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Pasture-Animal Indices and Stocking Rates of some Adamawa State Grazing Sites, Nigeria

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ABSTRACT

This research was carried out to determine the pasture – animal indices and stocking rates of three grazing sites in Adamawa State, Nigeria. The reserves are Gongoshi in Mayo-Belwa, Guyaku in Gombi and Chekelek in Madagali Local Government Areas. Forage yield involved cutting desirable herbage from within a series of quadrats of $1m^2$ laid randomly. Stocking rate and grazing capacity was assessed using the feed requirement of a matured zebu weighing 250kg estimated to be 6.0kg of dry matter per day. The forage yield obtained was 266kgDM/ha for Gongoshi, 237.70kgDM/ha for Guyaku and 237.20kgDM/ha for Chekelek range sites accordingly. Results of the stocking rates of the range sites were 0.584 Tropical Livestock Unit per hectare per year (TLU/ha/yr) and 0.622 TLU/ha/yr for Gongoshi and Guyaku (both in the guinea savanna) and 0.552 TLU/ha/yr for Chekelek, located in the sudan savanna.A proper grazing plan that will take into consideration the actual carrying capacity of the range sites should be developed. This will balance rangeland resources availability with animal number.

KEYWORDS: Forage yield, pasture-Animal indices, stocking rates, range sites.

Introduction

Changes in rangeland ecosystems in most cases are as a result of some climatic and anthropogenic factors which could improve or destroy them. Barbier *et al.*(1994) reported minimum temperature, Plant Available Moisture (PAM), Plant Available Nutrients (PAN), fire, and herbivores as determinants of natural rangeland vegetation. The combination of these factors prevents the establishment and growth of trees and other woody plants in high densities, although their significance varies in different parts of the world. The South African and American (north and south) rangelands are good examples of soil and climate favouring the production of grass and herbaceous species, rather than trees. Elsewhere, the evolution of large herbivores is related to the creation and extension of rangelands.

Rangelands are used primarily today for livestock production. All other forms of land use, such as foraging, recreation or military activity, are of minor importance (Solbrig, 1993). In most continents, livestock production has been intensified through the application of new technologies and practices, such as the use of fertiliser, the seeding of high-yielding grass and legume species, modifications to the natural water regime, and heavy grazing through high stocking rates. The principal goal of intensive ranching is to provide enough high quality fodder to sustain high stocking rates. For that reason, natural pastures are replaced

partially or totally by planted pastures with a high proportion of cultivated legumes. Such pastures cannot be maintained without fertilisation and may also require irrigation during the dry season (Solbrig, 1996). These practices have transformed the rangeland ecosystems generally in the direction of reducing biodiversity, which allows the producer to focus biomass production towards the needs of a particular species.

Generally, market forces are the underlying causes of transformation and intensified use of rangelands. If only economic costs and benefits are considered in decision-making, rapid loss of biodiversity will not be halted. The short term negative effect of converting rangelands into artificial (species poor) pastures or agricultural fields are low, and the benefits in increased productivity are sufficiently high as to outweigh the negative effects (Solbrig, 1996). Human activities are also shaping the extent and location of rangelands. On one hand, the original extent of natural grasslands has been extended by human activities.

Range professionals and ranchers are better recognising that successful range management depends on stocking rangelands so that adequate vegetation residues remain to protect rangeland health, maintain multiple values, and ensure economic viability (Galt *et al*., 2004). Sutherland (1999) noted that the problem of range managers is one of designating a specific number of animals that can graze on a unit of land year after year without injury to the land. Early efforts to determine grazing capacities focused on examination of the vegetation by combining occurrence of each species with forage value ratings to arrive at an index of forage productivity. Plant abundance was also used and measured in terms of cover. This procedure according to Lacey *et al*. (1994) falls short of being a practice guide to grazing capacity examination because: -

i. cover is not a good index to production, low growing spreading plants being over-valued as compared to tall erect ones.
ii. there are great variations in individual estimates on the sample plot.
iii. forage-rating indices (proper-use factors) vary greatly from place to place and are often optimistic.
iv. forage acres thus determined are not of equal value in support for grazing animals among different range types and areas even when numerically equal. Because of the shortfall of plant abundance and cover for estimating grazing capacities.

