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Dynamics of Ruminant Livestock Management in the Context of the Nigerian Agricultural System

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Additional information is available at the end of the chapter

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1. Introduction

Among all the livestock that makes up the farm animals in Nigeria, ruminants, comprising sheep, goats and cattle, constitute the farm animals largely reared by farm families in the country's agricultural system. Nigeria has population of 34.5million goats, 22.1million sheep and 13.9million cattle. The larger proportion of these animals' population are however largely concentrated in the northern region of the country than the southern region. Specifically about 90 percent of the country's cattle population and 70 percent of the sheep and goat populations are concentrated in northern region of the country. Concentration of Nigeria's livestock-base in the northern region is most likely to have been influenced by the ecological condition of the region which is characterised by low rainfall duration, lighter sandy soils and longer dry season. This submission is predicated by the fact that drier tropics or semi-arid regions are more favourable to the ruminants, Notwithstanding this situation, certain breeds of sheep and goats, particularly the West African Dwarf (WAD) species, are peculiarly adapted to the southern (humid) region of the country and are commonly reared by rural households in the region. Although, no breed of cattle is peculiar to the southern humid region of Nigeria, the available cattle in the region was largely due to settlement of the Hausa/Fulani pastoralists, who constitute the main cattle rearers, in the region.

The option of settled lifestyle of the Fualani pastoralists in the southern region of Nigeria was largely informed by a number of changes in the ecological condition of the region. One of the changing conditions that made the southern/humid region of the country habitable for cattle rearing was the drastic reduction in the incidence of tsetse fly (*Glossina spp*) infestation- a vector of the cattle disease known as trypanosomoses or sleeping sickness, in the region. The reduced incidence of tsetse fly the reduced incidence of tsetse flies was brought about by considerable transformation of the southern region's forest-base to derived savanna arising from continuous and expanded land clearing for agriculture and human habitation; and the emerging incidence and severity of bush burning. These actions

respectively lowered the region's humidity and heightened its heat intensity, thereby making the environment less conducive for the tsetse flies' survival or lifecycle completion. In the same vein, the successful settlement of the pastoralists in the southern region to the animal's development of a level of tolerance or resistance to the trypanosomosis or sleeping sickness as a result of prolonged exposure to tsetse flies. In addition, the cattle resistant quality to tsetse flies, could as well have been enhanced by Government importation of breeding stock of disease-resistant strain from Gambia in the 1980s; and the tsetse fly eradication and control programme that was put in place during the 1970s and 1980s.

2. Breeds of ruminants' characteristics and distribution in Nigeria

With the changing ecological condition of the southern Nigeria and its conduciveness to cattle survival, the animal have become common in the region, though with the Fulani and Hausa tribes that have chosen to settle in the southern region with their herds of cattle. Based on this cattle, sheep and goats, as commonly found in the northern region of Nigeria, are as well found in the southern part of the country, though in less proportion to that of the northern region. Most of the available ruminants in the country are however of indigenous breeds.

Cattle breeds: breeds of locally available cattle in Nigeria are basically indigenous and are grouped as the Zebu and Taurine. The zebus as locally recognised by the cattle rearers in northern part of Nigeria include Bunaji, Rahaji, Sokoto Gudali, Adamawa Gudali, Azawak and Wadara. The Taurines on other hand include Keteku, N'dama and Kuri [11, 12]. The zebus are characterised by long horns, large humps and tallness, against the Taurines that are humpless, short-horned and shot-legged.

Although, there are varying estimations of cattle population in Nigeria ranging between 10 and 15million [2,3,14] the mean average of the nation's cattle population was put at 13.9 million as at 1990 [12]. While about 11.5 million of the cattle population was kept in pastoral systems, the remaining 2.4 million were kept in villages. Country-wide distribution of the cattle population however showed that the sub-humid region of Nigeria has about 4.5million heads¹ [13], with the mean cattle density of about 15 per km² or 6.6 hectare per head; and approximately 45% of the national herd could be readily found in the sub-humid zone of the country on year [12].

Production characteristics of surveyed cattle in the Kaduna plain of Nigeria, entails an average of 45.9 head, out of which 64.4% were females; 60months (5years) as first age of calving, 25months (about 2years) of calving intervals and calving percentage of 48%. Calf life-weight and mortality to 1 year of age averaged 103 kg and 22.4% respectively. Milk production by the cattle, after adjusting for length of calving intervals, for humans and calves averaged 112 and 169 litres/cow/year respectively.

Sheep: Nigeria has a population of about 8 to13.2million sheep out of which about 3.4million are found the southern/humid region and the larger proportion of the animal in

¹ Based the use of low-level systematic aerial surveys (Bourn, Milligan & Wint, 1986)

the northern region of the country. Available breeds of sheep in the country are mainly indigenous and these are the West African Dwarf (WAD) sheep, Balami, Uda and Yankasa. Out of these four major breeds of sheep in the country, the WAD breed is common to southern region against the widespread of Balami, Uda and Yakansa breeds in the northern region of the country. Characteristics analysis of sheep in the country, especially among the Fulani pastoralists showed that ewes had approximately 120% fertility rate, 12% rate of twinning and 25% lamb mortality rate at 3months old. Sheep productivity index puts lamb weight at 0.327 kg at a weaning age of 90 days, and 0.490 kg at a weaning age of 180days per ewe per year. Mature males of the local breeds of sheep have a live weight of about 30 to 65kg and their female counter parts often weigh between 30 and 45kg.

