Working Paper 122

TRADITIONAL LIVESTOCK BREEDS: GEOGRAPHICAL DISTRIBUTION AND DYNAMICS IN RELATION TO THE ECOLOGY OF WEST AFRICA

Roger Blench

October 1999

Overseas Development Institute
Portland House
Stag Place
London, SW1E 5DP

Contents

Tables

Figures

Maps

Acronyms

ADP	Agricultural Development Project
ARU	Agricultural Research Unit
BASAC	Bauchi State Agriculture Corporation
DFID	Department for International Development
FOS	Federal Office of Statistics
ILCA	International Livestock Centre for Africa
ITCZ	Inter-Tropical Convergence Zone
NLPD	National Livestock Projects Department, Kaduna
NNLRS	Nigerian National Livestock Resource Survey
WAD	West African Dwarf

Currency

The currency of Nigeria is 1 Naira (₦) = 100 kobo. Its approximate value in March–July, 1987 was 4 Naira to the US Dollar. This rose to 10 during 1990 and by October 99 the exchange rate was ₦ 85 to 1US$ or ₦145 to 1UK£.

Geographical terms

Adamawa	A pre-colonial political unit consisting of the region directly south of Lake Chad, comprising modern day Adamawa, Taraba and southern Borno States in Nigeria and adjacent parts of Cameroun Republic.
Middle Belt	A commonly used term for the northern part of the Nigerian subhumid zone; generally referring to the area north of the Niger-Benue.

Administrative Divisions

Subsequent to the fieldwork analysed in this working paper, Nigeria created more States. Gongola State was split into Adamawa and Taraba states, Borno into Borno and Yobe. As of September 1996, the Federal Government had embarked on another round of State creation. In the face of this administrative instability, the States referred to in the text are those that existed at the time of the survey.

1. Introduction

Until recently, technical ruminant livestock interventions throughout much of Africa have focused on the introduction of 'new' or 'improved' livestock breeds. Impressionistic accounts of indigenous or anciently established breeds suggested to developers that their productivity was low compared with European livestock. This was particularly salient in the case of dairy cattle, when the comparison was made between indigenous breeds customarily milked when they were suckling a calf and exotic European dairy breeds heavily selected for high yields of watery milk. While results from stations and university farms across Africa showed that productivity could improve under more intensive management, the baseline was still so low that the importation of exotic breeds was seen a means to short-circuit the otherwise slow process of breeding more productive stock (Blench, 1997a). Moreover, occasional successful farms using European breeds, though usually based on economically unrealistic management practices, seemed to validate such a strategy (Dunbar, 1970). In reality, however, in West-Central Africa such ranches or farms never were sustained on a long-term basis. The European stock that was imported either died or was cross-bred with local animals to such an extent that whatever desirable characteristics it originally possessed disappeared. High-input farms in Kenya and Southern Africa, supplying urban markets with relatively developed infrastructure may be said to constitute a partial exception. However, in terms of the continent, imported breeds have largely been a failure. This is particularly the case in West Africa, where the traditional sector continues to supply almost all of the meat requirements in the region (RIM 1992, Volume VI). Livestock production remains essential to the food security in the poorest households and those situated in marginal areas and the pattern of development tended to ignore these.

One of the consequences of a realisation of this was a shift in the nature of typical livestock projects. Ranch, farm and other intensive models have largely been dropped in favour of working with the traditional sector. Many types of traditional management practice have been revalidated and an attempt is made to work with indigenous knowledge rather than override it. Looked at from a livelihoods perspective, it could be said that traditional sectoral approaches rejected the substantial natural and social capital accumulated by traditional livestock producers. The conclusion that development should draw on this capital has only recently been drawn. Consequently, there is a need for considerably more knowledge about existing livestock breeds, their ecological adaptations and their productivity under traditional management. While this shift has begun to take place at a policy level it has yet to result in the detailed field research that could feed into the decisions of resource planners. For example, although participatory plant breeding is now widespread in many areas of development-oriented agronomy, similar processes have barely begun in the field of livestock, where hi-tech interventions remain dominant (Blench, ined.).

In some ways, this is surprising; pastoralists themselves are very interested in their animals and are fond of enumerating their virtues to visiting researchers. The diversity of African livestock breeds excited comment among early European travellers and was used as an example by Charles Darwin (1868, 2:107);

> 'At the present day various travellers have noticed the differences in the [cattle] breeds in Southern Africa. Sir Andrew Smith several years ago remarked to me that the cattle possessed by the different tribes of Caffres, though living near each other under the same latitude and in the same kind of country, yet differed, and he expressed much surprise at the fact. Mr. Andersson in his letter to me says that, though he will not venture to describe the

> differences between the breeds belonging to the many different sub-tribes, yet such certainly exist, as shown by the wonderful facility with which the natives discriminate them.'

The classic descriptions by Doutressoulle (1947), Mason and Maule (1960) and Epstein (1971) provide a considerable body of material on African breeds of livestock. However, there is some evidence that the data these authors present have been used more by historians and archaeologists than by practical planners. There are several reasons for this:

- they provide sparse productivity data based on station results;
- they give only the sketchiest data on geographical distribution;
- they include hardly any information about the role of different species and breeds within farming systems.

This suggests that there is a research lacuna where more usable information should be available.

The Nigerian National Livestock Resource Survey (NNLRS) of 1989–1991 is a descriptive account of the numbers, distribution and productivity of indigenous species and breeds of livestock in Nigeria (RIM, 1992). Such a report inevitably focuses on a specific point in time, but interviews were conducted with livestock producers in numerous contexts to establish the diachronic pattern of change. These suggested that both the relative numbers and distributions of livestock should be seen as dynamic. This working paper[1] summarises the evidence for the principal livestock species and breeds, and then uses this to analyse the evidence for changing patterns of distribution, to suggest a variety of contributory factors responsible and to draw out the policy implications. Although the material on the breeds is somewhat lengthy it is essential to the understanding of livestock producers' strategies. A final section considers related evidence for the distribution of camels, donkeys and chickens and the policy implications that can be drawn from these findings.

Map 1 shows the principal places and regions mentioned in the text.

---

[1] The field research upon which this working paper is based was conducted for the Federal Government of Nigeria by the author as part of a contract for the Nigerian National Livestock Resource Survey (NNLRS) with Resource Inventory and Management (RIM). The author is grateful to the FDL&PCS of the Government of Nigeria for the opportunity to conduct the fieldwork described in this working paper and for the comments of the readers appointed by the Federal Government relating to the original submission to Government. In particular he is grateful to the other ground survey personnel on the team, Helen de Jode, Andrew De Jode, Adrian Rayson, Peter Maitland, Edoardo Gherzi, Cathy Di Domenico, Stephen Hall, Alh. Natta Alla Sambo and to the other members of the RIM team, notably David Bourn and William Wint. Adrian Rayson was responsible for the early versions of some of the maps and his contribution is gratefully acknowledged. A preliminary version of parts of the present document was commissioned by Jan Slingenbergh, AGAH of FAO in the context of interest in changing tsetse distributions. The earlier version of the text has thus benefited from the comments of Dr. Slingenbergh and other FAO staff. The expansion of the text, to include species other than cattle and its reorientation towards a breed manipulation strategy was prepared as part of the 'Partnerships and Policies' programme grant made by DFID to ODI. The analysis of the data presented here is however, the author's own interpretation and should not be interpreted as the views of the Federal Government of Nigeria, of Resource Inventory and Management or of FAO. The present text has benefited from detailed comments by Stephen Hall.

1 The principal places and regions mentioned in the text

2. The Present Situation

2.1 Historical data

To model change over time in livestock breeds within their biotic and cultural environments in any quantitative way, reliable time-series data would be required. Since nothing comparable with the NNLRS has ever been conducted in Nigeria, earlier records are inevitably anecdotal. For example, the NNLRS recorded the presence of Azawak cattle in Nigeria, although these were not mentioned in earlier sources. This may be either because they were not present or because they were simply not observed. This suggests that care must be used in interpreting earlier sources and that where possible they should be cross-checked against pastoralists' accounts.

It is not usual to include observations of travellers or ethnographic accounts in studies of livestock distribution. Since some early writers describing the interior of Nigeria made observations that run counter to established wisdom this working paper incorporates their accounts (see Blench, in press, d for a summary of the different methods of reconstructing livestock history).

2.2 Background

2.2.1 Existing numerical data

Estimates of national livestock populations throughout West Africa have to be treated with considerable reserve. In the case of Nigeria, figures have been cited in many Federal Government documents, often with no indication of the source, or description of the methods of estimation. In some cases, cattle population figures have been derived indirectly from various administrative sources, including *jangali* tax (a head tax on cattle being moved), vaccination returns, slaughter records, trade movements and exports (Fricke, 1979). Interpreting such information is highly problematic as unverifiable assumptions must be made about what proportion of a total population is unrepresented. Data collection is rarely standardised or methodical and any given statistic is usually incomplete. Reviews of existing population estimates showed that in some years the discrepancy between the Federal Office of Statistics' estimate and the FAO estimate was of the order of 100% (RIM, 1992, II:32). Given these uncertainties, together with the fact that current livestock populations are extrapolated from old data, it is not surprising that such estimates have always been viewed with a degree of scepticism (Colville and Shaw, 1950).

2.2.2 Data from the Nigerian National Livestock Resource Survey (NNLRS), 1990

Due to a long-term dissatisfaction with existing data collection methods and the difficulties of reconciling past figures, the Federal Government of Nigeria commissioned a fresh study of the national livestock resource. A preliminary survey in two states was undertaken in 1989 (RIM, 1989) and the National Livestock Resource Survey took place throughout 1990, with periods of intensive fieldwork from January to May, and August to December. The final report was submitted in 1992 (RIM, 1992). A more informal account of the survey is given in Bourn et al. (1994) and Blench (in press, e).

The complete methodology used in the NNLRS is set out the final report, but the principal methodology was combined air-ground survey. Systematic low-level aerial transects were flown on

a grid pattern to record pastoral herds, settlements and ecological data. Settlement data from the air survey was then combined with village surveys conducted following the grid system to establish the numbers of animals kept within houses. At the same time interviews were used to record the presence/absence of particular species/breeds of livestock. These were then plotted on a countrywide basis to permit the construction of maps showing the distribution of breeds. Detailed follow-up surveys were made for minor breeds to map isolated populations.

2.3 Ecological background

Nigeria occupies 923,768 km^2 (FOS, 1989) and is a country of marked ecological diversity and climatic contrasts. The overall physiography is described by Buchanan and Pugh (1955) and Udo (1970). The predominant soils are ferruginous tropical, with alluvial deposits along the Niger and Benue. Together with the Lake Chad Basin, these rivers constitute the major drainage basins of the country, with several important catchment areas, such as the Sokoto-Rima system in the north-west, and the Donga and Taraba in the extreme east. The other major topographical features are the high altitude grasslands of the Jos and Mambila Plateaux, which despite occupying a relatively small area, are of considerable significance to the livestock populations.

The climate is determined largely by the seasonal movement of the Inter-Tropical Convergence Zone (ITCZ) which leads to contrasting dry and wet seasons and a marked north-south rainfall gradient. Northern areas receive substantially less rainfall and have a much shorter wet season: mean annual rainfall is less than 500 mm in north-eastern Nigeria with only 2 months a year receiving above 100 mm. In the south-east, rainfall exceeds 4000 mm annually, with more than 100 mm falling during at least 9 months of the year. The rainfall patterns are modified, in the centre of the country, by the Jos Plateau to the south-west, precipitation rises to 1500–2000 mm annually; to the north-east, the highlands cast a rain-shadow which significantly reduces rainfall (Barbour et al. 1982).

The country's natural vegetation reflects the climatic and topographic diversity. Paramount influences are the rainfall gradient, the minimum relative humidity, and the length of the dry season. As a result, dominant vegetation types range from the dense mangrove forests of the Niger Delta and the rain forests of the south, to the dry grassland of the north, and also include areas of montane grasslands on the Jos and Mambila Plateaux.

A number of classifications of Nigerian vegetation have been published since the 1950s. The development of categories reflects changing perceptions of the significance and value of such classifications. The former trend was to consider vegetation in isolation from cultivation and other aspects of human intervention. However, as it has become clearer that most of the landscapes in Nigeria are anthropogenic in some way, vegetation and land use are most often considered together in current classifications.

Keay (1959) established many of the vegetation classes that are still used today, including mangrove, freshwater swamp, and wet and dry forest types. The last two of these are structurally very similar, though differing floristically; mature wet forest has all but disappeared in Nigeria, although dry forest, mostly under the protection of forest reserves, is present in many parts of the south, including Bendel and Ondo States. The Delta area of Rivers State, and of neighbouring states, hosts mangrove and freshwater swamp forests, the latter type being an 'edaphic variant of rain forest' confined to the banks of the Delta's numerous waterways (Keay, 1959).

Keay's southern guinea savannah, or transition woodland, denotes areas comprising both forest and savannah type vegetation. Widespread throughout the middle belt and beyond, for example around Minna and Makurdi, this type of woodland readily transforms into grassland. The denser, two-storey, broad-leaved woodland, or northern guinea savannah, is also common, but further north. Sahel savannah, an open thorn woodland dominated by *Acacia* species, is confined to north-east Borno. A composite of this latter type and Guinea Savannah, described as Sudan Savannah, is prevalent in Sokoto, Kano and Borno, frequently much modified and degraded.

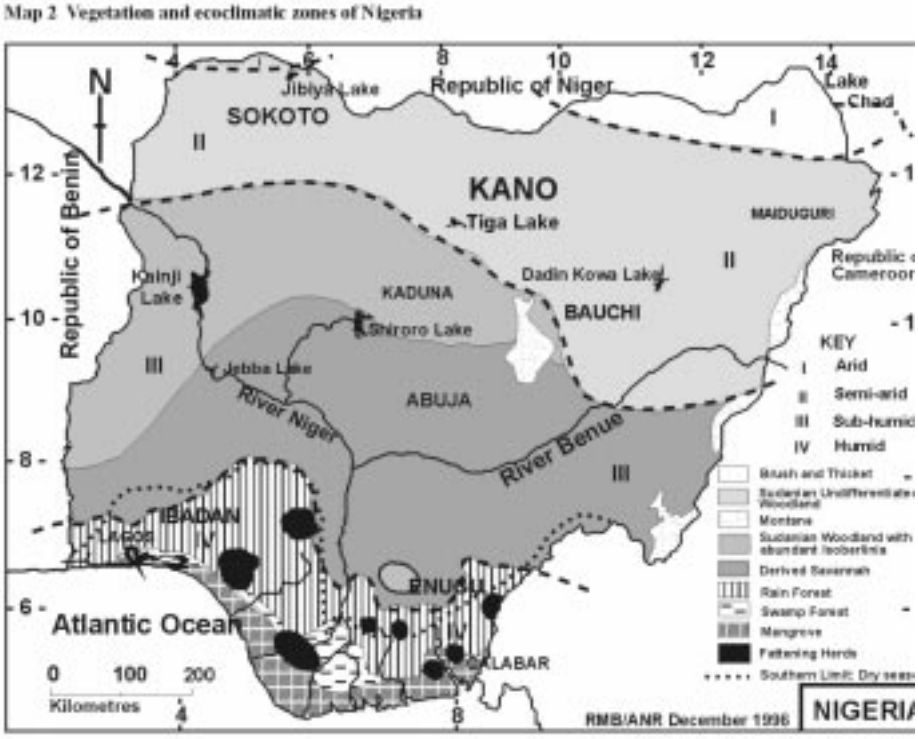
An ecological zonation of natural vegetation, reflecting the situation in the late sixties and early seventies, is the National Atlas of Nigeria (Federal Surveys, 1978). The stratification follows Keay but refines the zonal nomenclature: coastal; mangrove; aquatic grassland and herbaceous swamp; swamp forest and riparian forest; sub-montane forest; moist lowland forest; dry forest woodland; wooded tropical steppe; edaphic and biotic savannah. Keay (1989) has published an updated 'Nigerian Trees' that gives the most recently accepted botanical nomenclature for trees.

White (1983) identifies 11 different vegetation categories within Nigeria, all being variants of his forest, woodland and wooded grassland types (with the exception of those in upland areas). Forest vegetation is characterised by multi-storey woody species, in excess of 10 m in height, with interlocking crowns, usually non-fire-tolerant, and with little or no grass beneath. Woodland comprises open stands of trees standing at least 8 m tall, and giving a canopy of 40% or greater. Savannah is dominated by grass with fire-tolerant woody growth present. Grassland and wooded grassland are distinguished as having less than 10% and 10–40% woody vegetation respectively.

Several wider regional zonations have also been put forward, such as the 'eco-climatic zonation' developed by FAO and ILCA (ILCA, 1979). Though defined in agro-climatic terms of plant-growing period, it is also a very general indicator of vegetation zones. The Humid Zone, where annual rainfall exceeds 1500 mm, corresponds approximately to the forest zone, whilst the Sub-humid and Semi-arid Zones, having 1000–1500 mm and 500–1,000 mm average annual rainfall respectively, partially reflect the limits of Keay's northern and southern guinea savannahs. The Arid Zone, with less than 500 mm rainfall per year, occupies a relatively small part of the country, and is restricted to its northern extremes. Map 2 combines vegetational and ecoclimatic zones.

Natural vegetation is locally variable, with swift transitions between these broadly defined categories. All formal classifications comment on the influence of man-induced changes to the natural environment. Encroachment into natural vegetation by active cultivation has created a number of transitional or derived vegetation types. Remnant species, generally those of economic importance, may be the only relics of the natural ecosystem. Vegetation tends to consist of local mosaics of natural and transitional species interspersed with areas of cultivated or fallow land. Cultivation and the associated transitional ecotypes are now the dominant form of vegetation and land use.

Map 2 Vegetation and ecoclimatic zones of Nigeria



3. Indigenous Cattle Breeds of Nigeria

3.1 General

Individual breeds and races of cattle in Nigeria have been characterised, but overviews of the country as a whole are rare. The most important of these is Gates (1952). Standard references such as Doutressoulle (1947), Epstein (1971) and Mason (1988) constitute useful reviews of the general literature on West Africa but do not cover the specific situation in Nigeria.

A specific study of the breeds of cattle recognised by indigenous producers was undertaken as part of the NNLRS in 1990. Using the locally named categories, village survey data using the grid square method (see previous section) was plotted to map the presence or absence of individual breeds. The maps accompanying this working paper are based on this data.

All types of cattle interbreed and can therefore be regarded as a single species. However, lower levels of subclassification remain confused, conflating biological cultural and linguistic differentiation. Standard texts such as Mason (1988) or FAO (1987) tend to confound different levels of variation; thus Rahaji (=Red Bororo), West African Dwarf shorthorns and Kuri are all regarded as ‘breeds’. This makes them almost useless for interpreting local understanding of breeds.

