

## **Research Paper**

# **Pastoralists' grazing systems and eco-related outcomes in Yewa Division of Ogun State, Nigeria**

## *Sistemas de pastoreo y su impacto en el ecosistema en Yewa Division, Estado de Ogun, Nigeria*

O.A. LAWAL-ADEBOWALE<sup>1</sup>, I.A. AYINDE<sup>2</sup>, J.A. OLANITE<sup>3</sup>, V.O.A. OJO<sup>3</sup>, O.S. ONIFADE<sup>3</sup>, A.O. JOLAOSO<sup>3</sup>  
AND O.M. ARIGBEDE<sup>3</sup>

<sup>1</sup>*Department of Agricultural Extension and Rural Development, Federal University of Agriculture (FUAAB), Abeokuta, Ogun State, Nigeria. [unaab.edu.ng](http://unaab.edu.ng)*

<sup>2</sup>*Department of Agricultural Economic and Farm Management, FUAAB, Abeokuta, Ogun State, Nigeria. [unaab.edu.ng](http://unaab.edu.ng)*

<sup>3</sup>*Department of Pasture and Range Management, FUAAB, Abeokuta, Ogun State, Nigeria [unaab.edu.ng](http://unaab.edu.ng)*

### **Abstract**

In Nigeria heavy dependence of cattle on natural pasture for grazing has resulted in the emergence of a range of grazing systems and ecosystem challenges. Consequently this study appraised the grazing systems in use and their eco-relational outcomes for sustainable cattle management in Yewa Division of Ogun State. A total of 143 pastoralists agreed to take part in the survey and provided data on the commonly practiced grazing systems and ecological effects through the use of an interview format, interactive discussions plus field observations. The study outcome showed continuous, unpatterned rotational and transverse grazing systems were commonly practiced. The study also revealed that the employed grazing systems were independent of size of the cattle herds. While cattle were healthy under the grazing systems employed, soil degradation occurred in some instances. While the grazing systems employed by the pastoralists were satisfactory from the animal perspective, studies are needed to minimize the extent of soil degradation in the area.

**Keywords:** Ecosystems, natural pasture, sedentary pastoralists, sustainable cattle management.

### **Resumen**

En Nigeria, la alta dependencia del ganado de pasturas naturales ha resultado en el surgimiento de una amplia gama de sistemas de pastoreo e impactos en el ecosistema. El estudio se realizó en Yewa Division, estado de Ogun, Nigeria, con el objeto de evaluar los diferentes sistemas de pastoreo en uso y sus implicaciones ecológicas para el manejo sostenible del ganado. En total se entrevistaron 143 productores pastoriles utilizando formularios, discusiones presenciales y observaciones en el campo. El estudio mostró que los sistemas más frecuentes fueron el pastoreo continuo, el pastoreo rotacional sin patrón definido, y un pastoreo llamado 'transverso' (en búsqueda de forraje, animales son llevados a áreas distantes, regresando el mismo día). El estudio también mostró que los sistemas de pastoreo son independientes del tamaño de los rebaños de ganado. Aunque los animales presentaban buenas condiciones de salud, la degradación de los suelos era evidente en algunos casos. Si bien los sistemas de pastoreo practicados son satisfactorios en términos de producción animal, se necesitan estudios para minimizar el grado de degradación de los suelos en el área.

**Palabras clave:** Degradación del suelo, manejo sostenible de ganado, pastos naturales, productores de ganado sedentarios.

---

Correspondence: O.A. Lawal-Adebowale, Department of Agricultural Extension and Rural Development, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.  
Email: [deboakals@yahoo.com](mailto:deboakals@yahoo.com)

## Introduction

Cattle production, which traditionally entails breeding and management of cows and bulls for meat, milk and possibly skin production, alongside raising of calves, constitutes the economic resource-base of the Fulani pastoralists and is vital for survival and livelihood sustenance (Otchere 1984; Ingawa 1986; Rota et al. 2012). Sustainable production depends on feed quality and adequate feeding of the stock. Although feed rations vary, pasture is crucial to sustainable management of ruminants (Atanga et al. 2013). According to Buckingham et al. (2013), pasture is the cheapest source of feed for ruminant livestock and a well-managed pasture can supply more than 90% of the energy requirements for sheep and beef cattle and 70% for dairy cows.

In contrast with the situation in developed countries where land is owned/leased by farmers and cattle are confined to paddocks, in developing countries, especially those in sub-Saharan Africa, pastoralists are often nomadic or transhumant and solely dependent on the natural grassland for cattle, moving about in search of pasture for grazing. The quantity and quality of the natural pasture depends on soil type, the duration of the rainy season, amount of rainfall received and grazing pressure exerted by cattle grazing the grassland (Kemp et al. 2013). According to Awa et al. (2003), regions with annual rainfall of 750–1,500 mm can potentially support cattle rearing because of the length of the growing season and the resulting pasture production. As pastures deteriorate during the dry season, pastoralists must go further afield to seek pasture and water for their stock (ILC 2007; Rota et al. 2009). While transhumant pastoralists traverse large tracts of land and/or long distances in search of forage for their stock (Ndathi et al. 2011), the sedentary pastoralists remain within or close to their communities placing significant pressure on the available pastures.

According to Roberson (1996) and Belsky and Blumenthal (1997), livestock grazing can reduce herbaceous plant cover and litter, result in soil disturbance and compaction, reduce rate of water infiltration and increase rate of soil erosion. In the same vein Greenwood and McKenzie (2001) indicated that cattle grazing, especially under permanent pasture or rangeland, can lead to soil compaction. According to Howery et al. (2000), light stocking rates not only allow the grazing animal increased dietary selectivity throughout the year, but also greatly reduce grazing pressure on grassland.

