Nigerian livestock resources survey

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Background

Reliable information is the foundation of sound management and should be the basis upon which government policies are formulated and development priorities are established. Unfortunately this is not always the case in practice. The need for an impartial, objective and comprehensive assessment of Nigeria's livestock resources has long been recognized, but until recently the subject had remained a matter of debate and conjecture rather than one of concerted effort and coordinated field inquiry.

In the past, official livestock population figures were derived indirectly and extrapolated from various administrative sources, including *jangali* cattle tax receipts, vaccination returns, slaughter records, trade movements and exports. The information itself was frequently out of date, inaccurate and/or incomplete and yielded population estimates of considerable uncertainty that related only to a few of the many livestock species kept. Such figures should obviously be treated with caution (Colville and Shaw, 1950; Fricke, 1979), but this is rarely reflected in official publications. More recently, further doubt has been cast on the validity of livestock statistics by the pervasive impact of human population growth and agricultural expansion on the natural environment (Bourn, 1983) and the associated redistribution of livestock within it.

Under the prevailing circumstances of doubt and speculation, the Government of Nigeria commissioned Resource Inventory and Management Limited (RIM) to conduct an independent national livestock resources survey. This study was undertaken in collaboration with the Federal Department of Livestock and Pest Control Services and academic institutions as a component of the World Bank-assisted Second Livestock Development Project, and it included the assessment of both traditional and commercial sectors of livestock production. Nigeria is a large country of considerable diversity with a wide range of agroclimatic conditions and corresponding varieties of vegetation (Figure 1).

1 Nigeria: agroclimatic zones and types of vegetation - Nigéria: zones agroclimatiques et types de végétation - Nigeria: zonas agroclimáticas y tipos de vegetación

Uda ram staked out for roadside sale near the northern city of Kano - Bélier Uda á l'attache pour les ventes en bord de route, près de Kano, dans le nord du Nigéria - Carnero Uda atado a una estaca pare su venta al lado del camino,

cerca de la ciudad septentrional de Kano

The general purpose of the survey was to obtain more reliable, up-to-date information about Nigerian livestock resources and production systems in order to establish a sound foundation for livestock development planning and more effective targeting initiatives in the future. Specific objectives of the study were to:

· assess the seasonal distribution and abundance of traditionally managed livestock;
· determine the characteristics and distribution of the major species and breeds;
· collect baseline herd productivity parameters;
· describe the features of locally important livestock production systems;
· identify the major constraints on production;
· assess the size and composition of commercially managed livestock holdings.:

Methods

A two-tiered sampling strategy, combining low-level aerial surveys and complementary ground studies, was adopted, based on techniques developed over the past decade and extensively employed in many parts of Africa, including Kenya, Mali, the Niger, Nigeria, Senegal, the Sudan and Chad.

In essence, pastoral livestock were assessed from the air, while those concealed from view in villages were appraised on the ground. The two were linked by the number of rural rooftops counted by both aerial and ground survey teams. "Hidden animal" to rooftop ratios, derived from ground observations, were applied to aerial rooftop counts to give indirect assessments of "hidden" village livestock. These were added to pastoral livestock numbers, which were determined from direct aerial observation, to give population totals for each species. This integrated approach optimized the use of available resources and avoided the problems inherent to purely ground-based methods of assessment: double counting of mobile herds and the underrepresentation of livestock in remoter areas.

Low-level aerial survey

Uniform sample coverage over the whole of Nigeria (just under 1 million km^2) was achieved using the now well-established low-level aerial survey technique of Systematic Reconnaissance Flights (Norton-Griffiths, 1978; ILCA CIPEA, 1981; GEMS/UNEP, 1986). For the purposes of the survey, two four-seater high-wing light aircraft were equipped with global navigation systems and radar altimeters for accurate navigation and fitted with external viewing frames to delineate sampling strips on both sides of the aircraft (Figure 2).