This working paper attempts to develop a hierarchical classification which is at least coherent, although it runs counter to some established usages. The primary distinction is taken to be that between the broad categories of zebu and taurine, here called subspecies. Within West Africa there are three categories of taurines: West African Dwarf Shorthorn (henceforth muturu), n’dama and kuri. The n’dama, a humpless longhorn, is not indigenous to Nigeria but was imported from Senegambia during the twentieth century and is now established in some rural areas, albeit crossbred. Table 1 provides an overview of these with vernacular names and alternatives recorded in the literature.

Although there is a long history of introductions of European breeds, very few have passed into village production and these have not persisted.

3.2 Cattle and their distribution in 1990

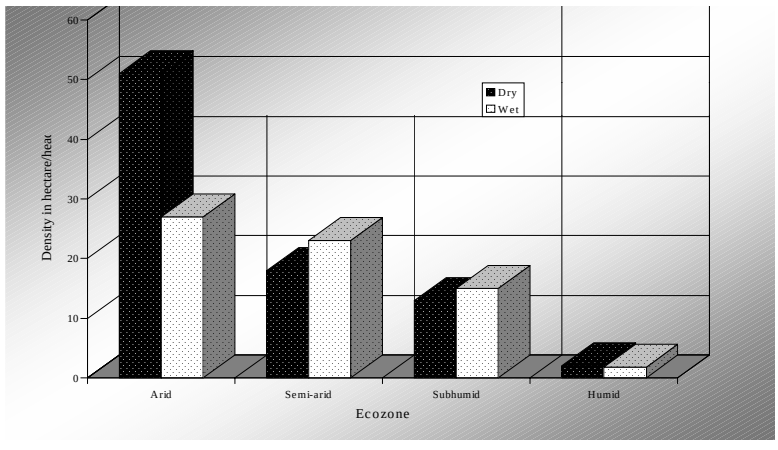
Nigeria had a mean (i.e. averaged between wet and dry seasons) cattle population of some 13.9 million in 1990, of which 11.5 million were kept in pastoral systems and 2.4 million in villages. These were predominantly zebu, but included 115,000 muturu, some keteku, n'dama and kuri. Country-wide, the mean density of cattle is approximately 15/km^2, or 6.6 hectare/head. Cattle numbers increase steadily with declining rainfall, so that much of the south has low cattle densities and most of the population is in the north. This trend is illustrated in Figure 1 which shows the densities by ecozone in both wet and dry seasons.

There is some seasonal change in the relative proportions of cattle in the various ecozones. Approximately 45% of the national herd stays within the subhumid zone throughout the year, with almost all of the remainder in the semi-arid or arid zones. In both seasons, there are several hundred thousand cattle in and around Lake Chad.

Table 1 Cattle subspecies and breeds in Nigeria

Status	Nigerian Reference Name	Other Names	Fulfulde
Zebu Types			
Resident:	Bunaji	White Fulani	Daneeji, Yakanaaji, Akuji
	Rahaji	Red Bororo, Abore	Bodeeji, WoDaaBe
	Sokoto Gudali		Bokolooji
	Adamawa Gudali		
	Azawak	Tagama	Azawa
	Wadara	Shuwa, Choa	
Not Resident:	Jali (=Diali)		Jaleeji
	Ambala	Arab, Bahr el Ghazal	
Taurines	West African Dwarf shorthorn	muturu	
	Keteku (shorthorn x zebu	Borgu	Kataku, Ketari, Kaiama
	Keteku (n'dama x muturu)		
	N'dama (humpless longhorn)		
	kuri (humpless longhorn)		
Doubtful breed status:	Daleeji? = Azawa		
	Buzaye? = Azawak x Sokoto Gudali cross		
	Noori? = colour name and not race		

Figure 1 Densities of cattle by ecozone



The great majority of the cattle in Nigeria are owned by pastoralists, and even those owned by settled farmers are often managed by pastoralists for part of the year.

This explains the considerable intra- and inter-annual fluctuations in numbers and distribution. Herders respond to the various constraints on production such as disease, pasture and political developments extremely rapidly, moving their stock and largely ignoring international borders, control posts and veterinary regulations (Blench, 1996).

Although there is a variety of pastoral groups, especially in the northeast, throughout most of Nigeria the pastoralists belong to a single ethnic group, the Ful≡e (FulBe), or Fulani. The Ful≡e are the best known and most numerous of all the pastoral groups in West Africa (Blench, 1999). They are also the major suppliers of cattle to settled farmers. As a consequence, to a large extent, their breeding strategies and choice of livestock breeds define the situation in the country as a whole.

3.3 Zebu types

3.3.1 Overview

As shown in Table 1, zebu are divided into six distinct resident breeds as well as animals that are of doubtful breed status or are only seen as trade stock. These breeds are of uneven numerical importance, with three breeds constituting 90% of the zebu. Zebu, in turn represent the great majority of cattle with perhaps 115,000 muturu and statistically insignificant numbers of other breeds.

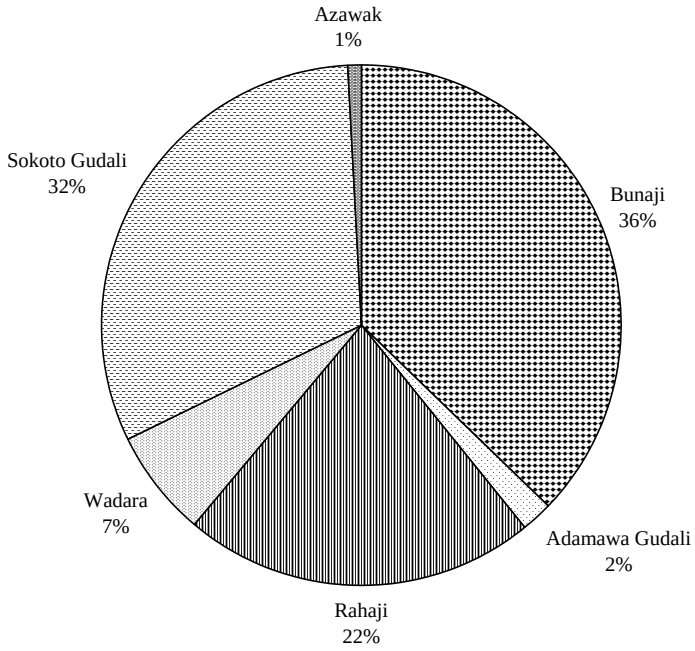
By combining densities noted from aerial survey with distributional data, it was possible to calculate approximate percentages of individual breeds in relation to the national herd. These are shown in Table 2 and Figure 2:

Table 2 Estimated percentages of different zebu breeds in the Nigerian National Cattle Herd

Breed	Proportion of Cattle Population (%)	Calculated Number of Each Breed
Bunaji	37.2	5,118,547
Sokoto Gudali	31.6	4,351,523
Rahaji	22.0	3,029,541
Wadara	6.6	904,731
Adamawa Gudali	1.9	263,019
Azawak	0.7	103,280
Total	100.0	13,770,641

Source: RIM, 1992, II:436

Figure 2 Contribution of zebu breeds to Nigerian National Herd



3.3.2 Bunaji

Bunaji or White Fulani cattle is a white, black-eared and medium-horned breed, and is the most numerous and widespread of all Nigerian cattle breeds. The NNLRS estimated that they represent some 37% of the national herd. They are found from Lagos to Sokoto, Katsina and Kano States and spread across the Nigerian Middle Belt. The only areas from which they are significantly absent are Borno, where Rahaji and Wadara predominate, and in the south-east, where there are no resident zebu. The movement into the derived savannah and to the edge of the humid zone has largely been of Bunaji and pastoralists generally agree that they are superior to all other breeds of zebu in resisting disease. Map 3 shows the distribution of Bunaji and indicates the approximate variation in their seasonal movement.

3.3.3 Sokoto Gudali

There are two quite distinct types of Gudali in Nigeria – the Sokoto Gudali (or Bokolooji) and the Adamawa Gudali (see below). The Sokoto Gudali is a uniform cream, light grey or dun, the dewlap and skin folds are highly developed and the horns almost absent. Although the Sokoto Gudali stereotypically occurs mainly in the northwest of Nigeria, in reality it is now distributed widely throughout the country (Map 4). The NNLRS estimated that they represent some 32% of the national herd.

3.3.4 Rahaji

The Rahaji is one of the largest zebu breeds and is distinguished by its deep burgundy-coloured coat, pendulous ears and long, thick horns. It is the third most numerous breed of cattle in Nigeria, some 22% of the national herd. The Rahaji is adapted to arid and semi-arid regions and rarely goes

further south than Kaduna in the wet season, except for the isolated population on the Mambila Plateau in the south-east (Map 5).

Ful≡e pastoralists consider the Rahaji an extremely prestigious breed and many herds of 'white' cattle include a few Rahaji for crossbreeding. Nonetheless, it tolerates neither humidity-related diseases nor poor nutrition. Strikingly, a Ful≡e clan, the Rahaji, named for the breed they traditionally herded, has been obliged to exchange their stock for Bunaji as they have moved south into the Middle Belt because of high mortality among the 'red' animals.

3.3.5 Wadara

Wadara cattle are medium-sized, lightly built cattle, and are usually dark red, black, pied or brown. They are shorthorned and have a small erect hump, representing some 6.6% of the national herd. Their present-day distribution is shown on Map 6. Wadara cattle are the 'indigenous' cattle of Borno and are referred to by the Koyam and related pastoralists as 'our' cattle. They are frequently called 'Shuwa' in the literature, after the Shuwa Arabs who also herd them. A related breed with a white coat, the Ambala, is often traded into Nigeria from Chad.

3.3.6 Adamawa Gudali

The Adamawa Gudali resembles the Bunaji in conformation. It is medium to large sized, with medium-length horns, and usually pied, or with a white, black, red or brown coat. It has thick, crescent-shaped horns, a pendulous hump, and a short head and muzzle. The pendulous hump is the feature that most reliably distinguishes it from the Bunaji. The NNLRS estimated that Adamawa Gudali represent some 2% of the national herd. At least two local types were originally recognised in Nigeria: the Banyo, with Rahaji blood and rather large horns, often with a white face and red eye patches, and the Yola, which had an admixture of muturu (Gates, 1952). The muturu element has been progressively diluted since the 1950s and the Yola breed is no longer recognised as a distinct variety by local herders. The Adamawa Gudali, as its name implies, is restricted to Adamawa (Map 7).

Both Kanuri and Ful≡e pastoralists own Adamawa Gudali cattle. It is rare for them to have complete herds of Adamawa Gudali, and often they are mixed with Wadara, Bunaji or Rahaji. Adamawa Gudali is regarded by many farmers as the indigenous race of the region and they are common in villages. Adamawa Gudali are favoured for ploughing, but when they become too large to pull a plough effectively they are further fattened in the compound and sent to market.

3.3.7 Azawak

The Azawak is said to be native to the Azawak Valley north-east of Nigeria and is distributed along its north-western border. It is lightly built with medium-length horns. Although Azawak in Niger are commonly described as red, the Azawak that enter Nigeria are usually a light fawn colour, though they can also be white, brown, pied and black. The NNLRS estimated that they represent just 0.7% of the national herd.

A small population of Azawak cattle exists in Nigeria throughout the year, but the majority are seasonal transhumants. Azawak are generally only found on the border north and west of Sokoto (Map 7) but there were also some in the north-west of Borgu and dotted along the frontier from Sokoto to Katsina.

3.4 Taurines

This section covers animals usually described as 'trypanotolerant' (e.g. ILCA, 1979), the West African dwarf shorthorn or *muturu* and the various types of Keteku, zebu x *muturu* and zebu x n'dama crosses. No judgement is offered on their powers to resist disease.

3.4.1 West African Dwarf Shorthorn

The West African dwarf shorthorn or muturu is small bodied, and blocky in conformation with short, fine-boned limbs. It has a compact body, no hump, a straight back, and a broad head. The face is slightly dished, and the horns are very short. In south-central Nigeria, the muturu is generally black, or black and white. Animals on the Jos Plateau itself are usually black and white but are distinctly larger than lowland animals. There are more variations in the northern populations; brown, red or tawny animals were recorded.

Within Nigeria, muturu cattle have a very disjunct distribution suggesting the gradual retreat of a once more widespread population (Map 8). The dotted line represents the speculative distribution of muturu prior to the rinderpest epidemics of the 1880s. The history, distribution, management and productivity of muturu have recently been reviewed in Blench et al. (1998a). Numerical estimates of the numbers of muturu have been seriously marred by inadequate maps of their distribution. Muturu are widely dispersed and often stall-fed, and so are less visible than zebu. As a result, published population figures are little more than informed guesses. Moreover, since northern muturu are barely known and their trypanotolerance is unmeasured, they have usually been excluded from estimates of 'trypanotolerant' cattle. ILCA's (1979) estimate of 120,000 muturu should be contrasted with that of Ngere (1983) who gave a figure of 60,000 or 0.7% of the national herd. Akinwumi and Ikpi (1985) surveying five states in the south, give 85,000. The NNLRS, the first survey to take all the population islands into account, gave an estimate of some 115,000 for 1990 (RIM, 1992, I:7).

Northern
There are isolated populations of muturu along the Republic of Cameroon frontier up as far as south-eastern Borno, adjoining the Michika-Mubi area of Adamawa. Small clusters exist in the Atlantika mountains, south-east of Yola and near Cham east of Bauchi. Muturu are still relatively common south-east of the Jos Plateau in the dry savannah. There is another nucleus of muturu north

of Tegina in the north-west, with diverse coat-colours suggesting a link with the north-eastern populations.

Southern
Muturu were probably once kept throughout the whole of southern Nigeria and that their disappearance from many areas is relatively recent. West of the river Niger, muturu were once widespread but are now uncommon. They have either been replaced by keteku and zebu, or communities have ceased keeping them. At present, the major concentrations of muturu are in the south-east, in the Cross River area and among the Tiv people in and around Makurdi. Muturu are kept throughout the Igbo areas but in very low densities.

The division of muturu into different populations is somewhat controversial. The research defined four subsets; northern savannah/montane, plateau, derived savannah and forest. Only the first group is distinctive in physical appearance; the further north they are found, the larger in stature they are. Muturu in the derived savannah and forest are similar in colour, conformation and management and contrast with those in the northern savannah/montane environments.

3.4.2 Keteku (taurine x zebu crosses)

Apart from the muturu there are essentially three cattle types that fall under the broad rubric of trypanotolerant:

- crosses of the West African Dwarf Shorthorn (=muturu)
  with zebu
  with n'dama
- b) pure-bred n'dama.

The first two are known as Keteku within Nigeria, although they are very different in conformation. In this working paper, the muturu x zebu cross is called the Borgu Keteku and the muturu x n'dama the Lagos Keteku. The n'dama, unlike the zebu and muturu, are not indigenous to Nigeria but have been imported from the Senegambia during the twentieth century. The distribution and productivity of Keteku have been studied in more detail in Blench et al. (1998b).

The definition of keteku has become more problematic in recent years with an increasing proportion of zebu blood in 'keteku' herds. As Ful≡e pastoral herds push ever further south and increasingly inhabit regions previously restricted to trypanotolerant stock, more zebu are bought in for village herds. For example, the 'Biu', a zebu x savannah muturu cross found near Biu in southern Borno and described in the literature (Gates, 1952), has effectively become submerged in the local zebu gene pool. The application of the name keteku to an individual animal may reflect as much the owner's cultural background as its actual genetic composition.

Map 9 shows the distribution of the various keteku crossbreeds established in 1990. The population size given by ILCA (1979, II:204) was 180,000 keteku in Nigeria, a figure almost certainly inflated by a distorted map of keteku distribution (see their Figure 2). Keteku are significantly less common than previously thought and their distribution quite different. It is unlikely that there as many as 100,000 of all types.

Borgu Keteku
The Borgu Keteku also Kataku, Ketari, Borgu, Borgawa and Kaiama, is a trypanotolerant, stabilised muturu x zebu cross (Gates, 1952). It combines muturu and Bunaji features with white, grey and black types predominating, and more occasionally red and brown. The horns are long compared with a muturu, but the hump smaller, and the legs shorter than a Bunaji. In Nigeria, keteku in herds are restricted to a narrow band along the Benin Republic border in the region usually known as 'Borgu'.

Further east, keteku are occasionally kept adjacent to villages in northern Yorubaland. West African dwarf shorthorn were once common through this region and the keteku fills the same niche. Keteku are sometimes bought as investment stock in the Ondo area by farmers who value their combination of size and trypanotolerance. Keteku were formerly distributed from breeding farms as part of livestock extension programmes and the Government Livestock Centre in Ado-Ekiti still keeps a stock of keteku.

In contrast to other West African countries, there has been very little 'new' crossing of zebu and muturu in southern Nigeria. In some ways, it is surprising that the crossbreeding of zebu and muturu did not take place all along the line where the two types came into contact. Further east, among the Igbo, farmers tend to assume that the two breeds are incompatible; attempts at cross-breeding would conflict with religious strictures. The continuing genetic separation on the Jos Plateau probably reflects ethnic competition between the owners as much as animal production considerations.

N'dama
N'dama cattle are native to Senegambia and adjacent parts in the west of West Africa (Starkey, 1984; Blench et al. 1998b). They were first brought in to Nigeria from Guinea in 1939 on an experimental basis, because they were trypanotolerant and yet were larger than muturu. The n'dama has a medium-sized compact body with lyre-shaped black-tipped horns and no hump. There is a small dewlap in the male, but a fairly large head. Although those imported into Nigeria are generally light brown, there are black and pied animals in Guinea.