Goats: on the other hand has a population of about 22 to 26million in Nigeria with rough estimates of 6.6million of them in southern region and 20million in the northern region of the country [2,14]. The breeds of goats in Nigeria are largely indigenous; and the common ones [19] include the West African Dwarf (WAD) goat, Sahel/desert goat- known as West African Long-Legged goat; and Sokoto Red/Maradi. The Kalahari goat breed, which is of South Africa origin is gradually being adapted to the Nigeria's ecological zones on experimental efforts. Distribution of the goat breeds in the country showed that the West African Dwarf (WAD) goat is common to southern Nigeria while the Sahel or desert goat and Sokoto Red are common to the northern region of the country. Production characteristic of the small ruminant showed that breeds of goats in the country had low fertility rate (below 100%), 40% twins and triplets birth rates, and low mortality rates of 22% for kids and 14.4% for adults. The productivity indices for 90 and 180 days weaning age were 0.259 kg and 0.437 kg kid/kg doe respectively. Milk production characteristic of the goats varies from breed to breed. [20,21] The Sokoto Red produces a daily milk yield of about 0.5 to 1.5kg and 100days of lactation; Sahel goats produce between 0.8 and 1.0kg of milk daily with lactation period of 120days; and the WAD breeds produce about 0.4kg milk per day on a lactation period of 126 days. It was further indicated that these local breeds of goat usually weighs between 18kg and 37kg.

3. Social and economic values of ruminants in Nigeria

The economic values: the ruminants play significant roles in the social and economic wellbeing of the Nigerians in various ways. Economically the animals serve as source of income earning to major ruminants' dealers- sellers of live animals and butchers/meat sellers; generates employments and creates markets for larger number of people who explore the animals' product and by-products for economic gains. Meat constitutes the foremost animal product that is highly explored by the Nigerian households, particularly for direct consumption and as such, the ruminants, especially cattle, constitute the major and cheapest source of meat consumption for most households in the country [22] about 1million cattle are annually slaughtered for meat in the country. This suggests heavy dependence on cattle for meat consumption by households in the country. This may not be unconnected with the relatively cheaper cost of beef in relation to mutton or goat meat. For

instance, while a Kilogramme beef might cost about N400 (US\$2.5)², the equivalent is about N1000 (US\$6.25) for mutton or goat meat. In addition, the large size of cattle also makes it possible for daily meat demands of the Nigerians to be readily met. Although, the small ruminants, especially goat, are as well slaughtered for meat sale, the small size of the animals and high market price of their meats makes the animals less demanded for regular meat consumption.

However, live goats and sheep are much more easily acquired by individuals in relation to cattle owing to market price differentials between the small and large ruminants. For instance, a sizeable cow or bull sells for about ₦70, 000 (US\$437.5) in most open cattle markets in the southwestern part of Nigeria, against the average market price of ₦10, 000 (US\$62.5) for WAD sheep and goats, ₦18, 000 (US\$112.5) for Sahel goats; and ₦20, 000 (US\$125) for sheep (Uda and Balami)³. This situation thus accounted for the widespread of sheep and goats among individuals in Nigeria either for consumption, though mostly on events celebration, or rearing for widespread sheep and goats as important animals of trade within humid West Africa though with different demand and consumption patterns in the region. For instance, while sheep are largely consumed during Muslim religious holidays, goats are used for all ceremonies throughout the year, especially for ceremonies such as births, deaths, marriages and festivals; thereby making the demand for goats consistently high. As a result of this, there is a clear price premium for male sheep during the festival period, and some early purchasing for fattening and re-sale takes place.

The market value of the ruminants not only creates employment and generates income for those that directly owned the animals, but indirectly for the butchers, foragers and government. For instance, cattle slaughtering and dressing cost N3, 000 per head per cow and the same services on sheep and goat cost N1, 000 per head per the animal. And to a lesser extent, the animals indirectly generate income for the Nigerian Government through licensing of abattoirs and taxation on every slaughtered animal at the registered abattoirs. Although, ruminants are generally kept on free range management system, conscientious feeding is provided the farm animals primarily kept for commercial purpose. Based on this, forages, either fresh or dry, are sought from the foragers for feeding the commercially-oriented farm animals. In the light of this, crop debris such as dried cowpea shafts and ground vines and husks becomes additional source of income for farmers that cultivate cowpea and groundnuts. Valuation of the Nigerian livestock resources [23] puts the total livestock value at N60billion, based on mid-1991 market prices and as indicated by [22], account for as much as one third of the country's agricultural gross domestic product (GDP).

Social values: socio-cultural value of the ruminants varied across the country. While the sheep and goats are highly prized for cultural heritage in the southwest Nigeria, cattle is of much significance among the Hausa/Fulani in the northern region. Before now, when agriculture constitutes the main Nigerian economies, sheep and goats were kept for status,

² Exchange rate at ₦160 to US\$1 as at March 2012

³ The indicated prices are based on personal market survey between February and March 2012 and off the festival periods. The market price of sheep goes for ₦50, 000 (US\$) during the festival period, especially during the Muslim (Idi-el Kabir) celebration.

and are largely used for measuring the state of one riches. But with the relegation of agriculture from the economic fore, use of the number or size of farm animals as measuring tool of social status is no longer tenable, especially at rural level in southwest Nigeria where subsistence agriculture is the main practice. However, the small ruminants still found value in sacrificial offerings among the traditional worshippers in southwest Nigeria. Up till now, goat, specifically doe, constitutes traditional requirement as part of bride price and the animals are kept in memory of the enacted marital relationship between in-laws. Unlike beef and mutton, goat meat are generally considered and consumed as delicacy.

Unlike the devalued state of the socio-cultural value of the small ruminants in southwest Nigeria, cattle, sheep and goats remained relevant as measuring tools of social status and economic strength among the rural households in the northern region of the country. The size of cattle herds and flock of sheep owned by a particular individual or household determines the economic strength of such ones. In addition, a herder's stock of animals constitutes his financial base thereby disposing the animals for income generation whenever it is necessary [24]. Cattle also serve as good means of transportation and animal traction among the livestock farmers in the northern region of the country, whereby the animals are used for land cultivation in preparation for crop cultivation, transportation of farm families to and from the farms and transportation of farm produce between farms and storage points. Given the volume and nature of excreta produce by cattle, the large ruminant have served as valuable source for manure for soil fertility and development of organic agriculture. [22] cattle produces manure outputs of 1368 kg DM/head/year and 248 kg DM/head/year by sheep for soil fertility.