Clipping forage according to Galt *et al*. (2004) is often resorted to a range to provide an index of forage production and further concluded that clipping is confined to the key areas to provide factual data to support more general information developed in extensive surveys. This study therefore, provides the pasture-animal indices and stocking rates of some Adamawa State grazing sites with a view to determining the number of animals to be stocked and the quantity of forage to be made available.

Materials and Methods

Study Area

Adamawa State is located at the North eastern part of Nigeria. It lies between latitude 7^{o} and 11^{o}N of the equator and between longitude 11^{o} and 14^{o}E of the Greenwich Meridian. It shares common boundary with Taraba State in the south and west, Gombe State in its north-west and Borno to the north. Adamawa State has an international boundary with Cameroun Republic along its eastern boarder. The State covers a land area of about 39,741km^{2}(Adebayo, 1999).The major vegetation formations in the State are the Guinea and the Sudan savanna. Within each formation is an interspersion of thickets, tree savanna, open grass savanna and fringing forests in the river valley (Akosim *et al*., 1999).

Gongoshi range site (Fig. 1) is located in Mayo-Belwa Local Government area of Adamawa State in the northeastern part of Nigeria. The local government covers a land area of about 1,768km^{2} while the range site covers a land area of about 8,000ha. It lies between latitude 9^{o}3'N and longitude 12^{o}3'E. Guyaku range site (Fig. 2) is located in Gombi Local Government area of Adamawa State in the northeastern part of Nigeria. The local government covers a land area of 1,101km^{2} while the range site covers a land area of about 6,250ha. It lies between latitude 10^{o}30'N and longitude 12^{o}30'E. Chekelek range site (Fig. 3) located in Madagali local government area of northeastern Nigeria covers a land area of about 5,750 ha. It lies between latitude 11^{o}N and longitude 13^{o}E (Adebayo, 1999).

Study Design

The two ecological zones in the State (Guinea and Sudan savanna)were delineated. Rangeland sites representative of each zone were selected. In view of the relative size of Guinea savanna to Sudan savanna in the State, two range sites were purposely selected in the Guinea savannaand one in the Sudan savanna. The area of each site wasdetermined and all the ecological investigations carried out on the selected rangeland sites.

Forage Yield Evaluation

Forage yield evaluation followed the method outlined by Kershaw (1979) and Khobe and Ayuba (2010). The procedure involved cutting desirable herbage from within a series of quadrats (1m^{2} in size) laid randomly at ten (10) points along each transect. Cutting height varied from ground level to about 10cm above ground level depending on the growth pattern of the herbaceous plant. The cut herbage was put in a sample bag for subsequent drying and weighing until a constant weight was attained in order to obtain the dry matter yield. The figures obtained from all the sample quadrats were summed and divided by the number of quadrats used to obtain the mean yield of the desirable herbage per quadrat. The yield for the entire study area was extrapolated from the mean yield per quadrat.