Each aircraft operated independently and flew a series of parallel flight paths at a nominal height of 800 feet above ground level (Figure 3). Flight lines were spaced 20 km apart and each line was divided into sectors 20 km in length. This procedure created a federation-wide sampling grid of 2 280 cells (Figure 4), each measuring 20 x 20 km, which provided a common geographical frame of reference for both aerial and ground survey data collection and subsequent analysis. Aerial surveys were conducted at the end of the dry season - March and April 1990 - and again at the end of the wet season - September and October 1990.

Air crews consisted of a team of four: pilot, navigator (who also acted as front-seat observer) and two rear-seat observers. The front-seat observer recorded flying height above ground and various environmental parameters, such as vegetation cover, land use intensity and bare ground, within each grid cell. As navigator, the front-seat observer also operated the computerized navigation system, made frequent visual

checks of aircraft position, cross-referenced map coordinates and informed the rear-seat observers of their grid reference position.

Rear-seat observers recorded the size of livestock herds and human settlements within two ground sample strips, each nominally 500 m wide, on either side of the aircraft, and took photographs of them whenever possible. Overall sample intensity was 5 percent (two 0.5 km-wide strips across each 20 x 20 km grid cell). Subsequently, accurate counts were obtained from these photographs and counting biases determined for each observer, so that their visual records could be corrected in those cases for which no clear photographs were available.

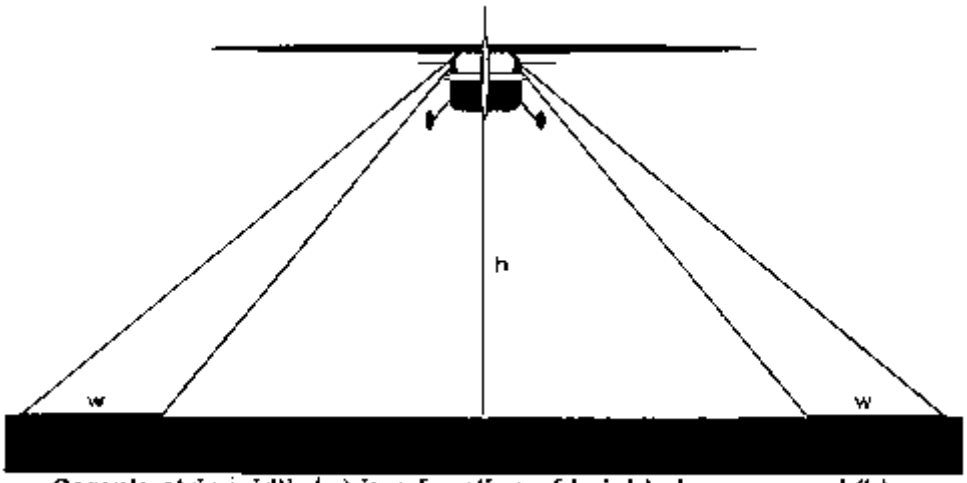
Complementary ground studies

Four types of ground survey were undertaken: a rural village survey to determine livestock numbers in villages in relation to rooftop numbers and also to record animal husbandry practices and socio-economic data; a livestock herd survey to establish the productivity parameters of the major animal breeds; urban livestock surveys to estimate animal numbers in the larger towns and major urban centres; and a supplementary survey to assess the holdings of commercial livestock enterprises.

Village surveys. The aerial survey grid provided a sampling frame for village livestock site selection. In the first instance, sample grid cells were chosen to give the widest possible geographical and ecological coverage, and selected villages within each were then visited. Two sets of data were collected in the village surveys: one concerned the characteristics of the local system of livestock production and the other related the livestock holdings per household to the number of rooftops. A total of 2 148 villages were visited by ground teams and information about livestock holdings was collected from 58 162 households.