4. Dynamics of ruminant livestock management system in Nigeria

In general, farm animals are poorly managed in Nigeria's agricultural system owing to the fact that the animals are mostly managed on free range/extensive system and semi-intensive system. These management systems are basically influenced by cheap means of feeding the stock all year round. Based on this, the animals are thus allowed to roam the streets and neighbourhood to fend for themselves with little or no special or conscientious provision of supplements for the animals. Although, commonly raised farm animals under the free range and semi-intensive systems include the monogastrics and ruminants, sheep and goats, alongside chicken constitutes the major farm animals largely raised in these systems of livestock management by the Nigerian rural households or livestock farmers.

Small ruminant management system: the small ruminants are however intensively managed on the free range/extensive system, especially in the southern part of Nigeria where crop farming dominates the agricultural practices and with farmers keeping an average of 10 sheep and/or goats. Under the free range system, the animals move about freely to feed on forages/grasses, which are abundantly available during the raining season, and on other feed source such as left over foods/ kitchen wastes and refuse dumps. Hardly are the animals provided supplementary feeds and even shelter by their keepers. The animals thus squat around corridors or available shades in the compounds. Animals under this system of management may however become destructive, feeding on whatever eatables

that might come their ways, including live crops, during the dry season when pastures must have dried out. This implies that the free range system may be a healthy practice for ruminant management during the rainy seasons, at least for abundance of forage availability, and but unhealthy during the dry seasons as livestock infringement on the neighbourhood property often lead to conflicts.

Some households or livestock keepers on the other hand maintain semi-intensive management system whereby the animals are provided shelter and kept indoors for security purpose. The animals somehow have their movements regulated and as such are released to fend for themselves in the early and late hours of the day, after which they are kept indoors over the night. As it were in the extensive or free range system, the animals feed on natural pasture and kitchen wastes or by-products of processed foods/farm produce, especially during the rainy season. Although, hardly are the animals under semi-intensive management provided supplements or essential ration for consumption, efforts are made by their keepers to feed them with by-products from farm produce, especially during dry season when pasture are hardly available for free grazing.

The extensive management system is however largely applied for the WAD sheep and goats than for other breeds such as Balami, Uda and Yakansa breeds of sheep; and Sokoto Red goats in southwest Nigeria. This may not be unconnected with economic value of these breeds of small ruminants arising from their bigger body size and better market prices than the WAD breeds. In addition, these breeds of small ruminants are highly prized for social ceremonies and prestige; and are more tempting to be stolen than the WADs. The Balami, Uda, Yankasa; and Sokoto Red breeds of the small ruminants are thus kept on a 'modified intensive management system' whereby the animals are mostly tethered or kept in a guarded enclosure and fed on cut-and-feed forages and by-products of farm produce.

Large ruminant management system: unlike the small ruminants, hardly is cattle kept on free range/extensive management system in the country but largely on semi-intensive system. A level of modification is however applied to the semi-intensive management for cattle. Unlike the small ruminants that could be left to freely range about all alone, cattle are never left all alone to freely graze about or scavenge, but are conscientiously guided by the rearers in the search for pasture and water; and thereafter, are securely checked into the provided shelter. This may not unconnected with the social and economic value of the large ruminant, as the loss of a cattle, either in death or getting misplaced, is at great cost to the herder(s) and as such, the animals are jealously guided for survival, productivity and profitability. Socially, the size of the animal is highly intimidating to humans as appearance of unguided cattle in the public is known to cause commotions whereby people run helter-skelter. This farm animal is never neared as one would near sheep and goats. This situation thus accounted for the need to guide the cattle on grazing over a wide range of vegetations.

Nomadism/Exclusive pastoral system: in addition to the modified semi-intensive management of the cattle by herders, [12] other pastoral management systems commonly practised by cattle herders in the country include the exclusive, transhumant and agro pastoral systems. The exclusive pastoral practice or nomadism entails sole management of

the ruminants, especially cattle for the socioeconomic wellbeing of the pastoral farmers. [12] The exclusive pastoralists do not grow crops but simply depend on sales of their ruminants and dairy products to meet their food needs. As a feeding practice, the exclusive pastoralists usually move their animals over long distances, usually through a set migration routes, in search of pasture for their animals or by going into advance arrangement with crop farmers for collection of crop residue for their animals.

Transhumance pastoral system: this entails rearing of ruminants in settlements with a low level of crop cultivation. The transhumant pastoralists [25], often have a permanent homestead and base at where the older members of the community remain throughout the year. The herds are however regularly moved in response to seasonal changes in the quality of grazing and the tsetse-fly challenge, or in an attempt to exploit seasonal availability of pasture. The herds are however regularly moved in response to seasonal changes in the quality of pasture and the tsetse-fly challenge, or in an attempt to exploit seasonal the availability of pasture. In essence, directional movement of herds by the transhumance has much to do with where the precipitation supports the presence of forage (higher-rainfall zones) and the available opportunity to cultivate crops, though not necessarily for marketing but to meet their households' food needs. They however meet their other basic needs through the proceeds from sales of milk and other dairy products. While the women take care of the production and marketing of the dairy products in the local markets, the men take away majority of the herds in search of grazing, leaving the older members of the community with a nucleus of lactating females. The male herders however return at the start of the wet season to help with crop cultivation and where necessary, household income is supplemented with the sales of surplus male sheep or cattle.