As sedentary pastoralism in Yewa Division of Ogun State is widespread, owing to the ready availability of natural pasture in the host communities, pastures have

been grazed continuously for many years. This grazing system(s) might have been an intuitive strategy for ensuring their economic survival and maintaining social relationships with their host communities (Omotayo et al. 1999; Adebayo and Olaniyi 2008; Blench 2010; Oladele and Oladele 2011). In the light of this, we deemed it necessary to document the grazing systems adopted by the settled pastoralists in Yewa Division of Ogun State and the eco-related outcomes, which have permitted continuous cattle management in the area. The strategy adopted had the following objectives:

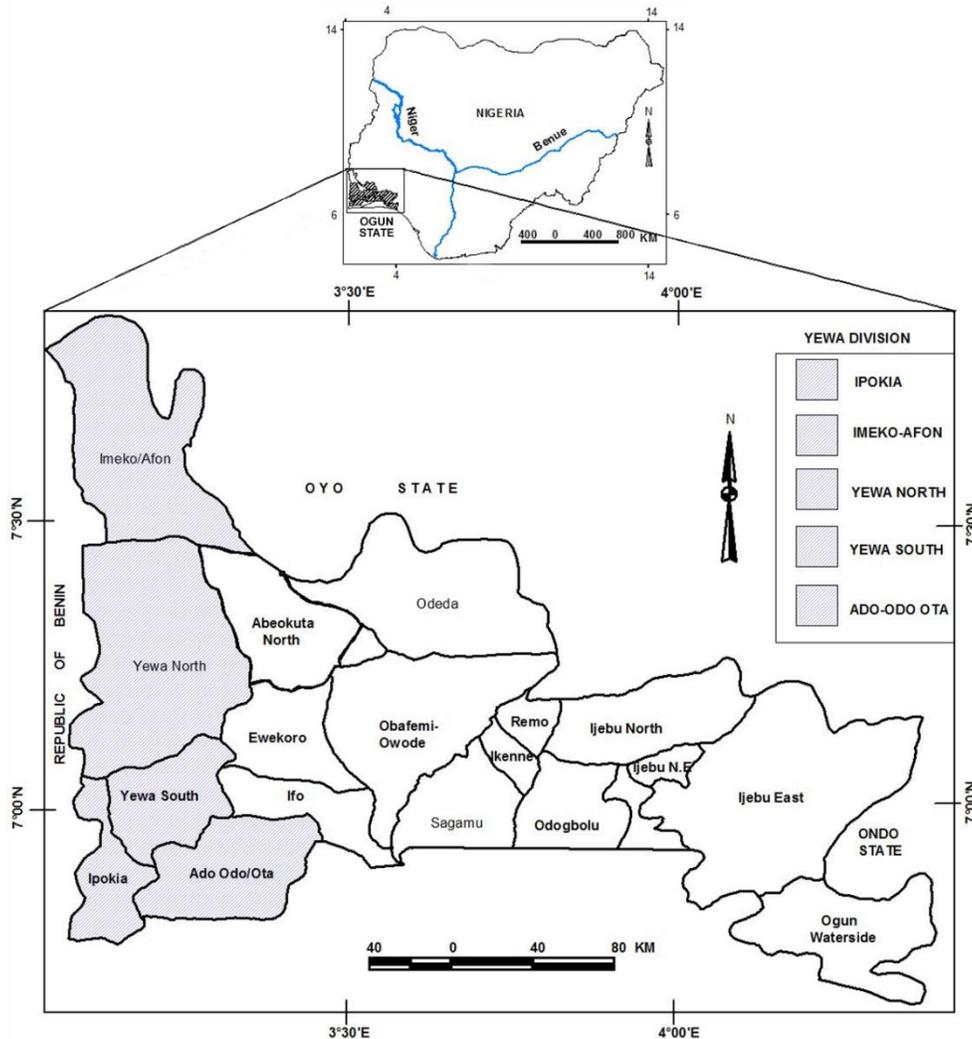
1. Describe the socioeconomic characteristics of the settled pastoralists in Yewa Division of Ogun State;
2. Document natural pasture distribution in the study area;
3. Ascertain the grazing systems employed by the settled pastoralists; and
4. Ascertain the eco-related outcomes of the grazing systems for cattle management.

## Research methodology

### Study area

The study was conducted in Yewa Division of Ogun State. The Division is composed of 5 so-called Local Government Areas, namely Yewa South, Yewa North, Imeko-Afon, Ado-Odo/Ota and Ipokia, with a total land mass of about 5,878 km<sup>2</sup> (Figure 1). Rainfall in Yewa Division has a bi-modal distribution (early rains from April to July and late rains in September and October) with a total of about 1,300 mm/yr (Apantaku et al. 2003). The Division is largely characterized by wide distribution of natural grasses/pasture and other herbaceous plants and shrubs (derived savanna), and is considered as attractive to pastoralists for grazing or for settlement. Economic activities are largely farming with maize, cassava, vegetables and spices as dominant crop production. Cattle production in the area is by sedentary Fulani pastoralists and transhumant pastoralists.

The unit of analysis for the study comprised the settled Fulani pastoralists in Yewa Division of Ogun State. Due to non-availability of a comprehensive list of the pastoralists in the study area, a non-probability sampling technique based on selection of as many respondents as were willing to interact with the researchers (Bailey 1982) was employed. A total of 143 pastoralists were eventually selected across the surveyed 13 communities (Oja-Odan, Ebute, Iselu, Igbo-Iro, Egua, Gbogo, Oke-Odan, Seke-Aje, Agbo, Asa, Ibeku, Moro and Igbokoto). Primary data on the pastoralists' socioeconomic characteristics, the



**Figure 1.** Map of Ogun State showing the study area, Yewa Division.

natural pasture distribution across the designated areas for grazing, grazing systems employed by the pastoralists and grassland management of the designated grazing areas were collected by means of an interview, interactive discussion and field observation.

The interview format was subjected to validity testing before commencement with a view to ensuring it would accurately measure the concepts of grazing system and grassland management. To achieve this, items of the developed interview format were carefully considered by members of the research team using acquired experiences on similar studies and current developments in the literature. The reliability of the instrument was established by pre-testing the interview guide on trial-sampled pastoralists in the study area. The outcomes allowed researchers to modify the instrument by eliminating ambiguous questions to ensure all respondents would interpret questions in a similar way.

The data collected were subjected to both descriptive and inferential statistical analyses. Descriptive tools such as frequency counts and percentages in tables form the basis for summarizing the data collected in relation to the respondents and discussion of the results.