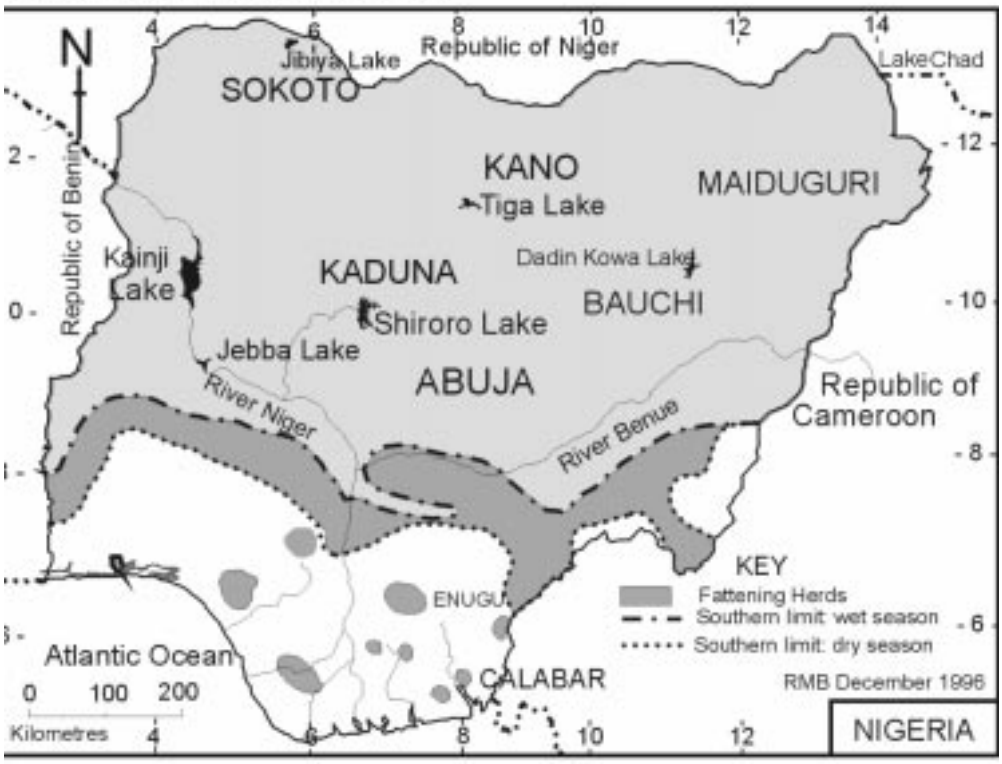
N'dama cattle have been sold to farmers and pastoralists with a view to improving the resistance of local herds to trypanosomiasis. In most cases, herders cross them with zebu and there are now few pure n'dama outside institutions, although some were recorded in northern Yorubaland.

3.5 Kuri

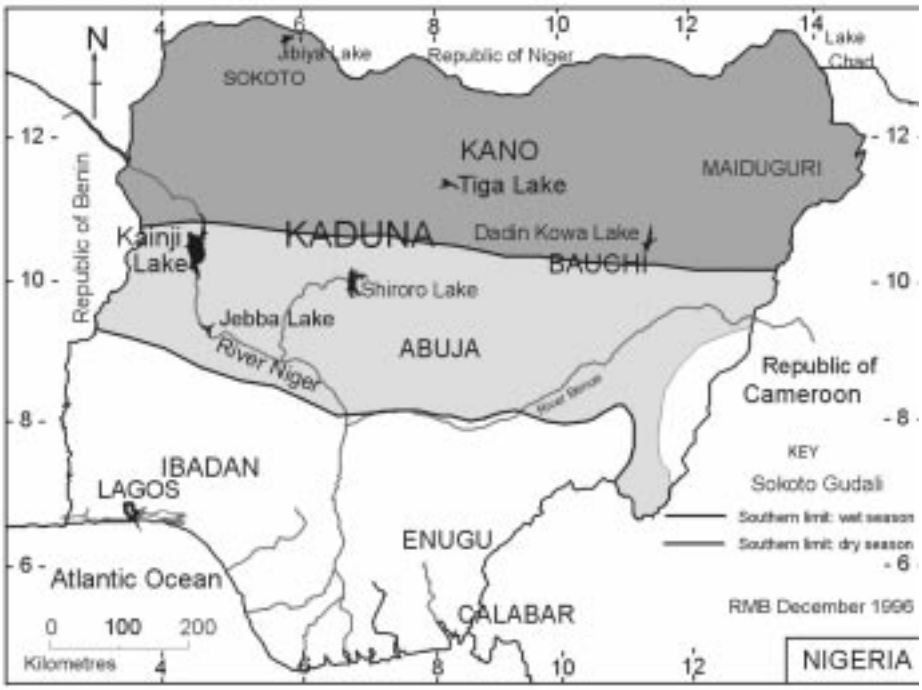
The kuri is a large-bodied humpless longhorn whose exact historical origin is unknown (Blench, 1993; Meghen et al., 1999). The kuri has distinctive, inflated, spongy horns unknown in any other breed and with a mean height of 1.5 m, and weight of some 550 kg, is one of the largest breeds of African cattle. Kuri are noted for their extremely variable colours and their ability to thrive in semi-aquatic conditions.

The nucleus of the kuri cattle population is within the region of the former Lake Chad, and along its eastern shores. In Nigeria, kuri are found not only on the Lake but on its shores and along the Yobe valley, as far west as Gashagar. There is also a restricted export of kuri as traction animals to the region north-east of Kano. The breeds along the Komadugu Yobe are crossed with zebu and are generally referred to as Jetkoram in the literature.

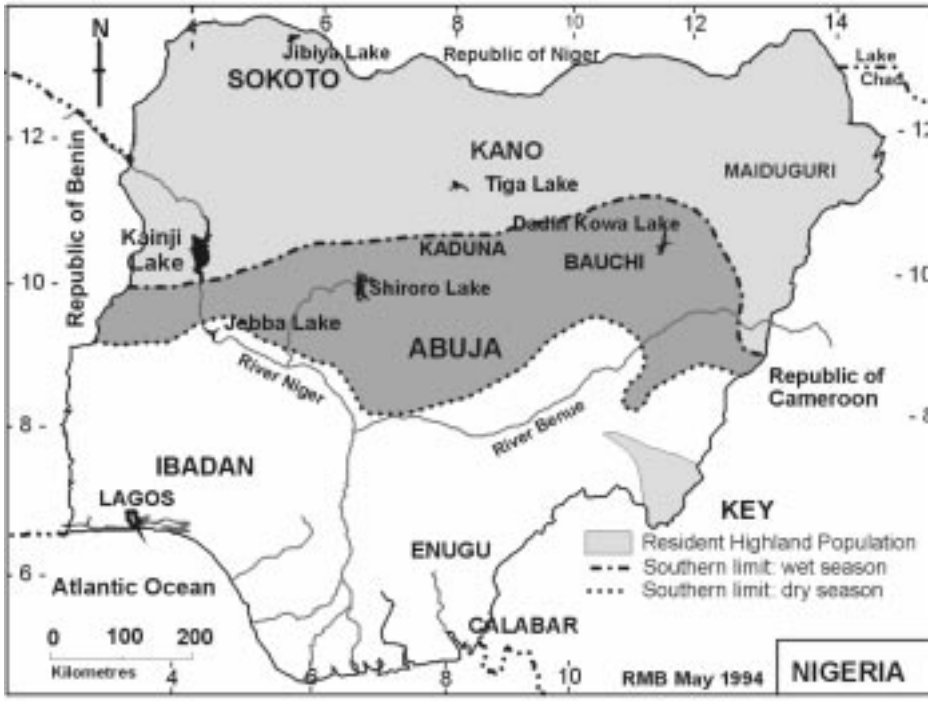
ap 3 Distribution of Bunaji cattle in Nigeria - 1900



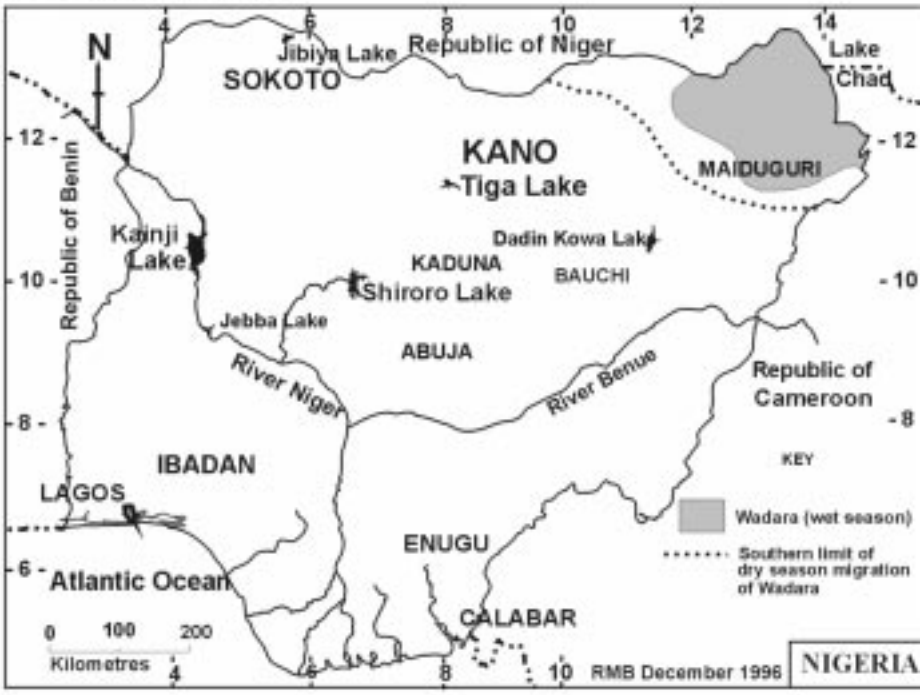
Map 4 Sokoto Gudali cattle in Nigeria



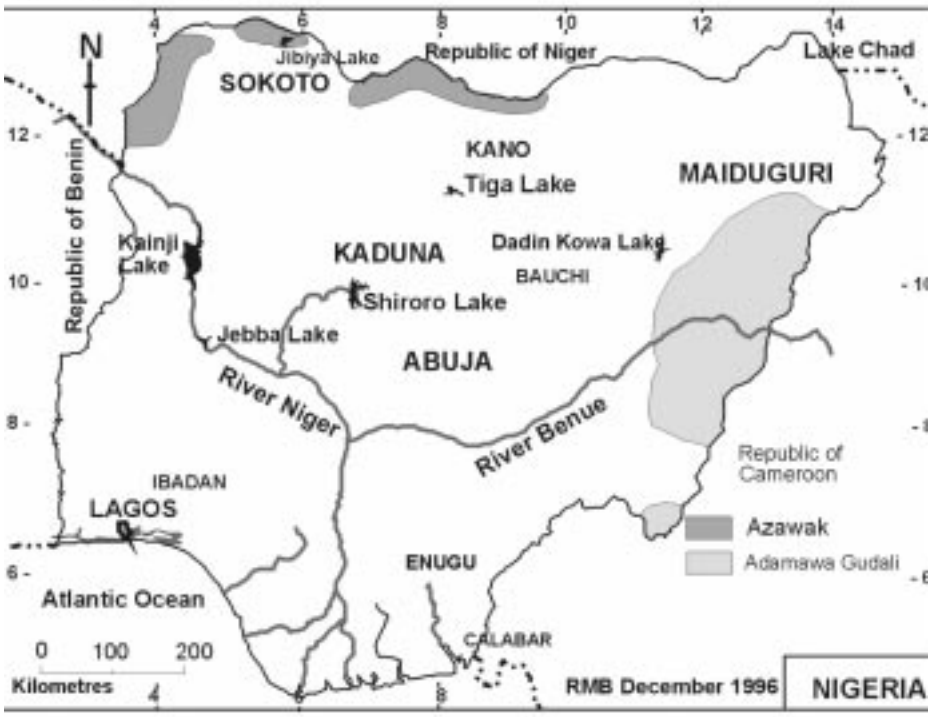
Map 5 Rahaji cattle in Nigeria



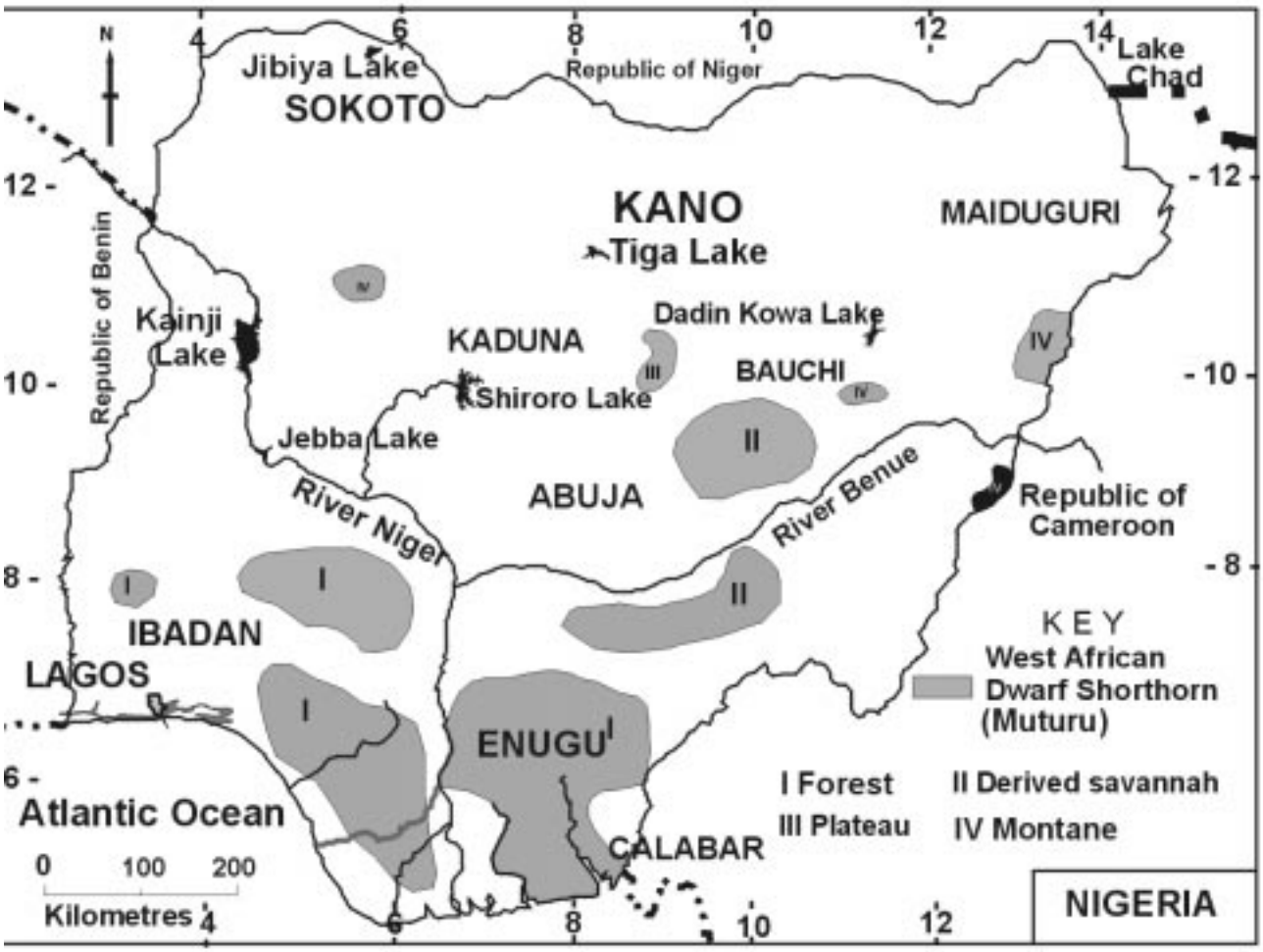
Map 6 Wadara cattle in Nigeria



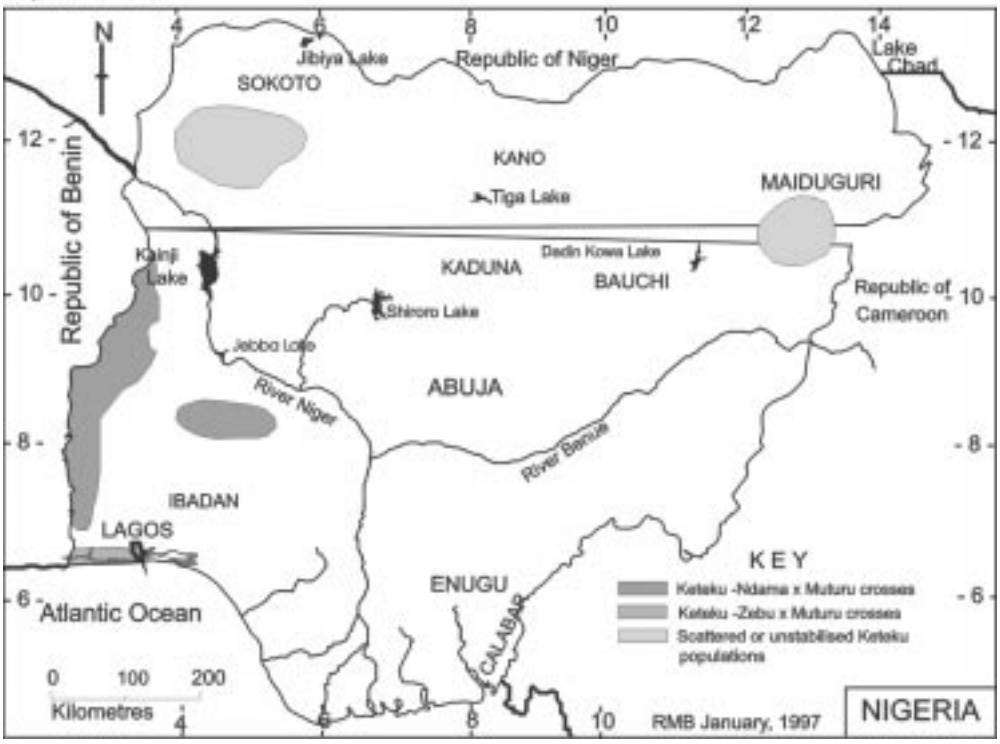
Map 7 Adamawa Gudali and Azawak



Iap 8 West African dwarf shorthorn cattle



Map 9 Keteku cattle



4. Sheep and Goat Breeds

4.1 Sheep

Sheep are kept everywhere in Nigeria, with a broad distinction between their importance and ubiquity in the north, and the more dispersed populations of the humid zone. Sheep and goats are seen as having secondary importance in relation to crops. There are generally considered to be four breeds or races of sheep native to Nigeria, the Balami, Uda, Yankasa and West African Dwarf (WAD) (Adu and Ngere, 1979).

4.1.1 Balami

The Balami is the largest bodied native sheep in Nigeria. As a pastoral animal it is confined to the semi-arid north, but it is favoured as a stall-fed breed by Muslims throughout the Nigerian Middle Belt. Map 10 shows its distribution in pastoral herds. It is white and hairy with pendulous ears and a long thin tail; rams have a throat ruff and are horned but ewes are normally polled. Another feature that makes the Balami distinctly recognisable is its Roman nose, a large bulbous nose that distinguishes it from the Yankasa.

4.1.2 Uda

The Uda is slightly smaller-bodied than the Balami, although their size ranges overlap. It is easily recognised by a distinctive coat colour pattern; entirely brown or black forequarters and white behind. Uda sheep give their name to a Ful≡e clan, the Uda'en, who herd large flocks of this breed between Niger and the northern reaches of the Nigerian Middle Belt. Studies on Nigerian Uda are lacking. Haumesser and Gerbaldi (1980) studied traditionally-managed Uda flocks in Niger Republic; Wilson and Durkin (1983a,b) and Wilson and Light (1986) report on related sheep production systems in central Mali.