Agro pastoral system: the agro-pastoralist practice entails conscious crop cultivation for both home consumption and marketing purposes alongside their reared cattle.[25] Agro-pastoralists hold land rights and cultivate acquired land for crops such as maize, sorghum, millet, yams and cassava, using family or hired labours. While cattle are still valued property, the size of herds are averagely smaller than that of other pastoral systems, usually about 30 head per household in southwest Nigeria [26], possibly because they no longer solely rely on cattle for their livelihood sustenance. In this case, the large ruminants are guided on grazing within a short distance range from their permanent place of abode while the women explored the lactating animals for milk and having it processed into local cheese (*wara*) and skimmed sour milk (*nono*) for consumption and local marketing. The Agropastoralists, [25], invest more in housing and other local infrastructure, and where their herds become large, they often send them away with more nomadic pastoralists. In addition, the agropastoralists often act as brokers in establishing cattle tracks and negotiation of "camping" of herds on farms, whereby crop residues can be exchanged for valuable manure, and as well for rearing of work animals, all of which add value to overall agricultural production.

Implications of the extensive and semi-intensive management systems: widespread adoption of extensive and semi-intensive systems of management for livestock in general. Ruminants, is believed to have been highly influenced by its relatively low cost of feeding

the animals. Although, the animals may feed on freely available pasture and forages, these systems exposed the livestock to environmental dangers, ranging across stealing and death of the animals [27]. In addition, these systems of livestock management accounted for the generally observed poor production performance of the local breeds of ruminants in terms of meat, milk and litter production in Nigeria, and does not allow for proper recording keeping of the animals production performance [28]. On the same note, [24,29] stress that farm animals kept under the extensive and semi-intensive management systems are burdened with high incidence of diseases, parasites, low productivity and small contribution to household's earnings.

5. Ruminants' pests and diseases and dynamics of management

Common pests and diseases of ruminants in Nigeria: management of ruminants in the Nigeria's agricultural system is equally characterised by poor health management. As a matter of fact, [30] maintenance and sustenance of healthiness of farm animals constitutes a major challenge to efficient livestock production among the Nigerian livestock entrepreneurs. Several surveys of ruminants kept by the rural farmers, and even in the markets, across the country revealed that the animals are mostly infected with one form of diseases/pests or the other [30-32]. According to Dipeolu (2010), most of the diagnosed livestock diseases in the country were identified to be bacteria, viral, fungi and parasitic-caused diseases. Specifically, the diseases include rinderpest, foot-and-mouth disease, and contagious bovine pleuropneumonia to be the common diseases of cattle in Nigeria. In addition to these are small number of cases of dermatophilosis, lumpy skin disease, papillomatosis and keratoconjunctivitis. [33] on the other hand, indicated that infections such as pneumonia, helminthiasis, peste des petits and enterotoxaemia as common diseases of sheep and goats in Nigeria. Assessment of seasonal pattern of tick load on Bunaji cattle under the traditional management by [31] revealed the dominant tick species as *Amblyomma variegatum*; *Boophilus decoloratus*, *Rhipicephalus (simus) senegalensis*, *R. tricuspis* and *Hyalomma spp.*

Although, the incidence and intensity of pests and diseases infestation in the ruminant farm animals may vary between the rainy and dry seasons, and Across Nigeria's ecological zones, the infestation portends a great danger for healthiness and productivity of the animals. According to Dipeolu (2010), livestock farmers may experience total loss of stock in death, or partial losses (through morbidity) in which the productivity of the animals becomes greatly reduced. Disease such as pneumonia, especially PPR, as the major causes of deaths in of ruminants; diarrhoea is mostly caused by parasitic gastroenteritis and PPR; and abortions and neonatal deaths are associated with starvation. In order to overcome these gruesome effects of pests and diseases on the ruminants, it becomes essential for the livestock farmers to either prevent or control the incidence of the diseases.

Pests and diseases control: in terms of control of livestock diseases, the livestock farmers hardly take up veterinary treatment of the affected animal(s), especially the small ruminant farmers, as they considered the veterinary treatment as too expensive to bear (Fabusoro, Lawal-Adebawale & Akinloye, 2007; Oluwafemi, 2009). In as much as the small ruminant

farmers may wish to save any diseased animals by taking to ethno-veterinary treatment, they may afford to lose the animal in death rather than expending their hard earned income on veterinary treatment of a diseased animal. The losses may be marginal in case of one or two of the animals are lost in death, but will be a great economic loss where about five or more of the animals are lost in quick succession as result of disease infestation (Dipeolu, 2010; Aina, 2012). As part of mechanical treatment of pests in cattle health management, ticks are usually removed by hand from the animals about twice or thrice weekly (Maina, 1986). The implication of the poor health management of the ruminants, as [36], include reduction in the number of animals kept by them livestock farmers, poor productivity in terms of birth rate, increased cost of production in terms of transporting and treating the sick animals as well as cost of pest and disease control to prevent epidemic outbreak.

On another note, ante-mortem and post-mortem inspection of the ruminants, particularly cattle, meant for slaughtering across the major abattoirs in the country further underline the poor state of ruminant, especially cattle, management in the country. The ante-mortem inspection of cattle to be slaughtered at a major abattoir in Ibadan, southwest Nigeria, between 1990 and 1994 showed that between 2.4% and 6.3% of the slaughtered cattle were pregnant (Dipeolu (2010). The implication of this, [37], was a tremendous loss of potential cattle offspring that would have contributed to the cattle population growth and meat supply profile of the country. A post-mortem study of another major abattoir based in Lagos, Nigeria, between 2004 and 2007 showed that the slaughtered cattle portends a health risk to beef consumers as about 1.91% of the slaughtered cattle had lesions of diseases comprising tuberculosis, fascioliasis, internal myiasis, dermatophilosis and cystercosis [38,30]. Laboratory examination of some of the meat-borne diseases showed that the meats are tainted with bacteria pathogens such as *Campylobacter spp.*, *Clostridium spp.*, *Escherichia coli*, *Salmonella serotypes*, and other enteric bacteria which may not cause clinical diseases in the animals but a potential threat to public health (Dipeolu, 2010).

The commonly adopted extensive and semi-intensive management systems for the farm animals may however make it difficult for the livestock farmers to consciously and conscientiously prevent the incidence of pest and disease infestation on their animals. This is based on the fact that, as the animals are allowed to freely roam the neighbourhood they readily contact infectious diseases or pests from other infected animals they mixed with in the course of fending for themselves, and may as well sustain injuries which in turn may eventually impair their health status and probably lead to their deaths (Lawal-Adebowale & Alarima, 2011).