## Results

### *Respondents' personal characteristics*

Assessment of the personal characteristics of the surveyed sedentary pastoralists (Table 1) shows that: all were male; 70% were within the age range of 31–50 years; and 90% of households contained 5–10 persons. While 54.5% of the pastoralists had Qur'anic education, a further 30% had no formal education and all practiced the Islamic religion. The data also show that more than 85% of the pastoralists had lived in the study area for at least 11 years.

**Table 1.** Respondents' personal characteristics (n = 143).

Variable	Frequency	%
Gender		
Male	143	100
Female	0	0
Age		
≤30	22	15.3
31–40	57	39.9
41–50	43	30.1
≥51	21	14.7
Educational level		
No formal education	43	30.1
Qur'anic education	78	54.5
Vocational education	0	0
Primary school	15	10.5
Secondary school	7	4.9
Tertiary school	0	0
Religion		
Islam	143	100
Christianity	0	0
Traditionalist	0	0
Years of residence		
≤10	21	14.7
11–20	71	49.6
21–30	36	25.2
31–40	15	10.5
≥41	0	0

#### *Cattle production characteristics among the Fulani pastoralists*

Table 2 shows the commonly reared breeds of cattle among the settled pastoralists in Yewa Division of Ogun State. White Fulani (Bunaji) were most common, being reared by 84.6% of respondents, Sokoto Gudali by 68.7%, Adamawa Gudali by 55.2% and Muturu by 28% of respondents. Size of cattle herds varied widely with the most common herd size being 61–80 head (44.1%), while a further 20.3% had 81–100 head, and only a few (13.3%) had more than 100 head of cattle (Table 2). Assessment of ownership of cattle by respondents showed that 79.7% of them actually owned the cattle in their custody, while a further 12.6% jointly owned the cattle with others and the remaining 7.7% were share keepers of the animals or keeping the animals on behalf of the owners. The majority of respondents (79%) had more than 11 years of experience in cattle management, with more than 15% having managed cattle for more than 20 years (Table 2).

**Table 2.** Cattle production characteristics among Fulani pastoralists (n = 143).

Variable	Frequency <sup>1</sup>	%
Breed of cattle		
White Fulani (Bunaji)	121	84.6
Sokoto Gudali	98	68.5
Adamawa Gudali	79	55.2
Muturu	41	28.7
Herd size (head)		
≤40	9	6.3
41–60	23	16.1
61–80	63	44.1
81–100	29	20.3
≥101	19	13.3
Ownership of cattle		
Self-owned	114	79.7
Jointly-owned	18	12.6
Share keepers	11	7.7
Experience of cattle management (years)		
≤10	30	21.0
11–15	52	36.4
16–20	39	27.2
≥21	22	15.4

<sup>1</sup>Multiple responses.

#### *Pasture distribution on the designated grazing areas*

Table 3 shows the common grasses, *Pennisetum purpureum*, *Panicum maximum*, *Andropogon gayanus* and *Cynodon dactylon*, available for cattle grazing and found in Yewa Division as well as the naturalized legume *Stylosanthes hamata*. Among the grasses, *Pennisetum purpureum* and *Panicum maximum* were the most common as indicated by 93.0 and 90.2% of respondents. Almost 82% of the respondents indicated the presence of *Stylosanthes hamata* in the grazed areas, while *Andropogon gayanus* (72.0%) and *Cynodon dactylon* (67.8%) were also present.

**Table 3.** Pasture species distribution in the designated grazing areas (n = 143).

Species	Frequency <sup>1</sup>	%
<i>Pennisetum purpureum</i>	133	93.0
<i>Panicum maximum</i>	129	90.2
<i>Andropogon gayanus</i>	103	72.0
<i>Cynodon dactylon</i>	97	67.8
<i>Stylosanthes hamata</i>	117	81.8

<sup>1</sup>Multiple responses.

### Grazing systems adopted by the pastoralists

Table 4 lists the grazing systems practiced by the surveyed pastoralists. It shows that all (100%) pastoralists practiced continuous grazing, while 83, 96 and 16% practiced also unpatterned rotational, transverse and zero grazing (cut-and-carry), respectively.

**Table 4.** Grazing systems adopted by pastoralists (n = 143).

Variable	Frequency <sup>1</sup>	%
Continuous grazing	143	100
Unpatterned rotational grazing	119	83.2
Transverse grazing	131	91.6
Zero grazing (cut-and-carry)	23	16.1

<sup>1</sup>Multiple responses.

The grazing systems are defined as follows:

- Continuous grazing: Animals graze a pasture for a whole grazing season with no rest to the pasture (e.g. for regrowth, reseeded).
- Rotational grazing: Animals move from one pasture to the next, allowing the grazed pasture a planned rest period for forage plants to regrow and accumulate storage carbohydrates. 'Unpatterned' refers to the fact that the duration and frequency of grazing and rest periods is managed flexibly.

- Transverse grazing: Animals are moved farther away from the pastoralist's homestead in search of pasture to graze and return home on the same day.
- Zero grazing (cut-and-carry): Animals do not graze at all; rather they are stall-fed with forage that is cut and carried to them.

### Outcome of the grazing systems practiced by pastoralists

Examination of the eco-related outcomes of the pastoralists' grazing systems for cattle management and sustenance (Table 5) showed that the adopted grazing systems, namely continuous, rotational, transverse and zero (cut-and-carry), allowed for periodic regeneration of pasture over time ( $\bar{X}$  = 3.08; SD = 0.62) and made pasture available for a considerable period of the year ( $\bar{X}$  = 3.30; SD = 0.31). Cattle remained in good health ( $\bar{X}$  = 4.63; SD = 0.60) with good marketability ( $\bar{X}$  = 4.87; SD = 0.33) and herd sizes were generally maintained with few mortalities ( $\bar{X}$  = 4.34; SD = 0.90). While there was some destruction of soil condition ( $\bar{X}$  = 2.68; SD = 0.77) and limited damage to cultivated crops ( $\bar{X}$  = 4.78; SD = 0.64) in the area, some conflicts between resident farmers and the sedentary pastoralists ( $\bar{X}$  = 3.22; SD = 0.83) in the study area did arise.