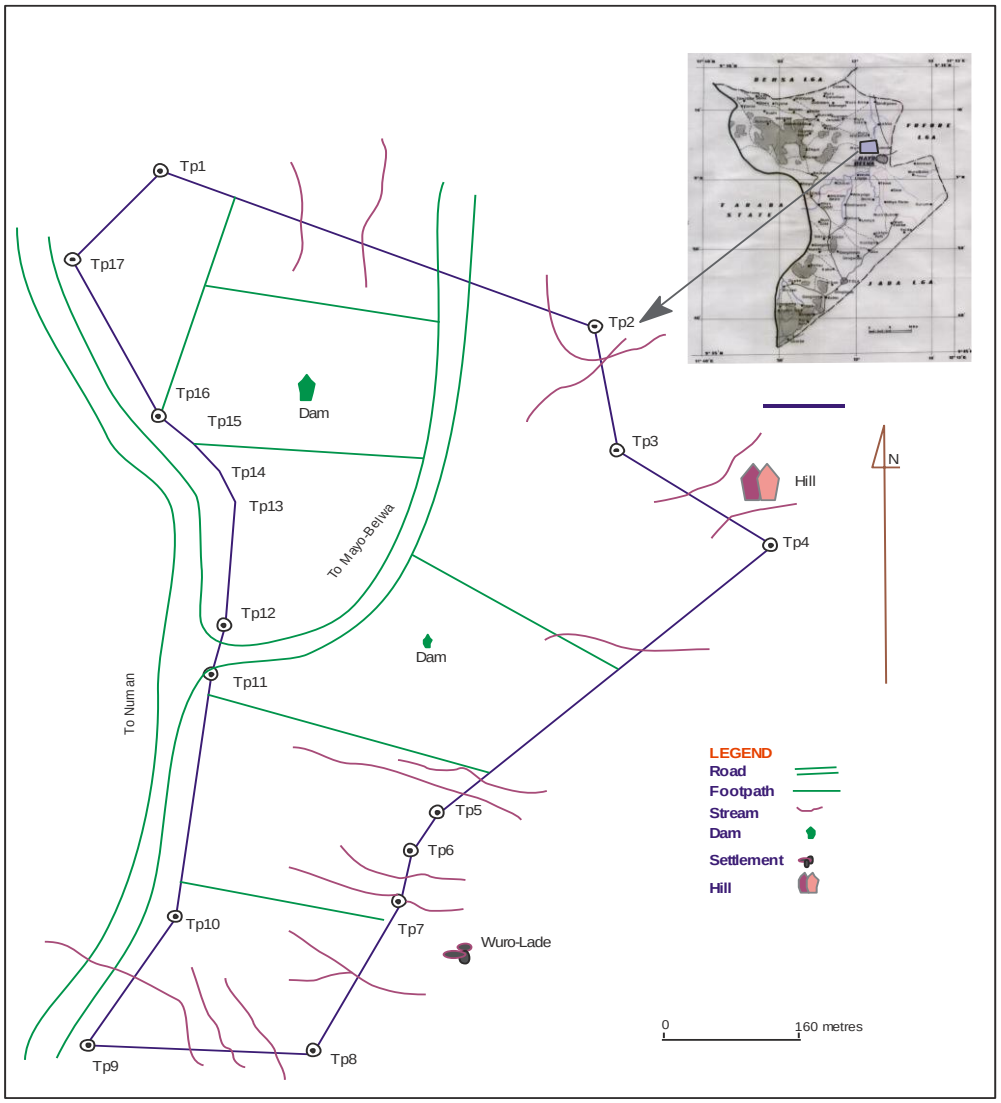

Figure 1: Sketch Map of Gongoshi Grazing Reserve, Mayo-Belwa Local Government Area, Adamawa State (Area = 8,000ha)
Source: Adamawa State Ministry of Livestock and Nomadic Settlement (2010)

