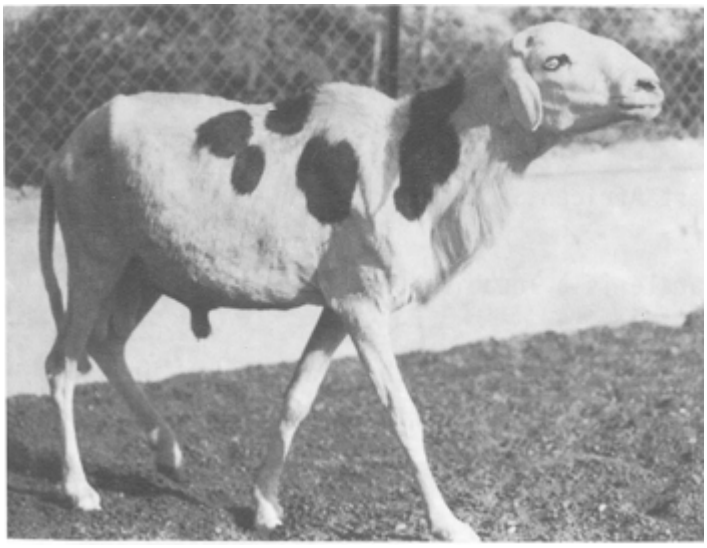

Figure 66 A Touabire ram at Dahra station in northern Senegal (note the wall eye)

Colour usually white but with variable amounts of black spotting. Coat short and stiff. Males often have longer hair on brisket.

Products. Meat; milk; (skins).

Productivity.

REPRODUCTION. *First lambing:* 739 ± 50.5 (s.d.) days (n=85) at Dahra; capable of lambing much earlier as when put to ram at 5 months first lambing averaged 374.8 days. *Lambing interval:* 342 days (n=76) at Dahra. *Multiple births*: very few. *Litter size*: 1.02 at Dahra.

GROWTH. *Birth weight*: 3.7 kg at Dahra. *Weight for age:* 30 days-9.8, 60-15.0, 90-77.2 kg at Dahra. *Average daily gain:* birth-30 days - 176, 30-60 - 115, 60-90 - 73 g. *Mature weights*: males 46.4 ± 4.4 (s.d.) kg (n=5); females 34.5 ± 4.4 kg (n=65).

MILK. *Lactation length*: 5-6 months. *Yield*: 200-400 g/d. MEAT. *Dressing percentage:* 40-45.

Research. Laboratoire national de l'élevage et des recherches vétérinaires, Dahra, Sénégal.

References. Bradford, 1983; Sow, Thiongane & Tchamitchian, 1987.

PEUL-PEUL

Synonyms. Fulani (English); Foulbé.
Origins. Part of the West African Sahel or long-legged group.
Sub-types and races. Waralé is a Touabire/Peul-Peul crossbred.
Distribution. Central Senegal.
Ecological zones. Semi-arid to sub-humid in Sahel and Sudano-Sahel zones.
Management systems. Pastoral and agro-pastoral.
Physical characteristics. Medium size 65-75 cm. Weight: 30-50 kg.
Horns: present in males, loosely spiralled.
Colour variable but usually white with black or red spots or whole red. Coat short and stiff.
Products. Meat.
Productivity.
REPRODUCTION. *First lambing*: > 24 months. *Lambing interval*: 12 months in Senegal traditional system; 7.3 months (n=35) on station (40, 36, 16 and 8 per cent with intervals of < 7, 7-8, 8-9 and > 9 months).
GROWTH. *Birth weight:* male 3.1 kg, female 2.9 kg from dams provided with some supplementary feed. *Average daily gain:* 0-40 days - 124.4, 40-180 - 110.6 g.
MEAT. *Dressing percentage*: 50
Research. Laboratoire national de l'élevage et des recherches vétérinaires, Dahra, Sénégal.
References. Tchakerian, 1979; Bradford, 1983.

TORONKE

Origins. Part of the West African Sahel or long-legged group.
Sub-types and races. Several are recognized, usually based on colour and markings (Futanké, Figure 67), locality (Banamba, Figure 67), or ethnic group (Fulani). The Peul Voltaïque of Burkina Faso is similar.

Figure 67 Toronke sheep of the Futankeé (left) and Banamba (right) sub-types at Bamako market in Mali

Distribution. West-central Mali and south into Burkina Faso.
Ecological zones. Semi-arid to arid.
Management systems. Agro-pastoral and pastoral.

MALI. Sheep are owned in two major types of sedentary livestock systems -- rainfed millet and irrigated rice -- and in a number of transhumant systems. In both the rainfed millet and irrigated rice systems about 56 per cent of households own sheep (compared to 100 per cent owning goats). Flock sizes average about 13 head in the rain- fed and about 12 in the irrigated systems for those families owning sheep, and about 25 head in the transhumant system. Sheep are outnumbered by goats in the ratio of about 5.4:1.0 in the millet system, by about 1.4:1.0 in the rice system and by about 2.6:1.0 in the transhumant system. Unlike goats, which are often tethered at night in the sedentary system, sheep are penned communally in a thorn enclosure. Flock structures are related primarily to meat production: females 76.7 per cent (54.3 per cent breeding), males 23.3 per cent (2.4 per cent > 15 months) in sedentary systems; females 70.3 per cent (53.5 per cent breeding, males 29.8 per cent (7.5 per cent > 15 months of which 3.2 per cent castrates) in transhumant systems.
BURKINA FASO. "Sahel" sheep are owned by about 80 per cent of Fulani agro-pastoral families in Yatenga, with an average flock size of 23 head: 87 per cent of families own goats, average flock size about 54 head. Both sheep and goats are loosely herded except during the short crop growth period. Flock structures are related mainly to meat production: females 76.2 per cent (59.6 per cent breeding), males 23.8 per cent (5.7 per cent > 15 months of which 2.0 per cent castrates).
Physical characteristics. Large size 70-80 cm. Weight: male 40 kg; female 30-35 kg.
Head strong and elongated. Convex profile in males, straight in females. Horns: almost universal in males, slightly flattened in cross- section and deeply ribbed, spiral in classic "ram's horn" shape and up to 65 cm long; about 32 per cent of females carry horns, usually light and rudimentary, and up to 15 cm long. Ears are semi-pendulous and of medium length (11-14 cm). About 25 per cent of males and females have toggles, variable in position and length.
Neck rather long and thick, clean in that there is neither mane nor longer hairs on the throat. Withers prominent, average height 74.1 ± 4.1 (s.d.) cm (n=48) in females. Chest fairly well developed, about 8 per cent greater in circumference than withers height. Back medium length, slightly dipped and fairly wide over kidneys. Croup more or less well developed. Legs long but well boned and fleshed. Tail long, to below hocks, and thin.
Colour v*ery* variable: 49 per cent red pied, 28 per cent black pied, 19 per cent white, 9 per cent red and 3 per cent black (n=367) at Kayes research station in west Mali. Futanké is usually sparsely spotted black. Banamba is red. Burkina type is mainly white with various degrees of spotting.
Products. Meat; (milk).
Productivity.
REPRODUCTION. *First lambing:* 23.4 months at Kayes; 480 ± 115.3 (s.d.) days (n=210) in central Mali traditional system over 6 year period 1978-1983; 13.9 months in 1979-1980 in northern Burkina Faso but much later (22-24 months) in 1983. *Lambing interval:* 261 ± 76.3 (s.d.) days (n=984) in central Mali traditional system, most being in range of 6-8 months, longer in millet than in rice system, reducing with increasing parity, longer after a twin birth and longer after a previous birth in post-rains or cold dry (Oct-Feb) seasons; 290 + 69.9

Table 35 Lambing data for 24 flocks of sedentary sheep in central Mali

Parameter	Physiological age of goat					Overall
	Pairs permanent incisors				Temporary incisors	
	4	3	2	1		
Number in sample	37	21	22	42	16	138
Type of birth						
single	124	52	43	41	0	267
twin	9	2	2	1	0	14
triplet	1	0	0	0	0	1
Total births	134	54	45	42	7	282
Total lambs born	145	56	47	43	7	298
Litter size	1.08	1.04	1.04	1.02	1.00	1.06
Births per ewe						
mean	3.62	2.57	2.05	1.00	0.43	1.84
mode	3	2+3	1	1	0	1
range	2-8	0-5	1-4	0-3	0-1	0-1

(s.d.) days (n=44) in Burkina Faso in 1983-1985. *Multiple births:* rare; 94.7 per cent single, 5.0 per cent twin and 0.3 per cent triplet in 282 parturitions in central Mali according to owner recall in 1978 (Table 35); 95.7, 4.2 and 0.1 per cent respectively for 1650 parturitions in 1978-1983 in central Mali. *Litter size:* 1.01 on station at Kayes; 1.06 by owner recall in Mali traditional system; 1.04 ± 0.21 (s.d.) (n=1650) in Mali long term study, larger for births in cold and hot dry seasons related to conceptions during and just after rains; 1.05 ± 0.22 (s.d.) (n=258) in Burkina Faso. *Annual reproductive rate*: 1.45 in long term Mali study; 1.33 in Burkina faso. *Lifetime production:* 1.84 parturitions per ewe in central Mali, full mouth ewes averaging 3.62 parturitions (Table 35); 0.13, 0.52, 1.40, 2.20 and 3.43 parturitions per ewe with temporary, 1, 2, 3, and 4 pairs of permanent incisors in the Gourma in Mali.

GROWTH. *Birth weight:* 2.9 ± 0.88 (s.d.) kg (n=613) in central Mali traditional system in 1978-1984, heavier in rice (3.0) than in millet (2.6) system, males (2.9) heavier than females (2.6), singles (3.1) heavier than twins (2.4), heavier in lambs from older females and heavier in lambs born in rainy season. *Weight for age*: 30 days-6.0, 90-11.8, 150-16.1, 240-21.5, 365-27.2, 550-32.0, 730-35.1, 1095-39.2, 1460-37.9 kg in Mali; 30 days-5.9, 90-10.3, 150-14.9, 240-18.6, 365- 24.9 kg in Burkina Faso; 27.4, 28.9, 30.1 and 32.0 kg per females with 1, 2, 3 and 4 pairs of permanent incisors in Burkina Faso, and 28.1, 29.4, 32.8 and 37.2 kg for males at same stages. *Average daily gain*: 0-150 days - 88.7, 0-365 - 66.9, 0-1095 - 33.3 g in Mali; 0-150 days - 83.3, 150-365 - 45.4 g in Burkina Faso. *Post-partum weights*: 30.0 ± 5.33 (s.d.) kg (n=1536) in central Mali, varying by system, type of parturition and parity (first parity 27.7 kg, fourth parity and above 33.9 kg). Weight variations due to season are slightly more marked than for goats in the same systems Table 27.

MEAT. *Dressing percentage:* castrates 48.6 at 31.8 kg live weight, entire males 44.5 at 33.4 kg and females 45.5 at 28.6 kg at central Mali abattoir. *Carcass composition:* butcher's carcass 45.7 per cent at 31.2 kg in central Mali, stomachs and intestines 5.1, kidneys 0.5, liver 1.9, lungs and heart 2.9, mesenteric fat 4.1, spleen 0.1, head 6.9, feet 2.8, skin 7.1, udder 0.9, gut fill 15.4, blood and body fluids 6.2.
Average carcass weights 14.2 kg for all ages and sexes combined in central Mali, dressing percentage being lower than goats mainly due to greater gut fill. Sheep contributed 4.4 per cent to total meat available from Niono slaughterhouse in central Mali in *1979/1980. Most* sheep are slaughtered at home for household consumption, however, many being reared specifically in a "Mouton de Case" (smallholder fattening) system.

Figure 68: Moutons de Case in the irrigated rice system in central Mali

In the Mouton de Case system, 1 or a small number of sheep are specifically fattened for slaughter at the main muslim festivals, in a totally confined system Figure 68. More than 25 per cent of total sheep slaughter occurs in connection with 'tabaski', the Feast of the Sacrifice. In central Mali 39 per cent of households in the rice and 24 per cent in the millet systems practised this fattening system. Average numbers fattened were 1.98 in the rice system (52, 24, 13, 4 and 7 per cent of owners fattening 1, 2, 3, 4 and > 4 animals) and 2.19 in the millet system (41, 39, 8, 0 and 12 per cent fattening 1, 2, 3, 4, and > 4 animals). About 77, 3 and 20 per cent of sheep were males, castrates and females with 62 and 28 per cent of males being < 15 and 15-21 months old. Mouton de Case were significantly heavier at all ages than their extensively reared contemporaries Table 36. There was a significant price premium per unit weight for heavier animals. Most animals were in the weight range of 40-50 kg (32.4 per cent) and of 30-40 kg (31.9 per cent) at slaughter or sale in 1980 and 1983, with 15.3 per cent weighing more than 50 kg.

Table 36:Comparative weights of Moutons de Case and extensively reared sheep in central Mali

Age	Weight (kg)	
	Mouton de Case	Extensively reared

< 15months[1)]	32.4	18.3
15-21 months	38.0	27.3
22-27 months	40.02	31.5
28-33 months	53.5	34.8
>33 months	52.9	44.8

Note: 1) average 8 months

Research. Mainly *systems* studies carried out by ILCA, EEC and national organizations, the two first now stopped. Institut national des recherches zootechniques, hydrobiologiques et forestières, Station de Toronké, Kayes, Mali.

References. Bourzat, 1980; Peacock, 1983; Wilson, 1983b; Wilson & Durkin, 1983; Wilson, 1984a; 1984b; Kolff & Wilson, 1985; Wilson, 1986; Wilson & Light, 1986; Wilson, 1987; Wilson & Sayers, 1987; Wilson, 1988; Wilson & Durkin, 1988; Bourzat & Wilson, 1989.

TOUAREG

Synonyms. Targui (=singular of Touareg).
Origins. Part of the West African Sahel or long-legged group.
Sub-types and races. A smaller "Touareg" sheep is sometimes distinguised in the Gourma in Mali.
Distribution. North-east Mali from the top of the Niger bend and Timbuctoo, north to the Adrar n'Iforas at about 19°N and eastwards to Niger from Niamey and Dosso in the south to the Aïr region in the north.
Ecological zones. Semi-arid and arid to extreme arid.
Management systems. Pastoral, transhumant and nomadic, and to a lesser extent agropastoral. Flock fairly large, 50 head or greater in Mali, and 100 head in Niger flock structures are related to meat production in Mali and milk production in Niger: females 73 per cent (48 per cent > 15 months, 62 per cent breeding), males 27 per cent (9 per cent > 15 months, 8 per cent castrates) in the Gourma in Mali; females 82 per cent (64 per cent breeding), males 18 per cent (6.1 per cent > 15 months of which 4.0 per cent castrates) in Niger.

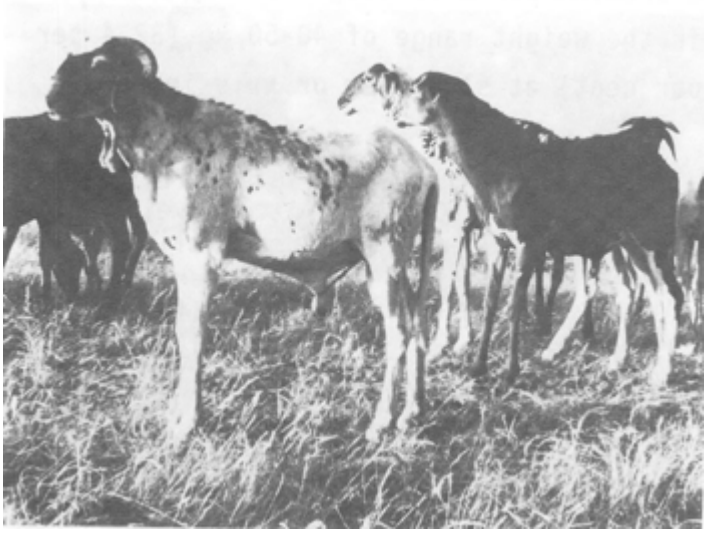

Figure 69: A ram of Touareg type (note 'kunan' to control breeding) in the Air region in north Niger

Physical characteristics. Large size 75-80 cm. Weight: 40-60 kg. Head fairly strong. Forehead prominent with strongly convex profile. Muzzle narrow. Eyes not v*ery* prominent.
Horns: usually present in male, strongly ribbed, spiralling backwards; usually absent in female. Ears medium length, 15 cm. Toggles occur in both sexes. Some males in some areas may have a mane and a slight throat ruff.
Neck long with fat fold at nape in males in good condition. Withers prominent. Chest shallow and narrow, girth circumference barely exceeding withers height. Back straight and fairly long. Croup sloping but less than in neighbouring Maure and Toronké types. Legs long with flat thighs and lightly fleshed. Tail medium length, reaching to hocks. Udders well shaped with long, well-spaced teats.
Colour white, usually more or less heavily spotted Figure 69. Other colours, notably red, occur. Coat of short stiff hair.

