

SURVEY ON THE IMPACTS OF ANTHROPOGENIC ACTIVITIES AND EROSION ON THE SUSTAINABILITY OF RANGELANDS ON THE MAMBILLA PLATEAU, NIGERIA

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ABSTRACT

This study was conducted to investigate threats to Natural Rangelands on the Mambilla plateau of Nigeria due to anthropogenic activities and biomass loss due to erosion. Four different rangelands were selected and surveyed for the presence of any anthropogenic activity and erosion. The results obtained showed that overgrazing (35.71%) was the highest human activity constituting a threat to the flourishing of these rangelands. This is followed by logging (25.00%), plant cultivation (21.43%), bush burning (14.29%), hunting (6.67%) and the least was mining (3.57%). Total land area loss due to erosion was estimated at 23,658.67m². Lekitaba had the highest eroded land area of 8,782.99 m², followed by Yerimaru with an eroded land area of 8,298.98 m², then Zongo Ajiya with 5,152.73 m² and the least eroded land area was Ngel-nyaki with 1,423.97 m². Total Biomass loss due to erosion in the entire studied rangelands was estimated at about 137,147.23 individuals, with an average of 5.80 individuals/m². The highest biomass loss was observed in Lekitaba with 57,935.35g (42.24%), followed by Yerimaru with 46,470.79g (33.89), then Zomgo Ajiya with 25,763.64g (18.79%), while the least was recorded in Ngel-nyaki as 6,977.45g (5.08%). Although the rangelands on the Mambilla Plateau Sardauna LGA of Taraba State is still productive in terms of forage yield, the prevalence of these threats as identified could change such status over time. Hence, concerted management efforts are required to ensure sustainability.

Keywords: Rangelands, Erosion, Anthropogenic Activities, Threats, Biomass.

INTRODUCTION

Rangelands are typically characterized by low precipitation, shallow soils and slow nutrient cycling making the environment suitable usually to be dominated by grasses, forbs and shrubs, and are efficient at water and nutrient utilization. Therefore, practices that are appropriate to pastures, such as fertilization and ploughing, are often inappropriate on rangelands. They are very productive, providing sustainable income for ranch communities while protecting valuable natural resources through appropriate grazing strategies (Freidel *et al.*, 2000).

Rangelands are called different names around the world and have varied characteristics. Some rangelands are dominated by grasses, others by shrubs or low-growing trees, while the driest rangelands are deserts.. Rangelands are not farmlands, nor forested. Current figures estimated that 26% of the world

land area and 70% of the world agricultural area are covered by grasslands, which contribute to the livelihoods of over 800 million people. These are important feed source for livestock, a habitat for wildlife; provide environmental protection, storage of carbon and water and in situ conservation of plant genetic resources (Austin and Williams, 1988; Arntzen, 1990; Barbier *et al.*, 1994).

Rangeland are useful for grazing, Habitat for wildlife, biodiversity, drinking water, protect erosion and purified runoff water (Freidel *et al.*, 2000). Hence, these lands are economically important to many regions of the world. Because vegetation can be sparse and an area can be overgrazed if it is too small, cattle ranches are often very large and may consist of hundreds, if not thousands of hectares. The open spaces and natural beauty make it ideal for outdoor activities, including hiking, fishing, hunting, biking, and driving off-road vehicles.

Also, this vast land, with rolling landscapes and little vegetation to break up wind or shade the sun, provides a great location for renewable energy sources, such as wind and solar power (Behnke, 1994; Freidel *et al.*, 2000).

Globally, 10–20% of drylands, and 31% of African rangeland soils are degraded. Unsustainable grazing management, fire and land-conversion are important drivers of degradation and Green House Gases (GHG) emissions. Grazing-induced desertification severely impacts biological diversity, and is estimated to emit 8.2 MT-C.yr⁻¹ (FAO/LEAD, 2006). The conversion of rangelands to cropland, including biofuel production, may result in a loss of 95% above ground and up to 60% below-ground carbon (Guo and Gifford, 2002). Further degradation leaves bare ground, which reduces the effectiveness of the conversion of rainfall in primary production by 50-70%. Climate change induced shorter crop growing seasons may lead to abandoning of cropland and increase the area under rangelands in the future (Jones and Thornton, 2008).