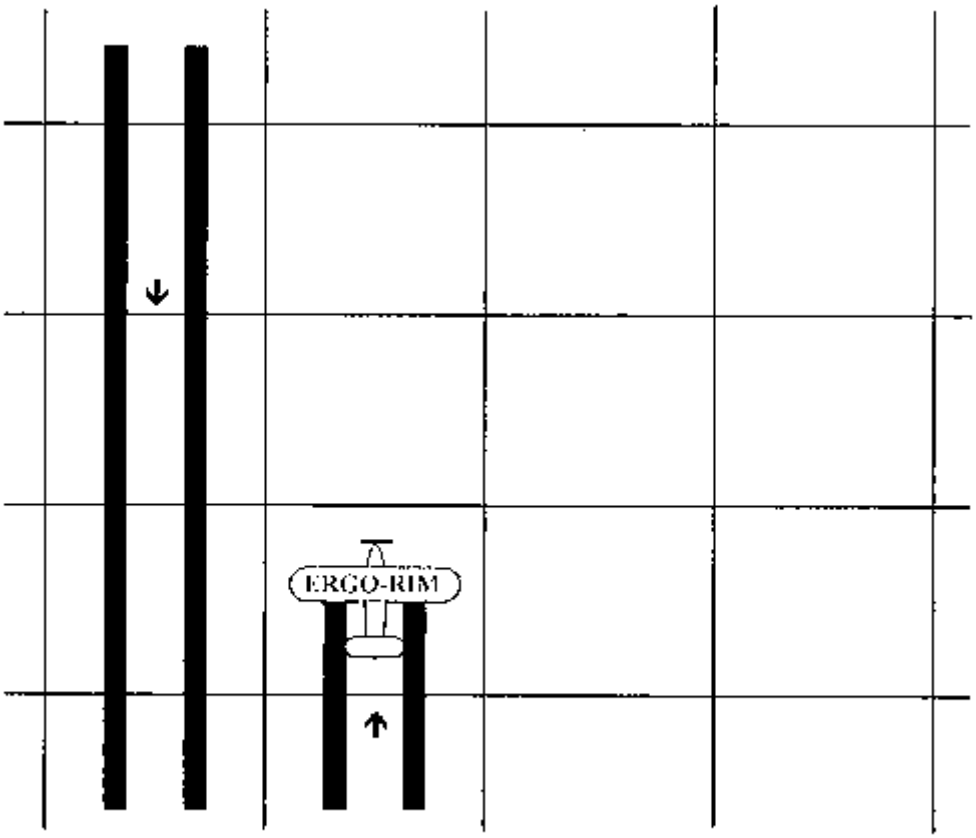
Productivity surveys. The primary purpose of the animal production survey was to establish productivity parameters for the principal breeds of Nigerian livestock kept under traditional management. As many breeds have restricted distribution, the surveys were focused on specific regions. An elegant method of herd productivity assessments based on the known fates of all progeny from a representative sample of mature females, was used to provide measures of productivity that could otherwise be obtained only by long-term herd monitoring. Comparative herd productivity information was obtained for various breeds of zebu cattle, including Adamawa Gudali, Azawak, Bunaji, Rahaji, Sokoto Gudali and Wadara, as well as for Muturu, N'Dama and Kuri cattle. The same technique was also used to collect productivity data for traditionally managed sheep, goats, camels, donkeys and pigs.

2 Aerial survey sample strips - Bandes d'échantillons de levés aériens - Franjas de muestreo de los reconocimientos aéreos



Sample strip width (w) is a function of height above ground (h)

3 Aerial survey grid sampling pattern - Grille d'échantillonnage de levés aériens - Modelo de muestreo por cuadriculas de los reconocimientos aéreos



Parallel flight lines establish sampling grid

4 20 x 20 km sampling grid - Grille d'échantillonnage de 20 x 20 km - Red de cuadriculas de muestreo de 20 x 20 km

Urban surveys. The aim of the urban surveys was to assess the size and composition of livestock populations in representative urban settlements. A standard method of stratified ground sampling was used to determine livestock densities in each stratum, from which overall livestock estimates were derived. Twenty-four towns and cities were chosen to reflect the different types of conurbation found in Nigeria and to

provide broad geographical coverage of the country.