Products. Meat; milk.
Productivity.
REPRODUCTION. *First lambing:* apparently delayed, many ewes not lambing until 2 years Table 37. *Lambing interval:* about or longer than 365 days. *Multiple births:* uncommon. *Litter size:* ?1.03. *Annual reproductive rate:* 0.59 in the Mali an Gourma in 1983. *Lifetime production:* only 4 per cent of ewes produce more than 4 lambs.
MILK. *Yield:* 200-400 g/d in dry season; 400-600 g/d in wet season.
Milk is converted to a very hard cheese which is stored as small, flat, round cakes.

Table 37 Reproductive careers based on owner recall in Touareg sheep in the Gourma of Mali

Age class (months)	Number of parturitions									Mean parturitions per female
	0	1	2	3	4	5	6	7	8	
10-15	91	1								0.10
15-21	86	17	3							0.21
21-27	35	20	23	3						0.92
27-35	4	15	24	13						1.82
>35	3	10	88	68	38	10	8	3	1	2.29

MEAT. *Dressing percentage:* 46.
Said to fatten easily and to produce nicely marbled meat. A preferred type for "Mouton de Case" (see Toronké).
References. Wilson & Wagenaar, 1983; Peacock, 1983.

ARA ARA

Origins. Part of the West African Sahel or long-legged group.
Distribution. South-central and central Niger.
Ecological zones. Semi-arid.
Management systems. Agro-pastoral and pastoral.
Physical characteristics. Similar to Uda.
Products. Meat.
Productivity.
REPRODUCTION. *Multiple births:* relatively many for arid zone sheep; 84.6 per cent single, 13.0 per cent twin, 2.4 per cent triplet in 1985 and 1986 on station at Maradi. *Litter size:* 1.18 (n=208).
GROWTH. *Birth weight:* 2.7 kg; single males 3.0, twin males 2.4, single females 2.7, twin females 2.3 on Maradi station. *Weight for age:* single males 1 month-8.0, 2-10.6 kg; single females 1 month-7.3, 2-13.9 kg.
Research. Centre d'élevage caprin du Maradi, BP 379, Maradi, Niger.
References. CECM, 1985; 1986.

UDA

Synonyms. Oudah; Peul; Bali-bali; Bororo (western Sudan); Fellata. (western Sudan).

Origins. Part of the West African Sahel or long-legged group.
Sub-types and races. There is considerable confusion of terminology in this type. In Niger the pied (Oudah bicolore) and white (Bouli) varieties are considered to be colour variants. In Nigeria the white type is called the Balami and generally accorded full breed status. In Chad and northern Cameroon the pied type is known as Foulbé and the white type as Waïla. The Bali-bali is sometimes considered a separate type and not just a synonym in Niger.
Distribution. Southern Niger, northern Nigeria, central Chad to western Sudan and Cameroon.
Ecological zones. Semi-arid monomodal rainfall lowlands to arid.
Management systems. Agro-pastoral and pastoral transhumant.
Physical characteristics. Large size up to 85 cm (male 75-85 cm; female 65-75 cm). Weight: male 65 kg; female 45 kg.
Head long and heavy with flat forehead, often with a central depression, and slightly convex profile.
Horns: almost universally present in males, long and spirally twisted growing horizontally out from head Figure 70; when present in females short and fine. Ears pendent, thin; long to v*ery* long (22 cm). Both sexes occasionally have toggles. Males may have a mane. Neck long, occasionally with dewlap. Withers prominent and higher than sacrum. Chest shallow and narrow, girth measuring about the same or slightly more than withers height. Back long and dipped. Croup short and sharply sloping. Legs long and lightly fleshed. Tail long and thin.

Figure 70 Ram of Uda type at the Niamey research station of the Institut national de la recherche agronomique nigérienne

Colour black and white pied, black on fore and white on hind quarters with clean dividing line in classic Uda type: all white in Bali-bali. Forehand is dark chocolate to reddish in some animals. Coat of short coarse hair.
When crossed with forest type sheep in the south of its range the animal becomes smaller, has shorter ears and may carry a mane, a throat ruff and also some hair on the chest and rib cage Figure 71.

Figure 71: A "Sahel crossbred" showing Uda and forest type characters at Maruma Cameroon

Products. Meat

Productivity.

REPRODUCTION: *First oestrus:* 351 ± 37.8 (s.d.) days (n=12) on station in Niger. *First lambing:* 15-17 months on station in Niger; 448 days (314-662) (n=28) at Yagoua station in Cameroon, 11 per cent lambing at < 365 days. *Lambing interval: 270* days at Shika in Nigeria.

Multiple births: uncommon, 1 triplet in 404 births over a 7 year period in Niger; 10 twin and 61 single at Shika in Nigeria. *Litter size:* always less than 1.1 on station in Niger with pied types having larger (1.10) litters than white ones (1.04); 1.14 at Shika in Nigeria. *Fecundity* (=lambs/100 ewes/year): 151 per cent at Yagoua station in north Cameroon.

Oestrus cycle: 16.8 ± 0.06 (s.e.) days (n=109) in Niger but with much longer intervals in Jan-Apr

leading to a reduced frequency of oestrus Figure 72; heat lasts 33.2 ± 3.1 hours (n=28).

Gestation period: 154.8 ± 1.0 (s.d.) days (n=28) in Niger. *Ovulation rate:* 1.3 ± 0.04 (s.e.) with no seasonal variation in Niger.

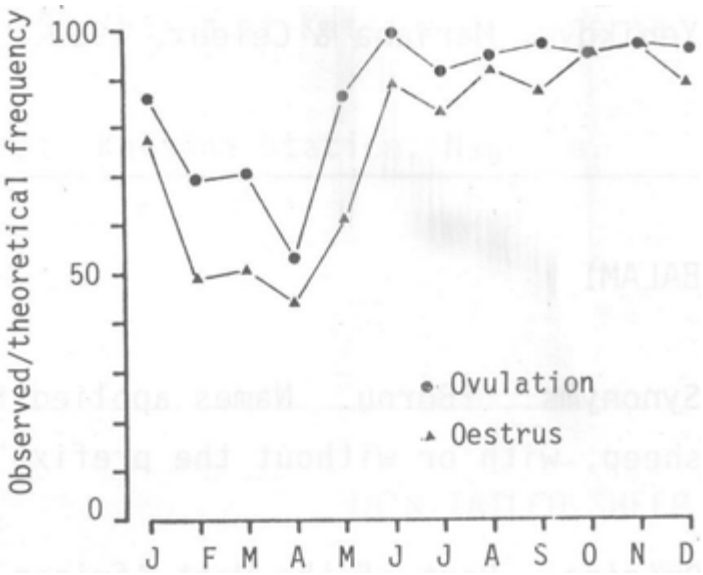

Figure 72: Seasonal variations in expression of oestrus in Uda ewes in Niger

GROWTH. *Birth weight:* 3.5 kg on station in Niger; males 3.9, females 3.5 kg at Shika. *Weight for age:* on station in Niger weights at 30, 90 and 180 days increased from 7.3, 13.6 and 20.4 kg in 1981 to 11.0, 18.9 and 27.0 kg in 1987, probably as a result of better management; 3 months-males 16.2 and females 15.3, 12-32.6 and 27.1, 18-36.1 and 24.3 kg at Shika. *Average daily gain:* birth-18 kg - single males 150 (114-192), twin males 110 (75-174), single females 140 (79-170), twin females 113 (101-142) g at Katsina in Nigeria; 0-3 months - 156 singles and 111 twins, 0-6 - 109 and 95, 0-12 - 98 and 91 g in Nigeria.
MILK. *Yield:* estimated at 60 litres in 150 days on station in Niger.
MEAT. *Dressing percentage:* 48-50 on station in Niger; 38-41 at Shika at 13-14 months with carcass weight of 11.5 kg.
Research. Ecole supérieure d'agronomie, Université de Niamey, BP 10960, Niamey, Niger. Federal Livestock Department, Katsina Station, Kano Region, Nigeria.
References. Ferguson, 1964; Ibrahim, 1975; Gaillard, 1979; Ngere, Adu & Mani, 1979; Yenikoye et al, 1982; Yenikoye, 1984; Deciry, 1987; Yenikoye, Mariana & Celeux, 1989.

BALAMI

Synonyms. ?Bornu. Names applied to the Uda are also used for this sheep, with or without the prefix "white".
Origins. Part of the West African Sahel or long-legged group.
Sub-types and races. The Balami is probably the same sheep as the "Bouli" or white Uda variety of Niger.
Distribution. Northern Nigeria.
Ecological zones. Semiarid and drier sub-humid.
Management systems. Agro-pastoral.
Physical characteristics. Large size. Weight: heavier than Uda. Similar to Uda except colour is wholly white Figure 73

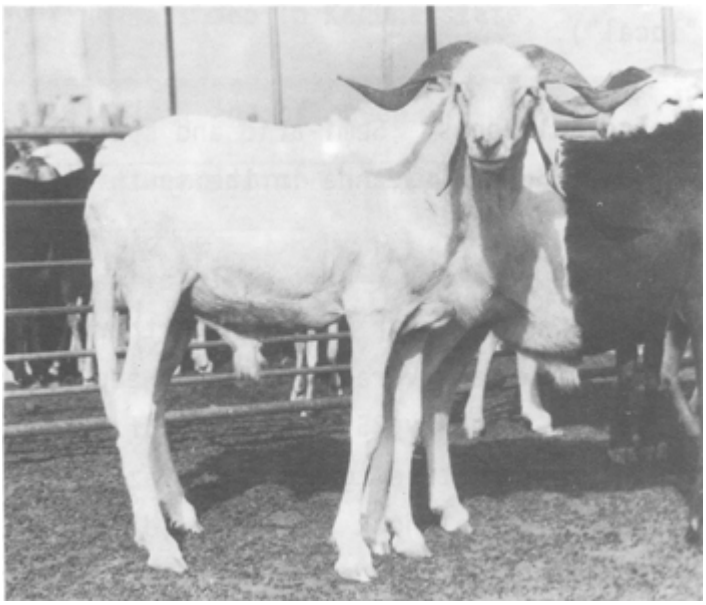

Figure 73: Balami ram at Katsina station, northern Nigeria

Products. Meat.

Productivity.

GROWTH. *Birth weight:* 3.5 kg singles, 3.1 kg twins. *Average daily gain:* birth-18 kg - males single 142 (101-190) twin 108 (67-167), females single 137 (76-198) twin 103 (69-133) g at Katsina in Nigeria.

Research. Federal Livestock Department, Katsina Station, Nigeria.

References. Ngere Adu & Mani. 1979.

YANKASA

Origins. Part of the West African Sahel or long-legged group although there has probably been some admixture of blood from sheep from farther south

Distribution. Northern and north-central Nigeria ("Yankasa" = Hausa "local").

Ecological zones. Semi-arid and sub-humid, extending into the northern Guinea savanna in the south.

Management systems. Agropastoral and pastoral. In a Fulani agro-pastoral system near Zaria in northern Nigeria 70.0 per cent of families own an average of 12.5 sheep in the range 2-50: goats and/or sheep are owned by 85.3 per cent of families. Unlike goats, sheep are managed with cattle, go out to graze with them, and at night are tied by an individual neck loop to a 'dangwali', a long, common rope attached to a picket at each end. Sheep are outnumbered by goats in the ratio 1.0:1.4 in Zaria. In the Kaduna area in sub-humid north-central Nigeria, sheep are more important than goats. Generalized flock structure: females 76.1 per cent (47.1 per cent with 1 or more pairs permanent incisors); males 23.9 per cent (3.6 per cent with 1 or more pairs permanent incisors) with a ratio of breeding males to breeding females of 1.0:12.9.

Physical characteristics. Large size. Weight: male 40 kg.

Horns, when present, are small and variable in shape. Ears relatively short and semi-pendent. Many males have a mane.

Colour white with black ears and around eyes, muzzle and on top of tail.

Products. Meat
Productivity.
REPRODUCTION. *First oestrus:* 238 ± 23.4 (s.d.) days (n=10). *Weight at first oestrus:* 18.4 + 0.4 kg. *First lambing:* rather delayed in northern Nigeria traditional system with only 1.5 per cent of ewes with temporary incisors and only 57.9 per cent of those with one pair of permanent incisors having lambed Table 38 . *Multiple births:*

Table 38: Reproductive data established from owner recall in 106 flocks of sedentary Yankasa sheep in Kaduna state, northern Nigeria

Parameter	Physiological age of sheep					Overall
	Pairs permanent incisors				Temporary incisors	
	4	3	2	1		
Number in sample	179	173	155	164	412	1083
Type of birth						
single	566	362	198	92	6	1224
twin	50	20	10	3	0	83
Total births	616	382	208	95	6	1307
Total young born	616	402	218	98	6	1390
Litter size	1.08	1.05	1.05	1.03	1.03	1.06
Births per ewe	3.44	2.21	1.34	0.58	0.01	1.21

uncommon to fairly common; 93.6 per cent single, 6.4 per cent twin in northern Nigeria traditional system; 74.5 per cent single, 25.5 per cent twin at Shika station, Nigeria. *Litter size:* 1.06 (n=1307) in northern Nigeria traditional system, rising from 1.0 for ewes with milk teeth to 1.08 for ewes having 4 pairs permanent incisors; 1.25 at Shika. *Lifetime production:* ewes in a northern Nigeria Fulani traditional system averaged 1.21 parturitions. *Oestrus cycle:* 18.1 ± 1.7 days; heat 25 ± 2.2 hours. *Ovulation rate*: 1.36 ± 0.34 (s.d.) in 454 slaughtered females at Zaria, Nigeria, with 67.8, 28.9, 2.9 and 0.4 per cent single, twin, triple and quadruple ovulations; in comparison to observed litter sizes probably indicates important embryonic losses.
GROWTH. *Birth weight:* 3.5 kg males, 4.0 kg females at Shika; 3.5 kg males, 3.0 kg females in traditional system. *Height for age:* 3 months-males 14.9 and females 13.9, 12-29.8 and 21.2, 18-46.9 and 30.0 kg at Shika. *Average daily gain:* 0-3 months - 148 singles and 116 twins, 0-6 - 99 and 82, 0-12 - 80 and 72 g.
MEAT. *Dressing percentage:* 42 at 30 kg live weight.
Research. National Animal Production Research Institute, Ahmadu Bello University, Shika, P.M.B. 1096, Zaria, Nigeria.
References. Ferguson, 1964; Ngere, Adu & Mani, 1979; Kwatu, Umunna & Chineme, 1983; Oyedipe et al, 1986; Otchere et al, 1987; N. Pathiraja, pers.comm.

MOSSI

Origins. Probably from an early cross of Toronké or Burkina Faso Peul Voltaïque sheep with the Djallonké.
Distribution. The Yatenga area of Burkina Faso in the ancient kingdom of Mossi between 13°N and 14°N and 1°W and 3°W. The area covers about 12 500 km^2, has a population of 600 000 people and possibly 120 000 sheep and 190 000 goats. Cattle are about equivalent in numbers to sheep and donkeys and pigs are also kept.
Similar sheep are said to occur from Senegal to Benin.
Ecological zones. Semi-arid with a short rainfall period of about 5 months, most rain (average 550 mm per year in 1973-1984) falling in Jun-Sep.
Management systems. Agro-pastoral. Individual farm sizes are about 9 ha with about one-third of this area cultivated to each of sorghum and millet. Except during the crop growing season sheep are not herded and roam freely over a wide area around the village. At night sheep are housed in small mud brick structures inside the house compound Figure 74. Small ruminants, and sheep in particular, are used specifically as a short term savings medium and flock turnover is very rapid. Sheep are owned by about 90 per cent of households, each with an average flock of 12.4 animals: in the same system only 43 per cent of families own goats, average holding size being 8.8head. Flock structure are related to cash saving and income generating functions with a fairly high proportion of males: females 67.8 per cent (breeding > 10 months 54.5 per cent); males 32.2 per cent; animals under 15 months old account for 49.9 per cent of the flock.