6. Ruminant feeds and dynamics of utilization

Given the distinct nature of the ruminant's stomach, the farm animals heavily depend on forage or roughage as major feeds. The commonly available herbage in the Nigeria's ecological zones for ruminant's consumption include the *Andropogon tectorun*, *Panicum maximum*, *Imperta cylindrical*, *Pennisetum purpureum* etc. These grasses, which are fibrous in nature, are rich in cellulose and provide the ruminants a high level carbohydrate and some measures of vitamins and minerals. These grasses grow rapidly during the rainy season and

as such become abundant for the ruminant's consumption. The ruminant kept on free range thus feed freely on the naturally occurring forages. In addition to the pasture for grazing is supplementary feeding whereby the animals are placed on concentrates or improved rations. Supplementary feeding of cows significantly improve weights of the calves at birth (20.1kg) and at one year of age (107.9 kg) when compared with other animals not placed on supplements (with birth weight of 18.6 and 99.3 kg at one year). At 365 days of age, viability of calves from supplemented dams averaged 88% against 67% in calves from non-supplemented dams. Milk for calves and humans from dams on supplements averaged 128 and 179 litres/cow/year. Although, supplementary feeding did not improve calving intervals, it suggests that it every essential to place the ruminants on supplements for better productivity in term of milk and meat production.

Cost of supplementary feeding and non-availability of forage during the dry season greatly challenged efficient livestock feeding and management in Nigeria. Based on the need for adequate feeding, it is believed that about 85% of cost of livestock production is feeding, and given the poverty status of most livestock farmers and poor marketing system of farm animals, hardly could they take up supplementary feeding. This accounted for preference of extensive and semi-intensive systems of management. Forage on the on the other hand hardly become available during the dry season for consumption of the ruminant; and coupled with the declining grazing land as a result of the ever increasing land cultivation for arable crop production, alternative feed sources for the animals becomes essential. Utilisation of fodder from crop residues compensates for non-availability of grasses during the off-season. Other alternative to mitigate the effect of dry season feeding was the establishment of fodder bank whereby legumes are established and properly managed in a concentrated unit [41]. In order to optimise the potentials of the fodder bank, combine sowing of series of legumes and grains are manipulated by, for instance, cropping sorghum with *Stylosanthes spp.* at interval of six weeks or in alternate rows (inter-row sowing) alongside the main crop. A study of the grazing behaviour of cattle among the settled Fulani pastoralists showed that the farm animals utilized a wide range of different feed resources, notably sorghum and millet residues, during the dry season. As further indicated, the residue accounted for 12.6% of annual grazing time in Abet- a farming area, and for 6.6% in Kurmin-Biri- a grazing reserve. Browsing accounted for 1.4% annual grazing time in Abet, and 11.2% in Kurmin-Biri.

The fodder bank alternative however mainly benefits selected animals as not all animals are allowed to graze the bank. Fodder banks are designed not to supply forage year-round for an entire herd but rather to be used strategically for limited periods with selected animals, thus only pregnant and lactating animals are allowed to graze the bank. This suggests that, only a few ruminants had access to grazing or foraging during the dry season, and thus portends that dry season feeding constitutes a major challenge to livestock production in Nigeria. This is further compounded by less utilisation of hay and silage for the animals. Since the reared animals cannot survive without food, the implications of dry season feed problem include straying or deliberate guiding of the animals into farms for grazing thus leading to conflicts and violent clash between the crop and livestock farmers.

7. Future of ruminant livestock development in Nigeria

Although, ecological categorisation of the Nigeria has varied over time arising from changing trends of the commonly used natural factors [12], critical examination of the country's ecozones in relation to livestock distribution revealed that the ruminants are distributed throughout the three major ecozones in the country, namely the semi-arid, sub-humid and humid zones. The semi-arid region, characterised by average rainfall of 500 – 1000mm, prolonged dry season and sparsely distributed vegetations, is known to have greatly favoured livestock management in the country over the years. But with the changing climatic trends in the country, the sub-humid zone and its characteristics rainfall distribution range of 1000 – 1500mm, vegetative cover and moderately dry periods, now enclaves about 45% of the cattle in the country. In the same vein, studies have affirmed that the changing situation of tsetse flies infestation in the region, coupled with the prolonged rainfall period and good rainfall distribution range of more than 1500; has equally made the environment favourable to cattle and other small ruminants' management. This observation suggests that Nigeria's agro-ecologies have the potentials to favourably support livestock development in the country. This notwithstanding, there is need to consciously harness the environment to enhance the country's livestock development through the following:

Efficient livestock feeding: exploration of the environment and the country's breeds of ruminant potentials for livestock industry development are yet to be fully harnessed. The larger proportion of the ruminant livestock in Nigeria lies in the hands of herders who keep them under extensive and semi-intensive management systems, whereby the animals only rely on natural pasture and crop residue for survival. The ruminants may though have access to enough forage during the rainy season; it becomes a great deal of challenge to efficiently feed the animals during the dry season. In order to sustain the animals and ensure better productivity, there is need to explore the available natural pasture for silage and hay making such that the animals could be adequately fed during the dry season. In addition, there is need for paddock establishment, especially in the rural communities or reserved areas, for grazing by the ruminants. Although, forage constitutes the bulk of food needed by the ruminants, supplementary feeding is equally essential, especially for the lactating animals. In view of this, the farm animals' diet needs to be supplemented with meals such as cottonseed cake, wheat bran, molasses, drugs and mineral salt licks etc. In view of the fact that the indigenous cattle can gain an average of 0.9 to 1.2 kg per day on silage and concentrate rations [22], it suggests that the local breeds of cattle have the potentials for efficient utilisation of feed for better production performance.