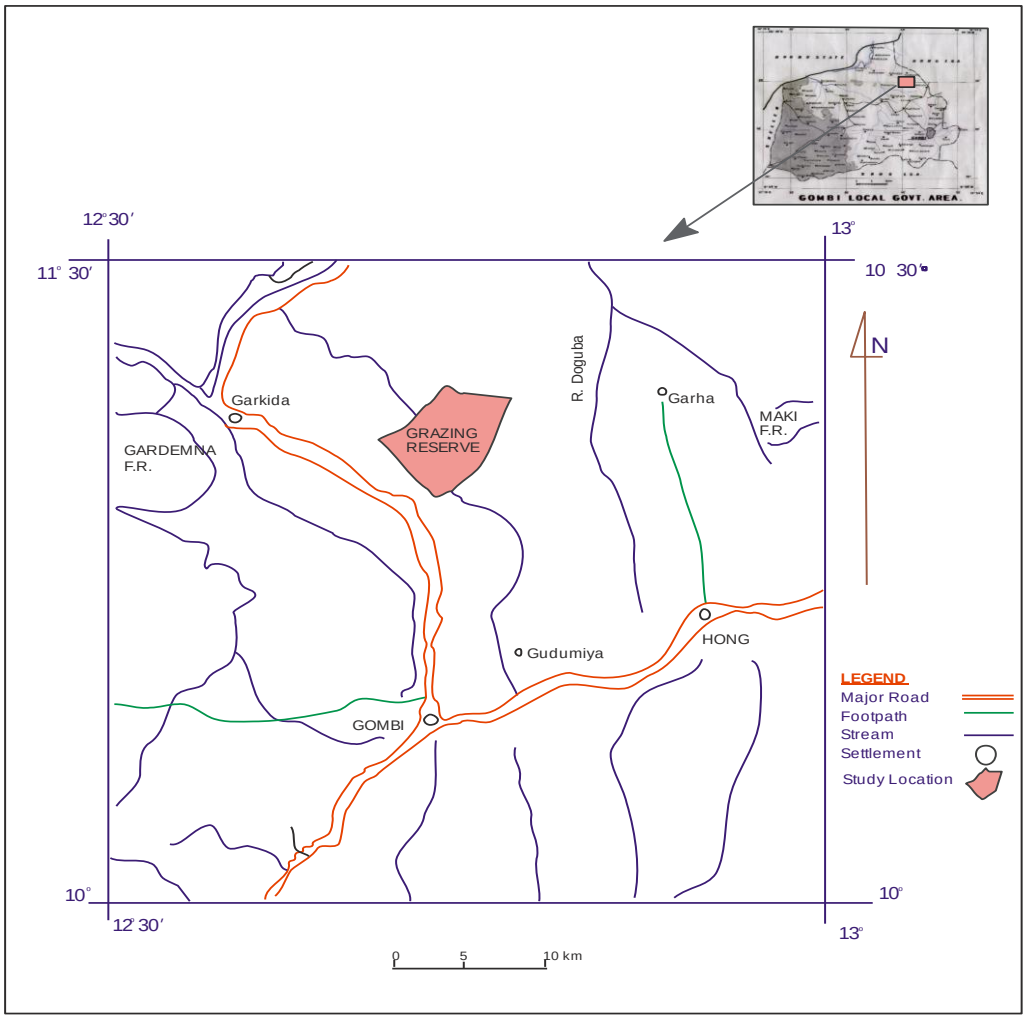

Figure 2: Sketch Map of Guyaku Grazing Reserve, Gombi Local Government Area, Adamawa State, (Area = 6,250ha)
Source: Adamawa State Ministry of Livestock and Nomadic Settlement (2010)