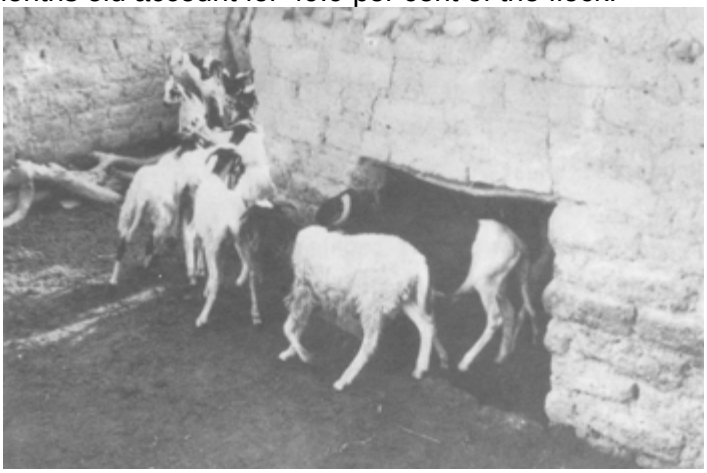

Figure 74: Mossi sheep in the village of You, Yatenga, Burkina Faso being released Flock structures from their night house

Physical characteristics. Small size 50-60 cm. Weight: male 25-30 kg; female 20-25 kg.

Head strong with convex profile.

Horns: present in males, triangular in shape and sprialling backwords then forwads; much lighter and shorter when carried by females. Ears short to medium length and semipendent. Toggles in a small proportion of both

sexes. Males have a mane, a throat ruff and an apron of long hair with the longer hair often extending backwards along the rib cage.

Neck short but fairly heavy. Withers not prominent, higher than tail head. Back short with slight dip. Croup sharply sloping. Legs short, poorly fleshed. Tail thin, descending to hocks or just beyond. Colour usually pied with black forehand or head and neck and white rear (60 per cent); chocolate brown and red sometimes replace the black (7 per cent) and black patches are not unusual elsewhere on the body, especially the lower legs (19 per cent). Coat short to long of soft hair.

Products. Meat.

Productivity.

REPRODUCTION. *First lambing:* 446 ± 86 (s.d.) days (n=16) at You and 470 ± 111 days (n=64) at Kiré in 1983-1985; various studies in Yatenga from 1980-1984 indicate a range of 13.5-15,1months depending on the year. *Lambing interval.* 274 ± 76.0 (s.d.) ; days (n=191) at You and 296 ± 82.4 days (n=237) at Kiré.

Multiple births: very uncommon. *Litter size:* 1.02 ± 0.136 (s.d.) (n=320) at You, increasing from 1.00 at first to 1.04 at fourth and higher parities; similar small litter sizes are recorded by other studies.

Table 39: Weights (kg) of Mossi sheep at You, Burkina Faso, as affected by some indicate a range environmental variables

Variable	Age (days)					
	10	30	90	150	240	365
Overall average	4.0	6.1	10.6	13.6	17.2	21.2
Season of birth						
cold dry	4.6	6.9	11.5	13.3	15.8	21.8
hot dry	3.6	5.6	9.4	13.6	19.1	17.9
rains	3.3	5.5	10.3	14.2	17.1	20.7
post-rains	4.3	6.6	11.4	13.4	16.9	24.4
Year						
1983	4.4	6.9	13.1	15.6	17.2	20.2
1984	4.1	6.5	11.2	13.1	17.2	22.2
1985	3.4	5.0	7.6	12.2	-	-
Parity						
1	3.6	5.4	9.6	12.5	16.3	20.3
2	4.0	6.5	11.0	13.6	18.0	23.3
3	4.1	6.4	11.2	14.3	17.9	20.6
>4	4.1	6.3	10.8	14.1	16.6	20.7
Birth type						
single	4.1	5.9	11.4	15.6	18.8	22.8
multiple	3.8	5.4	9.9	11.7	15.6	19.7
Sex						
female	3.8	5.9	10.2	12.9	16.1	19.8

male	4.2	6.4	11.2	14.3	18.3	22.6

Annual reproductive rate: 1.36. *Fecundity* (=lambs born in year t+l/ewes present in year t): 0.82 in 1983-1984 and 1.46 in 1981-1982.
Births take place all the year round with a peak in Nov following conception in early rains and lowest in Jul-Sep related to conception in late dry season of Feb-Apr.
GROWTH. *Birth weight:* 2.5 kg. *Weight for age:* from a weight of 4.0 kg at 10 days lambs increased to 21.2 kg at 365 days at You; weights were affected to weaning by season and year of birth, by parity, by birth type and by sex, and season and sex effects persisted until 365 days Table 39; weights of females with 1, 2, 3 and 4 pairs of permanent incisors were 22.4, 24.5, 25.3 and 25.6 kg and for males for the first 3 stages were 27.8, 28.2 and 29.0 kg. *Average daily gain:* birth-150 days(weaning) - 87.3, 150-365 - 28.8, birth-365 - 59.2. *Mature weights:* full mouth females varied from 29.1 kg in the cold dry season (Jan) to 23.1 kg in the hot dry season (early Jul).
MEAT. *Dressing percentage:* 40-48 at carcass weight of 10-12 kg.
Research. Field studies and development projects carried out by IEMVT, GTZ, EEC and ILCA have been discontinued.
References. Bourzat, 1980; Ouedraogo, 1984; Wilson, 1987; Bourzat & Wilson, 1989.

VOGAN

Origins. Described essentially by a single author and said to be a cross (?bred inter-se) of Djallonké with Sahel sheep.
Distribution. Confined to southern Togo (and neighbouring Benin) in the vicinity of Vogan, in the Vo, Aneho and Tabligbo districts. In these 3 districts in 1976 there were 118 500 sheep, 92 000 goats, 7000 cattle and 356 000 people in an area of 2620 km^2.
Ecological zones. Sub-humid to humid coastal area with a long unimodal (or weakly bimodal) rainfall pattern.
Management systems. Principally urban where, it is said, the Djallonké is being absorbed by Sahel sheep to produce this cross. Flock sizes average 7 or 8 animals. Animals are grazed under palms or among annual crops where they go under the guidance of the farmer and where, it is claimed, the sheep have been trained to graze only on weeds.
Physical characteristics. Fairly large size 69-73 cm. Weight: male 45 kg; female 40 kg.
Head fairly strong with flat forehead and slightly convex profile.
Horns are triangular in males, almost all of which possess them, loosely spiralled and 30-40 cm long; only 5.6 per cent of females (n=581) carry small horns. Ears are medium long (14 cm), broad and pendent. Toggles are present in 1.9 per cent (n=717) of animals, equally in both sexes.
Neck long. Chest deep but flat. Withers and back rather ridged. Croup sharply sloping. Legs longish and poorly fleshed. Tail long (30-40 cm), with no fat and usually terminating about the level of the hocks. Scrotum split for the bottom third of its length.
Colour usually variable, red and black pied animals being commonest, whole browns next and whole blacks rare. Hair short.
Products. Meat; (milk).

Productivity.
REPRODUCTION. *Multiple births:* common; 62.7 per cent single, 34.4 per cent twin, 2.9 per cent triplet (n=308). *Litter size:* 1.40.
GROWTH. *Birth weight:* 2.26 kg (n=51); single males 2.69, twin males 2.32, single females 2.42, twin females 1.77. w*eight for age:* 40 days-singles 9.6, twins 7.7 kg; 228 days-entire males 30.3 kg; animals supplemented with agro-industrial by products and 17.5 per cent crude protein weighed 43.9 kg at 8.5 months. *Mature weights:* males 40-55 kg (n=29); females 30-45 kg (n=120).
MILK. *Lactation length*: 124 ± 12 days for ewes with singles; 139 ± 15 days for ewes with twins. *Yield:* maximum of 1300 g/d for ewes with singles and 1980 g/d for those with twins, increasing with lactation number and being highest between 19 days and 27 days post-partum, highest yields being obtained at a later stage of lactation in older ewes; total yield (taken by lamb and milked-out) 103.5 kg and 158.7 kg for ewes rearing singles and twins Table 40.
MEAT. *Dressing percentage:* 43.1 at a live weight of 27.6 kg; 45.0 in fattened animals at 43.9 kg live weight. *Carcass composition*: commercial carcass (=hot carcass weight/starved body weight) 43.1 per cent, true dressing percentage (=hot carcass weight/empty body weight) 51.6, liver 1.9, heart 0.6, kidneys 0.3, stomachs and intestines 8.3, lungs and trachea 1.3, skin 6.9, head 6.8, feet 2.5, testicles 1.1;

Table 40: Milk yield of Vogan ewes in Togo

Litter size and Lactation number	Daily yield (kg) in week of lactation								
	1	2	3	4	5	6	7	8	9
Single									
1	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99
2	1.00	1.08	1.18	1.19	1.20	1.20	1.14	1.02	0.95
3+4	1.05	1.12	1.13	1.14	1.16	1.17	1.18	1.02	0.93
Twin									
1	1.14	1.14	1.50	1.38	1.38	1.38	1.28	1.25	1.18
2	1.42	1.60	1.75	1.75	1.75	1.50	1.28	1.19	1.10
3+4	1.90	1.93	2.02	2.00	1.99	1.98	1.90	1.70	1.48

muscle/bone/fat ratio of 66/7/27; hindquarters and shoulders contain 56 per cent of total muscle.
Research. Ecole supérieure d'agronomie, Université du Benin, BP 1515, Lomé, Togo.
References. Amégee, 1983a; 1984a; 1984b; 1984c.

DJALLONKE

Synonyms. Mouton guinéen; mouton nain d'Afrique occidentale; West African Dwarf sheep; Forest sheep.
Origins. More or less trypanotolerant depending on zone and level of challenge.
Sub-types and races. The Kirdi (or Kirdimi or Massa) in northern Cameroon and south-west Chad Figure 75 is a whole black variant of the Djallonké. Also known as the Poulfouli in the far north of Cameroon and many other local and regional names, as for the West African Dwarf goat, are admitted.

Figure 75: Kirdi sub-type of Djailonké sheep at Garoua station, northern Cameroon

Distribution. West Africa from southern Senegal to Chad and south to Cameroon, Gabon and Congo.
Ecological zones. Humid forest zone of West and Central Africa, extending into derived savanna areas and sub-humid zones.
Management systems. Agricultural, urban and agro-pastoral. Owned by many ethnic groups.
NIGERIA. In south-east Nigeria far fewer families own sheep than own goats: 28 per cent of families own 11.4 sheep each (3.2 sheep average over all households) in the range 1-120, modal flock size being 1. Three management types are identifiable as for goats (see West African Dwarf goat, p.108). The percentages of households with different flock sizes are: 0=72; 1-4=14; 5-9=6; 10-19=4; >20=4.
SENEGAL. Djallonké sheep in Senegal are all found in the southern part of the country, in Casamance. Almost all families own either sheep or goats, or both species combined, but within families 60 per cent of men and 40 per cent of women own no sheep or goats: women own 60 per cent of all small ruminants but only 40 per cent of the sheep. Ownership of more than 5 sheep and goats combined is unusual, the average per adult human being 2.5. Only 32 per cent of households own more than 10 sheep and goats combined but these account for some 69 per cent of all small ruminants. Larger flock sizes, particularly in Fulani villages, usually infer accumulation of live capital for exchange for cattle. Integration of the small ruminant enterprise with crop production is achieved through grazing of crop residues in the dry season (Oct-Mar/Apr) and by use of rice strubbles and weedy

regrowth in the paddies (sheep only from Jan-May/Jun), animals often being allowed to roam freely at this period. During the crop growing season sheep and goats are individually attached to pickets or closely herded. Flock structure: females 69.0 per cent (38.9 per cent breed-ding > 1 year indicating a high reproductive rate) about 30 per cent of which are bought in; males 31.0 per cent (4.7 per cent > 1 year showing early offtake of males not to be used for breeding).

TOGO. Numbers of sheep in Togo were estimated at about 600 000 in 1982-1983. About 33 per cent of households (~ 87 000) own sheep. The majority of sheep (34.5 per cent of the national population) are in the extreme north but many of these are of Sahel type or Sahel crosses. In this mainly agricultural country many animals are permanently confined and fed on household wastes and crop residues: individual tethering is also a common practice. Average flock size for the whole country is 7 but it is larger (10) in the north; 43 per cent of flocks are less than 5 head and only 10 per cent are larger than 15. Flock structure: females 65 per cent (50 per cent breeding > 1 year); males 35 per cent.

Physical characteristics. V*ery* small 40-60 cm. Weight: male 25-30 kg; female 20-25 kg.

Strong and broad head, flat forehead, profile slightly bulging in male, wide muzzle. Eyes not prominent.

Horns usually present in males, usually absent in females: fairly well developed in males, wide at the base, curving backwards, outwards and then forwards, maximum curvature usually one and a half spirals; fine and short when present in females. Ears short (10 cm), narrow and usually pendent or semi-pendent. Toggles present only occasionally, about 5 per cent in Cameroon.

Neck long and rather fine. Chest fairly deep. Chest circumference 20 per cent greater than withers height. Withers higher than tail-head but less pronounced than in Sahel-type sheep. Back long in relation to height, usually dished. Croup poorly developed. Legs short. Tail descending to hocks, fairly thick at base but very fine at distal end, approximately 25 cm in length.

Colour usually pied (black forequarters, white hindquarters) or white but some sub-types -- notably the Kirdi -- have been selected for black. Hair short and stiff but males usually, although by no means always, have a heavy mane and apron of long hair with the long hair sometimes extending backwards along the rib cage Figure 76.

Haemoglobin Type A in this sheep confers some resistance to helminths.

Figure 76: Djallonké sheep of the Ghana Forest sub-type (note mane and apron of long hair)

Products. Meat.

Productivity.

REPRODUCTION. *Age at first oestrus:* 250 days (206-322) on station in Côte d'Ivoire. *First lambing:* 464 ± 110 (s.d.) days (n=92) in Senegal traditional system, 572 ± 24.3 (s.e.) days (n=115) on Senegal station; 514 days (n=85) in the range 371-721 days in south Cameroon on a University farm; 350 days (n=10) in Côte d'Ivoire traditional system, 411 days (n=21) on station but in a more comprehensive sample age at first lambing was 431 days (n=112) in a traditional system, 480 days (n=177) in a modified traditional system where breeding was controlled and 494 days (n=224) on a commercial ranch Figure 77; 344 ± 49.3 (s.d.) days (n=36) in range 225-429 days in Kirdi sub-type at Garoua station in north Cameroon, 61 per cent at < 365 days. *Lambing interval:* 267 days (n=101) for first interval and 244 days (n=360) for subsequent ones in Senegalese traditional system; 307 days (n=663) on Senegalese station being shorter at first (305 days) than at subsequent intervals; 230 ± 53.6 (s.d.) days (n=475) in traditional system, 275 ± 75.6 days (n=1095) in controlled traditional, 267 ± 107.5 days (n=1164) on commercial ranch and 208.0 ± 7.36 (s.e.) days (n=213) at National Programme in Côte d'Ivoire; 241 days on Cameroon University farm; births are almost equally distributed over the year throughout the type's range. *Multiple births:* numerous; twins common, triplets more rare (Table 41). *Litter size:* 1.17 in Senegal traditional system and 1.12 on station; 1.17 on Cameroon University farm; 1.15 in various systems in Côte d'Ivoire but 1.25 at National Programme; 1.24-1.53 in Chad; 1.15 on station and 1.49 in a traditional system in Togo; in different studies, season and year of parturition influence litter size but ewe age or parity exerts greatest effect, older ewes having larger litters (1.08 for first and second parities in Senegal traditional system rising to 1.29 for fourth and older parities and 1.12 for early parities rising to 1.21 from third parity in Côte d'Ivoire). *Annual reproductive rate:* 1.33 on Senegal station; 1.56-1.97 in Côte d'Ivoire. *Fecundity* (=number of lambs born in the year/number of ewes joined): 157 to 203 per cent in 1982 to 1986 on Togo station; 168 per cent on Cameroon University farm; 163-204 per cent in various systems in Côte d'Ivoire. *Fertility* (=number of females giving birth/number of females mated): 96 per

cent in Cameroon; 90 per cent in Côte d'Ivoire. *Annual fertility rate* (=number of females giving birth in a year/average number of females in the flock in the year): 136-178 per cent over 4 year period in Togo; average of 159 per cent in 2 year period at Côte d'Ivoire National Programme. *Fecundity:* (=lambs/100 ewes/year): 221 per cent for Djallonké and 231 per cent for Kirdi at Yagoua station in north Cameroon. *Lifetime production:* as many as 12 parturitions recorded in Senegal traditional system with 24.4 per cent of 1051 ewes having lambed once, 21.7 per cent twice, 16.7 per cent 3 times, 11.6 per cent 4 times, 9.2 per cent 5 times and 16.5 per cent 6 times or more; an estimate of 5 lambings per ewe suggested for Senegal station but an average of 3.7 achieved for ewes alive in 1981 and born between November 1974 and January 1977; ewes bought as adults in Cameroon averaged 6.2 lambings at the University farm; "reproductive life" estimated at 4.2 years on Senegal station (24 per cent annual replacement rate); culling age estimated at 6.0-6.5 years at Cameroon University. *Oestrus cycle:* 17.4 days (16-19) on station in Côte d'Ivoire with heat lasting 36 hours (12-60), there being no effects of season on cycle length. *Gestation period:* 148.1-150.2 days on station in Côte d'Ivoire.