Almost all over the world rangelands are recognized as significant baseline resource in the livestock industry. This is more so on the continents of Africa, Australia, North America and South America where vast expanses of territory provide habitat and grazing for livestock and wild life. Rangelands are home to some 200 million people in the tropics and support about a billion domestic animals (Heady and Heady, 1982; ILR I, 1998). For all practical purposes, ruminant livestock production in Nigeria is in the hands of pastoralists who own over 90% of the stock holdings. The stocks are mainly reared under transhuman system of grazing over large expanses of rangelands. Under this production system the livestock rely on the natural rangeland forages with little or no supplementation for their nourishment year-round.

The Mambilla plateau which is the house of the highest peak in Nigeria provides

good and favourable conditions for the establishment and development of rangeland resource. In fact, it house wild lands with enormous and diverse species of grasses, forbs and herbs that have the potentials of becoming rangelands. But because of improper understanding of the use and importance of rangelands, these resources are allowed to be wastes in the region. Despite the significant contribution of rangeland to the socio-economic lives of the inhabitants of developing countries, the resource is often abused and neglected in terms of planned utilization, development and management for sustainability (Kallah, 1999). This study was therefore, designed to investigate anthropogenic activities and effect of erosion on biomass loss on the Mambilla Plateau in Sardauna Local Area

MATERIALS AND METHODS

Study Area

The study took place on the Mambilla Plateau (Figure 1) which at about 1,500 m above sea level is Nigeria's peak. The Mambilla Plateau is located in Nigeria's Taraba State straddling the Cameroonian border (longitude 6°47'43"N and latitude 11°11'58"E). The Mambilla Plateau is the origin of the Taraba River, largest tributary to the Benue River. The Mambilla Plateau demarcates the northern edge of the Cameroonian Highlands and adjoining on the Nigeria side by fragments of montane forests and Africa's Gulf of Guinea forests considered to be a hotspot of biodiversity (Oates *et al.*, 2004; Sommer and Ross, 2011).

Heavy downpours from March – mid November are followed by 3 months period with very little or no rainfall. Habitat types include flat grassland, riverine and gallery forest, montane forest and montane grassland. It includes a succession of lowland along the cameroonian border (<825 m), sub-montane (>1,650 m) strata, rising to 2,419 m at Gangirwal, Nigeria's peak.