**Table 5.** Eco-related outcomes of the grazing systems practiced by pastoralists (n = 143).

Variable	Rating score <sup>1</sup>			Mean	SD
	1–1.67	1.68–3.33	3.34–4.99		
Grassland regeneration potential	Low regeneration	Regeneration for some period	All-year-round regeneration	3.08	0.62
State of animal health	Many stock are diseased	Some stock are diseased	Stock population remains healthy	4.63	0.60
Regularity of feed availability to the stock	Prolonged period with no pasture available	Pasture limited for only a short period (during rainy season)	All-year-round pasture availability	3.30	0.31
Stability of herd size against losses	High losses in herds	Some stock are lost	Herd size remains intact	4.34	0.90
Market acceptability of stock	Low/no market acceptability	Some stock acceptable for market	High market acceptability	4.87	0.33
Conflict status with farmers	Escalated conflicts	Mild conflicts occurred	Absence of conflicts	3.22	0.83
Cattle management sustenance	Cattle management is an unsustainable venture	Cattle management is barely sustainable	Cattle management is sustainable	4.19	0.91
Impact on soil condition	Serious destruction of soil condition	Limited destruction of soil condition (could still be cultivated)	No soil structure is destroyed	2.68	0.77
Impact on farm status	Serious farm destruction	Limited destruction of farms	No destruction of farms	4.78	0.64

<sup>1</sup>Rating score: 1–1.67 = less impact; 1.68–3.33 = moderate impact; 3.34–4.99 = high impact.

### Test of study hypotheses

Chi-square tests of the relationship between the practiced grazing systems and the number of cattle owned by the pastoralists showed no significant association (Table 6). This implies that the number of cattle kept by pastoralists was independent of the grazing system practiced in Yewa Division of Ogun State. Grazing systems adopted by individual pastoralists were not specially designed but were spontaneous, depending on where pasture was available in the area for the animals. This explains why a continuous grazing system seemed to be the norm among pastoralists, whereby they allowed their herds of cattle to graze continuously as long as pasture was available in the field. The observed unpatterned rotational grazing system was adopted when pasture on a given area became exhausted. Cattle were then moved elsewhere for grazing before returning to the earlier grazed pasture once it had regenerated. The transverse grazing system however was employed during the dry season as pastures failed to regenerate, and pastoralists were compelled to travel afar in search of pasture for stock. The zero grazing (cut-and-carry) strategy was an option for stock that were either sick or milking and as such were not taken out for grazing.

**Table 6.** Chi-square test of the relationship between the grazing systems practiced and the number of cattle owned by the pastoralists.

Variable	$\chi^2$	df	Sig	DS
Unpatterned rotational grazing	7.133	4	0.129	NS
Transverse grazing	1.961	4	0.743	NS
Zero grazing (cut-and-carry)	4.454	4	0.244	NS

Note: Continuous grazing was not computed due to constant responses on the item.

### Discussion

An overview of the outcomes from this study shows that aspects related to animals achieved higher scores (4.19–4.87) than those relating to pastures (3.08–3.30) and soils (2.68). This tends to suggest that pastoralists are more concerned about the wellbeing of their livestock than the environment they graze on. Since livestock generally belong to individuals and are a measure of wealth and status in the community and land tends to be communally owned, this situation is not surprising. The mean score for soil condition indicates that quite significant soil degradation was occurring. This cannot be allowed to continue and steps must be taken to endeavor to reverse the trends.

Assessment of the socioeconomic characteristics of the settled pastoralists showed that cattle rearing is largely a male business. The observed dominance of male pastoralists in the study area is associated with the social norm that vests authority in men as family or household heads, thereby giving men the cultural power for decision making. According to [FAO \(2001\)](#), the great majority of pastoral societies are patrilineal and male-dominated, basically because of the need to have their herds sustained within their genealogical camps and to prevent the movement of family stock to a new camp by their women on marriage. Although pastoral women take certain decisions on the care and management of cattle ([Mulugeta and Amsalu 2011](#); [Nosheen et al. 2011](#); [Rota et al. 2012](#)), males are responsible for movement of cattle from place to place for grazing and marketing of the stock ([FAO 2001](#)). Movement of the cattle from place to place for grazing by all pastoralists is underscored by the need to feed the animals. Unlike the nomadic pastoralist who travels long distances to obtain grazing and has no designated place of residence, cattle movement by the settled pastoralists is limited to the geographical bounds of Yewa Division, where they reside. On this note they certainly return to *Gaa*, as their settled base is generally referred to, on a daily basis. [Omotayo et al. \(1999\)](#) pointed out that movement of cattle for grazing is mostly done by the young people among the pastoralists, based on the fact that herding is a laborious task and as such could be readily undertaken by youths with strength and vigor.

The household membership range of 4–6 persons is similar to the findings of [Otte et al. \(2012\)](#) and [Omotayo et al. \(2013\)](#) that settled Fulani pastoralists in Southwest Nigeria often keep a fairly large household size. According to [Vabi \(1991\)](#), large households usually comprise parents, (adult) children and blood-related brothers. This practice is attributed to the cultural and/or religious beliefs that large household size is a sign of Allah's (God's) blessings, and in turn ensures sufficient hands are available for the care and management of the cattle and, where possible, farm cultivation and management. The pastoralists have limited formal education because they rarely attend school but mostly take up Qur'anic education. [Omotayo et al. \(2013\)](#) also observed that acquisition of Qur'anic education was common for the major proportion of Fulani pastoralists in Southwest Nigeria. This situation is probably a function of their Islamic religion, which requires a good understanding of the Arabic language for Qur'anic reading and worship. The low incidence of formal education among the pastoralists ([Ezeomah 1987](#)) may be due to their inability to see the link between education and cattle

management. As suggested by [Otte et al. \(2012\)](#), this educational situation indicates a low human capital among the pastoralists.