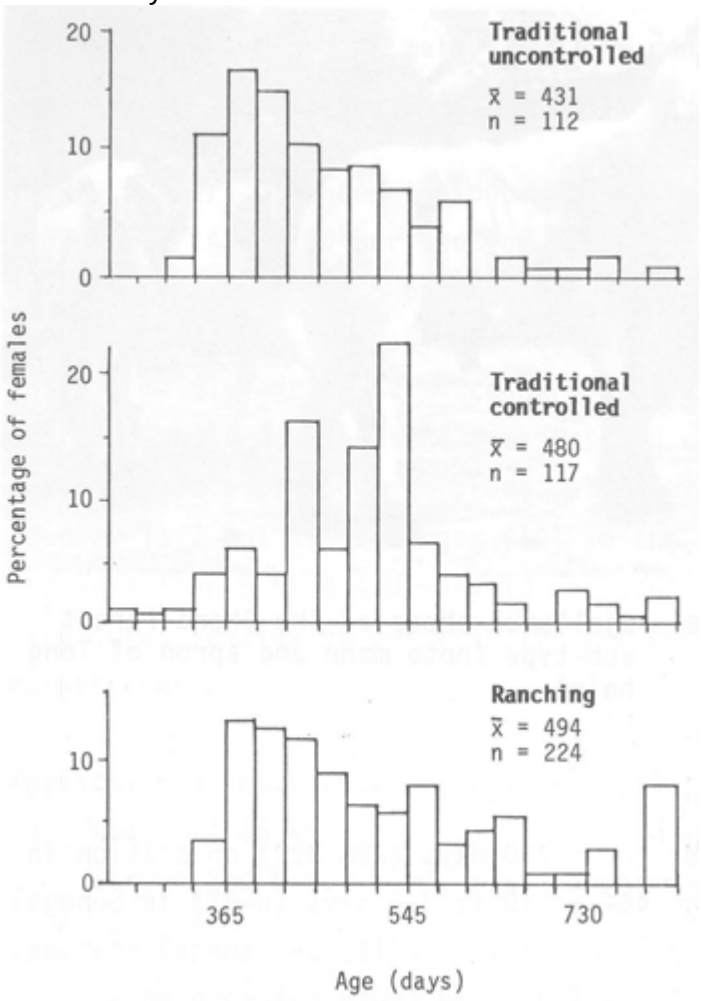

Figure 77: Distribution of ages at first lambing of Djallonké ewes under 3 systems of management in Côte d' Ivoire

Table 41 Multiple births by Djallonké ewes in various West African countries

Country and System	n	Percentage of births		
		Single	Twin	Triplet
Senegal traditional	1020	82.7	17.1	0.2
Senegal station	633	87.9	12.1	0.0
Togo traditional	-	53.7	44.0	2.3
Côte d'Ivoire	-	70.0	29.0	1.0
Chad	-	37-79	20-53	1-10

Heritability of 0.19 estimated for age at first conception, of 0.46 (dam-daughter pairs) for lambing interval, and of 0.26 for litter size in Cameroon. Repeatability (inter- and intra-dam variances) of 0.11 for lambing interval in Senegal. A non-significant positive correlation (0.17) between litter size and lambing interval in Cameroon led to the conclusion that selection for larger litters and shorter intervals would not produce any adverse interactions.

Table 42: Birth weights (kg) of Djallonké sheep from various countries and as affected by a number of variables

Variable		Country and System				
		Côte d'Ivoire		Cameroon	Senegal	Togo
		Traditional	Ranch	Station	Station	Station
Overall average		1.92	1.56	2.15	1.59	1.69
Season:	1	1.90	1.55	-	1.60	1.71
	2	1.94	1.53	-	1.70	1.70
	3	1.93	1.60	-	1.48	1.64
Year:	1	1.90	1.38	-	1.48	-
	2	2.00	1.58	-	1.71	-
	3	1.87	1.60	-	1.54	-
	4	-	1.58	-	1.65	-
	5	-	1.69	-	-	-
Ewe age:	1	} 1.83	1.45	-	1.17	1.29
	2		1.65	-	1.52	1.94
	3	} 1.99	1.64	-	}	1.78
	4		1.60	-		1.82
	5	1.96	1.58	-	} 1.66	1.68
Sex:	male	1.97	1.61	2.25	1.66	1.75
	female	1.88	1.52	2.05	1.52	1.62
Type of birth:	single	2.13	1.78	2.40	1.78	1.83
	multiple	1.72	1.35	1.90	1.41	1.54

Note: Seasons and years in different countries do not correspond and ewe age in Senegal relates to parity

GROWTH. *Birth weight:* 1.2-2.5 kg Table 42; at Côte d'Ivoire National Programme there was a linear relationship between ewe weight and lamb birth weight (singles y = - 0.431 + 0.086x, twins y = 0.002 + 0.059x). *Weight for age:* 1 month-4.7, 3-9.6, 5-12.8, 8-15.8, 12-18.0, 18-19.5, 24-21.2 kg in Senegal traditional system; 2 months-6.1, 4-8.7, 6-11.3, 8-13.8, 12-17.9 kg on Senegal station; 1 month-5.1, 2-7.9, 3-10.2, 4-11.7, 5-12.9 kg in Côte d'Ivoire traditional system; selection criteria by the National Sheep Programme in Côte d'Ivoire require males to weigh 13 kg at 80 days, 23 kg at 180 days and 37 kg at 365 days, resulting in v*ery* big sheep for this type Figure 78; 4 months-8.6, 12-16.2, 18-21.2, 30-24.0, 0,54-26.9 kg for Kirdi in Chad; 1 month-4.0, 4-9.6 kg on station in Togo. *Average daily gain:* 0-15 days - 50, 15-30 - 87, 30-120 - 77, 120-180 - 39, 180-365 - 25 g in Senegal traditional system; 0-30 days - 78.3, 30-120 - 57.1 g on station in Togo where affected by month and type of birth, sex and ewe age in the first period and month and type of birth only in the second period; 0-60 days - males 98.3, females 79.1 g at National Programme in Côte d'Ivoire. *Post-partum weights:* primiparous females (464 days) were 20.1 kg (72 per cent of maximum weight), second parity females (731 days) were 22.0 kg, third parity (992 days) were 23.7 kg, and older females were 25.2 kg in Senegal traditional system; all ewes 23.8 kg, affected by year and age of the animal on Senegal station.

Figure 78: Elite Djallonké rams selected on a weight for age basis at the National Sheep Programme station, Bouaké , Côte d' Ivoire

Repeatability of weights (intra- and inter-ewe variances) of 0.22 + 0.07, 0.18 + 0.07 and 0.24 ± 0.08 were obtained at birth, 60 and 120 days for lambs on station in Senegal. Repeatability of ewe post-partum weight in the same environment was 0.57 ± 0.05 and the phenotypic correlations between ewe weight and lamb weight at birth, 60 and 120 days were 0.20, 0.38 and 0.39.

MILK. *Lactation length:* 117 days in Mali; 105 ± 29 days for single bearing ewes and 112 ± 30 days for twin bearing ewes with "limited supplement" in Togo. *Yield*: 87 kg for supplemented ewes in Mali; maximum of 810 g/d and 1200 g/d with lactation yield of 57.4 ± 16.60 kg (n=42) and 86.4 ± 29.21 kg (n=34) for single and twin bearing ewes in Togo. *Composition:* DM 16.5 per cent; fat 6.0 per cent; ash 0.8 per cent; protein 5.4 per cent.

MEAT. *Dressing percentage:* 43.0 at 20.2 kg live weight in Cameroon; 44.1 at 19.5 kg in Côte d'Ivoire; 43.7 at 19.2 kg in Nigeria. *Carcass composition:* normal butchers carcass 43.1 per cent at 20.2 kg live weight in Cameroon, full stomachs and intestines 25.2, liver-kidneys-heart-lungs 4.7, head 8.1, feet 2.8, wet skin 7.3, testicles 0.9, losses (blood and urine) 7.9; 64.0/21.7/14.3 per cent lean/bone/fat in Nigeria.

Research. Institut sénégalais des recherches agricoles, Laboratoire national de 1'elevage et de recherches vétérinaires, BP 2057, Dakar-Hann, Senegal (station research at Kolda and traditional systems research in Kolda area). Projet Petits Ruminants, BP 65, Atakpamé, Togo. Institut de recherches zootechniques, BP 1457, Yaoundé, Cameroun. Societé pour le Développement de la Production Animale, BP 1249, Abidjan 01, Côte d'Ivoire. Programme national de selection ovine, Centre de recherches zootechniques, BP 1152, Bouaké, Côte d'Ivoire.

References. CRZ, 1957; Vallerand & Branckaert, 1975; Rombaut & van Vlaenderen, 1976; Berger & Ginisty, 1980; Dumas, 1980; Evans, Blunt & Southcott, 1983; Fall et al, 1983a; 1983b; Togo, 1983; Amégee, 1983b; 1984d; Deciry, 1987; Francis, 1988; Hadzi, 1988b; ISRA, 1988; Armbruster, 1989; Hadzi, 1989; Thys, 1989.

AFAR

Synonyms. Adal.
Origins. As for the Ethiopian Highland types, the Afar probably originates from very early importations from Arabia but the tail shape is different and these sheep carry no wool.
Sub-types and races. There is *very* little difference in this type from its northern limit in Eritrea to its southern one in Djibouti.
Distribution. Coastal strip, Danakil Depression, and Rift Valley in Ethiopia from 12°N to 6°N in the area where the Afar (Danakil) tribe is found. Northern part of Republic of Djibouti.
Ecological zones. Desert and coastal desert. Some extension has occurred westwards and upwards (to 1500 m) and into semi-arid zones in Ethiopia in recent years.
Management systems. Pastoral and, to a limited extent, agro-pastoral. In the pastoral systems management is identical to that of Afar goats (p.86) with *very* similar flock structures, females overwhelmingly predominant and ratio of breeding males to females of 1:42.
Physical characteristics. Small size. Weight: males 35 kg; females 24 kg. Head small, profile short and straight in females but slightly convex in males. The pads of fat on the nose and behind the poll are typical of fat-tailed sheep.
Hornless in both sexes. Ears short (10 cm) and pricked, but vestigial ears are common (about 80 per cent of all animals in Tigray). Toggles in 5 per cent of all animals.
Neck short, often with a pronounced dewlap. Chest shallow and narrow. Tail head higher than withers. Back short. Legs long in
relation to body size and poorly fleshed. Tail shield-shaped descending to hocks, with short S-shaped, upturned tip Figure 79.

Figure 79: After sheep in Kala graben on the Tigray Welo border in nothern Ethiopia.

Colour off-white to sandy. Coat of short stiff hair.
Products. Meat; (milk).

Productivity.
REPRODUCTION. *Lambing interval:* about 1 year in Tigray traditional system. *Litter size:* 1.03 at Melka Werer; estimated at 1.14 in Tigray traditional system. *Conception rate:* 90 per cent at Melka Werer research station.
GROWTH. *Birth weight:* 2.40 ± 0.6 (s.e.) kg (n=219); males 2.54, females 2.26, singles 2.83, twins 2.07, linear increase with increasing age of dam from < 1 year to 3-4 years at Melka Werer research station. *Weight for age:* 3 months-11.9 ± 0.07 (s.e.) kg (n=213) with similar environmental influences as at birth, 6 months-16.8 ± 0.52 (s.e.) kg (n=204) and again with similar influences at Melka Werer; 3 months-11, 6-19, 12-23, 18-25, 24-26, 30-27, 36-28 kg for females only in Tigray traditional system. *Average daily gain:* birth-6 months - 92 g in Tigray traditional system; 3 (weaning)-6 months - 64 g at Melka Werer.
Research. Melka Werer Research Station, Institute of Agricultural Research, P.O.Box 2003, Addis Ababa, Ethiopia.
References. Wilson, 1975; Galal, Sebhatu & Getachew, 1977.

ETHIOPIAN HIGHLAND

Synonyms. Abyssinian.
Origins. These sheep are almost certainly descended from very ancient importations from Arabia across the narrow Bab-el-Mandeb Straits at the mouth of the Red Sea.
Sub-types and races. Nomenclature is confused and many types (tribal or locational) have been named. Menz (from the district of the same name in northern Shewa region Figure 80, Bonga, Horro, Welo and Arusi are examples. Early Italian classifications included Akele Guzai, Rashaidi and Tucur.

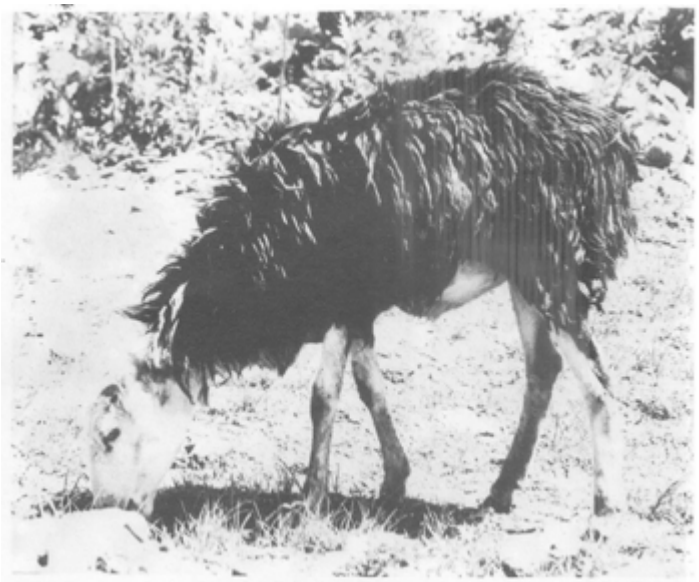

Figure 80: Mixed hair and wool fleece on Menz type Ethiopian Highland sheep in Addis Ababa

Distribution. Highland areas of Ethiopia.

Ecological zones. Semi-arid to sub-humid areas in highland Ethiopia with weakly bimodal or unimodal rainfall regimes, usually above 1500 m.
Management systems. Agro-pastoral to agricultural and urban. Sheep outnumber goats and are the commonest of all domestic herbivorous species in the highlands. In 4 peasant associations in Debre Berhan in northern Shewa, 80 per cent of families own sheep which account for 64.7 per cent of all livestock owned (outnumbering goats by a ratio of 58:1 and cattle by 3:1). Flock sizes are generally small to medium: 23.7animals owned by 1.5 people in Debre Berhan with 66.7 per cent of flocks in single ownership and 21.7, 5.8, 4.2 and 1.6 per cent of flocks owned by 2, 3, 4, and 5 or more people. Flock structure: gene rally related to meat production with some influence of minor wool output: females 74.8 per cent (52.0 per cent breeding); males 25.2 per cent (5.0 per cent > 6 months and 2.8 per cent castrates).
In Ada district 24 per cent of families own 4.1 sheep (2.2 ewes, 1.3 lambs and 0.6 rams). Only 12 per cent of families own 3.3 goats. Flock structures are related mainly to meat production: breeding females > 1 year 52.5 per cent; adult males 13.9 per cent (13.0 per cent of these being castrates); lambs < 1 year 33.6 per cent.
Physical characteristics. Small size 60 cm. Weight: male 35 kg; Female 25-28 kg.
Head short and rather coarse with rather large eyes. Profile flat to slightly convex. Pads of fat behind poll and on face at sides of nostrils.
Horns: usually present in males, variable in length but generally short, ribbed and spiralled; usually absent in females. Ears short to medium length, horizontal or slightly pendulous; rudimentary and atrophied ears are common.
Neck short and thin. Dewlap sometimes present. Brisket rather prominent. Chest narrow and shallow. Back short but straight. Croup sloping. Legs long in proportion to body, exceptionally long in some types Figure 81. Tail variable in length and shape, even within a type Figure 82, but generally shorter than in many other fat-tailed types.