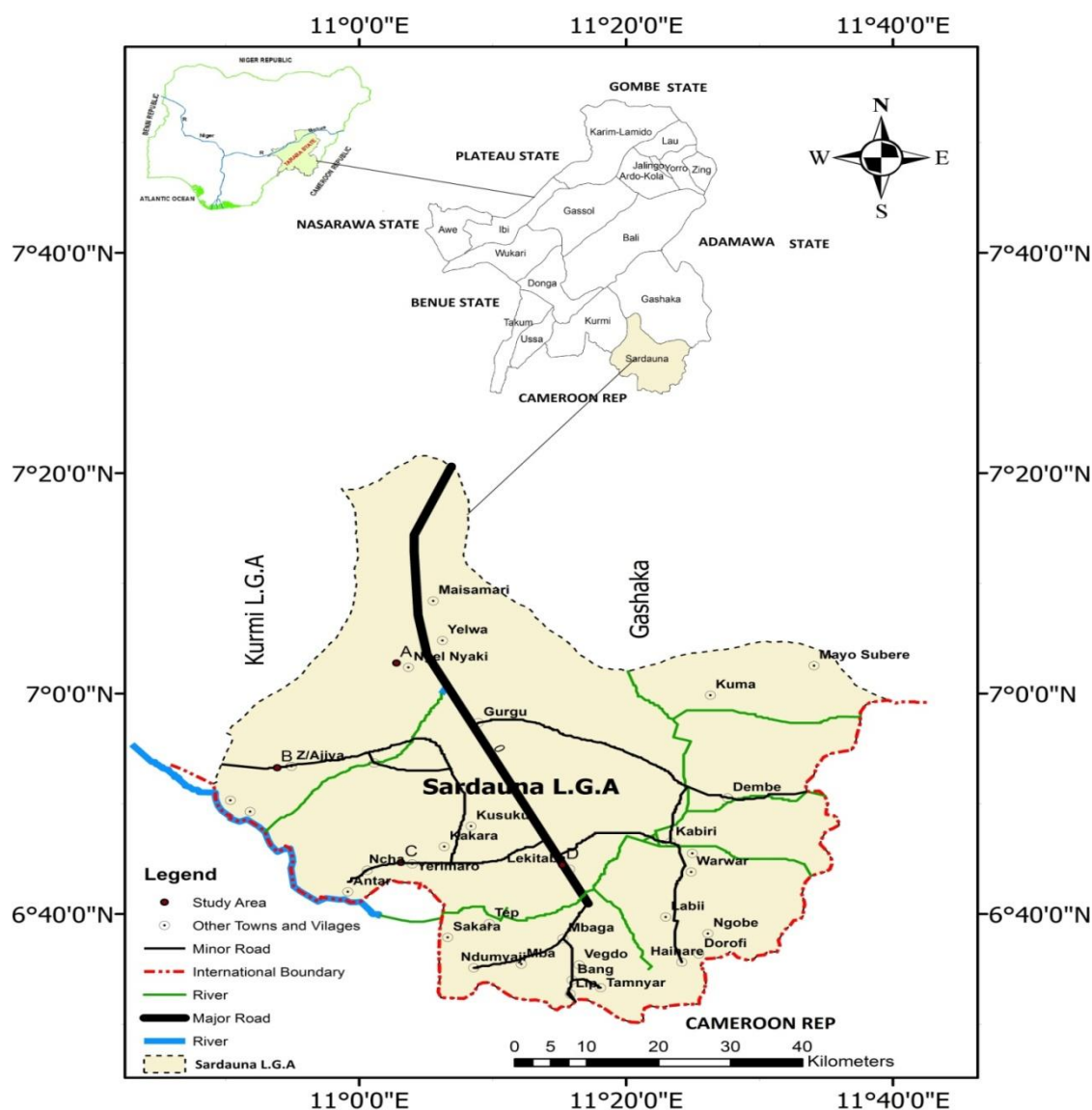


Figure 1: MAP OF SADAUNA LOCAL GOVERNMENT AREA SHOWING THE STUDY SITE

Study Design and Data Collection Methods

Four (4) rangelands namely; Ngel-nyaki (A), Zongo Ajiya (B), Yerimaru (C) and Lekitaba (D) were selected for the study, one each from the different geographic zones (that is, North, East, West and South respectively) and their Global Positioning System (GPS) positions were determined using the GPS machine. In each of the rangelands, longitudinal survey was employed to determine and record physically the presence of different anthropogenic activities.

To determine biomass loss, erosion sites in the study area were identified through survey and the area of land consumed or degraded by the erosion was determined using

formula $A = L \times B$ where A = Area, L = length of erosion gully and B = average width of the gully. Biomass loss was determined by making ten (10) random quadrants throws at either side of the erosion banks and counting the number of species available. Final population was estimated using the formula $N_2 = \frac{N_1 \times A_1 (m^2)}{A_2 (m^2)}$, where; N_2 = estimated population, N_1 = quadrant population, A_1 = total land Area (m^2) and A_2 = Sampled land Area (m^2).

Statistical Analysis

Mean and percentages were used to show the magnitude of occurrence of anthropogenic activities,

RESULTS

The different anthropogenic activities encountered during the cause of this study were

revealed in Table 1. The results showed that overgrazing (33.33%) is the major anthropogenic activity in the rangeland. While others such as deforestation (23.33%), agriculture (20.00%) and illegal bush burning (13.33%), hunting (6.67%) while illegal mining (3.33%) was the least observed threats.

Table 1: Observed Anthropogenic Activities in the Study Areas during the Study Period

Anthropogenic Activities	Frequency	Percentage Frequency (%)
Overgrazing	10	35.71
Bush Burning	04	14.29
Mining	01	3.57
Plant Cultivation	06	21.43
Deforestation	07	25.00
Total	28	100

The amount of green biomass loss due to erosion in the study area is presented in Table2. The results showed that a total of 137,147.23g of biomass (grass, forbs and herbs) was loss as a result of erosion, at an estimated 5.78g/m² for the whole Plateau Lekitaba (D) had the highest

biomass loss of 57,935.35g (42.24%) followed by site C (Yerimaru) with a value of 46,470.97g (33.89%), then site B and A with biomass loss of 25,763.64 (18.79%) and 6,977.45g (5.08%) respectively.