Notwithstanding the portrayed low human capital among the pastoralists, they had informally or culturally developed cattle management skills in terms of breed selection and herding. Among the breeds of cattle reared by pastoralists in Yewa Division of Ogun State, the White Fulani (Bunaji) was the most common. On a similar note, [Otchere \(1984\)](#) found that this breed of cattle constituted about 51% of the estimated 9.3 million cattle in Nigeria. The preponderance of White Fulani and Sokoto Gudali ([Blench 1999](#); [Omotayo 2002](#); [Akande et al. 2010](#)) among the surveyed pastoralists in the study area has been attributed to their adaptation to the agro-climate of Yewa Division and market acceptability of the animals produced for sale. An additional factor is the social value of these breeds of cattle to the pastoralists' families in terms of milk production, which the Fulani women often rely on for production of local cheese (*wara*) and milk (*nono*) as a means of income generation. The finding that herd size of the pastoralists was usually less than 100 animals conforms with the observation of [Vabi \(1991\)](#) that average herd size among Fulani pastoralists was 73.6 cattle. This observation implies that the surveyed pastoralists kept this size of herd for social and economic purposes. Interactive discussion with pastoralists revealed that they maintain a population of cattle that can easily be managed sustainably. In specific terms, determinants of herd size among the pastoralists included available grazing space, i.e. where to keep the animals, the feed resources and competent hands to herd the cattle.

While cattle ownership among the surveyed pastoralists in Yewa Division of Ogun State took different dimensions, i.e. sole or joint ownership and share keepers, all were geared toward their economic and livelihood sustenance. While individual cattle owners took decisions on day-to-day management and the accruing gains on the cattle, major decisions on cattle management, especially on marketing, and share of the accrued gains were made between the joint owners. Consequently, the individual pastoralist and one of the joint cattle owners personally took responsibility for herding the cattle for grazing and provision of other essential care. However, the share keepers do not actually own the cattle in their custody but keep the ruminants on behalf of the real owners and were described by [Johnson et al. \(2005\)](#) as 'contract graziers'. Care of the ruminants by the share keepers is usually on contractual agreement with the actual owners. The share keepers are thus remunerated for management of the cattle in their care either in cash or kind by the cattle owners. Interactive discussion with the share keepers reveals that

this practice made it possible for them to make a living from what is paid them by the cattle owners, as well as allowing them to have cattle to manage. Grazing livestock for other farmers is a way to make a land investment return additional dollars to the land owner. According to [Johnson et al. \(2005\)](#), contract grazing requires livestock managers to possess management skills to achieve the results that livestock owners will expect. Given the mean length of experience with cattle management was 13.8 years, one might assume the surveyed cattle farmers had developed the necessary skills to provide insight or in-depth information on cattle-related issues to produce acceptable and desired outcomes for both parties.

An adequate supply of grass is known to be one of the major factors essential to ensuring sustainable production by grazing cattle ([MLA 2007](#); [Boval and Dixon 2012](#); [Kemp et al. 2013](#)). According to [Aken'Ova \(1985\)](#), grasses constitute the basic form of feed for all classes of ruminant animals in the tropical regions. The type and nature of the available grasses however depends on the agro-climate of a particular region. For instance, the West African humid forest zones, of which part of Nigeria is one, are widely covered with a mixture of typical grass species, such as *Imperata cylindrica*, *Andropogon gayanus*, *Pennisetum* spp. and *Hyparrhenia* spp. ([Atta-Krah and Reynolds 1988](#)) that readily serve as feed materials for ruminants. An additional factor, highlighted by [McGufficke and McCormick \(2010\)](#), i.e. rainfall distribution, is a major determinant of persistence and production of these grasses in the tropics. Given the fertility of soils and adequate rainfall regime in Nigeria, pastoralists who manage stock effectively should have adequate natural pasture to support stock during the rainy season but pastures in tropical areas often are of inferior nutritional value during the dry season.

With dependence of the sedentary pastoralists on natural pasture for cattle grazing in the study area, sustainable grazing systems must be available to ensure attainment of quality livestock development. Our survey revealed that grazing systems adopted by the surveyed sedentary pastoralists included continuous grazing, un-patterned rotational grazing, transverse systems and zero grazing (cut-and-carry) systems. A continuous grazing system, as described by [Howery et al. \(2000\)](#), entails all-year-round grazing of a pasture area including the dormant/dry season, i.e. no deliberate attempt is made to leave a portion of the pasture ungrazed, at least for an interval within the growing period. Our results show that all surveyed pastoralists in Yewa Division of Ogun State allowed their cattle to graze available pasture throughout the year on some areas within their settled domain, while a large percentage also practiced rotational grazing and

transverse systems. Unless well organized, continuous grazing can result in overgrazing of the desirable species in a pasture with resultant negative ecological impacts ([Blanchet et al. 2003](#)), although this grazing system could be more viable where appropriate stocking rates are ensured ([Howery et al. 2000](#)). For the surveyed pastoralists to sustain their cattle on this grazing system, it suggests that they must have ensured manageable stocking rates of their cattle for grazing in the study area.

An alternative to the continuous grazing system is a transverse grazing system whereby the pastoralists travel over a wide range of land and long distances with their stock for grazing. This is similar to transhumance pastoralism whereby herds are regularly moved between fixed points with a view to exploiting the seasonal availability of pastures ([FAO 2001](#)). To distinguish this practice from nomadism, the FAO takes the view that the transhumance pastoralists often have a permanent homestead base where the older members of the community remain throughout the year. In essence, the surveyed pastoralists will always return home after traversing these long distances for grazing of their stock. This practice is contingent on having an available expanse of grassland for grazing. Traversing a wide range of land not only ensures feed availability for the stock but also prevents overgrazing of a particular area ([UNHCR/IUCN 2005](#)). A surprising 91.6% of the surveyed pastoralists in the study area led their stock over a wide range of grassland to obtain adequate grazing. This practice becomes necessary during the dry season when pasture becomes scarce following rainfall cessation and onset of the dry season. The cattle are usually led by the pastoralists beyond the proximity of their community of residence in search of grazing of green forage or fresh grasses as they cross the open lands.