Commercial livestock survey. To the extent that virtually all livestock producers in Nigeria participate in the country's monetary economy through the purchase and sale of stock and produce, there is obviously a commercial orientation to most forms of animal production. However, a legitimate distinction can be drawn- between those producers who essentially rely on well-established traditional systems of production and management and those who employ more innovative, modern and intensive methods.

A supplementary survey of commercial livestock holdings took place in early 1992, and 1923 out of a total of 4 622 enterprises identified by state authorities were visited.

Livestock distribution and abundance

Results of the Nigerian Livestock Resources Survey were presented to the federal government in the form of a four-volume, 1 250-page final report, *Nigerian livestock resources* (RIM, 1992), and also as a computer database, accessible to standard software packages. The assessment provides an objective basis for targeting future development initiatives and a firm foundation for monitoring and evaluation activities.

Nigerian livestock population totals, combining estimates from both the 1990 traditional sector survey and the 1992 survey of commercial livestock enterprises, are given in the Table. These estimates, based on standardized, systematic methods of sampling, are the most reliable population figures currently available, with standard error margins of less than 5 percent for major livestock species. In monetary terms, the value of Nigerian livestock resources, based on prevailing market prices in mid-1991, was conservatively estimated to be in the order of US$ 6 000 million.

Regional differences in livestock distribution are illustrated here in a series of maps, generated using MAPICS software, an unsophisticated form of the Geographical Information System (GIS).

Nigerian livestock population estimates - Estimations des populations animales du Nigéria - Estimaciones de la población pecuaria de Nigeria

Species	Number
Chickens	82 400 000
Goats	34 500 000
Sheep	22 100000
Cattle	13 900 000
Donkeys	900 000
Horses	200 000
Camels	90 000
Other poultry*	31 900 000
Pigs	3 500 000
Dogs	4 500 000
Cats	3 300 000
Rabbits	1 700 000
Guinea pigs	500 000
Giant rats	60 000

* Includes pigeons, ducks, guinea fowl and turkeys.

Poultry

Poultry outnumbers all other forms of livestock in Nigeria, and, not surprisingly, is found throughout the country, wherever there is human settlement. Although pigeons, ducks, guinea fowl and some turkeys are also widely kept, chickens are by far the most common. Typically they are maintained under traditional, low-input, free-range systems of management (Figure 5), but substantial numbers are also reared intensively on a commercial basis, particularly in the southern states. Commercial holdings account for some 10 million chickens, or 11 percent of the total estimated population of 82.4 million.

There was a boom in intensive chicken production in the early 1980s, when the government subsidized the prices of day-old chicks and feed ingredients. As the subsidies have now been withdrawn, however, both extensive and intensive commercialized production have tended to decline, especially in urban areas, despite the continued demand for chicken meat and eggs. The major constraint on traditional chicken production is Newcastle disease, which affects local breeds in particular, while for more intensive commercial producers it is the availability of feeds and drugs that is limiting.

Small ruminants

Small ruminants are almost as ubiquitous as poultry, though not so numerous. There is estimated to be a total of 56.6 million head throughout the country, with goats outnumbering sheep by three to two. Although some seasonal movement of pastoral sheep does take place, the great majority of small ruminants are sedentary village livestock and their patterns of distribution mirror those of human settlement (Figures 6 and 7).

Goats. There are three main varieties of goat in Nigeria: the West African Dwarf, the Sokoto Red and the Sahel. Goats are renowned for their hardiness and can survive in most environments: West African Dwarf goats are kept in the forest zones and in the Middle Belt; Sokoto Reds are kept throughout the north; and Sahel goats are restricted to a strip along the frontier with the Niger. Although pastoral Sahel goats are found in the northern semi-arid zone, most goats are kept in villages. The most common production system is that of seasonal confinement. Northern goats were found to be markedly more productive than West African Dwarf goats, with lower ages at first kidding and shorter kidding intervals, although they produced fewer kids per kidding.