Table 2: Erosion Sites showing the Total Green Biomass Loss in the Study Area

Erosion Sites	Length (m)	Average Width (m)	Approx. Area Covered by Erosion (m ²)	Average Density of Plants		Projected Population of Plants Loss (N)	Total Biomass Loss (g/m ²)	Biomass lost per square meters(m ²)
Ngel-Nyaki (A)	80.45 (10.45%)	17.7 (10.6%)	1,423.97	Sporobolus	22	3,132.73	6,977.45	4.89
				Sida acuta	06	854.38		
				Emilia spp	07	996.78		
				Vernonia spp	04	569.59		
				Aspilia spp	10	1,423.97		
Zongo Ajiya (B)	185.32 (24.03%)	27.8 (16.63%)	5,152.73	Sporobolus	18	9,274.91	25,763.64	4.99
				Diodia	06	3,091.64		
				Sida acuta	08	4,122.18		
				Spear grass	10	5,152.73		
				Gizotia	08	4,122.18		
Yerimaru (C)	172.84 (22.46%)	50.7 (30.32%)	8,298.98	Sporobolus	27	22,407.25	46,470.79	5.59
				Diodia	04	3,319.59		
				Cyperus	06	4,975.89		
				Spear grass	10	8,298.98		
				Arongana	09	7,469.08		
Lekitaba (D)	211.17 (27.40%)	39.3 (23.5%)	8,782.99	Sporobolus	32	28,105.57	57,935.35	6.60
				Aframomu	13	11,417.89		
				Sida acuta	08	7,026.40		
				Emilia	07	6,148.09		
				Vernonia	06	5,237.40		
Total			23,658.67				137,147.23	22.07

DISCUSSION

The many anthropogenic activities recorded in different proportions in the cause of this study could not be unconnected with the high pressure placed on the resources of the study area due to poverty and lack of awareness.

Overgrazing

This is one of the most common activities encountered in the study area that is detrimental to the survival of the rangelands. This happens probably because farmers want their livestock safe and secured and as a result, they often keep large populations of their livestock closely packed together for easy monitoring and security, which could lead to trampling of the grass cover that would probably lead to loss of biomass and land degradation. This findings agreed with the results of Brits *et al.* (2000), Yates *et al.* (2002) and Hassani *et al.* (2008) who all reported changes in palatability, composition and biomass of vegetations in overgrazed rangelands and also suggested lighter grazing to enhance sustainability.

Bush fire

Fire is an integral part of rangeland management as early and controlled burning ward-off older parts of the forage and stimulates fresh growth of forage. It also ensures the addition of ash to the soil thereby enriching it with essential nutrients that can support optimum forage and vegetative growth. However, excessive and uncontrolled burning could charred away vegetations and could destroy grasses, forbs and herbs ultimately reducing biodiversity, destroying their habitat and eliminating forage for grazing. This studies had confirmed that excessive burning is affecting forage availability in the study area as burnt lands takes longer time to regenerate than normal unburned part of the rangelands. This agrees with the findings of Dube *et al.* (2006) and Mapiye *et al.* (2008) who all reported that excessive burning could lead to biodiversity destruction and habitat degradation.

Land cultivation and Deforestation

These are important factors needed for food production and when such production occurs within a rangeland, they tend to affect the biotic potentials of the rangelands in terms of

forage yield and their continued occurrence could lead to the degradation of the rangeland conditions, leading to poor management and subsequent loss of green biomass. This findings is in agreement with the results of Hassani *et al.* (2008) and Mapiye *et al.* (2008) who reported that cultivation and deforestation are two important factors that lead to erosion which in turn destroys forages and subsequently productivity of a rangeland.

Illegal mining

The presence of many different mineral resources on the plateau and coupled with low economy of the area, had probably make the locals in the community to engage in such activities as a source of livelihood. This is another human activity recorded on the study area, which is capable of affecting the range productivity. Dart (2019) reported that due to richness in different minerals on the rangelands, mining them always create land disturbances that are mostly non-reversible and hence, could affect and limit the productivity of such rangelands.

Biomass loss due to Erosion

This study had observed that soil erosion greatly caused the loss of floral biodiversity and this is not elusive of the fact that soils constitute the medium on which plants anchors and grow, and also provides a medium for nutrient mobilization and uptake. When soil layers are being washed away by erosion processes, nutrients and nutrients fixing micro and macro organisms may be washed along with the soils, thereby depriving the plant matter of the region of adequate nutrients hence, they wouldn't be so firmly rooted and could invariably fall and die. The washing away of the soils could probably be the reason why there are no vegetation especially grasses and forbs on the eroded paths with consequent loss in the ecosystem which may also affect their ecological function as a unit. The result of this study is in accordance with the findings of Jiao *et al.* (2009) who reported that soil erosion has been the major reason for the loss of grasses in the Daobang Province of China, causing the loss of approximately 134,508 strands of grasses yearly.

CONCLUSIONS

Based on the findings of this study, it could be concluded that the persistent occurrence of anthropogenic activities on the Mambilla plateau rangelands has the potentials of affecting their productivity and sustainability. Hence, Government and conservation organizations should synergise efforts to educating and ensuring compliances of rangeland management by both the locals and rangeland owners.

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