Figure 81: Ethiopian Highland sheep near Debre Marcos, Gojam region
Colour extremely variable: self or mixed colours predominate depending on type and region. Coat usually fairly long, up to 8 cm of mixed hair and wool, shorter and finer in some varieties. Wool cover on head and neck varies considerably.
Products. Meat; (wool).

Productivity.

REPRODUCTION. *First lambing:* generally rather delayed in relation to most African sheep; 4.2 per cent and 12.6 per cent of 876 Menz ewes with temporary incisors and with 1 pair of permanent incisors had lambed in Debre Berhan area in 1984; 13.7 months in limited sample (and probably "early lambing individuals") at Ada. *Lambing interval:* 350 days at Debre Berhan; 239 days at Ada.

Multiple births: generally uncommon but this trait, as well as others, differs within sub-types of the Ethiopian Highland sheep and among other Ethiopian breeds Table 43); 144 of 3412 parturitions in Debre Berhan traditional system; 24 per cent of 432 pregnant ewes in an abattoir study were carrying twin foetuses, possibly indicating high embryonic mortality under field conditions. *Litter size:* 1.04 in Debre Berhan; 1.30 in Ada (n=84 parturitions); 1.35 in small sample of Menz type on Debre Berhan station; 1.35 in Horro type. *Annual reproductive rate:* 1.03 at Debre Berhan; 1.98 at Ada. *Fertility* (=ewes conceived/ewes mated): 87 per cent for Horro type.

Table 43 Production traits of Ethiopian sheep types under station management

Trait	Sheep type			
	Ethiopian Highland		Afar	Blackhead Ogaden
	Menz	Horro		
Ewe performance				
litter size (n)	1.09	1.35	1.05	1.04
conception rate *(%)*	-	91.6	82.0	63.0
milk yield (1itres)	-	17.8	23.6	-
4 year weight (kg)	29.5	38.0	30.6	31.7
Lamb weights (kg)				
birth	2.2	2.9	2.5	2.7
4 months	10.9	15.0	13.0	14.2
6 months	-	24.7	18.4	17.7
12 months	-	33.5	25.8	24.8

GROWTH. *Birth weight*: 1.9-2.7 kg for Menz type; 2.9 kg for Horro type. *Weight for age:* 120 days(weaning)-12.3 to 16.1 kg for Menz; 3 months-

13.5, 6-18.5, 9-21.2, 12-23.4, 18-27.7, 24-31.2, 36-34.7, 48-33.3 kg at Ada; 6 months-14.7, 12-33.5 kg for Horro; males with 1 pair permanent incisors-27.2, 2 pairs-30.4, 3 pairs-33.8 kg; females 1 pair-22.7, 2 pairs-24.7; 3 pairs-25.6; 4 pairs-27.7 kg; mature castrates-39.6 kg. *Average daily gain:* birth-3 months - 124, 3-6 - 90, 6-9 - 70, 9-12 -59, 12-18 - 47, 18-24 - 40, 24-36 - 30, 36-48 - 21 g at Ada.

WOOL. *Yield*: 400-1000 g per clip, usually 2 clips per year in Menz type in traditional sector; 600 g in single annual clip at Debre Berhan station. *Fibre length:* cm with CV of 57.8 per cent. *Fibre diameter:* 26.8 um with CV of 64.8 per cent. Manufactured wool has strong admixture of hair and is spun in natural colours. Used mainly for blankets in local manufacture but "cottage" and more commercial industries make a wider range of products Figure 83

Figure 83: "Cottage" and industrial products from naturally coloured wool of Ethiopian Highland sheep

In 1980, 33 tonnes of wool were exported from Ethiopia but 55 tonnes of greasy wool and 396 tonnes of wool waste were imported in the same year, most of which was re-exported as 9650 knotted and HOC woven carpets.

MEAT. *Dressing percentage*: Horro type lambs 35-38 at 28-30 kg live weight and 40-43 at 38 kg. *Carcass proportions:* 45 per cent . hindquarters in both males and castrates.

SKINS. In 1985 a total of 5 549 640 sheepskins was exported from Ethiopia, comprising about 1.8 million raw and 3.7 million processed skins: in 1986 the figures were 6 289 023 total skins of which 1.1 million were raw and 5.2 million were processed. Goat and kid skin exports amounted to 4.3 and 4.9 million in the 2 years but the proportions of raw and processed skins were reversed when compared to sheep.

Research. Institute of Agricultural Research, P.O.Box 2003, Addis Ababa, Ethiopia. International Livestock Centre for Africa, P.O.Box 5689, Addis Ababa, Ethiopia.

References. Agyemang et al, 1985; Kassahun Awgichew & Getaneh Hailu, 1986; Mukasa-Mugerwa, Ephraim Bekele & Tadesse Tessema, 1986; Mukasa-Mugerwa & Tekelye Bekele, 1988; Demissie Tiyo, Kassahun Awgichew & Yohannes Gojjam, 1989; Kassahun Awgichew, Demissie Tiyo & Yohannes Gojjam, 1989; Sisay Lemma et al, 1989.

RED MASAI

Synonyms. Masai.
Origins. Part of the East African long-fat-tailed group.
Sub-types and races. Principally owned by the Masai tribe but similar sheep are owned by many other tribes in Kenya (notably the Nandi, Busia and Bukusu), northern and central Tanzania (of which Gogo in central Tanzania is probably the best example) and the drier parts of Uganda (especially the Karamoja).
Distribution. Northern Tanzania (where there are probably more than elsewhere) and south-central Kenya.
Ecological zones. Semi-arid bimodal rainfall (600 mm) areas at altitudes mainly in the range of 500-1500 m.
Management systems. Pastoral and agro-pastoral. Usually kept in approximately equal numbers with goats in mixed flocks. Some owners keep only one species and there is some evidence that in recent years goats have survived drought conditions better than sheep and are beginning to predominate. Animals are usually herded by day and penned in thorn enclosures at night, suckling lambs separately from adults. Flock sizes are very variable but generally large: combined goat and sheep flocks average about 190 head. Flock structure: females 68.5 per cent; males 31.5 per cent, castrates are important in the flock as their fat is used to feed post-parturient women Table 44.

Table 44 Sheep flock structure (per cent of 547 animals) on a Masai group ranch in south-central Kenya

Age		Sex			Overall
Pairs permanent incisors	Months	Male		Female	
		Entire	Castrate		
0	<6	7.3	0.4	5.8	13.5
0	6-15	5.7	7.7	19.0	32.4
1	16-21	1.5	2.9	8.0	12.4
2	22-27	0.5	1.3	5.7	7.5
3	28-33	0.4	1.3	6.0	7.7
4	>33	0.7	1.8	23.9	26.5
Overall		16.1	15.4	68.5	100.0

Physical characteristics. Relatively large size 70 cm (male and castrate 72 cm; female 66 cm). Weight: male 41 kg; castrate 45 kg; female 32 kg. Forehead broad and short, profile convex in males and straight in females. Pads of fat occur on the front of the face and behind the poll in males but are less common than in other fat-tailed types.
Horns often present in both sexes: 33 per cent in males and castrates combined but 59 per cent in entires and 22 per cent in castrates (?entire males selected with horns), up to 27 cm long, carried in a tight backward spiral; 10 per cent of females have horns. Ears medium length, 11-15 cm, semi-pendulous but short vestigial ears occur in 7 per cent of sheep and complete absence of external ears is occasionally seen. Toggles occur in about 15 per cent of both sexes, variable in position and size.

Neck short, often with a pronounced dewlap. Chest narrow and shallow. Brisket relatively well developed with dewlap carrying some fat. Withers not prominent (66 ± 3.4 (s.d.) cm (n=131) in females, 72 ± 4.6 cm (n=4) in males, 72 ± 4.6 cm (n=10) in mature castrates. Back short. Croup sloping. Legs short. Tail variable in length and shape but generally very fat in sheep in good condition.

Colour preferably red but extremely variable. Coat relatively long, up to 4 cm smooth coarse hair but legs and face carry only fine hair: a short undercoat of woolly fibres is present in this animal.

Haemoglobin polymorphism indicates some possible resistance to helminth infestations in this type.

Products. Meat; fat.

Productivity.

REPRODUCTION. *First lambing:* 549 ± 112.1 (s.d.) days (n=37) on group ranch in south-central Kenya, considered to be v*ery* late in a traditional system and due to use of an apron to control breeding by male Figure 84 *Lambing interval:* 312 days (n=280) at Elangata Wuas group ranch in 1978-1981 but much longer in 1982 and 1983 on group anches near Sultan Hamed; longer than usual intervals for traditional system due at least in part to control of mating by males. *Multiple births:* uncommon, about 5 per cent in traditional system; relatively uncommon (14 per cent) at 01 Magogo station in Kenya. *Litter size:* 1.05 (n=1009) at Elangata Wuas group ranch, increasing from 1.00 at first to 1.08 at fourth parity, declining thereafter. *Annual reproductive rate*: 1.22.

Figure 84: Masai sheep at Elangata Wuas group ranch in south-central Kenya (note leather apron on male)

GROWTH. *Birth weight:* 2.7 kg (n=271) at 01 Magogo. *Height for age:* 10 days-3.9, 30-6.1, 90-10.5, 150-13.7, 240-17.7, 365-22.6, 550-26.5 kg. *Average daily gain:* birth-150 days - 73, birth-365 - 54 g in Elangata Wuas traditional system; birth-117 days - 128 g at 01 Magogo. *Post-partum weights:* 30.6 kg; 27.8 kg at first and 32.6 kg at fourth and subsequent parities; also influenced by parturition type (single 28.5 kg, twin 32.6 kg), season of parturition and flock. *Mature weights:* females 32.5 ± 4.55 (s.d.) kg (n=131) in range 21-47 kg; males 40.6 ± 7.53 kg (n=4) in range 33-49 kg; castrates 44.9 ± 5.38 kg (n=10) in range 38-53 kg.

SKINS. 1.25 to 1.65 million sheepskins per year entered the Kenya commercial marketing system in 1978-1984, compared to 1.59 to 2.61 million goatskins.
Research. Formerly at 01 Magogo by FAO Goat and Sheep Project and field studies by ILCA now discontinued.
References. Chemitei et al, 1975; Wilson, 1978; Preston & Allonby, 1979; Wilson, Peacock & Sayers, 1983; 1984; 1985; Wilson & Ole Maki, 1989.

EAST AFRICAN BLACKHEADED

Origins. Part of the East African long-fat-tailed group.
Sub-types and races. Several different tribal varieties might be recognized.
Distribution. Southern Uganda and western Tanzania, particularly around Mbarara in Uganda, and west of Lake Victoria and south and east into Sukumaland in Tanzania.
Ecological zones. Semi-arid and sub-humid, mainly bimodal rainfall areas at low to medium altitudes.
Management systems. Agro-pastoral. Possibly as many as 500 000 sheep of this type would have been found in Tanzania during the 1950s.
Physical characteristics. Small size. Weight: female 25 kg.
Head generally finer than other fat-tailed types but fat pads present on nose and behind head.
Horns usually absent in both sexes: when present they are short or occur just as scurs. Ears short (5-8 cm) but pendulous, or vestigial.
Neck rather long. Chest somewhat pinched. Withers level with or lower than sacrum and may carry some fat. Back short and straight or dipped. Brisket well developed but dewlap usually not very prominent except in really fat animals. Legs long and poorly fleshed. Tail variable in shape, length and amount of fat deposit.
Colour similar to Blackhead Persian with black head and fore part of neck, remainder of body white or white with black spots or splotches. Selected for this pattern at Mbarara in Uganda during 1950s. Other colours do occur.
Coat short and coarse without wool undercover.
Products. Meat.
Productivity
REPRODUCTION. *First lambing:* 532 ± 8.1 (s.e.) days (n=196) at Mbarara where ewes first put to ram at about 1 year. *Lambing interval*: 255 + 2.3 (s.e.) days (n=666), decreasing generally from 263 days at first interval to 232 days at ninth interval. *Multiple births:* fairly common at Mbarara, 82 per cent single, 18 per cent twin; apparently uncommon in traditional systems. *Lifetime production:* 7 lamb crops in 5-6 years at Mbarara.
GROWTH. *Birth weight:* 2.5 ± 0.02 (s.e.) kg (n=1531) at Mbarara; females lighter than males, lambs from first parity ewes lighter than all other parities, and twins lighter than singles. *Weight for age: 2* months-10.1 ± 0.07 (s.e.) (n=1273), 5(weaning)-15.5 + 0.10 kg (n=1168) for male single lambs from multiparous ewes Table 45; 12 months-male single 24, female single 21, male twin 23, female twin 20 kg. *Average daily gain:* birth-2 months - singles 123 twins 95, 2-5(weaning) months - singles 59 twins 55, birth-5 months - singles 82 twins 73 g.

Table 45 Weights (kg) of East African Blackhead lambs at Mbarara, Uganda

Variable	Age		
	Birth	2 months	5 months
Multiparous ewe			
male single	2.55	10.09	15.5
female single	2.37	9.45	14.2
male twin	2.05	7.64	12.2
female twin	1.96	7.27	12.0
Primiparous ewe			
male single	2.28	9.04	13.7
female single	2.14	8.99	13.6

Research. Formerly at Department of Veterinary Services and Animal Husbandry, Mbarara, Uganda.
References. Sacker & Trail, 1966.

Origins. Part of the East African long-fat-tailed group.
Sub-types and races. Sheep in Kivu in Zaire are similar to the Rwanda and Burundi types which appear to be undistinguishable from each other. The Tanzania Long-tailed is similar to this type, the Gogo sometimes being placed here rather than with the Red Masai.
Distribution. Rwanda, Burundi, Kivu province of Zaire, south-west Uganda and extreme north-west of Tanzania.
Ecological zones. As for the goat in the same area. Sub-humid bimodal rainfall zone of highland east-central Africa from 1200 m to 2500 m altitude in rainfall of 800 mm to 1500 mm per year.
Management systems. Agro-pastoral and agricultural. Table 5 provides some general data on the importance of sheep in 3 different localities within the general distributional area of this sheep. Sheep are much less common than goats and there are still some taboos against eating and keeping them. Only 32.6 per cent of families own sheep with an an average flock size of 2.1, larger flocks in Burundi (2.5) than than in Rwanda (2.2) and Zaire (1.8). In Burundi, 50 per cent to 90 per cent of all sheep are acquired by purchase. Generalized flock structure: females 76.8 per cent (62.6 per cent post-weaning); males 23.2 per cent (6.8 per cent post-weaning). Almost 45 per cent of sheep had only temporary incisors in traditional systems. Small ruminant population in Burundi was about 1.3 million in 1984 of which 25 per cent were sheep: an administrative census for tax purposes in Rwanda estimated 350 000 sheep in 1983 but an agricultural survey estimated 693 000 in 1984.

Figure 85: Ram of the African long-fat-tailed type at Songa station, Rwanda

Physical characteristics. Relatively small size 55-65 cm. Weight: 35-40 kg; male up to 45 kg; female 35 kg.
Forehead broad and short, profile convex. Males have typical fat pads on nose and behind poll common to all African fat-tailed types.
Both sexes usually hornless. Ears medium, pendulous towards the front; occasional vestigial ears.

Neck short and strong. Chest well rounded, averaging about 72 cm in circumference. Withers higher than sacrum. Back short, slightly dipped. Croup grades into fat tail. Brisket well developed. Legs poorly fleshed. Tail long and tapering Figure 85.
Colour generally black and white pied but red admixtures not uncommon. Hair longer or shorter, stiff, fine or slightly wavy. Males may have a mane and cape over withers and shoulders and an apron of long hair from throat, down the chest to the brisket.