5 Distribution of chickens - Répartition des volailles - Distribución de los pollos

6 Distribution of goats - Répartition des caprins - Distribución de los caprinos

7 Distribution of sheep - Répartition des ovins - Distribución de los ovinos

Sheep. There are four main types of sheep native to Nigeria: the Balami, Uda, Yankasa and West African Dwarf. Balami and Uda are kept in the semi-arid regions, West African Dwarf sheep in the south and Yankasa throughout the country. Sheep are the second most numerous pastoral species, and small flocks accompany many cattle herds in the north and in the Middle Belt.

A comparison of pastoral and village stock shows that pastoral animals are generally more productive. The productivity of West African Dwarf sheep was substantially lower than that of other breeds. All Nigerian sheep are used for wool, but they are rarely milked. In the north, they are eaten regularly and form part of the daily protein supply, but there is also a marked variation in demand coinciding with religious festivals. As a result, there are dramatic seasonal price fluctuations, and in some areas the household fattening of sheep for sale is a major economic activity.

Cattle. Cattle are found throughout Nigeria, but they are most common in the northern two-thirds of the country. Seasonal transhumance does take place, but

generally to a limited extent. The observed distributions of cattle during the wet and dry seasons are contrasted in Figures 8 and 9. Almost half the total cattle population is permanently resident within the subhumid zone. Humped zebu cattle are by far the most common, but limited numbers of Keteku, Muturu and Kuri cattle occur in the southwestern, southern and northeastern parts of the country, respectively.

Pigs. The traditional Nigerian black hairy pig is gradually being replaced by various exotic breeds, including the Large White, Landrace, Hampshire and Duroc. Pigs are generally kept under systems of seasonal confinement in the north and Middle Belt, but they are usually confined all year-round in the south, except in the Niger Delta region. Pigs must be given supplementary feeds, and in village systems the lees of beer are often combined with household scraps for food. The distribution of traditionally managed, small-scale, village-based production is shown in Figure 10. The production of pigs is obviously profitable and continues to spread in many parts of non-Muslim Nigeria.

Intensive pig rearing is economically viable on the periphery of large cities because of the availability of industrial by-products, particularly brewers' grain. Units of between 50 and 200 pigs kept in concrete pens are common, especially in the densely populated regions of the south. Commercially managed piggeries with more than five breeding sows account for about 3 percent of the total estimated pig population of 3.5 million.

Established trends for the future

Agricultural expansion and environmental change

With the continued growth of the human population, competition for limited land resources has steadily increased over the years and there has been a progressive expansion of settlement and agriculture. This process is taking place throughout Nigeria, but it is most marked in the north and south, where population densities are highest.

Expansion into the less densely populated subhumid zone, or Middle Belt, is channelled by an ever-widening road network and accelerated by the increasing urban demand for food and fuel. Deforestation continues apace, vegetation and land use patterns are being transformed and hunting has eliminated wildlife from many areas.

The natural environment is, therefore, experiencing a period of unprecedented change. Conspicuous signs of land degradation, in terms of the extent of bare ground and erosion, are associated with the highland areas of the Jos and Mambila plateaus.

Decline of tsetse and trypanosomiasis

Tsetse (*Glossina* spp.) and trypanosomiasis have for many years been regarded as the most important constraints on cattle production within the Nigerian Middle Belt. Today, with almost half the national cattle herd resident in that region of the country throughout the year, this obviously can no longer be the case.

Deforestation and the removal of wildlife have greatly reduced the natural habitats and wildlife hosts of the tsetse fly over much of the country (Bourn, 1983). Gradually, through natural selection and co-adaptation, this has led to the evolution of milder forms of the disease and the development of some trypanosomiasis-tolerant zebu cattle populations.

Towards mixed farming

In addition to the more overt, physical aspects of agricultural expansion and environmental change referred to previously, the Nigerian Livestock Resources

Survey has also confirmed a variety of other more subtle, qualitative changes currently taking place within local systems of agriculture. These include a marked reduction in pastoral nomadism; the increasing sedentariness of pastoralists and their adoption of crop cultivation in addition to keeping livestock (van Raay, 1975); the taking up of animal husbandry and livestock fattening by arable farmers (Figure 11); the utilization of crop residues by livestock in exchange for dairy products and/or manure; and the spread of animal traction for ploughing and carting (Figure 12).