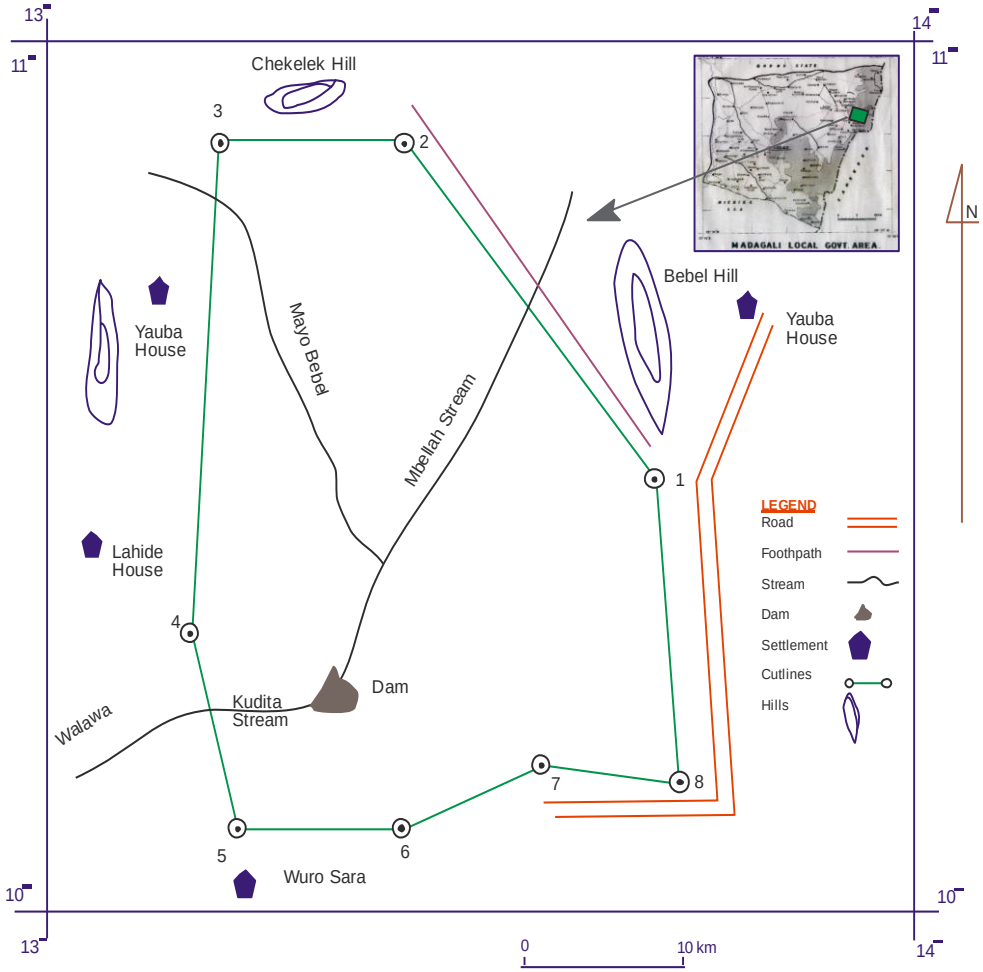

Figure 3: Sketch Map of Chekelek Grazing Reserve, Madagali Local Government Area, Adamawa State (Area = 5,750 ha)
Source: Adamawa State Ministry of Livestock and Nomadic Settlement (2010)

Evaluation of the Stocking Rate sand Grazing Capacity

The grazing capacity of the study areas was evaluated following the method outlined by Kallah (1982) and Akosim *et al*. (2004), and by using the feed requirement of a matured Zebu weighing 250kg, which was estimated to be 6.0kg of dry matter per day. The procedure was as follows: -

i. the yield of desirable forage per hectare was first evaluated.
ii. the amount of forage produced per hectare was reduced by 40% to provide for:
a. the forage lost to wildlife, insects, livestock trampling and contamination.
b. requirement for soil protection, and
c. the usual error associated with small plots (Kallah, 1982).

The data on the net yield of desirable forage per hectare and the feed requirement by a matured Zebu per day were then used to calculate the stocking rate.

Data Analysis

1. Pasture – animal indices: Assessment of grazing capacity or stocking rate involved the assessment of the following parameters: -
   i. Area of grazing reserve (ha)
   ii. Total forage yield (kg)
   iii. Useable forage {60% of total forage yield (kg)}
   iv. Animal requirement {zebu cattle of 250kg live weight (kg)}
   v. Grazing period

2. Stocking rate
   This was calculated using the model: -
   Stocking Rate = U/(FxG)
   Where,
   U = Useable forage (kg/ha)
   F = Total feed requirement by TLU
   G = Grazing period
   TLU = Tropical Livestock Unit which is equivalent to 6.0kgDM (Akosim *et al.*, 2004)

Results

Forage Yield at the Range Sites

The average forage yield per transect in the range sites showed that transect 10 at Gongoshi had the highest average yield of 266kgDM/ha while transect1 has the lowest average yield of 160kgDM/ha. The remaining transects had average forage yield of between 166kgDM/ha and 264kgDM/ha. In Guyaku range site, the result of the average forage yield presented showed that transect4 had the highest average yield of 237.70kgDM/ha while transect5 had the lowest average yield of 201.60kgDM/ha. The remaining transects had average forage yield of between 237.20kgDM/ha and 216.50kgDM/ha. While in Chekelek range site, result obtained showed that transect7 had the highest average yield of 215.90kgDM/ha while

transect4 had the lowest average forage yield of 181.90kgDM/ha. The remaining transect had average forage yield of between 209.90kgDM/ha and 192.10kgDM/ha (Table 1).