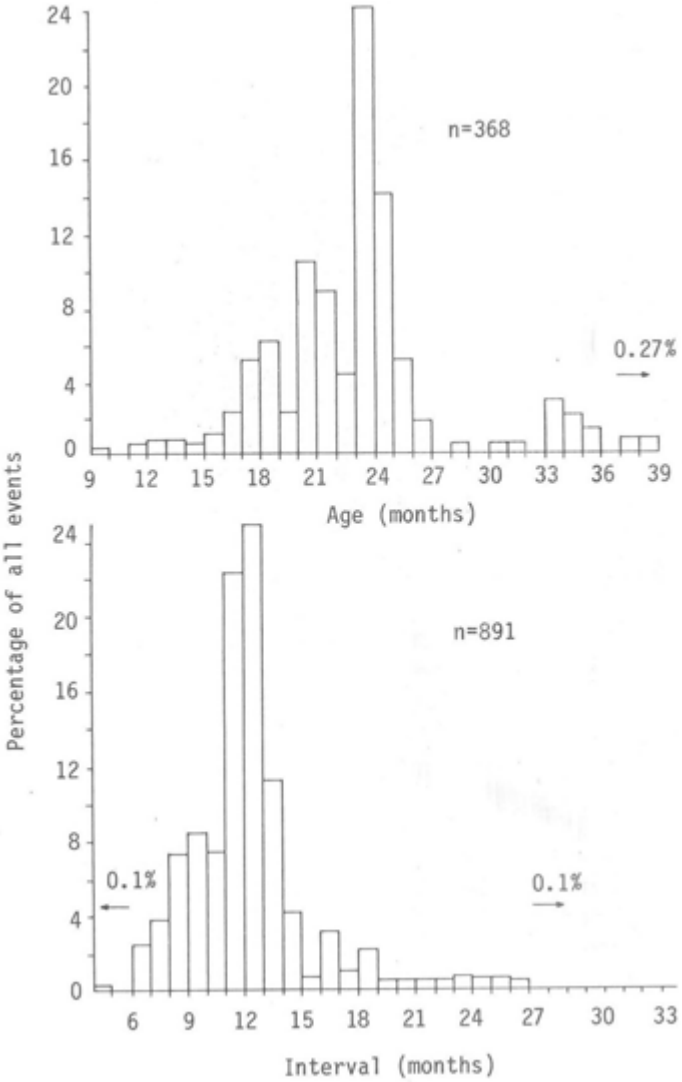

Figure 86: Age at first lambing (top) and parturition intervals (bottom) of Rwanda sheep on station

Products. Meat; (manure).

Productivity.

REPRODUCTION. *First lambing:* 714 ± 18.4 (s.e.) days (n=343) on station in Rwanda Figure 86 but not related to puberty as a breeding season and restrictions on age and weight at first service were imposed by management; affected by year, season and type (single or twin) of birth of ewe's own birth. *Lambing interval:* 406 ± 7.5 (s.e.) days (n=863) on two stations in Rwanda, varying with station of rearing, year and season of

previous parturition and increasing with parity. *Multiple births:* relatively uncommon in traditional system; single 85.5 per cent, twin 14.5 per cent (n=643). *Litter size:* 1.14 for 673 parturitions in traditional system Table 46); 1.43 on station in Rwanda, not affected by any environmental variables; 1.33 on station in Burundi increasing from 1.17 at first parity to 1.40 for all multiparous ewes. *Lifetime production:* relatively few ewes produced more than 4 parturitions in traditional system with an average of 2.29 parturitions for 643 ewes; on station few ewes exceed 5 parturitions (maximum 9) with an average of 3.44 for just over 600 ewes. *Gestation period:* 154 ±3.4 days (n=81) in range of 147 to 166 days.
Repeatability of litter size (calculated from within and between variances of ewes) 0.19 ± 0.035. Heritability (paternal half-siblings) 0.18 ± 0.086.

Table 46: Reproductive data established from owner recall in traditional flocks of long-fat-tailed sheep in Rwanda, Burundi and Zaire

Parameter	Physiological age of sheep					Overall
	Pairs permanent incisors				Temporary incisors	
	4	3	2	1		
Number in sample	413	151	150	133	405	1252
Type of birth						
single	317	117	105	36	3	578
twin	72	12	9	2	0	95
Total births	389	129	114	38	3	673
Total young born	461	141	123	40	3	768
Litter size	1.19	1.09	1.08	1.05	1.00	1.14

GROWTH. *Birth weight:* 2.6 ± 0.02 (s.e.) kg (n=1093) on station in Rwanda; 2.5 ± 0.56 (s.d.) kg (n=515) on station in Burundi, affected by sex, birth type and parity Table 47. *Weight for age:* 30 days-6.3, 90-11.9, 150- 17.0, 240-4.7, 365-31.0 kg on station in Rwanda, weights differ up to 365 days with station of rearing, type of birth (singles + 3 kg at 1 year) and sex (males + 6.7 kg at 1 year) but not by parity; males weighed 12.3, 15.9, 19.3, 21.0 and 24.5 kg at 3, 6, 9, 12 and 15 months on station in Burundi with females weighing 11.3, 15.0, 18.1, 21.0 and 24.1 kg at the same ages and 27.6, 27.9 and 29.0 kg at 18, 21 and 24 months. *Mature weights:* males 10 kg heavier than females at 3+ years.

Table 47: Birth weights (kg) of Burundi long-fat-tailed sheep

Parity	Single		Twin	
	Male	Female	Male	Female
1	2.66	2.50	2.11	1.91
2	2.90	2.80	2.20	2.17
$\geq$3	3.09	3.03	2.34	2.30

MILK. *Lactation length:* maximum 12 weeks. *Yield:* maximum 700 g/d, total about 45 kg in 12 weeks.
MEAT. A total of 12 600 sheep was slaughted in abattoirs in Rwanda in 1983.

Research. Institut des sciences agronomiques du Rwanda, BP 138, Butaré, Rwanda. Faculté des sciences agronomiques, Université du Burundi, BP 2940, Bujumbura, Burundi. Institut de recherche agronomique et zootechnique de la Communauté économique des pays des grands lacs, BP 91, Gitega, Burundi.
References. Ngendahayo, 1980; 1982; Bizimungu, 1986; Branckaert & Habonimana, 1987; Wilson & Murayi, 1988b.

TSWANA

Origins. Part of the African long-fat-tailed group.
Distribution. Botswana, mainly along the eastern and southern boundaries. Also in Zimbabwe and Bophuthatswana close to their common borders with Botswana. Total Botswana sheep population was estimated at 165 000 in 1983 of which about 25 per cent were Karakul and Karakul crosses in the extreme south-west, the remainder being the native hair type. Numbers increased to 200 000 by 1985. Total numbers were estimated in excess of 400 000 in the late 1960s.
Ecological zones. Semi-arid to arid with a single, short, unreliable rainy season in summer and up to 50 nights per year with temperatures below 0°C. Ranges into the annual/perennial short grass and herb areas of the Kgalagadi (Kalahari) desert where Cucurbitaceae are important dry season sources of food and water.
Management systems. Pastoral, agro-pastoral and ranching. About 16 per cent of sheep are kept in commercial systems. There were 70 cooperative groups comprising 1648 small farmers with 42 693 sheep and goats in 1985. Extension services provided to these groups include dipping, vaccination, castration and some other veterinary services. Flock sizes average 14.0 in the traditional sector and 113.8 in the commercial sector. Only 12 300 traditional households own sheep (compared to 53 000 owning goats). Flock structures are related to meat production with relatively early offtake of males: females 69.9 per cent (55.1 per cent breeding > 1 year); males 30.1 per cent (16.9 per cent > 1 year).
The ram subsidy scheme provided 2 rams to producers during 1985.
Physical characteristics. Medium size 60-70 cm (male castrate 3 pairs permanent incisors 64 cm; female 61 cm). Weight: male castrate 3 pairs permanent incisors 35.7 ± 2.77 kg; female 31.7 ± 5.98 kg. This sheep is larger than the Sabi and has a fatter tail, otherwise the two types are similar. Legs rather long. Tail fat but variable in shape and length.
Colour usually white but pied sheep common. Coat of rather coarse hair.
Products. Meat.
Productivity.
REPRODUCTION. *Lambing interval:* usually once a year. *Multiple births:* very rare; only 10 of 578 parturitions produced twins over an 8 year period (1976-1983) on research station in Botswana. *Litter size:* 1.02 (n=578) on research station. *Lambing percentage* (=lambs born/ewes exposed): 86 in 1976-1983 on research station for 686 ewes.
Ministry of Agriculture estimated 50.9-68.1 "lambing percentage" nationwide in 1980-1985.

GROWTH. *Birth weight:* 3.2 kg (n=588) on research station. *Weight for age:* 4 months(weaning)-17.1, 12-26.7, 18-34.1 kg.
percentage: 44 for live weight of 26.8 kg (milk teeth), 46 at 29.3 kg (1 pair permanent incisors), 49 at 31.3 kg (2 pairs), 47 at 35.7 kg (3 pairs) for male castrates Table 48;
45 at 31.7 kg for mature (4 pairs) females. *Carcass proportions:* 47.6 per cent hindquarters in male castrates with 3 pairs permanent incisors; 49.9 per cent in mature females. *Carcass composition:* 52.2/19.2/23.6 per cent lean/bone/fat in temporary incisor castrates and 52.4/19.5/21.8 in full mouth females.

Table 48: Carcass composition of castrate and female MEAT. *Dressing* Tswana sheep

Body component and Value	Castrate				Female
	Pairs permanent incisors			Temporary incisors	Full mouth
	3	2	1		
Carcass weight (kg)	15.9	13.4	12.4	11.1	14.7
Hindquarter (%)	47.6	48.3	47.9	47.9	47.3
Neck (%)	9.5	9.0	9.2	9.0	9.0
Shoulder (%)	15.7	16.3	16.0	16.3	15.9
Thorax (%)	20.4	19.4	19.4	19.8	20.8
Loin (%)	26.3	25.6	25.3	25.1	23.1
Leg (%)	21.1	22.6	22.7	22.8	20.1
Kidney (%)	0.5	0.6	0.6	0.7	0.7
Loss (%)	0.0	0.0	0.5	0.3	0.0

The Botswana Meat Commission slaughtered 10 032 sheep in 1985 paying Pula 455 984 to farmers.
SKINS. Revenue to BMC for skins in 1985 was Pula 70 360, about 25 per cent of the value of meat revenue.
Research. Animal Production Research Unit, Private Bag, Gaborone, Botswana.
References. Owen et al, 1977; 1978; Owen & Norman, 1977; APRU 1986.

SWAZI

Origins. Along with Zulu forms part of the Nguni group.
Sub-types and races. Part of the Nguni group which also includes the Landim and other varieties in the Republic of South Africa.
Distribution. Swaziland.
Ecological zones. Sub-tropical sub-humid areas at low altitudes.
Management systems. Principally agro-pastoral. Kept in common flocks with goats (p.55) but outnumbered by them at a ratio of about 1:5.
Physical characteristics. Small size. Weight: 25-35 kg.
Horns usually present in males but absent in females. Ears short.
Legs long in relation to overall size. Tail long and carrot shaped, rather flat with less fat than other sheep of the region.
Colour usually black, brown or reddish in whole colours but broken colours not uncommon. Coat hairy, longer along back and on rib cage.

LANDIM

Synonyms. Nguni ("Landim" = Portuguese "Landrace").
Origins. Part of the Nguni group, including Swazi, Zulu and Bapedi.
Distribution. Mozambique, mainly south of the Limpopo.
Ecological zones. Semi-arid to sub-humid sub-tropical rainfall areas.
Management systems. Agro-pastoral with subsistence crops as the dominant farm enterprise. Mozambique has less than 150 000 sheep.
Physical characteristics. Relatively small size 65 cm (Table 49). Weight: male 55 kg; female 35 kg.

Table 49: Body measurements and body mass of female Landim sheep

Age		n	Shoulder height (cm)		Chest girth (cm)		Weight (kg)	
Pairs permanent incisors	Months		x	s.d.	x	s.d.	x	s.d.
0	<15.5	10	50.0	4.0	60.8	4.6	18.0	3.5
1	15.5-22.3	14	57.7	3.4	72.3	5.0	28.6	3.1
2	22.3-28.3	25	57.5	3.4	76.2	4.2	31.6	3.3
3	28.3-38.8	31	60.1	3.3	77.9	6.1	33.5	4.5
4	38.8-48.8	66	60.1	3.3	79.9	4.1	35.6	3.5
Aged	>48.8	9	61.0	2.7	80.7	4.9	35.4	3.4

Forehead broad and short, profile convex. Males have fat pads on face and poll, as do females to a lesser extent.
Horns absent in both sexes. Ears pendulous but rather short, 12.9 cm: atrophied or vestigial ears are present in 12 per cent of sheep. Toggles absent in both sexes.
Neck relatively long and fine. Girth exceeds withers height at all ages. Brisket not well developed. Withers well covered and level with tail head. Back longish and usually straight. Croup merges into fat tail. Legs poorly fleshed. Tail similar in both sexes, tapering to a point at about one-third of distance between hocks and ground, averaging 35.6 cm in length Figure 87.

Figure 87: Landim sheep at Chobela research station, Mozambique

Colour variable. Coat of coarse hair, usually short but up to 4 cm long in some cases.

Products. Meat.

Productivity.

REPRODUCTION. *First lambing:* 768 ± 289.7 (s.d.) days (n=161). *Lambing interval:* 412 ± 163.1 (s.d.) days (n=464). *Multiple births:* common. *Litter size:* 1.41 ±0.049 (s.d.) (n=753). *Annual reproductive rate:* 1.40. Age at first lambing and lambing intervals controlled by station management. Landim sheep are capable of lambing all the year round Figure 88;

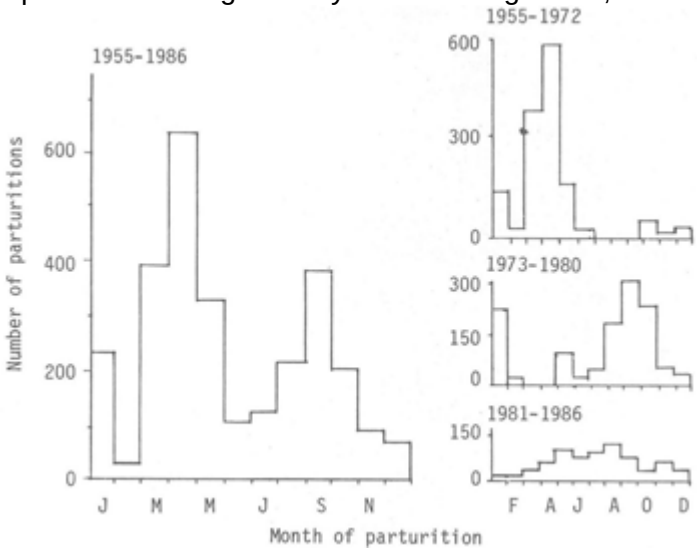

Figure 88: Distribution of lambings by Landim sheep at Chobela showing effects of management policies

GROWTH. *Birth weight:* 2.37 ± 0.441 (s.d.) kg (n=987); males 2.43 kg, females 2.32 kg, singles 2.52 kg, twins 2.24 kg. weight *for age:* 90 days-9.9, 180-15.6 kg. *Average daily gain:* birth-90 days - 83 g.

Research. Institute of Animal Production, CP 1410, Maputo, Mozambique.

References. Wilson, Murayi & Rocha, 1989; Rocha, McKinnon & Wilson, 1990a; 1990b.

SABI

Synonyms. Rhodesia.
Origins. Part of the African long-fat-tailed group.
Sub-types and races. Many local varieties.
Distribution. Zimbabwe.
Ecological zones. Semi-arid.
Management systems. Agro-pastoral. In low-potential tsetse infested areas in north-west Zimbabwe sheep are outnumbered by goats in the ratio of 12.9:1.0 and flock sizes vary from 12.7 to 5.7 for families owning in 3 Communal Areas. Most flocks are very small with less than 5 breeding ewes. Ratio of rams to ewes is about 1:5 but most flocks do not own a ram.
Physical characteristics. Large size. Weight: females 40-50 kg.
Head strong with prominent forehead and convex profile in males. Well developed pads of fat behind nostrils and behind poll in males, less well developed on dewlap Figure 89.
Horns: present or absent in males, if present they usually have only one twist; females usually polled but if horns are present they are usually straight and flat. Ears short and carried horizontally or slightly drooping; vestigial ears occur Figure 90.
Neck short and strong. Well-developed and prominent brisket.
Chest rather pinched. Withers about level with tail head. Back short and straight. Croup short and sloping. Legs long and very lightly fleshed. Tail long and tapering, generally almost reaching fetlocks but very variable in length and shape.
Colour generally fawn, brown or red but blacks also common, as are mixed colours. Coat of short, stiff hair.