Map 11 shows its distribution in Nigeria;

4.1.3 Yankasa

The Yankasa breed has been the most extensively studied in Nigeria. The body colour is white with black patches around the eyes and sometimes on the feet. The muzzle and ears are usually black too. Rams have curved horns and a hairy white mane, and ewes are polled. Yankasa sheep have been recorded in all parts of Nigeria, though the populations attenuate towards the northern border and the sea-coast. Map 12 shows the approximate range of the Yankasa. Some tentative studies have been made of its ecological adaptations. Yankasa sheep do not need daily watering in the wet season and watering once a day suffices in the dry season (Aganga et al., 1988).

4.1.4 West African Dwarf

The West African Dwarf is a small-bodied, compact breed which may be all white, black, brown, or spotted black or brown on a white coat. Its variation in colour and patchy distribution make it difficult to distinguish clearly from the Yankasa. Adu and Ngere (1979) say that different types exist, mentioning the 'Pagan' variety on the Jos Plateau, and the 'Umuahia' variety near the Confluence, but there is no published account of such varieties. Devendra and McLeroy (1982) argue that the WAD breed cannot be subcategorised on the basis of appearance, and no performance data is available.

Map 13 shows its approximate range.

4.2 Goats

The only published characterisation of the traditional varieties of goat in Nigeria is Ngere et al. (1984). Three main varieties of goat are recognised in Nigeria, the Sahel, Desert or West African long-legged goat, the Sokoto Red and the West African Dwarf.

4.2.1 Sahel or Desert goat

The Sahelian or Desert goat is found along the northern border of Nigeria, particularly in Borno, where it is often known as 'Balami', although this name has not been adopted as it would lead to confusion with the better-known sheep race, Balami. Mason (1988) uses 'Sahel', which seems appropriate, as this race is distributed from Senegal to Sudan. In Nigeria, the Sahel goat is generally the variety preferred by pastoralists. The distribution of Sahel goats in Nigeria is shown in Map 14.

Sahel goats are very similar in appearance to the sheep with which they are often herded. The coat is white or dappled, the ears are pendulous and the legs are notably longer than other breeds. Wilson et al. (1984) studied the productivity of goats and traditional management in the Republic of Niger and also included a valuable table of comparative data from other studies. Wilson and colleagues also studied the productivity of Sahel goats in the Republic of Mali (Wilson, 1987; Wilson and Durkin, 1983a,b; Wilson and Sayers, 1987). Dumas' (1980) description of the *chèvre Arabe* of Chad, corresponding to the Nigerian Sahel goat, quotes growth curves and fecundity data.

4.2.2 Sokoto Red goat

The Sokoto Red, Kano Brown or Maradi goat (Maradi is a *Département* of the Niger Republic) is probably the most widespread and well-known type in Nigeria (Haumesser, 1975). It is the usual village goat in the northern two-thirds of the country although it is less common with transhumant pastoralists. The distribution of Sokoto Red goats in Nigeria is shown in Map 15. Ngere et al. (1984) argue that populations of the Sokoto Red spread south and east from Sokoto through the savanna belts giving rise to the Kano Brown and, further east, to the Sahel types of Borno State. This type of historical speculation is difficult to accept without more detailed evidence.

The most complete overview of the breed is Robinet's (1967) comprehensive survey which integrates data from Nigeria and Niger. The Sokoto Red is the only Nigerian breed for which there

is a record of systematic attempts to stabilise a particular type. Henderson (1929), reviewing the work of the Veterinary Service in Sokoto Province, described how, in 5 years, 219,688 non-red[2] male goats were castrated resulting in the replacement of non-red skins by the more valuable red in the local markets.

The Sokoto Red goat was the source of 'Morocco leather' known in Europe from the medieval period onwards. It acquired this name because it was transported across the Sahara by caravans controlled by Moroccan merchants. The Sokoto Red is still known for its suitability for fine leather. Burns (1965) observes that the skins have coarse, thinly-spaced outer hairs and small sweat and wax glands and that they lacked fat. Alaku and Moruppa (1983) found that Sokoto Red goats slaughtered in the driest months suffered a 55% reduction in skin weight, making it 4.9% of the total body weight.

4.2.3 West African Dwarf goat

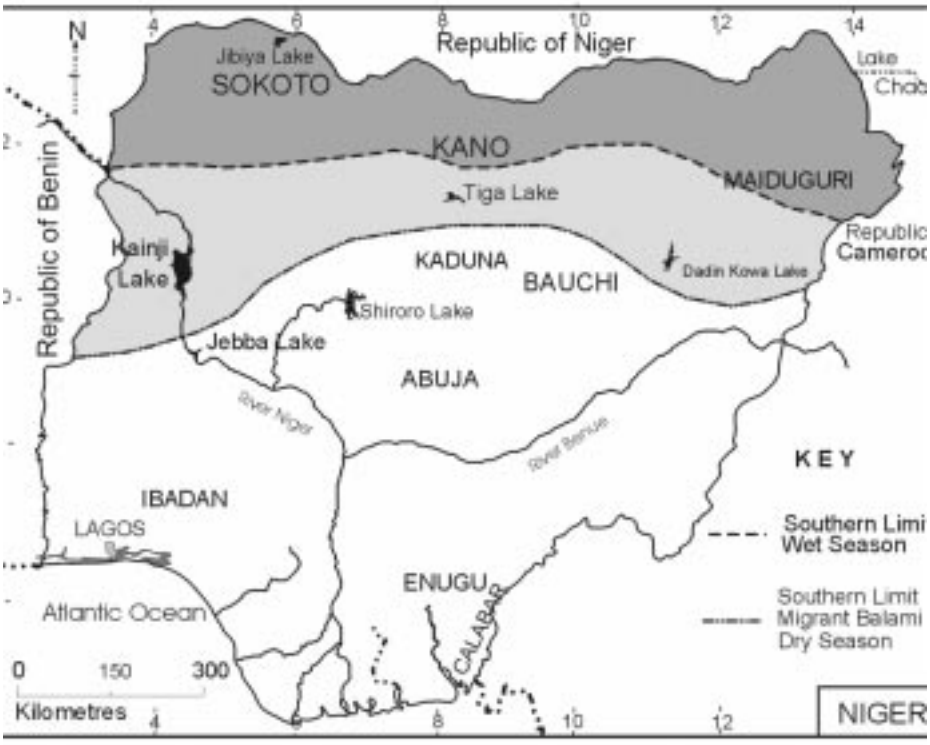
Although the West African Dwarf (WAD) goat is found in 'many local types' (Ngere et al., 1984) no published account differentiates them. Although they are stereotypically said to be native to the forest belts, their presence in Borno State and in adjacent Republics of Cameroon and Chad suggests that they were far more widespread until recently. They correspond the West African Grassland Dwarf described for Cameroon by Ndamukong et al. (1989). Indeed, like muturu cattle, they may once have been the main race of goat over most of Nigeria. Just as the zebu has replaced the muturu, so WAD goats have been driven to remoter areas in the savannahs. There is a strong association between the diffusion of the Red Sokoto goat and Islam, so for example, in southern Sokoto State, the non-Islamised populations still retain WAD goats while most Hausa villages have exclusively Sokoto Red. The distribution of WAD goats in Nigeria is shown in Map 16.

Goats are not native to West Africa, so the WAD goat must originally have evolved from a long-legged type, probably ancestral to today's Sahel goat. The WAD is usually black, although patched, pied, and occasionally all-white animals can be seen, even on the coast. Although Chang and Landauer (1950) argue that the WAD is a proportionate dwarf, Epstein (1971) points out that the distorted forms and extremely short legs do suggest achondroplasy. This small size is probably an adaptation to the goats' environment though the nature of the selective force is unknown. The WAD goats in the semi-arid zone resemble Sokoto Red goats in their body proportions.

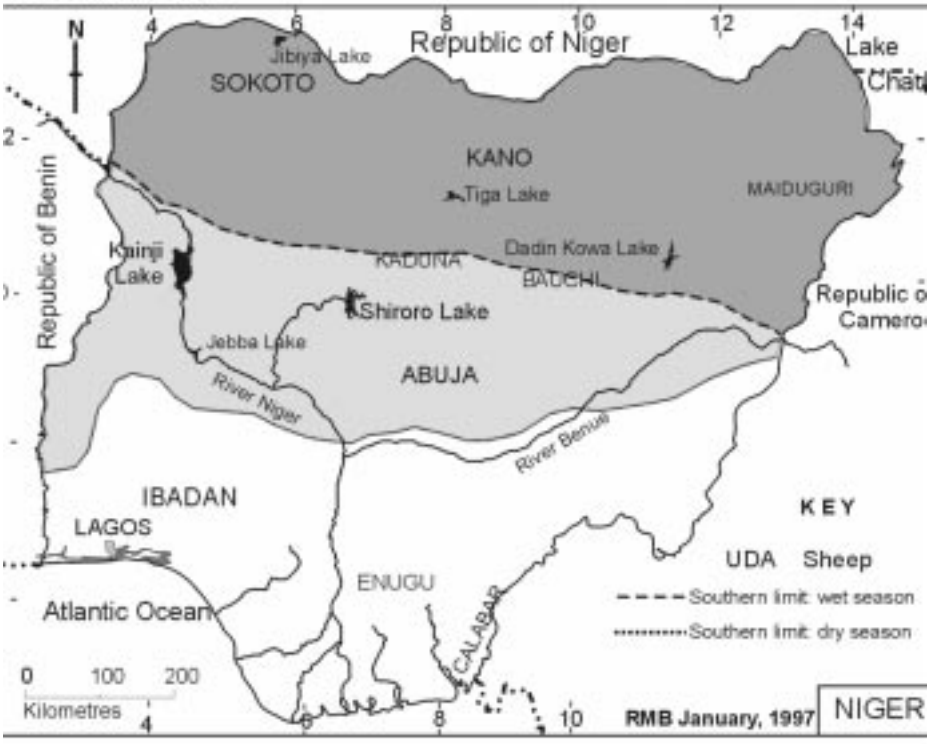
Paradoxically, physiological experiments have shown that the WAD goat is not particularly adapted to high ambient temperatures (Montsma et al., 1985). High temperatures and relative humidities, e.g. 30°C and 60% relative humidity, cause a reduction in food intake. The WAD goat is believed to be trypanotolerant because it thrives in tsetse areas, but there have been no critical studies of this belief.

2 It is unfortunate that there is no direct record of the breeds castrated, but presumably they were a mixture of Sahel types, WAD types and their crosses.

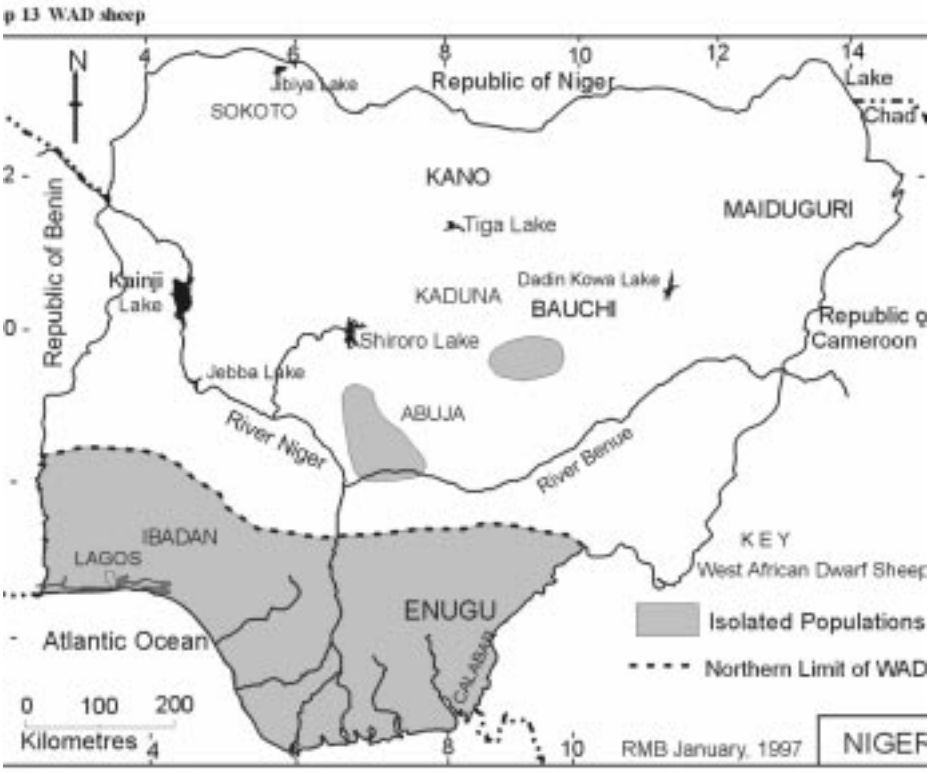
p 10 Balami sheep

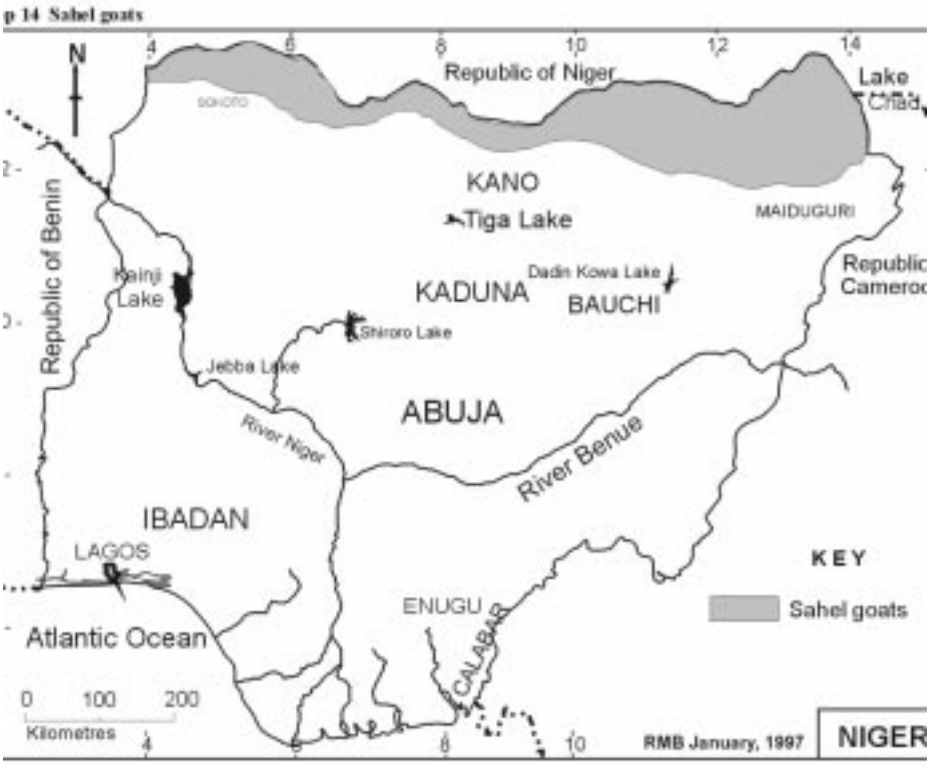


p 11 Uda sheep in Nigeria

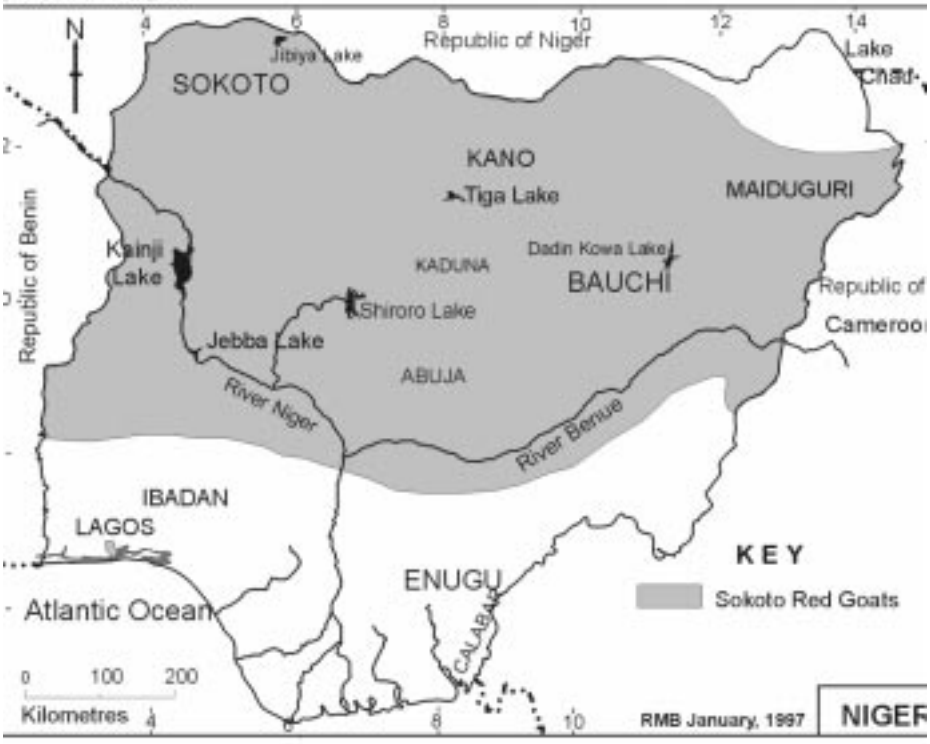


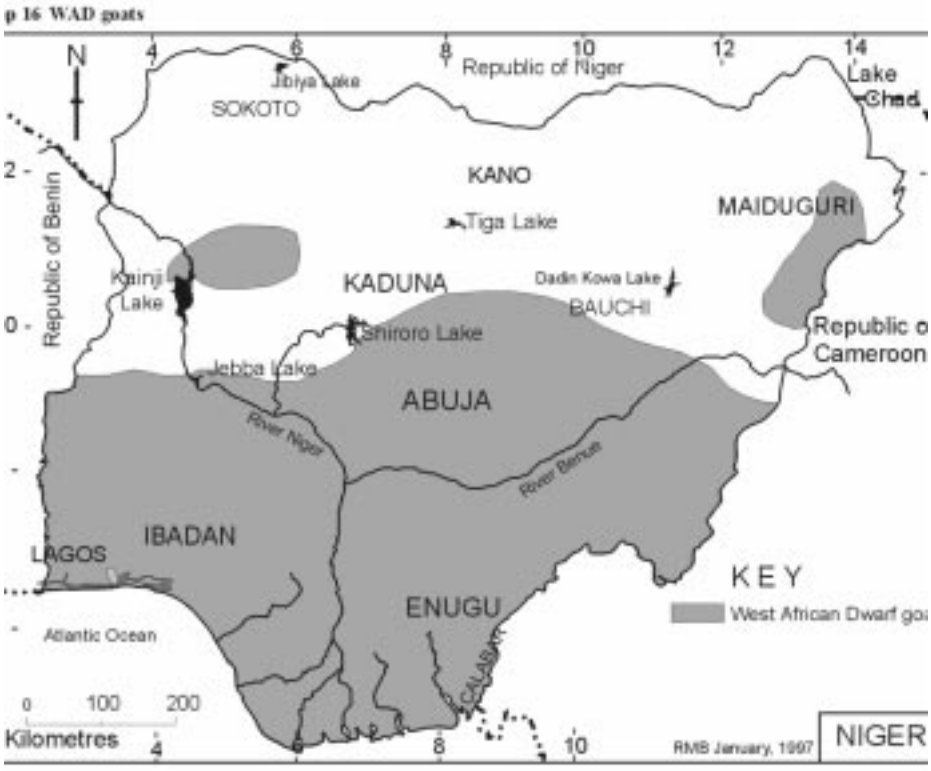

p 12 Yanaksa sheep
N
4
6
8
10
12
14
Jibiya Lake
Republic of Niger
Lake
Chad
SOKOTO
KANO
Tiga Lake
MAIDUGURI
Republic of Benin
Kainji
Lake
KADUNA
Dadin Kowa Lake
BAUCHI
Republic of
Cameroon
Shiroro Lake
Jebba Lake
ABUJA
River Niger
River Benue
IBADAN
LAGOS
Atlantic Ocean
ENUGU
CALABAR
KEY
Yankasa sheep
0
100
200
Kilometres
4
8
10
RMB January, 1997
NIGER