In contrast with the traditionally patterned rotational grazing system, whereby areas are divided into a large number of sectionalized paddocks and grazing livestock are shifted from section to section in a predetermined sequence, is the unpatterned rotational grazing system employed by the surveyed pastoralists in Yewa Division of Ogun State. Rather than partitioning the grassland into blocks with fences, pastoralists allowed the cattle to graze freely on a given part of the available grassland until they perceived the pasture was being excessively grazed, which might be some days, when they moved the livestock to a different area. This sequence was repeated on different areas. The practice of unpatterned rotational grazing by the pastoralists is possible during the rainy season in the study area when grasses regenerate rapidly as a result of high temperatures and adequate soil moisture for growth and development. The low incidence of zero-grazing (stall feeding, cut-and-carry) system (16.1%) by pastoralists was

not surprising as this practice becomes necessary only for those cattle which cannot be taken out for grazing due to illnesses or when suckling a small calf. In these situations, the animals are stalled and grasses are harvested by hand from the field and fed to the animals. In addition, pastoralists can resort to cutting grasses in swampy areas, particularly during the dry season, to feed their stock.

While the grazing system employed is crucial to ensuring sustainable feeding of the cattle, the system always impinges on the stability of the grassland and the environment in general. In our study area, continuous grazing of the natural pasture had reduced the available litter during the grazing period, which supports the finding of [Roberson \(1996\)](#) that grazed areas tend to have lower litter and soil organic matter levels than ungrazed enclosures. Against this backdrop, [Howery et al. \(2000\)](#) indicated that grazing systems such as rotational and transverse systems create the opportunity for grazed pasture or grassland to regenerate, particularly during the rainy season, when stock are taken elsewhere for grazing. This strategy was also espoused by [Rota \(2009\)](#), who stated that spelling of pasture areas by movement of stock is an essential way of ensuring sustainable use of the rangeland.

On another note, movement of animals from place to place in search of pasture can also prevent build-up of diseases and/or pests in a particular grazing area. According to [Omotayo et al. \(1999\)](#) and [Rota \(2009\)](#), pastoralists have adopted these grazing systems as a combination of providing the stock with feed and avoiding disease outbreaks and reducing livestock mortality. This probably contributed to the observed healthy status of the reared cattle. Discussion of this issue with pastoralists revealed that close association and contact with livestock, as occurs with regular movement of the cattle, makes it possible to quickly detect animals that might have become sick. In addition, since pastoralists must remain with their animals during grazing, it is possible to monitor animal movements and prevent losses or theft. This submission goes in line with [Omotayo et al. \(1999\)](#) indicating that movement of cattle for grazing within an established grazing orbit is strictly monitored by the pastoralists, at worst by the young boys in the households. Since pastoralists are with their livestock while grazing on a daily basis they are in an excellent position to monitor the condition of both the pastures and the soil.

Providing good quality forage for cattle ensures that animals gain weight and remain healthy, which in turn enhances their market acceptability. In fact, cattle buyers are known to purchase cattle from pastoralists in Yewa Division of Ogun State, because of their heavy weights. This supports the suggestion by [Blench \(2010\)](#) that the

demand for quality beef by residents of the urban centers in Southern Nigeria stimulates pastoralists to produce fat animals for slaughter. Adequate levels of pasture for grazing by the cattle make it possible to keep stock healthy and ensure they are attractive to buyers, making cattle raising a profitable or worthwhile venture.

While conflict between pastoralists and farmers in Nigeria and beyond arising from farm grazing is a significant social issue, the grazing systems employed by the surveyed pastoralists have somehow reduced conflict between the sedentary pastoralists and farmers in Yewa Division of Ogun State. Interactive discussion with the pastoralists showed that the conflict was reduced because cattle were often removed from farmed areas and in some cases outside the community for grazing, thereby reducing tension and apprehension between them and the farmers. The pastoralists however acknowledged that their animals sometimes strayed into cultivated farms unknowingly, resulting in mild conflict. Careful control of cattle in the process of grazing from one place to the other limited the damage caused to farms. In the same vein, pastoralists ensured that communal water sources for drinking, which usually consist of wells or closest river to the villages, were not contaminated by their stock. This is usually ensured by leading the cattle to other water sources, such as streams and rivers that were farther away from villages or those not used for drinking by the community members. This action thus prevents or minimizes direct or indirect pollution of the drinkable water sources and in effect protects human health against water-related diseases.

While deposition of cattle dung on soil during grazing can improve soil fertility, the mass movement of cattle across fields can destroy soil structure. According to [Warren et al \(1986\)](#) and [Whitmore \(2001\)](#) grazing cattle compact the soil structure and destroy the land surface on which they regularly travel. This ecological degradation becomes heightened in places with heavy concentrations of herds of cattle for grazing ([Adams 1996](#); [Blench and Marriage 1998](#)). This notwithstanding, the surveyed pastoralists were of the opinion that their cattle had limited impact on soil degradation as their cattle were rarely concentrated on cultivated land and were moved regularly on most grassland areas.

## **Conclusion and Recommendations**

Cattle rearing is an important economic and social venture among the Fulani pastoralists in Nigeria. The change from a traditionally nomadic lifestyle to a settled or sedentary existence for many of them, particularly in the southern part of the country, has changed the systems of grazing

employed. While the sedentary pastoralists in Yewa Division of Ogun State still move their cattle from place to place for grazing, it is usually in and around their communities, i.e. within a much more restricted area. Although rotational, continuous and transverse grazing systems are employed, there is greater risk that overgrazing of areas will occur. Our study has shown that farmers consider that soils are being damaged. In-depth scientific studies into the soil condition of the areas that are regularly grazed by the pastoralists are warranted. Knowledge generated from such research could be used to educate pastoralists on the impact of grazing on soil condition of their areas and the need for more control of grazing, e.g. by building fences to restrict access to given areas at appropriate times of year.

## **Acknowledgment**

The entire members of the research team greatly appreciate the financial support of the Federal Government of Nigeria in conjunction with the Directorate of Grant Management of the Federal University of Agriculture, Abeokuta for conduct of the research: Mitigating the Impact of Pastoral Grazing on the Natural Ecosystem and Rural Livelihoods in Yewa Division of Ogun State.