Figure 89: Sabi sheep with docked tail at Matopos research station, Zimbabwe

Figure 90: Vestigial ears on a Sabi ewe (note normal ears on her lamb)
Products. Meat.
Productivity.
REPRODUCTION. *Multiple births:*fairly common at 19.0 per cent of all pregnancies (8.2 per cent of ewes mated produce multiples at 2 and 3 years, 30.6 per cent at 4 to 8 years) at Matopos. *Litter size:* 1.37 (n=305) at Makoholi; 1.10 (n=890) at Matopos. *Birth rate* (=lambs born/ewes mated): 102.9 in . ewes 2 and 3 years old, 124.6 at 4 to 8 years at Matopos and similar at Makoholi. *Fertility* (=per cent of ewes lambing): 89 at Makoholi. *Gestation period:* 150.7 days (n=281) Figure 91; slightly shorter for male lambs and for multiple births.

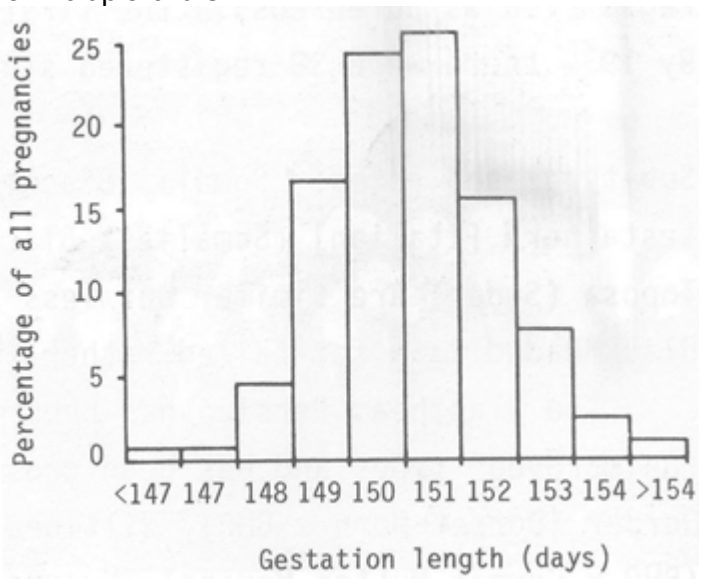

Figure 91: Duration of gestation in Sabi sheep at Matopos, Zimbabwe
GROWTH. *Birth weight:* 2.7 kg (n=414) at Makoholi; 2.57 ± 0.02 (s.e.) kg (n=1143) at Matopos. *Weight for age:* 120 days(weaning)-19.8 kg; males 5 months-21.4 (twins 16.9), 20 months-31 kg; females 5 months-19.3 (twins

14.9), 18 months-33.6, 30-34.4, 42-38.1, 54-38.7 kg; 140 days-20.9 ± 0.14 (s.e.) kg. *Average daily gain:* 0-140 days - 130.7 ± 0.09 (s.e.) g. *Post-partum weights:* 37.7 kg.
Heritability estimates of birth weight were 0.11 ± 0.064, of 140 day weaning weight were 0.08 ± 0.059 and of daily gain were 0.10 ± 0.062.
MEAT. *Dressing percentage:* 45.3 and 41.6 at live weight of 31.1 and 30.2 kg for male castrate single and twin at 20 months.
Research. Department of Research and Specialist Services, P.O.Box 8100, Causeway, Harare, Zimbabwe.
References. Chigaru, 1971; Hale, 1986; Tawonezvi & Ward, 1986; Chifamba et al, 1988a; 1988b.

FAT-RUMPED SHEEP

BLACKHEAD PERSIAN

Synonyms. Black Head Persian; Black-headed Persian; Swartkoppersie (Afrikaans).
Origins. In spite of its name it is certain that the sheep has its origins in the Blackheaded Somali. The foundation of the breed is one ram and three ewes from a ship which landed in South Africa in about 1870. Further importations were made subsequently but do not appear to have had any great influence on the breed. Blackhead Persians were registered as purebreds in the first South African Stud Book in 1906. By 1930 there were 38 registered studs with 4000 animals.
Sub-types and races. Somali, Blackheaded Somali, Pecora somala a testa nera [Italian] (Somalia); Blackhead Ogaden (Ethiopia); and Toposa (Sudan) are similar but less improved types. East African Blackheaded is a fat-tailed rather than a fat-rumped sheep.
The Blackhead Persian has been used in crossbreeding on many "unimproved" types and has been crossed itself with "improved" types. Dorper (Dorset Horn x BHP), Wiltiper (Wiltshire Horn x BHP), Permer (BHP x German Mutton Merino), Nungua Blackhead (BHP x Djallonke (Ghana)), van Rooy ((Ronderib Africander x Rambouillet) x BHP) and Bezuidenhout Africander ((Arabi x BHP) x (Arabi x BHP)) are African examples. The BHP has also played a role in the development of Karakul sheep in southern Africa.
Distribution. Originally developed in the drier areas of South Africa the breed has spread to other parts of southern Africa and farther north, notably to Tanzania, Kenya, Ethiopia and even to Ghana. It has also been introduced for crossbreeding purposes to the West Indies, and to Central and South America.
There were an estimated 2 million Blackhead Persian sheep in South Africa in the early 1950s but numbers of purebreds have declined, mainly due to dilution by crossbreeding.
Ecological zones. Semi-arid and arid. The sheep has been introduced to many wetter areas where the comparative advantages it enjoys in dry areas are lost.
Management systems. Ranching and (mainly in the past) research stations. Flock sizes can be very large in ranching systems (e.g. 9000 on West Kilimanjaro ranch in northern Tanzania in the late 1960s (Figure 92)).

Figure 92: The Blackhead Persian ram flock at West Kilimanjaro ranch, Tanzania

In central Somalia rainfall varies from 100 mm to 250 mm per annum. Management practices are similar to those adopted for Boran goats in the same area (p.93) except that some breeding control is imposed as sheep are not milked. Flock sizes are much smaller than for goats, averaging 31 head, and are in a smaller proportionate range of 6-53 head. Flock structures are related mostly to meat production: females 76.1 per cent (breeding 55.9 per cent); males 23.9 (breeding rams 9.8 per cent, mature castrates 9.7 per cent).

Physical characteristics. Medium to large size. Weight: male up to 70 kg in South Africa; female 50 kg.

The following description is close to that of the official South African breed standard. Many sheep elsewhere leave much to be desired in relation to these norms. The outstanding characteristics are, of course, the black head and the fat rump Figure 93.

Head strong, with strong nose and mouth. Both sexes have poll and nose pads of fat, giving convex appearance to profile.

Horns should be absent (although scurs do occur). Ears moderately long, soft and held horizontally.

Neck thick and well set and in good proportion to body. Body broad, deep and reasonably long with broad withers and back. Back straight. Chest prominent, standing out vertically, broad and with well developed freely-hanging dewlap. Shoulders and buttocks well filled. Legs fairly short, straight and well placed. Tail comprises three parts: the first broad and firm close to the rump, not hanging down and not tapering; the second is curved upwards and rests against the centre of the first, tapers towards the apex, which should be level with the back, and shows a clean black skin area; the third hangs from the apex of the second, is 5-8 cm long and covered with short smooth hair. The tail must hang true.

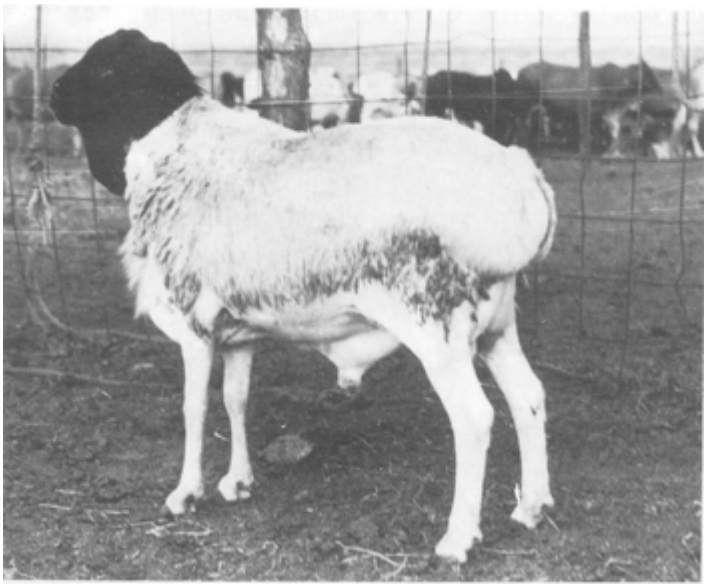

Figure 93: A Blackhead Persian ram imported from Rhodesia (Zimbabwe) to Kongwa in central Tanzania in 1963

Colour in the classic type comprises a black head and neck, with the black not extending farther back, and running evenly round the neck. Hooves are also black. The rest of the body is pure white. Coat is of kemp and up to 4 cm long on the body but shorter on face and head. There is an inner coat of fine wool fibre. Sub-types and races differ in colour from pure black to pure white.

Products. Meat; (fat); (skins).

Productivity.

REPRODUCTION. *First lambing:* 795 ± 220.4 (s.d.) days (n=1133) at West Kilimanjaro; 942 ± 159.5 (s.d.) days on station in Mozambique. *Lambing interval:* 351 ± 161.7 (s.d.) days (n=2886) at West Kilimanjaro; 342 ± 19.1 (s.d.) days (n=138) in Mozambique; 3 lambings in 2 years on station in Kenya; about 14 months in central Somalia but varying greatly with season. *Multiple births:* very uncommon; 93.6 per single (89.5 per cent of lambs), 6.3 per cent twin (10.3 per cent of lambs), 0.1 per cent triplet (0.2 per cent of lambs) (n=5951) at West Kilimanjaro. *Litter size:* 1.00 (n=172) in Mozambique; 1.06 at West Kilimanjaro (n=5951) in 1963-1988. *Fertility:* (ewes lambed/ewes mated): 70.6 per cent in Mozambique. *Lambing percentage* (=lambs born/ewes mated): generally low, 60-90 in Zimbabwe and Kenya. *Fecundity* (=lambs born/ewes present per year): 61 per cent in Somalia. *Lifetime production:* 4074 ewes averaged 3.16 parturitions, only 14 per cent having 5 or more parturitions, at West Kilimanjaro.

GROWTH. *Birth weight:* 2.4 ± 0.10 (s.e.) kg (n=209) in Mozambique; 2.7 kg (n=54) in Kenya. *Weight for age:* 90 days-12.4, 180-15.2, 365-32.0 kg in Mozambique; 6 months-15.0 kg in Somalia Table 50 .

MILK. *Yield:* 68 kg in 12 weeks on high and 38 kg on low plane nutrition in Trinidad; 98 000-130 000 tonnes, of which 20 000-26 000 tonnes offtake for human consumption, from Somali national flock in 1970-1984. *Composition:* averages of 9 ewes over 12 weeks were fat 5.9 per cent, protein 5.6 per cent, ash 1.0 per cent and lactose 4.8 per cent in Trinidad; total solids 20 per cent in Somalia.

Table 50: Weights (kg) at various ages of Blackhead sheep in a central Somalia traditional system

Age range (months)	Sex		
	Female	Male	Castrate
0-12	15.6	15.0	18.1
13-24	21.4	20.6	21.5
25-36	23.9	23.7	25.5
37-48	26.3	29.8	28.3
49-60	27.3	30.5	31.6
>60	29.2	26.5	36.0

MEAT. *Dressing percentage:* 45 at 18.6 kg live weight in South Africa; 43-48 at 29.9-42.2 kg on different planes of nutrition in Zimbabwe; 48.8 for 3 animals averaging 15.0 kg live weight in Angola. *Carcass proportions:* 51.3 per cent hindquarter in South Africa. *Carcass composition:* 54.6/38.8/6.6 per cent meat/bone/fat in Angola.

Blackhead Persian carcasses are characterized by heavy fat deposits on the rump, with relatively little fat elsewhere, and are thus not suited to all markets. First-cross carcasses also usually show poor conformation.

Somalia exported 350 000-793 000 head in 1970-1984 and slaughtered 1.08-2.06 million annually in the same period.

Research. Livestock Breeding Station, P.O West Kilimanjaro, Tanzania. Institute of Agricultural Research, P.O.Box 2003, Addis Ababa, Ethiopia.

References. Pepler & Hoffman, 1935; Labuschagne, 1948; Butterworth et al, 1968; Paiva, 1969; Racoczi, 1974b; Dahir Mumin, 1986; de Almeida & Pimental, 1986; Bourzat et al, 1989; Rocha, McKinnon & Wilson, 1990b; S.M. Das, pers.comm.

FAT-RUMPED SHEEP

Synonyms. Dorsian (Dorsie [Afrikaans]) for white variety.

Origins.This sheep was developed in the Grootfontein area of South Africa from 1942 onwards from crosses of Dorset Horn males on Black-head Persian females. A fixed type was developed through inter-se mating. A breed society was established in 1950 in the Republic of South Africa. The Dorsian (white variety) was affiliated to the Dorper in 1964.

Sub-types and races.Some specialization for different functions and markets is taking place. The Blackhead Persian is used in a variety of other crosses which have characteristics similar to the Dorper.

Distribution. Found over most of southern Africa including the Republic, Namibia, Zimbabwe and Angola, and Botswana in lesser numbers. Also in Kenya (Figure 94) and Tanzania with smaller numbers in some West African countries. The Dorper is the second most numerous sheep breed in the Republic of South Africa and accounts for 65 per cent of the "commercial" flock in Zimbabwe.

Ecological zones. Mainly semi-arid and arid areas.

Figure 94 Dorper ram, imported via Swaziland, on a commercial ranch in Laikipi a district, Kenya

Management systems. Principally ranching.

In Botswana 84 rams were provided to private owners under the subsidy scheme operated by the Animal Production Division.

Physical characteristics. One of the few breeds of small ruminants in Africa which has a full description. The following "standard of excellence" is adapted from judging notes by the Dorper Sheep Breeders' Society of South Africa.

Head strong and long with large eyes, widely spaced and protectively placed. Strong nose, forehead not dished. The head must be "dry" - i.e. no local fat deposits.

Small horns is the ideal but heavy horns are permissible. Ears in proportion to head.

Neck of medium length, well-fleshed, broad and well-coupled to the forequarters. Shoulders broad, firm and strong. Chest deep and wide.

Protruding brisket undesirable. Legs strong and straight. Well sprung ribs, broad and full loin, back long and straight with no "devil's grip" but a slight dip behind the shoulders is permissible. Croup (rump) long and wide: inner and outer twist well fleshed and deep. Udder well developed Figure 95 . Scrotum not too long but testicles equal-sized and not too small. Localization of fat on any part of the body is undesirable and even distribution over the carcass and between the muscle-fibres is the ideal.

Figure 95: Dorper ewe and lamb at Lobo farm, Middlepits, south-west Botswana

Colour should be white with black confined to head and neck. Limited black spots on body and legs permitted. There is a white colour variant. Too much wool or hair is undesirable; the ideal is a short, loose light covering with wool predominating on the forequarter and a natural clean kemp underline. A mane is grounds for disqualification.

Products. Meat.

Productivity.

REPRODUCTION. *Multiple births:* fairly common; 77.2 and 22.8 per cent single and twin (n=123) at Henderson in Zimbabwe; 24.4 per cent (n=603) at 01 Magogo in Kenya. *Litter size:* 1.09 (n=563) on Botswana station; 1.29 (n=232) at Grasslands in Zimbabwe, 1.23 (n=123) at Henderson. *Fertility* (=percentage of ewes lambing): 68 per cent of exposed ewes (n=830) lambed over 8 years (1976-1983) on Botswana station; 90 for 258 ewes exposed at Grasslands; 86 for 704 exposures over 5 years at 01 Magogo. *Lifetime production:* 4.7 breeding seasons at Grasslands.

GROWTH. *Birth weight:* 3.9 kg (n=616) on Botswana station; 4.2 kg (n=299) at Grasslands, 4.5 kg + 0.09 (s.e.) kg (n=151) at Henderson; 3.5 kg (n=750) at 01 Magogo. *Weight for age:* 4 months-20.7, 12-30.8, 18-38.2 kg in Botswana; 140 days (weaning)-16.3 kg at Grasslands; at 01 Magogo males were 45 and 53 kg at 1 and 2 years and 55 kg at 3 years and older, females 36, 43 and 45 kg at same ages; 100 day weight of performance tested sheep figure 96: in the Republic of South Africa increased by more than 30 per cent from 1964 to 1981. *Average daily gain:* birth-140 days - 243 g at

Henderson when creep fed *ad libitum;* birth-weaning(105 days) - 171 ± 48 g at 01 Magogo. *Age at 40 kg:* 146 days at Henderson.