p 13 WAD sheep
N
Republic of Niger
SOKOTO
KANO
MAIDUGURI
Tiga Lake
Kainji Lake
KADUNA
Dadin Kowa Lake
BAUCHI
Shiroro Lake
Jebba Lake
ABUJA
River Niger
River Benue
Republic of Benin
IBADAN
LAGOS
ENUGU
Atlantic Ocean
CALABAR
KEY
West African Dwarf Sheep
Isolated Populations
Northern Limit of WAD
0 100 200
Kilometres
RMB January, 1997
NIGER


p 14 Sahel goats
N
Republic of Niger
Lake Chad
SOKOTO
KANO
Tiga Lake
MAIDUGURI
Republic of Benin
Kainji Lake
KADUNA
Dadin Kowa Lake
BAUCHI
Shiroro Lake
Jebba Lake
ABUJA
River Niger
River Benue
IBADAN
LAGOS
ENUGU
CALABAR
Atlantic Ocean
KEY
Sahel goats
0 100 200
Kilometres
RMB January, 1997
NIGER

p 15 Sokoto Red goats




p 16 WAD goats
N
Republic of Niger
Lake Chad
SOKOTO
KANO
MAIDUGURI
Tiga Lake
Republic of Benin
Kainji Lake
KADUNA
Dadin Kowa Lake
BAUCHI
Shiroro Lake
Republic o
Cameroon
Jebba Lake
ABUJA
River Niger
River Benue
IBADAN
LAGOS
ENUGU
KEY
West African Dwarf goa
Atlantic Ocean
CALABAR
0 100 200
Kilometres
RMB January, 1997
NIGER

5. Factors Affecting Ruminant Breed distribution

5.1 Overview

Apart from the trypanosomoses, the major factors affecting the distribution of ruminant breeds can be classified as socio-economic and environmental. These are discussed under a number of broad headings:

- Ecology and Feed availability
- Disease
- Animal Traction
- Marketing Systems
- Cultural preferences including religion

Obviously these are not exclusive categories. For example, cultural preferences may reflect the ecology and nutritional requirements of cattle. Droughts may present farmers with the opportunity to buy cattle at exceptionally low prices thereby changing the farming system (Blench & Marriage 1999). The impact of diseases other than the trypanosomoses is very little known at present.

5.2 Ecology and feed availability

Particular feed preferences are usually ascribed to individual breeds which make them appropriate for certain environments. These are a major factor in determining breed distribution, but also in interpreting 'interlocking' distributions; two or more breeds can exploit the same ecozone by making different use of feed resources. As the vegetation gradually changes, due to both climatic and anthropic factors, producers must adapt either the breeds they use or bring in new ones.

An example of this type of adaptation is the Sokoto Gudali race which originated in the arid zone north of Sokoto and is reputed to be specialised in eating browse. Sokoto Gudali cattle can digest woody vegetation that other breeds find extremely unpalatable and herders are commonly seen lopping trees at the end of the dry season. One consequence is that Sokoto Gudali can thrive in regions that other pastoralists would consider overgrazed. Surprisingly, despite a basic adaptation to arid zones, the herders migrate every year to the edge of the humid forest, almost as far south as the Bunaji. This suggests a relatively rapid adaptation to new pathogens, although Sokoto Gudali are subject to less nutritional stress because of their varied diet. The consequence has been a very rapid expansion of this breed over a short period of time. Many farmers in the subhumid zone interviewed claimed to have first seen this breed of cattle in the 1970s.

The most discriminating feeder among the zebu breeds, according to the Ful≡e, is the Rahaji. Developed in the semi-arid zone, they are specialised in the pasture grasses of this region. They are said to refuse browse and the difficulty of making them eat 'new' fodders is cited as problem in moving them into the subhumid zone on a permanent basis.

The Adamawa Gudali, always of limited distribution, seems to have remained virtually static during the period within the recollection of herders. This is because its main habitat is the high-altitude grasslands of Nigeria and Cameroun. It is usually considered to have arisen from crossing with farmers' taurines and the incoming zebu and as such is poorly adapted to pastoralism. In terms of

diet it tends to specialise on the annual and perennial grasses of this region and cannot be easily shifted to another vegetational zone.

The management systems of taurines vary from hand-fed in permanent confinement to free range with almost no inputs. A result of their adaptation to their environment is that they will eat almost any type of vegetation. In the north-east, where muturu are allowed to feed on the steep mountainsides for most of the year, owners emphasised that they could eat all types of grass, herbs and woody vegetation, even when desiccated. Further south, muturu are more often stall-fed, but still they can digest a wide variety of feeds. This is in contrast to zebu breeds, which can rapidly go into decline if their owners cannot find the appropriate pasture composition.

The changing resources of Lake Chad

In the case of kuri cattle on Lake Chad, two notable features relate to their habitat: their tolerance of insect bites and their preference for fresh grass. Typically, when the waters of Lake Chad rise, zebu cattle have to leave the region because of biting insects, but kuri simply move to the islands. Their preference for fresh grass seems to be the major reason for their failure to spread to the semi-arid rangelands around the Lake. Historical data suggests that kuri were formerly more common along the valley of the Yobe because of the grass along its banks. As the river system has dried up they have been driven back to the Lake (Blench, 1991b).

Both the recorded distributions and the observations of pastoralists suggest that breed distribution is strongly linked to the preferences of individual breeds for different types of feed. Animals with a capacity to digest a wide range of foods are more widespread than those with a restricted diet. Breed distributions change as the overall environment of Nigeria evolves. For example, agricultural expansion and pressure on grasses has favoured the regrowth of woody vegetation in the spaces remaining between the fields. This has favoured browsing animals; not only cattle breeds but also goats and camels. Similarly on the edge of the forest zone, the cutting down of trees for farms has gradually led to an expansion of the region of derived savannah. This has favoured grass-eating zebu types in areas where formerly only taurines could have survived.

5.3 Disease: the trypanosomoses and others

Disease factors, and in particular the trypanosomoses, are usually considered to be a major factor in determining cattle distribution (Glover, 1960). In a standard text (Davies, 1977:65) it is stated ‘the presence of disease-carrying tsetse in Nigeria has greatly affected the distribution of domestic animals’. In support of this, Davies says that:

- Zebu cattle…cannot live for long periods in the *G. morsitans* and *G. palpalis* belts.
- Zebu cattle…cannot live at all in the southern part of the country... except on cattle ranches.
- Thousands of herds have to migrate southwards…during each dry season..; they return to the north in the wet season to get away from the dispersing tsetse.

Davies concludes that the cattle population of Africa could be doubled if tsetse were eradicated.

This can probably be taken as standard wisdom on the subject of tsetse and its apparent self-evident nature was the basis of policy in both the colonial and post-Independence eras. The colonial regime

instituted both tsetse control measures and made available a range of trypanocides. Tsetse control programmes continue to be Nigerian government policy up to the present, whether in the form of spraying or sterile male release.

Actually measuring the impact of tsetse eradication programmes and controlling for other factors is quite problematic. The southward expansion of cattle herds in Nigeria is usually taken as evidence that tsetse control programmes have opened new pastures. But an alternative explanation is that the expansion of population in the Middle Belt coincidentally acted to eliminate both the vectors (by hunting out the wild animals) and the forest habitats (cut down for agricultural land) of the tsetse fly (Bourn, 1983). It is thus hard to distinguish the effects of tsetse control programmes from the natural process of human population expansion. However, exact information in this area is no longer available. Since the mid-1980s, the survey of tsetse incidence has been reduced to minimal levels and control measures have virtually ceased. All published maps are thus based on informed guesswork.

One problem in interpreting livestock owners' statements about the incidence of trypanosomiasis is that most pastoralists are confused about the identification of the tsetse fly. All biting flies worry cattle, but the large flies that draw blood are considered the most dangerous types and they are identified as the cause of *samoore*. *Samoore* is a local term usually translated as trypanosomiasis but seems to be applied rather indiscriminately to any type of wasting disease, including tick-borne diseases. Anecdotally, therefore the incidence of trypanosomiasis may be apparently rather higher than in reality. Only clinical survey can establish the actual rates of infection.

More controversial is the role played by other diseases. There is little doubt that zebu cattle are progressively threatened by disease in more humid regions – however, the exact diseases and factors that act to reduce the challenge to stock are disputed. It is certain, however, that as cattle press further down into the subhumid and humid regions they are more susceptible to other types of potentially fatal disease. In interviews with pastoralists in surveys in both 1989 and 1990 (RIM, 1989; 1992) the most commonly cited problem was *kirchi*, usually identified with streptothricosis, but probably applied more broadly to a variety of skin conditions. Tick-borne diseases, babesiosis and other more minor conditions, are frequently cited by producers as more common in wetter regions.

Quantitative data do not exist to illustrate the importance of skin disease and other humidity-related problems in cattle mortality. However, a study on the reasons why farmers abandon ox-ploughing in the Middle Belt provided some indication of the relative importance of various diseases (Blench, 1997c). Farmers were asked the causes of ox-mortality when subjected to work-stress. Table 3 shows their responses. The category 'sickness' referred to skin problems and other diseases the farmers were unable to identify. The high figure for 'epizootic' reflects the rinderpest epidemic two years previous to the survey.

Table 3 Reasons given by farmers for ceasing to plough

n = 68

Disease	Number
Epizootic	37
Sickness	14
Trypanosomiasis	8
Liver-fluke	5
Trauma	4

Source: Blench (1997c)

Another aspect of disease with an important impact on muturu populations in Northern Nigeria is interaction with zebu herds. Muturu populations have traditionally been isolated in remoter areas

and have had little contact with other cattle. As a result, they are often not resistant to endemic diseases, or are more seriously affected than zebu, which not only traverse a wide variety of ecological zones, but are also frequently in contact with other herds. Muturu owners complained that when a zebu herd passed through their area, their animals often fell sick, even though the zebu appear to be healthy. The zebu presumably frequently harbour sub-clinical pathogens which infect the muturu.

5.4 Animal traction

Animal traction, especially ploughing and carting, now forms a major element in household production systems in most parts of the semi-arid zone. As farmers depend increasingly on traction animals they gradually develop more discriminating preferences for particular breeds. In some cases they are willing to buy animals and transport them long distances to meet their requirements. For example, farmers in some communities east of Kano were travelling to Lake Chad in 1990 to buy kuri cattle for use in ploughing.

Unfortunately, there seems to be little consistency between farmers' accounts of traction. For example, Sokoto Gudali are usually reckoned to be poor animals for ploughing because of their uncertain temperament. However, in Ilela LGA, near Sokoto, they were preferred by farmers. Similarly, Borgu keteku, that is muturu x zebu crosses, are brought from Borgu as plough animals in some parts of southern Sokoto. Farmers in Adamawa tend to use the local breed, Adamawa Gudali, but this animal has barely spread outside the region.

This process clearly functions to redistribute certain breeds outside their usual area. Farmers' choices may reflect specific features of the micro-environment, such as incidence of disease or soils, that cannot be easily quantified, or simply a well-organised trading pattern. It tends to favour breeds, such as the Bunaji, which resist work-stress, as opposed to the Rahaji which does not.

5.5 Marketing systems

Nigeria, with a human population of nearly 90 million according to the 1992 census, represents the largest market for beef in West Africa and has traditionally brought in considerable quantities of cattle on the hoof from Sahelian countries. The freeing of the exchange rate following SAP in 1986 has caused the Naira to decline dramatically in value. Before 1986, the Naira and the US$ were approximately equal in value – whereas by October 1999, the exchange rate was ca. ₦80 to the US$.

The basis of the meat trade in Nigeria was formerly the importation of Sahelian cattle from the Francophone countries, especially the Niger Republic, which have a hard currency[3], the Cfa. Producers in these countries saw the market price for their stock fall dramatically after 1986, since although prices rose in Nigeria, they did not compensate for the fall of the Naira. As a result, production within Nigeria became more attractive, and thereby giving a major impetus to the backyard fattening of cattle. This practice is particularly popular in the Middle Belt, with abundant vegetation and access to the large urban markets of the south. As with plough animals, farmers

3 In early 1994, the Cfa was devalued 50% relative to the French franc. However, at the same time, the Nigerian government temporarily reversed its policy of allowing the Naira to float.

entering this system buy any animal the pastoralists are willing to sell, but with more experience they begin to demand particular breeds of cattle. Except in the extreme east, the breed favoured for fattening is the Bunaji, since it is hardy and disease-resistant even though its weight-gain characteristics may be less attractive than Rahaji. Sokoto Gudali are favoured by villagers as fattening stock but they are not popular traction animals as they are said to be lacking in stamina.

5.6 Cultural preferences

Productivity parameters and cultural preferences are almost inevitably intertwined among pastoral peoples and cannot always be clearly disentangled. For example, Rahaji cattle are generally considered to be the most prestigious type of zebu among most Ful≡e clans. It is claimed that they are larger, give more milk and are more docile or simply more 'beautiful'. It is common for herders to introduce Rahaji bulls into more southerly 'white' herds to gradually adapt the breed to the higher rainfall zones. The Kanuri-speaking pastoralists of northeastern Nigeria identify strongly with the Wadara breed which they inherited 'from their forefathers' and they continue to herd it today. However, the Ful≡e pastoralists who exploit the same grazing in Borno usually prefer Rahaji or Sokoto Gudali and consider the Wadara small and unprestigious.

The expansion of the Sokoto Gudali is strongly identified with certain clans of Ful≡e pastoralists, the Sulebawa or Hausa'en, originally from the Sokoto region. These clans began to expand across central and eastern Nigeria since the droughts of the early 1970s and they have begun to appear in regions as remote as southern Adamawa and on the former Lake Chad. They move rapidly, through remote bush areas, and very often do not establish links with settled farmers, nor with the 'resident' Ful≡e.

6. Changing Livestock Species and Breed Distribution

6.1 Cattle

6.1.1 'Trypanotolerant' breeds

Muturu or West African Dwarf shorthorn cattle were once widespread throughout southern Nigeria but are almost everywhere in retreat (Blench et al, 1998a). In the past, many villages kept muturu cattle for ceremonial purposes. In the 1960s it was common to see them in the villages and by the roadside. Testimonies to the importance and prevalence of this breed can be found in Dudgeon (1911), Bradbury (1957), Okojie (1960), Ferguson (1967), Bohannan & Bohannan (1968), Isichei (1977), Grandin (1980), Ngofa (1988). These texts describe the role of muturu in traditional society in many parts of Southern Nigeria and many comment on the inter-related disappearance of ceremonial practice and the animals themselves.

A reason for their disappearance cited in many reports is low productivity. In reality, their productivity is much disputed, in part because of the great range of management systems under which they are kept. Muturu cattle were semi-feral in some areas and had to be ‘captured’ or simply shot by hunters. Elsewhere they were intensively stall-fed and had considerable levels of management inputs. The small mean size of holdings generally meant that there was a great variation between individual households. Hence the considerable differences in basic productivity parameters recorded in RIM (1992, II:76) and shown in Table 4. For example, calving interval varied between 13.9 and 26.8 months between different ecological zones.

Table 4 Comparative Productivity Data for Breeding Muturu Females

Race/Location	Breeding Females n	Mean Age (months)	Mean Age at First Calving (months)	No. of Previous Parities	Calving Interval (months)
Northeastern Muturu	41	84.9	41.8	2.8	17.1
Jos Plateau Muturu	36	90.2	46.0	2.1	26.8
S. Muturu (savannah)	40	na	28.3	na	13.9
S. Muturu (forest)	22	na	38.0	2.4	24.5

Source: RIM (1992, II:115)

Research station data for comparisons is summarised in ILCA (1979). Rege et al. (1994) have recently reviewed the productivity of taurines in West Africa under both station and village conditions and note a similar variability. Ferguson (1967) gives an age at first calving of 26 months for Ado-Ekiti while Roberts and Gray (1973) recorded 21.2 months at Vom. Calving intervals for the same sites range from 11 to 13 months with a mean of 11.5 months at Vom. It can be seen that the ‘best’ figures for muturu compare very well with those for zebu under traditional management (RIM, 1992, II:76).

There is little doubt, however, that the decision to keep muturu is not based on strictly economic parameters. Keeping muturu was a prestigious activity associated with chiefs and senior men and offtake associated with the ceremonial cycle rather than the market. Indeed, in many traditional production systems, muturu were never sold. At the same time, muturu were able to digest a wide

range of plant foods and survive the disease challenge represented by extremely high rainfall in southern Nigeria.

As human populations increased the extensive grazing systems became disruptive to crop production and new by-laws in the 1970s requiring them to be tethered and fed by cut and carry method. The principal advantage of muturu, their trypanotolerance, has less and less merit, with the cutting down of the forest and the wide availability of trypanocides. As a consequence, all across the derived savannah, farmers are either ceasing muturu production or are exchanging their animals for keteku (zebu x muturu crossbreeds) or zebu proper (Blench et al., 1998b). This is linked to the employment of Ful≡e graziers to look after the herds, replacing the children who used to manage the animals but now go to school.