Table 1: Average Forage Yield (kgDM/ha) of Range Sites

Transects	**Range Site {Dry Weight (kg)}**		
	Gongoshi	**Guyaku**	**Chekelek**
1	160	224.20	192.10
2	209	230.80	201.20
3	239	235.90	209.90
4	213	237.70	181.90
5	197	201.60	202.70
6	264	237.20	202.60
7	166	227.70	215.90
8	166	216.50	206.10
9	260	229.90	193.80
10	266	228.90	208.90
Total	2,130kgDM/ha	2,270.4kgDM/ha	2,015.10kgDM/ha

Pasture–Animal Indices and the Stocking Rates of the Range Sites

The result in Table 2 showed that the forage yield and stocking rates of the range sites calculated from 60% of the forage and animal requirement (Zebu cattle of 250kg live weight) (Akosim *et al.*, 2004) for a grazing period of 365 days was 17,040,000kgDM at Gongoshi, 14,975,500kgDM at Guyaku and 11,586,250 kgDM at Chekelek, while their stocking rates were0.584, 0.622, 0.552Tropical Livestock Unit per hectare per yer (TLU/ha/yr) at Gongoshi, Guyaku and Chekelek range sites.

Table 2: Pasture-Animal Indices and Stocking Rates of Range Sites

	Indices	Range Sites		
		Gongoshi	Guyaku	Chekelek
1.	Forage yield (KgDM/ha)	2,130kgDM/ha	2,270kgDM/ha	2,015kgDM/ha
2.	Area of range site (ha)	8,000ha	6,250 ha	5,750 ha
3.	Total forage yield of range site (kgDM)	17,040,000kgDM	14,975,500 kgDM	11,586,250 kgDM
4.	Useable forage (60% of total forage yield in kgDM)	10,224,000kgDM	8,512,500 kgDM	6,951,750
5.	Animal requirement (Zebu cattle of 250kg live weight)	6.0kgDM/day	6.0kgDM/day	6.0kgDM/day
6.	Grazing period	365 days	365 days	365 days
7.	Stocking rate	0.584TLU/ha/yr	0.622 TLU/ha/yr	0.552TLU/ha/yr

Discussion

The grazing capacity determined from this study for Gongoshi range sites are 4672 Tropical Livestock Unit (TLU) for one year or 1 TLU per 1.712 ha per year, 3888 TLU for one year or 1 TLU per 1.608 ha per year for Guyaku and 3002 TLU for one year or 1 TLU per 1.915 ha per year for Chekelek. The 1 TLU per 9 hectares reported by Kallah (1982) falls below the estimated stocking rate of 1 TLU per 1.712ha, 1.608ha and 1.915 hectares obtained from this study. These results imply higher forage yield in relation to animal requirement in the study areas, and therefore suggest that the area could take in more animals to attain the grazing capacity of 1 TLU per 9 hectares recommended by Kallah (1982) for the regions.

The 0.584TLU/ha/yr and 0.622TLU/ha/yr recorded for Gongoshi and Guyaku (both in the guinea savanna) and 0.552TLU/ha/yr recorded for Chekelek, located in the sudan savanna, are below the 4.2TLU/ha/yr and 1.2TLU/ha/yr recorded for guinea and sudan savanna ecosystems respectively by Kallah (1982). The variation is an indication of a deteriorating range in Adamawa State.

In stocking the three range sites, it must however, be recognised that successful range management depends on stocking rangelands so that adequate vegetation residues remain to protect rangeland health, maintain multiples values and ensure economic viability.

Conclusion

This study determined the pasture-animal indices and the stocking rates of Gongoshi, Guyaku and Chekelek range sites in Adamawa State. The findings indicated an inadequate balance in pasture-animal number on the three range sites. The resources available on the sites, fall much short of the recommended daily requirements of the livestock as observed by some scholars. There is therefore, the need to balance forage production, livestock requirements and stocking rates for profitability, output and the ease of management.

Recommendations

In view of the findings, the following recommendations are advanced:

i. The productivity and carrying capacity of rangelands be considered when stocking rangelands.
ii. Livestock should be removed when the area is muddy, damp or waterlogged and livestock should be kept outdoors, until when the soils become well-drained for re-introduction of the livestock. This will enhance forage quality and quantity.

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