Veterinary services: pests and diseases portend a major risk to livestock development in Nigeria, as incidence of pests and diseases are common in the country's livestock system. Although, prevention is known to be better than cure, it is invariably impossible to out rightly prevent the farm animals from being infested with either pests or diseases. This premise thus calls for establishment of sound veterinary services where infected animals could be taken care of. This requirement has been a great challenge in the Nigeria's livestock management system. Apart from inadequate veterinary services in the country, current

veterinary therapy in Nigeria is suffering from both scarcity and the high cost of drugs thereby making it impossible to save the livestock industry as it were in the country. Although, the livestock herders may take to ethno-veterinary treatment of their animals, this becomes possible only when the symptoms become manifested, and by then a serious internal damage or impairment of the animals' health might have taken place. The implication of this is that, it may be impossible to adequately treat the animals or ensure proper clinical remedy. This situation thus calls for government and non-government organisations intervention for development of the veterinary services such that it becomes affordable to be patronised by the stock herders. The easiest and most rational solution to the problem of livestock health is to develop acceptably effective drugs from reasonably inexpensive sources for use as supplements to commercial drugs. The veterinary traditional medicine practices may still be of value in the animal health care, but should be subjected to scientific investigation for efficacy. In the light of this, it becomes important to have baseline data about traditional ethno-veterinary practices for ethno-veterinary medical information generation. Combination of the orthodox and ethno-veterinary care could thus save the animals of impaired health and enhance productivity.

Livestock breeding: livestock breeding is crucial to livestock development globally. Good system of management of the resulting breeds/offspring from the crosses – in terms of intensive keeping, good health care and feeding, is however crucial to better performance of the animals. Adopted poor management systems for farm animals in Nigeria and most other developing countries certainly accounted for the poor production performance of the local ruminant breeds. The same poor management system accounted for poor performance of the exotic breeds imported into the country in the 70 (Blench, 1999). Just as the exotic breeds are known to have performed excellently well in their countries of origin under good management practice, results from experimental stations results from stations and universities farms across Africa showed that productivity of the animals could be improved under more intensive management. Similarly, where crossing has been successful under good management practice, dairy cattle dairy cattle portrayed a linear increase in milk yield as the exotic gene is increased up to the 7/8 level. The F₁ Friesian x Bunaji cow (50%) gives 1684 kg, the 3/4 (75%) gives 1850 kg and the 7/8 gives 2051 kg of milk in a lactation of about 260 days. This suggests that good practices and cross breeding with the exotic breeds of desirable quality stand the chance of enhancing the country's livestock development.

Profitable livestock marketing system: among all other agricultural enterprise production, livestock management remains a delicate and expensive venture; it however has the potentials of profitable returns. The livestock is delicate in the sense that the animals need to be adequately fed, not just with any ration, but a balanced ration for productive performance. In the same vein, the health of the animals cannot be forgone as healthiness of the animals is not only a vital for production performance, but survival and sustenance of the livestock venture. Placement of the ruminant on a good ration is certainly at a great deal of cost or financial incurment, the poor economic status of the ruminant keepers in the country however makes it extremely difficult to build the livestock industry. This situation may however be reverted through efficient marketing system of livestock and its products

and by-products. Poor marketing system is one of the bane livestock development in the country, whereby the animals are locally sold either directly as live animal or meat.

Livestock research development: development of the Nigeria's livestock industry will not magically occur, but through conscientious efforts in livestock research. This calls for baseline data generation about the breeds of ruminants in the country, their production performance and marketing. Other information-base that must be established include the common livestock feeds (pasture and feed meal supplements) and common pests and diseases of livestock and their effects on the animals. This will harm the livestock research institutes with the salient information as bench mark for research work and generation of livestock innovation. Social scientists inclusion in livestock research development is crucial as this disciplines helps to ascertain the psychology of the ruminant keepers and their economic status to adopt and adapt generated livestock innovation. Similarly, the social scientist, especially the economists, will help to ascertain the economic implications of the innovations and the market driving force for ensuring efficient production and marketing of livestock and its products.

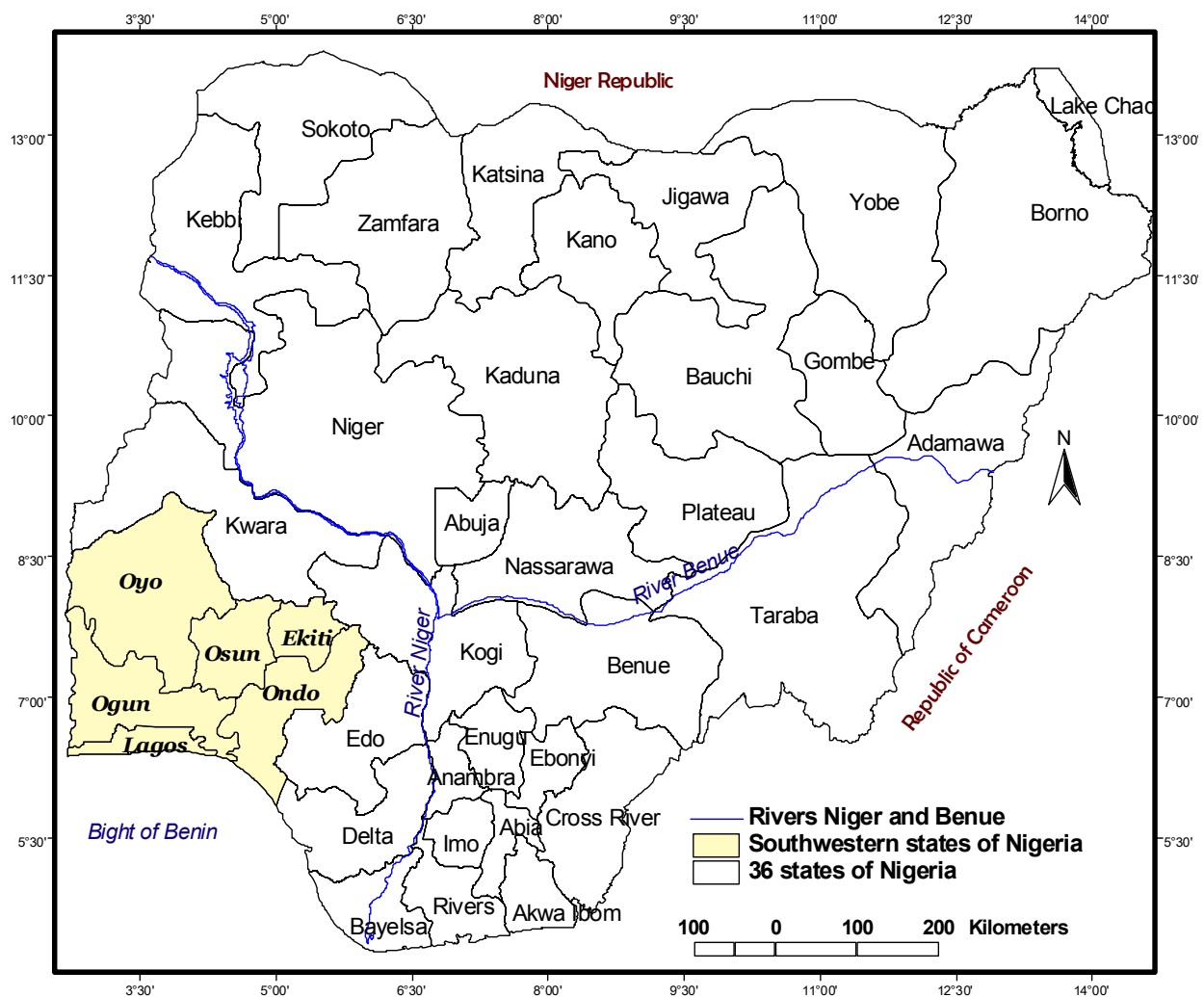
8. Livestock development in Nigerian: Policy recommendation