In some senses, muturu cattle provide an intriguing paradox. They are well-adapted to local diseases and thus are rarely ill. They can eat a wide variety of foods and are as productive as zebu, weight for weight, if properly managed. Yet they are everywhere in decline. The factors implicated in this decline seem to be as follows:

- Management was traditionally assigned to children who now attend school.
- Bulls were communally owned and protected by religious sanction. With the intrusion of the world religions, this practice often faces objections from within the community.
- Monetarisation of agricultural production has meant that there are economies of scale in specialisation, particularly in tree-crops.
- The small size of muturu compared with zebu was perceived as less prestigious.
- Cheap transportation meant that zebu for slaughter could be brought from the Sahel, where they are produced on extensive grazing systems, at comparatively low prices.

The situation of savannah muturu is somewhat different; since so little is known about their distribution and productivity it is unclear whether their populations are still in decline. The ethnographic literature is less rich than for the South, but sources such as Fitzpatrick (1910) for the Kwolla and Davies (1942–9) for the Jos Plateau again suggest disappearance in many areas. By contrast, muturu have spread in recent years in northern Adamawa, as people that formerly lived in the mountains gradually bring them down to the plains. This will bring them into greater contact with zebu, thereby increasing the degree of introgression of zebu genes. The taurine element will gradually be bred out from pastoral populations as happened with the Biu breed; an analogous process is occurring with the Borgu Keteku.

Section 3.4.1 quotes 1991 estimates of the national muturu population as 115,000. No earlier quantitative estimates exist based on a similar sample, making it difficult to establish population trends. The anecdotal accounts quoted certainly suggest that the population is falling. However, it is worth noting that muturu are co-distributed with human population, since almost all populations are closely linked to settled farming populations. Nigeria’s human population in 1991 was 88.5 million, whereas pre-1900 it was probably less than 5 million, i.e. only 6%. Even if muturu cattle were much more widespread, as is suggested in Map 8, the pool of potential owners was so significantly reduced as to make it unlikely that the population of muturu was substantially higher than at present.

6.1.2 Zebu

The historic distribution of zebu cattle over time is poorly known. It is likely that they entered West Africa more than a thousand years ago and spread westwards to Senegambia along the desert edge (MacDonald and MacDonald, 1999). Presumably they were at this time being herded by pastoralists, although who these people were and the exact system of production they used remains completely unknown. Trypanosomoses would have prevented them from moving southwards. However, once they encountered the Ful≡e, who were probably already pastoralists depending on n'dama, the Ful≡e seem to have adopted them with alacrity and begun the major thrust of eastward expansion familiar from more recent history.

The Ful≡e, highly expansionist pastoralists, presumably began the process of adapting zebu to less favourable environments further south almost immediately (Blench 1994, 1999). Part of their strategy would have been to move herds southwards every dry season to take advantage of more abundant vegetation. During the colonial era this movement was the subject of much comment and the notion grew up that zebu cattle had to retreat to the semi-arid region because the disease challenge in the subhumid and forest zones led to unacceptable mortality. This in turn was responsible for large-scale tsetse eradication projects which were intended to open up large areas for increased livestock production.

This 'flux and reflux' model of pastoralism which has large pastoral herds exploiting the derived savannah seasonally, has suggested that the move of zebu to the forest edge is a recent phenomenon. However, some accounts of travellers in the early nineteenth century seem to contradict this. It is clear that Ful≡e pastoralists were already well-established in the derived savannah of north Yorubaland at that period. For example, Adams (1823) refers to *wara*, a cottage cheese made by Ful≡e women in Yorubaland. The Landers (1832), who travelled through the region south of the Niger in 1830, encountered numerous settled Ful≡e villages and comment specifically on the large herds of cattle (op. cit, pp. 95–6, 98, 107–8, 110). Clarke, who travelled in northern Yorubaland in the 1850s mentions pastoral herds around Ilorin and the trade in cheese (Clarke, 1972:229, 266). The Landers (1832:107) seem to be the first travellers to comment on breeds, noting a snowy-white type and a white breed with red and black spotting.

The striking aspect of these accounts is that this was a period when there were still large numbers of wild animals, where habitat clearance had barely begun and no modern veterinary medicines were available. All of this suggests that the conventional story about cattle being prevented by the trypanosomoses from colonising the subhumid and humid zones because of the tsetse challenge must be seriously questioned. In reality, there is little doubt that:

- the absolute southern limit of zebu cattle has moved south gradually since this period and that
- the numbers of zebu in the derived savannah have risen substantially.

A detailed study of historical evidence for this can be found in Blench (1991a) for Adamawa in SE Nigeria and Blench (1994) discussing the whole of Southern Nigeria. These articles give details of dates, places and clans for many regions. From this it appears that the movement into the south-west was in some sense exceptional. Interviews with the leaders of the pastoralists in the central region, Igboland and in the extreme south-east, the Cross River, suggest that the first influx was in the 1970s after the end of the Nigerian Civil War.

This markedly earlier movement into the south-west has two linked explanations; ecological and religious/cultural. The climatic regime of the south-west is such that the derived savannah loops southwards west of Ọyọ, almost reaching the coast in Benin and the Togolese Republic (see Map 2). This creates relatively open land without the high humidity associated with forest proper and therefore reduces the disease risk to zebu cattle (Blench, 1994). Nonetheless, the speed at which zebu cattle have moved into this region, argues that resistance to humidity-related diseases can be acquired through exposure with surprising rapidity.

Combined with the ecology were cultural factors, and in particular the importance of Islam to the Yoruba people. Islam is widespread among the Yoruba, and dominant in Ilorin and the surrounding area where the pastoralists first entered the region. Since almost all the Ful≡e are also Muslim, the potential for establishing exchange relations with the local population was greater than further east. In regions where Islam has had virtually no impact, among the Igbo and Cross River peoples, such relationships are harder to build and conflict more likely.

Apart from these movements into the south, there have been analogous changes further north. The most striking of these is the intrusion of Azawak cattle. Azawak are well known as a breed adapted to the extremely arid conditions in the northern Niger Republic (Swift, 1984). They have not previously been reported in Nigeria, but the NNLRS found populations crossing the border and increasingly, becoming resident. This is a reflection both a prolonged drought in the Sahelian regions and of the replacement of vegetation in the semi-arid zone because of high intensity land-use.

Herders near Kangiwa in the semi-arid northwest of Nigeria originally had herds of mixed Bunaji and Rahaji but have been incorporating Azawak into their herds over the last 20–30 years. The DayaiBe clan prefer to buy female Azawak and crossbreed them with Rahaji to retain the large body size of their original stock. Azawak are said to give birth annually and are more resistant to disease, as well as eating both less, and a greater variety of, vegetation. The disadvantage of Azawak is that they cannot trek long distances like Rahaji. Azawak are also said to have a more placid temperament and can more easily be herded away at night by thieves. In contrast, Rahaji are said to only obey their own herders' commands. The Azawak are the preferred breed of settled farmers in the area because they fatten well, are docile and can be trained for ploughing and carting.

In general, there is a strong correlation between 'red' zebu cattle breeds, such as the Rahaji, Azawak and Wadara, and the arid and semi-arid zones (Map 6 and Map 7). These breeds are generally considered more prestigious by the pastoralists, and the evidence is that they are both heavier and better milk producers. However, they are notably less resistant to both nutritional stress and humidity-related disease. As a consequence, the general trend has been to switch to 'white' breeds, especially the Bunaji and these have now become the dominant breed throughout the subhumid and humid zones. This is usually achieved either by simply buying males of the preferred breed and gradually crossbreeding the herd, or by exchanging animals with pastoralists who grazing orbit is more northerly.

Animal genealogies and breeding control

One of the major differences between sub-Saharan African pastoral systems and those of Asia is the extensive use of breeding control in the latter systems. Shepherds in the Near East and Asia use mechanical means to control both the time of year at which males fertilise females and the males that are allowed to reproduce. This is a response to both the seasonality of pasture in arid environments and the desire to improve the genetic quality of sires. Throughout most of sub-

Saharan Africa, ruminant livestock are allowed to mate freely, and thus the only control exercised over the quality of sires is the fertility of individuals. Castration is practised in sub-Saharan Africa but it is neither common nor carried out with the primary goal of improving genetic quality but rather to control animals of unsuitable temperament.

Unlike Eurasia, where marked climatic seasonality causes seasonal oestrus, African cattle can come into oestrus at any time of the year. Oestrus is usually the result of nutritional factors, but this is only statistical; in any herd there are likely to be some females in oestrus at any given time. Males can always have access to females and breeding is therefore uncontrolled. What little evidence there is suggests that the greater the precipitation the more variable the oestrus, since the mother and calf are more likely to find nutrition subsequent to parturition.

Nevertheless, in the arid and semi-arid regions, some pastoralists give considerable attention is given to the ancestry of animals, especially males retained or brought in for breeding purposes. Ful≡e in Niger, who are herding principally Azawak, take great care to ensure that males brought into a herd are of known quality (Swift, 1984). Herds in the arid region are extremely small in overall size compared with further south and there are virtually no surplus males, since owners are compelled to sell male calves to buy grain. In order to ensure the viability of herds and to make sure that females produce calves during the season of maximum pasture resources, pastoralists do control both the time and quality of sires.

6.2 Small ruminants

The processes outlined above for cattle also apply to other species, most notably ruminants. Goats and sheep were spread all over Nigeria in the precolonial era, and West African Dwarf (WAD) types dominated the forest and derived savannah (Blench, 1993). These seem to have had the same advantages as taurines, the ability to digest a broad diet and resistant to high-humidity pathogens. Long-legged savannah breeds are being crossed with WAD goats and sheep or are thriving in pure-bred form in regions far south of their previous limit.

6.2.1 Sheep

Sheep are kept both in villages and by pastoralists in the north, and along the northern borders of Nigeria, there are occupationally specialised pastoralists who depend on very large herds of sheep for subsistence. Sheep are more prestigious than goats in Islamic ceremonies and substantial changes in price within the ritual year encourage sheep-production. In the south, the traditional purpose of sheep was as sacrifices at social and religious ceremonies, and they do not form a regular source of protein in human diet.

Uda sheep are adapted to long-distance transhumance and are less popular for fattening. Map 11 shows the approximate range of pastoral Uda and the seasonal fluctuations in their southern limit. Recent years have seen a considerable expansion in the distribution of this breed, since it apparently resists footrot and other high-humidity pathogens considerably better than the Sahel sheep. Pastoralists have been exploiting the derived savannah in the south-west of Nigeria, bringing Uda down to the edge of the forest, thereby bringing the flocks close to the large urban markets of the south.

6.2.2 Goats

The association between Sokoto Red goats and high-quality leather has had important consequences for the distribution of goats. The working of leather and the trade in it have in turn a strong association with Islam. Apart from the trans-Saharan export trade, Korans were commonly bound in red leather and Muslim leatherworkers are to be found in all major markets, well outside their home territory. As a result there is a strong cultural association between Islam and the Sokoto Red and as Islam has gradually pressed further south, converting various Middle Belt populations *en route*, so it has brought this goat breed. The Yoruba people, for example, inhabit the forest belt and spread as far the derived savannah in towns such as Ilorin. They are not Muslims of long standing, but the Hausa/Ful≡e expansion in the 19th century converted substantial numbers. Although traditionally the Yoruba keep WAD goats, in Muslim towns at the northern edge of their range Sokoto Red goats and their crosses are a common sight. These are gradually being acclimatised to the conditions further and further south and in the Muslim quarters of more southern towns, Sokoto Red goats are kept as backyard stock.

Pastoralists have been less influential in spreading goat breeds than sheep breeds, because they usually do not herd goats, except in the extreme north. Goats are widely believed to be troublesome and are either not kept at all or kept by women at base-camps and not moved with the main herd. As a result, less attention is given to their breeding and they are not sold to farmers as breeding stock in the same way as sheep.

6.3 Camels

Further north on the edge of the semi-arid zone a similar process is allowing camels and donkeys to push further south every year. Degradation of vegetation and the spread of thorns and woody plants gives stock that can digest these plants a comparative advantage. Camels, like goats, are specialised in eating browse and can ingest foliage from thorn trees and other armed plants that are virtually unavailable to other domestic species. Their greater height also gives them an advantage in terms of the types of tree and foliage they can browse. Their ability to manage without water for several days makes them ideal for work in arid environments and degraded regions of the semi-arid zone (Wilson 1989; Blench, in press, b). However, camel meat and milk are not popular with consumers and there is a broad tendency for livestock producers in the Sahel to herd cattle wherever the pasture and water resources permit.

Camels are commonly thought of as being confined to the northern borders of Nigeria, and this is still largely true of breeding herds. Although individual farmers may breed camels on a small scale, relatively few breeding herds spend the entire year in Nigeria; most cross into the Niger Republic for 3–4 months at the height of the wet season. Sokoto and Borno States are the main focus for such transhumant herds, though they also transit through Kano and Katsina.

By contrast, working bull camels are being used further south every year. The present limits of camel movement are shown on Map 17. Male camels are brought into Sokoto and northern Borno as work and transport animals, and are being brought further and further south into the centre of the country as portage stock.

There seems little doubt that this rather dramatic change is being driven by the changes in the environment. As human population has expanded, land between farms available as a grazing

resource has decreased. The cattle population has also grown, putting ever greater pressure on pastures. In many areas of the semi-arid zone, only browse plants remain and some of these are unavailable to any species except camels. Pressure on water-points has made watering large herds of cattle an expensive and time-consuming proposition.

There is no reason to think that any of these trends will reverse in the next few years and it is therefore likely that camels will become still more common, especially as work animals in villages but also with pastoral communities. This places clear responsibility with the Nigerian authorities responsible for livestock to take a more active role in both allocating veterinary resources and planning extension targeted to camel-users.

6.4 Donkeys

The primary function of donkeys is as pack animals, and they seem to have been used for this purpose in semi-arid West-Central Africa for a considerable period (Blench, 1997b, in press a). Donkeys are rarely subject to any improvement, development or loan schemes, because they are not conventional sources of meat, and do not fit within the stereotyped perspectives of livestock agencies. Nonetheless, they are essential to the economic life of communities in semi-arid regions, and relieve many families of repetitive tasks. They are cheap, maintain a good body condition on a poor diet and resist disease. In Nigeria, the *jakin Kano,* the Kano donkey, is proverbial and used to be the principal pack animal for the import and export of materials in Hausaland.

It is in this rôle that donkeys went into a temporary decline in Nigeria. The availability of motor transport following the oil-boom years from the late 1970s caused many breeders to give up with them, and villagers to switch to pick-up trucks, especially in the Middle Belt, where there are greater health constraints on donkeys. A combination of motor-bikes and cheaper, more regular, rural transportation provided effective competition. As a result, many donkeys were sold for meat, and the breeding stock declined; a history rather similar to that of muturu following the Nigerian civil war. By the mid-1980s, donkeys had almost disappeared throughout much of northern Nigeria.

Following SAP and the devaluation of the Naira in 1986, transport began to rise in price and become less regular in rural areas. Donkeys began again to become popular and a trade in donkeys from Niger and Chad developed again. Despite this, the donkey has not regained its official prestige. Little has been done to promote it as an alternative to expensive, and now often unavailable, vehicles. Nonetheless, its virtues are well recognised by rural communities, and the donkey population seems to be increasing. The present problem appears to be one of re-establishing a breeding stock to supply rising demand in the future.

6.5 Monogastric livestock

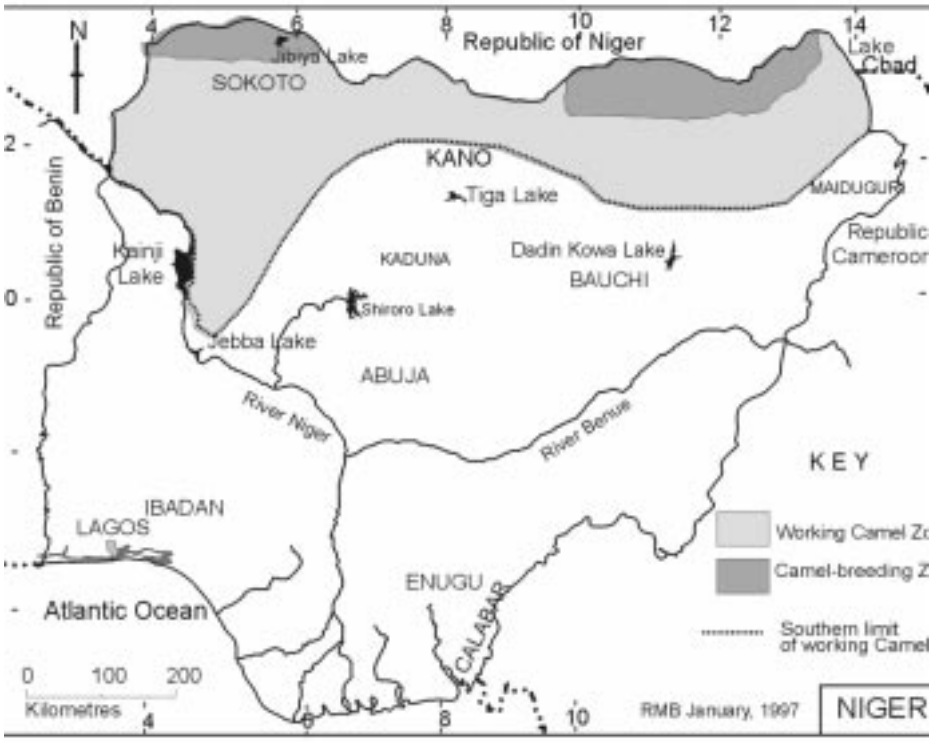
Ruminant livestock predominate in both pastoral and village production systems in Nigeria and indeed throughout West Africa. However, chickens and pigs are of considerable economic importance, especially in more humid areas (Blench, in press b, c; Blench & MacDonald, in press). They present a striking contrast to ruminants, in that exotic breeds have been considerably more successful in establishing themselves in competition with local breeds.

Chicken production in West Africa was traditionally based on low-input systems, where chickens were allowed to scratch for food around the compound but usually not fed. Chickens were, as a

result, small and scrawny, but resistant to most diseases except coccidiosis. The concept of small-scale, semi-intensive production was heavily promoted by government, ADPs and church-based NGOs from the 1970s onwards and both drugs and feed were heavily subsidised. The consequence was the establishment of a large number of non-viable poultry farms, most of which collapsed when the subsidies were removed in the early 1990s. However, by a paradox, the economics of feeding chickens and selling the eggs and meat in towns had by this time spread to numerous villages together a great variety of exotic breeds. These were usually cross-bred with local chickens to produce a great diversity of unstable crosses. As a result, the village chickens at present are both much larger and genetically more diverse than thirty years previously. there is every evidence that this gene pool will be conserved because the overall village production strategy has radically altered in conformity with the greater potential of the exotic breeds.