## **References**

- Adams M. 1996. When is ecosystem change land degradation? Comments on land degradation and grazing in the Kalahari. Network Paper No. 39e, ODI (Overseas Development Institute), London, UK.
- Adebayo OO; Olaniyi OA. 2008. Factors associated with pastoral and crop farmers conflict in derived savannah zone of Oyo State, Nigeria. *Journal of Human Ecology* 23:71–74. DOI: [10.1080/09709274.2008.11906057](https://doi.org/10.1080/09709274.2008.11906057)
- Akande FA; Takeet MI; Makanju OA. 2010. Haemoparasites of cattle in Abeokuta, South West Nigeria. *Science World Journal* 5(4):19–21. [goo.gl/EjaC2D](http://goo.gl/EjaC2D)
- Aken'Ova ME. 1985. The use of improved pastures in intensive small ruminant production. Proceedings of The National Animal Production Research Institute's conference on small ruminant production, October 6–10, 1985, Shika-Zaria, Nigeria.
- Apantaku SO; Lawal-Adebawale OA; Omotayo AM. 2003. Rainfall distribution pattern and its implications for seasonal farming calendar of agricultural extension services in Ogun State, Nigeria. *An International Journal of Agricultural Sciences, Sciences, Environment and Technology (ASSET)* 3(4):77–87. [goo.gl/PQG1Rg](http://goo.gl/PQG1Rg)
- Atanga NL; Treydte AC; Birner R. 2013. Assessing the sustainability of different small-scale livestock production systems in the Afar Region, Ethiopia. *Land* 2:726–755. DOI: [10.3390/land2040726](https://doi.org/10.3390/land2040726)

- Atta-Krah AN; Reynolds L. 1988. Utilization of pasture and fodder shrubs in the nutrition of sheep and goats in the humid tropics of West Africa. In: Timon VM; Baber RP, eds. Sheep and goat meat production in the humid tropics of West Africa. FAO (Food and Agriculture Organization of the United Nations), Rome, Italy. [goo.gl/Tsz3TQ](http://goo.gl/Tsz3TQ)
- Awa DN; Njoya A; Logtene YM; Ndomadji JA; Onana J; Asongwed-Awa A; Ngo Tama AC; Djoumessi M; Loko B; Bechir AB; Delafosse A; Maho A. 2003. Livestock production systems in the semi-arid savannah of the Central African sub region. CIRAD (Centre de coopération internationale en recherche agronomique pour le développement), Montpellier, France. [hal.archives-ouvertes.fr/hal-00137977](http://hal.archives-ouvertes.fr/hal-00137977)
- Bailey KD. 1982. Methods of social research. 2nd Edn. The Free Press, New York, USA. [trove.nla.gov.au/version/39724202](http://trove.nla.gov.au/version/39724202)
- Belsky AJ; Blumenthal DM. 1997. Effects of livestock grazing on stand dynamics and soils in upland forests of the interior west. Conservation Biology 11:315–327. DOI: [10.1046/j.1523-1739.1997.95405.x](https://doi.org/10.1046/j.1523-1739.1997.95405.x)
- Blanchet K; Moechnig H; DeJong-Hughes J. 2003. Grazing systems planning guide. University of Minnesota Extension Services, St. Paul, MN, USA. [goo.gl/aG2TM4](http://goo.gl/aG2TM4)
- Blench R. 1999. Traditional livestock breeds: Geographical distribution and dynamics in relation to the ecology of West Africa. Working Paper 122. ODI (Overseas Development Institute), London, UK. [goo.gl/QwYTMM](http://goo.gl/QwYTMM)
- Blench R. 2010. Conflict between pastoralists and cultivators in Nigeria. Review paper for DFID, Nigeria. Cambridge, UK. [goo.gl/NGuPYj](http://goo.gl/NGuPYj)
- Blench R; Marriage Z. 1998. Climatic uncertainty and natural resource policy: What should the role of government be? Briefing Paper No. 31. ODI (Overseas Development Institute), London, UK. [goo.gl/kq2XSb](http://goo.gl/kq2XSb)
- Boval M; Dixon RM. 2012. The importance of grasslands for animal production and other functions: A review on management and methodological progress in the tropics. Animal 6:748–762. DOI: [10.1017/S1751731112000304](https://doi.org/10.1017/S1751731112000304)
- Buckingham S; McCalman H; Powell H. 2013. Grazing systems. Fact sheet. Farming Connect, Aberystwyth, Wales, UK. [goo.gl/75v1Mk](http://goo.gl/75v1Mk)
- Ezeomah C. 1987. The settlement patterns of nomadic Fulbe in Nigeria: Implications for educational development. Deanhouse Ltd, Crewe, UK.
- FAO (Food and Agriculture Organization of the United Nations). 2001. Pastoralism in the new millennium. FAO Animal Production and Health Paper No. 150. FAO, Rome, Italy. [goo.gl/EtwC3W](http://goo.gl/EtwC3W)
- Greenwood KL; McKenzie BM. 2001. Grazing effects on soil physical properties and the consequences for pastures: A review. Australian Journal of Experimental Agriculture 41:1231–1250. DOI: [10.1071/EA00102](https://doi.org/10.1071/EA00102)
- Howery LD; Sprinkle JE; Bowns JE. 2000. A summary of livestock grazing systems used on rangelands in the Western United States and Canada. College of Agriculture and Life Sciences, University of Arizona, Tucson, AZ, USA. [hdl.handle.net/10150/144717](http://hdl.handle.net/10150/144717)
- ILC (International Land Coalition). 2007. Mobile livelihoods, patchy resources and shifting rights: Approaching pastoral territories. ILC, Rome, Italy. [goo.gl/HFsG2S](http://goo.gl/HFsG2S)
- Ingawa SA. 1986. Socio-economic aspects of Abet farming households. Paper 12. In: von Kaufmann RR; Chater S; Blench R, eds. Livestock systems research in Nigeria's subhumid zone. International Livestock Centre for Africa, Addis Ababa, Ethiopia. [hdl.handle.net/10568/49820](http://hdl.handle.net/10568/49820)
- Johnson T; Kemp DR; Guodong H; Xiangyang H; Michalk DL; Fujiang H; Jianping W; Yingjung Z. 2013. Innovative grassland management systems for environmental and livelihood benefits. Proceedings of the National Academy of Sciences of the United States of America 110:8369–8374. DOI: [10.1073/pnas.1208063110](https://doi.org/10.1073/pnas.1208063110)
- McGufficke BR; McCormick LH. 2010. Tropical perennial grasses for northern inland NSW. Primefact No. 1051. NSW Department of Primary Industries, Orange, NSW, Australia. [goo.gl/ydNLMj](http://goo.gl/ydNLMj)
- MLA (Meat & Livestock Australia). 2007. Grazing management for productive pastures. Tips and Tools Series. MLA, North Sydney, NSW, Australia. [goo.gl/MKQuVa](http://goo.gl/MKQuVa)
- Mulugeta M; Amsalu T. 2014. Women's role and their decision making in livestock and household management. Journal of Agricultural Extension and Rural Development 6:347–353. [goo.gl/kc6GYv](http://goo.gl/kc6GYv)
- Ndathi AJN; Nyangito MM; Musimba NKR; Mitaru BN. 2011. Climate variability and dry season ruminant livestock feeding strategies in Southeastern Kenya. Livestock Research for Rural Development 23, Article#199. [goo.gl/9zvaP3](http://goo.gl/9zvaP3)
- Nosheen F; Ali T; Anwar HN; Ahmad M. 2011. Participation of rural women in livestock management and their training needs in Potohar region. Pakistan Veterinary Journal 31:40–44. [goo.gl/NRYMAz](http://goo.gl/NRYMAz)
- Oladele OT; Oladele OI. 2011. Effect of pastoralist-farmers conflict on access to resources in savanna area of Oyo State, Nigeria. Life Science Journal 8(2):616–621. DOI: [10.7537/marslsj080211.86](https://doi.org/10.7537/marslsj080211.86)
- Omotayo AM. 2002. A land-use system and the challenge of sustainable agro-pastoral production in Southwestern Nigeria. International Journal of Sustainable Development & World Ecology 9:369–382. DOI: [10.1080/13504500209470131](https://doi.org/10.1080/13504500209470131)
- Omotayo AM; Adu IF; Aina AB. 1999. The evolving sedentary lifestyle among nomadic pastoralists in the humid zone of Nigeria: Implications for land use policy. International Journal of Sustainable Development & World Ecology 6:220–228. DOI: [10.1080/13504509909470012](https://doi.org/10.1080/13504509909470012)
- Omotayo AM; Dipeolu MA; Ekpo UF. 2013. Health consequences of lifestyle changes among settled Fulani pastoralists in Southwestern Nigeria. Research Report. Wellcome Trust, London, UK.
- Otchere EO. 1984. Traditional cattle production in the subhumid zone of Nigeria. Paper 6. In: von Kaufmann RR; Chater S; Blench R, eds. Livestock systems research in Nigeria's subhumid zone. International Livestock Centre for Africa, Addis Ababa, Ethiopia. [hdl.handle.net/10568/49820](http://hdl.handle.net/10568/49820)