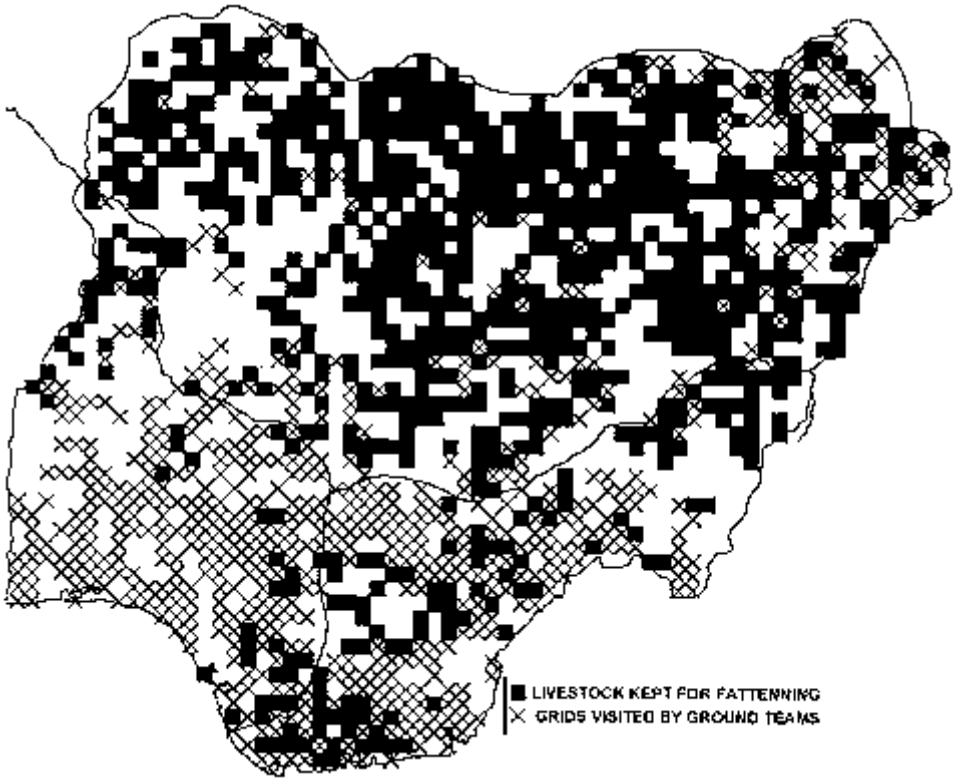
Collectively, these incremental changes are indicative of a progressive and widespread trend towards mixed farming (FAO, 1983; McIntyre, Bourzat and Pingali, 1992). The tendency is now firmly established in Nigeria and the further integration of livestock production within local farming systems is destined to become one of the major strategic goals of livestock development in sub-Saharan Africa (Winrock International, 1992).

8 Wet-season distribution of cattle - Répartition des bovine pendant la saison humide - Distribución de los vacunos en la estación húmeda