Over 90 percent of the ruminant livestock lies in the hands of rural livestock farmers, especially the pastoralists, in Nigeria. The animals though, are of considerable economic importance in Nigeria's economy, poor management system of the stock has greatly hindered the development of the livestock. And given the role of the livestock in sustenance of rural livelihoods and employment generation, farm traction and transportation, it becomes essential for serious attention to be given the livestock sector for productive and sustainable development in the country. In this regard, the livestock research institutes, comprising National Animal Production Research Institute (NAPRI), National Veterinary Research Institute (NVRI), and Nigerian Institute for Trypanosomiasis Research (NITR), need to be strengthened in terms of qualified and adequate research personnel and equipment for quality research on livestock related issues. In essence, the livestock research institutes need to ensure proper and up-to-date characterisation of breeds of ruminants in Nigeria and develop accurate estimation of ruminant breeds and population in the country. In essence, the livestock research institutes need to ensure proper and up-to-date characterisation of breeds of ruminants occurring pests and diseases in livestock, and the lethal effects of ill-health causative agents on the animals.

To effectively achieve this, research in livestock development should go beyond the traditional field visit to animal sheds for physical livestock condition monitoring and data collection. The country needs to harness the emerging information and communication technology (ICT) devices that allow for remote and continuous monitoring of livestock conditions and collection of data on the animals without physically being in the animals' sheds. With this, efficient data and information on farm animals' health status, productivity, feeding regime and feed conversion could be readily monitored. Similarly, documentation of particular livestock pedigree, characterisation of breeds of farm animals and simulation of

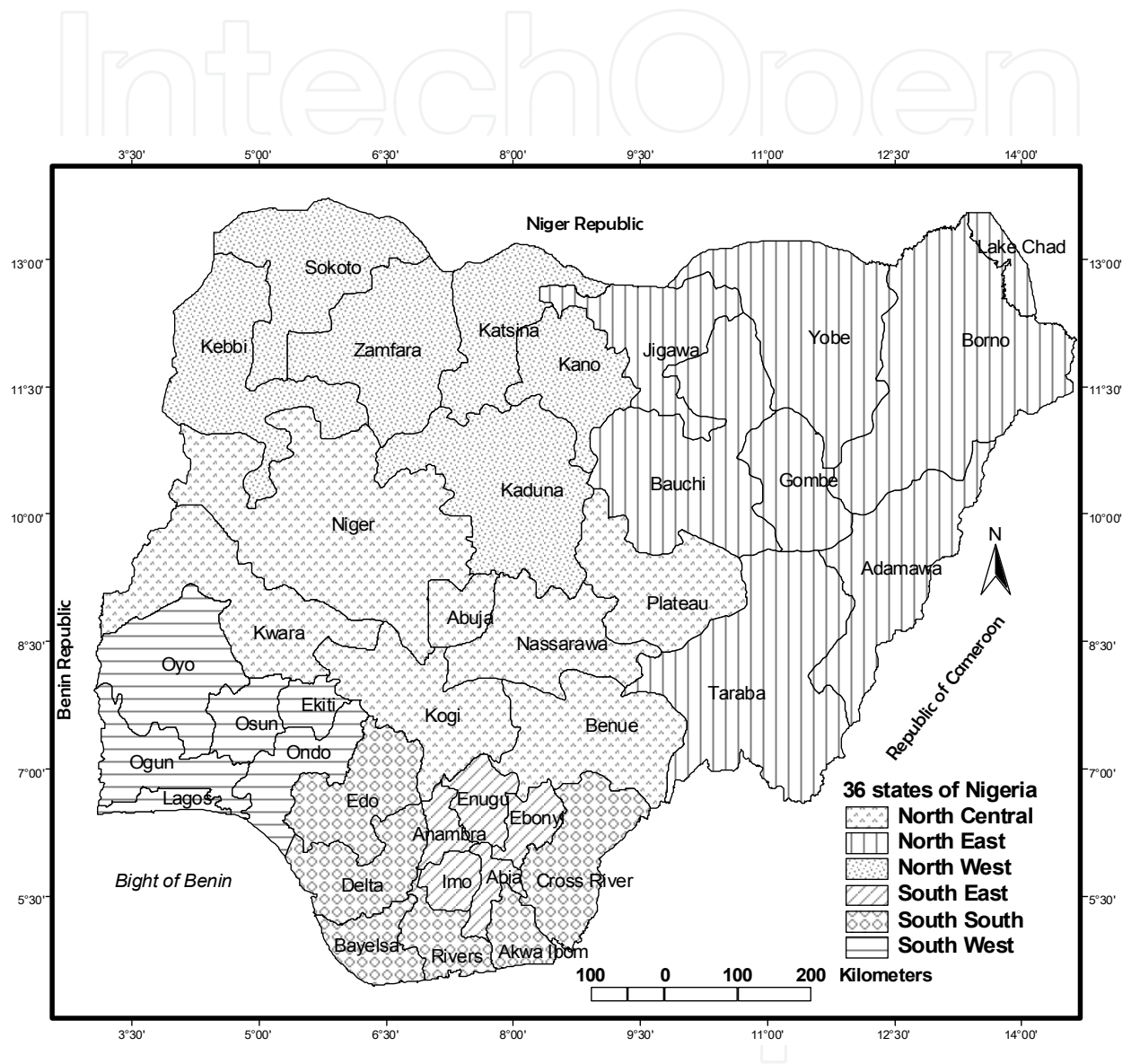
the animals' characteristics and production performance could be enhanced for effective management and transformational development of the livestock sector. In addition to this is need for better development of better grazing system and management practices in the country's livestock sector. Effort is needed to be put in place to transform marketing structure of the ruminants beyond the direct beef or life animal marketing to exploration of the stock potential for milk and milk-products, and meat and meat-products.