- Otte J; Costales A; Dijkman J; Pica-Ciamarra U; Robinson T; Ahuja V; Ly C; Roland-Holst D. 2012. Livestock sector development for poverty reduction: An economic and policy perspective. Livestock's many virtues. FAO (Food and Agriculture Organization of the United Nations), Rome, Italy. [lccn.loc.gov/2012476933](http://lccn.loc.gov/2012476933)
- Roberson E. 1996. Impact of livestock grazing on soils and recommendations for management. California Native Plant Society, Sacramento, CA, USA.
- Rota A. 2009. Livestock and pastoralists. Livestock Thematic Papers: Tools for project design. International Fund for Agricultural Development, Rome, Italy. [goo.gl/mbDSrF](http://goo.gl/mbDSrF)
- Rota A; Calvosa C; Liversage H. 2009. Livestock and land. Livestock Thematic Papers: Tools for project design. International Fund for Agricultural Development, Rome, Italy. [goo.gl/fzHAXh](http://goo.gl/fzHAXh)
- Rota A; Chakrabarti S; Sperandini S. 2012. Women and pastoralism. Livestock Thematic Papers: Tools for project design. International Fund for Agricultural Development, Rome, Italy. [goo.gl/85S47Y](http://goo.gl/85S47Y)
- Sharp H; Rinehart L. 2005. Grazing contracts for livestock. ATTRA Sustainable Agriculture. NCAT (National Center for Appropriate Technology), Butte, MT, USA. [goo.gl/bhBr6m](http://goo.gl/bhBr6m)
- UNHCR/IUCN (United Nations High Commissioner for Refugees/World Conservation Union). 2005. Livestock-keeping and animal husbandry in refugee and returnee situations: A practical handbook for improved management. UNHCR & IUCN, Geneva & Gland, Switzerland. [goo.gl/vntA9K](http://goo.gl/vntA9K)
- Vabi MB. 1991. Social relationships between indigenous cultivators and Fulani graziers in the derived savannah of Southwest Nigeria and the Northwest Province, Cameroon. Ph.D. Dissertation. University of Ibadan, Ibadan, Nigeria.
- Warren SD; Thurow TL; Blackburn WH; Garza NE. 1986. The influence of livestock trampling under intensive rotation grazing on soil hydrologic characteristics. Journal of Range Management 39:491–495. DOI: [10.2307/3898755](https://doi.org/10.2307/3898755)
- Whitmore A. 2001. Impact of livestock on soil. In: Hartung J; Wathes CM, eds. Livestock farming and the environment: Proceedings of workshop 4 on Sustainable Animal Production, held at Hannover, September 28, 2000. Landbauforschung Völkenrode Special Issue 226. Bundesforschungsanstalt für Landwirtschaft (FAL), Braunschweig, Germany. [goo.gl/U3zT9D](http://goo.gl/U3zT9D)

(Received for publication 30 June 2017; accepted 24 February 2018; published 31 May 2018)

© 2018



*Tropical Grasslands-Forrajes Tropicales* is an open-access journal published by *International Center for Tropical Agriculture (CIAT)*. This work is licensed under the Creative Commons Attribution 4.0 International (CC BY 4.0) license. To view a copy of this license, visit <https://creativecommons.org/licenses/by/4.0/>