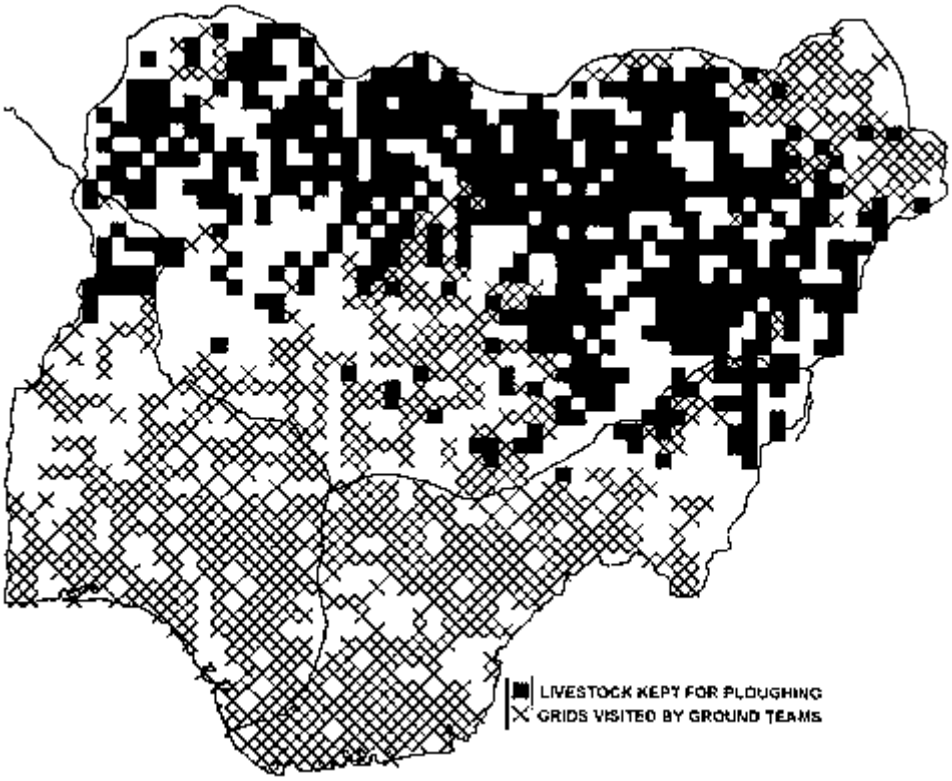
9 Dry-season distribution of cattle - Répartition des bovine pendant la saison sèche - Distribución de los vacunos en la estación seca

10 Distribution of pigs - Répartition des porcine - Distribución de los cerdos

11 Livestock fattening - Zones d'embouche - Zonas de engorde de ganado



12 Cattle ploughing - Traction animale - Arado con vacunos



Mature Balami sheep - Moutons Balami à maturité - Ovino Balami adulto

Stall-fed Sokoto Gudali zebu at an urban market prior to sale - Zébu Sokoto Gudali nourri à l'auge au marché avant d'être vendu - Cebúes Sokoto Gudali alimentados en establo en un mercado urbano antes de su venta

Stall-fed Red Sokoto goats prior to sale and transport to southern markets - Chèvres Red Sokoto nourries à l'auge avant d'être vendues et envoyées vers les marchés du sud - Cabras Sokoto rojas alimentadas en establo antes de su venta y su transporte posterior a los mercados meridionales

Urbanization

Urban populations in sub-Saharan Africa are estimated to be increasing at 6 to 7 percent per annum, twice the overall growth rate for the region as a whole, and they account for almost one-third of the total population of Africa (World Bank, 1989), As this trend continues, increased urban demand for food will create new markets for produce and promote the commercialization of agriculture in periurban environments (Winrock International, 1992).

The findings of the Nigerian Livestock Resources Survey certainly lend support to this scenario, with sizeable livestock populations being found in and around most urban areas, either as backyard stock or as commercial holdings. Poultry farms and piggeries are by far the most common forms of enterprise and, for obvious logistic reasons, are usually located within easy access of urban centres.

Potential for application elsewhere

Low-level aerial and complementary ground survey techniques used during the Nigerian Livestock Resources Survey have obvious potential for application in other regions of the world, where natural-resource status is uncertain and where up-to-date assessments are required for development planning and more effective targeting of interventions. Systematic sampling from the air and selective ground studies provide a rapid, cost-effective means of obtaining information about a wide range of environmental parameters.

In addition to the assessment of livestock resources, the Nigerian survey also mapped vegetation and land-use patterns, as well as the distribution of human settlement. Light aircraft with accurate on-board computer navigation systems also provide ideal low-cost platforms for high-resolution vertical photography, necessary for the validation of satellite imagery.

Costs depend on circumstances and specific information requirements, in particular the size of the survey zone, the intensity of sampling and how much ground work is involved. For low-intensity coverage of extensive land areas, unit costs are in the order of US$ 1 to $ 2 per square kilometre.

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