Appendix 1



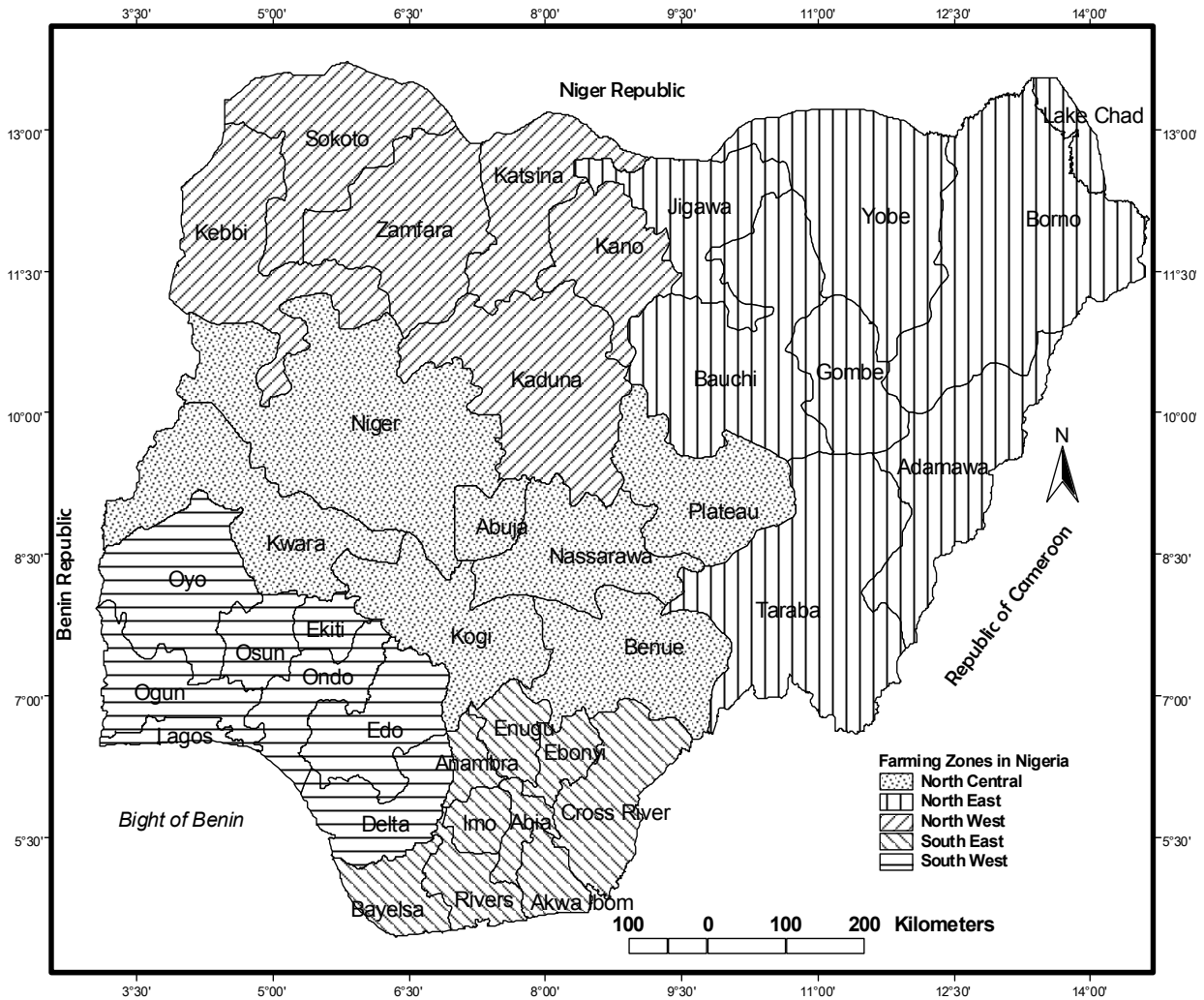
Map of Nigeria showing the natural division into three regions by rivers Niger and Benue

Appendix 2



Map of Nigeria showing the six geopolitical zones in the country for political administration

Appendix 2



Map of Nigeria showing the five farming zones in the country for agricultural development administration

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