The situation was very similar for pigs. Probably introduced by the Portuguese in most areas, pigs were generally fed on kitchen scraps and scavenged food in the dry season. Improved breeds were introduced in the early colonial period and either replaced or crossed with local breeds. Pig production is much of the Middle Belt in the non-Muslim areas, as pigs can be fed on the residual grain from the brewing process. Many of the imported breeds have thrived, largely in the absence of effective veterinary care.

p 17 Camels in Nigeria



7. Inter-Relations Between Livestock Breeds and Farming Practice

7.1 General

Nigeria has the largest human population of any African country and rural settlement densities are some of the highest in Africa. RIM (1992, II:28) estimated that some 31% of the land area of Nigeria was within the cultivation cycle, in addition to the oil-palm and tuber systems in the forest belt invisible to aerial survey. The large land area encompasses a wide variety of ecological zones and a corresponding diversity of farming systems have developed to exploit different environments. Table 5 summarises the most important of these with summary notes on their distribution.

Table 5 Principal farming systems and their distribution in Nigeria

System	Features	Distribution
Flood retreat	Cultivation on alluvial soils, regularly under water, using residual moisture.	Coastal and deltaic regions, also Lake Chad
Forest farms	Mixed crops under forest trees.	Humid Zone
Savannah	Rain-fed agriculture; usually ridged fields; suitable for animal traction.	North-Central Regions
Dune-foot	Wide-spaced cereals between sand dunes.	Along northern border
Firki	Residual moisture on clay plains; bunded fields.	West and south of Lake Chad
Farmed parkland	Continuous cultivation under economic trees; manure maintains fertility.	Around larger northern towns
Montane	Terraces, continuous cultivation; manure maintains fertility.	Along Cameroon border and on the Jos Plateau escarpments
Swamp	Riverine, based on natural flooding.	Along major river systems
Dry season gardens	Riverine, using irrigation and *shaduf* pumps.	Along major river systems

Figures for the distribution and extent of these systems are hard to come by, as are estimates of changes over time. Putt et al. (1980) in a study of time-series aerial photographs in the Lafia area of Central Nigeria estimated that land under cultivation was increasing at an annual rate of 4%. All types of intensive production, particularly flood-retreat cultivation, swamp cultivation and irrigated horticulture, have undergone a dramatic expansion in recent years to feed the expanding urban populations.

Although the great majority of cattle are assumed to be dependent on the rangelands, recent studies have cast doubt on this relationship. Wint and Bourn (1994) have analysed a substantial aerial survey database for sites in West-Central Africa. Their principal conclusion is that ‘cultivation

remains the primary predictor of animal density, and grass cover added comparatively little to the statistical significance of the relationships identified'. This broadly confirms the hypothesis that livestock production and farming settlement are co-distributed.

There is a strong, although imperfect, relationship between types of cattle and systems of production (see Kaufmann, Chater & Blench, 1986). This is partly an expression of their geographical range and partly comes from the role cattle play in the society of their owners. Kuri cattle, for example, are confined to Lake Chad and its environs and thus have patterns of movement and production strategies that cannot be imitated by other cattle. Muturu in the humid zone are in part defined by the forest environment, but their low numbers and systems of tethering reflect the ceremonial role they are called on to play in southern Nigerian societies. In contrast, savannah muturu in north-eastern Nigeria are herded in a fashion similar to the surrounding zebu.

Fricke (1979) classified West African cattle husbandry patterns by the prominence they are assigned in the household enterprise. He distinguished full-time cattle breeding, mixed farming and cattle husbandry as a subsidiary activity. Such classifications tend to reflect the degree of sedentarisation, assuming that pastoralists whose sole activity is cattle breeding are more 'nomadic' those who cultivate. However, this is not always the case. In the Bida area north of the Niger, pastoralists have been virtually settled for a century and yet they have still to begin cultivation. In contrast, the seasonal migrants from the semi-arid zone all have farms in their home state, despite the long swathes they cut through the sub-humid zone.

Table 6 Cattle types and systems of production in Nigeria

System	Zebu	Keteku	Taurines	Kuri
Exclusive Pastoralism	x	x	—	—
Transhumant Pastoralism	x	x	x	x
Agro-pastoralism	x	x	x	x
Traction	x	x	—	x
Compound Dairying	x	—	—	—
Seasonal Tethering	x	—	x	—
Short-Term Fattening	x	x		x
Stall-Feeding	x	x		x
Scavenging	—	—	x	—

Table 7 Cattle production systems

Pastoral	Compound-based
Exclusive Pastoralism	Traction
Transhumant Pastoralism	Compound Dairying
Agro-pastoralism	Seasonal Tethering
	Fattening
	Peri-urban herds
	Scavenging

Table 6 shows the different production systems within Nigeria and the relationship with individual cattle subspecies.

Cattle production systems can be divided into two major groups: the pastoral and the village-based systems (Table 7). These systems are described

in more detail below.

7.2 Pastoral systems

Pastoral systems in Nigeria are distinguished first and foremost by the integrated husbandry of three species; cattle, sheep and chickens.

7.2.1 Exclusive pastoralists

Exclusive pastoralists are livestock producers who grow no crops and simply depend on sales of dairy products and animals to buy grain. In the arid and semi-arid zones, such pastoralists, most notably the Ful≡e, Koyam, Shuwa and Uled Suliman, may move very long distances every year. Although it is often popularly supposed that such 'nomads' wander from place to place without any logic, in general these pastoralists have set migration routes and often long-standing arrangements with farmers to make use of crop residues. They usually only diverge from their existing patterns in the face of a drought, a failure of the pasture or the spread of an epizootic.

In the Niger-Benue valley there are pastoralists who migrate only a very short distance between the wet and dry seasons. The same grazing areas and rugas are used each year with the thatching on the houses at each location repaired annually. Some will even transport one set of huts to the other location by vehicle with all their other belongings. For example, many of the Ful≡e spend the dry season on the River Niger floodplain, only moving to higher ground before the flood rises during the rains. They can avoid crop cultivation and conflict with arable farmers as well as being closer to roads and towns during the wet season.

7.2.2 Transhumant pastoralists

Transhumant pastoralists have a permanent homestead and base at which the older members of the community remain throughout the year. They move in response to seasonal changes in the quality of grazing and the tsetse-fly challenge. Their housing varies in complexity and usually depends on the time they anticipate spending at one particular grazing area. The most basic form is a rough shelter of branches or a sheet of polythene as cover. The travelling unit normally consists of a common herd owned by close male relatives, father and sons etc. Grain and other basic needs are purchased from the proceeds of selling milk and dairy products by the women in the local markets. If necessary, household income can be supplemented with the sale of surplus male sheep or cattle.

Transhumant pastoralists grow crops primarily for their own use rather than for the market. The men take away the majority of the herds in search of grazing, but leave the older members of the community with a nucleus of lactating females. They return at the start of the wet season to help with crop cultivation. They have no traditionally-assigned grazing rights and have often been forced south by drought or population pressure in their original home areas.

7.2.3 Agro-pastoralists

There are substantial numbers of semi-settled pastoralists in many parts of northern Nigeria, who cultivate areas sufficient to feed their families from their own cereal production. Most of the pastoralists in Borno should be described as agro-pastoralists, since almost all have farms on which they depend for staples. Agro-pastoralists hold land rights, use their own or hired labour to cultivate land and grow yams and cassava in addition to the staple cereals such as sorghum, millet and maize. While cattle are still valued property, their herds are on average smaller than other pastoral systems, possibly because they no longer solely rely on cattle and the finite grazing area around their village that can be reached in a day will limit herd size.

There is also a relation between extremely local production systems and particular breeds. Among the agro-pastoral Shuwa Arabs living by Lake Chad, for example, Sabiad (1947:56) refers to the practice of keeping the shorthorn Wadara inside smoke-filled byres in the rainy season and notes that this is impractical with longhorn breeds such as the Rahaji. This labour-intensive practice is confined to the parts of Borno along the lakeshore where the cattle are badly worried by biting flies.

7.3 Village systems

7.3.1 Traction animals

Animal traction is largely confined to ploughing and is usually based on stall-fed cattle usually kept within the compound. The practice was first adopted by the Hausa in the 1930s and has since spread throughout much of the semi-arid zone. The cattle used for traction may be combined with fattened cattle or dairying herds. Animal traction is usually integrated with rainfed cereal cultivation systems, based on sorghum, millet, pulses and vegetables. Very often, farmers in the semi-arid zone send away their plough animals with pastoralists in the dry season to avoid the labour of managing the animals. Precise numbers of farmers making use of animal traction in Northern Nigeria are not available, but assuming that ploughs rarely go out of use, sales records for the major supplier suggest that there are not less than 250,000 farmers using draught animal power.

7.3.2 Compound dairying

Keeping milking animals in the compound to supply the family unit with dairy products is relatively unusual in the semi-arid zone, in part because of the free availability of pastoralists' milk. However, it has long been practised in some parts of Hausaland and was first described in Kano in the late nineteenth century. It is most common today in the homesteads of transhumant Ful≡e pastoralists, who generally take away the majority of their herd in the dry season, but leave some milking animals to supply their family. The animals are either stall-fed or grazed close to the compound in the day and shut up at night.

Taurines are usually not milked at all, although an example of a pastoral herd of muturu was recorded in southern Borno. Generally, only zebu and kuri are milked; kuri have a reputation as good milkers, but their feed preferences have confined them to the Lake Chad area. For northern Nigeria, Rahaji are generally considered by the Ful≡e to be the best milkers, although milk yields was one reason cited for bringing in more Azawak.

7.3.3 Seasonal tethering

A rare system of cattle production is the seasonal tethering of individual animals. For example, among the Gbari south-west of Kaduna, Bunaji cattle are bought from pastoralists and then staked out throughout the dry season in systematic rotation in order to manure the fields in preparation for the following wet season. Near Badagry, a similar system is used with the Keteku to manure coconut plantations. This system is often used in conjunction with fattening for seasonal markets.

7.3.4 Fattening

Throughout the centre of Nigeria, farmers keep zebu cattle, usually Bunaji, bought from the Ful≡e for fattening. Typically, shelters are built in the village and between one and six cattle are stall-fed throughout the year. The animals may be fattened for as little as six months to take advantage of seasonal variations in stock prices, a system promoted by government livestock agencies. However, it is more common to buy calves and fatten them for up to two years. This system has the advantage of a lower initial outlay and also it is perceived more as a cash reserve – fattened stock are sold to meet cash needs rather than to exploit seasonal price differences. Most of the holdings are exclusively of males, but even when there is the nucleus of a breeding herd the cows are not milked.

7.3.5 Peri-urban and 'modern' cattle husbandry

Peri-urban or 'modern' herds of cattle are owned by rich urban businessmen, wealthy Ful≡e and government officials. Such herds are found on the periphery of all the major towns in northern and central Nigeria. They capitalise on the potential of animals as an investment, a source of milk products for their family and the prestige associated with cattle ownership. The herders are usually Ful≡e pastoralists who have lost their cattle and who work for access to the milk and a small cash payment. To that extent, the management is very traditional, except that the herds do not go on long-distance transhumance.

The presence of complete breeding units based near a town is a comparatively recent development, as traditionally ownership was restricted to tethered male animals. One cause of this expansion into peri-urban herds was the fall in value of females during and immediately after the rinderpest outbreak in 1984. This enabled urban people with capital to buy breeding stock from impoverished pastoralists. To some extent this transition is still reflected in the herd structures; there is a higher percentage of mature male castrates compared to herds owned by Ful≡e pastoralists. In addition, since the herd is not really run as an economic enterprise, there is little pressure to sell male animals.

7.3.6 Scavenging

The most extreme form of low-input management systems is scavenging. In the Niger Delta, muturu cattle were sometimes considered common property and were allowed to roam freely in the village and its environs, scavenging food scraps and crop residues and sometimes fish-processing remnants. No notice was taken of mating, pregnancy, disease or anything else relevant to the survival of the animal, which was usually slaughtered as a result of a committee decision.

8. Conclusions

8.1 Dynamic distributions of livestock breeds

Both species and breeds of livestock show evidence of expanding and changing their distribution in Nigeria during recently recorded history. Archaeological evidence suggests that this is a long-term process in West African history and has been above all a response to changing environmental conditions. More recently, economic aspects, especially high urban demand for meat, have played a role.

The study suggests that cattle, as opposed to other ruminants, tend to form breeds, sometimes of quite restricted distribution. This reflects primarily greater human interference in cattle breeding, in contrast to small ruminants where uncontrolled mating is almost always the rule. However, cattle also have the propensity to develop specialised feeding adaptations and thus breed-like attributes. The kuri, for example, is highly adapted to the conditions of Lake Chad; this has the positive consequence that it can easily resist biting flies and high humidity but the negative effect of being unable to adapt easily to the semi-arid grasses and browse away from aquatic habitats. Sheep and especially goats tend to be less selective in their diets and to be generally less prone to develop regional specialisations[4].

8.2 The role of pastoralists

Another aspect of breed redistribution is the role played by pastoralists. Ruminant livestock is kept by both pastoralists and village producers, but pastoralists play a major role in both developing and spreading breeds. As mobile producers, they bring new breeding stock to markets to sell and must respond more rapidly to changing environmental conditions to remain viable. Ful≡e pastoralists, who are constantly exploring new ecological zones and management strategies also have their own breeding goals. One of the clearest of these is the gradual introduction of preferred breeds into areas of abundant vegetation previously considered unsafe. This is usually undertaken by programmes of cross-breeding and intensive management of at risk individuals. The result has been the continued survival of zebu herds in high-humidity zones. Nowhere in Nigeria (or, probably elsewhere in Africa) is any development agency capitalising on this expertise.

8.3 The role of disease

8.3.1 Trypanosomoses

This study suggests that the trypanosomoses can be interpreted as only one element in a complex array of factors contributing to the redistribution of breeds, especially in cattle. As zebu adapt to high-humidity regimes, taurines decline. Nevertheless, the endangered status of the muturu must still be underlined; the loss of an important genetic resource through inaction would be extremely wasteful. The disappearance of muturu in the south threatens to become a self-fulfilling prophecy. The poor quality and dispersion of males at present means delay in serving females, with bulls of no proven quality. As a result, age at first calving is late and productivity is poor, thereby acting as a

4 This seems to be less true in temperate zones; witness the huge variety of sheep breeds in Northern Europe.

disincentive to potential producers. The situation calls for urgent remedial action, essentially by creating stock farms to secure an adequate supply of breeding males and either to distribute them to farmers or use them as breeding sires.

Since the 1920s, considerable effort and resources in many regions of Africa have gone into the control of tsetse on the grounds that the trypanosomoses were the major constraining factor in preventing the production of ruminant livestock, especially in more humid areas. Tsetse clearly has been important, but its exact significance must remain debatable as it is now more evident that it occurs as part of a complex that includes both socio-economic factors and other humidity-related diseases.

These conclusions of the present study can be summarised as follows:

- Although productive breeds of ruminant livestock have been historically absent from high-rainfall zones in West-Central Africa, the standard assumption that the main barrier is the trypanosomoses is far from proven.
- Skin conditions and other disease problems are also significant in preventing non-resistant breeds from entering high-humidity zones.
- Tsetse and the trypanosomoses are receding in Nigeria (and by inference, in other parts of West Africa) due to the expansion of farming populations and the consequent habitat destruction and hunting out of wild animal vectors
- High-humidity zones in Africa have had populations of resistant cattle breeds until recently. These are everywhere in retreat because management costs are high and tree-crops compete with them in profitability; and zebu cattle can now survive in many regions where mortality levels were formerly unacceptable.
- Indigenous livestock producers are using all the methods available to them to breed races capable of surviving in high-humidity zones. This has been more successful with cattle because small ruminants are widely kept in low-input systems.
- The widespread availability of modern veterinary products has played an important role in this process.
- A major consequence of pastoralists' breeding strategies has been a redistribution of breeds throughout the region. Overall, this has led to 'white' breeds pressing further south and gradually displacing taurines. 'Red' breeds are moving south from the Sahel to the northern fringes of the subhumid region.
- Many of these changes also apply to other species of domestic stock, especially sheep and goats but also camels, donkeys and pigs.

8.4 Relevance for other regions of West Africa

The model presented here is based on extremely detailed survey material for Nigeria; there is no comparable material for the other countries of West-Central Africa. Surveys such as Troquereau (1961) for Benin or Doutressoulle (1947) for former French West Africa represent the conclusion of studies conducted over many years. Syntheses such as ILCA (1979) collate documentary material referring to different periods and thus cannot be said to represent the situation at a precise date. Nonetheless, there is little doubt that the same processes are at work elsewhere although changes are perhaps occurring more slowly, since human population density, which has driven many of the changes here described, is usually lower beyond the borders of Nigeria.

9. Policy Recommendations

Ruminant livestock are of considerable economic importance within the Nigerian economy and continue to play a major role in transforming the environment. They are also crucial to sustaining rural livelihoods, not only among pastoralists but also smallholders across the northern two-thirds of the country. They provide not only meat and milk but crucial services in terms of traction and transport to poor households. The livestock trade to large cities in turn affects the economy of other Sahelian countries. Despite the 'snapshot' provided by the NNLRS in 1990 no permanent monitoring systems have been established to quantify and analyse these changes[5]. This makes technical development strategies increasingly difficult to plan as 1990 recedes further into the past. Without up-to-date information, livestock cannot be incorporated into a national agricultural strategy in any meaningful way. The consequence therefore tends to be the repetition of former interventions with no clear means of interpreting their impact on the national situation (Blench, in press, e).

Two clear lacunae have been identified by the present study relevant not only for Nigeria but for much of West Africa, the absence of descriptive breed characterisations and the absence of reliable distributional data. This suggests several important lines of research to improve the usability of breed characterisation. These are:

- clearer genetic, biometric and phenotypic breed characterisation;
- more exact mapping of synchronic geographical distribution;
- collation of information about past distribution;
- more precise estimates of numbers, both relative and absolute;
- descriptive ethnographic studies of the role of different breeds within farming systems;
- quantitative studies of productivity of animals within these systems.