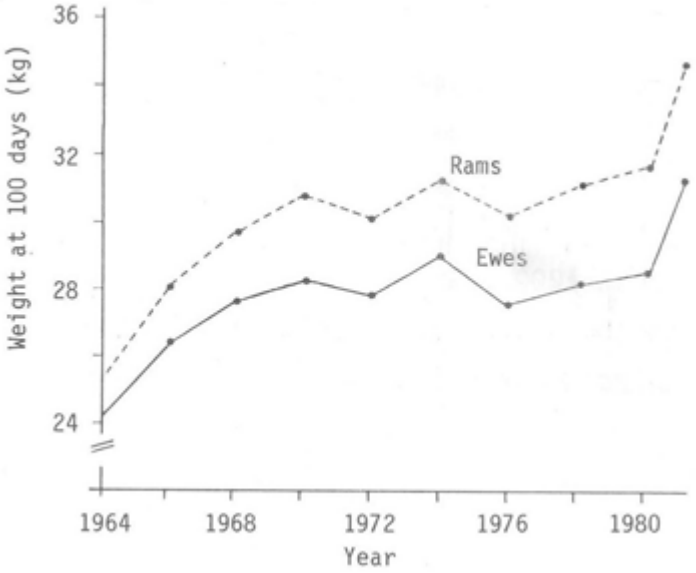

Figure 96: Changes in 100 day weight of registered Dorper sheep in South Africa

MEAT. *Dressing percentage:* 44.8 at live weight of 18.7 kg, 47.6 at 30.0, 51.2 at 40, 59.1 at 50.0, 52.3 at 60 kg following high energy diet at Matopos (Zimbabwe). *Carcass composition:* fat increased from 12.4 per cent at 18.7 kg to 35.8 at 60.0 kg at Matopos and back fat thickness from 1.35 to 11.10 mm.

Research. Department of Research and Specialist Services, P.O.Box 8100, Causeway, Harare, Zimbabwe.

References. Chemitei et al, 1975; Manyuchi et al, 1987; McLeod, 1988; H.P.R. Tawonezvi, pers.comm.

KARAKUL

Synonyms. Astrakhan; Persian Lamb.
Origins. Pelt producing sheep probably originated in the Near East (Syria, Jordan and western Mesopotamia). Karakuls were established about 1200 years ago in Bokhara and China. Karakuls were imported to southern African in 1907 from Germany to where they had first been introduced during the last few years of the 19th century.
Sub-types and races. Types are classified according to colour and pelt value. Mutton and wool types are being developed.
Distribution. The main pelt producing countries are USSR, Afghanistan, Namibia, the Republic of South Africa and Iran. Karakul are also found in Czechoslovakia, the German Democratic Republic, the Federal Republic of Germany, Austria and other European countries.
In Africa the major populations are in the Republic of South Africa, Namibia and Botswana, with small numbers in Angola and a *very* few in Rwanda: there may be a few crosses remaining from an original importation of 33 into Mozambique during the 1950s. In colonial times Karakuls were imported to Tanzania (then German East Africa), 12 rams introduced in 1907 producing 20 000 halfbreds by 1913. Karakuls were also imported, in the late 1920s, to the French Sudan (now Mali) in an attempt to produce pelts from the Black Maure sheep. In 1985 there were 1.4 million Karakul in Namibia, to where they were introduced in 1907, equivalent to about 66 per cent of the national sheep flock. The breed was introduced to south-west Botswana in 1953 and numbers had increased to about 30 000 on 200 farms by 1978 but in 1987 numbers had declined to about 14 000 in 80 flocks: the Smallstock Unit of the Botswana Animal Production Research Unit ceded 16 Karakul rams to farmers in 1985. Angola imported Karakuls from the United States of America between 1945 and 1959 (when 47 males and 77 females had been imported) and there were further importations of males from Austria in 1970. The maximum numbers of sheep with Karakul blood in Angola were 30 000 in 1969 but Karakul breeding was abandoned in 1975 although there is now renewed interest there in its use as a meat breed. Rwanda imported 2 rams and 10 ewes in 1983 for cross-breeding experiments with other exotic types and with local sheep.
Ecological zones. Arid to hyper-arid. In south-west Botswana rainfall is less than 200 mm per year: maximum temperature in January averages 35.8°C, minimum temperatures in July average 0.9°C and there are 35 frost nights per year. Carrying capacities of these areas are estimated at 27 ha/TLU. Low based vegetative cover is characteristic of the area and major grass species are *Stipagrostis* and *Aristida* while shrubs include *Acacia, Boscia* and *Rhizogum trichotomum.* The fruits of *Citrullus lanatus, C. naudinianus* and *Cucumis africanus* are important food and water sources in the winter.
The Rwanda highlands (1400 m, > 2000 mm rainfall) would not appear to provide an appropriate environment for this breed.
Management systems. Commercial ranching and pastoral. Flocks are very large in Namibia. In Botswana there are 11 "commercial" fenced farms

averaging 7100 ha in area with a mean flock size of 550 animals: flocks grazing on communal pasture average 170 head. Flock structures are related to pelt production (for which animals must be slaughtered immediately after birth) and are comprised of > 95 per cent females. A total of 16 rams was provided to farmers in Botswana in 1985 under the ram subsidy scheme operated by the Animal Production Division.

Physical characteristics. Large size. Weight: male 54 kg; female 41 kg. Head v*ery* strong, profile long and straight or very slightly convex in males. Horns: usually present in males, slightly ribbed and spiralling backwards and outwards, then forwards. Ears medium length and pendent.

Neck short and thick. Chest well developed. Withers prominent and level with sacrum. Back long and slightly dipped. Legs medium length and relatively well fleshed. Tail *very* fat with thin terminal portion figure 97 . Marked sexual dimorphism with males much larger than females.

Figure 97: Karakul ram and ewe in a commercially managed flock near Bokspits in south-west Botswana

Colour variable but for pelt production grey is preferred, with black next: mixed colours are not liked in the pelt trade. Homozygous grey is lethal. Coat of coarse wool in adult: the skin of the new born lamb varies in texture figure 98 and is the pelt of commerce.

Products. Pelts; (wool);(meat).

Productivity

REPRODUCTION. *Age at first lambing*: 446-672 days in South Africa depending on ewe's own birth season, earliest in ewes born in Oct, latest in ewes born in Mar. *Lambing interval:* 8.5 months (n=1305) in south-west Botswana.*Multiple births*: very rare; 19 of 3578 parturitions in Botswana traditional system gave rise to twins but 44 of 828 on Lobu station were twin parturitions. *Litter size:* 1.005 in Botswana traditional system; 1.05 at Lobu. *Fertility* (ewes lambing/ ewes joined): 84.4 per cent at Lobu station Botswana in 1985. *Oestrus cycle*: 18.9 ± 8.7 days (n=1081) in Namibia with heat lasting 25.2 ± 12 hours (n=3031); heat usually starts during daylight hours.

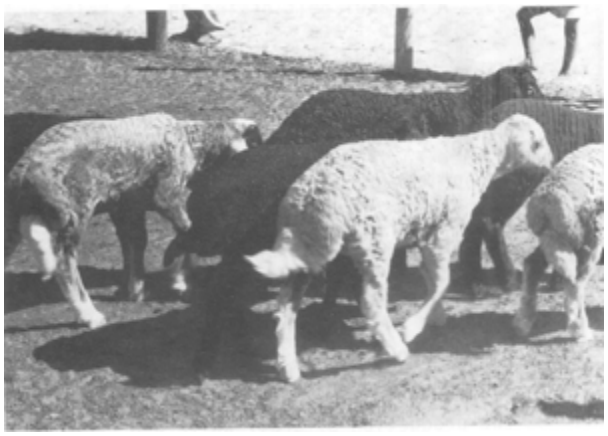

Figure 98: Karakul lambs showing variation in pelt types

GROWTH. *Birth weight:* 4.23 kg in Angola.*Weight for age*: 60 days-12.8, 120-19.7 kg in Angola. *Average daily gain:* birth-60 days -142, birth-120 -128 g in Angola.

WOOL. In Botswana 4488 kg of wool was sold to a cooperative by 171 farmers in 1985.

MEAT. *Dressing percentage:* 55.6 for 3 sheep averaging 17.6 kg live weight in Angola. *Carcass composition*: 61.3/35.1/3.5 per cent lean/bone/fat [tail presumably excluded] in Angola.

PELTS. Lambs used for pelt production are slaughtered the first day after birth, otherwise the characteristic curls and patterns disappear. Slaughtering and skinning is done by knife and by hand. Tissue and fat are removed with a knife and blood and dirt washed out with cold water. The wet pelt is spread, without fixing, on a frame covered with jute and dries in this form in the air figure 99. Most pelts are shipped to London for classification according to a standard system figure 100). The prices of pelts are related to:

Figure 99: A Karakul pelt drying on a jute frame

Colour. Grey pelts are better priced than black ones. Prices for chequered pelts are *very* low owing to a low demand and inferior quality. Botswana production of black and chequered pelts is higher than the southern African (SWAKARA) average, whereas the production of grey, white and brown pelts is lower .

< - ----(decrease)-----Hair length and spacing------(increase)---- + >
(curl size)

Curl development: ^ - + v

	Short (small curl)	Medium (medium curl)	Long (large curl)	Overgrown
Galliac Water-silk Shallow	S D light F	D flat D	O	RF
Shallow developed and Developed shallow	F M	KF	NF	RB
Ribbed	C	T	V	:
DS/PC and Pipe Curl	G	KC	NC	RC

Figure 100: Hudson's Bay and Annings classification of Karakul pelts from southern Africa

Pelt size. Pelt size depends on litter size and the nutrition and age of the ewe. *Pelts smaller* than a standard fetch much lower prices.</p>

Curl type. The breeder distinguishes among the shallow types in Galliac (almost without curls), Watersilk, Shallow and Shallow developed, and among the curl types in Developed shallow and Pipe curl, with many intermediate types. The shallow types were bred from the curl types in the 1920s. Only 4 classes are recognised on the market, these being Shallow, Developed, Ribbed and Curl. Better prices are achieved for shallower types.

Hair length and curl size. Prices are affected by hair length and curl size. "Good" is short hair or small curls and "bad" is overgrown hair or curls. Overgrowing is more common in years of good nutrition.

Hair quality and pattern. Hair quality is determined by lustre and texture while pattern has a considerable influence on the attractiveness of a pelt. Hair quality and pattern therefore have a high economic value.

Research. Animal Production Research Unit, Private Bag, Gaborone, Botswana.
References. APRU, 1986; de Almeida & Pimental, 1986; Faure, 1986; Martins, 1988; Matter, 1988.

MERINO

Origins. The Merino is native to Spain. Its major strongholds as a wool breed are Australia (where most research has been done) and Argentina, and as a mutton breed in Germany and some other countries.
Sub-types and races. Many different types have been developed for different qualities of wool, for meat and most recently for prolificacy.
Distribution. In Africa there are large populations of Merinos in the Republic of South Africa, in Lesotho, in Zimbabwe (where they are equivalent to about 13 per cent of the "commercial" flock -- the Dorper comprising 65 per cent of this group), and in Kenya. Small populations exist elsewhere and there have been some notable failures in attempted introductions, for example in Mali.
Ecological zones. Semi-arid to sub-humid, the latter mainly at medium to high altitudes in Kenya and in Lesotho.
Management systems. Ranching and agro-pastoral.
In Zimbabwe commercial flocks are fairly large to large with 46 per cent of flocks having > 100 sheep, these flocks comprising 83 per cent of the sheep in this sub-sector.
Merino sheep were introduced to Lesotho in the late 19th century with Angora goats (p.114). The administration imported 85 rams in 1910 and 286 in 1910. Lesotho imported 1799 rams and 707 ewes from South Africa in 1986 when Merino numbers were estimated at 1.5 million. Most sheep and most imported rams are owned by small farmers organized in 4234 producer groups figure 101:. About 30 per cent of all households own sheep and/or goats, slightly more owning sheep than goats. Flock sizes are related to the age of the household head, owners > 60 years having 49 sheep, those 41-60 years 44 sheep and those 21-40 years 41 sheep. 'Mafisa' is a customary exchange system which can greatly augment the current flock of owners with small numbers of animals. The proportion of livestock (animal sales + fibre) to total income increases with age of owner but is about 25 per cent overall.

Figure 101: An imported Merino ram in a producers' cooperative flock in Lesotho

Physical characteristics. Small to large size. Weight: females 40 kg in Zimbabwe, 30 kg in Lesotho. Different types differ in conformation and

productivity. Even "meat" types produce reasonable quantities of good quality wool.

Products. Wool; meat.

Productivity.

REPRODUCTION. *Multiple births:* fairly common in comparison to African indigenous sheep in Zimbabwe; very uncommon in Kenya, 97 per cent single, 3 per cent twin. *Litter size:* 1.35, 1.27 and 1.16 ± 0.079 (s.e.) (n=277) at Henderson, Grasslands and Makoholi stations in Zimbabwe. *Fertility* (=ewes lambing/ewes exposed): 88, 88 and 68 per cent at 3 Zimbabwe stations. *Lambing percentage:* 90 on combined Quthing and Mokhotlong studs in Lesotho (n=500). *Lifetime production:* 5.6 breeding seasons in flock at Grasslands.

GROWTH. *Birth weight:* 4.5, 4.2 and 3.4 ± 0.09 (s.e.) kg (n=53) at 3 Zimbabwe stations. *Weight for age:* 135 days(weaning)-14.8 and 20.4 + 1.21 (s.e.) kg (n=36) at Grasslands and Makoholi singles being 4 kg heavier than twins at the latter. *Average daily gain:* 238 g to 40 kg at 150 days when intensively fed at Henderson; birth-weaning - 148, post-weaning - 60 g in Kenya. *Post-partum weights:* 47.9 ± 0.90 (s.e.) kg (n=63) at Makoholi.

WOOL. *Yield:* rams 5.2 kg, ewes 3.4 kg on Kenya station; 2.2-2.5 kg on Lesotho sheep cooperatives figure 102 where wool is shorn, sorted and sold by producer groups figure 103.

Figure 102: The shearing and sorting shed in a Lesotho wool/mohair producers' cooperative

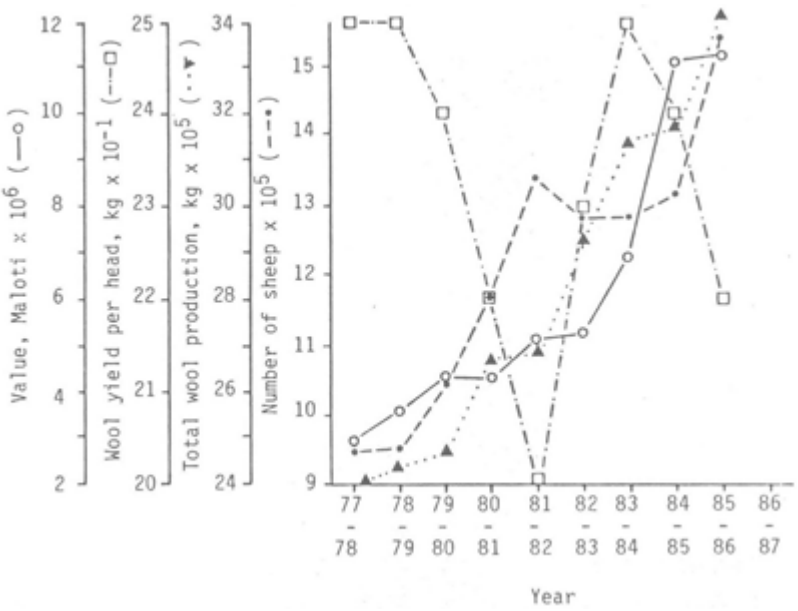

Figure 103: Technical and financial productivity of Merino sheep in Lesotho

Total wool production in Kenya rose from 823 280 kg in 1957 to 1.6 million kg in 1967, then to 2.1 million kg in 1968 but in the 1980s it has varied between 1.2 and 1.4 million kg per year. The share of wool in total agricultural production in Kenya dropped from 0.6 per cent in 1964-1972 to 0.1 per cent in 1973-1981.

MEAT. *Dressing percentage:* 44 in Kenya; 40.1 ± 2.45 (s.e) (n=12) at live weight of 37.1 ± 2.91 kg at an age of 284 ± 5.3 days in Zimbabwe.

Research. Formerly at Naivasha by FAO Goat and Sheep Project in Kenya. Department of Research and Specialist Services, P.O.Box 8100, Causeway, Harare, Zimbabwe.

References. de Bruijn, 1986; Mburu, 1986; Makhooane, 1986; Chifamba et al, 1988b; L.A. McLeod, pers.comm.; H.P.R. Tawonezvi, pers.comm.

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