An important aspect of these recommendations is escaping standard research station methodology. Although much has recently been written about the importance of participatory plant breeding, very little attention has been given to working with pastoralists. Despite this, there are even more compelling reasons for working with traditional sector livestock producers than in the case of crops. The most important of these is that, unlike crops, where agronomists can select a sample of seed that meets their criteria without depleting the farmer's seed stock, to breed from selected livestock on a research station is problematic because pastoralists never bring their best animals to market. Indeed, their usual strategy is to bring their worst animals, those they suspect are sick or weak or infertile. Money cannot usually induce a pastoralist to sell a prize female.

The great majority of the meat and milk reaching the market in West Africa comes from the traditional sector, and its producers therefore set breeding priorities. Research station priorities in Africa continue to be set by textbooks designed along European lines; to publish in prestigious journals requires meeting rigid research protocols. The conditions under which animals are kept on stations in no way reflect those in which they actually live; breeding goals are thus remote from those of real pastoralists. Yet it is pastoralists who must be influenced if interventions that will affect the productivity of animals reaching markets are to have any chance of succeeding.

---

5 Following the Third Livestock Development Project Appraisal Mission in mid-1993, FDL&PCS decided not to approve any further surveys along the same lines (Blench, in press, e).

In case these ideas should be considered evident in the light of changed priorities in plant breeding[6] the recent strategy prepared by the International Livestock Research Institute (ILRI) for breed characterisation illustrates this approach is still very much alive (Rege et al., 1994). In this version, nuclear herds of threatened breeds are to be purchased and transported to research stations where their genetic potential will be evaluated. These experimental herds will then be used for breed conservation.

At one level, a simple suggestion can be made; since pastoralists are anyway initiating substantial breeding strategies it would be more economic to work with them rather than in isolation from them. The primary advantage is that the best breeding females would be used as they would remain in the herd. The costs of long-term investment necessary to successful animal breeding would be borne by the producer and the sample of animals could thereby be much increased. More importantly still, breeding goals would be established through negotiation with producers and thus an outcome that had a much greater chance of being used would be achieved.

6 It is hard to determine how much participatory plant breeding occurs in reality as opposed to ideology. An article in the Sunday Mail (Harare), 10/11/96, pointed out that tight budgets and rigid funding milestones have the effect of discouraging this type of research. Indeed the article suggests that farmers and extension workers become cheap labour for researchers rather than participants in the research.

References

Adams, J. (1823). *Remarks on the Country extending from Cape Palmas to the River Congo.* London.

Adu, I.F. and Ngere, L.O. (1979) The indigenous sheep of Nigeria. *World Review of Animal Production* 15,3: 51–62.

Aganga, A.A., Umunna, N.N., Oyedipe, E.O. and Okoh, P.N. (1988) Seasonal variations in water requirement and influence of intermittent watering on grazing Yankasa sheep. *Small Ruminant Research* 1: 381–386.

Akinwumi, J.A. & Ikpi, A.E. (1985). *Trypanotolerant cattle production in Southern Nigeria*. Report to International Livestock Centre for Africa (ILCA) Humid Programme, Ibadan.

Alaku, O. and Moruppa, S.M. (1983) Dry season weight losses in Red Sokoto (Maradi) goats reared in the Sahel region of northeastern Nigeria. *International Journal of Biometeorology* 27: 143–156.

Barbour, K.M., Oguntoyinbo, J.S., Onyemelukwe, J.O.C. and Nwafor J.C. (eds) (1982) *Nigeria in Maps*. Hodder and Stoughton, London, England.

Blench, Roger M. (1991a). Ful≡e movement into Southwestern Adamawa from 1835 to the present. Pp. 15–64 in *Du Politique à L'Économique: Études Historiques dans la bassin du Lac Tchad.* Ed. J. Boutrais. ORSTOM, Paris.

Blench, Roger M. (1991b). The dessication of Lake Chad in 1990. *Méga-Tchad Bulletin*, 91/2.

Blench, Roger M. (1993). Ethnographic and linguistic evidence for the prehistory of African ruminant livestock, horses and ponies. In *The Archaeology of Africa. Food, Metals and Towns.* eds. Shaw, T., Sinclair, P., Andah, B. and Okpoko, A. 71–103 London: Routledge.

Blench, Roger M. (1994). The Expansion and Adaptation of Ful≡e Pastoralism to Subhumid and Humid Conditions in Nigeria. *Cahiers d'études Africaines*, 133–135:197–212.

Blench, Roger M. (1995). *The Influence of trypanosomiasis on the dynamics and evolution of cattle populations in Nigeria*. Rome: Report to Animal Health Service, FAO.

Blench, Roger M. (1996). Pastoralists and national borders in Nigeria. pp. 111–128 in *African boundaries: Barriers, conduits and opportunities*. eds. P. Nugent and A.I. Asiwaju. Francis Pinter for Centre of African Studies, Edinburgh.

Blench, Roger M. (1997a). *Neglected species, livelihoods and biodiversity in difficult areas: how should the public sector respond?* Natural Resource Perspective Paper 23. London: Overseas Development Institute.

Blench, Roger M. (1997b). The history and spread of donkeys in Africa. ATNESA Workshop Reader, *Donkey Power Benefits,* pp. 38–46. Addis Ababa, May 5–9, 1997.

Blench, Roger M. (1997c). *Animal traction in West Africa: categories, distribution and constraints on its adoption and further spread: a Nigerian case study*. Working Paper No. 106. London: Overseas Development Institute.

Blench, Roger M. (1999). Why are there so many pastoral peoples in East Africa? In: *Pastoralists under pressure*? eds. V. Azarya, Anneke Breedveld, Miriam de Brujn and Han van Dijk. 29-49. Brill, Leiden.

Blench, Roger M. in press, a. A history of donkeys and mules in Africa. In *The origin and development of African livestock.* R.M. Blench & K.C. MacDonald. (eds.) London: University College Press.

Blench, Roger M. in press, b. Minor livestock species in Africa. In *The origin and development of African livestock.* R.M. Blench & K.C. MacDonald. (eds.) London: University College Press.

Blench, Roger M. in press, c. A history of pigs in Africa. In *The origin and development of African livestock.* R.M. Blench & K.C. MacDonald. (eds.) London: University College Press.

Blench, Roger M. in press, d. Combining different sources of evidence for the history of African livestock. In *The origin and development of African livestock.* R.M. Blench & K.C. MacDonald. (eds.) London: University College Press.

Blench, Roger M. in press, e. The Nigerian National Livestock Resource Survey: a narrative account. Paper to appear in *Comptes Rendues du MegaChad 97*, Paris: ORSTOM.

Blench, Roger M., Maitland, P., De Jode, A., Gherzi, E., Di Domenico, C., Hall, S. & Sambo, N.A. (1998a). West African Dwarf Shorthorn cattle in Nigeria: History, Distribution and Productivity. In *Des Taurins au Cameroun et Nigeria*. eds. C. Seignobos & E. Thys. 249-292. Paris: ORSTOM/IEMVT, Maisons-Alfort.

Blench, R.M., De Jode, A., Gherzi, E. & Di Domenico, C. (1998b). Keteku and Ndama crossbred cattle in Nigeria: History, Distribution and Productivity. In *Des Taurins au Cameroun et Nigeria*. eds. C. Seignobos & E. Thys. 293-310. Paris: ORSTOM/IEMVT, Maisons-Alfort.

Blench, Roger M. & Zoë Marriage (1999). *Drought and livestock in semi-arid Africa and Southwest Asia*. *An essay and an annotated bibliography*. ODI Working Paper 117. London: Overseas Development Institute. Available in Acrobat format at: http://www.oneworld.org/odi/publications/wp117.pdf

Blench, Roger M. & Florian Sommer (1999). *Understanding rangeland biodiversity*. ODI Working Paper 121. London: Overseas Development Institute. Available in Acrobat format at: http://www.oneworld.org/odi/publications/wp121.pdf

Blench, Roger M. & K.C. MacDonald in press. Domestic fowl. Article for the Cambridge Encyclopaedia of Nutrition, Volume I.

Blench, Roger M. (ined.) *Why conserve livestock biodiversity?* LPPB Issues Paper on for NRPAD, DFID.

Bohannan, P. and Bohannan, L. (1968). *Tiv economy*. Longmans, London.

Bourn, D.M. (1983). *Tsetse control, agricultural expansion and environmental change in Nigeria*. D.Phil. thesis, Oxford University, England.

Bourn, D. & R.M. Blench (1999). Can wildlife and livestock co-exist? An interdisciplinary approach. London: Overseas Development Institute.

Bourn, D.M., W. Wint, R.M. Blench & E. Woolley (1994). Nigerian livestock resources survey. *World Animal Review*, 78:49–58.

Bradbury, R.E. (1957). *The Benin Kingdom and the Edo-speaking Peoples of Southwest Nigeria*. Part XIII of Western Africa, Ethnographic Survey of Africa. Ed D. Forde, International African Institute (IAI), London.

Buchanan, K.M. and Pugh, J.C. (1955) *Land and people in Nigeria. The human geography of Nigeria and its environmental background*. London: University of London Press.

Chang, T.K. and Landauer, W. (1950) Observations on the skeleton of African dwarf goats. *Journal of Morphology* 86: 367–369.

Clarke, W.H. (1972). *Travels and Explorations in Yorubaland, (1854–1858).* Ibadan University Press.

Colville, G. and Shaw, T. (1950). *Report of Nigerian livestock mission*. Report to the Colonial Office, HMSO, London.

Darwin, Charles (1868). *The variation of animals and plants under domestication.* Popular Edition, 1905. London: John Murray.

Davies, H. (1977). *Tsetse flies in Nigeria.* Nigeria: OUP.

Davies, J.G. (1942–9). *The Bi Rom*. ms. Bexhill-on-Sea.

Devendra, C. and McLeroy, G.B. (1982) *Goat and sheep production in the tropics*. London: Longman.

Doutressoulle, G. (1947). *L'élevage en Afrique Occidentale Française*. Paris: Larose.

Dudgeon, G.C. (1911). *The agricultural and forest products of British West Africa*. John Murray, London.

Dumas, R. (1980). Contribution à l'étude des petits ruminants du Tchad. *REMVT* 33,2: 215–233.

Dunbar, G.S. (1970). African Ranches Ltd, 1914–1931: an ill-fated stock-raising enterprise in Northern Nigeria. *Annals of the Association of American Geographers,* 60: 102–123.

Burns, M. (1965) The skin histology of some Nigerian goats. *Tropical Agriculture* (Trinidad) 42: 243–259.

Epstein H. (1971). *The origin of the domestic animals of Africa*. (2 vols) New York: Africana Publishing Corporation.

FAO (1987). *Trypanotolerant Cattle and Livestock Development in West and Central Africa*. (2 Volumes). FAO, Rome.

FAO/IDC. (1992). *Nigerian Livestock Sub-Sector Review*. (2 vols.) FAO, Rome.

Federal Surveys (1978). *National Atlas of Nigeria*. Lagos: Federal Surveys.

Ferguson, W. (1967). Muturu cattle of Western Nigeria. *Journal of the West African Science Association.* 12: 37–44.

Fitzpatrick, J.F.J. (1910). Some notes on the Kwolla district and its tribes. *Journal of the African Society*, X:37:16–52.

Fricke, W. (1979). *Cattle husbandry in Nigeria: a study of its ecological conditions and social-geographical differentiations*. Heidelberger Geographischen Arbeiten, Heft 52, Geographisches Institut der Universität Heidelberg, West Germany.

FOS (1989) *Facts and Figures about Nigeria*. Lagos: Federal Office of Statistics.

Gates, G.M. (1952). Breeds of cattle found in Nigeria. *Farm and Forest*, 11: 19–43.

Glover, P.E. (1960). *The tsetse problem in northern Nigeria.* Patwa News Agency, Nairobi.

Grandin, Barbara E. (1980). *Small cows, big money; wealth and dwarf cattle production in southwestern Nigeria*. Ph.D thesis, Stanford University.

Haumesser, J.B. (1975) Some aspects of reproduction in the Red Sokoto goat. Comparison with other tropical and subtropical breeds. *REMVT* 28: 225–233.

Haumesser, J.B. and Gerbaldi, P. (1980) Observations sur la reproduction et l'élevage du mouton Oudah nigérien. *REMVT* 33,2: 205–213.

Henderson, W.W. (1929) *Nigerian Veterinary Service Annual Report*. Government Printer, Lagos.

ILCA, (1979). *Trypanotolerant livestock in West and Central Africa*. (2 vols.) ILCA Monograph 2. ILCA, Addis Ababa.

Isichei, E. (1977). *Igbo Worlds*. Macmillan, London.

Kaufmann, R. von, Chater, S. & Blench, R.M. (eds.) (1986). *Livestock systems research in Nigeria's subhumid zone*. Proceedings of Sub-humid zone Livestock Conference. ILCA, Addis Ababa.

Keay, R.W. (1959). (3rd edition) *An outline of Nigerian vegetation*. Lagos: Federal Ministry of Information.

Keay, R.W. (1989). *Trees of Nigeria*. Oxford: Oxford University Press.

Lander, Richard & Lander, John (1832). *Explorations and adventures on the Niger River*. Ward Lock, London.

MacDonald, Kevin C. and Rachel H. MacDonald (1999). The Origins and Development of Domesticated Animals in Arid West Africa. In *The origin and development of African livestock.* R.M. Blench & K.C. MacDonald. (eds.) London: University College Press.

Mason, Ian L. (ed) (1984). *Evolution of Domesticated Animals*. London: Longman.

Mason, Ian L. (1988). (3rd ed). *A world dictionary of livestock breeds, types and varieties*. CAB International, Wallingford, UK.

Mason, Ian L. & J.P. Maule (1960). *The indigenous livestock of eastern and southern Africa.* Technical Communication no. 14 of the Commonwealth Bureau of Animal Breeding and Genetics, Edinburgh. Farnham Royal: Commonwealth Agricultural Bureaux.

Meghen, C., D. E. MacHugh, B. Sauveroche, G. Kana & D. G. Bradley (1999). Characterisation of the Kuri Cattle of Lake Chad using Molecular Genetic Techniques. In *The origin and development of African livestock.* R.M.Blench & K.C. MacDonald. (eds.) London: University College Press.

Montsma, G., Luiting, P., Verstegen, M.W.A., van der Hel, W., Hofs, P. and Zijlker, J.W. (1985) Effects of high ambient temperatures on the metabolism of West African Dwarf goats. II. *International Journal of Biometeorology* 29: 23–35.

Ndamukong, K.J.N., Sewell, M.M.H. and Asanji, M.F. (1989) Management and productivity of small ruminants in the North West Province of Cameroon. *Tropical Animal Health and Production* 21: 109–119.

Ngere, L.O. (1983). The White Fulani (Bunaji) of Nigeria. Animal genetic resources in Africa: high potential and endangered livestock. pp. 67–77 in *2nd OAU expert committee meeting on animal genetic resources in Africa: November 1983*. Bulawayo, Zimbabwe. OAU Nairobi, Kenya.

Ngere, L.O., Adu, I.F. and Okubanjo, I.O. (1984) The indigenous goats of Nigeria. *Animal Genetic Resources Information* 3: 1–9.

Ngofa, O.O. (1988). *The people of Eleme*. Self-published, Port Harcourt.

Okojie, C.G. (1960). *Ishan native laws and customs*. John Okwesa, Yaba, Lagos.

Putt, S.N.H., Shaw, A.P.M., Matthewman, R.W., Bourn, D.M., Underwood, M., James, A.D., Hallam, M.J. and Ellis, R.P. (1980). *The social and economic implications of Trypanosomiasis control: a study of its impact on livestock production and rural development in northern Nigeria*. Study no. 25, Veterinary Epidemiology and Economics Research Unit, Reading University.

Rege, J.E. O., Aboagye, G.S. & Tawah, C.L. (1994). Shorthorn cattle of West and Central Africa. *World Animal Review*, 78:2–48.

RIM, (1989). *Livestock and land use in Niger and Anambra States, Nigeria*. (2 vols). Report by Resource Inventory and Management Limited (RIM) to FDL&PCS, Abuja, Nigeria.

RIM, (1992). *Nigerian National Livestock Resource Survey*. (IV vols). Report by Resource Inventory and Management Limited (RIM) to FDL&PCS, Abuja, Nigeria.

Roberts, C.J. and Gray, A.R. (1973). Studies on trypanosome-resistant cattle. 1. The breeding and growth performance of N'Dama, Muturu and zebu cattle maintained under the same conditions of husbandry. *Tropical Animal Health and Production*, 5: 211–219.

Robinet, A.H. (1967) La chèvre rousse de Maradi. *REMVT* 20,1: 129–186.

Sabiad. (1947). Lake Chad cattle. *Farm and Forest*, VIII,2: 55–56.

Starkey, P.H. (1984). N'Dama cattle – a productive trypanotolerant breed. *World Animal Review*, 50: 2–15.

Swift, J.J. (1984). *Pastoral development in Central Niger*. Final Report of the Niger Range and Livestock Project, Niger. Niamey.

Troquereau, P.J.A. (1961). *Les Ressources Animales de la République du Dahomey*. Report to the Government of the Republic of Dahomey.

Udo, R.K. (1970) *Geographical regions of Nigeria*. London: Heinemann Educational Books.

White, F. (1983) *Vegetation Map of Africa*. Paris: UNESCO/AETFAT/UNSO.

Wilson, R.T. (1987) Livestock production in central Mali: environmental factors affecting weight in traditionally managed goats and sheep. *Animal Production* 45: 223–232.

Wilson, R.T. (1989) Reproductive performance of the one-humped camel. The empirical base. *REMVT* 42,1: 117–125.

Wilson, R.T. and Durkin, J.W. (1983a) Livestock production in central Mali: weight at first conception and ages at first and second parturition in traditionally managed goats and sheep. *Journal of Agricultural Science*, Cambridge 100: 625–628.

Wilson, R.T. and Durkin, J.W. (1983b) Livestock production in central Mali: reproductive components in traditionally managed sheep and goats. *Livestock Production Science* 19: 523–529.

Wilson, R.T. and Light, D. (1986) Livestock production in central Mali: economic characters and productivity indices for traditionally managed goats and sheep. *Journal of Animal Science* 62,3: 567–575.

Wilson, R.T., Wagenaar, K. and Louis, S. (1984) Animal production. In *Pastoral development in central Niger*. Final report of the Niger range and livestock project to the Government of the Republic of Niger. ed. J.J. Swift. pp 69–144. Niamey: USAID.

Wilson, R.T. and Sayers, A.R. (1987) Livestock production in central Mali: effects of climatic variables on the period of birth and on litter size in traditionally managed goats and sheep. *Agricultural and Forest Meteorology* 40: 31–36.

Wint, W. & Bourn, D. (1994). *Livestock and Land-use Surveys in Sub-Saharan Africa*. Oxfam Research Paper, 11. Oxfam (UK and Ireland), Oxford.